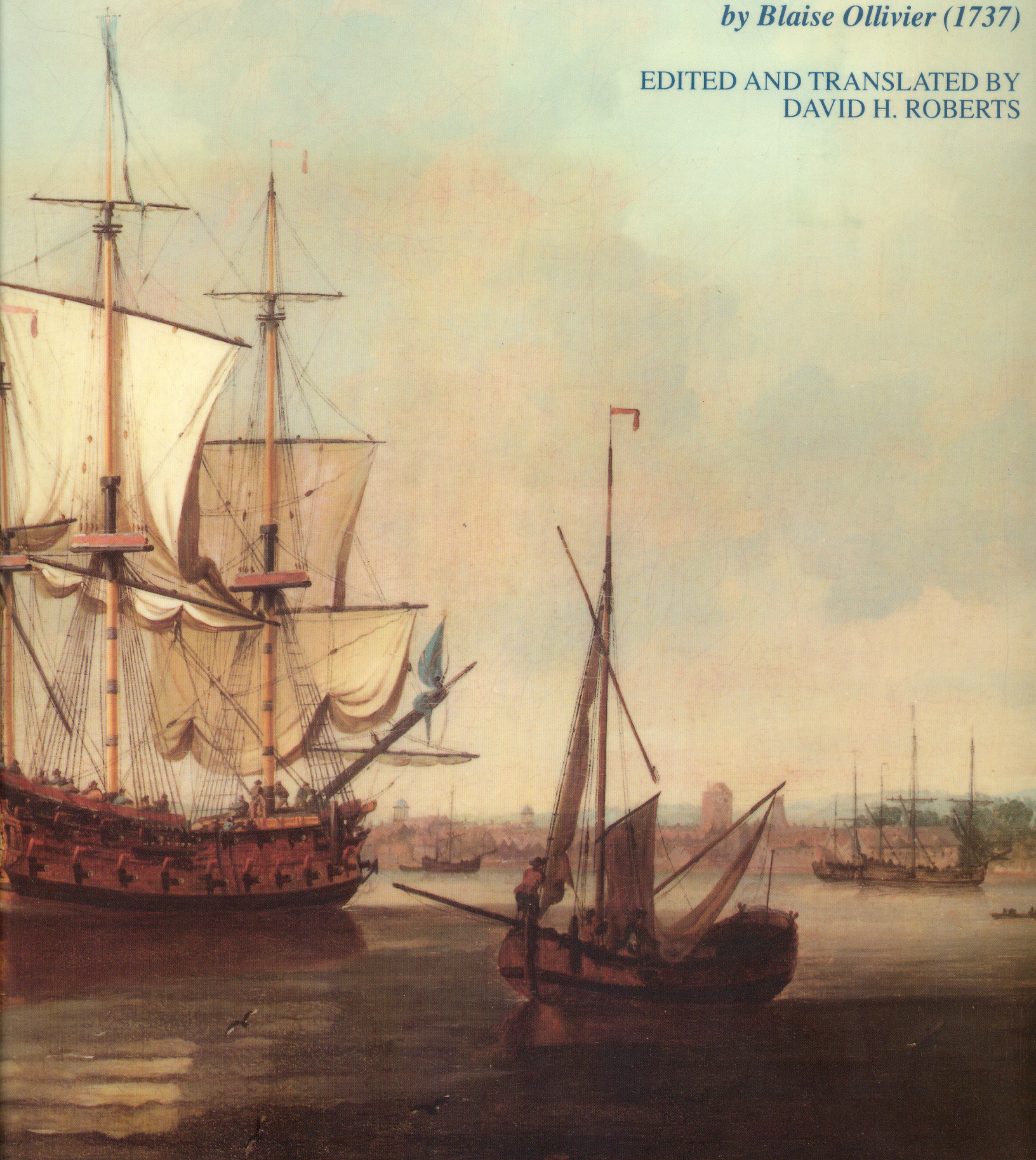
18th CENTURY SHIPBUILDING

Remarks on the Navies of the English & the Dutch

by Blaise Ollivier (1737)

EDITED AND TRANSLATED BY
DAVID H. ROBERTS



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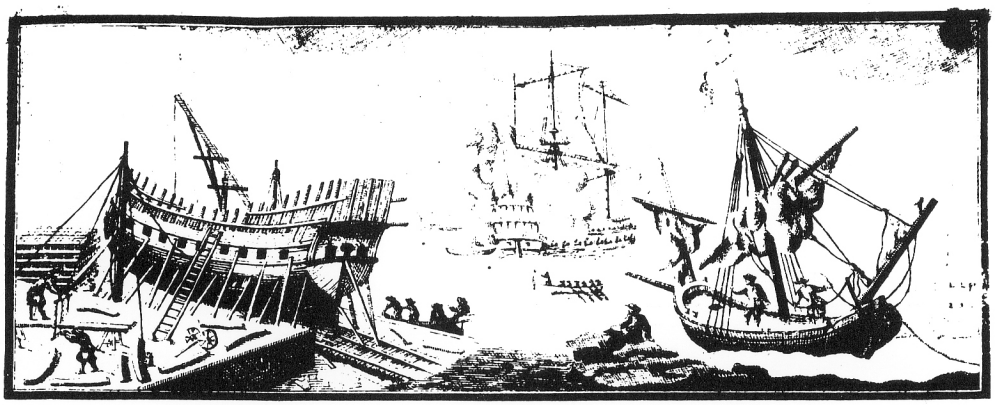
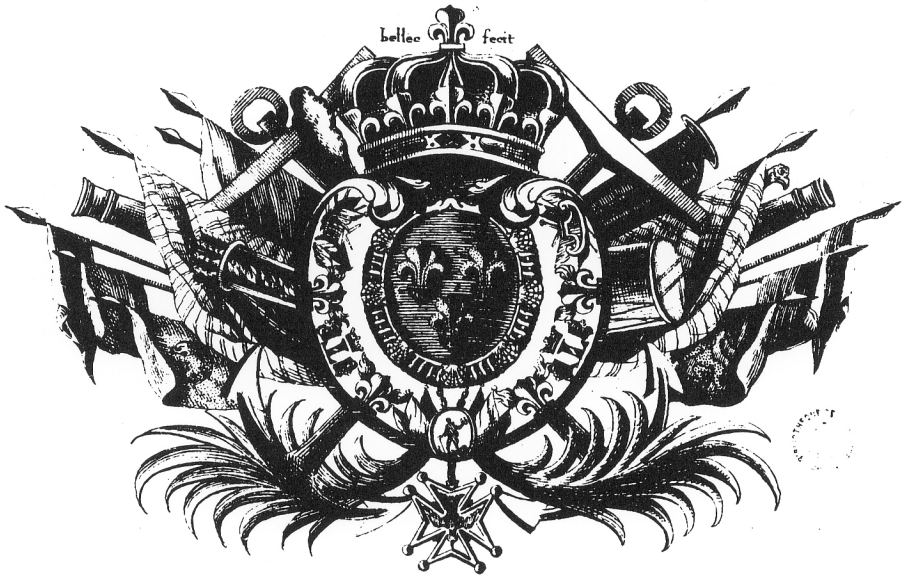


REMARQUES SUR LA MARINE DES ANGLOIS ET HOLLANDOIS

faites sur les lieux en l'année MDCCXXXVII

PAR Mr OLLIVIER

constructeur des Vaisseaux du Roy



This beautifully decorated title page is from the Brest manuscript. The artist, who has signed his work, is Bellec, an employee of the dockyard. Obviously a talented illustrator, he is known to us from another work in his hand preserved at the Service Historique de la Marine in Brest, entitled A General Collection of the Tools used in the Workshops of a Royal Dockyard. Dated 1738, this extremely attractive landscape notebook contains sixty or so illustrations in Indian ink, coloured with watercolour. (Photograph courtesy S.H.M., Brest.)

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1992

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The preparation of this book for publication has taken some considerable time: I completed the translation in 1985, as a sort of "busman's holiday" between the first and second volumes of *The Seventy-Four Gun Ship*. The research has taken up odd moments over the seven years which have elapsed since then, and has involved three visits to Holland, and two to the archives at Brest. Inevitably, this has left me in the debt of many people.

First of all I have to thank Jean Boudriot, my mentor, guide, inspiration, and friend. It was he who first showed me the manuscript when he acquired it, and who has constantly encouraged me in my researches. He has unstintingly given me his time in unravelling the secrets of French shipbuilding of the period, but his help has not ended there: he has patiently considered my views, explained at times where I was mistaken, and worked closely with me throughout the preparation of this book. He has moreover refused to allow his role to be recognised through the addition of his name as co-author. Such modesty is entirely typical of him, and I have come to realise that his generosity is habitual and has been extended to many people. But honesty demands that I pay tribute to him with the utmost sincerity and humility. Truly, without him this book could never have been written.

Thanks are due to the several public archives who have kindly permitted the reproduction of many of the illustrations used in this book. With one shameful exception, all agreed to waive any reproduction charges, a gesture which I particularly appreciate in an academic book of this kind, the sole purpose of which is to make known to as wide a public as possible some of the treasures which are conserved in such archives. Their names are acknowledged individually in the captions.

In Brest I was received most generously by Capitaine de Vaisseau Daguzan, the former Curator of the Service Historique, who extended not only his full and enthusiastic cooperation but also his personal hospitality. Since his retirement I have enjoyed the assistance of Mr Philippe Henwood, who has been most helpful in my researches.

I am grateful too for the encouragement of Dr Trevor Kenchington in Canada; a student of 18th century naval architecture, he has embarked on a most erudite series of articles on the subject which I hope one day will become a book. He has read through my manuscript with great care, and made many suggestions for improvement which have been gratefully incorporated.

In Holland, my research was facilitated by the kindly intervention of Bas Kist at the Rijksmuseum, and by the patience of Jan-Piet Puype, formerly of the Nederlandsch Historisch Scheepvaart Museum in Amsterdam. In Rotterdam, Mevr. Ellie Bos-Rietdijk spent considerable time searching the archives of the Prins Hendrik Museum for material on the van Zwijndregts and for contemporary illustrative material. My thanks also go to Jaap Bruijn, Professor of Maritime History at Leiden University, who examined my manuscript and made a number of most helpful comments; in particular, he was able to assist significantly and most generously with the List of Dutch Ships in the Appendix.

Captain Adrian Caruana has helped with questions relating to the ordnance of the period, and was able to unearth for me the secret recipe of the compound used to coat guns for their preservation. I am grateful not only for his erudition, but also for his friendship.

In my search for background material on Blaise Ollivier I turned to the archives of North America, where two important collections of French papers from this period are to be found: the Duhamel du Monceau Papers, and the Maurepas Papers. Both collections are now scattered, but by far the larger part of the former are now in the Peabody Museum of Salem, and of the latter at the Olin Library of Cornell University. I am happy to acknowledge the unstinting help given by Dr Victor Lewinson at Salem, and by Lynne Farrington at Cornell.

Mr Richard Shell, an expert on Pacific vessels, was kind enough to correspond with me at some length on the subject of the *Ladrone* at Portsmouth, and the footnote relating to that section owes much to his erudition.

Finally, I must pay tribute to the adult students of Jean Boudriot's weekly class on naval archaeology at the Musée de la Marine in Paris, for whom Blaise Ollivier's *Remarques* have been part of the "curriculum" for the past year. Their questions, always pertinent, have alerted us to many aspects of the manuscript which might otherwise have been neglected. It is with great sorrow that I record the death last year of a particular friend among their number, Mme Paule Miraval, and extend my sympathy to Georges.

David H. Roberts
1992

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INTRODUCTION

1. Preamble

In 1737, Blaise Ollivier, Master Shipwright at France's foremost Royal Dockyard, Brest, received instructions to undertake a secret mission to England and Holland, where he was to visit all the major naval dockyards and report on the way ships were built by France's maritime rivals. On his return, after five months' absence, he drew up a report running to 360 manuscript pages and accompanied by 13 sheets of diagrams and plans, entitled *Remarques sur la Marine des Anglois et des Hollandois faites sur les lieux en 1737 par le Sr Ollivier constructeur des vaisseaux du Roi* (*Remarks on the Navies of the English and the Dutch made in their Dockyards in 1737 by Mr Ollivier shipwright to the King*). The report describes everything that Ollivier saw in the most minute detail, and makes recommendations as to whether the techniques should be imitated in the French dockyards.

This book contains the fully annotated text of that report (in both the original French and in translation), published for the first time, to which this Introduction provides the background.

The book also contains, in the Glossary of Shipbuilding Terms at the end, about 10% of a second Ollivier manuscript, entitled *Traité de Construction*, but in fact an alphabetical dictionary of shipbuilding terminology and technology. Written in 1736, it contains nothing on foreign practices, but contains on the other hand as much or more detail on the French Navy of the same period as do the *Remarques* for the English and Dutch Navies. Despite its alphabetical rather than thematic format, it repays careful reading. Taken together, the two manuscripts provide the most detailed analysis of the shipbuilding technologies of three of Europe's foremost maritime powers ever written.

2. Source of the Manuscript

Two copies of Blaise Ollivier's manuscript report on his journey to England and Holland are known to exist, and a third was presumably also made for the Minister, Maurepas, but this last copy appears not to have survived. The report was never published. One copy is in the Archives of Brest Dockyard (*Service Historique de la Marine*), donated by the descendants of Blaise Ollivier: the first page bears the inscription "donated to the Library of Brest Dockyard March 1st 1843 by the Ollivier family", (signed) E. Ollivier. Currently classified under reference M.68, it was listed as N° 49 on page 292 of Volume I of the *General Catalogue of the Manuscripts preserved in the Navy Libraries*[1]. The full entry reads as follows:

> "'*Remarques sur la Marine des Anglois et des Hollandois, faites sur les lieux, en l'année 1737, par M. (Blaise) OLLIVIER, constructeur des vaisseaux du Roi*', sent by Maurepas to discover the secrets of the shipwrights of these two countries.
> "Frontispiece decorated with a vignette and coat of arms by Bellec. Lists of the 207 British ships-of-war and 82 Dutch ships in 1737 ....
> "The family has retained one copy of this manuscript which concludes with a series of confidential letters written by Blaise Ollivier to Maurepas.
> "18th century. Paper. 296 pages. 350 x 240 mm. Brown calf binding."

It is possibly this second copy to which de la Roncière refers which is currently in the private collection of Jean Boudriot, for which it was acquired in 1985; alternatively, it may be a third copy, for the "confidential letters" are (regrettably) missing, and it has proved impossible so far to locate them. It consists of 360 unnumbered folio pages, bound in contemporary brown calf.

1. Charles de la Roncière (Paris, *Plon* 1907).

genoux, ou si dans la distribution des membres il y a quelque vuide il est garni de remplissage. Dans ce meme espace les coutures de membres sont par dedans et par dehors sont calfatés. Je n'ay point penetré la raison de ce calfatage, je tacheray de la decouvrir dans la suite, mais j'approuve beaucoup la methode de ne point laisser de vuide entre les membres du fond, et depuis long temps je me suis proposé de remplir ainsi les vuides du Dauphin royal avant de l'achever. Il resulte trois grands avantages de ce remplissage. 1° le remplissage tient lieu de lest et d'un lest plus pesant que le lest meme parceque'il est plus eloigné du centre de mouvement du vaisseau que le lest ordinaire. 2° il est impossible qu'il ne reste de l'eau dans ces vuides quelque attention qu'on ait a la pomper souvent; Cette eau se porte sous le vent quand on est a la voile et tend a faire incliner le vaisseau. 3° les vapeurs de cette eau gatent le biscuit. Or remplissant les vuides avec du bois il ne doit plus y rester d'eau, le vaisseau porte mieux la voile et le biscuit n'est point sujet a se gater. Ces considerations meritent bien qu'on ne laisse point de vuide dans les fonds des vaisseaux, mais je ne vois pas qu'il soit necessaire d'etendre les remplissages jusqu'a la tete des genoux comme chés les anglois; il suffit de les mettre jusqu'a un pied au dessus de la tete des varangues.

Depuis la tete des genoux jusqu'a la flotaison les membres des vaiss=

1. *A page reproduced from the Boudriot copy of the manuscript. Note the neat handwriting and the lack of corrections of any kind (there are almost no crossings-out in the whole 360-page manuscript).*

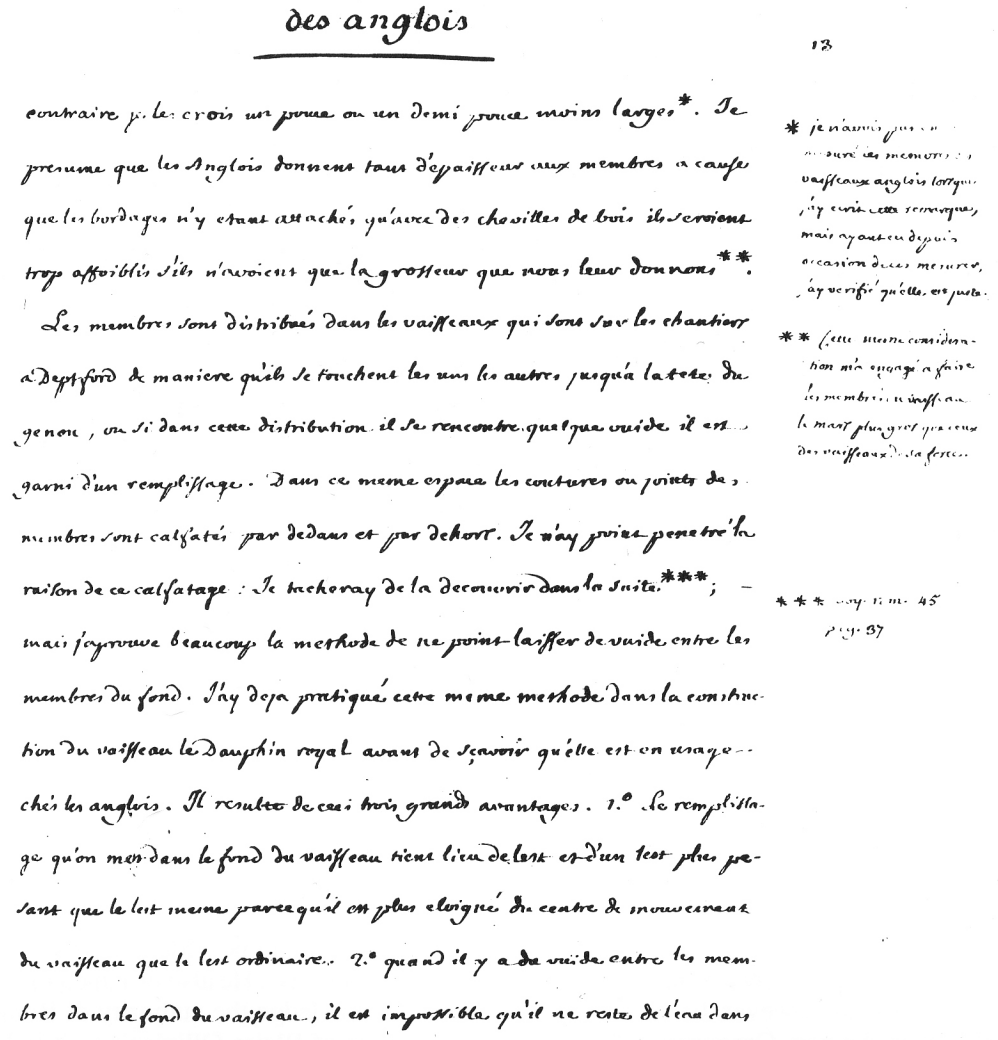
Both copies of the manuscript are in the author's own hand, and while they are very similar, they are not identical. This published version is a combination of both manuscripts: transcribed from the Boudriot copy, the original French text which is also included in this book incorporates any significant differences or additions from the Brest manuscript. These can be identified (in the French text only) by the following devices:

- Text which is in the Boudriot version but missing from the Brest version is indicated in square brackets [ ];
- Any text which is in the Brest version but not the Boudriot version is printed in *italics*;
- Wherever there is a divergence between the two manuscripts, both versions are given, the alternative reading from the Brest copy being shown in the margin in *italics*, and indicated by a dagger symbol †.

The English translation is of the full combined text, and, as with the French transcription, variants between the two manuscripts are indicated in the margin, where the text from the Brest manuscript is given in *italics* and highlighted by the same dagger symbol †.

Most of the differences between the two texts are minor; the Brest manuscript is clearly later than the Boudriot copy, and it is reasonable to assume therefore that in the main it is the text from the former which is to be preferred in cases of conflict. While the majority of the variants are simply rewordings, which do not significantly alter the sense, there are some which are more important: these can be summarised as follows:

- The Brest manuscript lacks the Plates, and it is possible that these were never copied;
- It contains however a nominal list of English ships in 1737, which is missing from the Boudriot copy; also missing from the Boudriot copy is the attractive title page and vignette by Bellec;
- The Brest copy has a number of additional marginal notes of exceptional interest, written in Blaise Ollivier's own hand some years later, and these have been included in this edition; they are discussed on pages 31 *et seq.*


des anglois

13

contraire je le crois un pouce ou un demi pouce moins large*. Je presume que les Anglois donnent tant d'epaisseur aux membres a cause que les bordages n'y etant attaché, qu'avec des chevilles de bois ils seroient trop affoiblis s'ils n'avoient que la grosseur que nous leur donnons**.

Les membres sont distribués dans les vaisseaux qui sont sur les chantiers a Deptford de maniere qu'ils se touchent les uns les autres jusqu'a la tete du genou, ou si dans cette distribution il se rencontre quelque vuide il est garni d'un remplissage. Dans ce meme espace les coutures ou joints de membres sont calfatés par dedans et par dehors. Je n'ay jamais penetré la raison de ce calfatage: Je tacheray de la decouvrir dans la suite.***; — mais j'approuve beaucoup la methode de ne point laisser de vuide entre les membres du fond. J'ay deja pratiqué cette meme methode dans la construction du vaisseau le Dauphin royal avant de sçavoir qu'elle est en usage chés les anglois. Il resulte de ces trois grands avantages. 1.° Le remplissage qu'on met dans le fond du vaisseau tient lieu de lest et d'un lest plus pesant que le lest meme parce qu'il est plus eloigné du centre de mouvement du vaisseau que le lest ordinaire. 2.° quand il y a du vuide entre les membres dans le fond du vaisseau, il est impossible qu'il ne reste de l'eau dans

* je n'avois pas vu [illegible] mesure des membres des vaisseaux anglois lorsque j'ay ecrit cette remarque, mais n'ayant eu depuis occasion d'en mesurer, j'ay verifié qu'elle est juste.

** Cette meme consideration m'a engagé a faire les membres de mes vaisseaux le moins plus gros que ceux des vaisseaux de la ferme.

*** voy. le n.° 45 page 37

2. *Part of a page from the Brest manuscript, showing the marginal notes which Ollivier added later. This is an extract from Remark XII, relating to the imitation of English timbering practice in the frames of the* Dauphin Royal.

3. The Translation

As noted in the previous section, there are a number of differences, some minor, some extremely important, between the two manuscript copies of the *Remarques*. The translation is based on a composite of the two versions, and I have made no attempt to show this in the English text: differences in construction and word order between English and French make such distinctions impossible to show easily and clearly. Readers who are interested in this aspect are accordingly invited to refer to the transcription of the original French text, where all significant variants are indicated.

In translating Ollivier's *Remarques* into English I have endeavoured to retain as much as possible of the flavour of the original. Of necessity however, this can only partially succeed: despite the "Cartesian" clarity with which Ollivier expresses his views, the descriptions which he gives will not always be obvious to a modern reader, particularly one who is unfamiliar with the technology of shipbuilding. I have had therefore to use a degree of caution, and have in the main not attempted to employ the somewhat idiosyncratic spellings of the early 18th century, the use of capital initial letters for nouns, nor the characteristically erratic punctuation: apart from certain archaic forms of speech, and a few early spellings such as "capstern" for capstan and "lanthorn" for lantern, I have for the most part used language which will be easier for a modern reader to understand.

This constraint necessarily impacts on the authenticity of the language and terminology, and purists may reasonably object, for example, to the use of the term "ceiling" to describe the internal planking below the gundeck: it would be more accurate in this period to talk of the *footwaling*, *thickstuff*, and *middlebands*, for the term "ceiling" does not seem to have made its appearance until a few decades later. By the same token, I have preferred the more familiar (but probably later) term "spirketting" to *spirket risings*, and have eschewed the term *spurkets* or *spirkets* which at this time was used to describe the gaps between the floors and lower futtocks. Likewise, I have employed the term "frame", even though I have a suspicion that this did not appear until somewhat later. There are no doubt many other examples for which I might be reproached by lexicographers. I hope therefore that I may be forgiven for sacrificing some authenticity in favour of greater clarity of expression for a modern reader.

Weights and Measures

Almost all the weights and measures used by Ollivier are, as is to be expected, those employed in France at this time. To simplify comprehension for the modern reader, I have inserted in square brackets [ ] and in *italics* the metric equivalent. The French foot (*pied*) measured 324.8 mm, and was divided into 12 inches (*pouces*); each inch was in turn divided into 12 lines (*lignes*), and each line into 12 points (*points*). The French pound (*livre*) weighed 489 grammes; it was divided into 16 ounces (*onces*) of 30.56 grs. The ton (*tonneau*) was equivalent to 2,000 *livres* or 1,956 kgs. The fathom (*brasse*) measured 5 *pieds* or 1.62 m.

Dates

Up to the 16th century, the whole of Europe calculated dates on the basis of the Julian calendar, where the new year started on March 25th (the vernal equinox in Caesar's time), and there were 365¼ days in the year; the fraction was compensated for by the insertion of an extra day every fourth year, called the leap years. However, the true solar year is in fact about 11 minutes shorter than 365 ¼ days, and this resulted in a gradually increasing difference between dates as calculated by Europeans and true dates as measured by the sun, amounting to one day in every 131 years. By the 16th century this difference amounted to ten days. In 1582, Pope Gregory XIII changed the calendar, correcting the accumulated error by calling October 4th October 15th, and ordering that an extra day should be added in 1600 and thereafter in every fourth century only, rather than in every century as had previously been the case. He also ordained that the new year should begin on January 1st. England however, being Protestant, did not acknowledge the authority of Rome, and continued to use the Julian rather than the new Gregorian calendar. Thus at the time of Blaise Ollivier's visit to England the English and French calendars did not accord. There were two major differences, one affecting the years, and the other the days.

Years: In England, the year still started on March 25th and not on January 1st; thus, for the English, March 24th 1737 came **after** March 26th 1737! January 1st 1737 would have been called January 1st 1738 by Blaise Ollivier. Fortunately, since Ollivier arrived in England in April and left in July, the differences in year do not concern us over much: both Ollivier and his English hosts agreed that the year was 1737.

Days: By 1737 the difference in dates as measured by the Julian and Gregorian calendars amounted to 11 days. Thus April 12th 1737 (the date of Ollivier's first visit to Deptford Dockyard) was counted as April 1st 1737 in England. Ollivier signed his report in London on July 5th, which would have been called June 24th by other Londoners.

The discrepancy between English and Continental dates continued until 1752, when the Gregorian calendar was adopted in England: September 3rd was counted as the 14th, and the new year started on January 1st 1753.

I have assumed in the foregoing that the dates given by Ollivier were French rather than English dates – by far the most likely supposition, since he was writing to Maurepas in France. However, this discrepancy needs to be borne in mind when considering the information given in the footnotes about the dates of occurrences in England, such as those indicated in the *Progress Books*, or in those derived from Colledge's *Ships of the Royal Navy* (see the Bibliography for details).

4. Explanations Regarding the Notes

The placing of explanatory notes in the text has caused some problems, not least because of the need to distinguish between my own notes and those written by Ollivier. The original text of the manuscript makes use of the margin for a number of explanatory notes (especially the Brest copy), and this has forced me to find alternative placings for my own notes of explanation. I have a deep-seated objection to being forced to go to the end of a chapter or book for explanations, since turning the pages breaks up the flow of reading and comprehension. I have accordingly settled on the following arrangement:

Marginal notes: The margin has been (almost) exclusively reserved for notes made by Ollivier himself. As indicated above, on page 3, notes and headings in the margin are shown in ordinary bold type if present in both manuscripts, and in bold ***italics*** if they are only to be found in the Brest manuscript. Any significant variants between the two manuscripts are indicated by the presence in the margin of the Brest variant, in light *italics*. Where a marginal note requires some explanation, this is also to be found in the margin, in smaller type and in square brackets [ ]. In a number of his marginal notes, Ollivier has provided cross-references to other *Remarks*, followed by the appropriate page number; I have of necessity had to change these to suit the pagination of this book, and the altered number is accordingly shown in square brackets [ ].

Footnotes: The vast majority of editorial explanations and cross-references are given in the form of footnotes appearing on the same page as the text to which they refer. **None** of Ollivier's own notes are to be found as footnotes.

Other notes: Where it has seemed desirable to append a significantly longer note of explanation, this is usually to be found on the facing left-hand page. Further important explanations are given in this Introduction, and I have also added a number of more general Appendices.

5. Historical Background

When Blaise Ollivier visited England and Holland, in 1737, the long period of peace which followed the Treaty of Utrecht in 1713 (with only a few brief warlike incidents), was drawing to a close. Within a few years, France, England and Spain would be engulfed once again in war – first the War of the Austrian Succession, and then the Seven Years' War. However, for the moment these cataclysmic events lay over the horizon of history, and while France was slowly building up her Navy under the able administration of Maurepas, the Minister, most plans were bedevilled by shortages of money to the point where ships had to be completed over several years in order to spread the cost, and only small squadrons were able to put to sea each year.

In England, things were a little better, but new building of ships was at a minimum: the budgeting of new building was extremely complex, since the Ordinary and sea service budgets for the Navy were supposed to provide what was needed for wear and tear and the replacement of ships lost in service. They did not however provide for significant new building programmes, which were (in theory) to be financed from the Extraordinary budgets which might be voted from time to time by Parliament. In practice, during the first half of the 18th century, these were only occasionally, and reluctantly voted: the Extraordinary budget for 1733 was £104,003, but this was probably an exceptional amount to finance a number of vessels built to the 1733 Proposals (see below); in 1734 and 1735 no money was voted at all under this heading; there was a modest concession in the following three years, with £30,167 voted in 1736, £50,000 in 1737, and £40,000 in 1738; between 1739-1749 the budgets were again nil. While it is true that the Navy Board "cheated" by using funds from the Ordinary, budgets were nevertheless tight. However, the nation was at peace, as it had been to all intents and purposes for a quarter of a century, and there seemed little reason to authorise large expenditure on new ships.

Ships at this time were built to approved designs, codified in what were known as the "Establishments". Following the Treaty of Utrecht, a new Establishment was approved in 1719, laying down the principal dimensions which were to apply henceforth. The previous Establishment, dating from 1706, had been the first systematic attempt to standardise shipbuilding for the Navy, but it had been introduced rather hastily; in time it became apparent that it was not ideal, and that a new Establishment was called for. This was brought about in part by the attempt made in 1716 to introduce a new and more rigid Establishment for guns, which did not take fully into account the ability of individual ships to bear them: despite the Establishment, by no means all ships of the same class were yet built to the same dimensions, and as vessels aged their weight of guns, in any case never rigidly standardised at this time, frequently had to be reduced. But what was also apparent in the 1719 Establishment was a desire to extend the degree of standardisation: while the earlier Establishment had confined itself to laying down only the principal dimensions of ships, the new Establishment ratified in 1719, while making only relatively minor changes to these principal dimensions, laid down in far more detail how ships were to be built, since it specified many minor dimensions, and scantlings as well. The principal dimensions laid down in all these Establishments are given on pages 37-39.

This was in effect a recipe for disaster: with no new monies being voted, with Establishments which expressly forbad any experimentation, and with a Surveyor of the Navy (Sir Jacob Ackworth) who had been appointed in 1715 but who was to remain in post until his death in 1749, ship design for the Navy was in effect frozen. For the first few years no doubt little change was necessary, but as time went by it began to be apparent to the Admiralty that some changes had to be made: Ackworth was growing older, and both the French and the Spanish were beginning to rebuild their fleets. French vessels in particular tended to be significantly longer for the same number of guns. Accordingly, in 1732, the Admiralty called for suggestions from the Master Shipwrights of the Dockyards as to what changes might be necessary. At the same time, a new Establishment for guns was being discussed, essentially aimed at increasing by one calibre the weight of metal on each deck; naturally this demanded some design changes, especially in breadth and length. In the event, the Master Shipwrights were unable to reach any consensus: their differing suggestions are shown on page 40, but none were sufficiently radical for the Admiralty, and what came to be known as the "1733 Proposals" were never ratified by the King in Council, but at least they allowed a degree of freedom in designing new ships which (in theory) had not been available within the rigid framework of the 1719 Establishment.

This description is necessarily something of a simplification: while it is true that there was no programme of planned innovation or renewal of the fleet during the interwar years, it should not for all that be supposed that all experimentation was banned. As the *Remarks* show, there were in fact a large number of minor changes being made.

The situation in Holland was complicated by the fact that there was no single centralised body responsible for building or arming the fleet: there were five independent Admiralties, each responsible for building ships for the country's defence, but to no standardised design. The most important of these was Amsterdam, followed by the "*Maze*" (the Maas, or Rotterdam), but it was difficult in peacetime to persuade the Provinces to vote monies for warships.

Holland was in the middle of a decline engendered by the disastrous wars of the 17th century against England; she had lost her dominance of the spice trade, and was gradually losing her position as the pre-eminent nation trading with the Baltic. The coffers of the Provinces were empty, and the fleets of the Admiralties were rotting at their moorings. English shipwrights had been recruited at Amsterdam Dockyard, where 100 years previously Holland had led the world in shipbuilding, and most of the Navy was little changed from the 17th century.

In an excellent book on the period by J.R. Bruijn, aptly entitled *De Admiraliteit van Amsterdam in Rustige Jaren, 1713-1751* ("The Amsterdam Admiralty in the Peaceful Years"), the author describes in detail the problems which beset Dutch shipbuilding during this era of gradual decline.

History books tend to pass over these years as a brief hiatus in a century better-known for its great wars, and naval historians find little of interest to report. Few major new books were published on naval architecture between 1717 (Sutherland and Middagten) and 1746, when Bouguer's *Traité du Navire* appeared. It would be tempting therefore to assume that with shipbuilding in the doldrums and public interest in the Navy probably lower than at any other time in the 18th century, nothing new was being developed in the realm of shipbuilding. As Blaise Ollivier's manuscript reveals, nothing could be farther from the truth ....

The Ship-builders Assistant:

OR, SOME

ESSAYS

Towards Compleating the Art of

Marine Architecture:

VIZ.

I. A General Introduction, wherein is consider'd the Solid of Least Resistance, so far as relates to the Formation of a Ship's Body, *&c.*

II. Observations for Regulating the Price of Timber, taken from the Proportion of its different Dimensions; with Estimates of the Value of Oak Timber, and several other Materials relating to Naval Stores.

III. Rules for Building the Hull of any Sort of Ships. To which is added the *Scantling* or *Measuring* of Ship-timbers, and some Directions about Moulding them.

IV. A New Method for finding the Tunnage of any Ship.

V. Rules for Proportioning the Rigging.

To which is Annexed,

An Explication of the Principal Terms used in this Art.

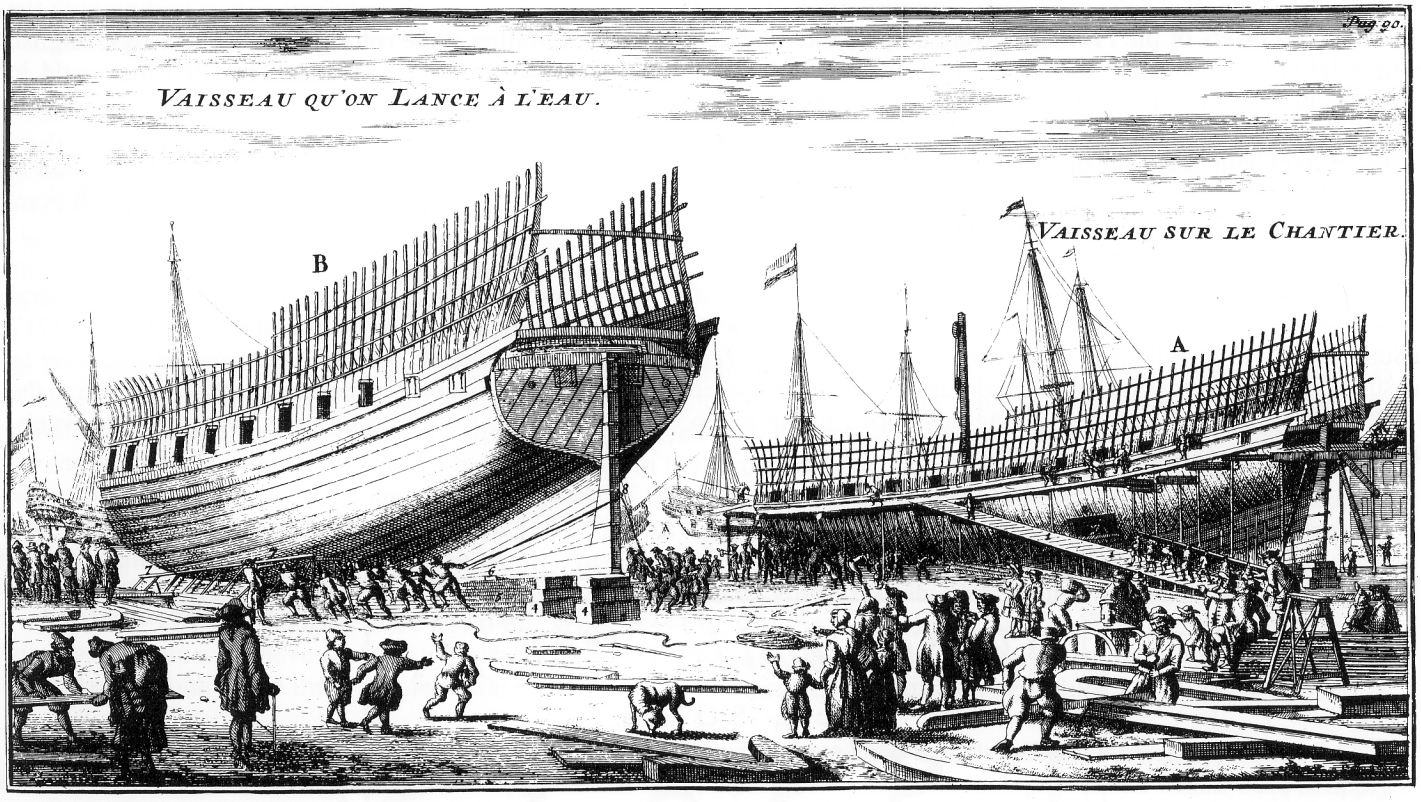
The whole Illustrated with many Schemes *proper to each Part, most of them from* Copper Plates.

By William Sutherland, *Shipwright and Mariner.*

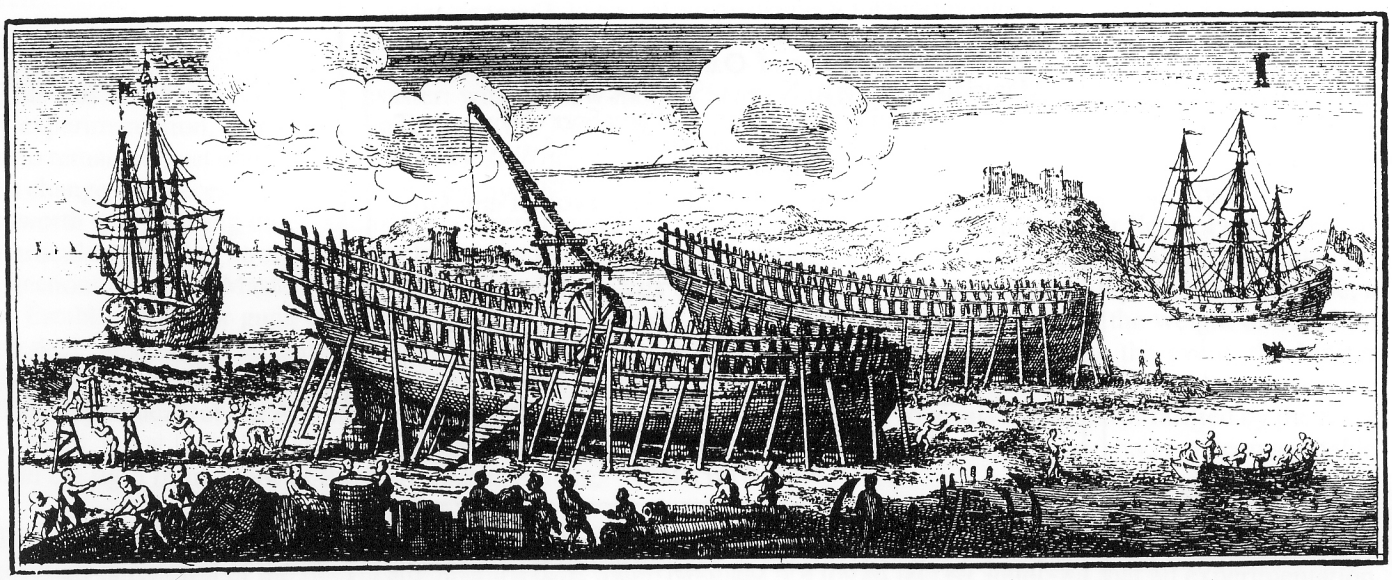
LONDON:

Printed for R. Mount on *Tower-hill*, A. Bell at the Cross-keys and Bible, and R. Smith under the *Royal Exchange, Cornhill.* 1711.

3. *Title page of the first edition of William Sutherland's* Ship-builders Assistant, *the first English book on shipbuilding to discuss the structures of ships in any detail. (Private collection)*



4. *View of a dockyard from* L'Art de Batir les Vaisseaux *of 1719. Published anonymously, it is in fact a version of Allard's* Nieuwe Hollandsche Scheepsbouw *of 1695. The book contains considerable detail on shipbuilding, but it relates to Dutch rather than French practice, and for the second half of the 17th century. By 1737 it would have been obsolete. Note the launching of ships bow-first. (Private collection)*



5. *Vignette from Hoste's* Théorie de la Construction des Vaisseaux *of 1697, a book with which Ollivier would certainly have been familiar. The book concentrates on the mathematics of ship design and tells us nothing about how they were built. Note that in France at this time ships were also launched bow first in certain yards. (Private collection)*

6. Published writings on shipbuilding

When examining the published literature on shipbuilding and naval architecture, it must at once be recognised that, at least until the 19th century, the sum total of published writings is extremely small. Apart from a number of manuscripts which were not intended for public circulation, and were to remain unpublished until this century[2], the following list covers all the important 18th century writings in English, French and Dutch, in chronological order of publication of the first edition (full bibliographic details of these books are given in Appendix II on pp. 341 *et seq*):

1643	Fournier	*Hydrographie*
1664	Bushnell	*The Complete Ship-Wright*
1671	Witsen	*Aeloude en hedendaegsche Scheeps-bouw*
1677	Dassié	*L'Architecture navale*
1678	Anon.	*Hollandsche Scheepsbouw*
1688	Renau d'Éliçagaray	*De la théorie de la manœuvre des vaisseaux*
1695	Allard	*Nieuwe Hollandsche Scheepsbouw*
1697	Hoste	*Théorie de la Construction des Vaisseaux*
1697	van IJk	*De Nederlandsche Scheeps-bouw-konst open Gestelt*
1706	Hardingham	*The Accomplish'd Ship-Wright and Mariner*
1711	Sutherland	*Ship-builder's Assistant*
1717	Sutherland	*Britain's Glory: or, Shipbuilding Unvail'd*
1731	Pitot	*La Théorie de la Manœuvre des Vaisseaux*
1746	Bouguer	*Traité du Navire*
1752	Duhamel du Monceau	*Élémens de l'Architecture Navale*
1754	Murray	*A Treatise on Ship-building*
1757	Udemans	*Korte Verhandeling van den Nederlandschen Scheepsbouw*
1757	Zwijndregt & de Ruiter	*Verhandeling van den Hollandschen Scheepsbouw*
1768	Murray	*Sixty Gun Ship*
1771	Duranti de Lironcourt	*Instruction Élémentaire et Raisonnée sur la Construction Pratique des Vaisseaux*
1773	Euler	*Théorie Complète de la Construction et de la Manœuvre des Vaisseaux*
1776	Du Maitz de Goimpy	*Traité sur la Construction des Vaisseaux*
1777	Hutchinson	*A Treatise on Practical Seamanship*
1779	Chapman	*Traité de la Construction des Vaisseaux* [French translation of *Tractat om Skepps-Byggeriet* (1775)]
1781	Stalkartt	*Naval Architecture*
1783	de Juan	*Examen Maritime* [French translation of *Examen Maritimo* (1771)]
1783-7	Vial du Clairbois (ed.)	*Encyclopédie Méthodique: Marine*
1784	Gordon	*Principles of Naval Architecture*
1787	Vial du Clairbois	*Traité Élémentaire de la Construction des Vaisseaux*
1788	Anon.	*The Shipbuilder's Repository*
1805	Steel	*The Elements and Practice of Naval Architecture*

The above list is not quite exhaustive, but no major 18th century publication has been omitted. The inclusion of the last entry, Steel, is justified by its importance, even though it did not appear until 1805. As can be seen, the list is relatively short: 31 titles in all, with scarcely 5 each of any importance either in English or in Dutch. And when we examine the content of these books, a notable gap is immediately apparent: few of them tell us more than superficially how ships were actually built, the authors preferring to concentrate either on the theory of hydrostatics and/or hydrodynamics (Hoste, Bouguer, Euler, Pitot, Maitz du Goimpy, Juan), or on how ships should be built in terms of their lines or other notional ideals (Chapman, Duhamel du Monceau, Vial du Clairbois, Stalkartt). Thus, in most of these titles, we look in vain for details of the compositions used to pay the hulls below the waterline, of the methods of fastening timbers and assembling frames, of the construction of dock gates and the means of docking and undocking ships – in fact, all the mundane practicalities of building and maintaining what were the largest and most complex edifices hitherto undertaken by man.

2. Notably Deane's *Doctrine of Naval Architecture*, written in 1670, published by Conway Maritime Press in 1981; the anonymous *Treatise on Shipbuilding* written about 1620 and published in 1958 by the Society for Nautical Research; and another manuscript by Blaise Ollivier recently published by Éditions Oméga, Nice.

An exception might reasonably be claimed in the case of the *Encyclopédie Méthodique*, where Vial du Clairbois, drawing freely (and somewhat plagiaristically) from other authors, includes a number of articles which are extremely informative of mundane details: the article "*Construction*" (drawn from the work of De Gay), and the article "*Perceur*", are two examples. But there remains a fundamental difference between all these books and Ollivier's *Remarques*: they are not intended to be read by shipwrights; the audience is the educated "officer and gentleman", the sea officer perhaps, but the humble mechanic never.

These comments apply for the period covering the the whole of the 18th century; but when we examine specifically the works which appeared before Blaise Ollivier's visit to England in 1737, the paucity of published information available on how ships were actually built is striking: for England, Bushnell and Hardingham can effectively be disregarded, leaving only the two books by Sutherland, which probably relate more to merchant practice than to that of the Royal Navy. In Holland, the works of Witsen, van IJk and Allard contain information which is primarily of relevance to the 17th century, there being nothing at all for the first half of the 18th century. The same comment applies to France, where only Dassié provides very much of interest, and this, once again, for the 17th century.

The *Remarques* thus provide a unique insight into shipbuilding techniques in England and in Holland (and indeed France), in the period preceding the Seven Years' War. I would however go further than that, and state that they are, to my knowledge, not only the most detailed study ever written about this period, but they also constitute the most meticulous account of the structures and technology of shipbuilding written at any time in the 18th century, and in any language. It is true that there are other important French manuscripts, including several by Blaise Ollivier, one by Bigot de Morogues, and another by Pierre Morineau[3], and no doubt others of which I am unaware, but none of those which I have seen stand comparison with Blaise Ollivier's *Remarques*, save perhaps Ollivier's own *Traité de Construction* in the form of a dictionary, to which I have already referred, and of which a small part appears in translation at the end of this book. But this treatise tells us only about the French Navy of the time.

It has to be said that such arcane details were not to the taste of the reading public in this first half of the 18th century: many older shipwrights, even those working in the Royal Dockyards, were barely literate, and certainly few if any of the artisans could read or write; moreover, the age of Diderot, when men of letters took an interest in the crafts and skills of their social inferiors, had not yet dawned. By the same token, the men who built ships for their living paid more heed to practical example than to book learning, and could have had little inclination to read about the subject.

There is also, no doubt, a further reason why so few books on shipbuilding were published at this time, and that is the question of professional secrecy: most shipwrights were accustomed to work to "recipes" of their own devising, usually based on a preferred shape of midship bend and an arithmetical formula or two for extrapolating this shape to the other frames and to other sizes of ships. Such secrets were handed down from father to son, and jealously guarded. While this picture is perhaps a caricature, and more true of the 17th century than of the 18th (and of England or Holland than France), it must nevertheless still have held true for many shipwrights as late as 1737. As Ollivier himself comments (*Remark CXXXIX*), "I have found that all their theory can be reduced to a few working practices, ... which lead to no demonstrated method nor are founded on any principle".

To divulge their secrets in print was tantamount to reducing their unique value in a competitive marketplace. This holds true even for Blaise Ollivier himself, who is remarkable for the objectivity and, dare one say it, the scientific method of his observations: none of his writings were ever published, and it is doubtful if he ever intended them to be: one of his manuscript treatises is inscribed as being dedicated "for the instruction of his children"[4].

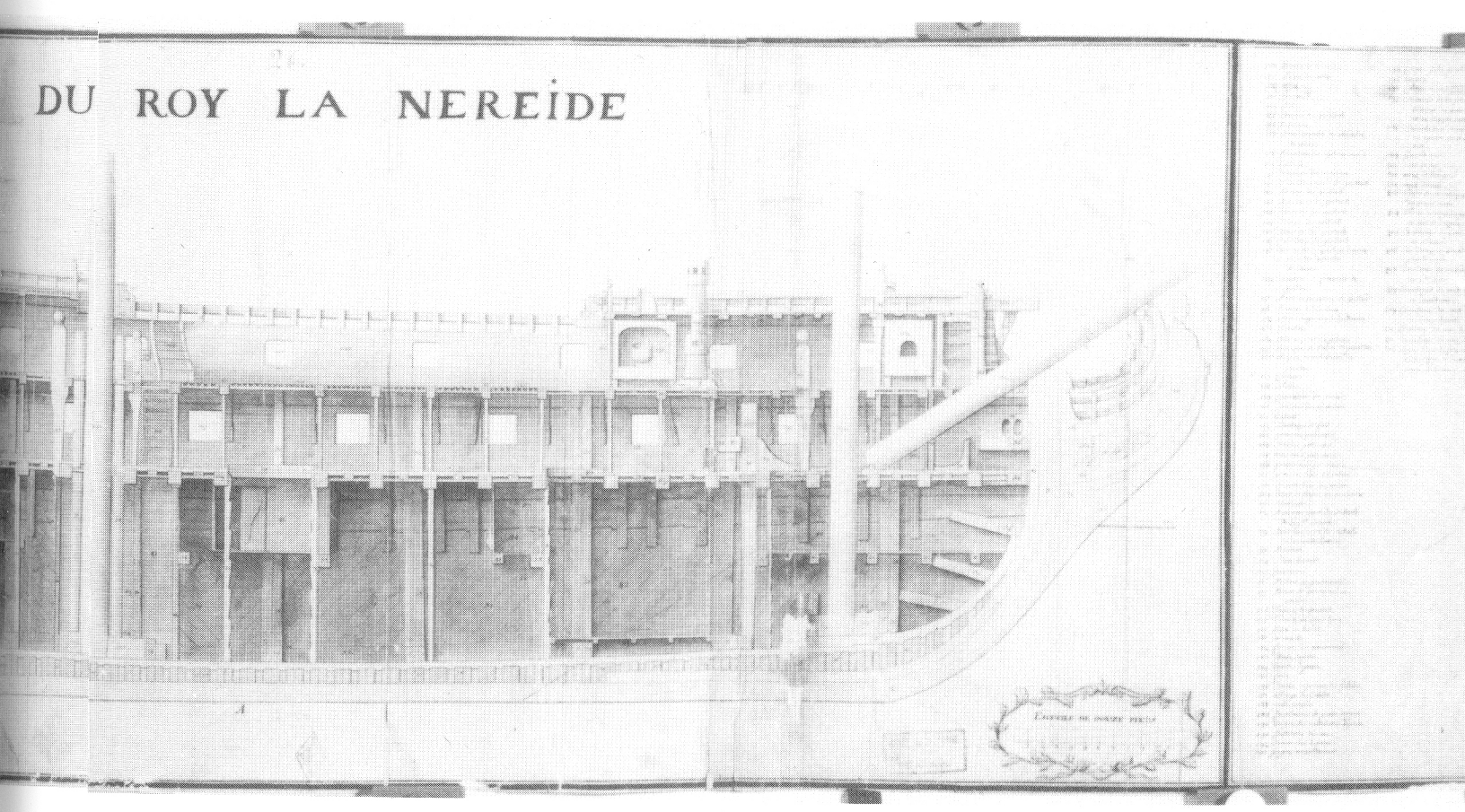
3. All of which we hope to publish in due course.
4. See on this subject Duhamel du Monceau (*Élémens de l'Architecture Navale*, 1752): "Since there are ships of very different moulds which have given satisfaction to sailors, & one shipwright would work to find a method to copy a ship of such and such a mould, while another shipwright would find a way to copy a ship of another mould, this resulted in very different methods; each shipwright was attached to his own: he claimed it to be the best, & revealed it only to such of his children as were destined to work in the yards. This mystery, this secrecy, constituted a great barrier to the advancement of shipbuilding; & we see with pleasure that it is disappearing as shipwrights become more skilled in the theory of their art. We have men today who are well-versed and who do honour to their profession, & who are above the reproaches which are made of others."

7. The Originality of the *Remarques*

The question of the originality of the Ollivier manuscript has been touched on in part in the preceding section, and it is always dangerous to claim originality for any author: I have little doubt that any such claim made here will be instantly refuted by readers who have found similar information in contemporary archives which I have not seen. A recently published book, describing the building of a 74-gun ship in 1753, claimed (admittedly on the jacket) that "the techniques and the building sequence ... are, therefore, valid for ships built for nearly a century from 1715 to around 1810". How far this is incorrect will be immediately apparent to anyone reading Ollivier's *Remarks*, and it seems appropriate therefore, in the light of such commonly held misapprehensions on the subject of 18th century shipbuilding, to attempt to list some of the statements which may appear to be surprising:

- Different methods of building were used at Deptford, Woolwich and Chatham;
- Filling frame timbers were not fastened to each other at all, but only held in place by the fastenings of the planks of the hull and the ceiling; moulded frames were only fastened together by three treenails at the scarph chocks; even the timbers forming the riders were not fastened together;
- Frame timbers were sometimes fashioned from timber which curved in the fore-and-aft plane, to avoid cutting into them when making the gunports;
- Frame timbers did not have to be made from compass-timber;
- No nails or bolts at all were used to fasten the planking of the hull, including the wales: only treenails were used;
- Carved work was protected from striking seas by "guard-irons" – a framework of iron bars surrounding them;
- Iron knees and standards were being used on English ships;
- There was no false post laid against the sternpost;
- Deck beams were left wider where they met the ship's sides to reduce the angle of the lodging knees;
- Pillars in the vicinity of the capstans which had to be shifted before the bars could be used required the use of a screw-jack to raise the beams enough to remove them;
- Drop-pawls were already in use on capstans in 1737;
- Gammoning fishes were not fitted to bowsprits made in Chatham, although they were used in other Dockyards;
- English ships were never rebuilt: when the frames were rotten, they were broken;
- There was no cable-tier on English ships: the cables were simply stretched out along the orlop;
- The inside of English ships was not painted at all in the between decks;
- Three different methods of shipbuilding were being used in Holland in 1737;
- Some Dutch ships were built with no difference in draught fore and aft, and others even with greater draught forward;
- Dutch ships had no orlop-beams;
- Ships built in Flushing and Veere were sunk for a year before completion, in order to preserve the timbers; the *Middelburg* was sunk three times for this purpose over a period of 30 years;
- Ships in Ordinary in the same Dockyards were roofed over with a tiled roof to preserve them from the weather;
- Some Dutch ships had adjustable mast-steps, moved by a screw, in order to alter the rake at sea.

Having discussed the originality of the manuscript, it may now be appropriate to look at the author of the *Remarks*.



6. *Blaise Ollivier's draughts of the* Néréïde, *launched in 1724. (Courtesy Musée de la Marine, Paris)*

In 1720, the Olliviers, father and son, were transferred to the Royal Dockyard at Rochefort, where Joseph was charged with supervising the building of the *St Philippe* (74) and the *St Louis* (62), both ships having beeen designed by P. Masson, who died in that year. They arrived in Rochefort on December 1st 1720. Shortly afterwards, the young Blaise Ollivier was granted the rank of Assistant to his father: this was a mark of approbation on the part of the Comte de Toulouse[7], following the successful launch of the *St Louis*. In the same year, Blaise was sent on a mission of inspection of the Forest of Lagrée, in Languedoc, which belonged to the Archbishop of Narbonne. This forest contained timber suitable for masts.

Joseph Ollivier, for his part, was charged with the design and building of a powerful frigate, the *Néréïde*: the vessel was laid down in 1722, and launched on March 26th 1724. Preserved in the Archives of the Musée de la Marine in Paris (Ref. J 9q-6963) are the beautifully executed pen-and-wash draughts, complete with a numbered key, of the *Néréïde*[8], in Blaise Ollivier's hand .

In May and July of the same year, Blaise Ollivier submitted two reports on shipbuilding timber. On August 12th 1724, father and son left Rochefort for Brest; this was a promotion in terms of the hierarchy of the Dockyards, Brest being the premier post, and may also have been a personal promotion for Joseph Ollivier, with the title of *Maître-Constructeur*[9].

7. Acting Minister, and chairman of the *Conseil de la Marine*.
8. See J. Boudriot: *The History of the French Frigate*, shortly to be published, for a minute examination of this draught.
9. i.e. Master Shipwright. The exact date of this promotion is unknown; it is uncertain whether it preceded his move to Rochefort, or only when he moved to Brest, although the former seems more likely. During the time that he was still at Toulon, he had written a paper entitled *Collection or Mirror of Shipbuilding: Containing all that is Necessary for the Perfect Instruction of the Ship-Wright*. This manuscript, 340 folio pages in length and accompanied by a large number of Plates, was recorded in 1844 by P. Levot as being in the Library of Brest Dockyard, but was marked as "Missing" in de la Roncière's catalogue of the manuscript collection published in 1904. This is particularly regrettable, for it must have been a document of enormous interest.

In 1725, Blaise Ollivier took off the lines of ship of the line *Le Lys*, built to the draughts of Blaise Pangalot[10]. The vessel, which was built in 1705, was so highly regarded that she was almost entirely rebuilt in one of the dry docks at Brest, so that Blaise Ollivier had every opportunity to take off her lines with complete precision; unfortunately, his draughts have not survived.

In 1727, the Olliviers, father and son together, were charged with the design and building of a light frigate, the *Astrée*. The following year, in 1728, Blaise Ollivier was ordered to sea, as was customary in France as part of the training of all shipwrights[11]: he completed a commission on board a 74-gun ship designed by Pangalot, the *Achille*, built in 1705 in Brest and refitted in 1714. The ship fitted out in Brest, and was paid off at the end of September in Toulon. She evidently possessed all the qualities demanded of such a vessel, as a report written by Blaise Ollivier at the end of the six month commission testifies. This remarkably lucid document, entitled "*A Memorandum, or Observations on Shipbuilding*", gives a fascinating analysis of the properties desirable in a ship of war and of the means of attaining them through good design; he is also unstinting in his praise of the *Achille*.

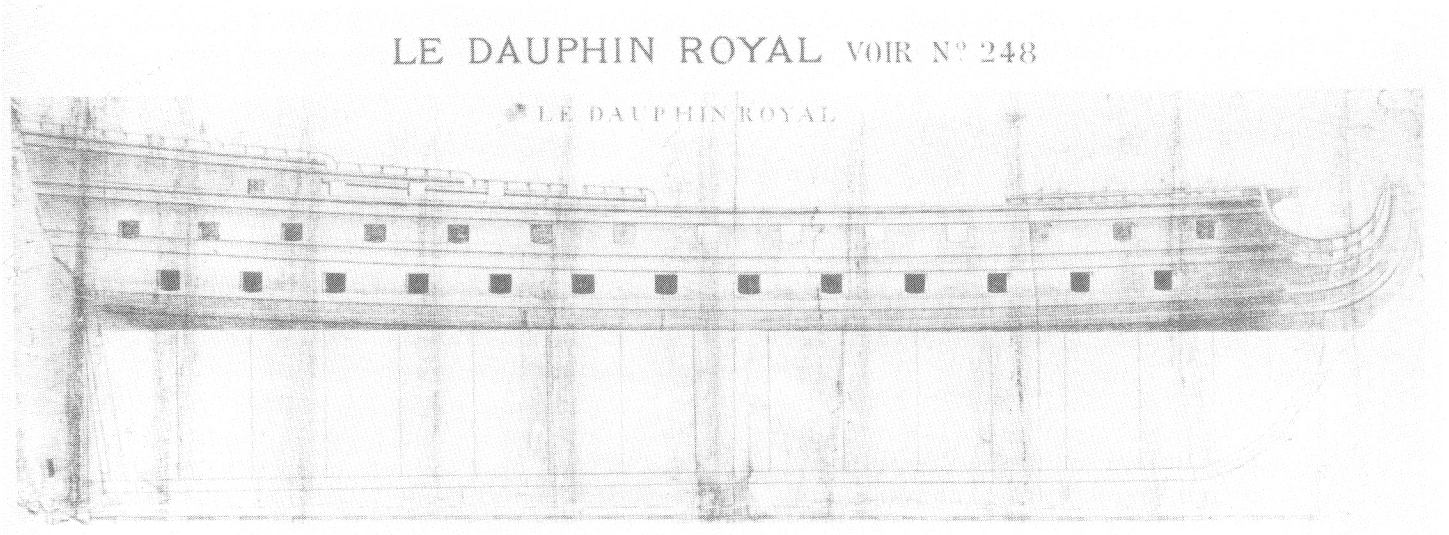
It is reasonable to suppose that the young Blaise Ollivier was influenced by the two designs of Blaise Pangalot with which he had become so familiar, and this view is confirmed to some extent by the manuscript rules for lofting the frames of ships and frigates, written in his own hand, and forming part of two treatises on shipbuilding preserved at the Musée de la Marine in Paris. Further evidence for this may be found under the article *Acculement* (deadrise) in a third treatise on shipbuilding by him, in the form of a dictionary[12], where he refers to Pangalot: "*The common opinion is that the greater the deadrise in ships of war and frigates, the more fit this makes them for sailing close to the wind, for giving the vessel a great draught of water has the effect of making her less leewardly. The extreme deadrise in the ships built by Mr Pangalot has been remarked upon. This Builder gave up to 3 feet of deadrise to his ships and even to his frigates, and he was so skilled in placing in the entry and in the run aft that capacity which he did away with by virtue of the steep deadrise that not only were his ships fast sailers, but for the most part they also had a good height of gundeck sill, had easy rolling and pitching motions, and carried their sail well. No other Builder has employed such a great deadrise; many have come close to it and have failed.*" In the whole of this remarkable manuscript, which runs to 1,012 pages, only Pangalot and Gobert are quoted as being worthy of esteem.

In 1729, the Minister of the Navy, Maurepas, entrusted to the two Olliviers the design and building of a 64-gun ship, the *Fleuron*. The order is dated April, and exactly a year later, in April 1730, the ship was launched. She proved to be an extremely successful ship, and by good fortune an illustrated manuscript on the vessel, written entirely in the hand of Blaise Ollivier, has survived in the archives: it gives a valuable insight into this period of French naval architecture[13].

In 1733, Blaise Ollivier was ordered to carry out inspections of the forests of Lorraine, and in the following year he was entrusted with the design and building of two bomb vessels, the *Salamandre* and the *Tonnante*. It is clear that by now his talents were becoming officially recognised, and he appears to have enjoyed the confidence if not the direct patronage of Maurepas, for in 1735 he was given responsibility for the design and building of a 70-gun ship, a singular honour for a man so young; the ship, the *Dauphin Royal*, was recognised as one of the most successful of that class ever built. In confirmation of the favour he enjoyed, although probably also coinciding with the death of his father Joseph, Blaise Ollivier was promoted in 1736 to the position of Master Shipwright at Brest, and thus to the most senior post in the shipbuilding hierarchy in France. He was clearly becoming recognised as a man of singular talent.

In 1737, Maurepas made a decision which at first sight might seem unusual: he charged Blaise Ollivier with a secret mission, to visit the dockyards of France and Holland. Ollivier was after all building the *Dauphin Royal*, and had many other responsibilities at Brest. However, as the Dockyard correspondence for Brest shows, an experiment was being made to test whether spreading the building over three years might not allow the timbers to season better: an exchange of letters in April 1736 makes it clear that this was at least being advanced as a "new method of building": "*We have followed the orders which you have given, my Lord, in the manner of building the* Dauphin Royal *and the* Superbe. *The frame timbers of the said ships were raised during the second half of 1735, and we have taken every possible precaution against their*

10. Biaggio Pangalo, known as *Maître Blaise*, was a Neapolitan by birth; he was "discovered" by de Tourville and enjoyed the patronage of no less a person than Duguay-Trouin; he went to work at Brest Dockyard from 1684 until his death in 1722. A shipwright of real talent, he took over with distinction from the two Hubacs (father and son).
11. The Regulations of March 1671, ratified later by the Order in Council of 1689, specified that "*on every ship there will be embarked a good shipwright, who shall be instructed to observe carefully everything which concerns his profession while the ship is at sea, and to keep a journal thereof....*"
12. Preserved at the Service Historique de la Marine, Vincennes, and recently published for the first time by Éditions Oméga, Nice. Part of it is translated in the Glossary of Shipbuilding Terms to be found on pp. 349 *et seq.* of the present volume.
13. The *Fleuron* manuscript is also reproduced in full in the same publication by Éds. Oméga, Nice.



7. *Draughts of the* Dauphin Royal *(70), built by Blaise Ollivier in 1735. (Courtesy Musée de la Marine, Paris)*

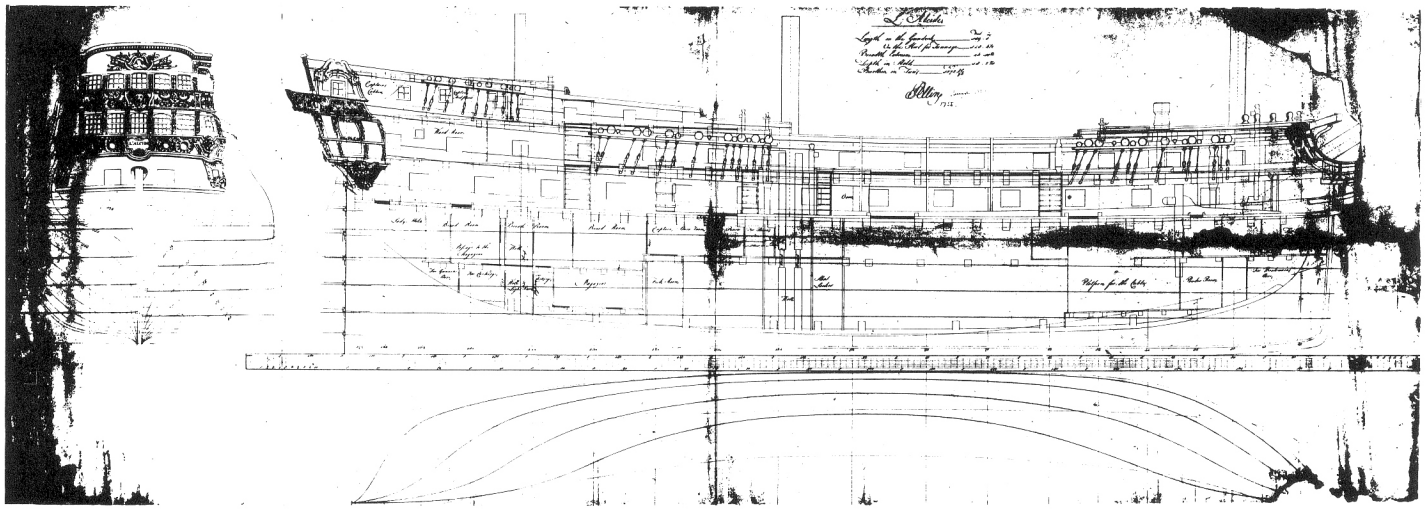
being spoiled and that they will dry out quickly. Mr Ollivier has cut spaces between the timbers, without for all that in any way diminishing their strength, so that the air may circulate between the joint lines where the timbers ordinarily meet. Mr Hélie has followed the same method."[14] There is little doubt that shortage of funds was at least as powerful a motivation for delaying the completion of the vessel, but be that as it may, it is evident that the Minister viewed Ollivier's mission to England and Holland as being of paramount importance, and the need to further season the timbers of the *Dauphin Royal* provided at least a plausible excuse.

It is interesting to note the secrecy which surrounded the mission: not even Ollivier's superior, Bigot de la Mothe, was given the details, and an elaborate subterfuge was evidently worked out between the Minister and Ollivier: in a letter dated March 11th 1737, Bigot de la Mothe writes to Maurepas, saying "*I have told Mr Ollivier, my Lord, that he may absent himself from the Dockyard for his personal affairs, in accordance with the permission which he had requested of you*", this following a letter from the Minister to the Intendant (March 3rd), in which Maurepas says: "*I have authorised Mr Ollivier to absent himself for a journey which I have approved, during the period while the* Dauphin Royal *is to remain on the stocks, so that he may take advantage of this permission.*"[15] It is not entirely clear whether or not the Intendant, Bigot de la Mothe, was being kept in the dark, or whether it was for reasons of discretion that the correspondence between Versailles and Brest between March and July 1737 makes no mention of Ollivier's mission to England. There is a brief hint, in a letter dated April 14th, when Maurepas tells Bigot de la Mothe that he has *spoken* with Ollivier, but apart from this oblique reference, only at the end, in a letter dated July 28th, does Maurepas mention the fact that Ollivier is in Holland "*where I have asked him to enquire as to how the Dutch preserve their shipbuilding timber*", and this certainly suggests that the true facts behind Ollivier's mission to both England and Holland were being kept as discreet as possible.

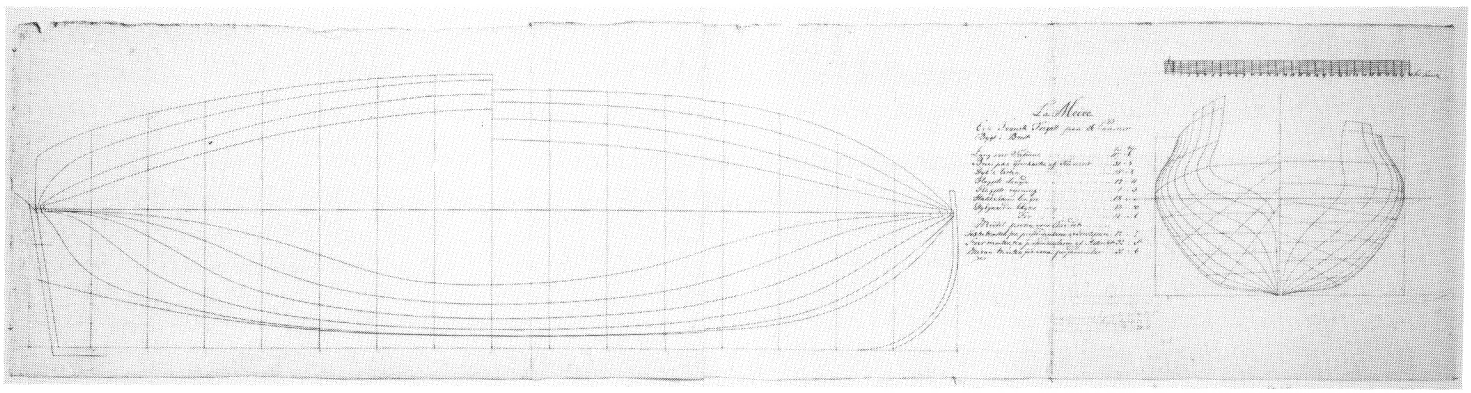
The instructions he was given appear not to have survived, but according to Levot, from papers which were evidently still extant in the 19th century[16], we learn that Ollivier left Brest on March 9th 1737, and went to Paris to receive his instructions verbally from Maurepas himself. From there went on to London where he arrived on April 10th. During the period of three months which he spent in England he devoted the daylight hours to visiting the dockyards, and a large part of the night to writing his Remarks, which were dispatched to the Minister by routes which they had agreed upon together. His mission to Holland encountered fewer obstacles. The question of his mission is discussed more detail below, in section 11, so we need not dwell on his voyage here.

Ollivier stayed in England until about the end of July 1737, going to Holland in August. He completed his work there by the end of that month, and appears to have returned to Paris, where he stayed for some considerable time: Dockyard correspondence indicates that he was still there at the beginning of December, although his return to Brest was then imminent[17]. By February 1738 he was however back in Brest, for on the 16th of that month he bought a house, on the Place

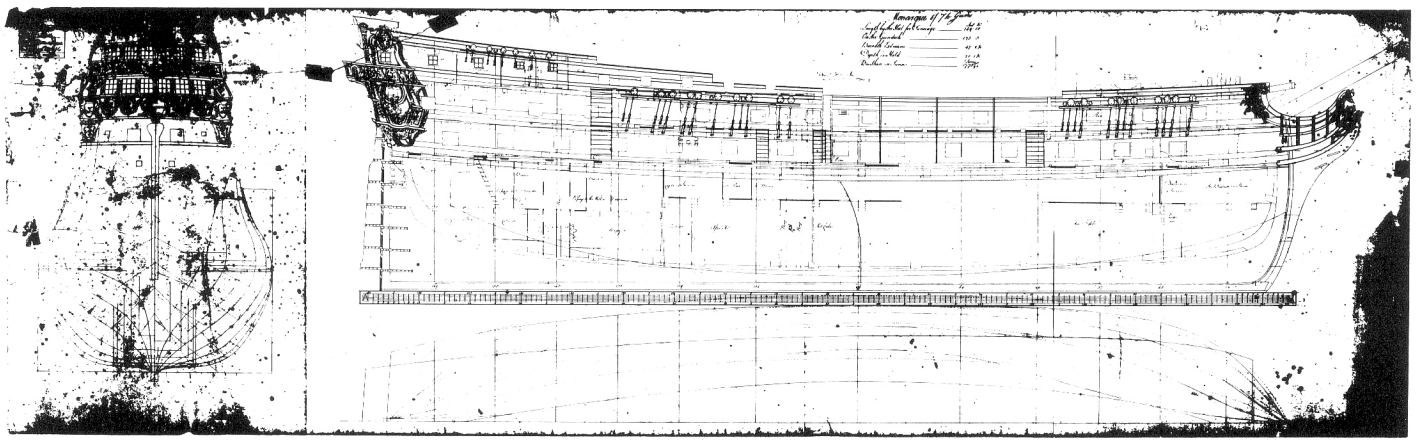
14. Lettres de l'Intendant à la Cour, Series 1E515, September 19th 1736.
15. Lettres de la Cour à l'Intendant de Marine, Series 1.E.86
16. Quoted by P. Levot in the article already referred to.
17. Lettres de la Cour à l'Intendant de Marine. Series 1.E.86 (December 1st 1737).



8. *Draughts of the* Alcide, *built by Blaise Ollivier in 1742.*
(Courtesy National Maritime Museum, Greenwich)



9. *Draughts of the* Médée, *built by Blaise Ollivier in 1744.*
(Nº F.30, Courtesy Danish National Archives, Copenhagen)



10. *Draughts of the* Monarque *(74), built by Blaise Ollivier in 1745.*
(Courtesy National Maritime Museum, Greenwich)

de la Médisance in Brest[18]; it cost 8,000 *livres*, a considerable sum in those days: is it unreasonable to speculate that this was made possible by payments for "special services"? Interestingly, the vendor was a widow, a certain Claire-Luce Lemaître *née* Pangalot, presumably the daughter of "Maître Blaise".

Following his return to Brest, his responsibilities were increased: in 1739 he was appointed to the "*direction générale des travaux du port de Brest*", a new post created specially for him. It is possible that this may have been in part a device to secure him better financial rewards, but plans were afoot to undertake major civil engineering works in the Dockyard, notably with the construction of new dry-docks at Bordenave and later at Pontaniou, and Ollivier's talent was such that he was to take responsibility for their design and building over several years.

The scale of these civil engineering works was considerable, and they pay tribute to the abilities of Ollivier in more than one domain[19]. These engineering works are discussed separately in section 9 below.

At the same time, Ollivier completed the building of the *Dauphin Royal*, launched on October 13th 1738, and built a 64-gun ship, the *Mars*, launched two years later. In that year he started work on the *Royal Louis*, a three-decker armed with 124 guns, and the largest ship ever built in France. Much admired at the time, she was unfortunately destroyed by fire while still on the stocks in December 1742. In the same year that he started the *Royal Louis*, 1740, Ollivier also built the *Médée*, the draughts of which are reproduced opposite. This was the first frigate to carry a full battery on the upper deck with the lower deck (in fact an orlop, since it was a shifting deck, able to be taken up), situated about the waterline, left as a berth-deck and unarmed. This was to become the standard design for all frigates built thereafter, and it was rapidly copied by all the maritime nations of Europe. It is thus to Blaise Ollivier that we owe the design of the "modern" frigate[20].

1742 marked the keel-laying of a 64-gun ship, the *Alcide*; captured by the Royal Navy, her plans are preserved in the National Maritime Museum and are reproduced opposite. Note the peculiarity of the vertical stem and sternpost, with no rake at all, for which an explanation can be found in Duhamel du Monceau's *Élémens de l'Architecture Navale*: in the 17th century this rake was very considerable, so that the keel measured only two thirds of the length overall. It was gradually diminished, until by the middle of the 18th century it was no more than one twelfth of the length overall. The reduction in the rake secured a number of advantages, which Duhamel du Monceau discusses at length, adding: "*it was what determined Mr Ollivier to do away altogether with the rake of the stem and sternpost in the* Mars *and the* Alcide"[21]. It is perhaps worth commenting that this innovation was not influenced in any way by either English or Dutch practice, where the rake was greater than was usual in French ships anyway (see *Remark CXXVII*, p. 134).

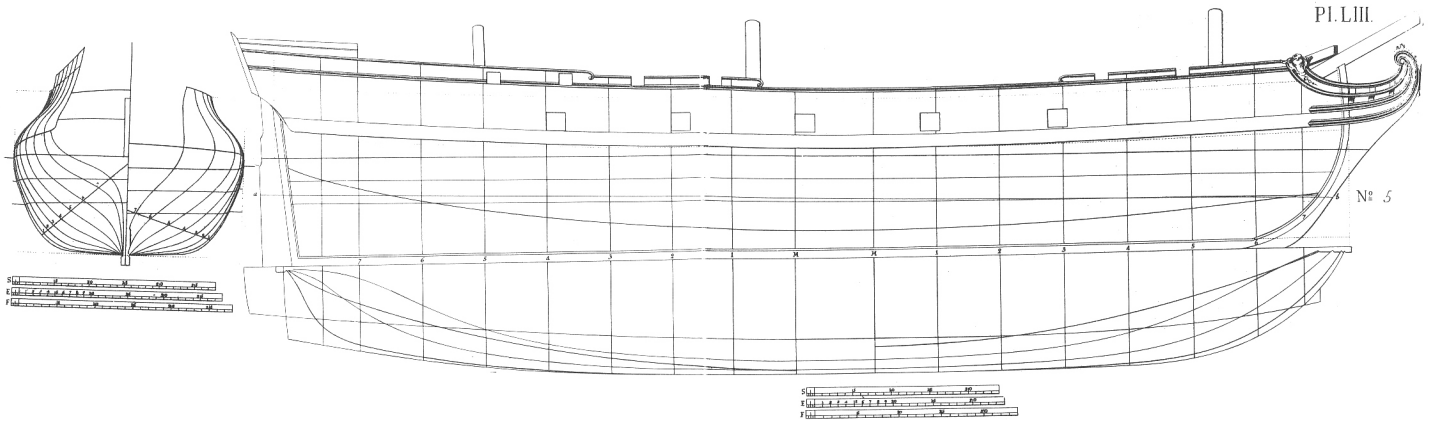
Ollivier was also busy instructing a group of young shipwrights who were all to make a name for themselves later in the century: J.L. Coulomb, J. Chapelle, Clairin-Deslauriers, and his own eldest son, Joseph[22].

In 1744 Ollivier started work on a store-ship, the *Chameau*, which according to contemporary reports "sailed like a frigate". Her draughts, like those of the *Médée*, are preserved in the Danish National Archives, and were used by Chapman in his famous compendium of plans *Architectura Navalis Mercatoria* (1768). In the same year Ollivier was awarded the signal honour of the Cross of a Knight of the Order of St Louis, an extremely rare distinction for a shipwright.

The year 1745 signalled the arming of the French war machine, and the laying down of three 74-gun ships, the *Monarque*, *Sceptre* and the *Intrépide*. The plans of the first-named have survived in the National Maritime Museum at Greenwich and are reproduced on page 16. There is also a body plan in the Danish National Archives.

Blaise-Joseph Ollivier died on October 20th 1746, aged only 45, probably of consumption (tuberculosis). A letter written by him to the Minister, in the third person, shortly before his death (dated August 22nd), testifies to his energy: "*Sieur Ollivier has served for the last 30 years in the Navy .... although only 45 years old, he has worn out his health in the labours which he has undertaken .... the state of his health leads him to fear for his life.*" A marginal note indicates that he was

18. These details are derived from G.-M. Thomas' thesis referred to above. Archival source: AD29: B.1457
19. It is worth noting that this combination of talents was not unique in the 18th century: Groignard, a distinguished successor to Blaise Ollivier's dual functions at Brest in the second half of the century, carried out the extremely complex construction of the dry-docks in Toulon, where the near absence of tide posed particular problems.
20. For a detailed examination of the originality of this design, see the forthcoming publication by Jean Boudriot, *The History of the French Frigate*.
21. *op. cit.*, 1st edition p. 47, 2nd edition p. 100.
22. Ollivier was married to Suzanne Canévet – the date of the marriage is unknown – and had seven children: according to Thomas (*op. cit.*), these were Louis-Joseph (born 1728, although Thomas gives July 1739, which must be an error); Louis (b. 22.8.1730), François Honoré (b. 13.1.1735), Françoise Louise Suzanne (b. 13.1.1740), Suzanne-Jacquette (who gave a model of the *Royal-Louis*, since lost, to the Minister for the Navy on July 3rd 1796), Joséphine, and Barbe. The eldest son Joseph (1728-1777) was appointed *sous-constructeur* in 1737, at the age of nine, "on account of the services rendered by his father"; this no doubt formed part of the rewards for his mission to England and Holland.



11. *Draughts of the* Chameau *(storeship), built by Blaise Ollivier in 1744, reproduced from Chapman's* Architectura Navalis Mercatoria. *(Private collection)*

awarded a pension (or possibly a single payment) of 1,000 *livres*.

His premature death denied him the fame which would undoubtedly have accrued to him had he lived through the great conflicts of the Seven Years' War. His achievements were recognised by his contemporaries, but have been largely forgotten by history. The great theorist du Maitz de Goimpy wrote of him (in his book published in 1776) "*Finally, in the reign of Louis XV, the celebrated Ollivier appeared. It is to this latter shipwright that we owe the new hull form and deck arrangement of frigates, changes subsequently adopted in England. He perfected all types of ships, and it may be said to his credit that there are well-founded arguments even in his errors, especially if only the guiding principles are considered.*"

His influence, through the young men he had trained at Brest in the 1740's, was to outlast him by a generation, and in the design of the frigate at least, it was felt throughout Europe. He marks the final break with the conservatism inherited from the 17th century, and the dawn of a new age of scientific method in shipbuilding which was to flower a few years later with Bouguer and Duhamel du Monceau. Arguably France's most innovative shipwright, he deserves to be better known, and it is hoped that with this and other planned publications his name will become more familiar to students of 18th century naval architecture.

List of Surviving Papers by Ollivier

The following list has been compiled by Jean Boudriot, and appeared in Ollivier's *Traité de Construction* published for the first time earlier this year (Éditions Oméga, Nice).

Because of the fire at Brest Dockyard in 1742, in which many of Ollivier's personal papers were destroyed, only a very small number of his writings have survived.

Major writings:

By far the most important of these are the following:

- *A Treatise on Shipbuilding* (Musée de la Marine, Ref. B 251). Written in 1743. The manuscript ends with a detailed list of dimensions of the *Dauphin Royal*, and a description of a 56-gun ship built as a privateer in 1744.
- *A Treatise on Shipbuilding* (Musée de la Marine, Ref. B 276). Undated, but internal evidence suggests that it was written some time between 1733 and 1737. This can be deduced from the fact that Article XXXIV refers to 74-gun ships pierced for 26 36-pdrs on the gundeck (the first 74 pierced for 28 guns was laid down in 1737); on the other hand, he describes 68-gun ships as being pierced for 26 24-pdrs, and the first vessel of this type was built in 1733. These facts taken together suggest an earliest and latest date for the manuscript as indicated.
- *A Treatise on Shipbuilding* (Service Historique de la Marine, Vincennes, Ref. 310). This manuscript takes the form of a dictionary, and has recently been published by Éditions Oméga, Nice. Roughly 10% of it appears in translation on pp. 349 *et seq.* of the present volume. From the fact that it treats at some length the bomb-ketch, of which Ollivier himself built two in 1734, but makes no reference at all to English or Dutch practices, it is reasonable to suppose that it was written prior to the *Remarques*, in about 1736.
- *The Third Rate Ship of the Line Le Fleuron* (S.H.M., Vincennes, Ref. 273). This extremely detailed description of the 64-gun ship *Le Fleuron* of 1727 has been included in the publication mentioned above by Éditions Oméga, and contains some beautiful pen-and-wash draughts. The manuscript was originally part of the Augustin Normand collection, and was acquired for the S.H.M. relatively recently. It is notable for being the first known example of the calculation of displacement of the underwater hull and the weight of a ship fitted out for sea undertaken at the design stage. There is no doubt that Ollivier was the pioneer of this approach, which he had already advocated in his report on the *Achille* in 1727. The manuscript on the *Fleuron*, written in 1729, is thus a milestone in writings on naval architecture, demonstrating an approach made possible for the first time with the introduction in the latter part of the 17th century of the ship draught. The *Fleuron* was probably Blaise Ollivier's first major design, for by now the role of the father was effectively reduced to that of assistant to his son.
- *Remarks on the Navies of the English and the Dutch* (1737), the subject of this book.

These five documents represent the sum total of all the major writings of Blaise Ollivier which are known to survive. In addition, there are a number of scattered items, of which the following is a provisional listing:

Draughts:

- 1724: *Néréïde* (Musée de la Marine, Ref. J 9q-6963). Described above.
- 1735: *Dauphin Royal* (in Ollivier's own hand). (Musée de la Marine)
- 1740: *Médée*, 8-pdr frigate (Danish National Archives, Nº F.30)
- 1742: *Alcide*, 64-gun ship (National Maritime Museum, Greenwich)
- 1744: *Chameau*, storeship (Danish National Archives, Nº F.162 & G.3107, and Chapman, Plate LIII Nº 5.)
- 1745: *Monarque*, 74-gun ship (National Maritime Museum, Greenwich, and also in the Danish National Archives)

Miscellaneous manuscripts:

- *Memorandum, or observations on shipbuilding* (Rochefort Dockyard Archives, Ref. 1G1). Written in 1727 at the conclusion of Ollivier's commission on board the *Achille*.
- *Memorandum on the building of a 70-gun ship* (Archives Nationales, fonds marine $D^1 3$). Dated February 1735.
- *Memorandum on the building of frigates* (Archives Nationales, fonds marine, D^1 15). Dated November 1743.
- *Letter to the Minister on the situation of Master Shipwrights* dated 31 January 1746. (Archives Nationales, fonds marine, D^1).

Lost manuscripts: (all except the second item mentioned by P. Levot in the article already quoted, and known therefore to exist in 1844)

- *Memorandum concerning the types of timber suitable for shipbuilding*. 16 pp., 4to.
- Draughts of the *Lys*, taken off in 1725.
- *Proposal for the building of dry-docks at Brest*. 8 pp., 4to.
- *Memorandum in which it is proposed to do away with upper futtock riders*. 8 pp., folio.
- *Memorandum on the ballasting of ships in Ordinary* (1738).

In addition to all the items mentioned above, we have come across a large number of letters in various archives, notably those of Brest Dockyard; there are some in the Duhamel Papers, and some in the Maurepas Papers. It is our fervent wish to locate other papers if they survive, and most especially those which were still in the hands of the Ollivier family in the middle of the last century.

Summary Chronology of Blaise Ollivier's Life

1701	Birth of Blaise-Joseph Ollivier (exact date unknown)
1720	Appointed *sous-maître constructeur*, January 12th 1721
1722	Inspection of forests (report dated December 8th 1722)
1724	March 26th: Launch of the *Néréïde* May 14th and July 24th: two reports on shipbuilding timber August 12th: Ollivier and his father seconded to Brest (date unknown): promotion of Joseph Ollivier to Master Shipwright
1725	Taking off of the lines of the *Lys*, built by Blaise Pangalot. Launched in 1705, she was docked in 1725 and rebuilt to her original lines. The Draughts made by Ollivier have apparently not survived.
1726	Taking off of the lines of the *Royal-Louis* by Joseph Ollivier
1727	Design and building of the light frigate *Astrée*
1728	Commission on board the *Achille*
1729	Design and building by father and son together of the 64-gun ship *Fleuron* (ministerial order dated April 5th, building started June 20th)
1730	April 29th: launch of the *Fleuron* July 16th: fitting out completed
1733	Inspection of the forests of Lorraine for shipbuilding timber
1734	Design and building of two bomb ketches, the *Salamandre* and the *Tonnante*
1735	Design and building of the *Dauphin Royal* (74)
1736	Promoted Master Shipwright
1737	Mission to England and Holland March 9th: left Brest April 10th: arrived in England April 12th: visit to Deptford Dockyard April 20th: visit to Woolwich Dockyard after May 10th (English calendar): visit to Chatham Dockyard May: visit to Portsmouth Dockyard May 4th (English calendar): visit to Sheerness Dockyard July 5th: *Remarks on the English Navy* concluded in London August: visits of the Dutch dockyards of Amsterdam, Rotterdam, Flushing, Veere, and Hellevoetsluijs August 29th: *Remarks on the Dutch Navy* concluded in Rotterdam
1738	January (?). Return to Brest
1739	Design and building of the *Mars* (64)
1740	Design and start of the building of the *Royal Louis* (1st Rate, 124 guns), which was destroyed by by fire while still on the stocks in December 1742
1742	Design and building of the *Alcide* (64) Instruction of the young shipwrights Clairin-Deslauriers, J.-L. Coulomb, Joseph Chapelle, and of his elder son Joseph-Louis Ollivier. This continued until Blaise Ollivier's death in 1746 Design and building of the first "true" frigate, the *Médée*
1744	Design and building of the *Chameau*, storeship
1745	Design and start of the building of three 74-gun ships, the *Monarque*, *Sceptre* and *Intrépide*
1746	Death of Blaise-Joseph Ollivier on October 20th.

Joseph-Louis Ollivier

There is no doubt that Blaise Ollivier's eldest son Joseph-Louis Ollivier, who died on January 17th 1777 at the age of 49, having attained to the same title of Surveyor General as his father, was considerably less talented. However, the many ships which he was responsible for building at Brest bear witness to the fact that he was nonetheless a worthy successor to the long line of his shipbuilding forbears. The following list of ships which he built between 1761 and 1772 demonstrates the scale of his activities:

- *Le Citoyen* (74), begun in 1761 and launched August 11th 1764;
- *Le Saint-Esprit* (74), given to the Crown by the Order of the Holy Spirit, begun in 1762 and launched on October 12th 1765;
- *L'Artésien* (74), built in 1764;
- *Le Conquérant* (74), begun January 17th 1765 and floated out on November 26th of the same year;
- *Le Palmier* (74), built in 1766 in one of the docks at Pontaniou;
- *L'Actif* and *le Zodiaque*, built to the same lines as *le Palmier*, and floated out of the docks at Pontaniou on October 5th and 6th 1767;
- *Le Zéphir*, frigate (42), begun October 19th 1767 and launched October 25th 1768;
- *La Flore*, frigate, built to the draughts of Groignard and launched November 11th 1768;
- *Le Rossignol*, sloop (16), begun June 5th 1769 and launched November 14th;
- Three schooners, begun in the early months of 1769 and launched August 11th of the same year;
- *Le Roland* and *l'Alexandre* (64's), begun January 22nd 1770 and launched February 14th and 28th 1771;
- *Le Prothée* and *l'Eveillé* (64's), begun February 13th 1771 and launched November 10th and December 10th 1772.

9. Blaise Ollivier as a Civil Engineer

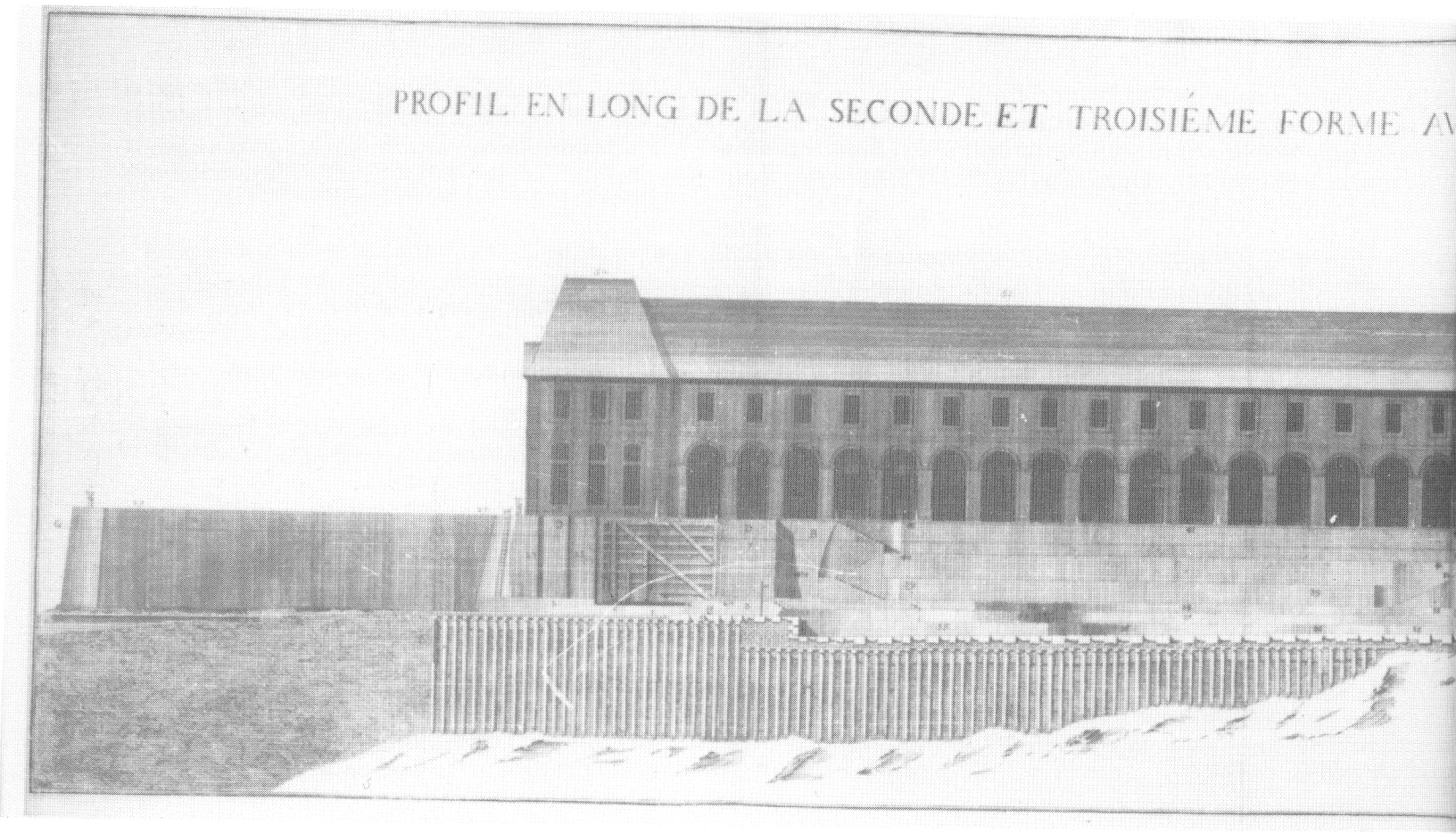
As noted above, towards the end of his career Blaise Ollivier had responsibility not only for all the shipbuilding carried out at Brest, but also for the very considerable works which were afoot to modernise the Dockyard. He was assisted in this by an extremely able engineer, Choquet de Lindu, whose two books[23], published in 1759 at the conclusion of the works, describe the project in detail. The summary which follows outlines Ollivier's major achievements in the domain of civil engineering, and is derived from the article by Levot already referred to:

- 1742: the first ramp of the Horseshoe Battery;
- 1745: the renovation of the first ramp and of the level area of the outer-guard;
- the mortar beds of the Goulet Bastion;
- the repair and completion of the dry dock on the Brest side of the harbour.

The dock had originally been established six metres below ground level, which left it only 90 centimetres above low-tide level. The spring tides being seven metres and ten centimetres in height, and the sill being only 64 centimetres high, the sea went down only 16 centimetres below the sluices, and this only four times a year at the time of the equinoxes. It was necessary to have recourse to two machines (the "hydraulic engine" referred to in *Remark CXX*), one powered by men and the second by horses, which had to drain not only the water left behind but also that filtering in from springs. Despite their efforts, these machines were unable to pump out the full 80 centimetres of water left above the floor of the dock, and success was only achieved by means of channels dug in the bottom of the dock which discharged through outlets cut in the sluice-gates, and then only on days of exceptionally low tides, by dint of the labour of a large number of men pouring buckets of water into the channels.

The apron and the dock, being entirely timber-built, were also defective; for despite the expense of a coffer-dam constructed as was customary to preserve the foundations, the dock chamber was damaged by the sea which entered under

23. Antoine Choquet de Lindu: *Description des trois formes du port de Brest, bâties, dessinées et gravées en 1757* (Brest, R. Malassis, 1757), and, invariably bound with it: *Description du bagne, pour loger à terre, les galériens ou forçats de l'arsenal de Brest. Projeté, bâti, dessiné et gravé* (Brest, R. Malassis, 1759).



12. *Plate from Choquet de Lindu's description of the new dry-docks at Brest, completed after Ollivier's death. (Courtesy Musée de la Marine, Paris)*

pressure the first time that the gates were closed, so that it was necessary to fasten it down by nailing and bolting it into pilings, and to weigh it down with 120,000 pounds of iron which had to be lowered and raised each time a vessel was taken out of the dock.

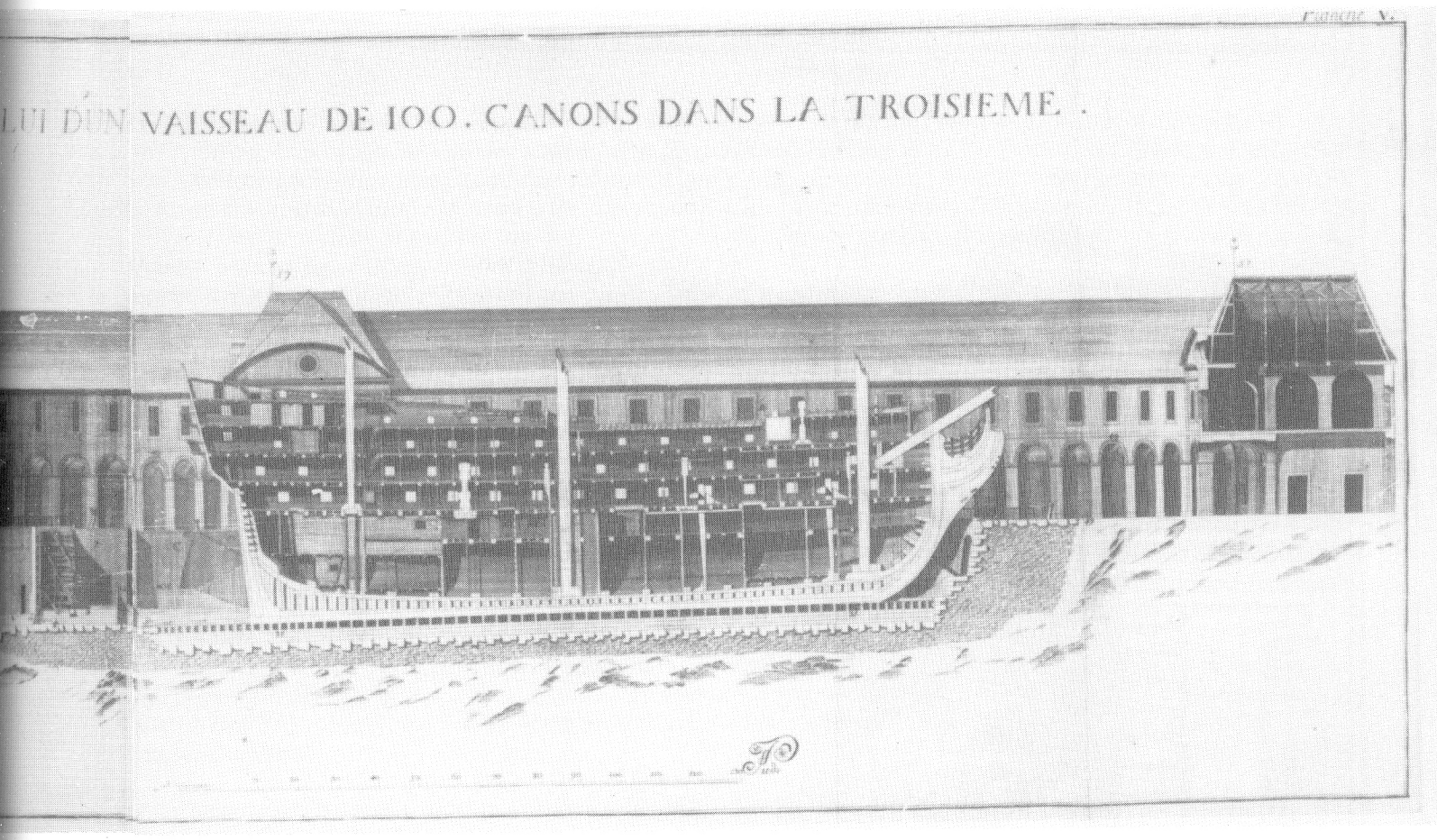
Such were the problems with the original dock as it was built. Prior to Ollivier's taking responsibility for this work, Mr Roblin, Director of Fortifications for Lower Brittany, had already resolved one of them, that of moving the weight of iron, by designing a sort of inverted cradle sufficiently wide to allow entry to the maximum breadth of the fullest ships. This expedient produced the desired result. With the dock chamber firmly anchored, the transport of iron weights was no longer necessary; but the other problems remained.

The honour of resolving them fell to Ollivier. Shocked by the great difficulty of draining the dock, he came up with a proposal for doing away with it by filling up the area around the bows and the stern and the lower hull with aulters arranged around the sides of the dock which followed the exterior shape of the ships in a series of graduated steps; for rebuilding the gates and raising the sill by one metre twelve centimetres and leaving the original depth of water only over a small area in the centre, by which means he was able to take advantage of the tides at every new and full moon. Other work undertaken by Ollivier in the Dockyard can be summarised as follows:

- The building of smitheries for the Dockyard (demolished in 1789);
- Four building-slips at Bordenave, begun in 1741; he was to die before he was able to see them completed in 1748.

Ollivier had produced a first set of plans for them in 1734; further studies had resulted in a plan drawn up by M. Dumains and dated 1737. The 1734 version incorporated seven slips in all, to be situated between the house occupied at that time by M. Roussel, one of the dockyard officers and that of M. de Bordenave. They were all designed to serve either for new building or for repair work, and the ships were intended to be worked on in the dry under roofs.

- A new general storehouse;
- The preliminary works for the first three dry docks in Pontaniou.



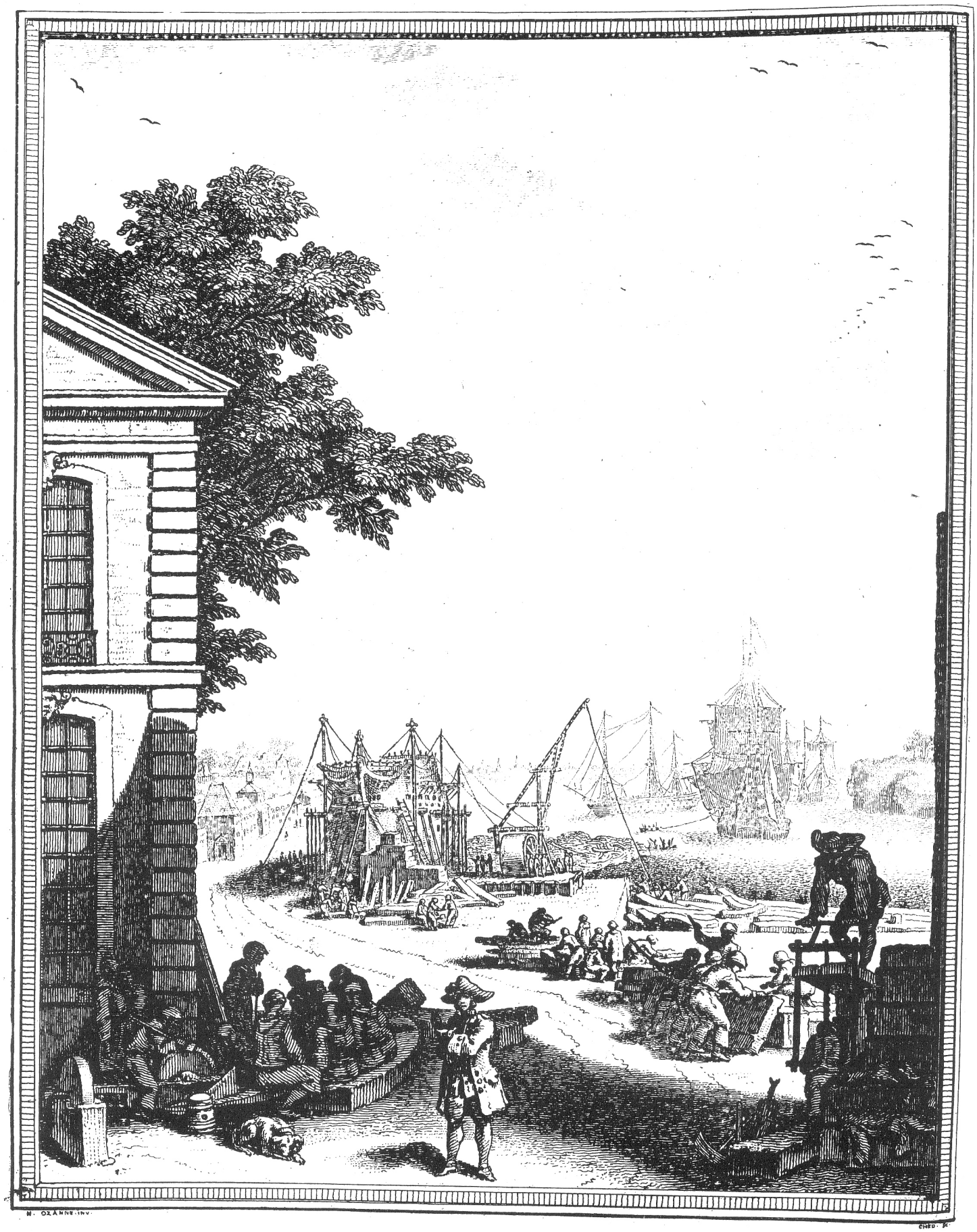
It was in 1742 that it was decided to construct in this bay the docks which had been planned many years previously. At that time the area was used for building small dockyard service-vessels, and ships of a certain size were also repaired there. As soon as they were left high and dry on keel blocks laid on the mud they were holed in order to keep them there. It was here also that old ships were broken up, once they had been left on the mud and holed.

There were thus major obstacles to be overcome: the pilings which represented the first stage had great difficulty in finding a solid foundation – despite all the precautions taken to remove the timbers from the mud, the bottom was so spoiled by the presence of foreign bodies that the pilings were constantly being deflected; the two side walls of the dock were in the one case on rock and the other on mud; the most favourable tides gave scarcely two hours per day to drain out the water and to undertake the building work. Thus, when Ollivier died, they had only placed the hoods over the first rows of pilings at the entrance to the cove, seven metres sixty-eight centimetres deep, and there still remained a considerable area to be piled when in 1751 M. Choquet de Lindu received orders to pick up again the work started by his predecessor.

It is interesting to note two innovations in the list given by Levot, both of which are in imitation of English practice (*Remark CXX*):

- Filling up the area around the bows and the stern and the lower hull with aulters arranged around the sides of the dock which followed the exterior shape of the ships in a series of graduated steps;
- Raising the sill and leaving the original depth of water only over a small area in the centre.

Levot's article refers to a manuscript written by Ollivier, at that time in the possession of a Mr Segodat, Director of Shipbuilding, and entitled "*A Project for the New Dry-Dock at Brest*", 8pp. 4to. According to Levot, this describes the improvements which Ollivier carried out in 1741 to the docks at Brest. It has unfortunately proved impossible to find this most interesting manuscript. There is much more that could be said about the innovations introduced by Ollivier in these building works, but they fall outside the principal subject of this book which is naval rather than civil architecture; I can only recommend them as a most interesting subject for further study.



13. *Frontispiece by Ozanne from Duhamel du Monceau's Élémens de l'Architecture Navale (2nd edition, 1758). (Private collection)*

10. "Espionage"

The word "espionage" tends to be coloured by 20th century images, and requires some explanation in the context to which we are referring, that of Blaise Ollivier's mission to England and Holland in 1737. France was not at war with either country, and foreigners were able to circulate relatively freely. Fifty years later, Lescallier and Forfait were denied access to the Royal Dockyards in England, despite the protestation made in the columns of *The European Magazine* in 1792, that "*.... the pretence of secrecy in keeping our arts from our enemies, which pretence is carried so far as to exclude a Briton admittance without especial orders and a porter to attend him, while foreigners of any nation if cloathed in an officers uniform find ready admittance*". There is some conflict between these statements, but be that as it may, in 1737 such access appears not to have presented significant difficulties.

It must be remembered that the shipwright's trade was an international one: English shipwrights worked in large numbers in the Spanish yards at this time; all the senior positions at Amsterdam Dockyard were occupied by Englishmen, and May came there from earlier employment at Toulon. Peter the Great worked in the Dutch Dockyards as a young man (although this was no doubt a special case). The famous Swedish shipwright Fredrik Henrik af Chapman spent the years 1750-54 in England, and while it is true that he was arrested towards the end of his stay, he was indicted for attempting to entice away dockyard workers into the French service, not for spying (his papers, which had been confiscated, were even returned to him!); from England, he went on to Holland, and then to France. All Danish shipwrights were obliged, as part of their training, to spend a period working abroad, which explains the richness of the Danish National Archives in foreign ships' draughts.

In the light of this free movement among shipwrights, one might be tempted to assume that ideas of espionage were foreign to the 18th century, or that a clear distinction was made between espionage in time of war, and what we would call "industrial espionage" today, the former being proscribed, the latter freely admitted. This is, however, an over-simplification, as we shall see.

It may be appropriate at this stage to examine to what extent Ollivier's mission was an isolated case, or whether it fell into a pattern; after all, a single voyage to England and Holland does not necessarily add up to a deliberate policy of espionage, all the more so since Blaise Ollivier was a distinguished shipwright who might readily have been received in certain circles abroad, at least on a social basis. Searches of the French archives reveal however that Blaise Ollivier's mission was far from being an isolated case: we have identified what amounts to a regular and consistent pattern, one of the earliest being the mission of no less a personage than Colbert's own son, as the following list shows:

French "espionage" missions to England and/or Holland

Date	Name	Published or manuscript report
1669-70	Étienne Hubac	(England and Holland). Instructions, and a report.
1670	de Seignelay	(England and Holland). Instructions from Colbert to Seignelay, and his replies.
1670	Pierre Arnoult	*Remarques faictes sur la marine de Hollande et d'Angleterre dans le voyage qu'il fit en l'année 1670 par ordre de Monseigneur Colbert*
1713	Hélie	No significant documents known.
1729	Blaise Geslain	Instructions *Extrait des ouvrages qui ont esté le sujet de mon sejour en Angleterre et de ceux dont j'ay randu compte* Various draughts and letters. Draughts of the *Orox* storeship, designed "according to the uses and practices observed in the English dockyards" (1734).
1737	Blaise Ollivier	*Remarques*; Several shorter manuscripts.
1739	Blaise Geslain	(Holland only). Report (April 1740).
1768	Lt Col de Béville	*La reconnaissance faite en Angleterre aux mois de septembre et octobre 1768 par le Sieur de Béville, Lieutenant Colonel de Dragons.*
177?	Charles Romme	*Art de la Mâture; l'Art de la Voilure.*
1770-5	Daniel Lescallier	*Dictionnaire; Traité du Gréement*; etc.
1775	Baron de Bavre	*Notes sur la construction.*
1790	Lescallier & Forfait	*Mémoire des Observations qu'ils ont faittes ensemble, sur la Marine, pendant leur séjour en Angleterre.*
1816-20	Charles Dupin	*Voyages dans la Grande Bretagne.*

Royal Command, ordering the Sr Geslain, Shipwright, to Proceed to England

Signed at Versailles April 3rd 1729

By Order of the King,

Sr Geslain will depart immediately for England, will present the enclosed letter to the addressee, the person to whom it is addressed will see to it that he is given access to the Dockyards where they build merchant ships and ships of war and that he is recommended to the principal Shipwrights. Sr Geslain will regulate his conduct according to the advice of this person, who will provide him with board and lodging during his stay in London, and he will conduct himself with such wisdom as no complaint may be lodged concerning him, his only care being to acquire the knowledge necessary to train a skilful shipwright.

He will apply himself first and for some months to learning the language of the country, he will then instruct himself in the principles which the English follow in establishing the lines of their ships. He will seek to obtain memoranda or general tables of the proportions of each Rate and class, and when he has done so he will make draughts on which he will distinguish with lines of different colours the differences which there may be between the English moulds and those of France, with particular observations on the principles upon which they are founded. If he is able to obtain the draughts of those English ships which are best reputed he will not fail to bring them back, and he will omit nothing in seeking to discover the art and principles of English shipbuilding, because this is the principal purpose of his mission.

He will examine their practices in the matter of preserving timbers, whether there are in this regard established customs and habits, whether they be kept under the water or under cover on land, whether before they are placed in store they are first soaked in seawater, whether they leave them to dry out before converting them, and in what manner they arrange them.

He will examine the fires or stoves which the English employ for their plank. It has been proposed to build in our own French dockyards fires or stoves of the same type as the English ones in order to impart to the plank the winding [which is needed] with greater ease and with less cost. Sr Geslain will measure their length and breadth and examine the materials used to build them, such as bricks, stone or iron, and what they fire them with, and he will make drawings of them and detailed notes, such that it only remains to build them, if it were judged appropriate to substitute these stoves for the ordinary practice of bending and curving our plank.

He will examine whether the English use filling-pieces in the fastening of their beams to the ships' sides, wooden knees of two parts with bolts of iron, in place of wooden knees of a single piece or some other new method of joining them, and he will bring back drawings of them if it be possible, or at the least detailed notes in which he will explain how long these inventions have been in use and how successful they have been.

He will find out from what timber the English fashion their treenails, whether it be from trees which are 40 to 50 years old only, or whether from trees which are older, for we are assured that they employ only young trees, since those which are too old furnish plank and frame-timbers. Sr Geslain will discover whether there be fixed and established rules for measuring masts, and determining their diameter, and if so he will convert the rules to French feet of 12 inches and palms of 13 lines for masts of every proportion, so that they may be understood by a table of comparison. He will examine particularly whether there be rules for establishing the proportions of masts and rigging in their ships of each Rate. He will do what is required of him to obtain faithful notes of them, it being important that he should put forward only facts of which the truth has been proved.

He will also verify what the English do to protect their ships on long voyages from the worm, whether they place as we do in France bullocks' hair and crushed glass between the planking of the hull and the sheathing, whether they use sheathing nails, and whether they have any compositions of stuff for paying their hulls which have been successful.

He will find out where the English obtain their shipbuilding timber, he will ascertain whether it be tight pored or coarse grained, how long their ships last, and what they do to maintain them in harbour in winter and in summer.

In order to obtain all this knowledge, Sr Geslain will endeavour to be allowed in to [all] the various workshops of the dockyards, and even to work there with his own hands if that were the only way, for it is important that he bring back accurate and well-explained notes on the forging of anchors, where they obtain their iron, the shape which they give them, which is to say whether the bars be round, square, flat or triangular, their breadth and thickness, whether they put them together in bundles, and whether in making these bundles they place filling-pieces in the spaces between or in the weak places such as at the head of the shank, and of the flukes, whether they swell them at the ends to weld them, whether they weld or braze, with what charcoal, how much the hammers weigh, how many men they set to strike together, or if they use a drop-hammer, what weight they use for an anchor of 6 quintals 3 quarters, and proportionately for the others, how much they heat the bar or bundle along its length for welding, whether the bundles are welded square by folding back the edges after or whether round; if the anchors are of bar-iron, whether those which form the centre of the bundle are used for the full length of the shank, and how long their bars are which serve to thicken the shank at its head, to establish the place where this swelling starts, the proportions of their anchors and their weights for the ships of each Rate and the number given to each. Sr Geslain will inform himself thoroughly on how they are tested to establish their good quality, and he will concerning all this make the most certain and accurate observations, in a report to be written before his return to France, and as soon as he has succeeded in arriving at these explanations, Sr Geslain will acquire such other knowledge as relates to his profession, and he will profit by the favour which is accorded him to enable him to be of use to the service and to merit his advancement.

(signed) Louis

This list is certainly not claimed to be exhaustive, and it can moreover reasonably be argued that some of these journeys represented little more than professional curiosity on the part of men of science, rather than specific espionage missions undertaken at the instigation of the French Crown or government. While Ollivier's own instructions appear not to have survived (and indeed may never have been committed to paper), we are fortunate in having those issued to Geslain in 1729. As an indication of the nature of at least some of the missions they are entirely unequivocal, and I make no apology for reproducing them on the opposite page in full.

These instructions make it abundantly clear that for Geslain's mission at least, espionage was the purpose. However, since we do not have Ollivier's instructions, it would be premature to assume that his journey should be considered in the same light (despite the precautions taken to ensure the secrecy of his mission in Brest, which we have already examined). An assessment of the true nature of his mission can only be derived from close scrutiny of the *Remarques*, where indeed we are given certain clues, and from the hints provided by Levot from the now vanished family papers.

To take the latter first, it seems clear that the *Remarks* originally took the form of letters, "which were dispatched to the Minister by routes which they had agreed upon together" – it must be presumed that these were clandestine. It is not impossible that they were also in code – at least one coded letter survives among the Maurepas Papers, from a spy in the West Indies. This in turn implies that the present form of the manuscript is essentially a copy of these letters, which would explain the prefatory comment in the Brest manuscript: *The remarks which I give here on the navies of the English and the Dutch are the fruit of three months which I spent in the dockyards of England and six weeks in those of Holland. This short time did not permit me arrange them in a more accurate order. I wrote them as they occurred to me and I have sought to remedy somewhat the order which is missing through the addition of an alphabetical index."*

I am inclined to suspect that the drawings may not have been communicated to the Minister in their present form: the numbers have clearly been inserted afterwards in spaces left in the text (this seems to have been Ollivier's method of writing, since we see it in other manuscripts also). Either no drawings were sent (they would presumably have been a security risk), or, possibly, these took the form of sketches in the body of the letters, which were later redrawn on the present 13 sheets. It has to be admitted that this is supposition, but it seems probable enough.

We have few clues as to the degree of openness with which Ollivier went about his investigations: he was able to meet Cromwell Mortimer, one of the two secretaries of the Royal Society, but a check of the Journal Book of the Society does not indicate that he ever attended a meeting; if he did, it must have been under an assumed name.

He met and had lengthy discussions with the Master Shipwrights of the Dockyards, and it is from these discussions that a few hints can be gleaned: for example, in *Remark CLXIV*, Ollivier says: "Mr Fellows did not expound any further, perhaps because he supposed that I should not understand his meaning ...." It is clear from this comment that Fellows was not aware that he was talking to the Master Shipwright of Brest! Again, in Chatham he was shown the draughts of the *Royal Sovereign*, and comments: "I also measured thereon the deadrise, but I could not without compromising myself extend my curiosity further". Once again, the implication is clear: Ollivier had not told Ward who he was.

The conclusion is I believe inescapable, that Ollivier had taken a false identity (we know, for example, that when Blaise Geslain undertook his second mission to Holland in 1739, he travelled under the name of Dubois). What that identity was we have no means of knowing, but it seems likely that he pretended to be either a junior shipwright, or else simply a gentleman amateur with an interest in shipbuilding. And from the fact that he was obliged to disguise his real interest, we may likewise conclude (*quod est demonstrandum*) that Ollivier was indeed spying.

There are of course other clues, as if further proof were needed, such as the occasions when he measured the cables in several ships: *Royal Sovereign*, *Royal George* and *Victory* (see *Remark CLXXVI*); and when he measured the headroom on the *Britannia* (*Remark CXIX*). Had he been able to reveal his identity and ask questions completely freely there would have been no need to resort to such subterfuges. It may be worth adding that since the dimensions of cables were determined by the breadth of the ship, measuring the cable allowed a cross-check of other dimensions.

From the foregoing comments, it is apparent that Ollivier was not entirely free to examine everything which excited his interest. However, it is equally clear that he had a far larger degree of liberty, and was shown far more than discretion might have dictated had his interlocutors been aware of his true identity and objectives. In *Remark CXXIII* we learn that he was able to go on board the ships anchored at Spithead, even visiting the magazine of the *Lancaster* (*Remark CXLVI*). He was freely shown a number of draughts, including those of the newest experimental ships.

The freedom of his discussions appear to have been greater at Portsmouth and Chatham than at either of the Thames Yards. There are two possible explanations for this: it may be that in London the Dockyard officers felt themselves to be too much under the eye of the authorities in London to extend the same freedoms which he enjoyed in the outlying ports.

Alternatively, and perhaps more probably, he found in Portsmouth and Chatham officers who spoke at least some French.

I will conclude this section with one final speculation: did Ollivier speak English? It is in all events unlikely that he was required, like Geslain, to learn English – he would not have had enough time. The phonetic spellings of certain English words, notably the list of ships to be found in the Brest manuscript, where moreover several of the names are given in French rather than in their original English form (i.e. *Écureuil* rather than *Squirrel*, *Guillaume et marie* for *William and Mary*), all suggest that his English was very basic, even though there are some grounds for believing that the list was originally derived from an English printed source (see the note on page 190). It is true that in the Boudriot manuscript he says of the English books on naval architecture (*Remark CXCVIII*): "I shall translate into French whatever is good, so soon as my affairs allow me the leisure", but it should be noted that this comment is entirely missing from the later Brest manuscript. In another similar passage (*Remark CLXXXIII*), Ollivier says: "An English shipwright gave me a memorandum .... and after having it translated ..."; this text reads ".... after translating it into French ...." in the Brest manuscript, but in this instance I am more inclined to believe the earlier Boudriot manuscript version, and conclude that whatever English he had was at best rudimentary.

11. Blaise Ollivier's Mission, and its Impact on French Shipbuilding

Having discussed at some length the probable circumstances of Blaise Ollivier's visit to the English Dockyards, albeit making a large number of assumptions which cannot be affirmed with certainty, it is worth considering what Ollivier's instructions were. We have concluded that he was engaged on a spying mission, and we have examined the instructions which were given to his compatriot Geslain a few years earlier. Are there any grounds for assuming that Ollivier's instructions were very similar, in other words that his mission was simply to "update" the information supplied by Geslain?

I believe that it is unlikely that Ollivier received instructions which were as detailed. It must be remembered that he occupied a very important position at Brest, and it would have been impossible for him to absent himself for the three years that were required of Geslain (1729-32). However, from what we can learn from the internal evidence of the *Remarks*, it seems possible that he was asked to pay particular attention to First and Second Rates, since almost all his comments place emphasis on three-deckers; moreover, the impecunious Navy of the young Louis XV had only one three-decker at the time, the *Foudroyant* (110), built by Hélie in 1724. Originally intended to be armed with 30 48-pdrs (!) on the lower deck, she measured 173′10″ x 47′0″ x 22′10″ (French measure). She had a relatively short life for a First Rate, for she was broken up in 1742 without ever having been commissioned. By 1737, she was undoubtedly showing signs of decay, for Ollivier was about to start work on the *Royal Louis*, the largest ship ever built in France. Sadly, as already noted, the *Royal Louis* was accidentally burnt on the stocks in 1742. The next three-decker, the *Impétueux* (later *Ville de Paris*) was not laid down until nearly 20 years later, in 1757, so that if the assumption is correct that Ollivier's mission was primarily to examine First Rates, it must, in that sense at least, be considered to have been wasted.

In respect of detail also, it seems likely that he was not asked to investigate in the same depth as Geslain; after all, if Geslain had reported satisfactorily, in those days of relatively slow technological change there would have been little sense in sending the Master Shipwright of France's premier Dockyard to investigate further the same questions after such a short lapse of time.

The internal evidence would seem to suggest on the contrary that Blaise Ollivier was asked to investigate certain aspects in particular, and we can only speculate what; his *Remarks* are encyclopaedic, but this does not necessarily mean that he was asked to look at all aspects of shipbuilding: he may simply have been very conscientious. It is true that the English had recently evolved what Ollivier calls "a new manner of building" (he was referring either to the 1733 Proposals, or else to an independent experiment designed to test the validity of Newton's solid of least resistance, which he seems to have confused). It is tempting to think that this was the main purpose of Ollivier's visit, but in fact it emerges that Geslain had already reported on both in 1732 (see below). On balance, I believe that the first hypothesis put forward, namely that he was to look most carefully at the English three-deck ships, is the most likely, especially as he paid similar attention to

three-deckers in Holland, despite their extreme rarity in the Dutch Navy at this time.

It is perhaps worth examining in this context what Geslain himself had achieved during his three years at Blackwall and Woolwich, and the following mission to Holland. His full report, if he wrote one, does not appear to survive; however, there is an incomplete 50-page letter dated February 14th 1732, written to the Minister from London[24], and a summary[25], dated Versailles, July 10th 1732, which lists an impressive catalogue of espionage successes; the following brief résumé is taken mainly from this summary:

- Methods used to preserve timbers from rot;
- Complete sets of plans of various stoving ovens and steam chests for bending plank;
- The use of cross-pillars, and their design;
- The various types of iron knees and standards;
- The reasons for filling up the spaces between the floors;
- The installation of what appear to be "sweetening cocks" in the hold, to allow seawater to be drawn in (presumably to preserve the timbers – see footnote 209 on page 223);
- A translation of the 1719 Establishment;
- A very large number of draughts: 3 of the *Royal Sovereign* (including her original builder's draught), *Great Britain*, *Neptune*, *Blenheim*, *Princess Caroline*, the old and the new *Kent*, *Grafton*, *Revenge*, *Falmouth*, *Assistance*, *Lively*;
- the draughts of a "frigate of 20 guns built to the new manner of building of the Cone demonstrated and explained by the savant Isaac Newton";
- From Holland, Geslain brought back plans of camels, dredgers, a portable pumping engine, a lathe for polishing and boring musket barrels, sawmills, and a machine for proving gunpowder.

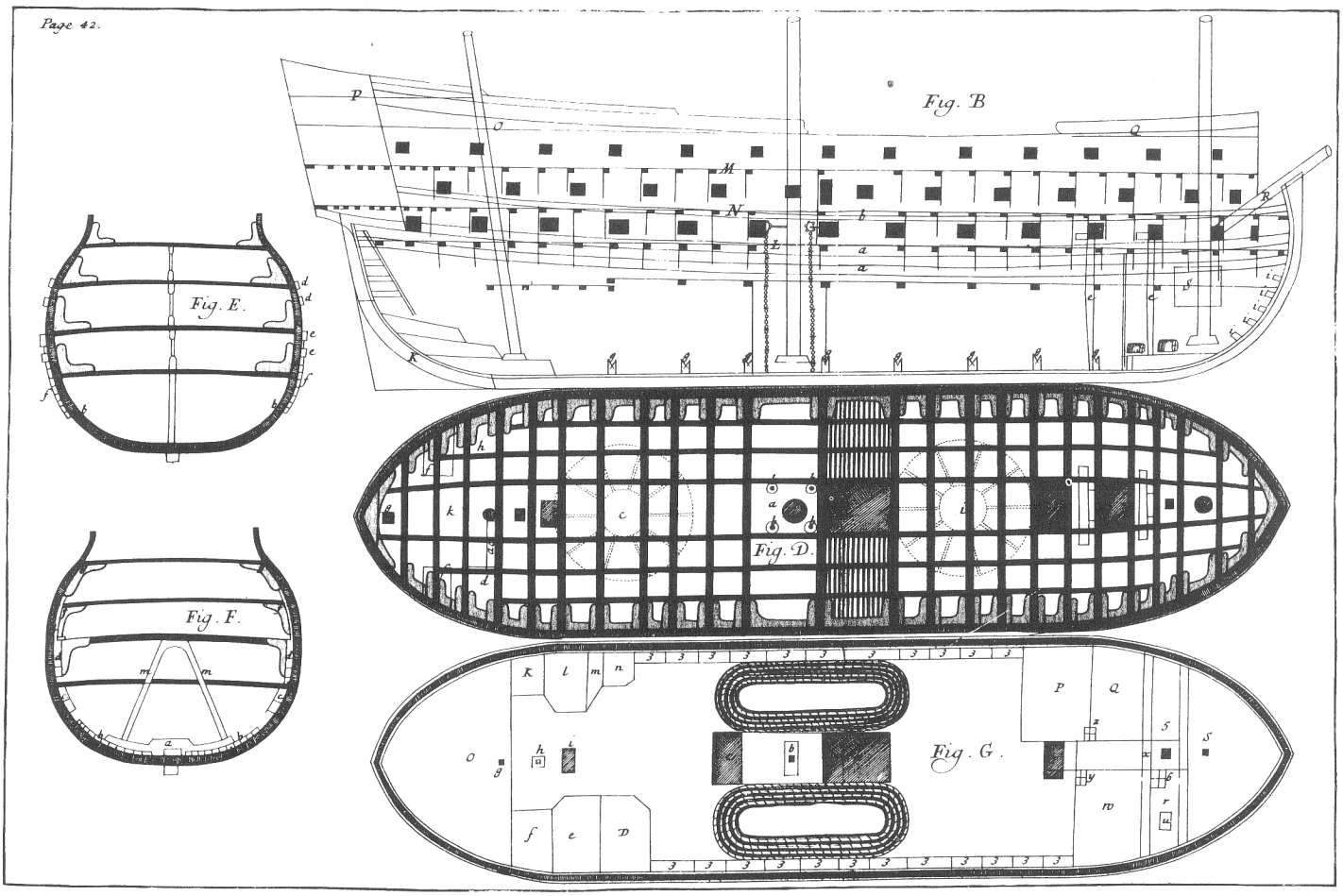
Geslain's handwriting and spelling suggest a man more at ease with the adze than the pen, but for all that, he was a more than competent shipwright, and enjoyed the favour and indeed the confidence of Maurepas[26]; moreover, the sum total of his espionage achievements is impressive, and an important background to Ollivier's mission five years later. These achievements raise however a number of questions, which I will attempt to address.

Firstly, it seems clear that Ollivier was not shown Geslain's reports, either when he was at Brest, where he might reasonably have expected to be on the "circulation list", or during his briefing in Paris, immediately prior to his departure. Astonishing as this may appear, the evidence is, I believe, unequivocal. To take just one or two examples: Ollivier analysed the *Royal Sovereign* minutely (*Remark LXV*), even commenting that he was shown her original draughts; since these were evidently available in Maurepas' office, his preoccupation with them is surprising. He even states, in the same Remark, that he could not "extend his curiosity further without compromising" himself, so that his ignorance of Geslain's reports put him at risk. Likewise, his comments on the solid of least resistance of Isaac Newton (*Remark CXCVII*) would have been made easier had he had access to the draughts which Geslain copied. Further, his description of the steam-trunks appears to duplicate the work already done by Geslain.

In this context, there is however a comment in the *Remarks* in connection with stoving ovens which should be quoted (*Remark XXXIII*): "I will say nothing of their construction since we already have the detailed plans of them"; this is accompanied by a marginal note: "I have a model of one in my office". There is a case for believing that these were the plans drawn by Geslain, and even that the model also came from the same source, but this cannot be affirmed with certainty, and it is the only instance which suggests that he might have had knowledge of Geslain's work.

From other archival evidence, it is known that Ollivier did not get on with Geslain when they worked together in Rochefort (this reached a stage where they were debarred from working on the same ships). We do not know the reasons for this personal antagonism, but it was probably simply a conflict of personality. Would this have been enough for him to disregard information which he had been given? I am inclined to believe that this was not the case; whatever his personal feelings, it would have done him no good to expose them to Maurepas.

24. Preserved in the Duhamel du Monceau Papers at the Peabody Museum, Salem, Mass., USA.
25. Preserved in the Maurepas Papers at the Olin Library, Cornell University, Ithaca, N.Y., USA.
26. He was responsible for the design and building of the *Magnanime* (74), which, when captured by the Royal Navy in 1748, was greatly admired, being referred to as a "crack ship". He was also entrusted with the design of an excellent frigate, the *Fidèle*, and of another 74, the *Couronne*, which was built after his death. On hearing the news of his decease, Maurepas wrote, in a letter dated July 18th 1748: "*I learned with sorrow of the death of Mr Geslain, who was a man of superior genius*".



14. *Plans of an English ship, from Sutherland's* Ship-builders Assistant. *Sutherland's book, published in 1711, was the first English book on shipbuilding to contain sophisticated draughts like these. (Private collection)*

This ignorance of Geslain's reports raises another important question: for whom were these reports, both Geslain's and Ollivier's own *Remarks*, intended? The *Remarks*, and to a lesser extent Geslain's letters, are written in the technical language of a professional shipwright, and although Maurepas had a reputation for having an extremely alert mind (although he was also at times criticised as a dilettante), it is unlikely that he was able fully to appreciate the information he was given. It is almost certain that they were circulated to the Navy Council in Versailles, where there were certainly advisers capable of appreciating the content of the reports, but they appear not to have been circulated further.

There is no evidence for example that they were ever circulated to the Dockyards, and in any case Ollivier's position was pre-eminent, to the point that he was consulted over draughts proposed by other shipwrights in other Dockyards[27], so that it might be argued that the only fit recipient for his reports was Ollivier himself. I have to confess that I have been unable to find a satisfactory solution to this enigma, and am left with the impression that both Geslain's and Ollivier's reports gathered dust on bureaucratic shelves in Versailles, without ever being seriously considered or implemented more widely in the French Navy.

This does not diminish the impact that such missions had on the shipwrights themselves: Geslain designed a storeship, the *Orox* in the English manner, although it is unclear whether or not it was ever in fact built; and Ollivier implemented many of the techniques he saw in ships which he built after 1737, as the marginal notes in the Brest version of the *Remarks* make abundantly clear.

27. As for example in a dispatch dated March 17th 1745 requesting his opinion on the plans of a 60-gun ship which was to be built by Chapelle at Toulon.

One is left with the suspicion that such reports were seen as sources of comfort in Versailles, as evidence that things were not too bad in the French Dockyards, and that after all they did not have so very much to learn from their rivals abroad. This was not, I should hasten to say, a purely French trait: in the English Dockyards too, there seemed to be a marked reluctance to copy French shipbuilding techniques, even where they could be shown to be superior. There are many examples of ships' lines being copied, but building techniques were another matter.

It is evident that conservatism was a potent force among shipwrights of the time, albeit a force of inertia. To take but a few examples: almost without exception, the spying missions referred to above reported consistently (and favourably) on the use of steam-chests or other devices for bending plank, on the use of treenails rather than nails or bolts for fastening planking, and on the general economy in (and indeed aversion to) the use of iron by English shipwrights; yet despite all these reports, which as we have seen stretch over a century or more, none of these changes were adopted by the French Navy until the the end of the 18th or the beginning of the 19th century (the use of less metal was forced on the Navy by the prohibitive cost of bronze fastenings as soon as the electrolytic problems associated with iron fastenings and copper sheathing were understood).

It is perhaps worth noting in this context a comment in the Levot article quoted above: shortly after his return in 1738, Ollivier wrote a "*Memorandum in which it is proposed to do away with upper futtock-riders and waterways and replace them by iron standards on the deck and by a second knee at the end of each beam, in order to fasten ships more tightly and make their repairs less frequent and less costly*" (8 pp. folio). The *Royal Louis*, which was on the stocks at that time, was built according to the system proposed by the author, which was inspired by English examples (*Remarks LXXI and XIX*), as was the *Alcide*. This system was abandoned after his death, and Chapelle, the Master Shipwright, issued a statement in 1752 to the effect that the fastening provided by iron standards did not adequately compensate for doing away with upper futtock-riders; as a result, Rouillé, the Minister of the Navy, ordered a council meeting of shipwrights at which the two systems were compared and debated. He evidently regarded the question as important, for he invited the members of the council first of all to deliberate together, and then to write up individually, for a second meeting, memoranda explaining their views. In the end, Ollivier's method was abandoned, and the French Navy reverted to its former practices. It is doubtful whether this would have occurred had Ollivier still been alive, and indeed it is more probable that in his position of Surveyor General, he would have forced changes not only at Brest but in other Dockyards as well.

I have already referred to a number of marginal notes in the Brest manuscript of the *Remarques* which are absent from the Boudriot manuscript. They were added some years later, and provide some insight into the degree to which he was influenced by what he had seen in England and Holland. Taken together, these notes make fascinating reading: there are no less than 22 of them, which are listed *in extenso* below.

Remark Nº	Reporting on	Text of Marginal Note
English Navy		
V	Projecting skeg	*I imitated this practice in the building of the* Dauphin Royal
VIII	Timbers laid over rising wood in stern	*I used this method in 1739 in the building of the* Mars. *I placed two deadwood timbers one over the other, both butting against the sternpost, and I placed the deadwood knee over the top.*
XII	Frame timbers thicker	*This same consideration led me to mould the timbers of the* Mars *thicker than those of other ships of her rate.*
XVI	Air-strakes in the quick-work between the gunports	*Since my voyage to England I have done this in the building of the* Dauphin Royal
XVIII	Putting beams under tension	*Since I wrote this Remark I have seen that the beams of the middle deck are scored down as they are in our own ships, which they do by forcing up the middle of the beam with a jack-screw in order to increase its camber by a few inches and shorten its length. I did it in the same manner in the* Dauphin Royal.
XXV	Gunport sills	*I copied this practice in the building of the* Dauphin Royal.
XXVII	Cheeks of the head	*I copied this English method in the building* .... [deleted].
XXVIII	Iron knees	*Since I wrote this Remark I did away with the chocks behind the iron knees in the building* .... [deleted].

Remark Nº	Reporting on	Text of Marginal Note
XLIV	Wing transom	*I gave this form to the wing transom* .... [deleted].
XLV	Assembly of frame timbers	*I copied this arrangement of the frames in the English ships* .... [deleted], *save only that I did not completely do away with all the iron bolts.*
XLV	Cant-frames	.... [deleted] *canted the frames in the quarters and the bow* .... [deleted] *following the example of the English ships.*
XLVIII	Heavier ribbands	.... [deleted] *copied the size of the ribbands of the English ships when building* .... [deleted].
LV	Made-masts	*Since I wrote this Remark the foremasts of the* Amazone *and of the* Atlas *were fashioned in the English manner, being worked according to the plans which I furnished and which appear in Fig. 27. They cost two fifths less than our usual masts.*
LX	Wrain-bolts	*I had them forge wrain-bolts similar to those of the English and they served during the building* .... [deleted] *with great success. The shipwrights found that they were safer to use than their usual wrain-tackles.*
LXXI	No bolts in riders	*I did away with these bolts when building* .... [deleted].
LXXVII	Double clamps	*I fitted a double row of clamps beneath the quarterdeck and forecastle of the* .... [deleted], *following the example of the English.*
LXXXVI	Rails painted black	*I imitated this in the building of the* .... [deleted].
CVII	Gratings	*I copied this method in the building of the* .... [deleted].
CLXII	Berthing over ladderway	*Since I wrote this Remark I had the hood of the after ladderway constructed in this manner in the* .... [deleted].
CLXX	Fitting out in dock	*Following the example of the English* .... [deleted].
CLXX	Leaving off deck planks temporarily	*I followed this practice* .... [deleted].
Dutch Navy		
XXIII	Filling pieces of fir	*I made this trial in 1738 in the* Dauphin Royal.

The above list constitutes an extensive list of the practices of the English and Dutch shipwrights which Ollivier copied in the years immediately following his return. It will be noted that many of these marginal notes (which, as already stated, only appear in the Brest manuscript) have been partially deleted: a systematic attempt has been made by someone to remove the names of the ships in which Ollivier put into practice foreign methods. The missing words have been scratched away with a sharp knife (the paper is relatively undamaged), but even under ultra-violet light they are no longer legible.

They were clearly not removed by Ollivier himself: had he wanted to keep his "borrowings" secret, he would not have recorded them in the first place. Levot in his article refers to the notes, and indeed quotes from some of them, but he makes no reference to the deletions. He also refers to a method being applied in the *Alcide*, of which no mention can any longer be found. This implies that when he saw the manuscript in 1844 the notes were still intact, although it may be an error on his part. It should be noted that Levot's article is relatively chauvinistic (a not uncommon trait in French writings at this period); but that does not mean that Levot himself was responsible for this regrettable act of vandalism. It is possible that it was done by one of Ollivier's descendants, or even by a reader. Some of the ships' names have survived; perhaps they were simply missed by the vandal – I can think of no other reason for such selectivity. It is difficult to understand the motive behind the deletions, since if it was desired to remove all evidence it would have been possible to delete all the notes completely; instead, only the ships' names have been removed; perhaps it was an attempt to disguise the fact that one of France's most prominent shipwrights had copied foreign practices in ships which were recognised as being extremely successful. Whatever the reason, this is a mystery which will probably never be solved.

Apart from the marginal notes in Ollivier's hand attesting to his adoption of some foreign practices in certain of his ships, we also have the attestation of no less an authority than Duhamel du Monceau, in his *Élémens de l'Architecture Navale*. In the *Chameau* storeship, to which we have already referred, Ollivier departed from the conventional practice in France of giving storeships the same beam as warships, and reduced the beam considerably. Duhamel du Monceau comments: "*Mr Ollivier did this with astonishing success in building the storeship Chameau, of a burthen of 750 tons, which sailed like an excellent frigate*"[28]. What however he does not add is that Ollivier was probably imitating English practice in this regard.

Further direct evidence that Ollivier incorporated the ideas of which he approved in English and Dutch shipbuilding into his own ships comes not only from the marginal notes listed above, but also from Brest Dockyard correspondence: in Series 1.E.86, we receive confirmation of the marginal note opposite Remark LV, that a trial was made on the *Amazone* frigate with the English method of assembling made-masts (March 9th and April 13th 1738) – the foremast cost £924 4 *sols* 6 *deniers* less than it would have done if assembled in the French manner. The trial made on the *Atlas* storeship evidently involved a comparative trial with one mast of each type (April 20th). Likewise, we find the answer to the missing part of the note opposite Remark CLXX: while the *Superbe* was finished afloat in the usual French manner, the *Dauphin Royal* was entirely finished in dock before being launched: "*Mr Ollivier is to adopt for the* Dauphin Royal *the new method which he has proposed to plank her slowly and to finish her entirely on land, since he has recognised that this is practised with advantage in England and that ships which have with this method all their fastenings when they are launched hog less readily, which is an observation which must be made in the future with these two ships which in other respects have been built with the same timber and adopting the same precautions since they were laid down*" (June 15th 1738). Another letter, dated June 8th 1738, approved the use of iron cheeks of the head and breasthooks in the *Superbe* and the *Dauphin Royal*, but this was certainly not in imitation of English practice, and suggests that whatever the missing name in the note opposite Remark XXVII, it was not the *Dauphin Royal*. In another letter, dated August 30th 1738, Maurepas gave instructions for the building of a 700 to 800 ton storeship "*with flat floors in the Dutch manner*"; Ollivier's draughts were received in Paris on October 9th. It is not clear whether this was the *Chameau*, which Duhamel du Monceau praised so fulsomely, but an examination of the body plan in figure 11 on page 18 suggests that this was very probably the case. The *Chameau* was launched in 1744. No doubt many other ideas were also taken up, of which no traces survive in the archives. We have already commented on certain aspects of his dry dock construction which would appear to have been borrowed from English practice, and it is interesting in this context to read, in a letter dated May 4th 1738, that Maurepas ordered "*that the dry-docks should be built according to the proposals put forward by Mr Ollivier, and which all the Dockyard officers have approved*". This strongly suggests that he incorporated English ideas into his plans, although it cannot be affirmed with certainty. There is no doubt, however, that Ollivier found much of interest in both Navies, and many ideas which he was able to use to advantage in the years which followed his return to Brest.

Throughout the *Remarques*, Ollivier assesses critically and objectively everything that he sees. In total, he makes some 160 judgements (135 on English practices and 25 on Dutch practices), stating clearly whether he believed each practice to be better or worse than those to which he was accustomed in France. While it is true that he was specifically looking for aspects which merited imitation, he nevertheless looked at practically every aspect of ship design and building, and his judgements clearly demonstrate that French ships at this time were not so manifestly superior as some authorities have stated: of the 160 or so judgements which he makes, no less than 100 highlight the superiority of foreign methods, while only 60 are critical of them. They are summarised below.

The aspects of English shipbuilding which Ollivier most admired were:

- The use of treenails rather than nails or bolts;
- The general economy in the use of iron;
- A generous height of gundeck sill;
- Hook-and-butt planking;
- Cant frames;
- Fewer, and above all shorter riders;
- Fewer deck beams;
- Cheaper methods of assembling made-masts;
- Sawpits, dry-dock and dock gate design;
- The arrangement of shot-lockers;
- Measures taken to reduce hogging;
- Lighter rigging and shorter masts;

28. *op. cit.*, 1st edition p. 54, 2nd edition p. 88.

- The use of stoneground glass rather than moulded glass or mica;
- Methods of cutting frame timbers;
- The practice of completing building in dock rather than afloat;
- The general reduction in the use of costly compass timber.

His criticisms were mainly directed at:

- The position of the rabbet of the stem;
- Excessive concavity of the lower counter;
- Insufficient beam, and ships which were too short for the guns they carried;
- Lack of scientific method in ship design (for example, the failure to do displacement calculations);
- The use of horizontal rather than diagonal strakes in the ceiling;
- The fastening at the heel of the sternpost;
- The complicated arrangement for shifting the pillars in the way of the capstan bars;
- Insufficient flare to the toptimbers at the bow;
- The size of the holes in gratings;
- Excessive sheer;
- The quality of the carved-work.

Of Dutch shipbuilding practices, Ollivier was in general less complimentary, but he nevertheless admired:

- The skill of Dutch shipwrights in fairing by eye;
- The absence of bolts in timbers and riders, as in English ships;
- The use of very wide strakes in the ceiling;
- The economy in the number of orlop-beams;
- Reduced rake to the sternpost;
- The method of stepping the capstan below the beams rather than on the deck below;
- The quality of refined tar;
- The widespread use of fir in place of oak for less important items;
- The practice of roofing over ships in Ordinary to protect them from the weather.

He criticised in particular:

- The arrangement of the futtocks;
- The use of softwood rather than oak for furrings;
- The use of sister keelsons in some ships;
- The excessive size of quarter galleries;
- The (mostly) old-fashioned designs of ships.

As can be seen from these lists, he was exhaustive in his analysis, assessing nearly every component of a ship of war and judging whether it was superior or inferior to French practice. If there is a criticism which might be made, it is in his failure to take into account that the whole may be greater than the sum of its parts: for example, in deck construction, he analyses each component, from beams, carlings and ledges to waterways and binding-strakes, criticising or praising the light scantlings of some or the method of assembly of others, but such structures need to be examined as a whole, since what appears to be a weakness in one component may be compensated for by greater strength in another. Such a criticism is perhaps a little harsh: the structures of ships were (and remain) extremely complex; there are very few straight lines, and few of the forces acting on a ship at sea are at right-angles to the structure. This means that before the advent of the computer such overall calculations were impossible to make with accuracy, and in all events beyond the mathematics and engineering know-how of the first half of the 18th century.

The lasting impression which one gains from the *Remarques* is that they were written by a shipwright of exceptional talent and understanding, one who, to use Ollivier's own words (*Remark CXL*), has "a nice judgement, capable of consideration and divorced of all prejudice".

12. The Rebuilding of Ships in the English Navy

Throughout the archives covering the last quarter of the 17th century and the first half at least of the 18th we see frequent reference to "rebuilding" of ships; yet in *Remark CXXI* Blaise Ollivier states categorically "the English never rebuild their ships". How do we explain this conflict?

First of all, it is perhaps necessary to define some terms, and distinguish between a "rebuild" (what in French is called a *refonte*), and a "repair" or *radoub*. Repairs in England fell into three categories, classified as "small", "middling", or "great", depending on the cost, but rebuilds in principle went a stage further. Brian Lavery, in an excellent treatment of this complex subject[29], talks of two different types of rebuild in the 18th century, in which a ship might be either broken entirely and rebuilt to possibly quite different draughts, retaining few or none of her original timbers; or else the ship might be only partly broken and rebuilt to essentially the same draughts, or in all events using such of her timbers as were sound. However, these distinctions were often blurred.

In France, the distinctions were somewhat simpler: there were two kinds of repair, those carried out afloat and those carried out in dock or with the ship hauled up (the latter being the more thorough); and there was the rebuild, defined by Ollivier in his *Traité de Construction* as "to shift all or most of the parts of which an old ship is composed and which are spoiled". The distinction was thus one of degree (as no doubt it had originally been in England), and there was no suggestion that the lines might be significantly altered in rebuilding.

As the constraints of peacetime budgets bit deeper, the Navy Board was forced to look for devices to spread the burden of cost of building new ships; the solution was to call new buildings "rebuilds". This came about gradually, and it is doubtful if the Board ever considered that what it was doing was a form of fraud, but the fact is that by the time Ollivier visited England in 1737 the definition of a rebuild was so flexible as to include ships broken in Plymouth and built several years later in Chatham – in other words with none of the timbers of the earlier vessel, and certainly not to the original draughts.

The explanation for Ollivier's comment is therefore clear: since for him the sort of practice described above was called building a new ship, he was surprised to discover that the English never rebuilt their ships. In other words, the system was now so flexible that what the Navy Board called a rebuild was not even recognisable as such by a professional shipwright. In effect, what he is saying is that the English had ceased to bother to even pretend that they were rebuilding. As he states in *Remark CLXXXV*: "The English repair their ships for as long as they are able to do so without shifting the frames, but as soon as their ships begin to fail in the frame timbers and they are no longer able to keep them in service without that they shift the frames, then they break them up, since the cost of such a repair exceeds that of building anew, and the work is never as well carried out".

Blaise Ollivier's descriptions of the methods used to repair ships are of great significance, since they help define rather more specifically the meaning of repairs and rebuilds at this time. The *Remark* quoted above goes on to say: "All their repairs consist but of shifting some of the planking of the underwater hull, some beams, knees, or ceiling-planks save those in the hold; they will also shift the keel if it be spoiled, and likewise the stem and the sternpost. These repairs are carried out in dry-dock without discharging the ballast and often without removing the masts. Here they do not condemn a ship when some of her frames are spoiled; they are content but to shift all the planking of the underwater hull in which the caulkers find any fault, to eke the forward and after riders with lower and upper futtocks; they increase the number of standards on the gundeck; they place similar standards on the middle and upper decks, and in this way they bring the ship to a state in which she will last a few years more, and indeed near as long as our own ships last after a rebuild which costs more than building a new ship".

This seems to make it clear: as long as ballast and other stores were aboard the ship, the work that was carried out was simply a repair, however extensive; but the extent of such repairs never went as far as it did in a *refonte* in France, where "all or most of the parts of which an old ship is composed and which are spoiled" were replaced. Ollivier makes this quite clear in the following *Remark*: "The English shipwrights break their ships as soon as they are no longer fit to put to sea and they judge that in order to repair them safely it would be necessary to shift the frames. They bring them into dock to break them". In other words, a "rebuild" in English terms occurred as soon as too many of the frame timbers were spoiled; the ship was broken, and a new one built.

29. B. Lavery: *The Ship of the Line*, Vol. I, pp. 64 *et seq.* (Conway Maritime Press, 1983).

He goes on: "they preserve here with great care all their old ship-timbers", but he also makes it clear that this is not necessarily for rebuilding: they "find a useful purpose for each timber, whether to build the dockyard buildings, or to line the sides and the building-platforms of their docks. I saw this economy at Portsmouth and at Chatham, where several sheds and other buildings are composed solely of old ship-timbers".

Part of the difference between French and English practices in this regard stemmed, it is clear, from the difference in assembly methods of the frame timbers. Whereas in French ships all the timbers of all the frames, whether moulded frames or filling frames, were fastened one to the other with bolts[30], in English ships only the timbers of the moulded frames were fastened together (with treenails), the timbers of the filling frames being secured only by the treenails fastening the planking of the hull and the ceiling. Thus breaking was "carried out more swiftly than we are able to do, because we break our ships while they are yet afloat. Moreover, since the timbers which go to make up the frames are not fastened one to the other they fall apart of their own accord as the hull-planking is removed".

In other words, if a significant number of frames had to be shifted, the vessel to all intents and purposes fell apart, losing her lines, and making a rebuild to the same moulds extremely difficult if not impossible. This method of assembling the frames eventually gave way to methods closer to those used by the French: I am unable to date this change with any precision, but would suppose it to be in about the 1750's. Nor am I able to say whether the same methods were in use in the middle of the 17th century, but it is not impossible that the confusion over rebuilding arose at least in part because of the technical difficulty described above. It is a subject worthy of further research.

Note

The information in the footnotes giving the dimensions and dates of the various English ships mentioned by Blaise Ollivier is taken mainly from the remarkable index of ships by J.J. Colledge, *Ships of the Royal Navy* (Greenhill Books, 1987). It should be noted that details of rebuilds given in these notes take at face value the notion that ships were "rebuilt" from the timbers of the older vessel, although as the greatly increased tonnages following the abbreviation "b.m." ("Builder's Measure") confirm, for the most part this was clearly not the case.

30. The French word is *goujons*, denoting a bolt which does not taper and could be either square or round; ordinary bolts (*chevilles*) were round in the shank and tapered from the head downwards.

13. The Establishments

The following dimensions are taken from Charles Derrick, *The Rise and Progress of the Royal Navy* (1806). They cover the Establishments of 1677, 1691, 1706, and 1719; the Proposals of 1733 and 1741; and finally, the Establishment of 1745. The full text of the 1719 Establishment (ADM 170/429) runs to 40 manuscript pages, and specifies every dimension and scantling – the first time that this was the case. The 1733 Proposals (never ratified by the King in Council), were much more summary. Since Ollivier also restricts himself to the principal dimensions only, we have not thought it worth reproducing the full texts.

DIMENSIONS OF SHIPS

An Account shewing the *Dimensions* established, or proposed to be established, at different times, for building of Ships.

	Establishment of				Proposed in		Establ. of
Gunships 100	**1677 Ft. In.**	**1691**	**1706**	**1719**	**1733**	**1741**	**1745**
Length on the Gundeck	165:0			174:0	174:0	175:0	178:0
Of the Keel for tonnage	137:8			140:7	140:7	142:4	144:6½
Breadth extreme	46:0			50:0	50:0	50:0	51:0
Depth in hold	19:2			20:0	20:6	21:0	21:6
Burthen in tons	1550			1869	1869	1892	2000
Gunships 90							
Length on the Gundeck	158:0		162:0	164:0	166:0	170:0	
Of the Keel for tonnage			132:0	132:5	134:1	137:0	138:4
Breadth extreme	44:0		47:0	47:2	47:9	48:0	48:6
Depth in hold	18:2		18:6	18:10	19:6	20:2	20:6
Burthen in tons	1307		1551	1566	1623	1679	1730
Gunships 80 with Three decks							
Length on the Gundeck		156:0	156:0	158:0	158:0	161:0	165:0
Of the Keel for tonnage			127:6	128:2	127:8	130:10	134:10¾
Breadth extreme		41:0	43:6	44:6	45:5	46:0	47:0
Depth in hold		17:4	17:8	18:2	18:7	19:4	20:0
Burthen in tons		1100	1283	1350	1400	1472	1585

	Establishment of				Proposed in		Establ. of
Gunships 70	**1677 Ft. In.**	**1691**	**1706**	**1719**	**1733**	**1741**	**1745**
Length on the Gundeck	150:0		150:0	151:0	151:0	154:0	160:0
Of the Keel for tonnage			122:0	123:2	122:0	125:5	131:4
Breadth extreme	39:8		41:0	41:6	43:5	44:0	45:0
Depth in hold	17:0		17:4	17:4	17:9	18:11	19:4
Burthen in tons	1013		1069	1128	1224	1291	1414
Gunships 60							
Length on the Gundeck		144:0	144:0	144:0	144:0	147:0	150:0
Of the Keel for tonnage			119:0	117:7	116:4	119:9	123:0½
Breadth extreme		37:6	38:0	39:0	41:5	42:0	42:8
Depth in hold		15:8	15:8	16:5	16:11	18:1	18:6
Burthen in tons		900	914	951	1068	1123	1191
Gunships 50							
Length on the Gundeck			130:0	134:0	134:0	140:0	144:0
Of the Keel for tonnage			108:0	109:8	108:3	113:9	117:8½
Breadth extreme			35:0	36:0	38:6	40:0	41:0
Depth in hold			14:0	15:2	15:9	17:2½	17:8
Burthen in tons			704	755	853	968	1052
Gunships 40							
Length on the Gundeck			118:0	124:0	124:0	126:0	133:0
Of the Keel for tonnage			97:6	101:8	100:3	102:6	108:10
Breadth extreme			32:0	33:2	35:8	36:0	37:6
Depth in hold			13:6	14:0	14:6	15:5½	16:0
Burthen in tons			531	594	678	706	814

	Establishment of				Proposed in		Establ. of
Gunships 20	**1677 Ft. In.**	**1691**	**1706**	**1719**	**1733**	**1741**	**1745**
Length on the Gundeck				106:0	106:0	112:0	113:0
Of the Keel for tonnage				87:9	85:8	91:6	93:4
Breadth extreme				28:4	30:6	32:0	32:0
Depth in hold				9:2	9:5	11:0	11:0
Burthen in tons				374	429	498	508

MEM^{o} – Several Ships were built by the establishments proposed in 1733 and 1741. The establishment of 1745 was not generally adhered to for more than ten years, if so long; and there has been no establishment of the kind since.

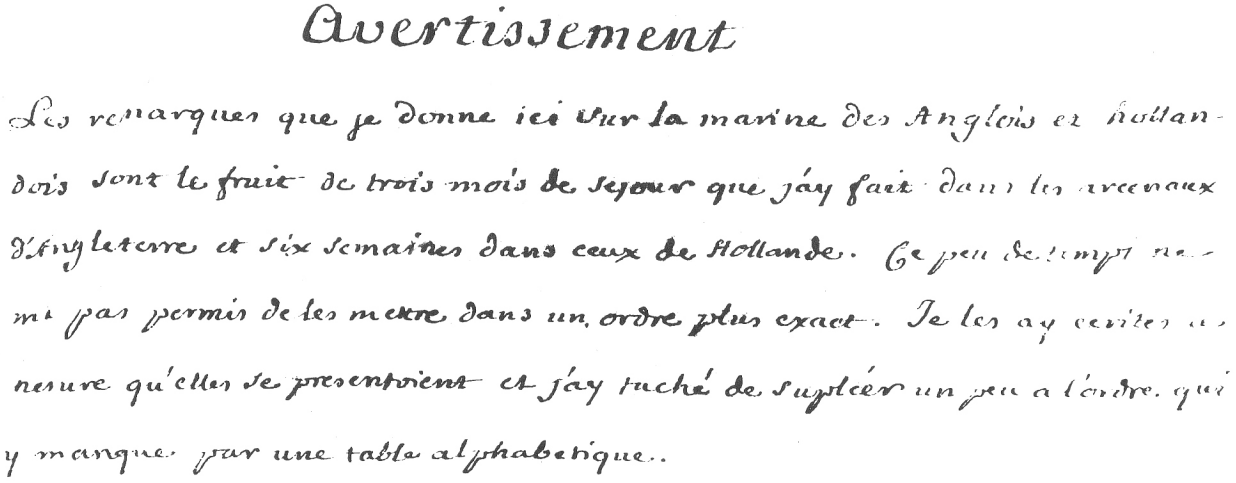
COMPARATIVE TABLE OF PROPOSED DIMENSIONS OF SHIPS

These were the detailed proposals submitted by the various Master Shipwrights in 1733

(Source: John Fincham, History of Naval Architecture)

PARTICULARS.		GUNS. 100.	90.	80.	70.	60.	50.	40.	20.	SLOOPS.
		Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.
Length on the gun-deck from the rabbit of the stem to the rabbit of the post.	Per Establishment of 1719	174 0	164 0	158 0	151 0	144 0	134 0	124 0	106 0	——
	Mr. Ward's proposition	174 0	169 0	161 0	154 0	144 5	134 9	125 2	106 0	——
	Mr. Stacey's ,,	175 0	167 0	160 0	151 0	144 0	134 0	124 0	105 0	87 6
	Mr. Hayward's ,,	174 0	166 0	158 0	151 0	145 0	136 0	127 0	109 0	80 $0\frac{3}{10}$
	Mr. Allen's ,,	——	165 $9\frac{1}{2}$	158 0	152 0	143 0	135 0	127 $2\frac{3}{4}$	106 0	80 6
	Mr. Locke's ,,	——	——	160 0	151 0	144 0	135 9	127 6	109 0	——
Breadth, extreme.	Per Establishment of 1719	50 0	47 2	44 6	41 6 44 10	39 0	36 0	33 2	28 0	——
	Mr. Ward's proposition	50 0	48 2	46 1	42 6	39 8	37 1	34 6	29 2	——
	Mr. Stacey's ,,	50 4	48 0	46 0	41 6	39 7	36 10	34 1	29 1	23 0
	Mr. Hayward's ,,	50 0	47 8	45 5	43 4	41 0	38 6	36 0	30 10	24 0
	Mr. Allen's ,,	51 0	48 7	46 $3\frac{3}{4}$	43 3	40 9	38 $4\frac{3}{4}$	36 1	30 6	24 6
	Mr. Locke's ,,	——	——	44 6	41 6	39 6	37 4	35 0	30 0	23 4
Depth in hold.	Per Establishment of 1719	20 0	18 10	18 2	17 4 18 4	16 5	15 2	14 0	9 2	——
	Mr. Ward's proposition	20 0	19 2	18 5	17 0	15 10	14 9	13 9	11 7	——
	Mr. Stacey's ,,	20 6	19 7	18 9	17 4	16 6	15 5	14 3	9 5	10 0
	Mr. Hayward's ,,	20 4	19 5	18 5	17 7	16 11	15 4	14 4	11 6	9 6
	Mr. Allen's ,,	20 0	19 $0\frac{1}{2}$	18 $1\frac{3}{4}$	17 $3\frac{3}{4}$	16 $7\frac{3}{4}$	15 $4\frac{1}{4}$	14 $5\frac{3}{4}$	9 $1\frac{3}{4}$	9 6
	Mr. Locke's ,,	——	——	18 6	17 4	16 5	15 2	14 0	9 2	9 6
Burthen in tons.[1]	Per Establishment of 1719	Tons. 1869$\frac{43}{94}$	Tons. 1566$\frac{89}{94}$	Tons. 1350	Tons. 1128$\frac{29}{94}$	Tons. 951$\frac{27}{94}$	Tons. 755$\frac{89}{94}$	Tons. 594$\frac{55}{94}$	Tons. 374$\frac{45}{94}$	Tons. ——
	Mr. Ward's proposition	1870	1680	1460	1240	1005	818	660	400	——
	Mr. Stacey's ,,	1903	1651$\frac{38}{94}$	1454$\frac{26}{94}$	1128$\frac{29}{94}$	977$\frac{18}{94}$	787$\frac{74}{94}$	624$\frac{56}{94}$	392$\frac{51}{94}$	200
Draught of water.[2]		Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.	Feet. Ins.
	Per Establishment of 1719. afore	21 6	20 2	19 0	17 7	16 6	13 10	13 10	11 4	——
	Per Establishment of 1719. abaft	22 10	21 6	20 4	18 11	17 10	12 $\overset{3}{10}$	14 10	12 4	——
	Mr. Allen's proposition. afore	21 $4\frac{3}{4}$	20 4	19 $6\frac{1}{4}$	17 0	15 $11\frac{1}{2}$	14 $11\frac{3}{4}$	14 0	11 0	7 9
	Mr. Allen's proposition. abaft	22 $10\frac{3}{4}$	21 10	21 $0\frac{1}{4}$	19 0	17 $11\frac{1}{2}$	16 $11\frac{3}{4}$	16 0	12 $9\frac{3}{4}$	11 3

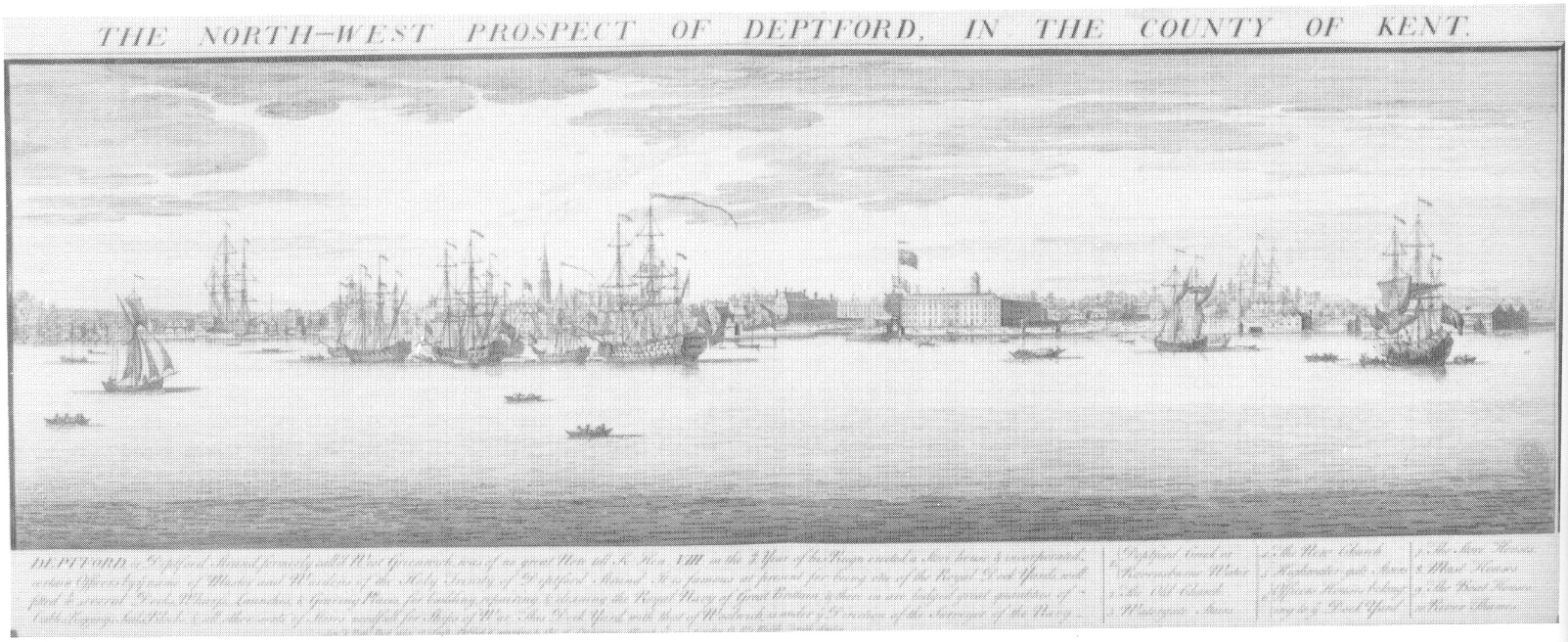
[1] The burthen is not given to the proposed constructions of Messrs. Hayward, Allen, and Locke; — [2], Nor the draught of water to these of Messrs. Ward, Stacey, Hayward, and Locke.
[3], Apparently an error.


Avertissement

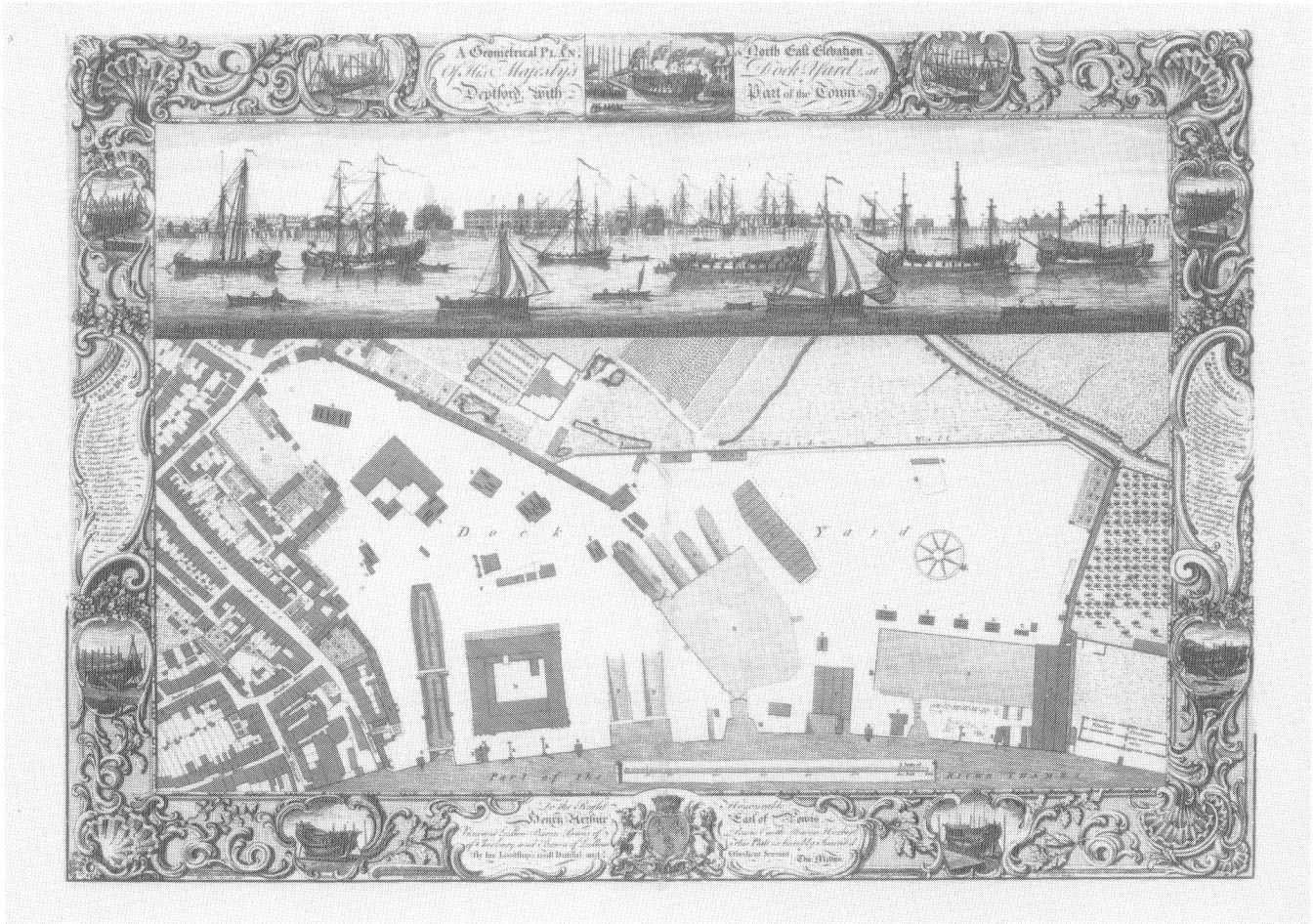
Les remarques que je donne ici sur la marine des Anglois et hollandois sont le fruit de trois mois de sejour que jay fait dans les arcenaux d'Angleterre et six semaines dans ceux de Hollande. Ce peu de temps ne m'a pas permis de les mettre dans un ordre plus exact. Je les ay ecrites a mesure qu'elles se presentoient et jay taché de suppléer un peu a l'ordre qui y manque par une table alphabetique.

Notice

The remarks which I give here on the navies of the English and the Dutch are the fruit of three months which I spent in the dockyards of England and six weeks in those of Holland. This short time did not permit me to arrange them in a more accurate order. I wrote them as they occurred to me and I have sought to remedy somewhat the order which is missing through the addition of an alphabetical index.



15. *View of Deptford Dockyard by Samuel and Nathaniel Buck, published March 26th 1739. (Private collection)*



16. *View of Deptford Dockyard in 1753 Close examination reveals that there has been considerable building in the Yard. (Courtesy National Maritime Museum, Greenwich)*

Remarks on the English Navy

Deptford Dockyard

I. The English have a Naval Dockyard at Deptford, a town situated on the Thames one league[1] below London. There are in this Dockyard five building docks, of which three are today* occupied, one by an 80-gun ship, the second by a 70-gun ship, and the third by a ship of 60 guns.

*12 April 1737

Docks

The first dock is a sort of basin which is about 300 feet[2] [*97.4 m*] long and 50 feet [*16.24 m*] wide, its depth at the water's edge being about 18 feet [*5.85 m*], while at the upper part this depth is but 7 to 8 feet [*2.27 - 2.60 m*]. This dock is closed by a gate as are our own docks, but the gate is of much simpler construction. I shall give its description later*.

*See Rem. 120 p. [111].

The vessel of 80 guns which is on the stocks occupies the upper end of the dock and has its stern to the water; the other end is occupied by two yachts which are being repaired. And between the stern of the ship and the yachts is a bridge which crosses the dock at right-angles, and which they take down when the ship is to be launched.

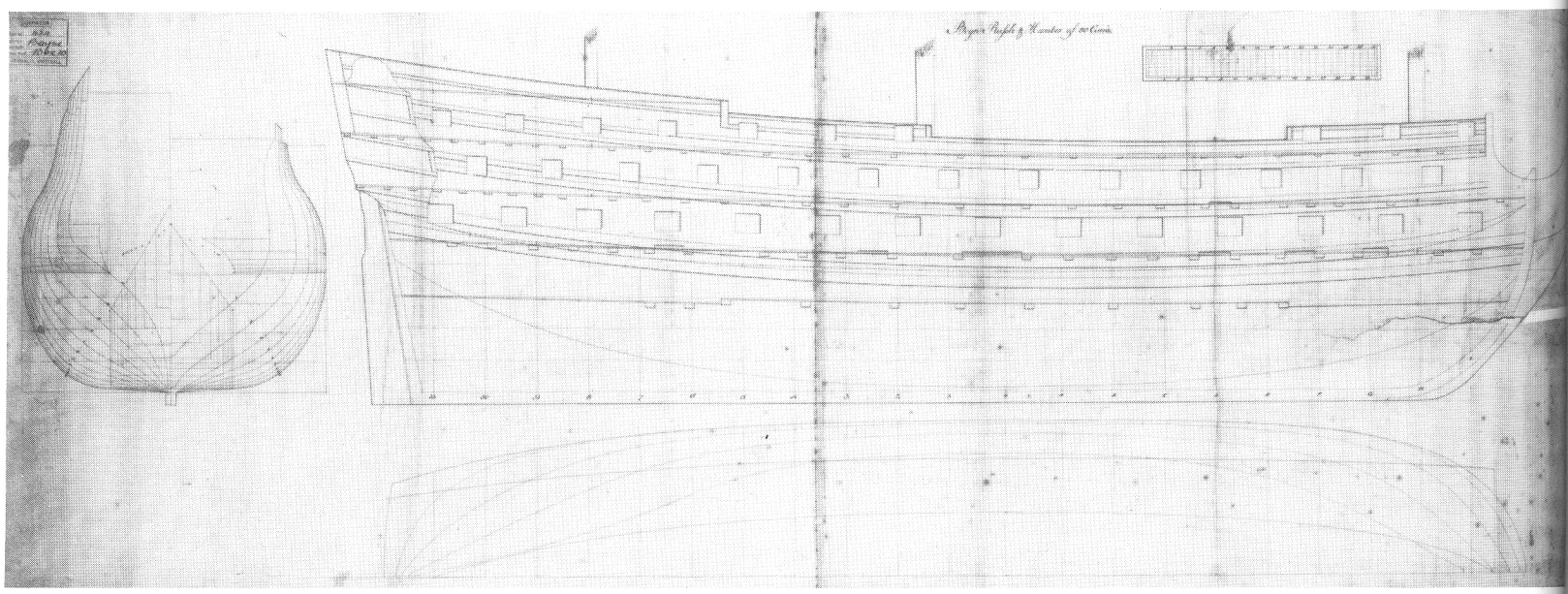
The other docks are less deep than this one; their upper end is almost level with the ground; they are about 250 feet [*81.2 m*] long and 50 feet [*16.24 m*] wide and are closed in the same manner as the first. The ships of the line which they are building there occupy the upper end and the other part is used to repair and grave frigates and yachts. We could draw the same advantage from the new building docks which are to be constructed at Brest by setting up gates on the edge of the quays which are planned to be built between the slips, which would leave between these gates and the ships building on the stocks a space suitable for the repair and graving of small vessels, yet it would be enough to equip in this manner one or two only of the new docks.

II. Access to the ships of the line on the stocks at Deptford is afforded by three bridges, of which one is forward as I have shown by the line **AB** in **Fig. 1**[3]. This bridge is about 12 feet wide [*3.90 m*], and ends at a doorway four feet square [*1.30 m*] cut in the ship's sides next to the stem below the gundeck. The hawse-pieces are cut through at this point as if the doorway were intended to remain always as it is now, and I do not understand at all how it is possible to slide the hull timbers into this part of the ship when they come to the planking and the ceiling of the place where the doorway is situated*. When we make an entrance of this kind we arrange the frames in such a manner that they occupy their normal position when the doorway is shut up. I have seen nothing like this in the ships which are on the stocks at Deptford; all the frame timbers are in place; there is no space into which others can be fitted; the doorway is fashioned as we would fashion a gunport. Perhaps I shall have the opportunity to observe something more of this on another vessel? The two other bridges by which access is afforded to the ships of the line on the stocks at Deptford are situated on either side and three or four feet [*97 - 130 cms*] from the ship like the bridge which I have shown by the line **CD** on **Fig. 1**. They rise obliquely to the plankshеer; their width up to the height of breadth is about 12 feet [*3.90 m*], and from there to the top about 8 to 9 feet [*2.59 - 2.92 m*]. From these bridges access is afforded to the stages which surround the ship by little flying bridges*. I find these three bridges very useful for bringing on board all the timbers more conveniently and at less cost than we do. They are not taken down when the ship is launched in the water, for I have seen them still standing in the docks which are not occupied, and I judge from this that they always build ships of the same strength or near the same strength in the same docks, or else the bridge at the bow and those on

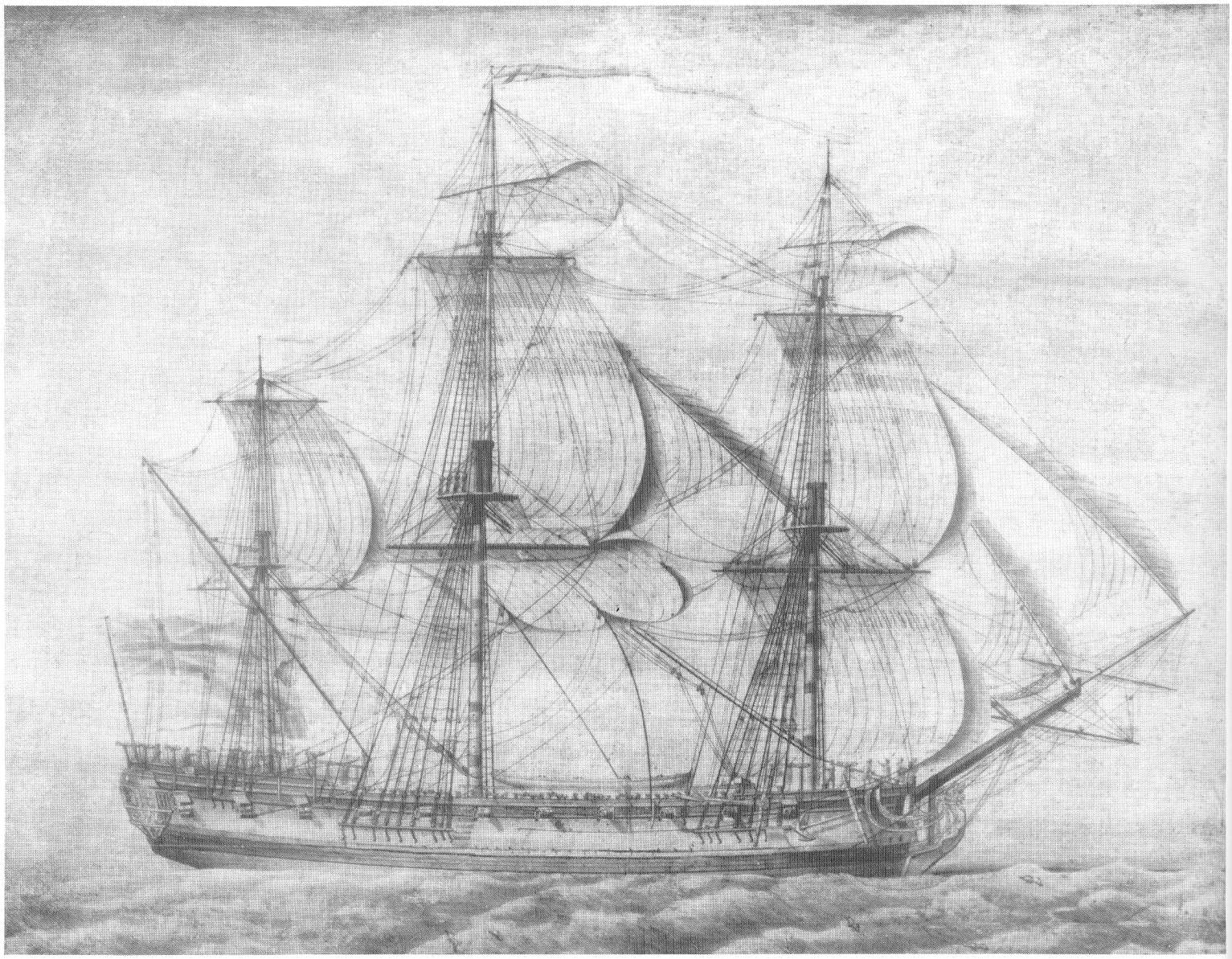
*See Rem. 47 p. [69].

**Since I wrote this Remark I have seen the same bridges in the docks of the other English Dockyards.*

1. **League**: A French "common" league is 4,683 metres, while the nautical league is 5,565 metres. Presumably Blaise Ollivier means common leagues (land measurement).
2. **Feet**: All dimensions are given in French feet (*pieds*), equivalent to 324.8 mm or rather more than an English foot. The French foot is divided into 12 inches (*pouces*) of 27.1 mm, and each inch into 12 lines (*lignes*) of 2.26 mm. To avoid confusion we have inserted the metric equivalent in square brackets after each measurement, and converted lines where possible into fractions of an inch.
3. See Plate 1, pp. 56-57.



17. Boyne *(above). and* **18.** Lion *(below). (Courtesy National Maritime Museum, Greenwich)*



the sides would be either too high or too low, too near or too far away from the ships if they varied much in size.

III. The ship of 80 guns[4] which is on the stocks at Deptford has all her frames in place, the footwaling is partly installed; she has her gundeck beams and part of her spirketting between the gundeck and the lower sills of the gundeck ports; her bottom is planked save for the garboards and an area a few feet below the height of breadth. The wales, the planking at the waterline and that of the upper works are berthed up to the lower sills of the middle deck gunports. This ship is pierced for 14 guns on either side on the gundeck and is intended to have three decks; she seems to me to be of lesser length, lesser breadth and lesser depth in hold than our ships of 74 guns*. The rake of her stem and her sternpost is greater than in most of our ships. Her midship bend is placed well forward of the mid point between stem and stern; I estimate that she has a deadrise of two feet [*65 cms*] and that her tumblehome is the same or a little less great than in our ships. The underwater lines of this ship have a rather fair run especially the after part; her floors rise very little; her stern is admirably well done; she has much fullness at her height of breadth especially at her bow, but a curve in both her waterlines and her vertical sections little suited to cleaving the water. I find her capacity is small in regard to her size. Nevertheless since the English use a smaller crew, take on less munitions of war and victuals than do our ships, this ship may prove to have an adequate height of gundeck sill, to be weatherly and to carry her sail well, yet she will never be a fast sailer. I know of scarce any ships of ours which have better underwater lines.

Ship of 80 Guns, called the Boyne.

**See the proportions of English ships, page [132].*

The ship of 70 guns[5] which is on the stocks at Deptford has as yet only her keel, her stem, stern-frame and some of her floors.

Ship of 70 Guns, called the Frederick.

That of 60 guns[6] is a little farther forward than the ship of 80 guns; she is pierced for 13 guns on the gundeck and is no larger than our 50-gun ships. I find her much better built than the ship of 80 guns; she has a better shape to her underwater lines, her entry is sweeter; she has proportionately greater capacity than the other and a fuller body at the waterline. I think that she will be a good ship in all respects, but for all that a slower sailer than many of our ships.

Ship of 60 Guns, called the Lion.

IV. I have noticed in the ships which are building at Deptford that the English shipwrights make the keel wider and thicker than those of our French ships. I have not measured them but I judge there to be a difference of two inches [*5.4 cms*] in the breadth and and likewise two inches in the thickness. This excessive size is somewhat unnecessary. The position which the keel occupies in a ship is no more important than that which is situated six inches or a foot [*16 or 32 cms*] away from the keel where there is but a single plank. Nevertheless, if it be wrong, as some of our shipwrights claim, that we continue to consider the keel as a necessary and important member, yet it is certain that the English shipwrights surpass us in that error.

Keel

They scarph their keel timbers side by side rather than as we do one on top of the other, I am ready to believe that they have as yet found no inconvenience in their method, yet for all that, our method is the better, for in our ships there can never be a leak sprung through the bolts of the keel scarphs, whereas the bolts of the English keel scarphs being of necessity clenched with roves on one side or the other of the keel and these roves being exposed to rusting are liable to fall away so as to cause a leak. Our keel scarphs are still more to be preferred to those which the English shipwrights practise in that the bolts of the floor timbers, of the keelson and of the riders find the full breadth of the keel for their fastening and weaken it not at all, while with the English method they find but half this breadth.

4. **Boyne**: 2nd Rate, 80 guns, 1160 tons Builders measurement. 157′0″ x 47′6″. Launched Deptford Dockyard 21 May 1692. "Rebuilt" – see Introduction – Blackwall 1708 as 1301 tons b.m., and again at Deptford in 1739 as 1390 tons b.m. Prison ship 1750. Break-up completed March 1763 at Portsmouth.
5. **Frédéric**: (Presumably) the *Prince Frederick*, formerly *Expedition*, 3rd Rate (70), 1116 tons Builders measurement, 152′0″ x 41′0″. Launched Portsmouth 1679, rebuilt Chatham 1699 as 1111 tons b.m.; renamed *Prince Frederick* 2nd January 1715. Rebuilt 1740 as 1739 tons b.m. and reduced to 64 guns. Sold 1784.
6. **Lion**: 3rd Rate (60), 906 tons b.m., 144′0″ x 38′0″. Launched Chatham Dockyard 20th January 1709. Rebuilt Deptford 1738 as 1068 b.m. Sold 14th March 1765.

The English shipwrights line their keel scarphs neither with kersey nor any other filling, they are content but to tar them.

The end of the keel of one of the ships which is on the stocks has no projecting skeg; it is cut off in line with the sternpost; I know not whether the English follow this practice with all their ships, since in the other two ships which are on the stocks, the end of the keel has not yet been trimmed*. Whatever be the case I am inclined to favour rather this cutting off of the skeg. A projecting skeg serves no purpose, and results only in the loss of a part of the breadth of the rudder and in consequence a part of its effect; a very small part it is true, yet it were much better to preserve that effect than to lose it. Between the keel of the English ships and the blocks on which it rests runs a four inch [*10.8 cm*] plank from one end to the other. I have not as yet been able to determine whether this be a false keel or a plank fastened to the keel blocks. I shall examine it again in the other ships which I will see*.

Since I wrote this Remark I have seen that the skeg of the keel is cut off in all the English ships. I imitated this practice in the building of the* **Dauphin Royal.

**Since I wrote this Remark I have seen in the other English ships that this plank is a false keel.*

In the place of the cleats which we nail on either side of the keel on each of the stocks the English use instead a wooden nog driven down vertically into the keel block.

Forefoot

V. There is no forefoot in the English ships, the forward end of the keel is half-lapped vertically to the side of the stem, and this scarph is fastened with iron bolts driven through from alternate sides and clenched over roves like those of the keel scarphs. This method was once practised in France, and it is no more used today except in some dockyards, and then only in the building of longboats and cutters. It is very easy to prove that the method of using a forefoot which is a part both of the keel and of the stem is to be preferrred to that of the English, yet since forefoots are timbers which are difficult to find, and in the absence of a forefoot there is no other course to be followed but that of fastening the end of the keel to the heel of the stem, I have examined with care how the English shipwrights join these timbers so that I may have recourse to it when the need should arise. They do not cut the keel off at the angle which we call the angle of the gripe as we were used to do when we did not employ a forefoot; they extend it forward by one and a half or two feet† [*49 -65 cms*] beyond this angle as may be seen in **Fig. 2**, where **ACB** represents the forward end of the keel, **CD** the heel of the stem, **CB** the scarph and **E** the angle of the forefoot. The English shipwrights working in this manner leave projecting from the angle of the gripe that part of the keel which is marked **EB**, thereby imparting to the scarph much greater strength than if the part **EB** were cut off. It is on this part **EB** that the face piece comes to rest later.

†.... they extend it forward by one foot or one foot and a half ....

Stem

VI. The stem of the English ships has the same siding as the keel, as in most of our own ships, save at the upper end where the thickness is increased by 5 to 6 inches [*13.5 - 16.3 cms*]. I presume that this is to make the stem alone bear the score in which the bowsprit rests. In our own ships the first two hawsepieces perform this task of the English stem, and I find our method superior, not because it be any stronger since in this respect both are equal, but because we do not need to employ such a large timber as the English to fashion the stem.

The English shipwrights cut the rabbet of the stem flush with the inner face of this timber, so that the stem projects out beyond the planking by all its thickness less that of the planking. This practice used to be employed in some of the shipyards in France, but today all our shipwrights leave 4 or 5 inches [*11 - 14 cms*] of the width of the stem within the rabbet, and some even half the width of the stem. Our practice in this respect is to be preferred to that of the English shipwrights, for the stem is better fastened to the vessel, the sea finds less purchase on its outer edge, and the planking has beyond compare a more solid fastening.

Sternpost

VII. The sternpost of the English ships is tennanted into the keel as in our own ships, but it is composed of two timbers, of which one, marked with the letter **A** in **Fig. 3**, rises from the keel to the helm-port transom and bears the tennant which fits into the keel. This piece at its heel is as wide as the timber will allow and the same siding as the keel. The other timber marked with the letter **B** rises to only half the height of the sternpost; it is 2 to 4 inches [*5.4 - 10.8 cms*] wide at the head and 8 to 10 inches [*21.7 - 27.1 cms*] wide at the heel. I can see no reason why the English make their sternposts thus of two timbers. I would be tempted to believe that the second timber takes the place of an inner post, since up to now I have seen no other, but in that case the

inner post used by the English does not as in our ships extend to the head of the sternpost, and the sternpost is cut into at the level of the upper googings of the rudder. If it be thus then our method is to be preferred to that of the English. I shall take up this Remark again if I see in other Dockyards ships more advanced in building than those at Deptford*.

Since I wrote this Remark I have seen that the English shipwrights do not employ an inner post.

VIII. Placed on top of the keel of the English ships is a rising wood which runs from the bow to the stern as in most of our ships. I have not seen how it is fastened at the forward end to the apron, yet I have seen that at the after end it is butted against the sternpost, rather than as in our own ships being scarphed to the arm of the deadwood knee. In one of the ships which is on the stocks at Deptford the deadwood of the stern is made up of a straight timber laid over the rising wood of the keel, assembled with hooked scarphs and scarphed to the deadwood knee; in another ship there are two like timbers placed one over the other on the rising wood; in the third ship there are three timbers over the rising wood. This last ship has no deadwood knee. All these timbers serve as the rising wood for the crotches at the stern and since they provide the same strength as our method we could follow the example of the English and place in the deadwood of the stern two or three timbers, should we lack for timbers suitable to build this part of our ships in the way to which we are accustomed, or should this allow us to conserve our timber better*. It appears that the English shipwrights also use this method according to their needs since the three ships which are building at Deptford are in this respect constructed in three different ways. That which we could do better than they would be to use timbers which are not so thick, since theirs are sided athwartships the same as the keel in the timbers of the stern, and when they come to plank the ship they are obliged to dub away 3 to 4 inches [*8.1 - 10.4 cms*] of the timber on either side to make a landing for the planks*.

Rising Wood

*I used this method in 1739 in the building of the Mars. I placed two deadwood timbers one over the other, both butting against the sternpost, and I placed the deadwood knee over the top.

*See Rem. 43 page [65].

IX. There is in the English ships an apron as in our own ships, with the difference that it is much larger, particularly in its siding athwartships, where it exceeds by 4 to 5 inches [*10.8 - 13.6 cms*] on either side the width of the stem. This thickness is necessary by reason of the rabbet of the stem being flush with the inner edge of this timber so that a heavy apron is needed to support the hooding ends of the wales and the planking. Our method is in this respect to be preferred to that of the English shipwrights; an apron of but middling thickness suffices for our ships since the rabbet of the stem is in the middle or near the middle of the stem; there is a greater strength, as I have already said when speaking of the stem, a greater economy, and the head of the ship is not so weighed down.

Apron

The timbers of the apron in the English ships are not scarphed as they are in our own ships, they are merely joined one to the other by a plain scarph a foot long. I shall comment elsewhere on how the apron is joined to the keelson*.

*See Rem. 43 page [65].

X. The fashion pieces of the English ships are set up in the same manner as in most of our ships which have a round tuck. Their heel is carried forward 4 to 4 ½ feet [*1.30 - 1.46 m*] from the outside of the sternpost; they are canted aft, by which I mean that they form an obtuse angle with the keel in the direction of the ship's breadth, so that they take on part of the bevel themselves; they have a two inch [*5.4 cm*] score in the way of each transom and they are joined to the transoms only with treenails. In France we do not score our fashion pieces at all.

Fashion-Pieces

XI. The wing-transom, the deck-transom and the helm-port transom are set up as in our own ships; the latter is broader underneath at the middle, and this thicker part extends for the whole distance between the two stern-chase ports of the gunroom. I do not see why this should be necessary. We save timber and lighten the stern of our ships by avoiding this practice.

Transoms

In the English ships there are filling transoms as in our own ships, and other timbers which I will call half-transoms which are quite unknown to us in France but their use seems to me to be good. These half-transoms are set up in the following manner. The English shipwrights place a timber on either side of the sternpost shown by the letter **A** in **Fig. 4**, scored one third at the upper end to the deck transom marked **B** and at the lower end to the filling transom which is level with the heel of the fashion piece and marked with the letter **C**; this timber is furthermore half-lapped to the transom marked **D**, which is placed between the deck transom and the first

of the filling transoms. There thus remains between the transoms **B** and **D** a space in which we place a further transom, and likewise between transom **D** and transom **C**. It is in these two spaces that the English shipwrights place a half-transom like that marked by the letter **E**. This half-transom is parallel to the filling-transoms; it runs from timber **A** to the fashion piece, to which it is half-lapped or scored down to a third of its thickness. Thus instead of using two transoms of which one is very considerable both in length and thickness, and the other by its shape is difficult to obtain, the English shipwrights use four half-transoms made of straight timber, short and common. I find in this method all the strength necessary and an economy of timber which is not to be ignored.

The English shipwrights place a transom between the wing-transom and the deck-transom; I do not think it to be necessary. Our ships are well enough fastened without this transom; they would never suffer any weakness in that part, and I think that we do better than they do in this respect in that we save the expense and the weight of this transom.

Here they assemble the sternpost with the fashion pieces and all the transoms save the helm-port transom before raising them up, and all these timbers are raised together just as we do in France, with the difference that the English shipwrights do not as we do fasten either the helm-port transom or the top-timbers of the fashion piece; they only add these timbers when the ship has been framed to the height of breadth, and this costs them more labour than we expend.

Frames

XII. The frame timbers of the English ships seemed to me to be one or two inches [*2.7 - 5.4 cms*] thicker in the floors than those of our ships, but at the waterline and in the upper works they exceed our own only in their thickness or sided dimension, while in the moulded dimension they are no heavier than in our own ships; on the contrary, I believe them even to be half an inch or an inch [*1.4 - 2.7 cms*] less wide. I did not measure them*. I presume that the English shipwrights give so much thickness to their frames because their planks are fastened but with treenails and they should be too much weakened thereby if the frames were only of the same thickness as ours*.

I had not yet measured the frames of the English ships when I wrote this Remark, but having since that time had the opportunity so to do I was able to verify that it is indeed the case.

***This same consideration led me to mould the timbers of the *Mars* thicker than those of other ships of her rate.**

***See Rem. 45 page [68].**

In the ships which are on the stocks at Deptford the frames are set up so that they all touch one another as far as the heads of the lower futtocks, or else if there be any space left in the arrangement of the frames it is filled with filling timbers. In all this area the seams or joint lines of the timbers both within and without are caulked. I have been unable to discover the reason for this caulking. I shall endeavour to find it out later*, but I approve greatly their method of leaving no space between the floors, and for some time I have thought to fill up the spaces of the **Dauphin Royal**[7] before she be finished†. Three great advantages result from this filling. 1.st the filling which is placed in the floors takes the place of ballast, and a ballast which is heavier than ordinary ballast in that it is placed at a greater distance from the centre of movement of the ship than ordinary ballast. 2.nd if there are spaces left between the timbers of the floors it is impossible to prevent water from remaining in these spaces however careful one is to pump the ship often; this water moves to the lee side when the ship is under sail and tends to make her heel; by means of the filling this disadvantage is avoided. 3.rd the vapours from this water which remains in the bottom of the ship spoil the bread. Thus by filling up the spaces with timbers no water should gather there, the ship will carry her sail better and the bread is not subject to be being spoiled. These considerations merit greatly that no space should be left between the timbers of the floors, but I do not see that it should be necessary to extend this filling so high as the heads of the lower futtocks as the English shipwrights do; it will suffice to fill up to a foot above the rungheads.

*†.... I had already put this same method into practice in the **Dauphin Royal** before I knew that it was employed by the English shipwrights ....*

From the head of the lower futtocks to the waterline the frame timbers of the English ships touch in some places, while in others there is a space of 1, 2, or 3 inches [*2.7 - 8.1 cms*]; at first sight one would say that they are so spaced by chance, yet I have noticed that they have frames drawn out in the loft every so often and indeed spaced equally one from the other. I shall perhaps

7. **Dauphin-Royal**: Commenced building in 1735 at Brest and launched after Ollivier's return in 1738. Struck from the lists in 1783. See the Introduction for many details of English practices which Ollivier employed on this ship.

have cause later to comment again on ships which have still to be planked, unlike those which I see at Deptford*.

*See Rem. 45 page [66].

At the waterline and up to the lower sills of the gundeck ports all the frames touch each other; from there to the plankshеer there are spaces, but smaller and less frequent than in our ships. The English shipwrights cut into few of their frames to form the gunports of the middle deck and to avoid cutting them they employ futtocks which are curved like that marked with the letter **A** in **Fig. 5**. This method seems to me to be good, and we could copy it insofar as the timbers are to be found or in those cases where such a method would result in a saving. I am inclined to believe that the English shipwrights only use this method in such circumstances, for by no means all the gunports of their ships are formed from futtocks of this shape*.

*Since I wrote this Remark Mr Ward Master Shipwright at Chatham with whom I spoke of it has confirmed my observation.

I have not yet been able to ascertain whether the timbers which go to make up the frames be fastened one to the other with iron bolts or treenails, or whether there be no fastening at all, for the ships which I have seen at Deptford are two of them near fully planked, while the third has only her floors in place. I shall remark this question from other ships, or from this last one if later on I should see her lower futtocks placed*.

*See Rem. 45 page [66].

XIII. The hawse-pieces of the English ships are fitted as in our own ships, with the difference that the first two are situated four inches [*10.8 cms*] from the stem and that there is a space between the others of two or three inches [*5.4 - 8.1 cms*], save in that place where the hawseholes are to be cut. Only recently in France have we also begun to leave a space between the hawse-pieces, but then only of one inch [*2.7 cms*]. I have related above when speaking of a doorway cut in the bow to provide access to the ship while she is building that the hawse-pieces on either side are cut through by this doorway.

Hawse-Pieces

The English shipwrights fashion their hawse-pieces in such a manner that in the place where the hawseholes are to be, an extra thickness is left which is 18 to 20 inches [*49 -54 cms*] high and flush with the hull-planking on the outside, and within is the full thickness of the planks of the ceiling, so that the planking and the ceiling are interrupted by this swelling and the hawseholes are cut only in the hawse-pieces as may be seen in **Fig. 6** which shows the hawse-pieces in the English manner. We in France cut the hawseholes in the planking of the hull, in the ceiling and through the hawse-pieces, and in this we do better than the English shipwrights, since with our method the planking and the ceiling are cut only by the hawseholes themselves, while with the English method they are cut through by the whole of the area of extra thickness[8], which must needs be a few inches larger than the diameter of the hawseholes; and the larger the area removed the weaker will be the fastening together of the ship, and in this case the English method weakens the bow of the ship more than does our own. It is easy to discover the reason why the English shipwrights leave the extra thickness in the hawse-pieces, which is so that there be no seam in the hawsehole; of necessity there are two such seams with our method, yet the care which we take and which the English shipwrights take also to line the walls of the hawseholes with a sheet of lead does away with the disadvantages which can result from having seams. And besides the fact that our method is to be preferred to that of the English shipwrights in respect of the strength of the ship, it is also cheaper since we are not obliged as they are to use timbers of excessive thickness in order to form the navel-hoods within and without.

XIV. The keelson of the English ships is twice as thick as that in our ships in its moulded dimension; the timbers of which it is made are scarphed as we scarph the timbers of the keel[9]. I was unable to see whether hooked scarphs are used*.

Keelson

*See Rem. 49 p. [70].

8. Called the *navel-hoods* or *navel-woods*.
9. i.e. horizontally.

Stemson

Since I wrote this Remark I have seen that there is no sternson knee in any of the English ships.

XV. At the bow of the English ships is a stemson which rises in three pieces to the head of the stem whereas in our ships it rises only as far as the deck or 2 or 3 feet [*65 - 97 cms*] from it, yet the English stemson is a third less thick than ours. I did not see any sternson knee aft in the ships which are building at Deptford*.

Ceiling

XVI. The English ships are planked horizontally in the ceiling; there is one strake about a foot [*32 cms*] from the keelson which runs from the bow to the stern whose thickness exceeds the other strakes by about 3 inches [*8.1 cms*]. I have not yet been able to see if this plank is let down over the frames[10]. There is a similar strake at the rungheads and another beneath the orlop-beams. The ceiling between these principal strakes is of the same thickness as in our ships. Between the orlop-beams and the deck-clamp of the gundeck there are four strakes of thickstuff assembled hook-and-butt as appears in **Fig. 9** in the manner that some of our shipwrights in France also do. These strakes are about the same thickness as the clamp.

The spirketting placed between the gundeck and the lower sills of the gundeck ports is also assembled hook-and-butt. This strengthening seems to me to be good, it opposes the tendency to hogging, and should be preferred to our practice, which differs from that of the English shipwrights in that we only butt these planks in the ceiling.

***Since my voyage to England I have done this in the building of the* Dauphin Royal.**

The quickwork between the ports of the gundeck is open in certain places as shown in **B, Fig. 5**. It is probable that this is to allow air to the frames[11]. This method deserves to be imitated in France*.

Orlop-Beams

See Rem. 142.

XVII. The orlop-beams in the English ships are more numerous than in our own ships; they run like the deck-beams to join the frames, and are supported by the ceiling-planking into which they are scored instead of finishing at the ceilng as in our ships[12]. The English method may well be better in this respect, yet it is by no means a point deserving of attention. Each of the orlop-beams is fastened with knees of timber at either end as in our own ships*.

Deck-Clamps

***Since I wrote this Remark I have seen that the beams of the middle deck are scored down as they are in our own ships, which they do by forcing up the middle of the beam with a jackscrew in order to increase its camber by a few inches and shorten its length. I did it in the same manner in the* Dauphin Royal.**

XVIII. The clamps of the gundeck in the English ships are set like those in our own ships, yet they are assembled like the planks of the wales, by which I mean that the scarphs are not plain but long. They are scarphed hook-and-butt with the plank of the ceiling on which they rest, as I have said in Remark **XVI**.

The middle deck clamps are also placed and proportioned as in our own ships, and assembled like the planks of the wales, but the English shipwrights install them before they put in the beams, whereas we place them after laying the beams. I saw the clamps of the middle deck in place in one of the ships on the stocks at Deptford, and the beams are not yet in, which leads me to believe that the beams will not be scored down into them. I shall remark on this later*. I shall say nothing of the clamps of the upper deck and of the forecastle and quarterdeck for I have not seen them yet.

Beams

I was mistaken; there are fewer. See Rem. 141, page [144].

XIX. The English ships have about the same number of beams on the gundeck as our own ships*; I have not yet sufficiently examined how they are spaced; I have seen only that there is but one beam between the mainmast and the main hatchway, and that between the two beams forming the partners of the mainmast there is a space one and a half times greater than that found in our own ships. I shall endeavour to find out the purpose.

10. Almost certainly not; the plank is the limber-strake. See Remark L, page 70.
11. Ollivier is correct. They were called *air-strakes.*
12. On French ships the orlop-beams were either butted against the ceiling and supported by small chocks which were nailed to it, or else fastened with a single knee at each end. See Jean Boudriot, *The Seventy-Four Gun Ship*, Vol. I, p.108, and the Glossary of Shipbuilding Terms, page. 351 of the present volume.

The beams of the gundeck are scored down into the deck-clamp, some but half an inch, and others one or two inches [*2.7 - 5.4 cms*], and nearly all are supported in the middle by a pillar which runs down to the keelson or else only down to an orlop-beam. Our practice of laying the beams over a carling and only placing pillars under every second beam seems to me to be preferable; the support is the same, and the hold is less encumbered.

Most of the beams of the gundeck and those which I saw being made for the middle deck in the ships at Deptford are made up from two or three timbers, scarphed together like those of our own beams of two or three timbers, save that instead of tabling them one inch as we do at the middle of the scarph, the English shipwrights cut a large number of tables in the form of coaks as in the half-beam represented in **Fig. 7**. Like us they strengthen the pieces which make up the beam with iron bolts[13].

The English shipwrights leave at the ends of the beams all the width which the timbers can provide fore-and-aft, even when it exceeds the amount required, and cut off this extra fullness diagonally. In this way they find more readily the lodging knees which they fay to the ends of the beams. Thus see for example **A** in **Fig. 8**, which is a beam seen from above, where **BC** is that part of the thickness of the timber which exceeds the normal width of the beam; they preserve this timber as far as **D**, from which point it disappears, and thus the knee **E** makes a more obtuse angle than if the beam ran in a straight line, and they are in consequence to be found more easily.

Knees

XX. The beams of the gundeck in the English ships are joined to the sides of the vessel each by four wooden knees, two at each end, of which one is a hanging knee and the other is a lodging knee. These knees are fastened to the sides of the ship and to the beam with iron bolts; these are the same size as in our own ships. By this method the English shipwrights fit four knees where we only place two, but their ships need this extra strength since the waterways are not scored down over the beams, as I shall explain in the following Remark.

I shall not speak of the knees of the middle and upper decks since I have yet to see them.

Waterways

XXI. The English ships have on their gundeck only a very wide plank as a waterway, one and a half inches [*4 cms*] thicker than the planking of the deck, laid flat over the beams and faired to the thickness of the planks of the deck and the spirketting. This waterway touches the frame timbers, and a part of its width is covered by the spirketting, so that there is in this area a seam which is very difficult to caulk. It used to be executed in the same manner in some of our French dockyards, 50 years ago, but the practice which we follow today of placing the waterway so that it fills the angle formed by the beam with the deck[14] is beyond compare superior in respect of the caulking which is always well executed in this place. Yet this is not the only advantage which our waterways have over those of the English; in our ships they are fastened to the ship's sides with iron bolts and scored down over the beams, they join the decks to the sides of the ship and resist any tendency to hogging. The lodging knees in the English ships achieve nearly this first effect of our waterways, yet not the second. Furthermore our waterways use less timber, and we fashion them from timbers which are more readily to be found than lodging knees, and fewer iron bolts are required for their fastening.

13. According to a letter (undated) written by Blaise Ollivier, composite beams were not introduced into French ships until 1686: "*Since 1686 we have been using these composite beams in Toulon. The first were fitted to the* Éclatant *(70). I find, on consulting the notes of my late father, that they were invented by my great-grandfather [Blaise-Joseph Ollivier], who built this ship .... Composite beams are not used at all in Rochefort. They are unknown in England and in Holland; even at Brest they are only known since the building of the* Royal-Louis." Since the latter vessel was not laid down until March 14th 1740 (by Ollivier himself), the date of this letter must post-date the Remarks, which makes the affirmation difficult to explain, unless he is referring to a particular method of assembly, of which there were several used in the French Navy (see the Glossary of Shipbuilding Terms, page 351.
14. Probably an error; Ollivier almost certainly means the angle between the deck and the ship's sides.

Deck-Hooks

XXII. In the ships which are building at Deptford I have seen only the deck hook of the gundeck, which is arranged as in our own ships, save that it is raised some 3 inches [*8.1 cms*] above the planking of the deck and has a rabbet cut in it 7 or 8 inches [*19 - 22 cms*] from the timbers of the hull, upon which rest the butts of the planks of the same deck. This practice seems to me preferable to that which we employ in placing the deck hook at the level of the beams and in extending the planks of the deck forward over the hook to the frame timbers. There is then a seam between the planking of the deck and the spirketting which is difficult to caulk, and this seam is not to be found in the English ships; the seam between the deck hook and the spirketting is found three inches [*8.1 cms*] in the deck, and may be caulked readily. I should also prefer the English method since when we need to shift a piece of binding-strake or a deck plank we must seek the butt under the spirketting, yet with the English method this butt is to be found within board. I shall speak later of the breasthooks*.

*See Rem. 72 page [86].

Hull Planking

XXIII. The English shipwrights plank the bottom of their ships with plank of the same thickness as that used in our French ships, yet instead of fastening them as we do with one nail and one treenail to each frame, they fasten them with two treenails. I have not seen a single nail in all of the planking of the two ships which are near fully planked at Deptford, and in this point I believe the English shipwrights act more wisely than we. Nor have I seen there a single iron bolt such as we employ at the butt of each plank; I shall observe in ships which are further forward than these whether any bolts are employed*. We lay the planks of the hull after first planking the ceiling, while the English shipwrights on the contrary plank before laying the ceiling. In order to lay them and set them to against the frames they use the same wrain-bolts as we do, yet they fasten their planks with the treenails before caulking the ship, whereas we only drive the treenails once the ship has been caulked. With our method we seek to prevent the treenails from splitting the planking; we desire also that the treenails shall serve to tighten the oakum in the seams, yet the English shipwrights desire on the contrary that the caulking shall tighten and strengthen the fastening of the treenails in their holes. I believe each method to be the equal of the other. In all events the English shipwrights cannot do otherwise than to drive their treenails before caulking since they employ no iron nails to fasten the planks.

*Since I wrote this Remark I have seen that the English shipwrights use no bolts at the butts of their planks.

The strakes about the waterline in the English ships are as in our own ships thicker than those of the bottom, yet rather than laying them edge to edge as we do, the English shipwrights assemble them hook-and-butt as in **Fig. 9**, and I find their method to be excellent since these strakes assembled in this manner resist the hogging of the ship.

The planks of the upper-works are of the same thickness and are laid as in our own ships; they are fastened only with treenails.

Wales

XXIV. The wales of the English ships are the same breadth and thickness and are fastened as in our French ships; they are joined at the edge to the planking of the waterline hook-and-butt, yet their sheer is so extreme that at the stern they are entirely pierced by the aftermost gunports*. The English shipwrights fasten the wales only with treenails.

*See Rem. 85, page [91].

Port Sills

XXV. The lower sills of the gundeck ports of the English ships are placed only in the thickness of the frames and do not as in our ships project within and without so as to be flush with the spirketting and the planking of the hull; they are set like our upper sills save that their ends are bearded and then driven into the frames, as may be seen in the sill marked **C**, **Fig. 5**. These English sills leave two seams[15] in the lower part of each gunport, yet the planking of the hull and of the spirketting is not cut into by the sills as in our ships. I find that the English method is better than ours*; the two seams can be so well and so frequently caulked that the water can never penetrate. We leave one seam in the lower sill of some of our gunports when we do not wish to cut into the wales through extending the sill outboard; it would not be difficult to leave

*I copied this practice in the building of the **Dauphin Royal**.

15. i.e. one between the sill and each of the outer planking and the spirketting.

two at each port, and I esteem greatly the benefit which would result from this practice whereby we should no longer cut into the planks of the spirketting or of the hull. It is probably with a view to preserving the fastening together of their ships that the English shipwrights follow this practice.

The upper port sills are fashioned as in our own ships, save that for every port the upper sill is bearded at either end before being driven home, as shown by the sill marked with the letter **D** in **Fig. 5**, whereas we drive ours home in divers ways which have the same effect.

Counter

XXVI. The counter of the English ships is as concave as it was 50 years ago in our own ships; unlike us, the English shipwrights have not done away with this great concavity, which offers a dangerous hold for any striking sea. This same counter has as great or a greater projection as in our French ships, yet it is not crowned by a second small counter as in our ships, and in this the English shipwrights do better than we, for there is nothing more useless in a ship than this small counter.

The English shipwrights fashion their counter timbers and taffarel supports as we do, yet these latter timbers, instead of being cut straight as in our ships, curve forward at the level of the stateroom as in the timber represented by the **Fig. 10**, so as to give a greater breadth and commodiousness to the stern-gallery, and to diminish the projection of this gallery. Likewise when there are two galleries one above the other, as in three decked ships, the timbers arch at the level of both galleries. I have shown the counter timber of a three decked ship in **Fig. 11**. I approve greatly these timbers; they detract not at all from the size of the cabins; they do away† only with the rake of the counter, which only brings to nought the excessive depth which we give to our stern-galleries. This practice I knew already, and had already some time ago so disposed the stern-timbers of the **Dauphin-Royal**† in such a manner as to draw near enough the same advantage as do the English shipwrights by this method*.

†.... they diminish only the rake of the counter ....

*†.... I used it in the ship the **Dauphin-Royal** which I began recently to build in Brest ....*

***See Rem. 100 page [98].**

Head

XXVII. The shipwrights here make a great saving of scarce timbers in the construction of the head; they do not as we do make the upper parts of the knee of the head, the trail-boards and the face piece[16] from compass timbers worked separately, but rather the English shipwrights make a mould which represents the exterior shape of the ekeing of the knee of the head, of the lacing and of that part of the face piece and the heel of the knee of the head which touch the stem, and then fill the area described by this mould with several straight timbers or compass timbers of a very common curve, which are fastened together with a series of hooked scarphs, as it appears in **Fig. 12**, which shows the assembly of these timbers as I saw them prepared and fastened together in the ship of 80 guns[17] which is on the stocks at Deptford. I have marked on this Figure with pricked lines the shape of the upper part of the knee of the head and of the trail-boards. In this place the English shipwrights diminish the thickness of the timbers on either side by one or two inches [*2.7 - 5.4 cms*], and then place there the cheeks of the head at this place. The beakhead has then the same form as if it were made up as it is in our French ships. I find this manner of building the head more simple, no less solid, and beyond compare less costly than that which we employ; I find also that the cheeks join the English head better to the ship than those of our ships, for with our method the cheeks are fayed only to the upper part of the knee of the head, whereas in the English head they are fayed to near all the timbers which go to make up the knee of the head, the trail-boards and the face piece. I shall have occasion again later to remark on the head*.

***See Rem. 99 page [97]. I copied this English method in the building .... (deleted).**

16. These are only approximately equivalent terms, for reasons which are clear from Blaise Ollivier's explanations.
17. i.e. the *Boyne*.

Iron Knees

XXVIII. I saw in one of the docks at Deptford the King's yacht[18] which is being repaired there; I found nothing remarkable about her save only the knees of the gundeck which are of iron and which have neither a diagonal brace nor a chock between the knee and the side. In the place of the brace there is a thickening at the throat which is very strong. The avoidance of the diagonal brace would not serve for our ships of war, yet the avoidance of the chock seems to me to merit attention, and I believe that following the example of the English shipwrights we could do away with it also. We use it only to correct the convexity of the sides of the ship, yet since the English smiths, who are no more skilled than our own, succeed in bending and canting the arm of the knee which meets the side in such a manner that it fairs completely with the side, we could as the English smiths do bring to our iron knees that perfection which they lack at present. There would result from that a rather considerable saving of timber, and the ceiling would no longer run the risk as it does today of becoming rotten beneath the chocks*.

Since I wrote this Remark I did away with the chocks behind the iron knees in the building .... (deleted).

Timber

XXIX. The compass timber which I saw used at Deptford arrives in the Dockyard rough-hewn or only worked on two faces, so that scarce the bark is removed and the upper branches cut off. The timber is from the English forests; it is of middling good quality and extremely dry, yet it is used with but little care; much of the sapwood is left on, and I saw many frames, timbers of the stem and transoms where there were two or three inches of sapwood already half rotted on one or two of their edges. I saw no shipbuilding timber in the water nor any place suitable to store it thus; the compass timber and scantlings other than plank are scattered and piled up without any system all about the docks and in very great quantity. The plank is stacked with great care under cover and seems to be timber of old felling, sawn already long since and very dry. It is I believe for the most part East Country plank†; its quality is equal to or less good than our plank of Lorraine[19]

†.... It is I believe timber from New England ....

Treenails

XXX. The treenails are piled up in storerooms as we do in France; they seemed to me to be very dry and mooted a long time ago; in thickness they exceed our own by one or two lines [*2.3 - 4.5 mm*]. I shall have occasion to speak of them again later*.

***See Rem.* [XLV]** (number left blank in the MS. Ed.).

Masts and Spars

XXXI. The masts in Deptford are worked in a mast-house; I saw in this mast-house mast caps in the English style with which we are already familiar*, and another kind of cap which I did not know at all. It is a topmast cap which bears an extra thickness of timber on either side in which there is a sheave, no doubt for the topsail yard ties.

See Rem. 55, 109, 174 on pages [71], [102], and [163].

I also saw at Deptford bowsprits which instead of having clamps for securing the jibboom have a cap rising vertically over the head of the bowsprit in which there is a round hole, through which the jibboom passes. To this cap is fastened a small hinged iron clamp to secure the jackstaff. I saw no other masts apart from some small spars upon which they are engaged at the moment.

There is a very large mast-pond at Deptford where the unworked mast timber is preserved in water. The quantity of these spars is very great. They are fastened together in pairs with oak dogs, and for the most part stand high and dry when the tide is out.

18. We have been unable to identify this yacht with certainty. On the one hand, a letter from the Admiralty to the Navy Board dated April 1st 1737 identifies this yacht as the *Mary*. (ADM/A/2256, N.M.M.) However, the *Progress Books* identify three other possible candidates: the *Royal Caroline*, docked on March 8th 1736 and launched on April 25th 1737; the *Catherine*, docked February 5th 1736 and launched on May 25th 1737 after undergoing a Great Repair; and the *William and Mary*, docked and launched on the same dates as the *Catherine*, also for a Great Repair.
19. Blaise Ollivier was well qualified to judge, having carried out a tour of inspection of shipbuilding-timber in Lorraine at the injunction of Maurepas in 1733 (see Introduction).

XXXII. Ship's boats are built under cover at Deptford. I saw a boat on blocks which is about 30 feet [*9.75 m*] long, the ribs of which are but of one inch [*2.7 cm*] scantling and the planks thereof scarce more than 7 lines [*1.6 cms*] thick. From their lines, to judge by that one which I saw and several others being repaired in the same boatbuilding sheds, I believe that they will only sail better than our own because they are lighter. I was more satisfied with their cutters; I saw one in particular which is so perfectly built that I devoted all of my last hour at Deptford in considering her.

Ship's Boats

XXXIII. Close to the docks at Deptford there are stoving-ovens for heating the planks which are to be bent; I saw one plank of 7 lines [*1.6 cms*] being taken out which would have taken the winding required of it without resort to the fire. I shall follow these stoving-ovens closely when I have a more favourable opportunity than I had at Deptford. I will say nothing of their construction since we already have the detailed plans of them.*

Stoving-Ovens

I have a model of one in my office.

XXXIV. I found next to one of the docks at Deptford a very great quantity of kentledge which they use to ballast their ships. The iron pigs are about 36 inches [*97.4 cms*] long, and 6 inches [*16.3 cms*] square, and with these dimensions they must weigh 350 pounds[20] [*161 kgs*]. I will say nothing about this sort of ballast: its usefulness is sufficiently well-known; I wish that no other were employed in the King's ships. The pigs which I saw at Deptford are pierced diagonally by several holes along the edges*.

Kentledge

See Rem. [CLXXXI] (number left blank in the MS. Ed.).

XXXV. The claws of the crabs which they use at Deptford are joined together at one end, as it appears in **Fig. 13** which represents a plan view of one of these capsterns. This renders them lighter and more easily moved from one point to another. I had no opportunity to see any other engines in Deptford Dockyard, save only a floating masting-engine set up on a hulk, which is constructed in the same manner as the sheer-hulk at Toulon.

Engines

XXXVI. There are many storehouses and sheds in the dockyard at Deptford; they are small, ill-constructed and in very poor repair.

Storehouses

XXXVII. I saw about 200 shipwrights in this Dockyard, yet among this whole number I saw scarce six who were good craftsmen†. All of them seemed to me extremely lazy. Their tools are better than those of our shipwrights.

Shipwrights

†.... I saw about 300 shipwrights in this Dockyard, yet among this whole number I saw but very few good craftsmen ....

20. **Pounds**: French pounds, equivalent to 489 grammes, or about 10% more than an English pound.

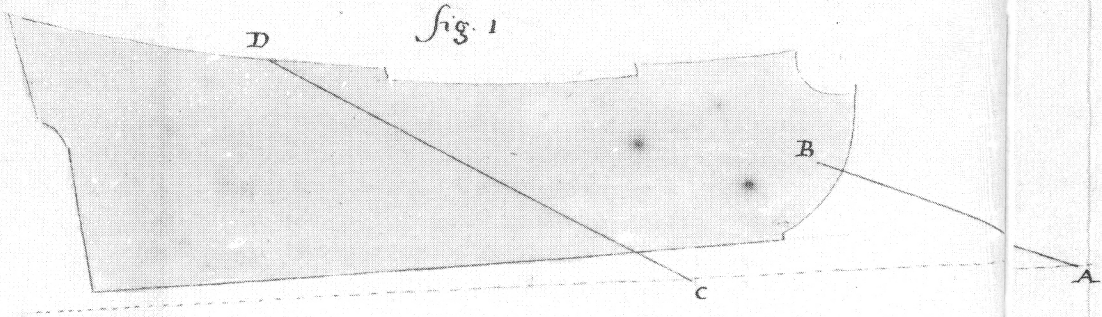


fig. 1

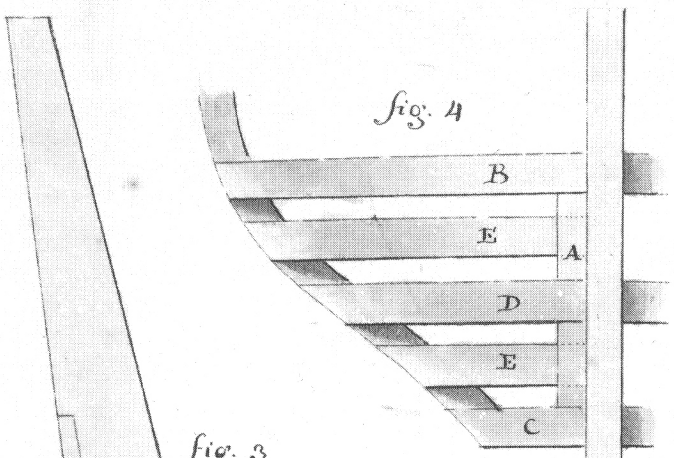
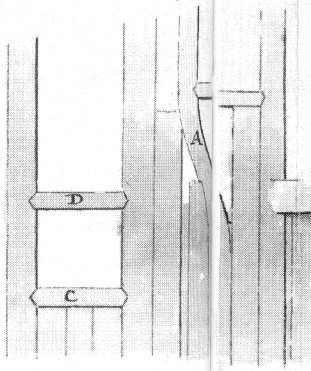


fig. 4



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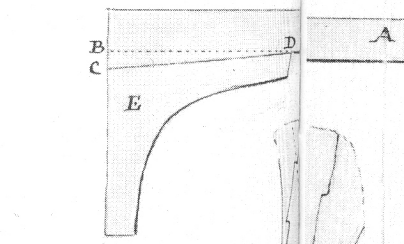

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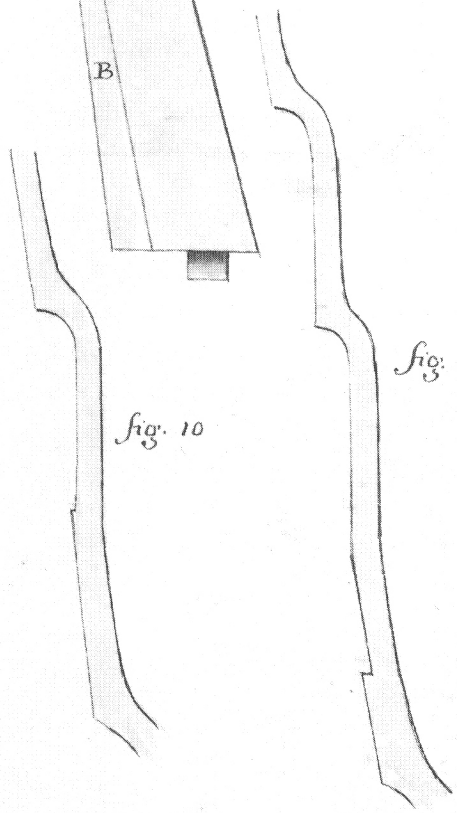

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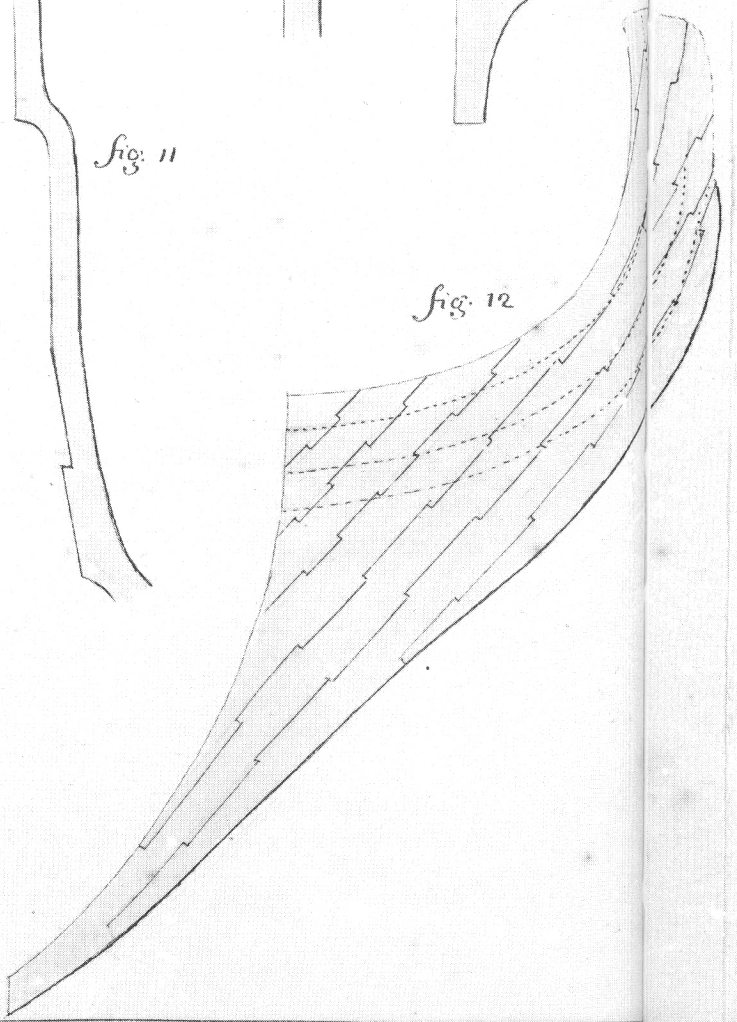

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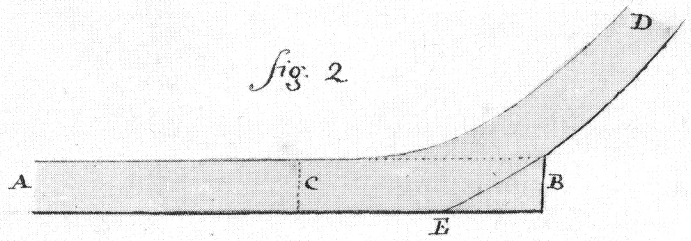

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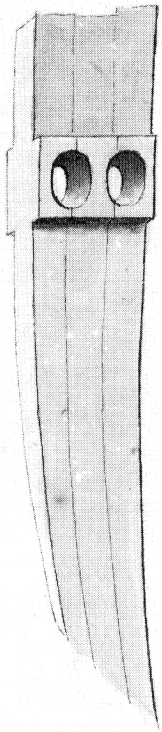

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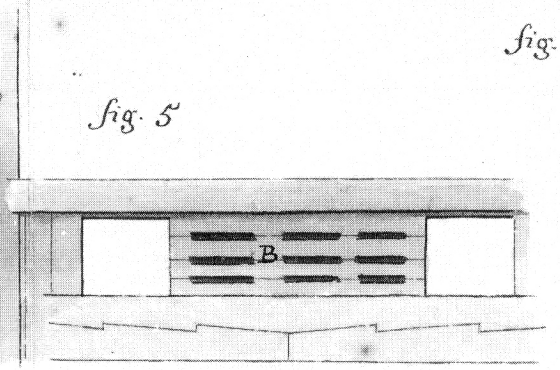

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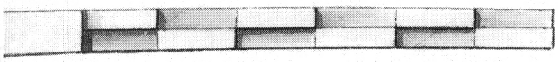

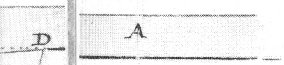

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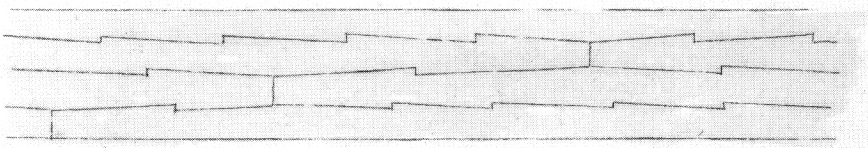

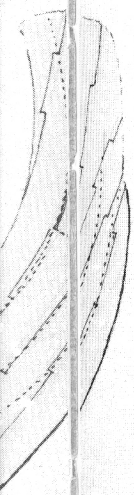

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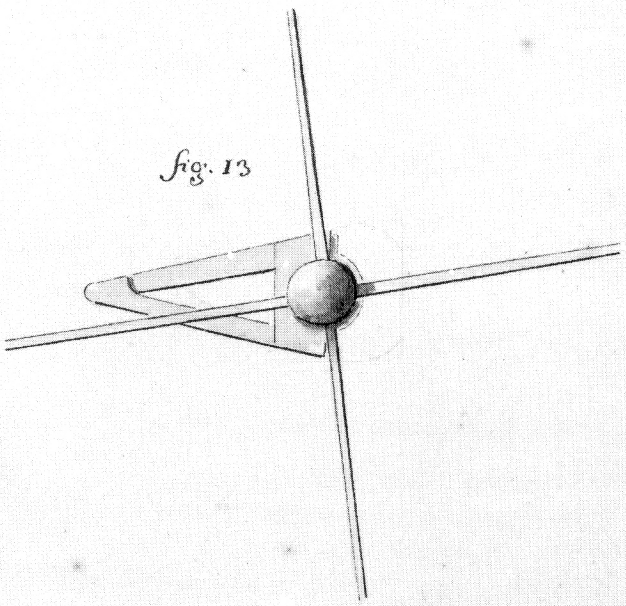
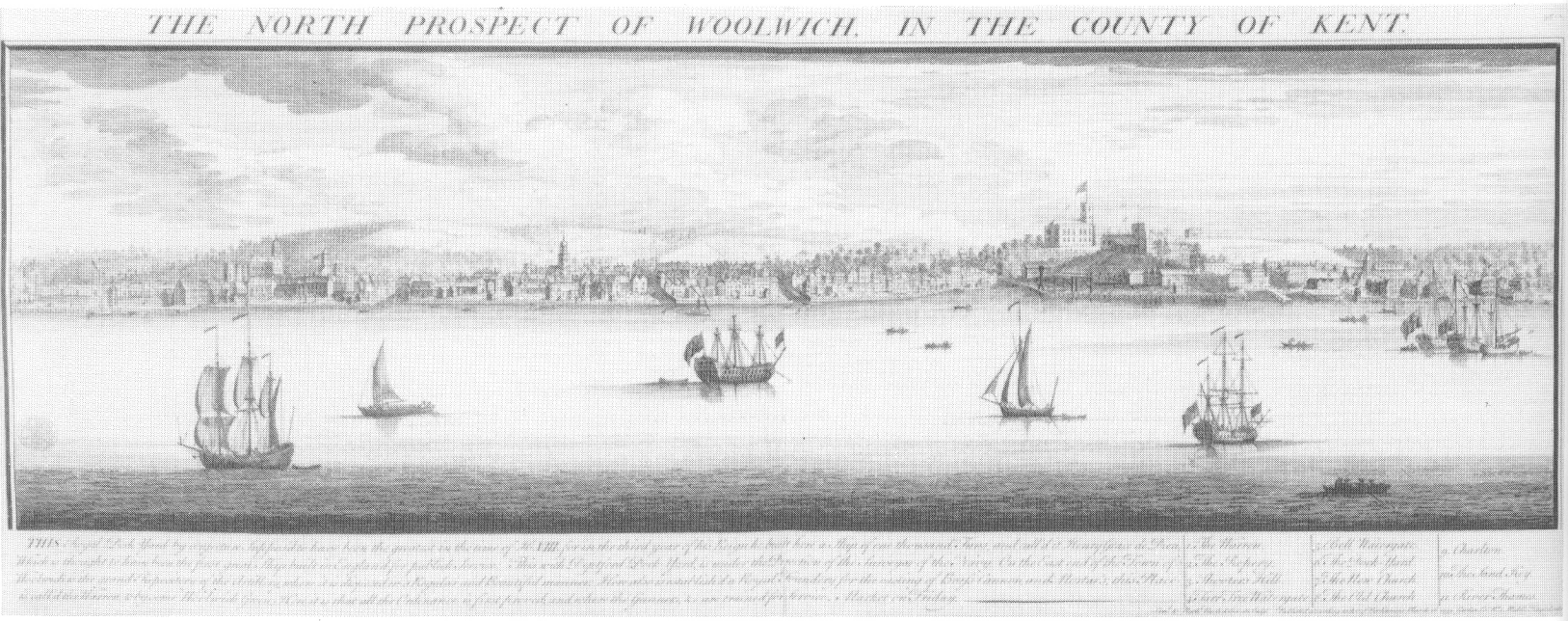
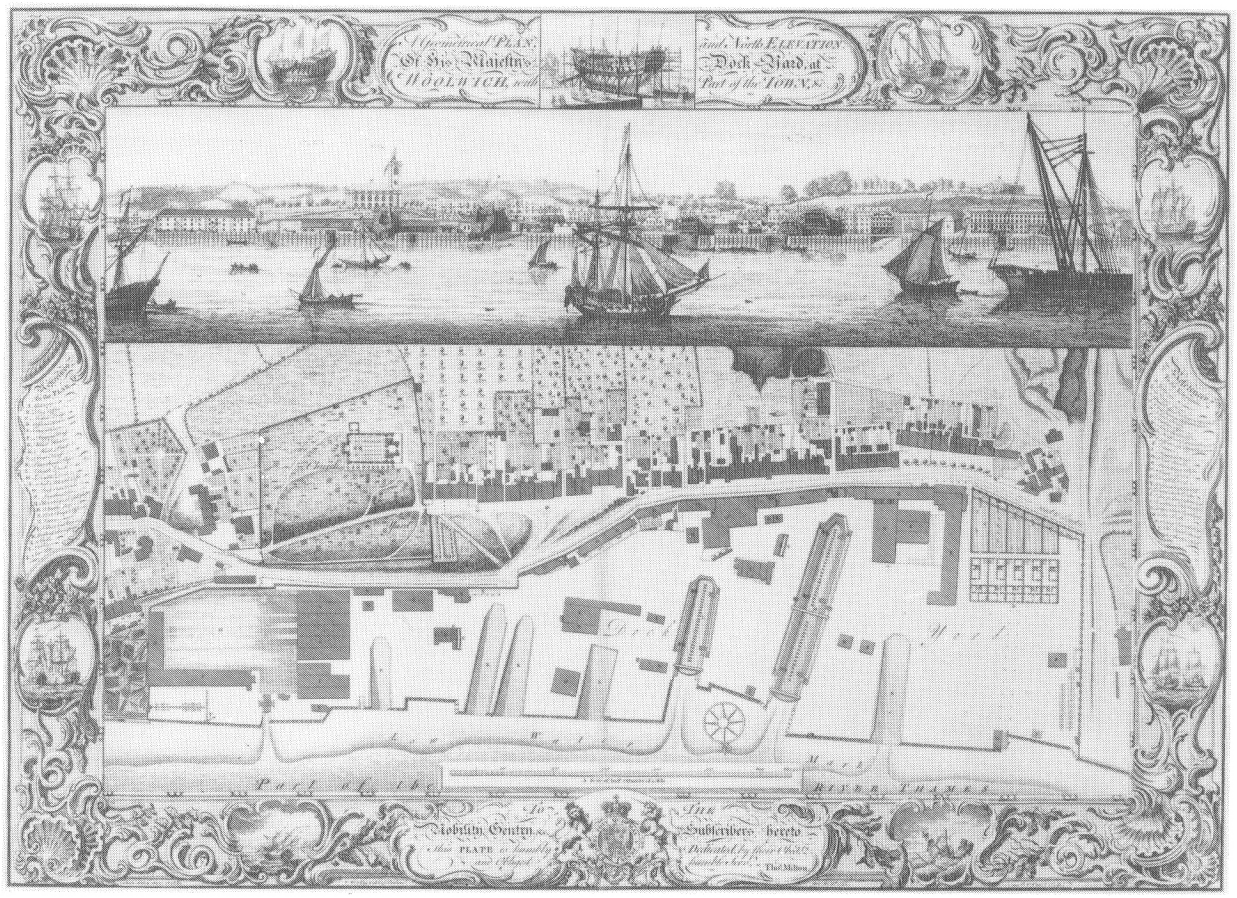




19. *View of Woolwich by Samuel & Nathaniel Buck, dated 1739. (Private collection)*



20. *Woolwich Dockyard in 1753. (Courtesy National Maritime Museum, Greenwich)*

Further remarks on the English Navy

Woolwich Dockyard

Docks

XXXVIII. The English have a Naval Dockyard at Woolwich[21], which is a town situated on the Thames two and a half leagues below London. There are in this Dockyard two dry docks and four building slips. I will distinguish the docks by their size, great and small.

The Great Dock is about 325 feet [*105.5 m*] long, French measure, 62 feet [*20.1 m*] wide at the edge and 21 feet [*6.82 m*] deep. The vertical distance from the top of the keel blocks in this dock to the edge of the quay is 18 feet 8† inches [*7.27 m*]; it is marked thus by depth-marks at the entrance to the dock. This entrance is some 50 feet [*16.24 m*] wide, and it is closed by a gate like the entrance to our docks. I have already said, in my first Remark, that I shall describe later the construction of this gate.

†.... 18 feet 3 inches ....

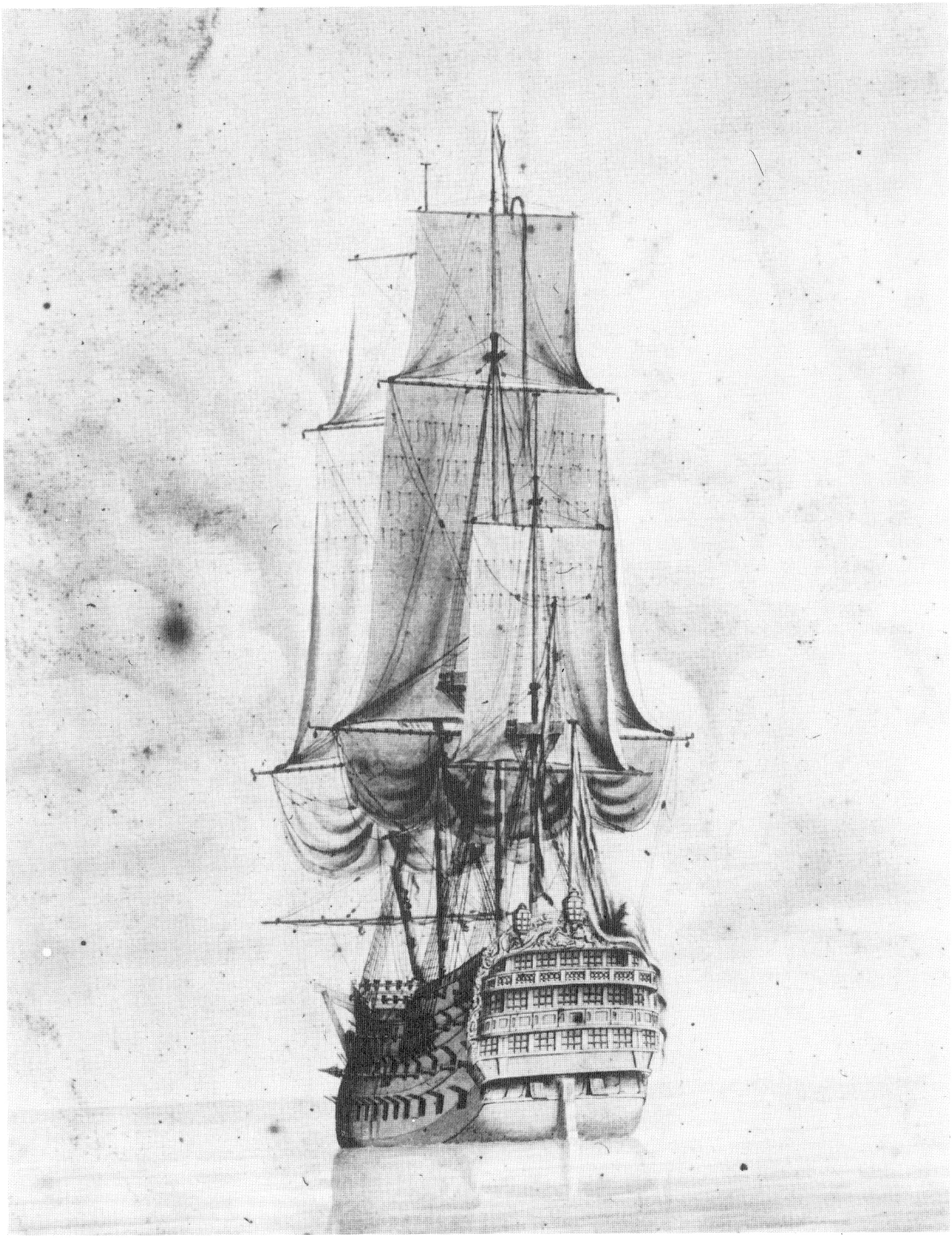
The Great Dock is stepped with two aulters at the sides; its walls are lined with oak plank in a somewhat poor state of repair; only ships drawing less than 18 feet [*5.85 m*] can enter this dock, wherefore it is used for graving frigates†, and for the building of ships which are floated out without ballast so that they draw as yet little water. This dock is today* occupied by two ships building, one of which is of 100 guns and is placed next to the gate with its stern towards the river and the other of 90 guns is placed forward of the first. Between the stern of the 90-gun ship and the bow of the 100-gun ship there is a bridge which crosses the dock at right-angles, and this bridge is supported by a number of pillars; it is no longer nor any wider than the bridge over the dock at Brest, yet it is by far neither as simply built nor as easy to be moved and put up again.

†...for graving ships of the Second Rate and below...

20th April 1737

Along the edge of the Great Dock at Woolwich there are a number of sheers raised straight up and 8 or 9 feet [*2.60 - 2.92 m*] apart, which serve to support the cross-timbers of the stages. These sheers are planted three or four feet [*97 - 130 cms*] into the earth in holes lined with dressed

21. Blaise Ollivier spells it Wolswich, suggesting that his knowledge of English was less than perfect, but see the Introduction.
Woolwich Dockyard was the first Royal Dockyard, founded in 1520 (although naval vessels had been built there before this). Enlarged in 1701, it was finally closed in October 1869. It may be of interest to quote Daniel Defoe, writing in about 1725 in his *Tour Through the Whole Island of Great Britain*:
"Woolwich, a town .... wholly taken up by, and in a manner raised from, the yards, and public works, erected there for the public service; here, when the business of the royal navy increased, and Queen Elizabeth built larger and greater ships of war than were usually employed before, new docks, and launches were erected, and places prepared for the building and repairing ships of the largest size; because, as here was a greater depth of water and a freer channel, than at Deptford, (where the chief yard in the river of Thames was before) so there was less hazard in the great ships going up and down.
"At this dock the Royal Sovereign *was built, once the largest ship in the whole royal navy, and in particular esteemed, for so large a ship, the best sailor in the world. Here also was rebuilt the* Royal Prince, *now called the* Queen, *a first rate, carrying a hundred guns, and several others. Close under the south-shore from the west-end of Woolwich, the Thames is very deep, and the men of war lie there moored, and as we call it, laid up; their topmasts, and all their small rigging taken down and laid in ware-houses....*
"Besides the building-yards, here is a large rope-walk where the biggest cables are made for the men of war; and on the east or lower part of the town is the gun-yard, or place set apart for the great guns belonging to the ships, commonly called the Park, or the Gun-Park; where is a prodigious quantity of all manner of ordnance-stores, such as are fit for sea-service, that is to say, cannon of all sorts for the ships of war, every ship's guns by themselves ...."



21. *The Duke of 1739. (Courtesy National Maritime Museum, Greenwich)*

stone, and thus they hold up without stays. This useful arrangement is lacking in our docks; they are too wide to permit of such a contrivance, for if we were to plant our sheers like those at Woolwich they should be of much less service to the stages, in that they would be too far removed from the ship.

The Small Dock at Woolwich is about 130 feet [*42.2 m*] long, 50 feet [*16.2 m*] wide, and the same depth as the Great Dock; its sides are stepped with two aulters; the walls are clad with planks in poor repair; at this time there is there a frigate of 20 guns with its principal spars[22] in place and which is to be graved.

Slips

Of the four building-slips which are in Woolwich Dockyard three are occupied, one by a ship of 80 guns, the second by one of 70 guns, and the third by a ship of 60 guns. These slips are similar to the second and third slips of Deptford Dockyard.

Ship of 100 Guns, called the *Royal Anne*

XXXIX. The ship of 100 guns[23] which is building in the dock at Woolwich seems to me much smaller than our French ships of this strength. I thought at first that she was but a ship of 90 guns; she is completely framed; her bottom-planking excepting the garboards and the strake next to them is in place, rising to within 7 or 8 feet [*2.27 - 2.60 m*] of the height of breadth; her keelson is laid, and they are beginning to plank the first strakes of the ceiling and the lower wales. This ship is pierced for 14 guns on the gundeck; she is very full in the body although she has less breadth than our ships at the midship bend; she has little deadrise; she has a full and fair run; great fullness at the waterline. I believe that she will be a weatherly ship carrying her sail well, be quick to answer the helm, yet be a mediocre sailer.

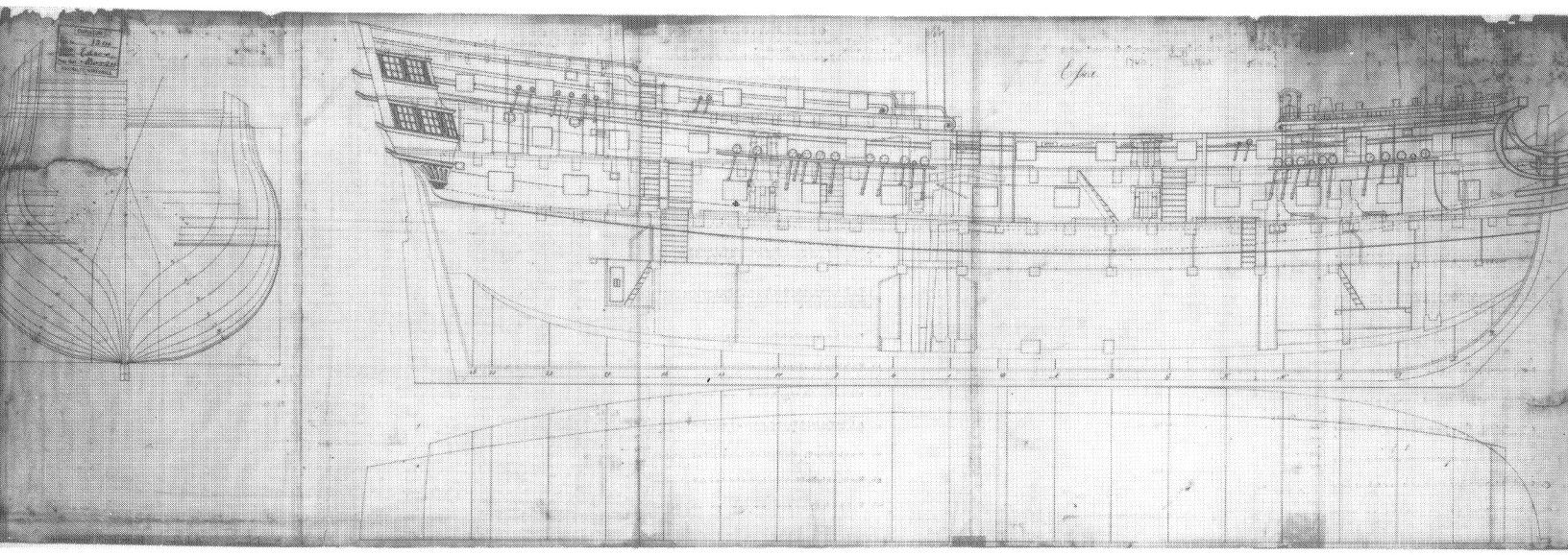
Ship of 90 Guns, called the *Duke*

The ship of 90 guns[24] which they are building in the same dock is scarce larger than our ships of 74 guns; she is near wholly planked in her bottom and to the waterline; her lower wales are in place, as are the keelson, the orlop-beams and a part of her ceiling. The building of this ship seemed to me less good than that of the ship of 100 guns; she is too full at the stern and too slight forward. I doubt she will steer well. I do not know whether the Shipwright who is building her is of the same opinion, or whether the English shipwrights are in the habit of giving great breadth to the rudders of their ships, yet I saw them preparing a rudder for this ship which has one and a half times the breadth at the heel that we would give it in France.

Ship of 80 Guns, called the *Cumberland*

The ship of 80 guns[25] which is on the stocks at Woolwich has as yet but a few of her floors crossed on the keel, her stem, her stern-frame and the floor ribband.

22. **Principal spars**: Fr. *mâts majeurs*; denotes the main and foremasts but not the mizen, and the main- and fore-topmasts.
23. **Royal Anne**: Formerly the *St Andrew*; 1st Rate (96), 1318 tons b.m., 159′0″ x 44′0″. Built Woolwich Dockyard in 1670 by Christopher Pett. Renamed the *Royal Anne* 8th July 1703 and rebuilt by Lea as 1st Rate (100), 1722 tons b.m., 170′0″ x 48′0″. Broken up in 1757.
24. **Duke**: Formerly the *Vanguard*; 2nd Rate (90), 1357 tons b.m., 126′0″ x 45′0″. Built Portsmouth Dockyard in 1678, she capsized on November 26th 1703 in the Medway. Raised the following year, she was rebuilt at Chatham in 1710 as 1551 tons b.m.. She was rebuilt again as 1625 tons b.m. in 1739 and renamed the *Duke*. She was finally broken up in August 1769 at Plymouth.
25. **Cumberland**: 3rd Rate (80), 1308 tons b.m., 156′0″ x 44′0″. Launched at Deptford Dockyard in 1710, she was rebuilt at Woolwich in 1739 and reduced to 66 guns, 1401 tons b.m. She foundered on the 2nd November 1760 while at anchor at Goa.



22. *Draughts of the* Essex, *as launched in 1740.*
(Courtesy National Maritime Museum, Greenwich)

Ship of 70 Guns, called the *Suffolk*

The ship of 70 guns[26] is framed to the height of breadth. I find her lines excellent. I have seen but few ships with so great a satisfaction as this one; her shape is conducted with infinite art; the more I examined her the more I discovered her perfection. If her Builder places her masts with as much art as he has employed in determining her lines, we have but few ships which sail as well as she will*.

***Mr Fisher who is building this ship told me after I had written this Remark that he has tried to imitate the lines of the* Assurance*, a 60-gun ship which the English captured from us**
*L'Assuré: see Remark CLXXXIV, p. 171 [Ed.].

Ship of 60 Guns called the *Essex*

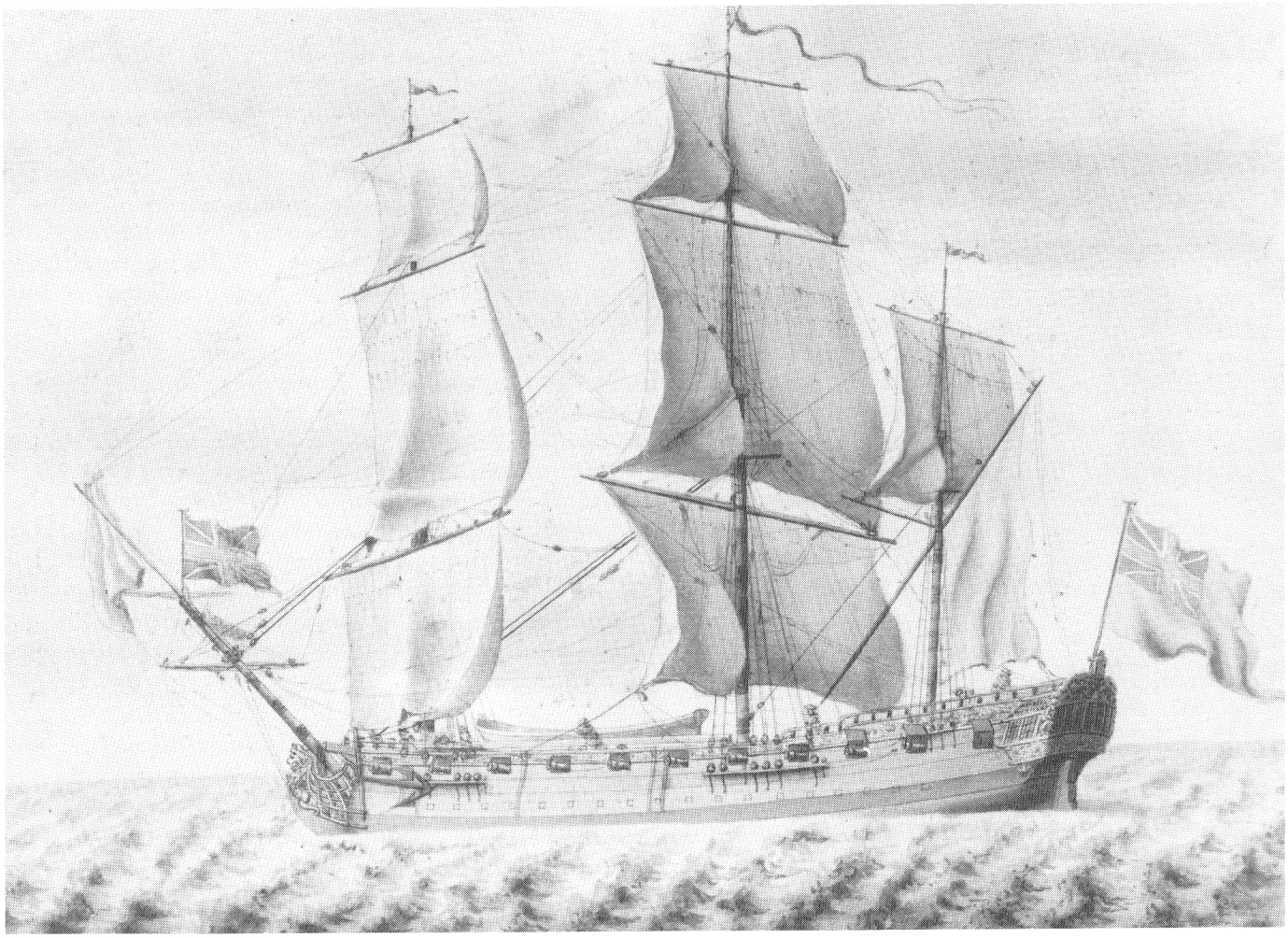
The ship of 60 guns[27] which is building at Woolwich is in the same stage of building as the ship of 80 guns.

Frigate of 20 Guns, called the *Seaford*

XL. The frigate of 20 guns[28] which is being graved in the Small Dock at Woolwich is as large as our frigates of that strength, or larger*; her run is very fine; her stern is square, which is rare in English ships; her upper works are very well done; she has two decks, the first raised one or one and a half feet [*32 - 49 cms*] above the water and the second four feet and a half [*1.46 m*] above the first. The battery of 20 guns is upon the upper deck, and there are 16 oar-ports pierced in each side on the gundeck. There is no forecastle in this frigate; she has only a quarterdeck as far as the mizen-mast, and from there forward her bulwarks rise no more than three feet [*97.4 cms*] above the upper deck. I was not able to see the arrangement of her hold, for the hatches were closed, yet I saw on the gundeck a number of cabins, some situated abaft the mizen-mast, others opposite the main-hatch, and the galley is set up abaft the bitts. The space beneath the quarterdeck is divided into two equal parts, of which one forms the sleeping cabin of the Captain, and the other his day-cabin.

***She is larger**

26. **Suffolk**: 3rd Rate (70), 1401 tons b.m., 151′0″ x 40′0″. Built by Johnson at Blackwall in 1680 she was rebuilt also at Blackwall in 1699 as 1075 tons b.m.; she was rebuilt again at Woolwich in 1739 as 1224 tons b.m., but with only 64 guns. Her break-up was completed June 12th 1765.
27. Technically this was not a new ship, but what the Navy Board called a "rebuild", since the *Essex* was built originally by Johnson at Blackwall in 1679. Following rebuilds in 1700 and 1713, she was taken into dock at Woolwich on August 20th 1736 and broken up. Originally armed with 70 guns, she was rebuilt as a 64 (and not as a 60 as Ollivier claims), but at the same time her tonnage was increased from 1,090 to 1,226 tons. Her rebuild lasted 3 1/2 years, and she was not launched until February 21st 1740. She sank following the Battle of Quiberon on November 21st 1759.
28. **Seaford**: 6th Rate (24), 248 tons b.m., 93′0″ x 24′6″. Launched Portsmouth Dockyard in 1697, she was rebuilt at Deptford in 1724 as 375 tons b.m. She was broken up in June 1740 at Woolwich.



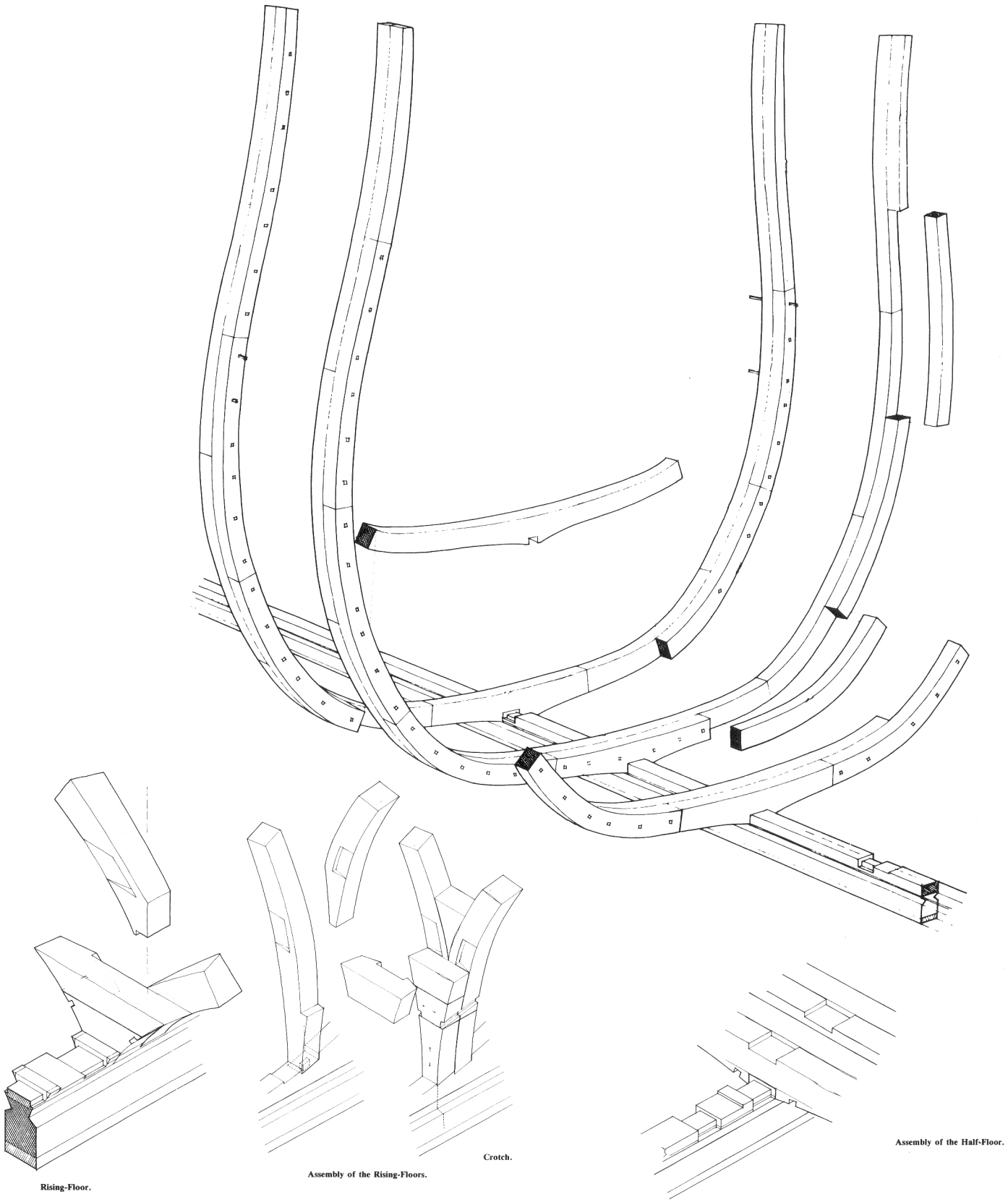
23. *20-gun Sixth Rate similar to the* Seaford. *(Courtesy National Maritime Museum, Greenwich)*

Keel

XLI. I have stated, in Remark **IV**, that the English make their keel larger than it is in our ships, yet I failed to note that they diminish greatly its breadth athwartships towards the stern, starting one third along its length, in such a manner that instead of being greater than in our ships at the place which bears the sternpost, it is near two inches [*5.4 cms*] less broad. That this breadth of the keel diminishes thus towards the stern proves that the English have no reason for its being so great either at the middle or forward, for if its breadth be sufficient at the stern, as there is no reason to doubt since all the English ships do thus sail, the same breadth must suffice forward and at the middle, which are ever less likely than the stern to strike, by reason of the greater draught aft. I understand well the reason whereby the English shipwrights thus diminish its breadth, since if they did not they should be obliged to have a rudder which were too broad, and perhaps also they are in the error of believing that the after end of the keel being less broad than the forward end, it will divide the water more easily, in the manner of a mast which is drawn through the water the butt foremost. In France also we for a long time committed this same error with regard to the whole shape of the hull, nor have we rid ourselves completely of it, despite that the contrary has been demonstrated.

Sternpost

XLII. I also omitted to observe in my Remark **VII**, concerning the sternpost, that the sternpost of the English ships has not the same thickness at the head as at the heel. At the heel this thickness is reduced to the siding of the keel as must needs be the case, yet at its head the sternpost takes on the full thickness of the keel, which is to say the thickness which the keel possesses at the middle of its length, which only serves to weigh down needlessly the stern of the vessel; for the sternpost has no need of greater strength at the head than at the heel. In our French ships the thickness is the same at either end, and our practice is in this regard clearly better than that of the English shipwrights.



24. *Arrangement of frames in French ships. (Jean Boudriot,* The Seventy-Four Gun Ship*)*

Rising-Wood and Apron

XLIII. When I spoke of the rising wood, Remark **VIII**, and of the apron, Remark **IX**, I had not yet observed how in the English ships the two are scarphed together, I had only noted that this scarph is not executed as in our own ships. I have had the opportunity of observing it in the ships which are building at Woolwich. The English shipwrights extend the rising wood forward as far as the stem, as indicated by the letter **A**, **Fig. 14**[29]. The lower piece of the apron **B** is fayed or scarphed to the top of the rising wood, and the butt gives shift to the piece **C** which runs up 5, 6 or 7 feet [*1.63 - 2.28 m*] against the apron and stretches back over the rising wood as far as the timber will permit. This piece **C** provides the rising for the crotches at the bow in the same manner as I explained that the timbers laid over the rising wood at the stern provide a rising for the crotches at the stern. I find this method good; the fastening is as strong as with our own, and there is a greater economy of timber, not for the quantity, for this is the same, but in regard to the quality of the pieces employed. The compass timber has a lesser curve for piece **C** than it should have if it were to serve as the apron **A** in the manner in which we ordinarily do it in our ships. Moreover the piece **C** allows the English shipwrights the possibility of fashioning the deadwood at the bow using timbers which are less rare. We should obtain a still greater advantage than do the English were we to follow this practice. By using a forefoot such as we do the rising wood of the keel and the apron could butt against the angle of the forefoot, giving shift to the butts of the forefoot and of the piece **C**. And, in order to find this piece **C** more readily than our usual apron it would be necessary but to leave at the head of the rising wood and at the heel of the apron all the timber to be found in the pieces from which they are fashioned. It is thus that the English shipwrights work, yet in our ships the fastening would be still stronger, by reason of the forefoot.

Transoms

XLIV. The wing-transom of the ships which are building at Deptford being already covered by a rail, it appeared to me to be of the same form as in our own ships, yet I have seen in the ships at Woolwich that it differs from our wing-transom in that it has no rabbet, and that it is fastened to the sternpost in such a manner that it lies flush with the inner edge of the sternpost like the deck-transom and the filling-transom*. The letter **A** in **Fig. 15** shows this wing-transom cut through at some point along its length. The planking of the counter lies against this timber as it does in our own ships, and the butts finish half way up the thickness of the wing-transom, as shown by the plank marked **B**. The moulded rail **C** seats on the butts of the planks of the counter and covers as in our own ships the heel of the counter timbers tennanted into the wing-transom. I find this method to be preferred to that which we follow; it is greatly simpler; the rabbet of the wing-transom being done away with, the shipwrights are in no need to use a timber so great as we employ for making the wing-transom, or if they use a piece of the same size it is capable of greater strength.

**I gave this English form to the wing-transom .... (deleted)*

In the ships building at Woolwich there are no half-transoms such as those of which I spoke in Remark **XI** and which I saw in the ships building at Deptford. All the transoms of the ships at Woolwich are like those of our own ships.

Frames

XLV. I shall add that which follows to what I have already said concerning the frames of the English ships in my Remark **XII**. The advancement of the ships building at Woolwich has allowed me to perceive their arrangement very much better than I was able to do in the ships at Deptford.

The English shipwrights set up as we do several moulded frames which they space along the keel 7, 8 or 9 feet [*2.27 - 2.92 m*] apart one from the other according to the size of the ship. These frames are made up of a floor timber, two first futtocks, two second futtocks, two third, fourth and fifth futtocks, like the frames of our own ships; and these timbers are fastened together one to another at each scarph by three† treenails, in place of which we use three iron bolts. The English shipwrights in this regard do better than we. They make a saving in iron, they render the ship lighter, and the fastening is equally tight.

†.... at each scarph by some treenails ....

At first they cross only the floors of these moulded frames, and having placed the first floor

29. See Plate 2, pp. 72-73.

ribband and shored it at its place, and having crossed the floors of most of the filling frames, they raise the first and second futtocks of the moulded frames; they place the second ribband, raise the third and fourth futtocks, place the third ribband and the height of breadth ribband, and timber the ship as far as the height of breadth before raising the toptimbers of the moulded frames. Yet they do not timber their ships as we do. The assembly of the timbers which make up a filling frame is in our ships the same as for the moulded frames. The floor timber is scarphed to the two lower futtocks, the lower futtocks to the second futtocks, the second to the third, and the third to the fourth. Whether with the moulded frames or the filling frames each scarph is strengthened by three iron bolts. The English shipwrights do not work in this manner. After having crossed the floor timbers of the filling frames and placed the ribbands, they raise the second futtocks on the rungheads of the floor timbers, and the fourth futtocks on the heads of the second futtocks. They place the first futtocks in the space between the second futtocks of adjacent frames, in such a manner that they divide this space into two equal parts, one forward of the first futtock and one abaft. The first futtock touches then neither one nor the other of the second futtocks. That which I have explained for the first futtock applies equally to the third futtock which rests on the head of the first futtock, and to the toptimber resting on the head of the third futtock.

Following this arrangement of the frames, the futtocks do not form pairs of frames as in our ships; these timbers are not fastened in any way one to another; there are neither treenails nor iron bolts; they are maintained in their place only by the planking of the hull and of the ceiling, and by the bolts of the riders*. I have shown these timbers in **Fig. 16**, where **A** represents the moulded frames, assembled like ours in pairs; **B** represents the floor timbers of the filling frames, **C** the first futtocks, **D** the second futtocks, **E** the third futtocks and **F** the fourth futtocks.

**I copied this arrangement of the frames in the English ships.... (deleted), save only that I did not completely do away with all the iron bolts.*

There is in many respects a very great difference between the arrangement of the frames in the English ships, as I have just described them, and the arrangement of the frames in our own ships. There appears with our method to be a better fastening together; each frame is made up of eleven or thirteen timbers, fastened in such a manner that they form together a single piece. With the English method there are 11 or 13 timbers detached one from the other. In the timbers which make up each side of our ships there are more than 2,000 iron bolts which resist the falling apart to which these timbers are exposed when the ship, as it heels over, loses as it must a part of its curve on one side, whereas on the other side the curve increases. In the English ships this side changes its shape with less difficulty, and it appears to be prevented in this only by the treenails which bind together the timbers of the moulded frames, yet with the English method there is an immense saving of timber, of ironwork, and of labour. There is a saving of timber since instead of the space of 4, 5, or 6 inches [*10.8 - 16.2 cms*] which we leave between each pair of frames the English leave two spaces of 3, 4 or 5 inches [*8.1 - 13.6 cms*] each, or in other words two of three inches there where we leave but one of 4. Thus for two ships of the same length and section the difference in the spaces reduces the number of frames.

The saving in ironwork consists of more than 2,000 bolts[30]. There is less labour in that the frames which are not fayed one against the other cost less work than frames which must be fayed accurately.

I have stated that in our method of assembly of the frame timbers there seems to be a better fastening-together than with the English method, yet it is proved by the success which accompanies their ships that in this fastening-together we are excessive, and needlessly so. All the English ships, whether those of 100 guns or those of 20, keep the sea and last as long as do ours, yet with their frames arranged as I have explained, without any inconvenience resulting from it. This is not at all a new practice in the English yards. I saw a ship being broken which

30. Each frame in larger ships required 36 bolts; ships had between 60 and 70 frames (see Glossary, p. 357), so that the total number of bolts required for the frames alone would have been between 2160 and 2520. Smaller ships had the same number of frames, but fewer futtocks, so that perhaps 24-30 bolts per frame were needed.

was built 22 years ago[31], whose frames are of the same construction as those which are building today. This practice succeeds quite as well as does the extra fastening-together which we give our frames. Yet I should still prefer our method to that of the English shipwrights if the expense were the same, but the saving which they find thereby and the proven sufficiency of their fastening-together shown by the long experience which the English have of it, lead me to favour the arrangement which they make of their frames over that which we follow.

Yet there are further advantages in the English manner of building which merit consideration; it makes the vessel lighter by all the timber which is avoided in the frames, and by the weight of more than 2,000 iron bolts; it provides a better landing for the planking of the hull and the ceiling on the frames, and a greater security in the caulking, since the spaces are more evenly spread and smaller. The frames do not as in our ships risk being corrupted by the rusting of the iron bolts. I do not say that they are also less likely to spoil each other as occurs when they touch, since recently we have begun almost to imitate the English shipwrights in leaving a space between the scarphs of our frames.

For the same shape of hull, the English shipwrights use timber with a lesser compass than that which we employ for our frames. The method which we employ in using three iron bolts at each scarph of the frame timbers obliges us to use for them neither timber where the grain is too much cut, nor timber which is too short, since in the first case the bolts in which we place so much trust would be of near no service, and in the second we should not find the place for three of these same bolts at each scarph were the timbers too short. The English shipwrights on the contrary, since they use no bolts, are able to employ with equal success any timbers which fall to hand, and that the grain of the timber should be followed or cut through by the mould matters not, so long as they are able to find the outside profile of the mould in the timber which they are working. Thus the ends of the frame timbers in their ships are bearded, as it appears in those marked **A** in **Fig. 17**. The grain of the timber is cut through in most of the frames of the English ships, since in England as in France straight timbers are more readily to be found than timbers of sufficient compass. The English shipwrights cut them to the outside profile demanded by the shape of the vessel, and fill the space thereby left on the inside with a scarph-chock such as is shown by the letter **B** in **Fig. 17**. While we also on occasion have recourse to a similar chock when we find ourselves in the same case, yet never or only very rarely is it as large as that to be found in the English ships, where it lines the scarph of the timbers in such a manner as to have the same effect as the three iron bolts with which we fasten each scarph. Were we able to resolve to imitate the English shipwrights in this arrangement of the frame timbers we should also gain the advantage of being able to do without a great quantity of compass timber which is so indispensably necessary to our method. In the English method it is in large measure indifferent to them whether they have straight or compass timber for making the frames of their vessels.

The frames of the English ships from athwart the riding bitts to the hawse-pieces and from the mizen-mast to the fashion pieces are not placed at right-angles to the keel as in our ships, across the breadth of the ship; they are canted, and this canting of the frames increases as they approach the bow and the stern. To demonstrate this, **Fig. 18** shows a plan view of the bow of a ship, with the section made at the height of breadth; **A** shows the keel, **B** the square frame which is near athwart the riding bitts. The frames from this point forward instead of being parallel to frame **B** are arranged along the lines **C**, and appear at the height of breadth as in **D**, instead of as in **E** which is the case in our ships. The same is true of the frames placed abaft the mizen-mast.

By this means the English shipwrights use timber which is less curved, for the same shape of vessel, than do we, since the vertical section which is at right-angles to the keel athwartships is more curved here than at any point, so that the angle can be neither opened nor closed to lessen the curve without changing the shape of the vessel. With their method the English shipwrights

31. It is impossible to be certain to which ship Ollivier refers, but the most likely candidates are the *Essex* or the *Cumberland*, which had only a few floors crossed when he saw them. The *Essex* had been rebuilt in 1713, which corresponds approximately to the 22 years that Ollivier refers to, while the *Cumberland* had been built in 1710. On balance the *Essex* is the more probable of the two. Of the other possible candidates, the *Dartmouth* had been broken at Sheerness and the *Prince Frederick* and *Lion* at Portsmouth, while the *Boyne*, the *Royal Anne* and the *Duke* were too far advanced in their rebuilds by the time Ollivier saw them. All in all, he is probably referring to the *Essex*.

use timbers of lesser scantling than that which we are obliged to use in the quarters and at the bow, since the timbers being canted take up part of the bevel which they are obliged to have. In this manner the English shipwrights are able to frame the quarters and the bow of their ships with timbers which only exceed by a small amount the scantling of the vessel, whereas with our method we require timbers which exceed this scantling by half or three quarters. This saving which is very considerable leads me to prefer the English practice to that which we follow, and I am drawn to it also by other considerations; namely, that the planking of the hull and the ceiling lies more fair on these cant-frames than on our frames, which from their position must necessarily be bearded, as is shown in the frames marked **E** in **Fig. 18**; the iron bolts or treenails which pass through the planking of the ceiling and the frame timbers are never perpendicular to the hull-planking in the quarters or at the bow of our ships; or if they be perpendicular, then they are fastened only in the edge of the frame, whereas in the English ships where these frames are canted the fastenings which hold the hull-planking and the ceiling to the frames are perpendicular to the planking and pass through the middle of the frame timbers*.

**.... (deleted) canted the frames in the quarters and the bow.... (deleted) following the example of the English ships.*

The floors in the English ships are scored into and half-lapped over the rising wood as in our ships, and they are fastened to the keel with iron bolts which appeared to me thicker than those which we employ.

The crotches of the cant-frames in the English ships have no floors[32]; the lower futtocks butt against the deadwood timbers of which I spoke in my Remarks **VIII** and **XLIII**, into which they are scored about an inch and a half [*4 cms*], as shown by the futtock indicated by the letter **B** in **Fig. 19**; this they do when the timber is not of sufficient scantling to run full down to the keel. In this former case, which is the most common, a filling-piece is fayed to the outside, as shown by the letter **C**. The futtocks on the one side and the other are fastened to each other by treenails which pass through the deadwood, and these timbers thus take the place of floors. It cannot be said that this method is not strong enough since all the English ships put to sea in this state without any inconvenience, yet I prefer our floor timbers constructed in three pieces. The expenditure in timber is the same or near the same, and they cost us but little more in labour.

In the English ships as in our own they place two cross-spales athwart the breadth of the moulded frames, one at the height of breadth, and the other at the planksheer, and at the centre of these cross-spales they mark a saw-kerf from which they hang a plumbline when they come to measure the ship for her tonnage. Most of our shipwrights follow the same practice.

I stated, in Remark **XII**, that the English shipwrights caulk the seams of the frame timbers up to the heads of the lower futtocks, as I observed in the ships building at Deptford, yet this practice is by no means generally followed in England. The seams of the frame timbers in the ships at Woolwich are not caulked, and can no longer be so. There are thus two different practices in two dockyards which are scarce one and a half leagues one from the other. I am unable to say which is the better, since I do not yet know the reason for this caulking.

I stated also in the same Remark that the English shipwrights fill up the spaces or the gaps between the frames up to the heads of the lower futtocks. They do not follow this practice at Woolwich, their ships are filled up but as far as the rungheads, and it is better so.

I will say nothing of the way the English shipwrights loft the frames of their ships, for I have not yet had the opportunity to see it done. I have observed only that each of the floors has an

32. **Floors**: The French word is "*fourcat*", which because of the differences in construction explained is impossible to translate exactly by an equivalent English word. See Jean Boudriot, *The Seventy-Four Gun Ship*, Vol I, p.83 (reproduced as Fig. 24 on p. 64 of the present volume).

arc of a circle drawn upon it, such as that pricked upon **Fig. 20**. The diameter [*sic*: radius?] of this circle seemed to me to be the same[33] for all their floor timbers, so that they differ one from the other only by their length and by the deadrise marked below this line. There is in this somewhat of the method called whole-moulding. I shall try to discover more of this matter as I go along.

XLVI. In the English ships which have a square tuck, the fashion piece may be seen withoutboard, being flush with the planking of the sides and the planking of the counter. To this end it is furnished with two rabbets, into which these planks are hooded. It is more than 50 years since we followed this practice in France, in some of the Mediterranean dockyards, but we abandoned this practice since it is much less solid than when the fashion pieces are enclosed by the planking.

Fashion Pieces

XLVII. The English ships which are on the stocks at Deptford being near fully-planked both in the hull and in the ceiling, I had not remarked that the English shipwrights make their hawse-pieces of two timbers scarphed in the middle, but I had the opportunity to observe this in the ships at Woolwich. Each hawse-piece is made up of two timbers with a plain scarph, as it appears in **Fig. 21**. We should think the bow of our ships very weak if the most part of our hawse-pieces did not run down in a single timber to the heel of the first frame at the bow, yet the method employed by the English shipwrights must prove to us that we should not be enslaved by this rule, since the bow of their ships is sufficiently fastened-together with hawse-pieces in two parts. There is in this method a great economy of timber, since they are able to employ only timbers which are commonly available.

Hawse Pieces

The hawse-pieces of the English ships are in no wise fastened one to the other, nor to the stem. In our French ships they are joined one to the other and fastened to the stem with large numbers of ragged bolts, which we can henceforth consider to be unnecessary, since the English ships put to sea in complete safety without these fastenings, which cost us much in iron, and contribute to the spoiling of the hawse-pieces.

I stated, in Remark **II**, that the hawse-pieces in the English ships are cut into by a port opened in the bow below the gundeck, to provide access to the ship while it is building. I have since then been able to discover how they close up this port when they finish the ship. The hawse-pieces are bearded above and below where they meet the port, like those marked **A** in **Fig. 22**, and the space between the timbers is then filled by the timber marked **B**. There are other timbers where they fashion a hooked-scarph as in **A**, **Fig. 23**. In both the one case and the other, the hawse-pieces are fashioned of three timbers which are not in any way fastened together save by that which is provided by the planking of the hull and of the ceiling. I should not criticise this method, since it succeeds well; yet I should prefer something rather more solid in this part of the ship.

XLVIII. The ribbands which they use to fair the frames when building the English ships are near two inches [*5.4 cms*] greater in thickness and breadth than those which we use. The floor-head ribband rises less than in our ships at the stem and the sternpost; there is one at the height of breadth, two, three or four between the floor-head ribband and the height of breadth ribband, and two in the upper works. They are of fir, with their butts made of oak as in our ships, and they are joined by long hooked-scarphs as we practise it at the dockyard in Toulon. I have seen none joined by a plain scarph and strengthened by an overlapping piece. They are fastened to the frames with nails and no chocks, so that in order to remove them when planking the hull they must perforce be broken.

Ribbands

33. This suggests that at Woolwich at least they were still using "whole-moulding" to determine the lines. Ollivier calls it the "*méthode de la tablette*", which he defines in his Dictionary of Shipbuilding as follows: "*It is the method by which all the frames of a ship are determined from the first floor of the fore body to the last of the afterbody, and likewise the moulds of the rising floors and of the upper works, proceeding from that of the midship frame, from the mould of the first frame of the fore body, and from that of the fashion piece and the toptimbers of the after fashion piece. This method is practised in all the ports of the Mediterranean by near all the shipwrights, and it is the oldest of all those which are in use today to establish the lines of ships.*" These are the opening sentences of an explanation which covers several manuscript pages in Ollivier's dictionary, of which a significant part appears in the present volume as the "Glossary of Shipbuilding Terms", starting on page 349.

The harpins of the floor-head ribband at bow and stern are bevelled, since the English ships are very bluff where they land; straight ribbands such as we employ in our ships, which are sharper at the entry and in the run than are the English ships, would not take a sufficient curve, nor the necessary winding.

I value greatly the size of the ribbands in the English ships; it is a very small expense to use ribbands which are two inches greater than those which we employ, and the advantages which result outweigh this expense. In our ships the filling-frames force the ribbands out of winding; there is always much fairing to be done, and great care to be taken to give the vessel the fair run which the flexibility of our ribbands makes it lose in the space between the ribband-shores. This does not occur with the English ships; the ribbands support the frames perfectly well, and yet the frames are not fastened together in any way, as I have already explained, which makes them bear more heavily upon the ribbands than is the case with our ships.

Yet leaving aside the fact that heavier ribbands than we employ would be greatly more suitable to our building, this greater thickness would become indispensable if we were to arrange our frames as they do in the English ships, since the ribbands would then have a greater burden to bear.

I approve also of the practice of nailing the ribbands to the frames without chocks; they hold up much better, and hold the frames better together in the interval before they are planked. We have no reason for nailing them to chocks save only to be able to shift them without breaking them so that they may then serve for some other purpose. Yet seeing that our ships now remain for a long time on the stocks, and that after two or three years of service these timbers are scarce good for any thing, I should find it more fitting that we should in imitation of the English shipwrights fasten them from the beginning solidly to the frames. For any device which contributes to hold our ships on the stocks[34] in exactly the shape which the builder has fixed upon should be carried out, for without it the shape may be lost, and whatever then may be the success of the ship, it will prove impossible to build another like her if she be good, nor to correct the errors with any certainty if she be bad; for her true shape will not be known*.

....(deleted) copied the size of the ribbands of the English ships when building .... (deleted).*

The English shipwrights mark out as we do the spacing of the gundeck ports on the height of breadth ribband before they frame the ship, so that the timbering be so calculated that whole frames serve to form the sides of the gunports. On this same ribband they mark out the ports of the middle deck, whereas we mark them out only on the ribband of the upper works.

Keelson

XLIX. The keelson in the English ships is not scored down over the floors as in our ships; only in certain places is it scored down over the floors where they are not correctly faired. It is certain that this timber binds the ship better together when it is scored down over the floors as in our method. See what I have already said on the subject of the keelson, Rem. **XIV**.

Ceiling

L. The limber-strakes laid next to the keelson and the thickstuff at the rungheads of which I spoke in Remark **XVI** are not scored down but only fayed to the frames like the other planks of the ceiling, or else let down one inch into the frames. I saw them place them in both these ways in the ships which are building at Woolwich, and I suppose that they follow the same practice at Deptford, where I was unable to see whether they were scored down or not.

The strakes of the ceiling beneath the deck-clamps which in the ships at Deptford are assembled hook-and-butt, are assembled in the ships at Woolwich with plain scarphs, as shown in **Fig. 24**.

Planking of the Hull

LI. The English shipwrights apply pitch to the face of the bottom planks where they meet the frames before planking up. I find this method to be good, provided that we were to use as the English shipwrights do only plank which is completely seasoned, and lay them on frames which are equally dry.

The planking of the transom in their ships is a third less thick than the planking of the lower hull. Those employed in the ship of 100 guns which is on the stocks at Woolwich are no more

34. See Introduction, page 15.

than three inches [*8.1 cms*] thick, while those of the bottom are at least 4 inches ½ [*12.2 cms*]. Perhaps the English reduce the planking of the transom to such slight scantling in order to bend them the more easily, for all those which I saw in place seemed to me to have been stoved.

The planking at the waterline, which I observed in the ships building at Deptford was assembled hook-and-butt, is assembled with plain scarphs in the ships building at Woolwich, as it appears from the planks shown in **Fig. 24**.

The planking at the waterline and the wales are in the English ships tarred withoutboard shortly after they are laid, and the planking of the upper works payed with resin.

When the English shipwrights lay a plank or a timber of the wales, they first bore all the holes which will be needed for the treenails to fasten it to the frames, yet they drive in only half the number of treenails which they then fair off with the frames on the inside, since the vessel has not yet its ceiling in place when they plank the hull. The other holes serve for the treenails which pass through the ceiling. There would be much to say about this practice, yet I do not have the time to expand upon it.

Tuck-Rail

LII. The tuck-rail in the English ships is moulded directly, whereas in our ships this moulding is fayed to the outside of the rail. This tuck-rail finishes at the side counter timbers in the English ships, and does not stretch as in our ships to the outside of the quarter-galleries.

Shores

LIII. The English shipwrights support the ships which are on the stocks with the same number of shores as we do, yet their shores are set up with less care; for the most part they have no chocks to butt against. The heads of the toptimbers in the English ships, where the deck has not yet been laid, are shored up on the floors by 15 to 20 shores evenly spaced one from the other along the whole ship, and set up like those shown by the letter **A** in **Fig. 25**. In our ships we have no need of this precaution, since the bolts which bind the toptimbers to the upper futtocks prevent them from falling inwards, yet if we were to do away with these bolts, which it would be reasonable to do, we should then have to employ the same shores which the English shipwrights use. They make these shores of handmasts or old topmasts. This is a very small expense.

Stagings

LIV. The stagings which the English shipwrights erect around the ships which are building are wider and more solidly constructed than those which we erect in France. In this they do better than we, since the shipwright works in greater safety.

Masts and Spars

LV. I have seen at Woolwich the principal masts of a number of ships of 60 and 70 guns. The mainmast and the foremast are each made of three sticks which they assemble in the following manner. A single stick of fir which is the full length of the mast from the tennant of the heel to the crosstrees and the same diameter as the given diameter of the mast, forms the spindle. This is shown in **Fig. 26**. The spindle retains at its head in the fore-and-aft dimension the full diameter which the mast must have at this point, but to port and starboard it is faired away at the masthead to 4, 5, or 6 inches [*10.8 - 16.3 cms*] in size as far down as a quarter or only a fifth part of its length. It is seen from this latter direction in **Fig. 26**.

They fay then to either side of the part which has been made thinner a fish, like those marked with the letter **A** in **Fig. 27**. These two fishes are of oak, they complete the full height of the mast, and they are assembled with the spindle by tables and fastened with iron bolts. They are joined together and bound by iron hoops where they form the head of the mast, by which I mean the part from where the spindle finishes to the tennant of the mast-cap. These two fishes are cut square at the masthead with sharp corners, instead of being rounded like the rest of the mast, but below the hounds they are rounded off and exceed the diameter of the spindle by an inch and a half or two inches [*4.0 - 5.4 cms*]. The hounds of the mast are formed by these two fishes as they are in the masts of our own ships*.

The rubbing-paunch which we fay to the fore side of the mainmast and the foremast of our ships and which runs down only a few feet below the parrels, extends on the masts of the English ships as far as the partners of the upper deck. I do not see that this should be necessary.

****Since I wrote this Remark the foremasts of the* Amazone *and of the* Atlas *were fashioned in the English manner, being worked according to the plans which I furnished and which appear in Fig. 27. They cost two fifths less than our usual masts.****
*See Introduction, p. 33 [Ed.].

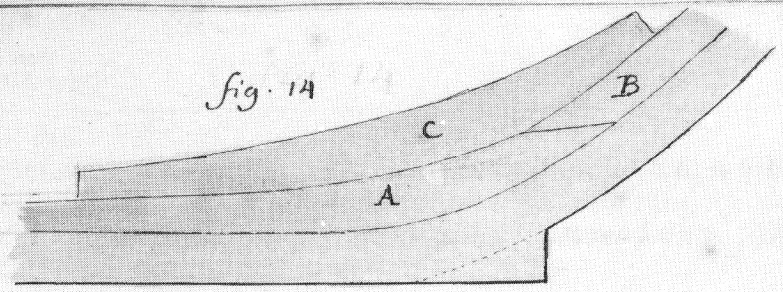


Fig. 14

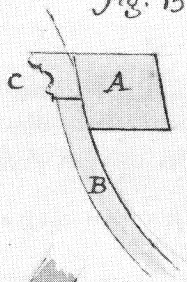


Fig. 15

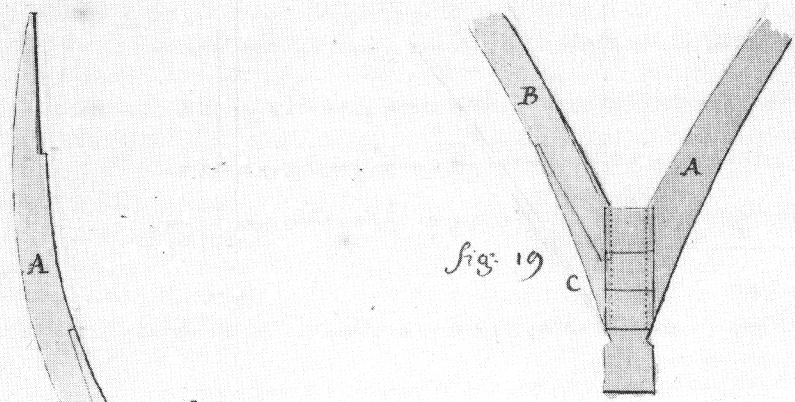


Fig. 19

Fig. 17

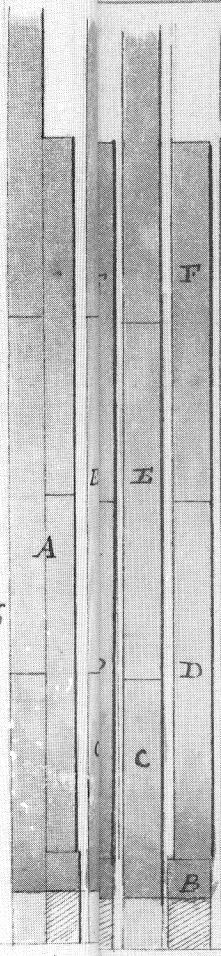


Fig. 16

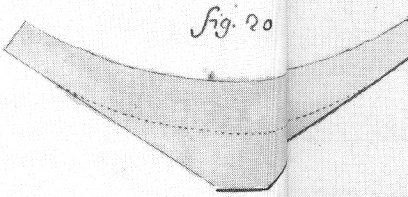


Fig. 20

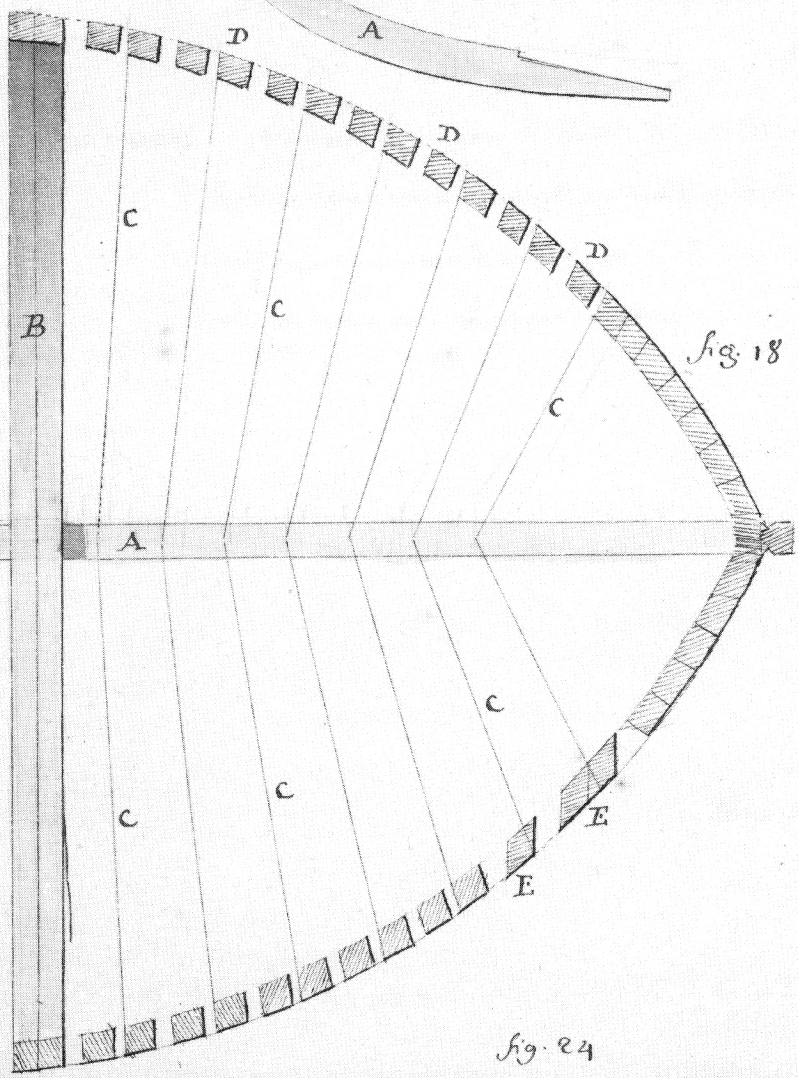


Fig. 18

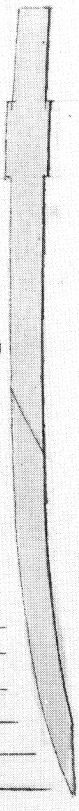


Fig. 21

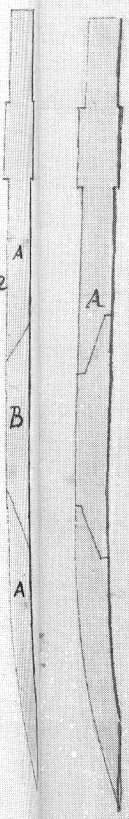


Fig. 22

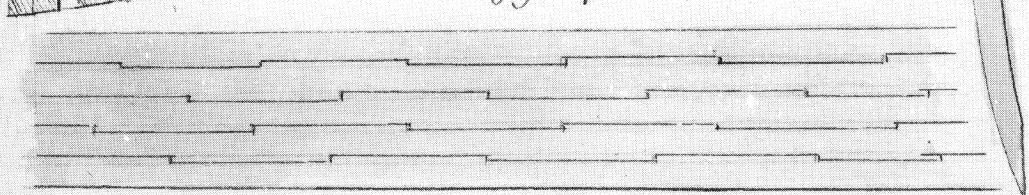
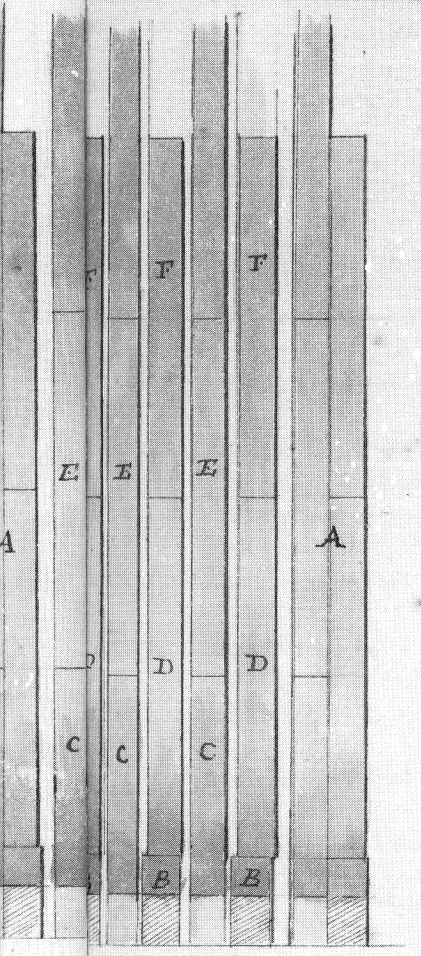


Fig. 24



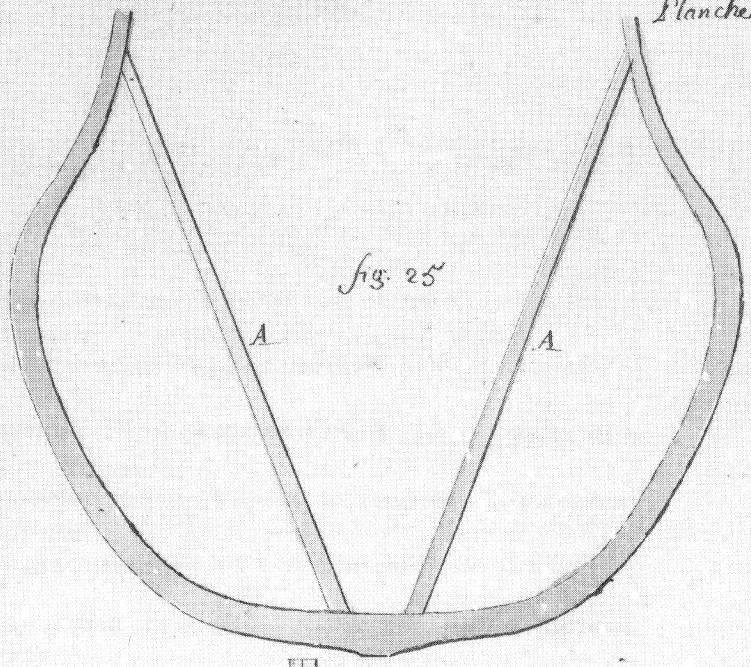


fig. 25

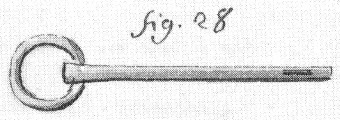
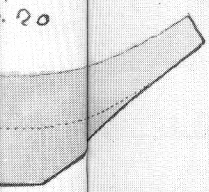


fig. 28



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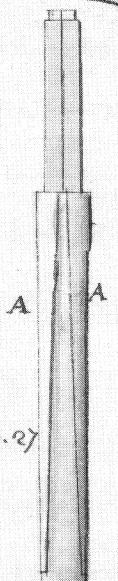


fig. 27

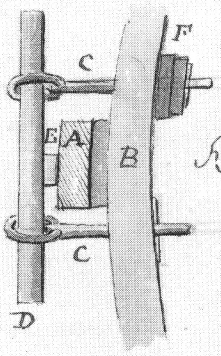


fig. 29

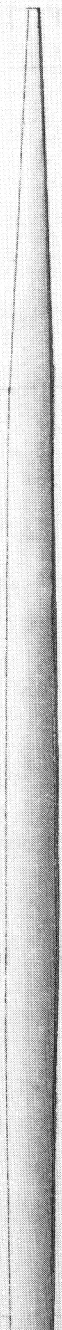


fig. 26



fig. 30





fig. 23.

The tennant of the heel of the mainmast, the mizen-mast and the foremast of the English ships is shaped in the same way as the tennant at the head, as is shown by the letter **B** in **Fig. 27**. The shape of the tennant in our masts seeems to me to be more solid.

The bowsprits are made of a single stick, or of a stick to which a fish is fayed on one of its faces to arrive at the given diameter. These spars have an oak fish like our bowsprits.

The crosstrees of the masts are of the same form as in our ships. I will say nothing of their topmasts nor of their yards, for I have as yet seen none.

All the masts and spars at Woolwich are stored in store-houses or open sheds. It is in these same sheds that they are worked. Opposite the mast-houses at Woolwich is a mast-pond which is about 300 feet [*97.4 m*] square, where they keep unworked masts in the water. This mast-pond has a number of slipways running up to the doors of the mast-houses.

Timber

LVI. There is a very great quantity of shipbuilding timber at Woolwich Dockyard. This timber is piled without any order in every available space[35] in the dockyard. It is in the form of almost whole trees, which still have most of their large branches; I believe that they always extract them thus from the English forests, since those at Deptford Dockyard are in the same state. Plank is stacked under cover with great care; all those which I saw used were frost-riven. The English shipwrights place as we do the cracked side against the frames.

Ironwork

LVII. The bar-iron in the storehouses at Woolwich is leant up on end against the walls instead of being laid flat as in our storehouses.

Ship's Boats

LVIII. There are at Woolwich a great number of boats in several sheds, some on blocks, others suspended from the roof-beams of the sheds, yet all rather ill-made and in poor repair. I saw no cutters.

Stoving-Ovens

LIX. I saw at Woolwich several stoving-ovens where they stove the planks which they wish to bend. I was present when they put in a plank 34 feet [*11.04 m*] long and 5 inches thick [*7.3 cms*], with a natural winding which was within a foot and a half [*49 cms*] of that which was needed to fill the place for which it was intended. They kept it five hours in the stoving-oven on its back and then offered it up in its place, whereupon it broke as they drove the wedges at the fourth wrain-bolt. They use here fresh water to moisten the sand of the stoving-ovens[36].

Engines

LX. The moveable capsterns, the claws of which at Deptford have a different form from that of our crabs and of which I made mention in Remark **XXXV**, are fashioned in Woolwich as in our own dockyards.

The English shipwrights employ neither cordage nor iron chocks to make up the wrain-tackles which they use as we do to set to the planks and the wales against the frames. They use a sort of iron wrain-bolt which has a ring at one end also of iron, and which is pierced at the other end to take a forelock. The shape of this implement is represented in **Fig. 28**. They use them in the following manner. In **Fig. 29**, **A** represents a plank seen end-on, which it is desired to set to against the frame **B**; one wrain-bolt is driven through the frame above the plank and another below, as represented by the letter **C**; the wrain-staff **D** is passed through the rings of these wrain-bolts; the wrain-bolts are forelocked inside the frame, and the wedges **E** are driven in between the wrain-staff and the plank which it is desired to set to against the frame. If the mortice into which the forelock is to pass is not flush with the inside of the frame, they insert between

35. Seasoning sheds were not in fact built at Woolwich until 1772.
36. Note in this context a comment in John Fincham's *History of Naval Architecture* (1851): "*The practice of stoving timber owed its origin to a Mr. Cumberland, to whom, as a compensation for his useful discovery, was granted a tenth part of the saving which should result from the use of it. But it does not appear that he pursued his investigations very vigorously, or to more than general results; for when the practice was introduced generally into the royal dockyards, the instructions stated that the planks and thick-stuff were not to be kept too long in the heat; and the degree of subjection to the process, and the time of it, were to be ascertained by experiments in performing that service. Salt water and salt water sand were considered preferable to fresh in improving the durableness of the timber; and they were therefore ordered to be always used for this purpose. This means of suppling and improving the condition of timber remained in use until 1736....*"

the frame and the mortice one or a number of chocks like those marked with the letter **F**, whose shape is as shown in **Fig. 30**, and by this means they use always wrain-bolts of the same size to set to planks of different thickness and against frames of different scantling. I find this method excellent, and beyond compare better than that which we employ in fastening the wrain-staff with lashings of cordage to iron chocks nailed to the frames. We need thereby more time, we consume large numbers of nails and quantities of cordage with this operation, and we obtain thereby much less purchase than do the English with their wrain-tackles. I am not aware that this engine is known in our dockyards*.

I had them forge wrain-bolts similar to those of the English and they served during the building.... (deleted) with great success. The shipwrights found that they were safer to use than their usual wrain-tackles.

LXI. The English sawyers do not as we do raise upon jacks the timbers which they wish to saw; they employ a much simpler method, and one which would afford us great saving were we to imitate it in our ports. They have in their dockyards sawpits which are 22 to 25 feet long [*7.1 - 8.1 m*], 3 feet [*97 cms*] wide, and 6 feet [*1.95 m*] deep, situated 3 to 4 feet one from the other like those for which the plans are shown in **Figs. 31**, **32** and **33**[37]. The walls of these sawpits are lined with brick, with two or three small lodging places cut in the walls where the sawyers keep their tools. When they wish to saw up a timber they place it on rollers over one of the pits; the rollers are blocked with wedges; one of the sawyers descends into the pit, the other stands on top of the timber, and after they have sawn the full length afforded by the pit they slide the timber easily on its rollers with no need of any other device than a crow. When the timber has been sawn the planks lie so that they can be easily carried away.

Sawing of Plank

If we compare this method with that of propping the timbers which we wish to saw up on jacks with the aid of gins, the labour which we have in shifting over the jacks when they stand in the way of the saw, the time which is needed to lower to the ground the planks once they have been sawn and the risk thereby of breaking them, if we compare I say the method used by the English to that which we employ, we find a difference deserving that we should conform to their method.

Each day in our workshops (I speak of those at Brest) we must employ for the first two or three and often four hours of the morning all the workmen of the workshops at lowering the planks cut the previous day and at propping up new timbers onto the jacks. Whether the workshop be busy or idle it is always fully employed, since when it is busy there is always more timber to be sawn. The shipwrights lose the best part of the day in doing the work; they find the work heavy; it happens frequently that they suffer injury thereby, yet while the timber is being thus propped up and lowered the sawyers stand idle.

We can by imitating the English avoid this operation. For a very modest sum we could construct at Brest three or four sawpits next to each building dock and the same number next to the sheds where the timber is stored and by the inspection and maintenance shops. It will cost no more time to carry the timbers to the edge of these sawpits than we expend today to carry them to the places where they are sawn, yet we should be dispensed of having to raise them up on jacks, which is the greatest part of the work of sawing in our yards. Once the timbers are sawn we should only have to carry off the planks resulting from the work without having to lift them off the jacks. That which we should save in less than six months† by means of these sawpits would pay for their building, even if we should cover them with a roof like those of the English. I have not shown the roof in the drawings which I have made of the sawpits since it is no differently made from the roof of any shed. **Fig. 31** of these drawings shows a plan view of the sawpits. **Fig. 32** is a longitudinal section with a timber laid over the top of the pit, and the lodging places of which I spoke are shown by the letter **A**. **Fig. 33** shows the sawpits in cross-section, also with a sawn timber lying over one of the pits. The lodging places are once again shown in this drawing and indicated by the letter **A**. It may be seen from **Fig. 33** that not all the pits are separated by walls, but some of them by pillars **B** over which are laid three planks forming a floor which is level with the ground.

†.... in less than one year...

I should add that if we were to build sawpits of this kind in France, we should make them a few inches wider than those used by the English sawyers, since our sawyers are not like them in the habit of using saws without frames.

37. See Plate 3 overleaf.

Dessein des fosses ou l'on scie les bois de construction dans les arsenaux d'angleterre. Voy. Remarq. LXI.

Planche 3

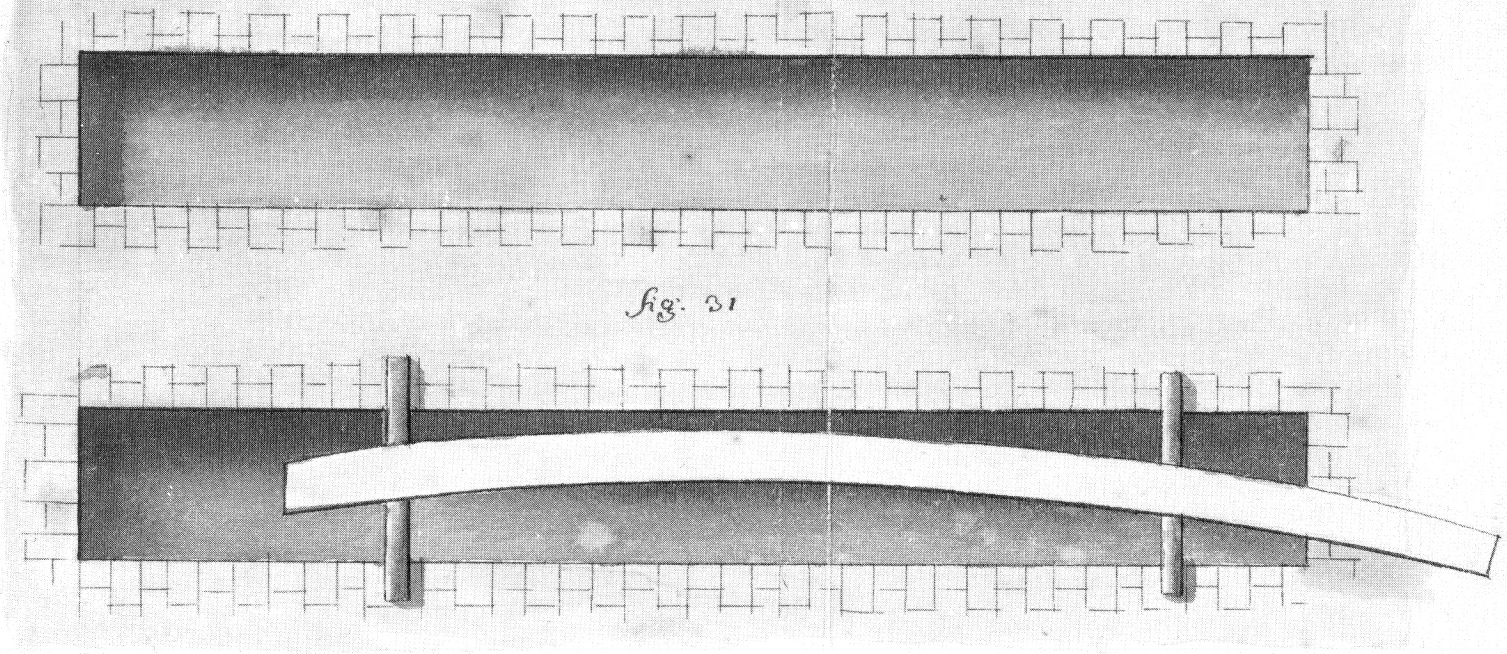


Fig. 31

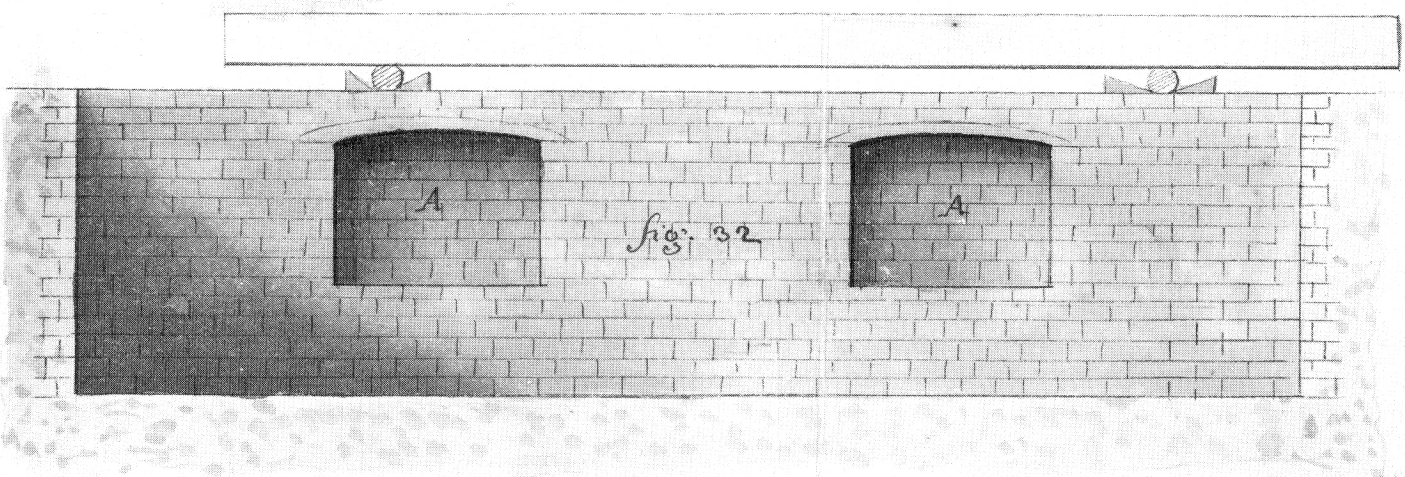
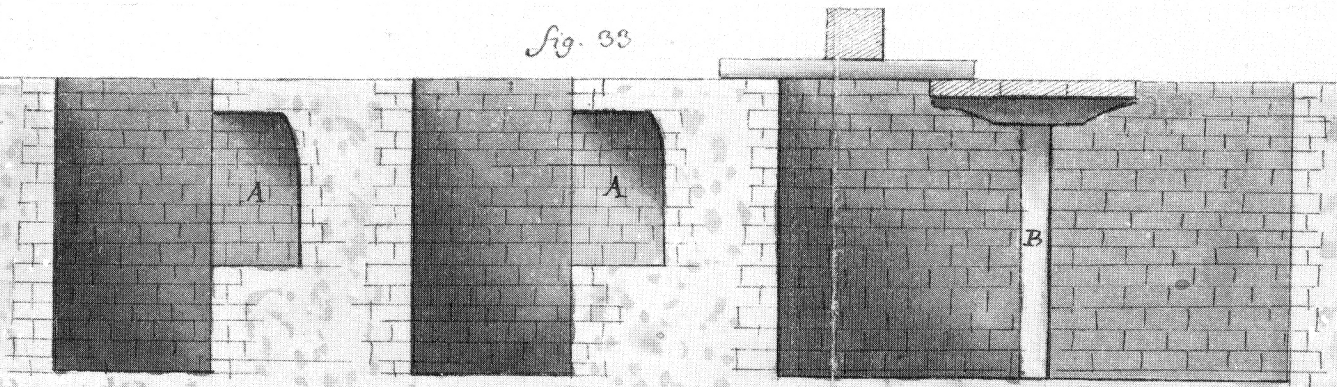


Fig. 32

Fig. 33





LXII. The stores at Woolwich Dockyard are larger than those at Deptford, yet just as ill-constructed and in poor repair. There are several sheds in the Dockyard.

Stores

LXIII. The shipwrights which I saw at Woolwich are no better nor less idle than those working at Deptford. The cost of labour in English ships must be four times greater than in our yards, for not only do they pay the shipwrights here 30 shillings per diem which is 57 sols ½ of our money[37], but they do not do half the work of our shipwrights†.

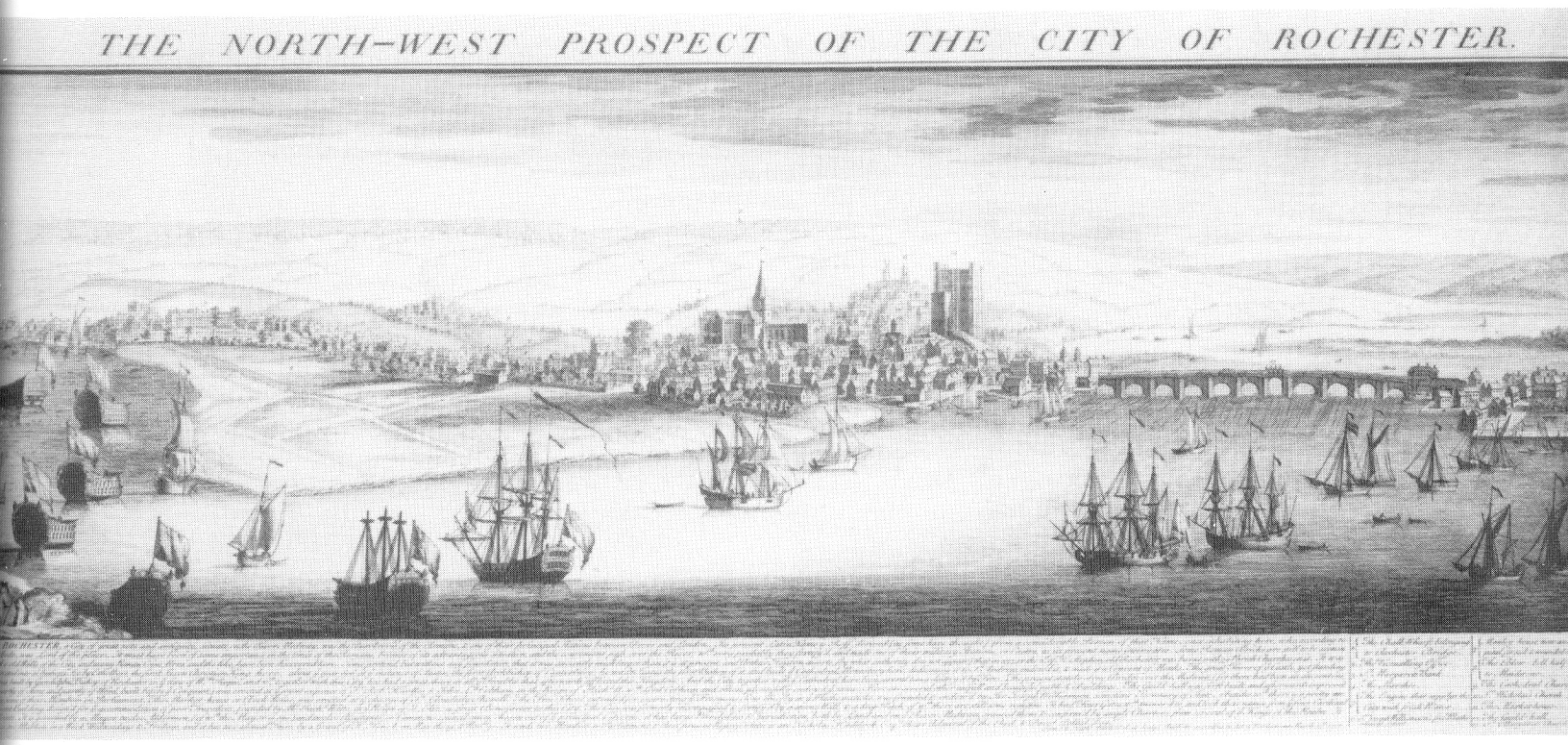
Shipwrights

†....but they do not work more than half of the time.

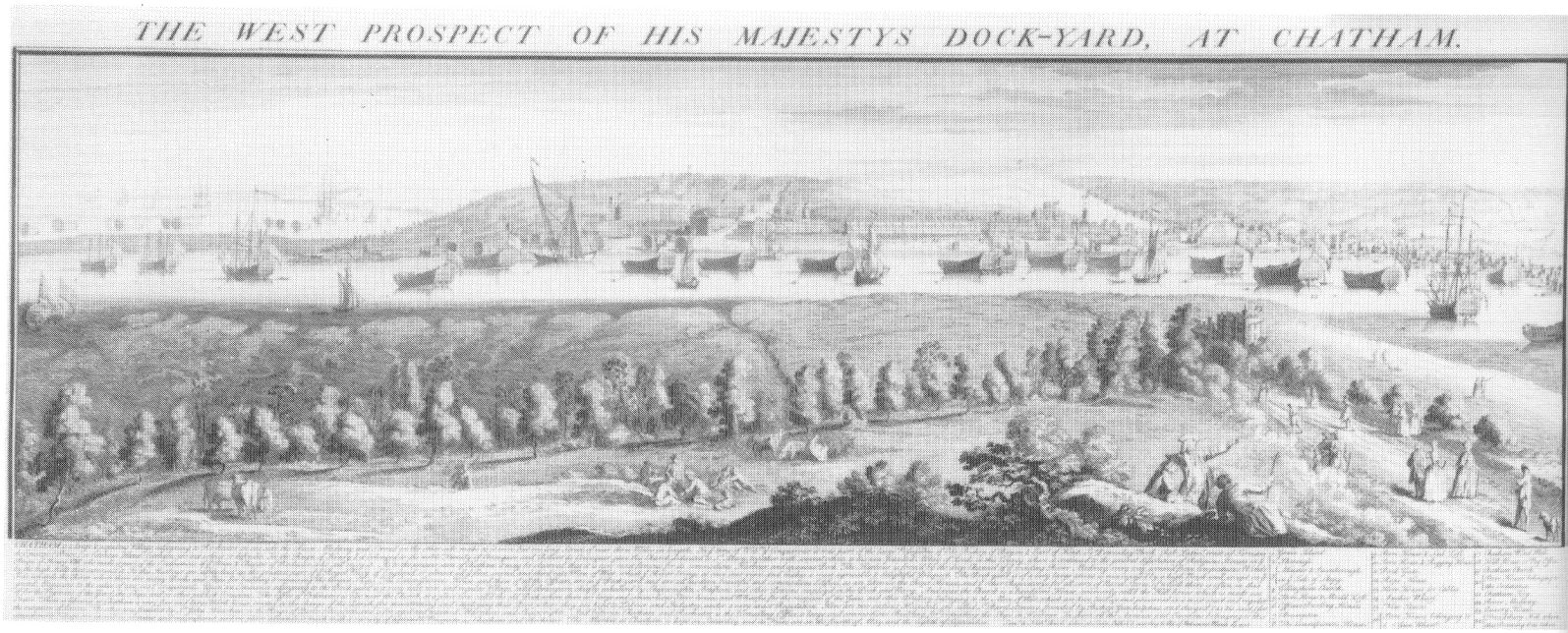
* * *

37. i.e. 2 *livres* 17 *sols* 6 *deniers*, equating to an exchange rate of 1 *livre* 18 *sols* 4 *deniers* to the pound sterling; like the English pound, the *livre* was divided into 20 *sols*, and each *sol* into 12 *deniers*.

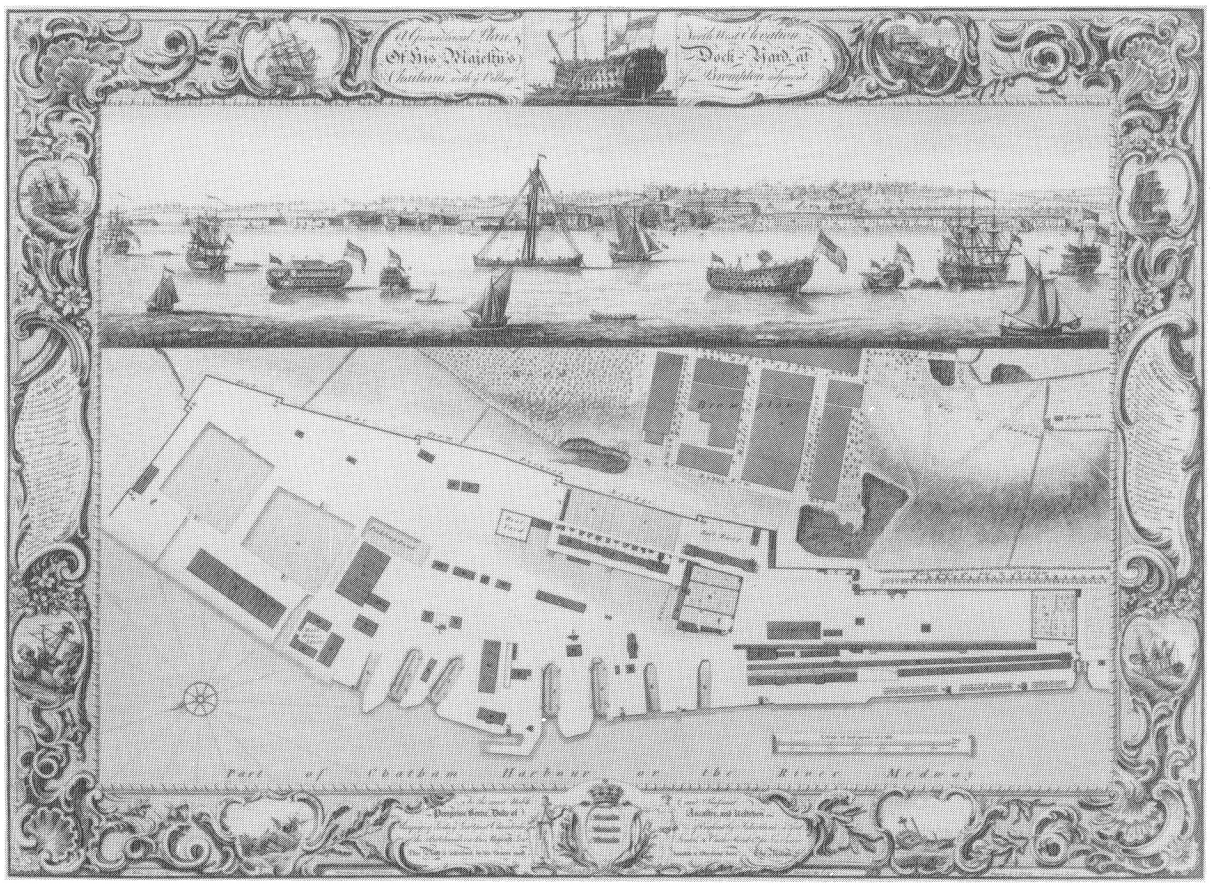
Plate 3. Drawing of the sawpits where they saw up shipbuilding timber in the English Dockyards. See Remark LXI. Scale in French feet.



25. *View of Rochester, on the River Medway next to Chatham. Engraving by Samuel & Nathaniel Buck dated 1738. (Courtesy National Maritime Museum, Greenwich)*



26. *View of Chatham Dockyard by Samuel & Nathaniel Buck, dated 1738.*
(Private collection)



27. *Chatham Dockyard in 1755.*
(Courtesy National Maritime Museum, Greenwich)

Further Remarks on the English Navy

Chatham Dockyard

LXIV. Chatham Dockyard[38] is situated on the Medway near to Rochester, 10 leagues distant from London and six leagues from the sea. There are in this Dockyard two building-slips for building ships of war and five dry-docks for repair and graving.

Building-Slips

The slips are about 160 feet [*52 m*] long, 36 feet wide [*11.70 m*], and 12 feet [*3.90 m*] deep at the water's edge; their upper part is level with the ground. There is at present (in May 1737) on the stocks of one of the slips a ship of 70 guns building, and they are working to repair the other in order to start a ship of 50 guns.

Docks

Two of the docks at Chatham are each about 175 feet [*56.8 m*] long, 64 feet [*20.8 m*] wide at their edges and 19′3″ [*6.25 m*] deep at the entrance; the water never rises there more than 18 feet ½ [*6.00 m*]. They have two aulters at their sides each 4 feet wide [*1.30 m*], and their walls are lined with planks of oak; they are about 50 feet [*16.2 m*] wide at the entrance, and are closed by a gate of three panels constructed as I shall explain later*. I saw these two docks occupied one by the **Royal Sovereign**[39], a ship of 100 guns, and the other by the **Union**[40], a ship of 90 guns. The former left the dock at Chatham while I was there, and the **Union** was taken in[41].

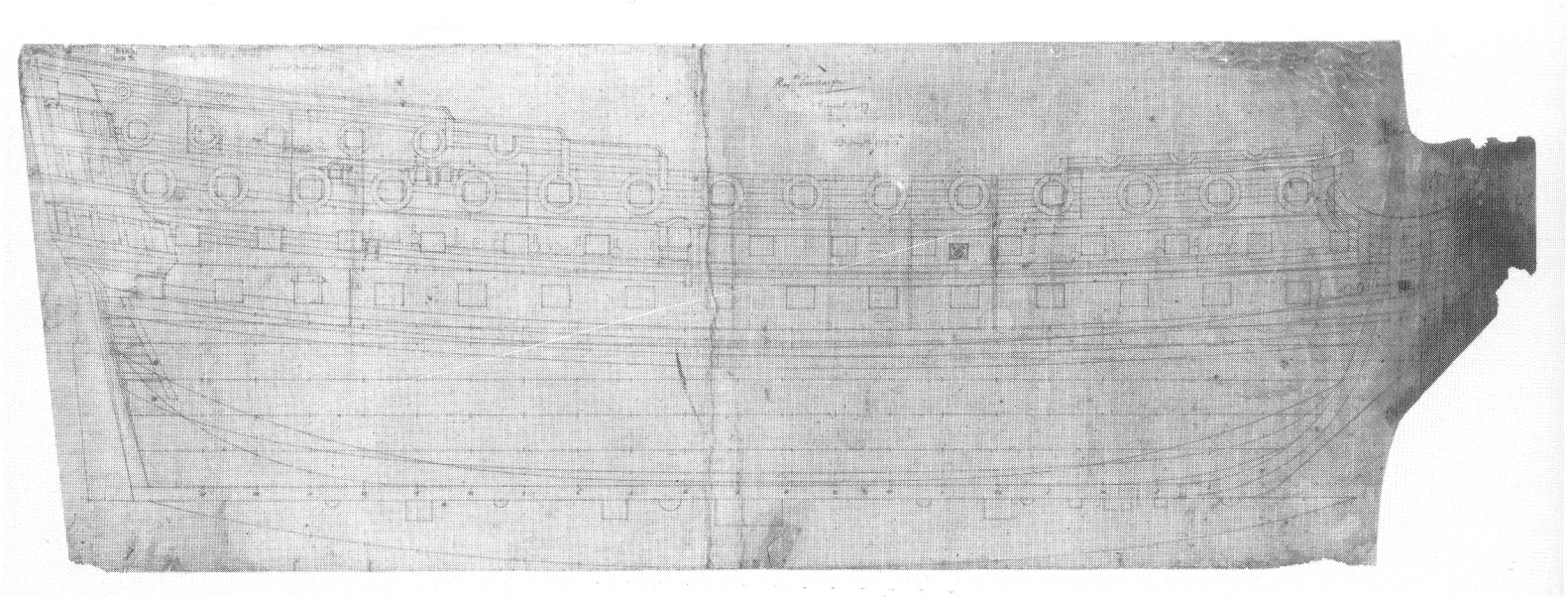
*See Rem. 120 page [114].

Two other docks are each about 150 feet [*48.7 m*] long, 60 feet [*19.5 m*] wide, and 18 feet [*5.85 m*] deep; they also have aulters at the sides, and the walls are lined with oak planks. One of these docks is occupied by the **Buckingham**[42], a ship of 70 guns which is being repaired.

The fifth dock is only 130 feet [*42.2 m*] long, 42 feet [*13.6 m*] wide, and 15 feet [*4.87 m*] deep; it is empty and in poor repair. I shall later on give a description of these docks*.

*See Rem. 120 page [111].

38. **Chatham Dockyard** dates from 1547, and was the pre-eminent English Dockyard during the Dutch Wars of the 17th century. It was considerably enlarged in 1662, but gradual silting of the Medway and a shift in strategic emphasis towards the Western Approaches gradually led to its decline and the development first of Portsmouth and then later in the 18th century of Plymouth (Devonport).
39. **Royal Sovereign**: 1st Rate (100), 1883 tons b.m., 175′0″ x 50′6″. Launched Woolwich Dockyard July 1701, she was rebuilt at Chatham in 1728; Ollivier's statement that she was repaired 8 years after her launch at Chatham shows that he considered her "rebuild" to be tantamount to new building. She was finally broken up, also at Chatham, in April 1768.
40. **Union**: 2nd Rate (90), formerly the *Albemarle*; built by Betts of Harwich in 1680 with dimensions of 1376 tons b.m. and 162′0″ x 44′6″. She was renamed the *Union* on December 29th 1709, and rebuilt in 1726 as 1578 tons b.m. She was finally broken up in November 1749 at Chatham.
41. According to the Admiralty *Progress Books*, the *Union* was taken into dock on May 2nd and the *Sovereign* left on May 17th. This provides valuable information concerning the dates that Ollivier was at Chatham.
42. **Buckingham**: 3rd Rate (70), 1128 tons b.m., 151′0″ x 41′6″. Built at Deptford in 1731, she had a relatively short life and was broken up in 1745.

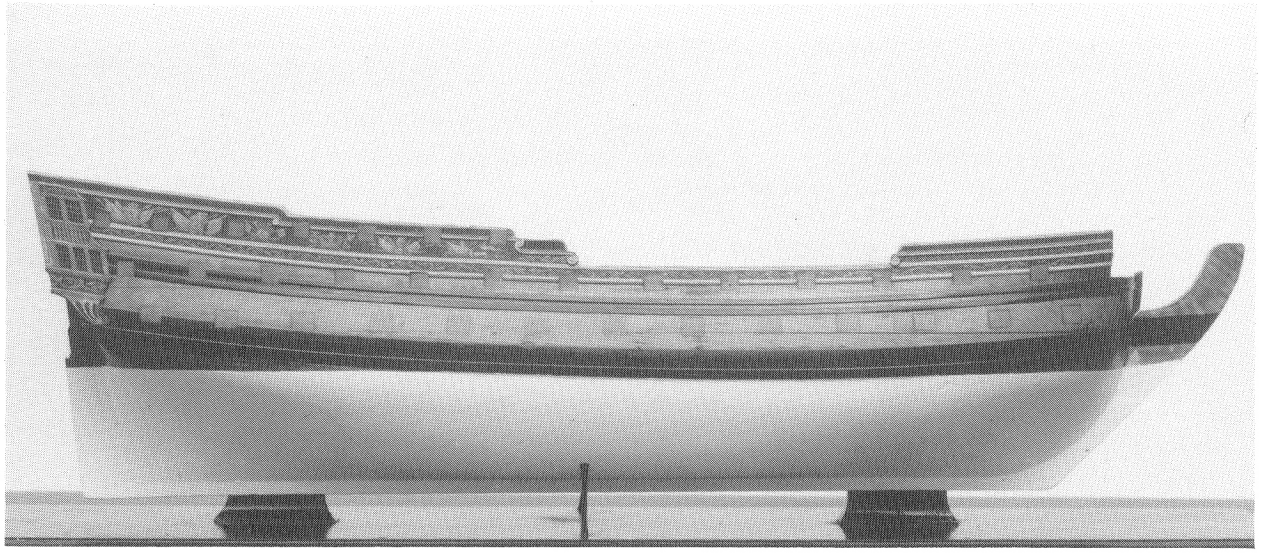


28. *Original 1697 draught of the* Royal Sovereign. *Since she was "rebuilt" in 1728, this is not much of a guide to her appearance when Ollivier saw her. (Courtesy National Maritime Museum, Greenwich)*

Ship of 100 Guns called the *Royal Sovereign*

LXV. The **Royal Sovereign** which I saw in the dock at Chatham was repaired there eight years after her building. Her length from rabbet to rabbet, reduced to French feet, is 163 feet 1½ inches [*52,98 m*]; her breadth amidships is 46 feet 10½ inches [*15.22 m*], and her depth in hold is 18 feet 9 inches [*6.09 m*]. She is pierced for 14 guns on either side on the gundeck and the same on the middle deck and the upper deck, for 2 guns on the forecastle and for 7 guns on the quarterdeck on either side. Her underwater lines are well drawn; there is only 4 inches [*10.8 cms*] of deadrise at the midship bend; she is fuller at the midship bend and at bow and stern than the other English ships of the same Rate which I have already seen. Her bow seems to me to be very well shaped to cleave the water; she is also very full at her height of breadth. This ship has already been in commission; I am assured that she is a fast sailer and that she has all the other qualities demanded of a ship of this Rate. Mr Ward[43], Master Shipwright at Chatham, showed me her original draughts, the same on which her lines were drawn out in full, and I was as pleased with them as with the ship herself. It is from this draught that I read the three principal dimensions which I have already quoted; I also measured thereon the deadrise, but I could not without compromising myself extend my curiosity further[44]. Nevertheless, I made many notes concerning the lines of this ship which I shall recall in my writings when after seeing all the Royal Dockyards of England I come to my essay on English shipbuilding[45].

43. **Ward**: John Ward first comes to notice as Second Assistant at Chatham, a post which he held from January 1st 1709 to April 26th 1711; from Chatham he moved to the "premier" Dockyard of Deptford where he occupied the position of First Assistant from April 27th 1711 to October 26th 1717. His promotion to Master Shipwright came next, with the appointment to the "junior" Yard of Sheerness, a post which he held until November 24th 1732, before being promoted to the post which he occupied when Blaise Ollivier met him, that of Master Shipwright at Chatham. He never secured the ultimate promotion to Deptford, and continued to occupy the post at Chatham until June 12th 1752. Towards the end of his career he was joined at Chatham by another John Ward, in the position of Master Caulker (1746-50); it is possible that this was his son.
44. This remark seems to confirm our belief that Ollivier's activities were indeed tantamount to spying, and that he was not therefore always free to pursue his enquiries as far as he might have wished.
45. Starting at Remark CXXIV, p. 132.



29. *Model of the* Elizabeth. *(Courtesy National Maritime Museum, Greenwich)*

The upper works of the **Royal Sovereign** are well made; she has near the same tumblehome as our own ships, save at the bow where the tumblehome is somewhat greater. Her headroom between the gundeck and the middle deck measures 5′10″ or 11″ [*1.90 - 1.92 m*]; between the middle deck and the upper deck she measures 6 feet 3 or 4 inches [*2.03 - 2.06 m*]; the height of her quarterdeck is 6 feet 6 inches [*2.11 m*] – (I measured this latter dimension exactly). The height beneath the forecastle is 6 feet 2 or 3 inches [*2.00 - 2.03 m*], that beneath the poop 6 feet [*1.95 m*], and of the poop-royal 5 feet and 6 inches [*1.79 m*]. The quarterdeck runs forward to within 8 feet [*2.60 m*] of the mainmast, and the poop to one deck beam forward of the mizen-mast. The forecastle is 30 feet long [*9.74 m*], and the poop-royal about 10 feet [*3.25 m*].

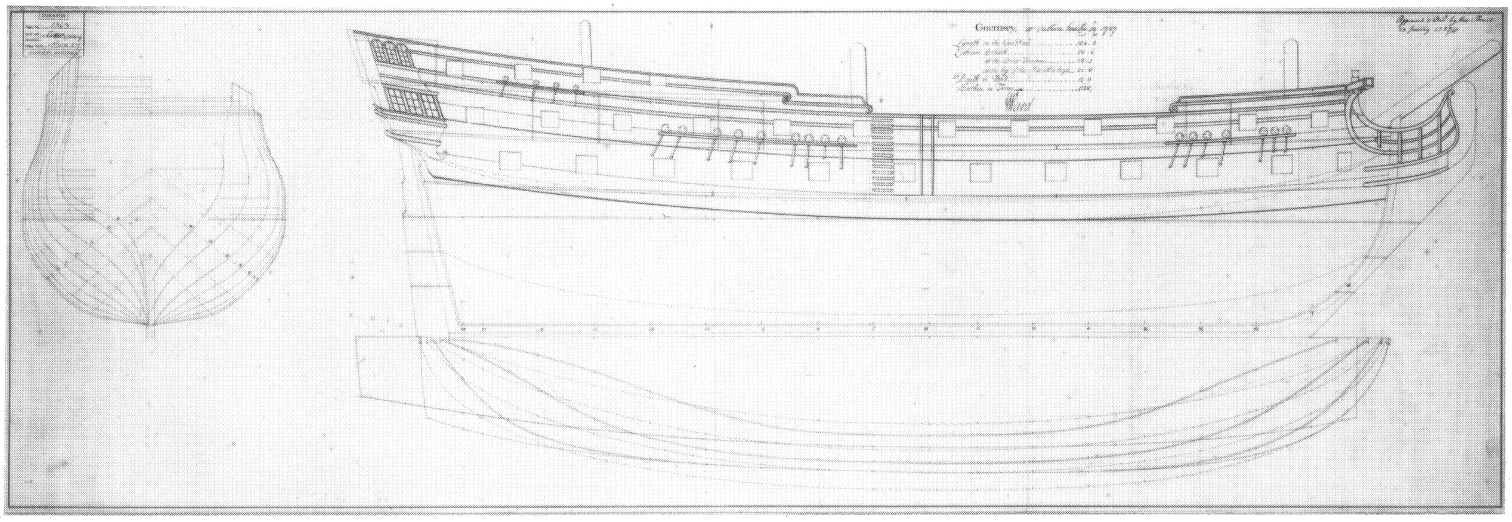
Ship of 90 Guns, called the *Union*

The ship **Union** which I saw docked in one of the docks at Chatham for graving has floors which are somewhat less full than is commonly the case in English ships, yet she is excessively full at the waterline, which compensates almost for the fineness of her floors. I was led to understand that she is not very weatherly, and this appeared to me very probable. The height between decks and beneath the forecastle and quarterdeck in this ship are within two inches [*5.4 cms*] the same as in the **Royal Sovereign**. She has no poop-royal, and the poop extends but to within 2 feet [*65 cms*] of the mizen-mast. She has 14 gunports on the lower, middle and upper gundecks, and 4 on the quarterdeck.

Ship of 70 Guns, called the *Elizabeth*

The ship of 70 guns which is on the stocks at Chatham is called the **Elizabeth**[46]; she is planked from the keel to the plankshеer; both her decks are finished; they are installing the beams of the forecastle and quarterdeck and working on the apartments of the hold. I saw the draughts of this

46. **Elizabeth**: 3rd Rate (70), 1110 tons b.m., 150′6″ x 41′0″. Built by Stacey at Woolwich and launched August 1st 1706. During her rebuild at Chatham in 1737 (launched 29.11.1737) she was enlarged to 1224 tons b.m. but reduced to 64 guns. She was finally broken up on May 10th 1766 at Portsmouth.



30. *Draught of the* Guernsey *of 1737. (Courtesy National Maritime Museum, Greenwich)*

ship in the office of Mr Ward; she is of a new manner of building such as was carried out but recently on the **Gloucester**[47], a ship of 50 guns, and on the **Eltham**[48], a frigate of 40 guns. I shall explain this new manner of building when I have seen the other ships on which it has been put in practice, and when I am able to add what I have been able to learn of a positive nature of the success which it has had; for the **Eltham** has already been commissioned, and for the moment I have heard both much good and much ill of her*.

*See Rem. – [CXCVII] page – [181].

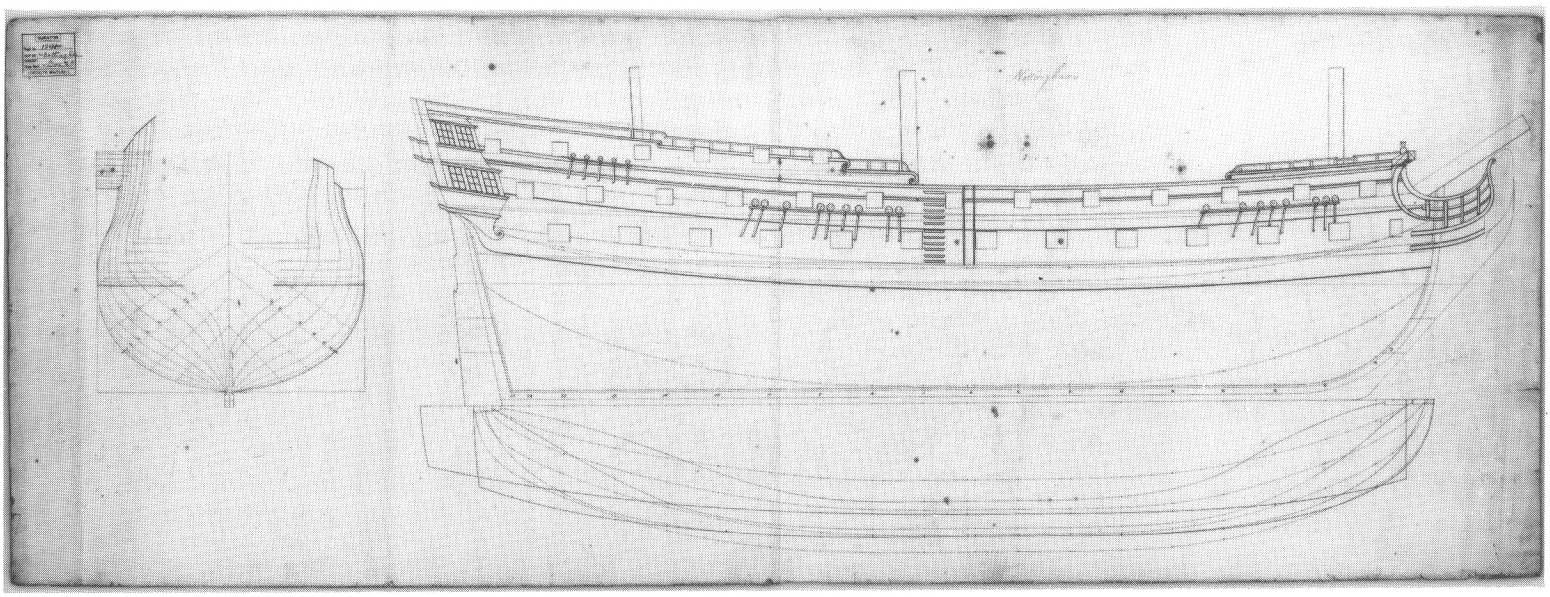
Ship of 70 Guns, nd. the *Buckingham*

The ship the **Buckingham** of 70 guns which is being graved in one of the docks at Chatham seems to me to be well built, yet I am told that she is a poor sailer, yet has all the other good qualities expected.

Ship of 50 Guns, nd. the *Guernsey*

I have seen the draughts of a 50-gun ship[49] which they are starting to build at Chatham, and I have also seen them lofting some of her frames full-size[50]. I saw nothing but which struck me as very mediocre. The ship will have a midship bend which is rounded and with a great deadrise, a very bluff bow, yet little fullness at the waterline; in general little fullness aft, and waterlines against which the water will find great resistance. It is Mr Ward who is the builder of this ship, yet I saw therein but little evidence of the genius of this builder who gave me by the several

47. **Gloucester**: 4th Rate (50), 866 tons b.m., 134′0″ x 38′6″. Launched at Sheerness Dockyard on March 22nd 1737, she had a relatively short life, being damaged in a storm in July 1742 and finally burnt on August 16th 1742 near the Ladrones to avoid capture by the Spanish.
48. **Eltham**: 5th Rate (44), 678 tons b.m., 124′0″ x 36′0″. She was built at Deptford in 1736 and broken up at Plymouth in June 1763. According to Colledge [*op.cit.*], she may have been rebuilt from the *Portsmouth*, but this seems unlikely. Her draughts are reproduced on page 180.
49. **Guernsey**: 4th Rate (48), 680 tons b.m., 132′0″ x 34′6″. Built by Johnson at Blackwall in 1696. She was docked on February 5th 1736 and taken to pieces "to search her defects" [*Progress Books*] during March. Her rebuild began a year later in March 1737, and was not completed for three years, since she was launched on August 11th 1740 as 863 tons b.m. Hulked in April 1769, she was finally sold out of the Navy in 1786.
50. Despite his clandestine activities, clearly Ollivier obtained considerable cooperation from at least some of the shipwrights. See Introduction.



31. *Draught of the* Nottingham. *(Courtesy National Maritime Museum, Greenwich)*

works which I saw in his office such a high opinion of his capacity. He has scrupulous orders to observe the old manner of building[51] in this ship, which made me think that perhaps he aims to spoil her deliberately in order to make a more brilliant show of the new manner of building in which he has played some part. I should not remain silent over the fact that he follows strictly the moulds of a ship of the same Rate which was very successful. If this be true, then I myself am in error in the opinion which I have formed of her.

Ships of Various Rates

Among the ships which are moored in the Medway before Chatham and which I have been on board, the most remarkable for their excellent building in all their parts which can be seen above the waterline, and within, are the **Royal George**[52], ship of 100 guns, the **Grafton**[53] and the **Nottingham**[54] of 70 guns, and the **Dragon**[55] of 60 guns. The first is much admired by the English, and I think them to be right in this. She is a very fair ship. Her lines are similar to those of the **Royal Sovereign**; I have seen her draughts. Yet she is superior to her, by the greater space which she has upon her decks, by the lines of her hull above the waterline, and by the fact that she is better executed in her upper works and has less sheer.

Keel

LXVI. I should add to what I have already said about the keels of the English ships, Remarks **IV** and **XLI**, that in all their ships the skeg of the keel is cut short. I had already remarked this in one of the ships at Deptford, yet I was not certain of it as I am today that all the English ships are the same in this respect. I have seen draughts in the office of Mr Ward where the long skeg is still shown, I asked him why I did not see it in all the draughts and he replied that for about the last ten years they have cut off this timber, finding it of no usefulness. In this we are nearly in accord with the English shipwrights, for we have already greatly reduced the projection of this skeg. See Remark **IV**.

51. i.e. the 1719 Establishment.
52. **Royal George**: formerly *Royal Charles*, 1st Rate (100). Built Portsmouth Dockyard 1673 as 1443 tons b.m.. Renamed *Queen* in 1693. Rebuilt at Woolwich and launched 20th September 1715 as 1801 tons b.m., 172′0″ x 49′6″. Subsequently renamed again, this time as the *Royal Anne* (January 19th 1756), finally broken up in 1767.
53. **Grafton**: 3rd Rate (70), 151′0″ x 40′6″, 1095 tons b.m. Built by Swallow & Fowler at Limehouse and launched August 9th 1709. Rebuilt at Woolwich in 1725 as 1133 tons b.m. Broken up in 1744.
54. **Nottingham**: 4th Rate (60), 924 tons b.m., 146′0″ x 38′0″. Launched Deptford Dockyard June 10th 1703. Rebuilt at Deptford in 1719 as 928 tons b.m.; subsequently rebuilt again at Sheerness in 1745 as 1077 tons b.m. Finally sunk as a breakwater at Sheerness in September 1773. Her draughts are shown above.
55. **Dragon**: 4th Rate (60), 1067 tons b.m., 144′0″ x 42′0″. Built at Woolwich Dockyard in 1736 and sunk as a breakwater at Sheerness in July 1757.

I stated that the English shipwrights scarph the timbers of the keel side by side, but I was not then aware when I spoke of these scarphs that they are cut with running tables as I have shown in **Fig. 34**, and as I saw them carry it out on the ship the **Guernsey** which they are starting to build at Chatham. The English shipwrights follow this practice in all their ships; they also use the same tables at the boxing of the end of the keel to the heel of the stem. The tables are about one and a half inches [*4.0 cms*] thick.

Stem

LXVII. The scarphs of the timbers of the stem in the English ships are tabled in a like manner to the scarphs of the keel. See the previous Article.

Sternpost and False-Post

LXVIII. I questioned in my Remark **VII** whether the timber marked **B** in **Fig. 3** which rises but half way up the height of the sternpost served as a false-post. I have since seen that there is no other false-post in the English ships save only this timber; it is tennanted at the heel into a mortice cut in the keel like the sternpost, and at its head it has a tongue which is fitted into the sternpost, as it appears in **Fig. 35**[56], which shows the sternpost seen from abaft.

False Keel

LXIX. I saw from the ships building at Chatham that the 4 inch [*10.8 cm*] plank which I saw at Deptford laid between the keel blocks and the keel is indeed a false keel, such as all the English ships have, both large and small. It serves to preserve the caulking of the scarphs of the keel and prevents this timber from suffering damage when they dock their ships without laying them up on keel blocks. The English shipwrights claim yet another advantage from it; which is that their ships being thereby 4 inches deeper in the keel by virtue of this false keel, they ply better to windward. There are some shipwrights in France that hold the same opinion in favour of a greater draught, yet this is an error. I shall expand on this further when I talk of the new manner of building[57] employed by the English. I saw them shift a piece of false keel on the **Buckingham**, which they are repairing at Chatham, and since the distance between this false keel and the floor of the dock is not sufficient to enable them to drive spikes from below, the keel blocks being but 18 to 20 inches [*49 - 54 cms*] high, they fastened it with ragged staples placed like those marked by the letter **A** in **Fig. 36**, which shows a keel assembled with a false keel, both cut through vertically at some point along their length.

Sternson Knee

LXX. They have no sternson knee in the English ships. I have already spoken of the stemson, Remark **XV**.

Riders

LXXI. There are fewer riders in the English ships than in our own, and they are composed of fewer timbers. The ships here of 90 to 100 guns have but nine or ten riders, whereas we fit fourteen or fifteen. In the English ships five or six of these riders finish at the clamps of the gundeck, while the others are composed but of a floor or of a floor and two futtocks: these are the riders at the narrowing of the bow and the stern. In our ships of this strength all the riders rise as far as the middle deck. The English ships of 70 or 80 guns have but five riders which run up to the gundeck, and three or four other floor-riders at bow and stern which have neither first nor second futtocks. In our ships of this Rate we place thirteen or fourteen riders, all of which are composed of a floor, two first futtocks, two second futtocks and two third futtocks. This same difference in the number and disposition of the riders persists in their ships of 60 guns. There are but three riders which run up to the gundeck in the English ships of 50 guns, and 5 or 6 floor-riders at bow and stern in place of the eleven riders which we employ in these same ships, all of which run up to the upper deck. It is true that in the English ships the riders are an inch and a half to two inches [*4.0 - 5.4 cms*] broader and thicker than in our ships, and this size renders them equivalent to ours which are smaller yet more numerous. Yet there remains still the great difference between ours and theirs of which I have spoken which resides in the fact that in the English ships the riders at the narrowing of the bow and the stern are but simple floor-riders, and that the other riders run up only as far as the gundeck, whereas in our ships they all rise as far as the next deck above.

56. See Plate 4, page 119.
57. Starting with Remark CXCVII, p.181.

It is certain that this English practice with regard to the riders at the bow and the stern does not impart to the sides of their ships all that strength which is to be found in the method which we follow in France, namely to make up these riders with the same number of timbers as have the riders at the middle; yet since the English ships experience no inconvenience in their sailing despite that they have but floor-riders alone at the bow and at the stern, and since they hold up each time that the ships are brought into dry-dock for graving, it is clear that the futtock-riders which we add to the floor-riders in this place are not required for the fastening of the the ship, and I think it would be good to do away with them in the new ships which we build. We should be afforded thereby a great saving in timber, in iron fastenings, and in days' labour, and we should lighten the bow and the stern of the ship by the weight of these timbers which the English manner of building demonstrates to be unnecessary. I am conscious how greatly the doing away with these timbers will shock the prejudices which we have concerning the strength which the riders impart, yet if their ships of all Rates (which are yet more laden with guns than are ours) are able to put to sea and hold up very well without having at the narrowing of their floors this extra fastening which heretofore we have held to be necessary, then we can without risk imitate the practice of the English shipwrights in this matter, taking into account the saving, the lesser weight and the greater room which their method will afford us in our building.

Since the English shipwrights run their riders only as far as the gundeck, they make up for the lack of fastening which the upper futtock-riders provide in our ships with standard knees of iron or timber which they place on the gundeck between the gunports of the lower battery. This method will provide, later on, the subject of an important Article, but I shall not write it until I have fully examined the advantages and disadvantages which lie therein, and whether the practice of the English shipwrights in this regard be better or less good than that which we follow.

The English shipwrights do as we do in fastening the timbers making up the riders to the sides of their ships with iron bolts clenched over roves, yet these timbers are not fastened one to the other in any way. In our own ships the scarph of the first futtock with the floor-rider is strengthened by three iron bolts, and likewise the scarphs of the second futtock-riders with the first, the third with the second, and the fourth with the third. In England these timbers are simply laid next to each other without any fastening, neither iron bolts nor treenails, as I have already explained in regard to the frame timbers. Once more in this item it would appear that there is a greater strength in our method, yet we cannot do otherwise but allow that in the English method there is strength enough, since their ships may be seen to exist, to put to sea, and to be left dry in their docks in that state. Thus the success of the English ships proving beyond all doubt their sufficient strength, it must follow from this that the iron bolts which we place in the riders of our ships are unnecessary, and that we can do away with them without risk. We would save thereby both in iron and in days worked, and our ships would be lighter. This saving in iron would for a ship of 74 guns amount to 312 bolts[58] 2 feet long [*65 cms*] and 12 to 13 lines square [*2.7 - 2.9 cms*]*.

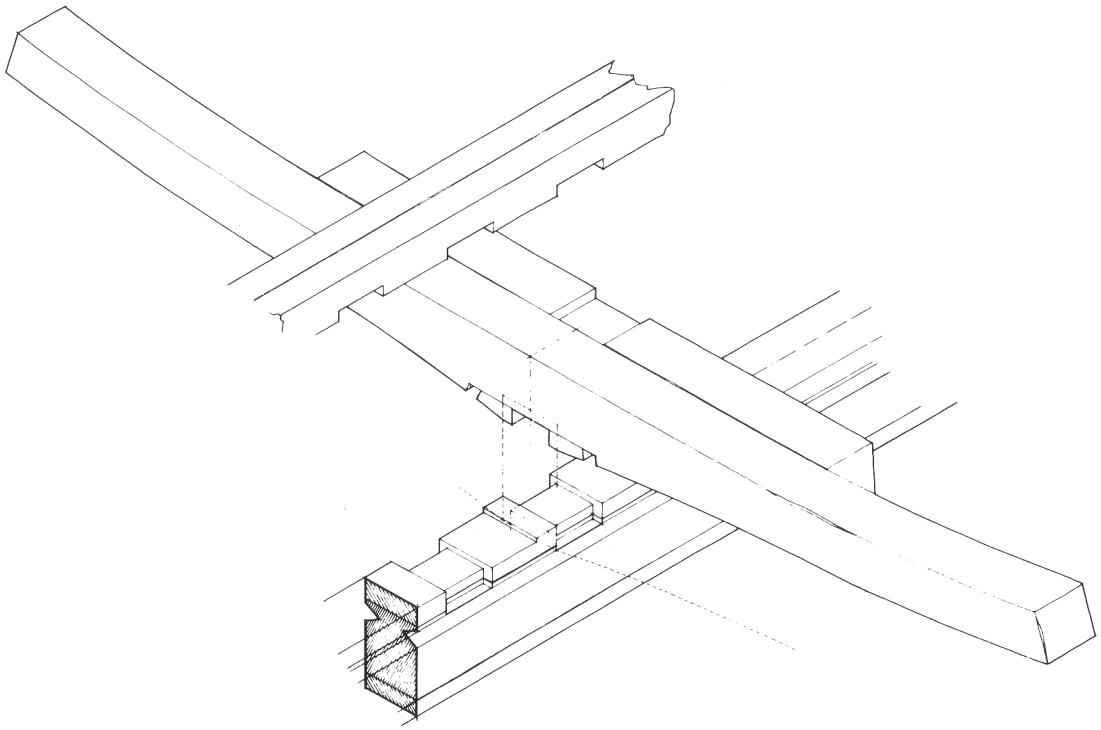
I did away with these bolts when building .... (deleted).

In France we are scrupulous in our care to assemble our riders like our frames, by which I mean that we butt the second futtock-rider to the head of the floor-rider and the third futtock-rider to the head of the first; the English shipwrights on the other hand are satisfied when they let the second futtock-rider overlap the first by 4 or 5 feet [*1.30 - 1.62 m*], and the third futtock-rider 4 or 5 feet below the head of the second, without any attempt to butt them one against the other. By this method they save much timber and yet their ships are as well fastened as our own, or at the least sufficiently well fastened, since their method succeeds well.

I have seen in the English ships the floor-riders scarphed to the first futtock-riders as it appears in **Fig. 37**, where **A** shows the floor-rider and **B** the first futtock-riders. The English shipwrights lay a second futtock-rider beside this latter timber which runs up as far as the deck, and which overlaps it by about five feet [*1.62 m*]. They employ this method or that which we ordinarily follow according to whether there is more timber to be saved by the one method or the other.

58. i.e. 13 riders made up of floors and first, second, third fourth and fifth futtocks, with three bolts at each scarph, or 24 bolts per rider. With thirteen riders for a 74, this gives 312 bolts in all.

32. *"Half-floors" in French ships. (74-G.S., vol. I)*



The English shipwrights never use half-floors[59] in the construction of the riders in their ships.

Breasthooks

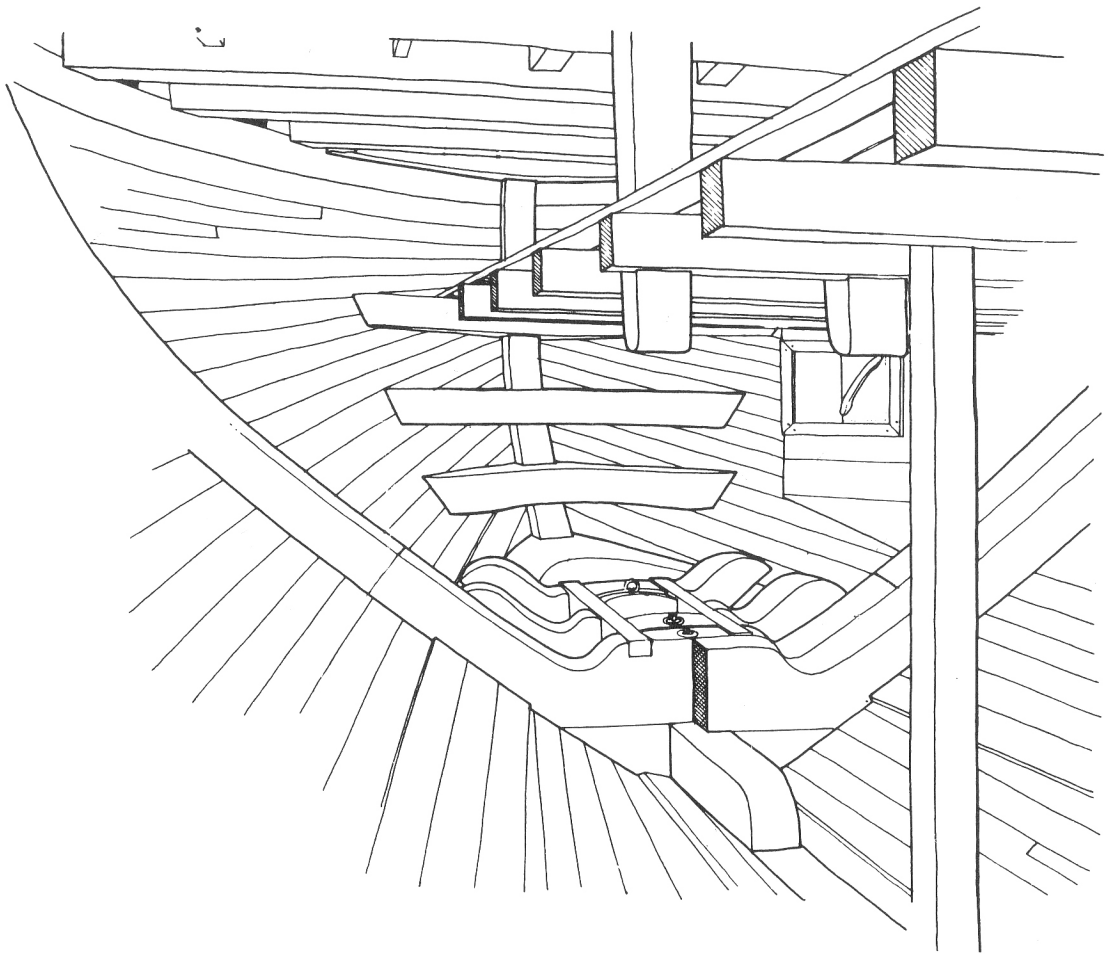
LXXII. There are in the English ships the same breasthooks as are to be found in our own ships, that is to say a deck-hook at each deck, a hawsehook beneath the hawseholes, and three, four or five breasthooks in the hold according to the size of the ship. I have hitherto only spoken of the deck-hook of the gundeck, Remark **XXII**, and I stated that in the English ships it is raised 2 or 3 inches [*5 - 8 cms*] above the planking of the deck, yet this practice is not followed in all the ships built in England. I have since seen that in most of their ships this deck-hook is faired level with the planking of the deck† as in our own ships, yet it is not covered by the planks of the deck save only for half of its thickness. For to the other half is fayed a waterway which butts at either end to the waterways of the deck, and thereby the English shipwrights avoid that seam which is so difficult to caulk and which we have in the deck of our ships between the planking of the deck and the ceiling over the hawse-pieces, just as they avoid it by means of a deck-hook which projects a few inches above the level of the deck. I find both the one and the other method preferable to our own. See Remark **XXII**.

†.... is faired level with the beams ....

Sleepers

LXXIII. There are four sleepers in the English ships as in our own ships, but while we place them obliquely, whereby the same sleeper fays to all or near all of the transoms, the English shipwrights place theirs horizontally like the lodging knees of the transoms, so that each of their sleepers is fayed only to one transom. I believe that there is near the same fastening with either practice, yet we have the advantage with our method of finding the compass timber for the sleepers more readily, since they form a more obtuse angle being laid obliquely than when they are laid horizontally.

59. *Half floor*: Fr. demi varangue. For a full explanation of this invented term, see *The Seventy-Four Gun Ship*, vol. I, p. 66 and the illustration on p. 81 of the same volume which is reproduced above.



33. *Foremast step in French ships. (74-G.S., vol. I)*

LXXIV. The English ships also have four lodging knees at the stern as do our ships; they are hooked into the wing-transom and the helm-port transom by one inch ½ [*4.0 cms*], and likewise into the planking of the ceiling, as I have shown them in **Fig. 38**, where **A** is the wing-transom, and **C** the ceiling. The first of these scores is used in France by some shipbuilders, but we do not use the second score at all. The one and the other form together an excellent fastening.

Lodging Knees of the Transoms

LXXV. The mast steps of the main and foremasts in the English ships present us with an object lesson in economy which deserves attention. We form both of these mast steps using a floor rider of the same or greater scantling than the ordinary floor riders, with two mast step carlings or side-pieces which are very broad and 5 or 6 feet [*1.62 - 1.95 m*] long, two filling timbers and two or four large wedges. All these timbers save only the filling timbers are fastened to the bottom of the hull with more than 20 iron bolts. The English shipwrights make these two mast steps for a lesser cost. If there is a floor rider beneath the main or foremast, they make this floor rider of greater scantling than the others and cut a mortice in it into which the tennant at the heel of the mast is fitted. If there be no floor rider to hand, they fay to the keelson athwartships a timber 6 or 7 feet [*1.95 - 2.27 m*] in length, in which there is a mortice to accept the heel of the mast. This timber is shown in **Fig. 39**; it is scored beneath to fit over the keelson, and is fastened with 4 or 6 iron bolts. Its breadth fore-and-aft is equal to the given diameter of the mast or greater by two or three inches [*5 - 8 cms*], and it rises 16 to 22 inches [*43 - 60 cms*] above the keelson, according to the size of the ship. Should timbers of sufficient scantling be lacking, which is commonly the case in the larger ships, they make the step of two timbers running athwartships which they bind together with two iron hoops, through which the iron bolts are driven which fasten the mast step to the bottom of the hull. This then is an extremely simple method and we should gain greatly by imitating it. I do not believe that it can be said that the heel of the mast is insufficiently solidly fastened, for since the English ships put to sea with their main and foremasts stepped in this fashion, it is probable that they would resort to the same precautions as we had they found any disadvantage in their method.

Mast Steps

The mast step of the mizen-mast is fashioned in the same way as in our ships.

Ceiling

LXXVI. I should add to what I have already said on the subject of the footwaling of the English ships that the quick-work between the middle and upper decks and that between the upper deck and the gunwale are of the same scantling as that which we employ in our own ships; that those strakes which are below the lower sills of the gunports[60] of the middle and upper decks and of the quarterdeck and forecastle are assembled with plain scarphs or hook and butt as I explained, Remark **XVI**, for the spirketting beneath the gundeck ports; and the quick-work filling the spaces between the gunports of the middle and upper decks is opened with air-strakes in divers places, as I explained in Remark **XVI** when speaking of the quick-work between the gunports of the gundeck. But to prevent the rainwater from entering by the air-strakes which are to be found at the waist between the quarterdeck and forecastle above the upper deck of both their two and three decked ships, the English shipwrights fit a weather board above these openings which is 4 inches [*10.8 cms*] wide and ⅔rds of an inch [*1.8 cms*] thick, resting on two chocks, like the plank marked with the letter **A** in **Fig. 40**, where **B** represents the frame timber of the ship, **C** the ceiling-planks, and **D** one of the chocks which support the weather board.

All the strakes of the footwaling in the English ships are fastened to the frames with treenails, not only in the hold, but also in the dead-works and the upper-works; we use only nails to fasten them in our ships, and our method is less good than the English one, for it is more costly, our ships are increased in weight thereby, and the fastenings are less tight.

The English shipwrights do as we do in employing fir for the quick-work between the ports of the middle and upper decks and of the quarterdeck, and all the other planks of the footwaling are of oak.

Deck-Clamps

LXXVII. In the English ships the clamps of the upper deck, of the forecastle and quarterdeck, and of the poop are set up as in our ships and put together as I have described, Remark **XVIII**, for the clamps of the lower and middle decks. They are fastened to the frames only with treenails. The run of the deck-clamps under the quarterdeck and forecastle is double; they stretch therefore from the bow to the stern insofar as the bulwarks at the waist permit, and the timbers from which they are made up are assembled with tabled scarphs or hook and butt fashion*.

I fitted a double row of clamps beneath the quarterdeck and forecastle of the .... (deleted), following the example of the English.

Orlop Beam Knees*

LXXVIII. I stated, Remark **XVII**, that the beams of the orlop in the English ships are joined to the sides with one knee at each end, and it is true that having seen but a single knee up until then I thought that they used no other, yet I have since seen in all the ships which are finished a second knee which is a lodging knee, as on the beams of the gundeck.

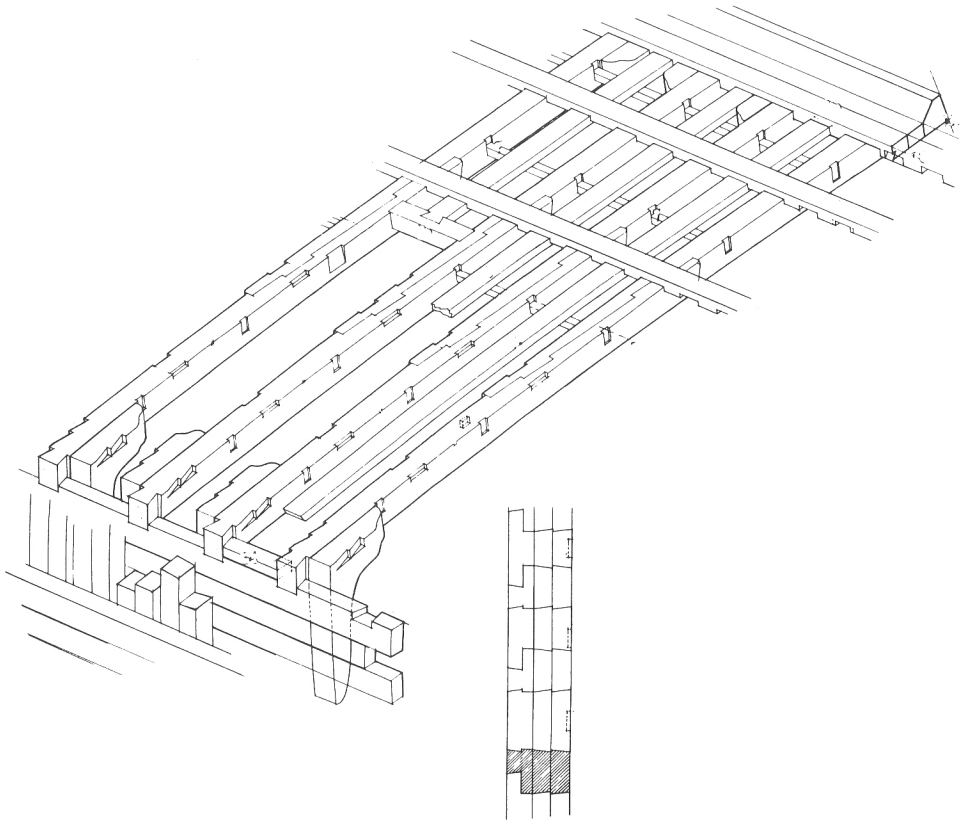
*This entire Remark is missing from the Brest manuscript. [Ed.]

Beams

LXXXIX. The great distance in the English ships which separates the two beams of the gundeck in the way of the mainmast, of which I spoke in Remark **XIX**, is to allow space for the chain-pumps which the English use, and which are placed between the mainmast and the beams forward and abaft this mast; but since the deck would be too much weakened by this great distance, they join to the beam forward of the mast which forms the after side of the main hatchway, and frequently also to the beam situated abaft the mast, one or two diagonal spurs upon which the deck planking finds the same support as from the beams. Thus for example in **Figure 41**, **A** represents a gundeck beam seen from above; they score the beam 2 inches [*5.4 cms*] at **B**, at two-fifths of its length; they take two timbers which are near the same shape as a pair of upper futtocks and place them one forward and one abaft this beam, as is shown by the timbers **C**; they are lapped into the score at one end and bolted to the beam, while at the other end they rest on the deck-clamp or on the lodging knee of the beam, and are fastened themselves to the ship's sides with a second lodging knee. These two spurs are about two inches [*5.4 cms*] less in scantling than the deck beams.

In place of a straight beam spurred in this manner, I have seen in some of their ships a curved beam like that shown in **Figure 42** and marked by the letter **A**, which rather than running across the ship diametrically, crosses instead obliquely. On one side of the ship there is a spur, placed

60. Called the *spirketting*



34. *Deck construction in French ships. (74-G.S., vol. I)*

on the forward side of the beam, like that shown by the letter **B**, and at the opposite side a second spur on the after side of the beam such as is shown by the letter **C**. These two spurs are scored into the beam and fastened with iron bolts; they also rest on the clamp and are each strengthened by a lodging knee and by a vertical hanging knee. In yet other ships I have seen in place of this beam two timbers which together take the form shown in **Fig. 43**, and which are assembled with a number of tablings in the same way as beams of two timbers are joined, and fastened with iron bolts. The four ends of this beam are each strengthened by two knees. That which I have said concerning the beams of the gundeck which are placed forward and abaft the mainmast is carried out for the corresponding beams, or else only for the forward beam, of the middle and upper decks.

The beams of the middle and upper decks and the small beams of the forecastle, quarterdeck and poop are set up in the English ships as in our own, yet there are fewer of them; the ends of the beams rest on the deck-clamps into which they are dovetailed one inch and a half [*4.0 cms*], and reinforced each with two knees like the beams of the gundeck. I have remarked that these two knees, in place of the single knee which we ordinarily employ, are necessary in the English ships because the English do not score down their waterways over the beams. See Remark **XXI**. The scantling of the beams of the decks and of the small beams of the forecastle and quarterdeck in the English ships seemed to me to be the same as in our own ships. I shall discuss in a separate Article the number and spacing of the beams.

Carlings

LXXX. The English shipwrights put in as we do two rows of carlings running fore-and-aft between the beams on either side of the vessel, but these carlings are at least two thirds greater both in breadth and depth than those which we ordinarily employ; and instead of being laid 2, 3, 4 or 5 inches [*5.4 - 13.6 cms*] below the level of the beams so as to support the ledges in the middle of their length as in our ships, they lie flush with the top of the beams and are scored to receive the ends of the ledges. They are scored down one inch [*2.7 cms*] into the beams as is our practice. I do not perceive the advantage which the English can obtain from the excessive size of their carlings. The effect of these timbers is to prevent the beams from pressing together and to maintain the bow and the stern of the ship always at the same distance one from the other as was fixed originally. However, these two ends of the vessel tend far rather to pull apart than to

be drawn together, and carlings which are still lighter and fewer in quantity than those which we employ would suffice, so that the English shipwrights overload their ships needlessly by using carlings which are heavier than those which we employ. The carlings are also used to support the ledges, yet this is no reason to build them 7 or 8 inches [*19 - 22 cms*] square, since in our ships the ledges find support enough on carlings of but 3 to 4 inches [*8 - 10 cms*].

Ledges

LXXXI. Instead of setting as we do one ledge between each pair of beams, the English shipwrights set two and more commonly three; they set four or five where we set but two or three, yet their ledges have but half the breadth of ours, and twice the depth, so that they are square while ours are rectangular in section. The English shipwrights score them down at one end into the lodging knees of the beams, and at the other end into the carlings of which I spoke in the preceding Article. They give them no support at their middle, and it is true that they are in need of no such support, for being scarce longer than those employed in our ships and yet being twice as thick, the support provided at the two ends suffices. I prefer our ledges to those of the English in that being made of fewer pieces there is less wastage in the timber and less labour employed, yet the English ledges are to be preferred to our own in that their greater thickness allows the planks of the decks to be fastened to these ledges with treenails, whereas we must use spikes. With regard to the support given, I judge it to be the same.

Binding-Strakes

LXXXII. I have been astonished to discover no binding-strakes in the decks of the English ships†. These timbers which in France seem so important to us and which we believe to be essential to resist the hogging of the ship, are considered by the English shipwrights to be needless. They suppose that the spikes fastening the deck-planks to the beams, and the treenails fastening these same planks to the ledges, provide a sufficient fastening together to which the scores of the binding-strakes add nothing, since the ends of these timbers are but fastened at the stern by the spikes which secure them to the deck-transom or to the last deck-beam, and at the bow to the deck-hook; it is thus of no consequence whether these timbers be scored down over the beams or merely laid like ordinary deck-planks, since the strength provided by the scores does not extend to the ends of the ship, to which it should necessarily extend if it were to produce the effect which we attribute to the binding-strakes. This reasoning is that of Mr Ward, Master Shipwright at Chatham. I asked him if he would not grant that binding-strakes which were scored down over the deck-hook and the deck-transom would resist the tendency of the vessel to hog (some shipwrights follow this practice in France). He agreed that such scores would provide a somewhat stronger binding together than that provided by the spikes, yet it should still be so very weak by comparison with what we imagine to be the case that it in no way merits being bought at the costly price which we must pay in timber and in days worked to obtain our binding-strakes. I leave it to those shipwrights who will read my Notes to judge whether we do better or less well than the English in covering our decks with eight rows of binding-strakes; yet I cannot deny that the English are right not to employ binding-strakes on the forecastle and quarterdeck; it is evident that they serve no purpose. For they cannot place the least obstacle in the way of the hogging of the vessel, since the forecastle and quarterdeck are not joined and run but for part of the ship's length. What then of the other purpose which they might serve, namely to prevent the beams from being pulled apart or drawn together one with the other? This is already prevented from occurring without the aid of the binding-strakes, since the beams are butted by the carlings and fastened at their ends into the dovetails of the deck-clamps and by the knees and the waterways.

†... I have found in the English ships but a single binding-strake on either side, which runs from bow to stern bordering the hatchways on the gundeck and the gratings on the middle and upper decks, and which is scored down but one and a half inches ....

Waterways

LXXXIII. I should add to what I have already said regarding the waterways, Remark **XXI**, that the waterways of the middle and upper decks, of the forecastle, quarterdeck and of the poop are laid in the English ships like those of the gundeck. See Remark **XXI**.

Planking of the hull

LXXXIV. The garboard strake and the strake next the garboards in the English ships finish in the rabbet of the sternpost like the other planks of the bottom, whereas in our ships they are let into the sternpost and the false post and run back as far as the after edge of the false post; we believe that we provide thereby a better fastening of the heel of the sternpost, whereas the English on the contrary claim that we weaken it thereby. I hold our method to be better than theirs, and it must be that they feel that the heel of the sternpost in their ships is not sufficiently well fastened to the body of the ship, since they strengthen it on either side with an iron dovetail plate two feet long [*65 cms*] and eight inches [*21.7 cms*] wide, the shape of which is shown in **Fig. 44**; it

is let into the timber, half in the keel and half in the sternpost. We do not require these plates in that we extend the garboard strake and the strake next the garboards to the after end of the false post.

I stated, Remark **XXIII**, that the English set to their planks against the frames using the same wrain-tackles as we do; I had then seen no others employed in the Dockyard at Deptford. I have since described, Remark **LX**, the other kind of wrain-bolts and staves which I saw at Woolwich Dockyard. In addition to these two methods, there is a third which is employed at Chatham, which consists of two iron cleats nailed to the frame into which the stave which serves as the wrain is inserted, without the aid of any cordage. I stated also, Remark **XXIII**, that I had seen no iron bolts at the butts of the bottom-planking in the English ships; I have since had the opportunity of observing in ships which are fully built that there are indeed no such bolts, and that the planking is fastened to the frames only with treenails; and not only the planking of the bottom, the waterline and dead-works, as I have already remarked, but also that of the upper works. There is in this method a very considerable saving in iron, their ships are fastened together more securely, are lighter, and their frames last better, since they are not as in our ships liable to be corrupted by the iron of more than 20 thousand nails. The English shipwrights know the error which we make in needlessly employing as much ironwork as we employ in the building of our ships.

Wales

LXXXV. In the English ships the wales other than the main wale of which I spoke in Remark **XXIV** are proportioned and arranged as in our own ships, save that they rise much more steeply at the stern. The English place two wales on either side between the lower and the middle deck, and two more between the middle and the upper deck as we do, but they fill in between these pairs of wales with timbers of the same thickness as the wales, whereas we use timbers of 2 inches or 2 inches and a half [*5.4 - 6.8 cms*] less scantling. They derive no great advantage either from the thickness of these filling timbers, or from the wales, since the aftermost gunports cut through them entirely. The wales in the English ships are fastened to the frames only with treenails.

Rails

LXXXVI. The waist rail, the sheer rail and all the drift rails other than the uppermost one are formed in the English ships only of mouldings which they fay to the planking of the upper works. The waist rail, which we situate in our ships of the First Rate above the gunports of the upper deck, and likewise in our ships of lesser Rates, is situated in the English ships at one third, one half or two thirds of the height of the gunports, so that it is interrupted by all the gunports from the bow to abaft the main chains, as it appears in **Fig. 45**[61], where **A** shows the rail, and **B** the gunports of the upper tier of guns. The sheer rail marked with the letter **C** runs in all the English ships level with the upper sills of the upper deck ports at the area about the midship-bend. This same rail is situated much higher in all our ships of 60 guns and above, and this because our ships are much higher in the bulwarks at the waist than are the English ships, in the interval between the quarterdeck and the forecastle.

The English shipwrights form a drift forward, and three drifts aft above the sheer rail in their ships of more than 50 guns, as we do. The fore drift is edged with a moulding as designated by the letter **D**, which serves as a drift rail, as do those in the after part of the vessel, each with a similar moulding, designated by the letter **E**; yet since these drifts do not give enough height to the bulwarks to rise above the upper sills of the gunports of the forecastle, quarterdeck and poop, because the sheer rail is but a small distance above the deck, the English shipwrights leave the toptimbers of some of the frames to project 12, 15 or 18 inches [*32 - 49 cms*] above the mouldings and fasten to the heads of these toptimbers a rail which is designated by the letter **F**. This rail is only 2 inches or two and a half inches [*5 - 8 cms*] in thickness; it is painted black in all their ships and the toptimbers are also painted the same colour, whereas the other rails are painted yellow; thus from but a very little distance from the ship it appears that the upper works finish at the rails **D** and **E**, or rather at the mouldings which take the place of these rails. I was myself deceived by the first ships which I saw. This method deserves to be imitated; it gives to their ships a form which is very agreeable to behold and makes the upper works lighter*.

I imitated this in the building of the .... (deleted).

61. See Plate 5, pp. 120-121.

Gunports

†.... three inches higher and 4 inches wider ....

LXXXVII. The gundeck ports of the English ships seemed to me to be the same size or an inch larger than in our own ships. Those of the middle and upper decks, and of the quarterdeck and forecastle (and especially these last), are at least three inches wider [*8.1 cms*] and 4 inches higher† [*10.8 cms*] than the gunports which we fashion on the same decks. I cannot see that this can be for any other reason than that they should be able to lay their guns with greater ease, yet since the size of our gunports must be recognised by practice as being sufficient, I must prefer our size to that of the English gunports since the smaller are the gunports the less the integrity of the hull is weakened.

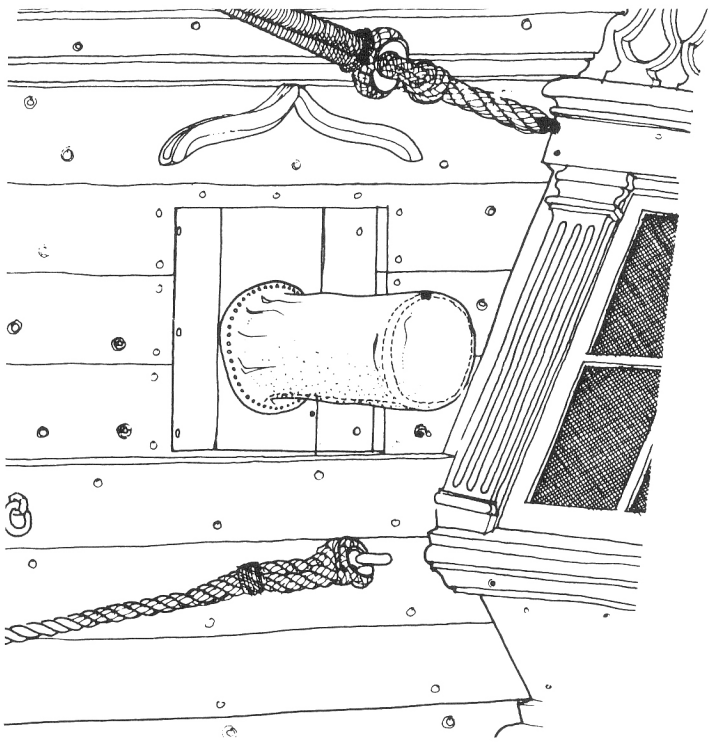
The lower sills of the gunports in the English ships also seemed to me to be higher than in our ships, especially on the upper gundecks. I measured them only on the upper deck of the **Royal Sovereign**, where the sills are 20 inches [*54 cms*] for 12-pdrs. Not many years ago we used to make them near this same height in our own ships, but we have since reduced this height to lower the weight of the ordnance, to bring it nearer to the centre of motion of our ships.

Our gunports are furnished with a ringbolt and a hookbolt on either side; the gunports of the English ships also have a similar ringbolt, but in place of a hookbolt they employ an eyebolt. The gundeck ports of their First Rates have two ringbolts on either side, as well as the eyebolt. I have not yet been able to discover the purpose of the second ringbolt; I was told only that it is of scant service. I presume that it serves to secure the gun in heavy weather[62]. Above† the gundeck ports of the English ships there is a hookbolt in place of the ringbolt which we place there. In some ships I saw an eyebolt.

†.... Below the gundeck ports ....

The lower and upper sills of the gunports of the middle and upper decks in the English ships, and those of the quarterdeck ports, are set up as I explained in Remark **XXV** on the subject of the sills of the gundeck ports. I shall speak in a separate Article[63] of the distance between ports in the ships of each Rate.

35. *French half-port as fitted to upper deck gunports (74-G.S., vol. II)*



Port-Lids

LXXXVIII. The gundeck ports of all the English ships, and also the middle deck ports of their three decked ships, have port-lids fitted as in our own ships. In the English ships however they are also fitted to other ports where we do not use them at all, as to the upper deck ports of three decked ships and other vessels alike, situated beneath the quarterdeck and the forecastle. The gunports of the quarterdeck situated beneath the poop also have the same port-lids. All these port-lids open from below upwards like those of our gundeck ports, save only the port-lids of the gunports beneath the forecastle, which are composed of two leaves, one opening forwards and the other aft.

62. Ollivier was forced to speculate as to the gun-tackles, breechings etc. because the ships were in Ordinary, and the guns had been sent on shore to the gun-wharf. As suggested by Ollivier, the extra ringbolt no doubt served to secure the gun, but it is also possible that it was used for training the gun: from 1779 onwards English ships were fitted with two eyebolts for the guntackles and a ringbolt for the breeching.
63. Remark CLIV, p. 150.

Hawse-Pieces

LXXXIX. I should add to what I have already said about the hawse-pieces, Remark **XIII**, that in the English ships the two hawse-pieces which are placed on either side closest to the stem[64] rise up about 5 feet [*1.62 m*] above the head of this timber; they brace the sides of the bowsprit, and receive in a mortice cut two and a half inches [*6.8 cms*] deep in either timber a locking-piece resting on top of the bowsprit, such as I have represented in **Fig. 46**, where **A** is this locking-piece, **B** the bowsprit, and **C** the hawse-pieces which support the bowsprit.

Hawseholes

XC. There are four hawseholes in the English ships as in our own, pierced at the same height and the same distance apart as we do, yet they are of smaller diameter, since the cables of the English ships are lighter than those which we employ. I have said, Remark **XIII**, that they cut into neither the planking of the ceiling nor that of the hull when they pierce the hawseholes in the English ships, since the hawse-pieces are armed within and without with an extra thickness of timber which lies flush with the butts of the planking of the ceiling and the hull. I should add that the English shipwrights fay to these navel-hoods on the outside of the vessel a bolster of 5 to 8 inches [*13.5 - 21.7 cms*] thickness, depending on the size of the ship, resting on its edge on the top of the cheeks of the head, and extended from the stem to a distance of two feet [*65 cms*] abaft the hawseholes. The width of this bolster exceeds by 5 or 6 inches [*13.5 - 16.3 cms*] above and below the diameter of the hawseholes, and they fashion it of two pieces when they are lacking timbers of sufficient width to make it in a single piece. It performs the same service as the filling-timbers which we place over the cheeks of the head, and compensates for the weakening of the planks of the hull and of the ceiling at the bow occasioned by the navel-hoods. Our method is simpler and we have less expense in timber.

Bitts

XCI. In the English ships the riding bitts are set up further aft than in our ships; we fay them to the second beam abaft the foremast, and the English shipwrights fay them to the third beam. The distance between the bitt-pins is the same or near the same as that which we observe; they also support a cross-piece, and are each braced by a standard as in our ships; but the standard is pierced in the English ships by a round hole as in **A**, **Fig. 47**. A double stopper is passed through this hole, and by this means they use less ringbolts on their standards than we do: in every part of their ships can be seen the care which the English take to reduce the quantity of ironwork[65].

The head of the bitt-pins has a hole through it here as in our own ships to receive a norman; the cross-piece is also pierced with a hole from top to bottom at either end to the same purpose, which we do not do at all. This cross-piece is armed with a bolster similar to those on the cross-pieces of our bitts.

Bitts abaft the Bitts

XCII. There are in our ships bitts abaft the riding bitts only in those of the First Rate, and also formerly on occasions in those of the Second Rate. In the English Navy every ship over 40 guns has double bitts; the after bitts are fayed to the second beam abaft the riding bitts, and are the same shape, the same size, and have the same cross-piece and the same standards as the riding bitts. It is probable that if the second pair of bitts, of which we know the usefulness since we fit them in our ships of the First Rate, had proved necessary in the smaller Rates then we should have fitted them like the English in all our ships; yet if the cables of our ships of 40 to 80 guns are sufficiently secured by but one pair of bitts; and if with recourse only to one pair of bitts we are able to avoid the accidents which the English seek to prevent by fitting two pairs of bitts, then it is certain that we do better in not fitting them than they do; we save timber, and the gundeck of our ships is less encumbered. Certain English officers, of whom I had enquired as to the advantage they obtained from two pairs of bitts, sought to demonstrate to me that we are wrong not to make use of them, and of all the reasons they gave, this is the least false and the one on which they most insisted. If, they say, a cable should part, and the ship must then ride to a second anchor put out on the same side as the parted cable is bitted, it is necessary in our French ships then to unbitt the parted cable before the other can be bitted, while in the English ships the new cable can be bitted to the second pair of bitts, unless as a precaution it be already

64. Ollivier is referring to the *knightheads* or *bollard-timbers*.
65. For a somewhat later English comment on the French use of iron fastenings, see ADM. 106/3308 (19th November 1748), where the Master Shipwright, writing of the captured French ship *Bellona*, states: "....all fastened with iron nails, etc. Consequently will soon be iron sick, and then very costly to repair."

bitted there at these same second bitts. This reasoning shows clearly that the second bitts have a certain usefulness, yet not that they are essential, for the time taken to unbitt a cable which has parted is so short that this consideration is scarce reason enough to encumber the ship with two pairs of bitts, only to avoid this loss of time which is but of a moment.

Catheads

XCIII. The catheads in the English ships are set up on the forecastle, and have two or three sheaves as in our own ships, yet they do not run in the same direction as we give to ours. We place our catheads along a line extending from the fore jeer capstern to the beakhead-frame as indicated by the line **AB** in **Fig. 48**; the English shipwrights on the contrary set them in such a manner that they form near a right angle with the side of the ship, like those indicated in plan by the letter **C**, and they steeve them upwards 5 or 6 inches [*13 - 16 cms*] at the head, as appears in **Fig. 49**, where **A** indicates the part of the cathead which projects outboard, seen in elevation. The part of the cathead which lies within board and which is indicated by the letter **D**[66] is extended over the forecastle across the ship and scarphed over by a straight timber designated by the letter **E** in **Figs. 48** and **49**. This timber[67] is fayed to the two catheads with scarphs 5 or 6 feet long [*1.62 - 1.95 m*], and runs diametrically athwartships; it is fastened to the catheads and to the first beam of the forecastle. Its scantling is the same as the catheads.

We do not employ such a cat-beam in our ships, and yet our catheads have all the strength required of them. Thus it may be said without fear of contradiction in favour of our method that the English shipwrights overload the head of their ships needlessly by seeking to provide for their catheads a strengthening which they do not require. The part of the cathead which projects outboard in the English ships is supported by a knee[68] as in our own ships, and is also strengthened by a lodging-knee fayed to its after face, like that marked **F** in **Fig. 48**. We are not obliged to employ this latter knee, in that we set our catheads along the line **AB**: a further advantage of our method over that employed by the English shipwrights.

The catheads in our ships have a round hole running through them from top to bottom, through which the ring-stopper is passed; in place of this hole there is a eyebolt in the English ships. I do not know whether this serves for the stopper, since in the English ships there is no score at the outboard end of the cathead as there is in our ships for the return of the stopper. This end of the cathead is surrounded by a moulding, and in most ships covered by carved-work[69]. The catfall of the English ships passes through a fixed-block set up on the plankshear of their ships above the cathead, and indicated by the letter **G** in **Fig. 48**.

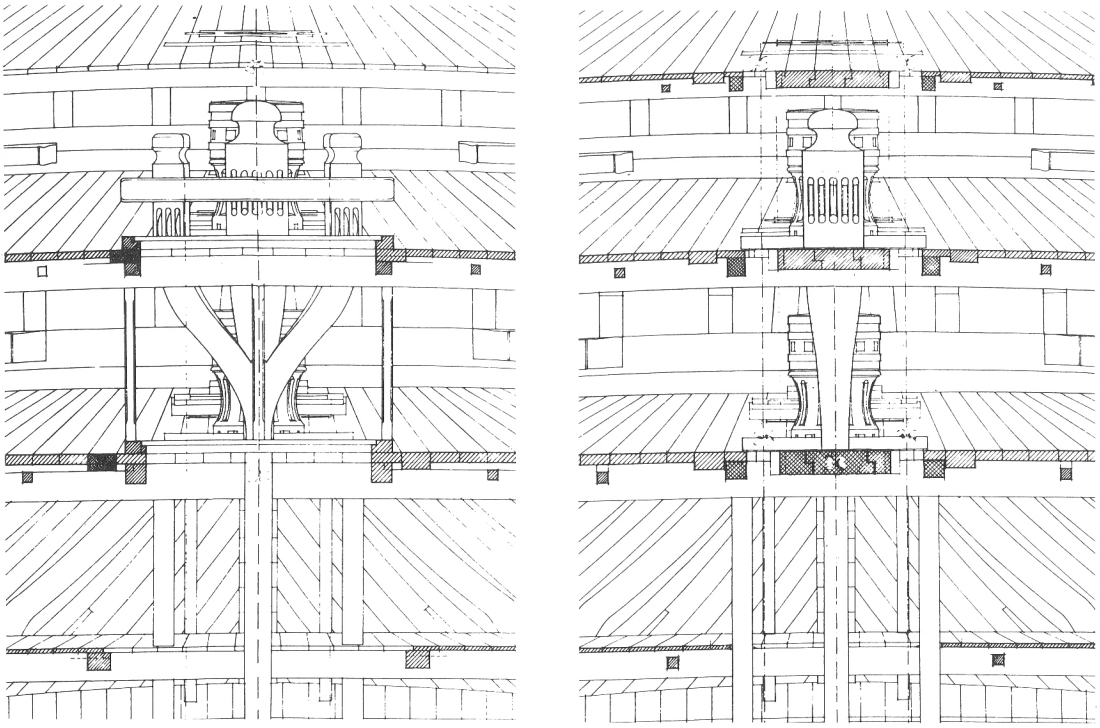
Topsail-Sheet Bitts

XCIV. There are topsail-sheet bitts in the English ships as there are in our own, one pair situated forward of the mainmast, and the other forward of the foremast, yet they do not have the same form as we give them. The English shipwrights build them of straight timbers which run down perpendicularly to the middle deck in three decked ships, and to the gundeck in other ships. The main topsail-sheet bitts rise to the level of the quarterdeck, and the English place over the heads of the pins a gallows which serves to support the spare topmasts, and the planks of a gangboard leading forward from the quarterdeck amidships. I have shown these topsail-sheet bitts in **Fig. 50**, where **A** marks the bitt-pins, **B** the cross-piece, **C** the gallows, the line **DD** the level of the upper deck and **EE** that of the middle deck or gundeck. The fore topsail-sheet bitts finish at some point about **F**, as in our own ships, or else rise to the level of the beams of the forecastle, for in most English ships these topsail-sheet bitts do not rise above the forecastle as they are seen to do in all our French ships.

The method of extending upwards the main topsail-sheet bitts to the level of the quarterdeck, and of covering them with a gallows when it is desired to place the spare topmasts there where the English keep them, by which I mean with one end resting on the forecastle and the other at some point further aft at the same level†, seems to me preferable to the method employed in some of our ships for supporting the spare topmasts placed in the English manner, on a special

†.... *and the other on the gallows of the topsail-sheet bitts* ....

66. The *cat-tail.*
67. The *cat-beam.*
68. The *cathead-supporter.*
69. Commonly of a lion's face, hence the name *cathead.*



36. *Topsail-sheet bitts and jeer-bitts in French ships. The forked pins of the former, and the single long spindle of the latter explain Ollivier's comments about the differences in construction. (74-G.S., vol. I)*

gallows. The support provided by the topsail-sheet bitts is more solid than that of our gallows, there is less timber employed, and less weight.

It can be seen from **Fig. 50** that the topsail-sheet bitts in the English ships are furnished with sheaves above the upper deck, and above the deck below; we do not employ these second sheaves; the shape of our topsail-sheet bitts prevents it; I was curious as to their utility, yet was unable to learn more than that they serve divers uses, of which they did not specify a single one. What I can however say is that I have seen no lines rove through them on any of the ships which are fitted out. Above these sheaves there is a cross-piece like that which is above the sheaves at the upper deck, or else only a small cleat of timber or iron passed through the bitt-pin, like that indicated by the letter **G**, and which serves as usefully as a cross-piece. The English use but this latter type in their ships of below 40 guns.

We experience difficulties in setting up the topsail-sheet bitts in our ships, which we should avoid were we to employ the very simple method which I have seen the English use. If we place the cross-piece of the main topsail-sheet bitts abaft the pins, the sheet chafes, and the angle which it forms as it goes round the cross-piece retards its running out; if we place it on the forward side, we lose thereby part of the width of the ladderways situated near the foot of the mainmast. One or other method is followed in our shipyards, with one or other of these disadvantages. The same is true of the cross-piece of the fore topsail-sheet bitts; if we place it on the after side the sheet chafes, and if we place it on the forward side it is scarce strong enough when we make fast to the topsail-sheet bitts a hawser or other cable for warping the vessel in harbour. The English shipwrights place the cross-piece of both bitts on the after side of the pins, and in order to prevent the sheet chafing and forming too acute an angle they pierce a hole in the cross-piece as shown by **C** in **Fig. 51**, where **A** is the cross-piece, and **B** the bitt-pins shown in section at some point above the cross-piece. The sheet runs down through this hole vertically to the sheave of the topsail-sheet bitts.

Jeer-Bitts

XCV. In the English ships the jeer-bitts[70] have a different form from those found in our own ships; they are made up like the topsail-sheet bitts of two pins and a cross-piece, and they are situated, the main jeer-bitts against the beam abaft the mainmast, and the fore jeer-bitts against the beam abaft the foremast. The pins are straight; in their ships of the First Rate they rise from the middle deck to four and a half feet [*1.46 m*] above the upper deck, and in their other ships from the gundeck to 4 feet [*1.30 m*] above the upper deck; they are furnished with two sheaves, one above each of the decks, and they have cross-pieces like those of the topsail-sheet bitts. In our ships there is an extremely massive timber fitted with several sheaves which serves as the main jeer-bitts, and a similar timber for the fore jeer-bitts. This difference arises from the way we hoist and hang the mainyard and the foreyard, which is not at all the same as the English use, as I shall explain in my Remarks on the rigging. I have noted the form of their jeer-bitts because it will be necessary to build them thus in our own ships, if the new method of hoisting the mainyard implemented recently by Honoré Mouton[71] in some of our ships at Brest is preferred to the usual method, as it deserves to be. In this case the jeer-bitts which we have employed up to now become needless, and it will be necessary to put in their place jeer-bitts made up of two pins and a cross-piece. We used to build them thus in some of our ships at Toulon, but only the fore jeer-bitts.

Cross-Pillars

XCVI. The cross-pillars in the hold of the English ships, if it be possible to give such a name to those timbers which take the place of cross-pillars in their ships, are composed but of two timbers which are both curved like a knee, with the hanging part having the same length as the whole depth of the hold, and the lodging part being 2 to 3 feet [*65 - 97 cms*] long. These two timbers are set up as they appear in **A, Fig. 85**[72]; their heel butts against one of the riders, where a small surrounding framework prevents it from shifting, and the knee part is bolted to the beam; in this place the two cross-pillars are butted one against the other, thereby providing support for the beam when the vessel heels, which the English shipwrights believe them to be in need of, just as for many years we in France believed our beams to be in need of cross-pillars. There are in the English ships three, four or five pairs of cross-pillars such as I have described, one beneath each of the beams flanking the main hatchway, one in the way of the chesstrees; one abaft the main capstern, and the other placed somewhere between the chesstrees and the main capstern, when they number as many as five. In earlier times the English shipwrights were wont to place cross-pillars under every second beam in their three decked ships, and I presume that they have begun to lose the confidence which they formerly placed in these timbers, since they have now so diminished their number.

Pillars, Samson's Posts

XCVII. I stated, in Remark **XIX**, that every one of the gundeck beams in the English ships is supported amidships by a pillar, and I forgot to make the exception of the first two beams at the bow and of the aftermost three or four beams, where their shipwrights place no pillars, the beams being of but little length so that the support of the clamps and of the knees suffices. It is needless to say that the beams supported by the cross-pillars have no vertical pillars, save those bordering the hatchways.

In the the hold there is a pillar beneath each of the orlop beams, save beneath the first at the bow. The pillars on the gundeck are set up as in our own ships, yet they are at least an inch [*2.7 cms*] greater, and the same is true of the pillars beneath the quarterdeck.

We are in the habit of placing shifting pillars in the way of the capstern-bars in our ships, and these pillars which are hung from an iron hinge are hooked up against the deckhead when it is

70. **Jeer-bitts**: used to belay the jeers (haliards) of the main- and fore-yards, they fell out of use over the next twenty years in English ships but continued to be used until about 1800 in some French ships.
71. I have not located the service dossier of Honoré Mouton, who was perhaps the Master Attendant. Ollivier describes in some detail in his *Traité de Construction* (article *vergue*, unfortunately omitted from the Oméga edition), a new method involving doing away with the jeers and jeer-falls, and substituting two temporary haliards (similar in function to girt-lines), and four pendants or strops which serve as slings once the yard is hoisted. This is no doubt the method to which he is referring above, since it did indeed make the jeer-bitts redundant, the yard being hoisted without the aid of the capstan.
72. See Plate 6, p. 122.

desired to use the capstern, and put back in their place as soon as the bars have been unshipped. The English do not employ this method at all, but rather they remove the pillars completely each time they wish to make use of the capstern, and in order to remove them and to put them back they raise the beam up with an endless screw such as I shall describe in my Remarks on their engines[73]. Next to each of the pillars to be removed is a piece of timber fastened to the beam, which is round in shape, up to 7 or 8 inches [*19 - 22 cms*] in diameter, and 2 inches [*5.4 cms*] thick, and against which the force of the screw-jack is applied. This small piece of timber prevents the head of the screw-jack, which is armed with three iron points, from injuring the beam. Our method is beyond compare superior to that employed by the English: we need but a moment to unship the shifting pillars and hook them up against the deckhead, or to put them back, whereas the English need a great deal of time for either the one or the other operation.

Partners of the Masts

XCVIII. The partners of the mainmast, the foremast and the mizen-mast are formed by carlings placed fore-and-aft between the two beams which are placed one afore and one abaft each mast, and by two further ledges running athwartships and assembled with the carlings so as to leave a passage for the mast in the middle where they are joined. These carlings and ledges are cut flush with the beams and covered by the planking of the deck. Our mast-partners are simpler and we use less timber. But in contrast the English shipwrights fasten the heel of the bowsprit with less expense than we do. In most of our ships there are vertical partners forward of the foremast, into which is morticed the tennant of the heel of the bowsprit. Forward of these partners is a filling-timber laid athwartships over the deck, and joined to the partners, which serves to support the heel of the bowsprit. Two or three feet [*65 - 97 cms*] forward of this filling-timber are two stantions between which the bowsprit passes, and planks are fastened to these stantions to lock the bowsprit in place. In place of the partners some of our ships have an iron collar, yet the stantions, the filling-timber and the locking-planks are used as well.

In not one of the English ships, whether three decked ships or the smallest of their frigates, have I seen any other timber for supporting and securing the heel of the bowsprit than the bowsprit partners, which resemble those which we use in our own ships. As in our own ships, there is a mortice cut in these partners 18, 20 or 24 inches [*49 - 65 cms*] above the deck to receive the heel of the bowsprit, yet there are to be found neither a filling-timber, nor stantions, nor locking planks. In some ships the tennant at the heel fills this mortice; in others it lacks one or two inches [*2.7 - 5.4 cms*] and in such a case the space is filled with small wedges. It is certain that with our method the heel of the bowsprit is better fastened, yet it is no less certain that the method employed by the English shipwrights is to be preferred to our own, since it saves several timbers and much labour, and makes the fore part of the ship lighter, and since they find thereby all the strength required: for the English ships put to sea each day with the bowsprit set up in this manner, and it is probable that if they found it necessary to give their bowsprits the extraordinary support which we give them, then the English shipwrights would use something more than just the partners alone.

The bowsprit in the English ships is secured by partners at the beakhead bulkhead as in our own ships; there are a third set of partners at the stem, formed by the bollard-timbers and by the locking-timber let into them, as I stated in Remark **LXXXIX**. This is not to be found at all in our ships, or else only half done in some of them, yet it serves no purpose since the bowsprit is never known to sheer save forward of the gammoning.

Head

XCIX. I should add to what I have already said of the head in Remark **XXVII**. The projection of the head in the English ships is equal to or greater than its projection in most of our ships; it is fastened to the ship with four cheeks which are less heavy than those which we employ. In their three decked ships these cheeks are placed below the hawseholes as they are in all their ships, whereas in the former ships we place one cheek below the hawseholes and the other above. There are no filling timbers between the cheeks in the English ships, yet they employ a bolster above the cheeks, which is that of which I spoke in Remark **XC**. The gammoning knee does not here as in our own ships run up to the head of the stem; it extends only as far as the length of the curve of the knee allows. The head of the gammoning knee has no score cut in it

73. Remark CXIII, p. 107.

for the collar of the mainstay, but rather in place of a score it has a mortice cut in the edge which is fayed to the stem, as in **A**, **Fig. 52**, and the mainstay collar passes through the hole thus formed. Nor is there on the gammoning knee of the English ships that triangular ringbolt which we needlessly place there, for today it no longer serves any purpose.

The head of the English ships has two or three rails on either side, like the head of our own ships; these rails are likewise supported by small hanging knees, and by head-beams running from one side to the other. Between these beams are gratings, laid as in our own ships, and these gratings are pierced by either two or four† soil-pipes for the seats of ease of the crew. I shall not describe the decoration of the head, since I shall speak of it in the Article on the carved-work[74].

†.... pierced by either two or three soil-pipes ....

The mortices which we cut in the facepiece to permit the passage of the gammoning are in the English ships cut one in the trailboard chocks and the other between the gammoning knee and the knee of the head. I have indicated these by the letter **B** in **Fig. 52**. From this practice the English have the advantage of using one third less cordage than we do for the gammoning.

The gripe is armed with a tennant which fits into a mortice cut in the forward end of the keel. Positioned about 20 or 24 inches [*54 - 65 cms*] from the heel of the gripe is an iron dovetail-plate on either side, which fastens the gripe to the stem. **Fig. 44** shows this dovetail-plate.

I have seen but few English ships where the cheeks of the head are fitted with wash-cants.

Counter

C. When I stated, in Remark **XXVI**, that the English shipwrights set up their taffarel timbers as we do, and that they fashion them in such a manner that they round forward at the level of the stern galleries, in order to make them more commodious, I had at that time seen only the ships which were building at Deptford Dockyard, where they employ this method. Since then I have observed that the English shipwrights follow two other methods in addition, in the way they set up their taffarel supports. According to one of these methods the timbers finish at the level of the upper deck on three decked ships and of the quarterdeck on other ships, like the timber designated by the letter **A** in **Fig. 53**, where **B** shows the counter timber, **CD** the level of the middle deck, **EF** that of the upper deck, **GH** the level of the quarterdeck, and **IK** that of the poop.

With the upper deck or the quarterdeck running aft as far as **E**, the English shipwrights raise up at **F**, which is 4, 5, or 6 feet [*1.30 - 1.95 m*] distant from **E**, a timber marked **L**, and placing four, five or six timbers along this same line they fashion the sternlights between these timbers; thus the space **EF** becomes the deck of the upper deck stern gallery, that marked **GH** is the deck of the quarterdeck stern gallery, and they erect from **E** to **M** and from **G** to **M** the balustrades of these galleries. Taffarel standards placed on the poop like that designated by the letter **N**, the vertical arm of which is aligned with the stern timber **A**, provide the timbering of the taffarel. In the event that they should fashion a stern gallery at the level of the poop, which is rare†, the taffarel standards **N** are placed on the poop-royal. Within the cove thus established, the stern galleries are broader, more commodious, and stronger than in our own ships; the cove weighs less upon the vessel, since the stern galleries project much less from the main structure. The stern appears more beautiful, since it is not masked by awnings over the galleries. It is true that one loses thereby from the cabins of the upper deck all that space which is marked **EF**, and from those of the quarterdeck that which is marked **GH**, yet this loss is made up for in the English ships by the positioning of the bulkheads of their cabins, which are carried further forward than in our own ships, as I shall explain when I come to describe the cabins. I should add that the side counter timbers, those which serve as timbers for the sides of the vessel, run up unbroken as far as the plankshеer along the line indicated by the stern timber **A**, extended upwards, so that the two ends of the stern gallery are formed by the sides of the ship itself. They open a doorway in the side of the ship like that indicated by the letter **O**, to provide access to the quarter gallery. I have stated that the distance **EF**, and in consequence **GH** also, is 4, 5 or 6 feet. I suppose that the reader will have understood that this distance is six feet in three deck ships, and 4 or 5 feet in lesser ships.

*†.... I have only seen a stern gallery at the level of the poop in a single ship, the **Victory**, which is building at Portsmouth ....*

74. Remark CLXXXVII, p.172.

The second method which the English shipwrights employ in setting up their stern timbers differs from the first, in that the timber **A** finishes at its head 3 feet [*97.5 cms*] above the middle deck, and the timber **L** runs down as far as this same deck, in which case they form a stern gallery at the level of the middle deck in the space between the timbers **A** and **L**, like those on the upper deck and quarterdeck. I have seen this stern gallery in but a small number of ships, especially in their old ships, which leads me to suppose that this is an ancient practice to which they scarce any longer adhere today. In all their new ships, the stern timbers are set up according to the manner represented in **Fig. 53**, or else as I have described in Remark **XXVI**. I prefer either method to that which we follow, especially the first, since it does away with the projection of the stern galleries.

Channels

CI. The channels in most of the English ships are placed as we used to place them formerly in the King's ships, and as they are still placed today in the ships built at Toulon. By this I mean that the main and fore channels on three decked ships are fayed to the wale which lies beneath the upper deck gunports, and those of ships of lesser Rate likewise. In some recently built English ships other than those of three decks the channels are situated above the upper deck gunports. We place our channels horizontal to the vertical axis of the ship, whilst the English on the contrary place them at a right angle or near so to the ship's sides; they strengthen them as we do with knees of iron or timber, and in their smaller vessels with a curved bracket, one end of which butts against the channel, and the other against the ship's side.

In certain of their three decked ships the edges of the main and fore channels are supported by three or four timbers running down vertically to the lower wale.

Rudder

CII. In English ships the rudder is at its head the same size or near the same as in our own ships, yet at its heel it is a third or a half wider. The English shipwrights fashion them as we do with a mainpiece of oak and an afterpiece of fir. The rudder irons in the English ships are the same as in our own, save that they give but 7 or 8 inches' length [*19 -22 cms*] to the pintles of their largest ships. I believe that this practice which we follow in giving them near twice that length is to be preferred to that of the English.

They set up as we do the tiller and the sweep, yet the tiller has no gooseneck, and there is no rowle on the middle deck since the English never steer their ships with a whipstaff[75].

The chock of the tiller in their three deck ships is furnished with a roller at the point where it rides on the sweep, as I have shown by **A** in **Fig. 54**, which represents the small end of the tiller riding on the sweep, which is cut through at some point along its length. This roller is of iron or of lignum vitae, and eases the movement of the tiller. On either side of the end of the tiller is an eyebolt, to which is made fast the tiller-ropes leading from the wheel. The wheel is situated as in our ships on the quarterdeck, but whereas we support it between two pillars, each composed of several timbers, the English let the two ends of the spindle of the wheel turn in two of the pillars beneath the poop, placed one afore and the other abaft the wheel. I find this method much simpler than our own. I have seen no axiometers[76] on any English ship, which leads me to presume that this instrument which we have found to be so useful in recent years in order to know the movement of the tiller is as yet unknown to the English.

75. This would imply that even in 1737 some French ships were still using a whipstaff. See the entry under "To steer with a whipstaff" in the Glossary of Shipbuilding Terms on page 366 of the present volume. It would appear that the wheel, which was introduced into the English Navy around 1700, made its first appearance on French ships some years later, albeit somewhat hesitantly, since the whipstaff was used in parallel until the 1740's on French ships, even though it had disappeared completely from English warships before 1720. For a further discussion of this interesting subject, see the report on the *5èmes Journées d'Archéologie Navale* (D.H. Roberts, J. Boudriot), in *Mariner's Mirror*, Vol. 75 No. 3, pp. 272-3.

76. **Axiometer**: See the entry under "Tell-tale of the tiller" on page 368, from which we learn that they were first fitted to the French ship *l'Achille* in 1727, and it is not unlikely that they were in fact invented by Ollivier himself. They were not introduced in English ships until January 1748, when they were copied from the captured *Invincible* (74) which had been taken during the First Battle of Finisterre in May 1747. They appear however never to have been generally adopted in the Royal Navy.

Fenders

CIII. There are but three fenders on either side of the deadworks on the English ships, of which two are placed 2 feet or 2 feet 3 inches [*65 - 73 cms*] apart opposite the main hatchway, and the third is abaft the chesstrees. This last one is six inches [*16 cms*] thick, and is hollowed in its outer face like a skeet, in such a manner that it carries off the water from a scupper situated on the upper or middle deck in the way of this fender. The other two fenders are but 3 inches [*8.1 cms*] thick. The fenders which we fit to our ships to serve as stringers for the entering ladders are not to be found in the English ships at all, and it is true that they are of little use. The face of the fenders which touches the deadworks is cut away with a series of scores 3 inches [*8 cms*] long and one inch [*2.7 cms*] deep in the way of the seams of the planking of the upper works, as I have shown with the letter **A** in **Fig. 61**, which represents a fender.

Scuppers

CIV. The English ships have only round scuppers, and they are also very small. The square scuppers cut at the level of the middle deck in most of our ships opposite the mainmast would be of scant purpose here, since their pumps discharge on the gundeck, as I shall explain when I come to talk of the pumps. I have seen in most of the English ships two scuppers on either side of the manger, one 8 or 10 inches [*22 - 27 cms*] above the other.

Head

CV. The head in the English ships is fashioned in the same manner as in our ships; there is a bulkhead situated 5, 6 or 7 feet [*1.62 - 2.28 m*] abaft the stem, and a platform formed by the upper deck in three deck ships, or raised in two-deck ships the full height of the lower port-sills above the upper deck, as in our French ships.

They have no ladderway here on the bulkhead to climb down into the head, since the angle formed by the bulkhead and the ship's side is taken up on English ships by two enclosed roundhouses[77].

The English open up two doorways as we do in the beakhead bulkhead which serve as bow-chase ports. They give less flare to the toptimbers of the beakhead frame than we do in our ships. These toptimbers rise vertically for the last two feet [*65 cms*] of their height, as in the toptimber shown in **Fig. 55**, and as may yet be seen in some of our own ships, but the practice which all our shipbuilders follow today in this regard is to be preferred to that of the English, since they find thereby a projection which is favourable to boarding an enemy.

The collar-beam which is set up in the English ships which have their beakhead platform raised above the level of the deck is of the same scantling and is strengthened by two knees in the same manner as in our own ships.

Capsterns

CVI. The English fit as we do three capsterns in their three deck ships, and two in their ships of a lesser Rate, yet they do not fit them in the same places as we do, nor give them the same shape.

Three or four beams abaft the mainmast, which is to say some few feet forward of the position occupied by the main capstern in our ships, the English shipwrights fit a capstern with a spindle which runs down to the orlop, the drum of which is situated on the gundeck. This capstern takes the form of that represented by **Fig. 56**, similar to that of most of the capsterns on the careening-pontoons at Brest. Its diameter is one and a third or one and a half times that of our main capsterns; in their great ships it takes up to twelve bars at the same height[78]; the tennant at the heel rotates in a step resting on the orlop, and there are a number of holes cut in the drumhead to receive the ends of the pawls, as is shown in the plan of the drumhead of this capstern shown in **Fig. 57**.

Situated two or three beams forward of the main hatchway in all the English ships is a second capstern; this is a double capstern; it is set up on the gundeck, and has but one tier of capstern bars, in the drumhead on the middle deck. Its form is shown in **Fig. 58**. It is of the same diameter or near the same as the main capstern in our ships, and it is constructed in such a manner that

77. Used as latrines by the petty officers.
78. In French ships there were a maximum of 10 bars in First Rates, 8-10 in Second Rates.

the drumhead of the upper drum can be removed. To this end the head of the spindle has a tennant which fits into a mortice in the drumhead, and this drumhead is fastened to the spindle by four iron bolts with forelocks like those indicated by the letter **B**. This capstern is struck down in some of their ships (save in their three deck ships†) each time that the longboat is stowed; in other ships only the drumhead is removed, in which case the longboat is turned up, keel uppermost, so that the head of the upper deck spindle of the capstern fits inside the boat. In three deck ships† this capstern is never struck down, since it is no obstruction.

†.... save in their ships of the First Rate ....

†.... In ships of the First Rate ....

The lower drum of the second capstern is never fitted with bars; it is used only to turn the voyal when the anchor is raised, and it has a number of holes cut in the trundlehead to receive the hanging-pawl which serves to block it, as I shall explain when I discuss the pawl. The second capstern in our three deck ships is situated in the same place as this capstern, yet it has but one drum.

The third capstern in the English three deck ships is situated two or three beams' distance forward of the second; it is set up on the middle deck, and has two drums, of which only one is fitted with bars. This is the drum on the upper deck. It is fashioned in the same manner as the second capstern.

The position and the shape of the capsterns in the English ships secure advantages which we lack in our own ships. The main capstern having but a single drum, the middle deck is less encumbered, and a capstern of this kind would be especially useful in our ships, other than those of the First Rate, since the bulkhead of the wardroom might then be carried further forward, the table set up forward of the wardroom under the quarterdeck, and the room taken up today by this table might then be employed to make cabins for the officers. I know well the objections which may be made against a single drum capstern; it will be said perhaps that it will not be strong enough to raise the anchor, since it will have fewer bars than a double capstern, yet the number of bars although less may still be equivalent to the usual number of bars of which half are turned on one deck and half on the other, whereas here all the bars are at the same level. Moreover the English have also an anchor to raise as we do, their crews are no stronger than ours, a single drum capstern suffices for them, wherefore then should not this same capstern suffice in our own ships?

The large single-barrelled capstern has yet a further advantage; it is lighter, or if on account of its size it weighs near the same as our double capstern, its weight is carried much lower down.

The second capstern in English ships save in their three deck ships, and the third capstern in their three deck ships, which correspond both to our fore jeer capstern, seem to me to be more conveniently situated in the English ships than on the forecastle of our ships, in that they are less high up, and that they can on divers occasions be of greater utility than our fore jeer capstern. The English use it frequently to raise the anchor, more commonly than the main capstern, and in this event the voyal is run to the mainmast, where it reeves through a large voyal-block made fast to the mast.

The capstern-pawls in the English ships are fashioned otherwise and set up differently than in our own ships. We make them of timber and place them on the deck; the English make them of iron and hang them from the deckhead. There is but one at each capstern; it is fastened to a beam at one end with a hinge, and a triangular notch is cut in this same end which butts against the angle of the beam; the other end drops into pawl-holes lined with iron and cut into the top of the drumhead. I have shown this hanging-pawl as **A** in **Fig. 58**. I have supposed in this Figure that the middle deck beam has been cut through next to the pawl, and I have shown with a pricked line the part of the pawl which drops into the pawl-holes in the capstern. I should not omit to mention that the part of the pawl-hole against which the pawl presses is lined with an iron plate.

CVII. The English ships are fitted with gratings as are our own, on the middle deck, on the upper deck, and on the quarterdeck, but they are made up of ledges and cross-battens which are an inch [*2.7 cms*] wider than those which we ordinarily employ, and which form holes four inches [*10.8 cms*] square, over which it is less comfortable to walk than over our gratings, where these holes are but 2 inches or 2½ inches [*5.4 - 6.8 cms*]. I enquired as to why they do not make

Gratings

them smaller since it would be more comfortable, and I was told that they would then provide less ventilation to the gundeck. This answer is ill-founded, since were they smaller there would be more of them.

The deck planks which flank the gratings in the English ships are one and a half or two inches [*4.1 - 5.4 cms*] thicker than the other deck planks, like the binding-strakes which we use in place of these planks.

The filling-pieces placed over the beams in our ships between the gratings are cut away underneath in some of the English ships, in such a manner that they touch the beam only at the ends and for a short distance in the middle. These filling-pieces are designated by the letter **A** in **Fig. 59**, where **B** represents a part of the beam. In others of their ships the filling-pieces are but the same thickness as one of the cross-battens of the gratings, and it rests in the middle on a small chock, as I have shown in **Fig. 60***. Both the first and the second method seem good to me, and to be preferred to that which we employ[79], since the filling-pieces are lighter, and the beam is better preserved.

****I copied this method in the building of the .... (deleted).***

Timber

CVIII. There is a large quantity of oak at Chatham Dockyard, piled one timber on another as in the other Dockyards, save for the plank which is stacked with great care. Most of this is East country plank, or from New England. I saw in some ships that the timbers were marked with signs to indicate their country of origin.

I saw at Chatham a large pond which is about 300 feet [*97.5 m*] square, in which are immersed several timbers which have already been worked for frames. I was told that they formerly immersed in this pond all the compass timbers intended for building a ship, after first moulding them, and that they left them there five or six months. This time was then reduced to three months, and today they immerse them but one or two weeks, and often they do not immerse them at all.

Masts

CIX. At Chatham Dockyard they work their masts in mast-houses. I watched them make there a mainmast of 106 feet 11 inches French measure* [*34.75 m*] for the **Royal Sovereign**, made up of 20 sticks, and of a construction very different from that which we practise. The spindle of this mast is made of two trees joined by a scarph 30 feet [*9.75 m*] long; between them they make up the length of the mast as far as the crosstrees, and they are joined with plain coaks. The diameter of the spindle is equal to two thirds of the given diameter of the mast, or else only three fifths of this diameter; it is shaped on the outside to the form of an eight-square, as it appears in **Fig. 62**[80], where **A** represents the spindle. To each of these eight faces a side-tree is fayed, like those marked with the letter **B**. These eight side-trees run from about two feet [*65 cms*] above† the partners to 9 or 10 feet [*2.93 - 3.25 m*] below the crosstrees, and they are each extended at their lower end by a short length of side-tree, joined by a scarph one foot [*32.5 cms*] long, as in **A**, **Fig. 63**. The upper end of the mast once it has been made up with side-trees in this manner is faired away at the sides and finished with two fishes of oak which form the masthead, as I have already explained in Remark **LV**.

114 English feet

†.... two feet below the partners ....

In all of this mast not a single coak is used to assemble the eight side-trees to the spindle, but the side-trees are fastened to the spindle with nails and iron bolts, which pass right through the mast, and which are clenched over roves. This fastening is moreover reinforced by several wooldings placed every 5 feet [*1.63 m*]. It is hooped only at the masthead, and at the heel. The wooldings which bind the side-trees to the spindle serve also to secure the rubbing-paunch to the body of the mast. The bibbs of the masts of the English ships are half as wide as in our own ships, since the oak fishes which form the masthead are sufficiently large in the way of the bibbs to take the place of that part of the bibbs which we fay to the sides of the mast. The other part which is the only one which the English employ, and which is formed as in **Fig. 64**, is fayed end-on to the forward side of the mast and bolted into the rubbing-paunch at the masthead.

79. For an explanation of the French method, see the Glossary on page 359 of the present volume.
80. See Plate 6, p. 122.

I stated, in Remark **LV**, that the bowsprit in the English ships has a gammoning-fish such as we employ in our own ships. I had seen these gammoning-fishes on two bowsprits which are at Woolwich Dockyard, but I have since found none on any of the bowsprits in the mast-houses at Chatham, nor on the bowsprits of any of the ships moored before the Dockyard. I can think of no reason why the English do not employ this timber which to us appears essential to strengthen the bowsprit, and to save it from being hurt by the nails of the gammoning-cleats which are fastened to this spar.

In some English ships the bowsprit is fitted with a standard similar to that which we have in all our ships, and at the head of this standard there is a sheave through which reeves the fore-topgallant stay when the jibboom is not in place.

In our ships the bolts which fasten the standard to the bowsprit are fitted with a sprig or with rings. In the English ships two of these bolts have a ring underneath the bowsprit, and the third has a double ring. The ships which are fitted with this standard have a jibboom iron, as do our own. The other ships have a cap in place of the standard, as I explained in Remark **XXXI**, which is shaped in the manner represented by **Fig. 68** or else that in **Fig. 69**. In both drawings, **A** designates the mortice to take the head of the bowsprit, **B** the hole through which the jibboom passes, and **C** a score into which fits the jackstaff. The cap represented by **Fig. 69** has a second cap similar to that on the sprit-topmast standard which serves to support the jackstaff, and the other cap has at the top of the score a hinged iron collar which serves the same purpose. One or other type of cap is to be found in most English ships, save in their three deck ships, more commonly than a sprit-topmast standard.

In my Remark **XXXI** I did not dwell long on the mast-caps of the English ships since their shape is already well-known to us, and yet I have since formed the opinion that they should perhaps find their place here, since we consider the English type of mast-cap to be inferior, and yet they may on the contrary be preferred to our own.

Fig. 65 represents a mainmast or foremast cap, seen in profile, **Fig. 66** the same cap seen from below, and finally **Fig. 67** shows this cap from the after side. The letter **A** designates the four-square or the mortice into which the head of the lower mast fits; the letter **B** is the partner or circular hole for the topmast; **C** shows two eyebolts placed one on either side of the mortice, and **D** two further eyebolts placed on either side of the round hole. These bolts are made like our eyebolts, and to them are fastened the standing parts of the top-rope, which is not rigged in English ships as it is in ours, as I shall explain when I come to talk of the rigging. The other two eyebolts take the form shown by **C** in **Fig. 67**, and the top-blocks are made fast to them. I believe, unless my memory is at fault, that it was because these two eyebolts were not made in this manner on two† English-style mast-caps which were made at Brest some years ago, that they were unable to be used, since the top-blocks were too close to the mast.

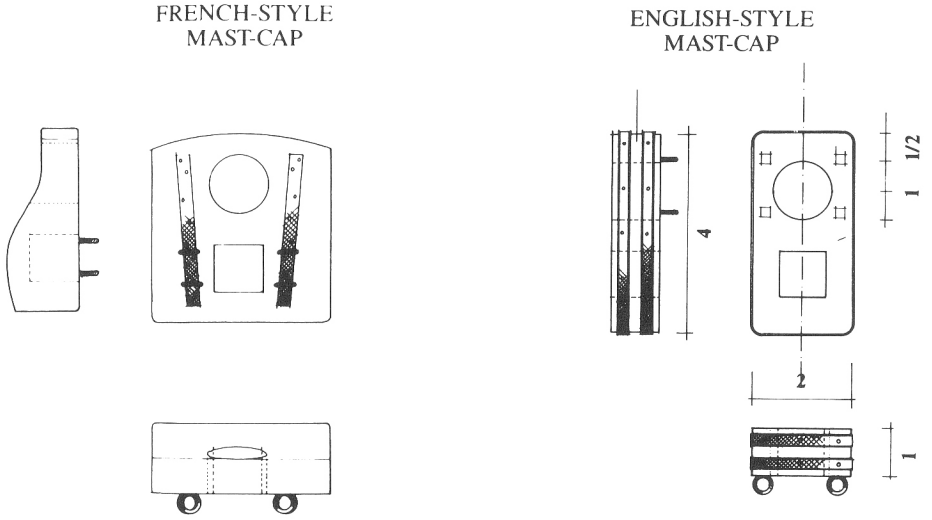
†.... one English-style mast-cap ....

The mast-caps of the English ships have the following advantages over our own. They are lighter because less timber goes into them and because they have no iron strap. Thus the masthead is much less weighed down: this difference may well be of 3 to 400 pounds[81] [*147 - 196 kgs*]. They save themselves the four† iron straps which we fasten to our mast-caps, and the copper which is used to line the scores which are cut in them. There is in the making of an English mast-cap but half the labour necessary to make one of our mast-caps. But of all these advantages the most important is in the saving of weight at the masthead.

†.... the six iron straps ....

The topmasts in the English ships are different from our own in that we cut the mortices for the top-rope sheaves below the mortice for the fid and parallel one to the other, so that both sheaves rotate on the same pin, while the English on the contrary cut one of these mortices above the fid as is shown by **A** in **Fig. 70**, and the other below the fid as in **B**; the two mortices cross the four-square of the topmast diagonally in opposite directions. Thus, for example, a topmast cut through at the upper mortice; at this point the mortice appears as in **A**, **Fig. 71**, and the mortice which is below crosses the former as indicated by the pricked line **B**. As may be seen

81. 1 French pound equals 489 grammes.



37. *So-called "French-style" and "English-style" mast-caps as used in French ships. (74-G.S., vol. III)*

in **Fig. 70**, which represents the heeling of an English topmast, the filling-pieces which form the four-square do not continue down to the heeling of the topmast as they do in our own. In two of the corners made by these filling-pieces the English shipwrights cut a score like that designated by the letter **C** in **Fig. 71**, down which the top-rope runs. I shall explain elsewhere how this top-rope is set up.

The topgallant-masts are made like those in our own ships, and on all three deck ships they have crosstrees and a cap so as to allow a command-pendant staff to be set up.

The yards on the English ships have squares at the arm which are but made up from blocks of timber fayed to the spar, whereas we fashion ours from the spar itself. The yards are worked to an eight-square at the slings, and along each face is fastened a batten of oak 2 to 3 inches [*5.4 - 8.1 cms*] wide and 6 to 8 lines [*14 - 18 mm*] thick. The ends of the mainyard and foreyard have studdingsail boom-irons like that designated by the letter **A** in **Fig. 72**; this iron is welded to an iron bolt which has an eye at one end as in **B**, to which a block is made fast for divers purposes, and the other end separates into two arms which run along each side of the yardarm. A hoop is welded to these two arms and shrunk round the end of the yardarm. These same yards have a second boom-iron some distance inboard from the end; I have shown its shape in **Fig. 73**, where **A** represents the part which surrounds the yard, and **B** that which surrounds the boom.

The topsail yardarms on the English ships are fitted with an iron eye like that represented by the letter **A**, **Fig. 74**; the bolt to which this eye is welded projects 18 to 20 inches [*49 - 54 cms*] beyond the yardarm, and at its inboard end it divides into two arms which are clasped to the yard.

The tops on the English ships are constructed like those of our own ships, but their shape is not exactly the same. Here they cut them off in a straight line abaft the futtock-shrouds, instead of continuing the circle round.

All the ships moored before Chatham have their bowsprits unshipped, several also have their foremasts out, and some are stripped of all their masts. I enquired as to the reason for this difference, and was told that after they have put into store all the topmasts, yards and bowsprits, they then place there as many foremasts as there is space for; and if there be space left over in the mast-houses they send down the mainmast and mizen-mast of those ships which they do not expect to fit out for a long time; and finally, if the number of vessels be very small, and all their masts and spars may be taken into the mast-house, they strip them of all their masts and spars complete.

There are at Chatham two mast-ponds each 320 feet [*104 m*] square, where they keep roughtree masts in the water.

Rigging

CX. In English ships the mainstay passes to starboard of the foremast instead of passing round it as it does in our own ships by means of the collar. The laniard of this stay is made fast between the foremast and the bowsprit; we set it up abaft the foremast. The mainstay collar passes through a hole cut in the gammoning-knee, rather than being blocked by a score such as we cut in the head of this knee in our own ships. The English claim that their method of setting up the stay is superior to ours; they agreed with me that the stay does not act with quite as much force as if it divided and passed round the foremast, since its direction is somewhat oblique, whereas for my part I could not but agree that it must act with sufficient force, since all the English ships put to sea with their mainstay set up in this manner. The advantages which they derive from it are: 1st, that there is less cordage required, for it is certainly true that although their stay is a few feet longer than ours, yet the collar being double with either method, the stay is shorter in the English ships than in our own by twice the additional length of the stay. 2nd, that the hearts through which the laniards are rove and the laniards themselves are 4 or 5 feet [*1.30 - 1.63 m*] lower in the English ships than in our own, and the lowering of this weight allows the ship to carry her sail better. 3rd, that here the mainstay laniard is to hand for the seamen on the forecastle, whereas in our ships it is beyond their reach. It should be said however that these advantages are but of little consequence.

In the English ships the preventer-stay is made fast to the foremast.

The forestay is set up as in our own ships; the mizen-stay passes round the mainmast whereas we make it fast at the quarterdeck.

For the same number of guns†, the English ships have one less shroud for each lower mast than do our ships, yet there are the same number of chains.

†.... *Size for size, ...*

The lower yards are raised and hung by two shifting halliards in the following manner. A treble block is made fast to either end of a strop which passes round the mast above the shrouds and hangs down below the crosstrees; there are two further blocks on the yard opposite these, and the two halliards are rove through these four blocks, one on either side, so that the falls run down to the deck where they pass through the sheaves of the knights of the jeer-bitts, of which I spoke in Remark **XCV**. The English find with their method the advantage that they can hoist the yard by hand, in a short space of time, and with but a small number of men, whereas with our usual method we must employ the capstern. They save the tie, the bronze sheaves and the large jeer-block which we put to this service. I shall not dwell further on this question, since quite recently in Brest this English method has been employed in some of the King's ships, and yet in a neater manner than is employed here.

In the English ships the topsail yards are hoisted each with two halliards, one on either side of the mast. The English claim that this arrangement is more rapid than the use of a single halliard such as we generally employ; that they employ less cordage thereby, either because the two halliards together are smaller than one single halliard, or else because the heavy tie can be done away with; that when the ship heels the weather halliard serves as a backstay and counters the drag of the lee halliard on the masthead, whereas in our ships whenever the halliard is on the lee side it becomes a drag on the mast. These advantages seem to me unarguable. Quite recently in Brest a similar arrangement was rigged in some of the King's ships.

The English send up and down their topmasts by means of a tackle which differs from ours and which is set up in their ships in the following manner. I stated, when describing the English style of mast-cap, that they are fitted with four eyebolts, and when describing their topmasts, that they are fitted with two top-rope sheaves placed diagonally and running in opposing directions one above the other. They make fast to each of the eyebolts situated next to the round hole in the mast-cap a rope which I shall call the top-rope. Each of these two top-ropes runs down to one of the sheaves in the topmast, and then up again to pass through two blocks made fast to the two eyebolts at the side of the square hole in the mast-cap. At the end of each top-rope a double-block is secured; there are two similar blocks set up on deck somewhere abaft the mast, and the falls of two top-rope tackles pass through them so that the topmasts can be sent up and

lowered. These tackles allow the English the advantage of being able to send up their topmasts by hand, with but few men, and in greatly less time than we usually employ to send ours up by means of the capstern.

The mainsheets, foresheets and topsail-sheets are rigged as in our ships. The maintack reeves through a hole cut in the bulwarks or through chesstrees, and the foretack through a bumpkin led out beyond the rails of the head, in the same way as has been recently done in France in some of the King's ships, yet the English bumpkins instead of being straight like ours are curved so that their outboard end is below the level of the head-rails and carries the clue of the sail lower than in our ships; which is much better.

I have as yet seen nothing new in the way they rig their braces, brails and bowlines in the English ships, save for the braces of the mizen topsail yard; the standing part of these braces is made fast near to the peak of the mizen yard, and the falls reeve through a block made fast to the same yard.

The English ships have at both ends of their lower yards a tackle which is used to haul up the ship's boats when in a harbour where a heavy sea is running. I shall describe in a separate Article the cables and the proportions of the different ropes.

Chains

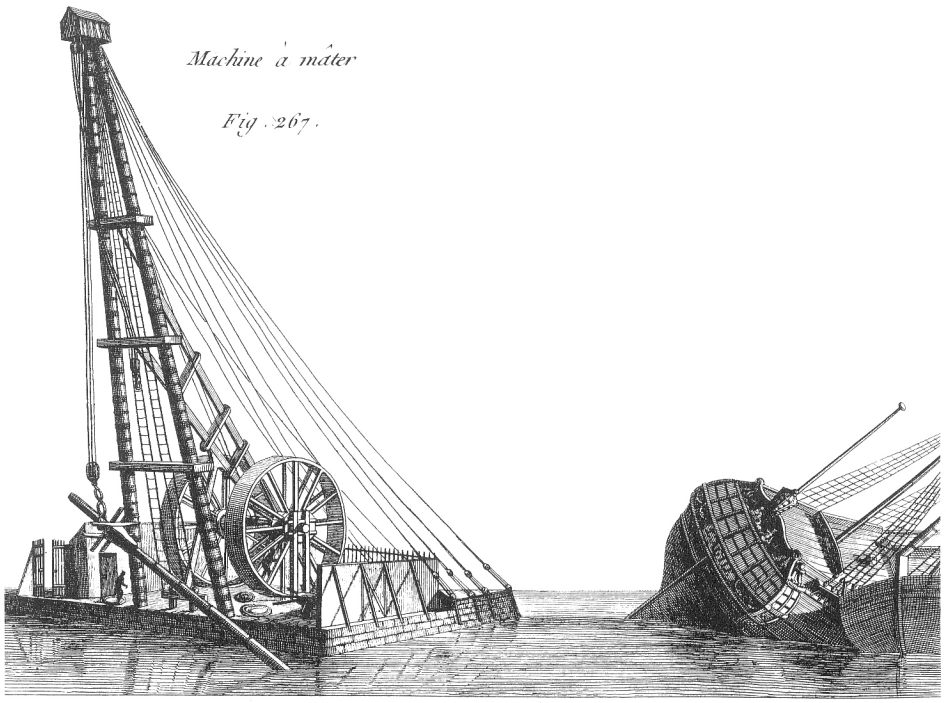
CXI. The chains in our ships are formed of a deadeye-strap, two links and a preventer-plate; and in the English ships, both large and small, there is only an iron strap in place of the two links, like that designated by the letter **A** in **Fig. 75**. The upper end of this strap is folded over and passes through an eye formed in the deadeye-strap. The lower end is fastened to the ship's side with an iron chain-bolt. Only the English three deck ships have preventer-plates. All their other ships have none at all. This practice allows for a great saving in iron and in labour, and the sides of the vessel are less weighed down.

Stoves

CXII. I saw at Chatham Dockyard several stoves made and set up like those with which we are already familiar in France, and I also saw them bend with all the success one could desire planks of 3 inches ½ and 4 inches [*9.5 - 10.4 cms*] which had been heated therein to plank the counter and bow of a ship. It would be well for our own service if we were to have similar stoves in our Dockyards in order to avoid the necessity of employing as we do timbers cut from the solid using moulds for planking the bow and the stern. I had already seen these stoves at Deptford and Woolwich, but I witheld my judgement until today when I saw at Chatham several demonstrations of the usefulness which may be derived from them. I noted that it is with fresh water that the planks are damped; that they use a small pump to draw up this water from the vessel in which it is boiled; and that they leave the planks in the stove about an hour and a quarter for every inch of thickness.

Apart from these stoves which are already known to us, there is another of different construction at Chatham Dockyard which is used for stoving the planks of longboats and cutters. **Fig. 76** shows this steam-trunk[82] in elevation, **Fig. 77** the end-on view, **Fig. 78** a cross-section along its longitudinal axis, and **Fig. 79** its vertical cross-section. The letter **A** in these Figures designates a trunk which is about 16 feet [*5.20 m*] long, 2 feet 6 inches [*81 cms*] wide and high

82. These were undoubtedly the steam-trunks referred to by Fincham (*op. cit.*): ...."*This means of suppling and improving the condition of timber remained in use until 1736, when it was superseded by the use of steam-trunks, which, in effect, were similar to the present steam-kilns. A Mr. Boswell, purveyor of timber in the dockyard at Deptford, was the first to introduce the method of suppling timber by steam. This practice was continued in the dockyards about eight years; and was then succeeded by the use of kilns, in which the thick-stuff and planks were boiled as they are at present. The steam-trunks or kilns have, however, been continued in use to prepare the wood for boat-building up to this time; as they have also for more general purposes in private yards; and the more extensive use of them was partially restored in the royal dockyards in 1839. The preparation of the wood by steam is doubtless superior, when the kilns are properly made and managed, to that of boiling it; since the extreme tenuity of the steam renders it capable of penetrating more effectually through the pores than water; and the process is conducted at a less expense*"
It seems astonishing that despite widespread awareness in France of the English use of steam for bending timber, steam-trunks were not adopted in France until after the Restoration, even the double curved planks of the counter being hewn from the solid. See also the Introduction for further comments on this subject.



38. *The more common variety of French masting-machine. From Lescallier's* Vocabulaire des Termes de Marine Anglais et Français,*1798. (Private collection.)*

at the centre, and 3 or 4 inches [*8 - 10 cms*] less at either end. It is made of oak planks 2 inches [*5.4 cms*] thick and held together by six iron hoops. This trunk is raised up on two trestles **B** which are about 5 feet and a half [*1.79 m*] high; its two ends are closed up completely by a sliding door†, and at a point one-third along its length there are several small iron bolts running down vertically 2 inches or one inch and a half [*5.4 - 4.0 cms*] apart, as shown by the letter **C**.

†.... by a hinged door ....

The trunk has a square hole in the bottom to receive a steam-pipe leading from a copper boiler designated by the letter **D**. This boiler is surrounded and supported by the masonry **E**, leaving a space **F** beneath the boiler for lighting the fire. At the back of the hearth is the chimney-flue **G** to allow the smoke to escape.

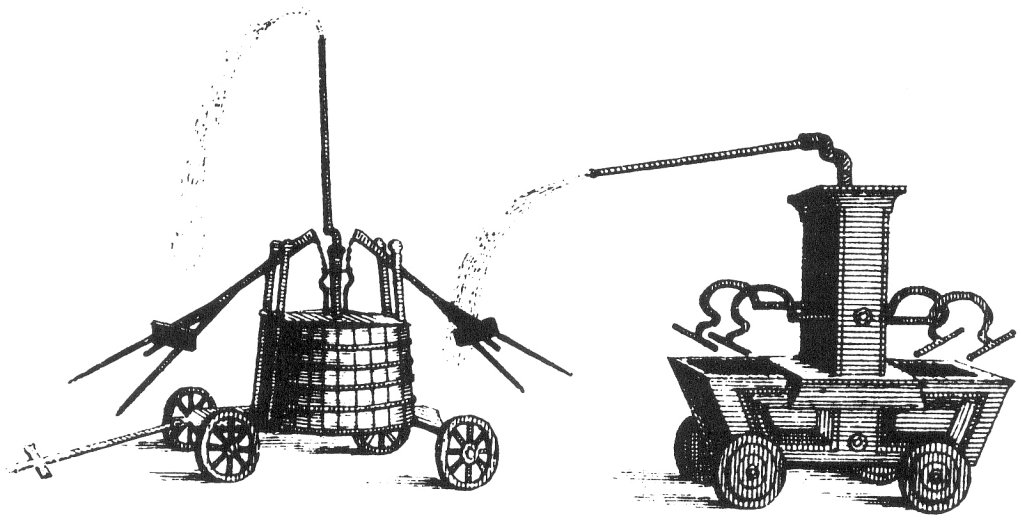
When they wish to make use of this steam-trunk they lay the planks which they wish to stove on edge in the trunk; the small bolts **C** which are inside serve to hold them in this position. The boiler is filled with water through a small hole **H**, which they then close up; they boil the water; the steam rises into the trunk and softens the planks in such a manner that when they are withdrawn from there after they have been two hours within, they may without breaking be bent to any shape desired.

CXIII. There is at Chatham a floating sheer-hulk made of an old ship and fitted out like the masting machine at Brest, save that the one at Chatham has but two sheer-legs and a single shore.

Engines

In the English ships they use an endless screw to raise up the deck-beams when they wish to remove the pillars on the gundeck which stand in the way of the capstern-bars, as I have already explained in my Remark concerning the pillars. This screw is represented in **Fig. 80**; it is about 5 feet [*1.63 m*] high, and is enclosed in a casing of the same height, the heel of which is armed with three iron points. The head of the screw is armed in like manner, and pierced by two holes into which they pass two iron bars 3 feet [*97.5 cms*] long and 14 lines [*32 mm*] in diameter.

39. *Illustration of a water engine, from T.R.Blanckley's* Naval Expositor,*1750.*
(Private collection.)



The jacks over which the English lead the cables and warps which they are getting out of store, are of the shape shown in **Figs. 81** and **82**, and they are fitted with three rollers, of which that designated by the letter **A** is horizontal, and the two others designated by the letter **B** are vertical. We only fit our jacks of this type with the horizontal roller, and in this we do less well than the English.

The flying pumps which the English use in the same way as we do to wet down the upper works of the ships when graving, are set up here in a cistern four times larger than that of our pumps, and this cistern is mounted on four wheels as in our Dockyards. Each pump-handle is 9 or 10 feet [*2.93 - 3.25 m*] long, and branches out at the end into two bars in order to allow room for several men. There is no leather hose as on our pumps, but a brass pipe fastened to the pump-barrel and which moves to the right and to the left, up and down, and down and up. This is what I find the best in their pumps.

Store-Houses

CXIV. The store-houses at Chatham Dockyard are well-built according to the usage of the country, yet they do not deserve to be compared to the store-houses of our Dockyards[83]. They are not of great size, yet every thing is stored there with such care that they contain all the stores for fitting out the fifty ships which are moored off Chatham. The storeys of these store-houses

83. cf Daniel Defoe, describing Chatham in his *Tour through the Whole Island of Great Britain* a few years earlier (c.1725): "*This being the chief arsenal of the royal navy of Great Britain. The buildings here are indeed like the ships themselves, surprisingly large, and in their several kinds beautiful. The ware-houses, or rather streets of ware-houses, and store-houses for laying up the naval treasure are the largest in dimension, and the most in number, that are any where to be seen in the world. The rope-walk for making cables, and the forges for anchors and other ironwork, bear a proportion to to the rest as also the wet-dock for keeping masts, and yards of the greatest size, where they lie sunk in the water to preserve them, the boat-yard, the anchor yard; all like the whole, monstrously great and extensive, and are not easily described.*
"*We come next to the stores themselves, for which all this provision is made; and first, to begin with the ships which are laid up there. The sails, the rigging, the ammunition, guns, great and small-shot, small-arms, swords, cutlasses, half pikes, with all the other furniture belonging to the ships that ride at their moorings in the river Medway. These take up one part of the place, where the furniture of every ship lies in particular ware-houses by themselves, and may be taken out on the most hasty occasion without confusion, fire excepted. The powder is generally carried away to particular magazines to avoid disaster. Besides these, there are store-houses for laying up the furniture and stores for ships; but which are not appropriated, or do not belong (as it is expressed by the officers) to any particular ship; but lie ready to be delivered out for the furnishing other ships to be built, or for repairing and supplying the ships already there, as occasion may require.*"

are not very high one above the other; I enquired as to the reason, and was given an explanation which seemed very true to me. There is no need for any great height in the storeys of a store-house, it is but wasted space unless it be filled up completely, and if it is desired to fill it up then much time is required to stow and to remove the stores which can be placed there. This is the reason wherefor the English allow but 9 or 10 feet [*2.93 - 3.25 m*] in height between the storeys of their store-houses.

Although all the stores for fitting out the ships are held in the store-houses at Chatham[84], yet each ship does not have as do ours a particular store-house. All the stores of the same type are placed here in the same store-house, with labels on which they write the name of the ship to which they belong. I asked whether it would not be better, with certain exceptions, to place in a single store-house all the stores which belong to each ship, and I was told in this regard that they would require a greater number of storekeepers to watch over the stores, since it is their practice here to look after them continuously, to inspect them, to replace those which are spoiled, and to maintain them all in good state as long as possible. A blockmaker, for example, is in charge of the block-store; he has under his eye all the blocks of all the ships, and thus he is able to look after them better and with less expense than if they were dispersed among different store-houses; and likewise also for all the other stores.

The cables and warps which are in store at Chatham are in some cases coiled as if in a cable-tier, while others are stretched out for their whole length. Previously they stretched them all out; then they found that it was better to coil them, and so they coiled them up†; today opinions are divided over the two methods, and so they are coiled or stretched out depending on the best way to use the space available for their storage.

†.... and this practice prevailed over the other for a time ....

All the ropework save for the cables and warps is stretched out full length in separate bundles; formerly they used to stretch out these bundles on the floor of the store-house, one on top of the other, but recently they have begun to employ a different method. They have fastened across the pillars which run down the centre of the store-house a series of cross-beams, such as appear in **Fig. 83**, marked **A**, placed 2 feet and a half or three feet [*81 - 97 cms*] one above the other; similar cross-beams have been fastened to the walls, like those designated by the letter **B**, and they stretch out the bundles of ropes across these beams as shown by **C**. In this manner the space of the store-house is spared, and the ropes do not rot through lying one on top of the other.

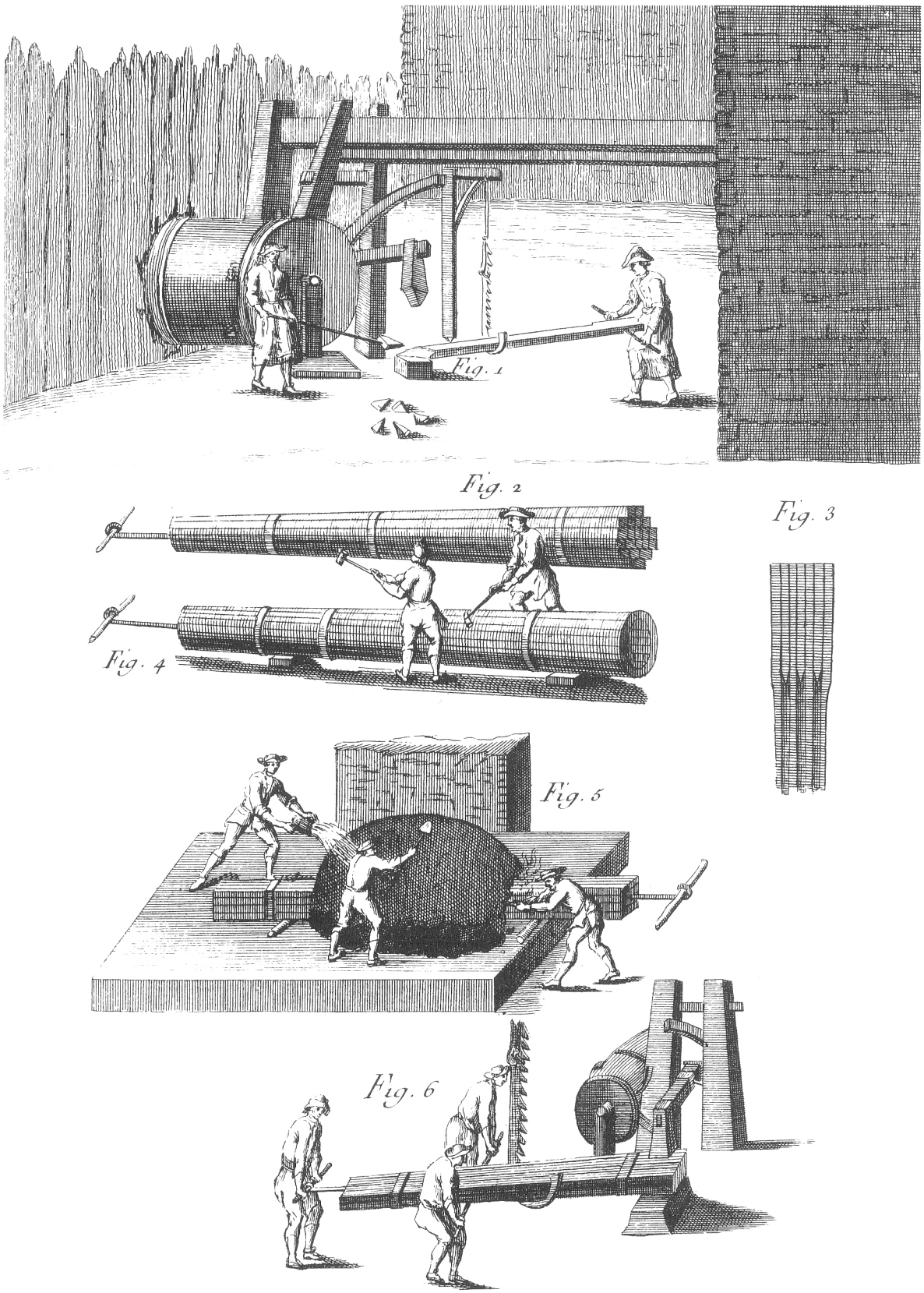
In **Fig. 84** I have shown the plan of one of the store-houses for smaller items, such as nails, tools, pig-lead, and other stores of this kind. The letter **A** marks a partition, which runs the length of the store-house down the centre. This partition is made of planks, or else formed merely by a series of posts spaced 2 or 3 inches [*5 or 8 cms*] apart, whichever the items they store in the berths permit. **B** indicates the storage berths, and **C** a corridor which runs all round the store-house. The partitions separating the berths are formed in the same manner as the central partition.

Sail-Loft

CXV. In the sail-loft at Chatham the sails are stored in such a manner that they leave a space three feet [*97.5 cms*] wide all round the walls of the loft; and between the walls and the sails is a curtain, to which are made fast a series of brails which allow it to be raised when they wish to air the loft.

Next to the sail-loft is a very great courtyard in which several sheers are set into the earth, 50 to 60 feet [*16 - 19 m*] high, each braced by four shores, and at the head of these sheers are set up tackles with which the sails can be hoisted up when it is desired to dry them.

84. Not quite; the guns were the responsibility of the Board of Ordnance (not a Navy Board department), and as such were stored at the gun-wharf.



40. *Forging anchors from bundles of iron bars.*
Illustration from the Mémoire sur la Fabrique des Ancres *by Mr Trésaguet. The memorandum earned the author the joint prize awarded in 1737 by the Académie Royale des Sciences. (Private collection)*

Ropery

CXVI. At Chatham there are two roperies like the old ropery at Brest; I examined carefully the ropes they make there, and it appeared to me that the hemp is of the same quality as that which we employ, and that it is neither better dressed nor better spun than in our Dockyards. I found only that the English apply less tar to their ropes, or else that they employ tar which has been better refined.

Smitheries

†.... of 4,000 pounds ....

CXVII. I saw them making an anchor of 3,000† pounds [*1467 kgs*] in the smitheries at Chatham; its shank was composed of a bundle of iron staves, as in all its other parts, and it was made in the same manner as we forge them in our own yards. To hold it up, offer it to the furnace and to withdraw it, they use the same trestles and all the other tools which we employ, yet when it left the hands of the smiths I did not find that it was finished with so much care as those which we make at Brest.

In the same smitheries I also saw them forging the mooring-chains which are used for securing the cables of the ships which are anchored off the Dockyard. The links of these chains are twice as long as those which we employ, and are made of bar iron which is about 2 lines [*4.5 mm*] thicker. I was told that they used to make them shorter and less fat, and they showed me some which were proportioned like the links of our chains, but they have changed this usage, since the links being fatter are also stronger and are slower to be consumed by rust, and they have found the means to give them this greater thickness without using any more iron than in the former chains, in that they make the links twice as long as they were previously.

Mooring-Cables

CXVIII. All the ships lying in Ordinary off Chatham are moored with but a single cable, which is made fast to an iron mooring-chain lying on the bottom; they also have a stream anchor at the ship's side or hanging from the cathead ready to let go should the mooring-cable fail.

The *Britannia* Ship of 100 Guns

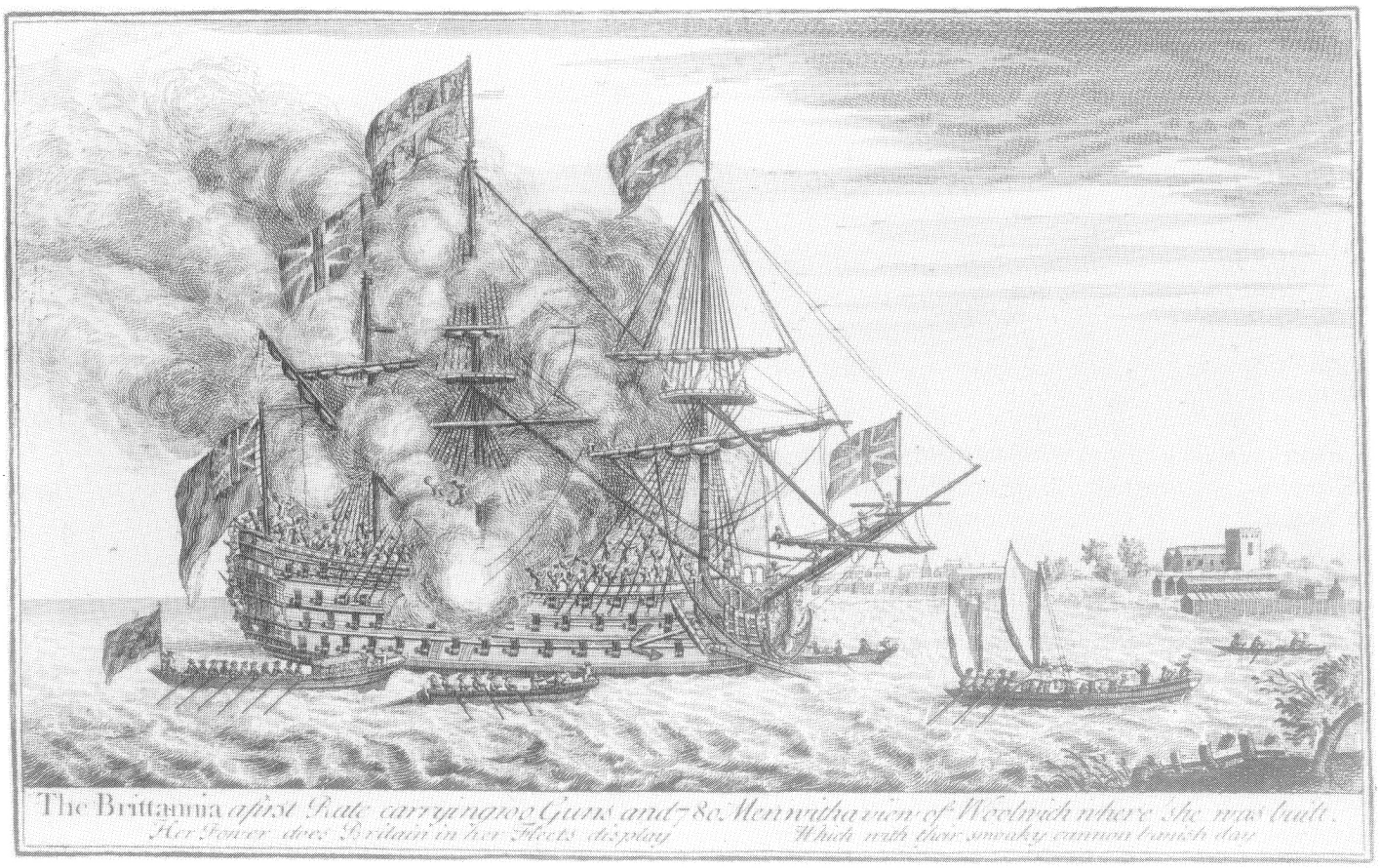
†.... 6 feet 5 inches ....

CXIX. Before leaving the Dockyard at Chatham I will say a few words of the **Britannia**[85], a 100-gun ship which I saw moored off the Dockyard. This ship is of the same size as the **Royal Sovereign**, but she is much more deep-waisted. There is 5 feet 10 inches [*1.90 m*] height from the gundeck to the middle deck, 6 feet 6† inches [*2.11 m*] from the middle deck to the upper deck, 6 feet 9 inches [*2.20 m*] under the quarterdeck and 6 feet 3 inches [*2.03 m*] beneath the poop; I measured these dimensions. Her upper works are very well executed. Her guns had already been taken off when I went on board, and I guessed from the weed at her waterline that her gundeck ports are 4 feet and a half [*1.46 m*] out of the water when fitted out for sea, and that she draws 21 feet 3 inches [*6.91 m*] of water aft. There would be much to say about the slight draught of this ship and her great height above the water, but this will form the subject of a separate Remark[86] later, when I shall discuss the proportions and the draught of the English ships.

Description of the Dry-Docks

CXX. The differences which I have found between our dry-docks and those of the English Dockyards has led me to take off the plans of the latter. **Fig. 86**[87] shows a plan view of a dry-dock taken from the dimensions of one of the large docks at Chatham already described, in Remark **LXIV**. **Fig. 87** shows a longitudinal section, **Fig. 88** the transverse section at the middle, and **Fig. 89** the same section at the gate.

85. **Britannia**: originally part of the 30-ship programme of Charles II, Britannia was built in 1682 at Chatham Dockyard by Phineas Pett II. However she was taken to pieces in 1715 and then "rebuilt" in 1719 by Hayward to dimensions of 174′6″ x 50′0″, 1894 tons b.m.; launched at Woolwich on October 30th 1719, she served until 1745 when she was used for harbour service, and she was finally broken up in September 1749 at Chatham. She was therefore nearing the end of her career by the time Blaise Ollivier saw her. The date of his visit to Chatham can be established with considerable accuracy, since *Britannia* arrived off the dockyard on May 10th, but had to wait until June 20th (English calendar) before being taken into dock.
86. Starting with Remark CXXV, p. 132.
87. See Plate 7, p. 123.

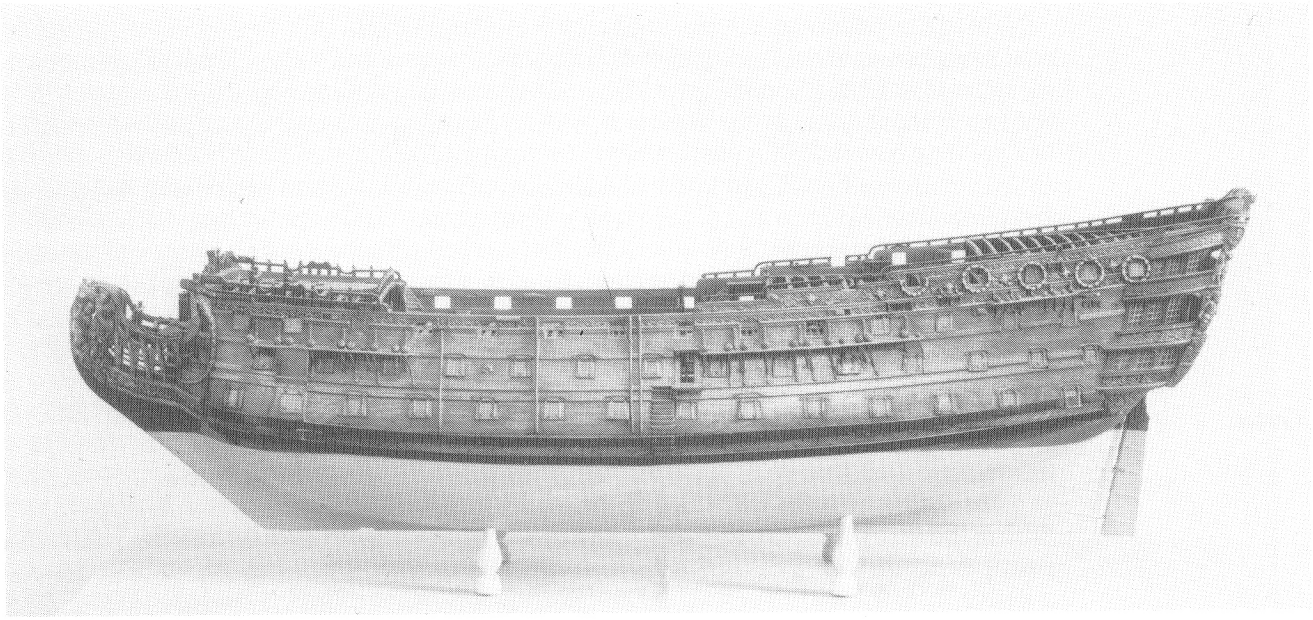


41. Britannia. *Anonymous engraving, c. 1730. (Courtesy National Maritime Museum, Greenwich)*

The building platform of the large English docks have 5 or 6 inches [*13.5 - 16.3 cms*] convexity along their length, while those of the middling docks round up only 4 or 5 inches [*10 - 13 cms*]. This curvature is established in consideration of the hogging of the keel.

The platform is made of oak timbers placed across the bottom of the dock, and these timbers are laid so that they touch one another, as in **A**, **Fig. 86**, but each is divided into three parts, of which one lies across the centre of the dock and the two others are butted to it and extend to the walls of the dock on either side. These latter timbers do not always touch each other exactly, and they are covered by oak planks laid the length of the dock, so that at this point the dock is 4 inches [*10.8 cms*] less deep than along its middle line. The declivity of the platform is the same as in our docks, yet its scope is proportionately less great, since the aulters at the sides are wider and the walls are more sloped, so that the English docks necessarily have a shorter and narrower building-platform than do our docks. There are keel blocks on the platform 18 to 20 inches [*49 - 54 cms*] high, which can be moved about readily, yet which are used but very rarely, as I shall explain when I describe how they dock their ships.

At the new and the full moon the building-platform is one or two feet [*32 - 65 cms*] above low-tide level, so that every two weeks the rainwater, or springwater if there be any within the dock, and the seawater which infiltrates into the dock, can run out through the sluices in the gates. But since in the intervening fortnight a few inches of water always accumulate, and in certain circumstances this water prevents the work from proceeding, they build a coffer-dam 7, 8 or 10 feet [*2.30 - 3.25 m*] from the gates which is 3 or 4 feet [*98 - 130 cms*] high, like that marked by the letter **B** in **Figs. 86** and **87**; it is caulked on the side facing the gates, and by means of skeets they bail out the water in the dock and throw it between the dam and the gates. This water then runs away out through the sluices as soon as the tide falls below the level of the building-platform. The dam also serves to prevent the water which seeps in to the dock through the gates from spreading over the whole area of the dock. This dam is made of two-inch [*5.4 cms*] thick planks nailed to uprights set up two feet [*65 cms*] apart, and braced by shores. By



42. *Model of the* Britannia *as built in 1719.*
The shallow draught of which Ollivier speaks is quite apparent.
(Courtesy National Maritime Museum, Greenwich)

adding a similar dam to the dock at Brest once it has been repaired, as it is proposed to do, it will be possible to do without the hydraulic engine completely, since it would no longer be necessary.

There is no apron in the English docks rising above the level of the building-platform as there is in our docks; the platform continues through to the gates, so that each time the sea drops below the sill of the gates the dock is dry. The dock at Brest lacks this advantage, and will not even be so contrived after the repair which is to be carried out, since the platform is below the level of the apron. It is true that the dock at Brest is deeper than the English docks, yet this great depth is more harmful than useful; it has the effect that the apron is rarely uncovered, and that we are not always able to close the gates whenever necessary. If this dock were only the same depth as the English docks, even the largest ships† could still be accommodated, the apron would be uncovered 24 times in the course of a year, and the water entering the dock through the gates or from springs within could run out of its own accord. I enquired of the dockyard officers at Chatham whether they would not find it more advantageous if the building-platform were one or two feet below its present level, the dock being deeper would thereby be more practical for taking their ships in†. They conceded this advantage, yet prefer a middling depth which gives the benefit of a dry dock; and I find that they are correct. Having to dock a greater number of ships of middling draught than First Rates, they need only choose for the latter a suitable tide, which they always find very readily, and we should find the same in our Dockyards, and yet they enjoy the advantage for these and for all other ships of being able to work in a dry dock the same day that the ship is docked. We were of a different opinion when we built our docks; we built them to take the largest ships, and thereby made them less useful for all other ships. I believe that if we should build any new docks it would be right to imitate the length, breadth and the depth of the English docks. They would cost but half the price of building them to the dimensions of the dock at Brest, mainly on account of the middling depth, which by placing the building-platform above the low-tide level would allow us to work on the building of these docks at every tide, without having recourse to a coffer-dam. It is true that our ships draw more water that the English ships, and from this fact it might be concluded that we require deeper docks than the English, yet to that I would reply that the English are able to dock their largest ships which still have all or a large part of their ballast on board, as I saw them dock the **Union**, a ship of 90 guns, and as I saw them float out the **Royal Sovereign**, a ship of 100 guns, and were we to have docks which were as shallow as the English ones, then we could dock our largest ships by relieving them of their ballast, providing always that we continue in the error of building ships with such a great draught of water.

†.... even ships of 100 guns....

†.... more practical for graving large ships ....

Next to the gates of the docks at Chatham is a baulk of fir 18 inches [*49 cms*] square, which runs straight across the dock, the ends being laid on top of the walls. This baulk is marked with the letter **C** in **Figs. 86** and **87**; it is chocked by two wedges, **D** in **Fig. 87**, and serves as a bridge to cross from one side of the dock to the other. But since it is too narrow to form a convenient bridge, they have added a plank which is supported by iron standards fastened to the baulk of fir, as appears in **Fig. 90**, where **A** is this timber seen in section at some point along its length, **B** an iron standard knee and **C** the plank which serves to form the bridge. On the opposite side to the plank there are stantions of iron like that marked with the letter **D**, and over these stantions is a wooden batten which serves as a guard-rail. On this same side of the baulk there are several iron rings, to which they make fast the tackles used to close the gates.

Dock Gates

I have already said in the earlier Remarks that I would give a description of the gates of the English dry-docks, and I delayed doing it until I had seen them open and close these gates. In the docks at Deptford, Woolwich and Chatham the gates are made up of three panels, of which two are shown with the letter **D**, **Fig. 86**, and are of the shape represented by **Fig. 91**, and the third is shown by the letter **E**, **Fig. 86**, and is of the shape represented by **Fig. 92**. The two former panels fit against the walls of the dock on either side, marked **F** in **Fig. 86**, and they butt against a timber fastened to the dock side. The third panel is let into a rabbet cut in the edges of the two others.

Each panel is made up of four timbers **ABCD**, **Figs. 91** and **92**. These timbers are about 15 inches [*41 cms*] square and 12 inches [*32.5 cms*] thick, and are scored down one over the other, and fastened together with iron straps, shown with the letter **E**. Running between the timbers **A** and **C** are several stantions 8 to 9 inches [*22 - 24 cms*] square, marked with the letter **F**, and morticed into the top and bottom timbers so that the space between each is equal to their thickness. On one side of these stantions the panel is clad with planks 2 inches ½ [*6.8 cms*] thick, nailed across the stantions and with their ends fitting into rabbets cut into the side-timbers **B** and **D**. The top and the bottom planks are also let into rabbets cut respectively in the timbers **A** and **C**. It is this side of the panel which faces the sea; the opposite side, which is shown in **Figs. 91** and **92**, is reinforced by the two cross-members **G**[88] placed parallel to **A** and **C**, and bolted to the stantions. The two side-panels are fitted with a pivot of iron like that marked by the letter **H**, **Fig. 91**; this pivot is about 4 inches [*10.8 cms*] long and 4 inches in diameter, and it fits into a hole cut in the building-platform and surrounded by an iron plate.

When they wish to close the gates of the dock they offer up the panels while the tide is still high approximately in the position which they should occupy, which is to say that the two side-panels are placed next to the walls and the central panel next to one of the side-panels. And when the tide has fallen to about the level of the apron, the two side-panels are fitted into their place by means of several tackles made fast to rings fixed to the panels and to the rings fixed in the baulk of fir forming the bridge crossing the dock which I have already described in the previous article. Each of the two panels is secured at the bottom of the dock by two removable iron straps made approximately in the form of knees, of which one arm is braced against the gate and blocked by a forelock in the same manner as a capsquare is locked on a guncarriage. Then the central panel is fixed in position with tackles set up like those used to position the side-panels. The three panels are fastened together with three or four iron straps at each join; these are 4 or 5 feet long [*1.30 - 1.63 m*], 6 inches wide [*16.3 cms*], and 1¼ inches [*34 mm*] thick. One end rests in an iron bracket fastened to one of the panels, while the other end is secured to the other panel† with two forelocks. With the gates thus set up, they place three or four shores at either end on the inside, which are 7 to 8 inches [*19 - 22 cms*] square, like those marked **G** in **Figs. 86** and **87**, and a like number on the outside as marked with the letter **H**. The inner shores are braced at one end against a vertical timber fastened to the wall of the dock and marked with the letter **I** in **Figs. 86** and **87**, while at the other end they have a snape which fits over the edge of one of the stantions of the side-panels. The outer shores are braced against the side of the dock like the inner ones, while at their head they fit into a shoe with a 7 inch [*19 cms*] square hole nailed to the gate.

†.... *secured to the middle panel* ....

88. These are drawn but the letter **G** is omitted on Figs. 91 and 92; the explanation is however perfectly clear.

When they want to open the gate of the dock they secure to the panels the same tackles as they used to put them in place; the shores on the outside and on the inside are removed while the tide is out, the tackles are slacked off so that the panels open up to allow the sea as it comes up to enter the dock, and when the tide is high the panels are placed against the side of the dock.

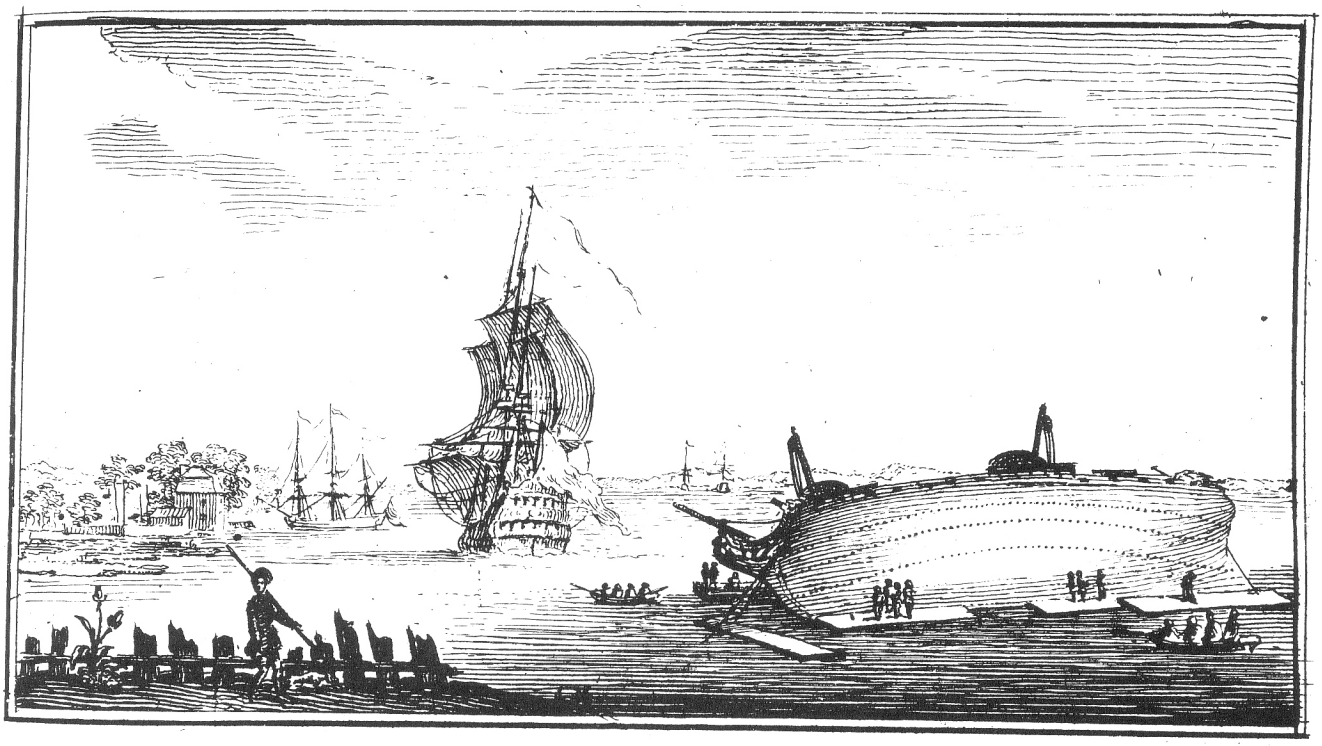
The English have found much economy in the construction of this gate; they use less timber than we do for the gates of our docks, and more common pieces since they use but short timbers of middling thickness. It is true that they do not have the same facility as we do to close them, since their gates do not turn on two hinges as do the gates of our docks, yet the panels which they have to move being but small and light, they are able to set them in place with but few men and in less than a quarter of an hour. They have the advantage of being able to shore up the gate with very little labour and fewer shores, and thus with less expense than we. The English could easily arrange for their side panels to move on hinges as do the gates of our docks, but in that case the walls of the docks in the way of the gates would have to be vertical, whereas today they are sloped, so that their docks are much narrower at the bottom at that place; as it appears from **Fig. 89**. The English prefer the advantages secured from these sloping sides to having their gates open on hinges. These advantages are: 1st, that the gate being of lesser extent at the bottom where the weight of the water exerts the greatest effect, they are not obliged to use the great quantity of locking pieces and shores which we employ to brace the gates of our docks; 2nd, that they employ less timber, and timber of lesser scantling to make up the gates, since they are of smaller size; 3rd, gates which are not fastened to the dock can, when it comes to closing them, be inspected, caulked and lined with kersey very much more conveniently than can the gates of our docks. For all that, I should prefer gates the panels of which could be swung on hinges, and all that I should wish to copy from the gates of the English docks would be to make my gates of three panels in place of the two we use at present. I should make the walls of the dock vertical in the way of the gates, but inside this gate I should make them sloped in the same manner as the English docks; thus by making the gate in three panels in place of two, the two side-panels would have the square shape **KLMN**, in **Fig. 91**; they would swing on two hinges; all the part marked **O** being solidly braced against the sloping part of the wall, and the width of the dock being divided into three panels, they could be made of short timbers of middling thickness like those employed by the English, and they could be braced by the same shores.

Method of Floating Ships into the Docks

CXXI. We have often been told in France that the English grave their ships in dry-dock fully fitted out and stored, yet I can affirm that they do not do this at all. The depth of their docks is insufficient for their larger ships, since the deepest dock is but 19 feet 3 inches deep [*6.26 m*], and whilst this depth may be sufficient to allow them so to dock their smaller ships and their frigates, yet the English are too well aware of the ill effects that the weight of the guns would have on the vessels' sides to dare to dock them fully armed.

An English ship being made ready for sea is docked with only her lower masts stepped and with her ballast or but a part of her ballast aboard, and she is fitted out only after being graved and floated out of the dock, if she be a large ship, by which I mean a ship of more than 70 guns. If she be of a lower Rate, she always has the whole of her ballast aboard, her topmasts, and a large part of her rigging, and they complete the rigging while she is in dock as if she were afloat; often the cables are taken on board, sometimes the victuals or a part of them, according to whether or not her draught will allow it. But neither the water nor the guns are taken on board, nor any other warlike stores, before she be floated out of the dock.

In the case of a ship which has been at sea, and needs to be docked rapidly before she can proceed to sea again, the guns are always taken off before she is docked, and if her draught exceeds the depth of water which the state of the tide allows, part of the rigging is sent down, her cables, anchors and even part of her ballast are taken off, in order to reduce her draught. The larger ships are always so treated. These operations require near as much time as is needed to



43. *Heaving down onto pontoons for careening. Vignette by Nicolas Ozanne, from Duhamel du Monceau's* Elémens de l'Architecture Navale, *1758. (Private collection)*

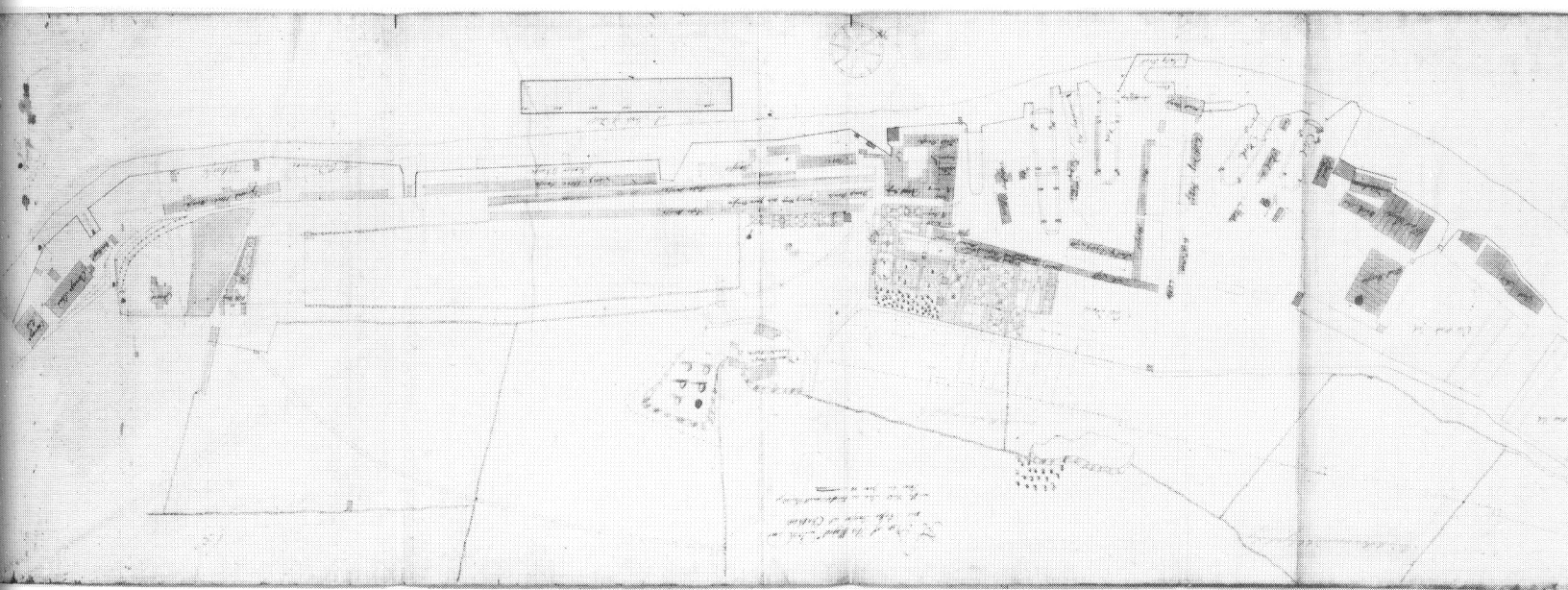
grave a ship on pontoons as is our practice in France. The greatest speed which I have heard related here which was during the last war[89], was with a ship of 50 guns which was stripped of her guns and stores, graved in one of the docks at Plymouth, and made ready again for sea in 72 hours. We should undertake this work just as quickly in our Dockyards were we in a great hurry, by graving on pontoons[90], and I believe indeed that there are examples of our having done so. The English believe that we require two weeks; we believe in France that they accomplish it in 24 hours in their docks without unloading their ships. They are in error, for they do not know our method of graving well enough to come to a just calculation of the time which is needed, and we are equally in error regarding the speediness of the English, since we believe that they dock their ships while they are fully armed and stored for sea; which they do not do. Nevertheless, I find their method of graving their ships in dry-dock much better that that of using pontoons; the ship is not harmed in any way, and if any small repair be required it can be carried out with greater speed, more safely, and at less cost.

I stated in the previous Remark that the platform of their docks rounds up along its length. This is so that the ships which they bring into dock to be graved and which have always hogged a few inches do not lose this round-up of the keel completely; without this precaution the ships would take up their original shape on settling in the dock, and would then lose it again suddenly on leaving the dock, and would thereby be exposed to leaking. The English observe a similar care when they lay the keel-blocks at the bottom of the dock upon which to rest the keel, by which I mean that they arrange the height of the blocks according to the curvature which they suppose the keel to have taken. Yet they only use these keel-blocks when they expect that there be a piece of keel to be shifted; save in this single case their ships are docked without keel-blocks, and the keel rests along its full length on the building-platform.

89. i.e. The War of the Spanish Succession, 1702 - 1713.
90. **Pontoons**: see the illustration above. We have been unable to identify this particular case, but the Dockyard correspondence for Portsmouth [POR/H/4] indicates that this is extremely likely; for example, between August 16th and 18th 1737 the *Ipswich* and *Berwick* were graved in the Great Dock, and the *Solebay* and *Plymouth* in the North Dock, each ship succeeding the other on the same tide.

The method which the English employ to dock their ships is much simpler than our own; they employ less time, fewer artificers, and fewer shores. Half an hour before high tide they unmoor the ship which they wish to dock; they present her before the gates, and haul her with two hawsers which enter the ship through the doorways in the beakhead-bulkhead, and which are made fast to two posts driven into the ground beyond the upper end of the dock. I watched this work being carried out by 100 men on a ship of 90 guns*. Once the ship is positioned in the centre of the dock, the tide is allowed to go out until the depth-marks on the walls of the dock showing the depth in feet indicate that the the ship is about to take the ground on the platform. Then 60 shipwrights, half on each side of the dock, shore up the vessel at the height of breadth from the chesstrees to the mizen-mast with 10 or 12 outriggers which are 8 to 9 inches [*22 - 24 cms*] thick, for the most part of fir, and block them with one or two ordinary wedges. These same men then place five or six oblique shores forward of the chesstrees and abaft the mizen, which run up from the edge of the dock to the upper wale. This is the only support which the English give their ships if they wish but to grave them. I saw the **Union** of 90 guns in this condition. And if there be some small repair to be undertaken, or if the ship is required to remain long in the dock, they shore up the floors with five or six poppets on either side, which are not fastened with a heel-chock as we do it, but simply hammered in with a wedge placed between the heel of the poppet and the platform. The **Royal Sovereign** of 100 guns, on which I saw them complete a repair at Chatham, and which I then saw them float out of dock, was only shored in this manner while in dock. Her keel was touching the platform, and since the tide was not high enough to float her on the day they wished to fetch her out of dock, they moved to the forward part of the gundeck a portion of her ballast, in order to reduce her draught. The ship **Buckingham** which they are repairing in one of the docks at Chatham, is also only shored with the outriggers and oblique shores of which I have spoken, and by four poppets on either side beneath the floors. She is raised on keel-blocks 18 inches [*49 cms*] high, and she has been so raised up in order to shift a section of her keel which was spoiled. This ship has all her ballast and masts aboard.

The* **Union.



44. *View of Chatham Dockyard, probably in the 1720's. (Courtesy Public Record Office, Kew)*

If the English rebuilt their ships as we do, then this support which they provide in dock would not be sufficient, for then the ship's ceiling would be unplanked, her gundeck demolished and a part of her frames taken apart, so that she would never hold her shape, but the English never rebuild their ships[91], and never touch the frames when they repair. I shall explain the method which they adopt when I come to speak of their repairs. Thus in shifting but the planking and the beams, and in shifting them in succession one after the other, never demolishing the decks, the vessel always remains fully fastened, and a support as simple as that which they furnish in the dock suffices. I say that it suffices, because the English, who practically every day dock their ships and sometimes keep them there six months to repair them, as they have recently done with the **Royal Sovereign**[92], experience no difficulty thereby. We could therefore follow their example when we place in dry-dock ships which only need graving, and dispense with setting up at great cost the great quantity of needless shores on which we support them; there would thereby result a considerable saving in timber and in days' labour, and the graving would be executed more rapidly. By instituting this English method in our Dockyards we should make our docks more useful than they are. We are deterred from graving in dock vessels which are being made ready for sea only because the work of docking them, of graving them†, and of floating them out, is more slow and more costly than heaving them down on pontoons, yet by making this operation as simple, as speedy, and as cheaply undertaken as it is in England, we might obtain from our docks the same utility which they obtain from theirs†. If, for reasons which I cannot predict, it should not be desired to copy the English by preparing ships for sea in dry-dock, then at least the docks should be used for the triennial trimmings which we carry out to maintain our ships, and were we then in this instance to imitate the English in the method employed to dock our ships, there would be a great difference in the expense of the operation, compared with that of stepping the masts[93], of heaving the ship down on pontoons to bream her, and then of removing the masts again after the careening is finished. It is true that we use our docks at Brest for our large ships when their masts are not in place, and which cannot therefore be breamed other than in dry-dock; we should do the same also with all our ships, and shore them up in the same manner as the English do; we should find thereby a great economy; we should not have to shift the ballast entirely or in part; they would not suffer as they do when they are hove down on pontoons so that they stay several days in the water without ballast. They should be breamed and graved the same day that they were docked, and could be floated out the following day, if there were no repair to be done.

†.... of shoring them, and of floating them out ....
[The version found in the text of the Brest manuscript is no doubt the correct one. Eds.]

†.... as cheaply undertaken as it is in England, we should be able to grave for example in the dock at Brest, at a time when a large number of ships were fitting out, three or four larger vessels and as many again of a smaller size. The former when the moon is new or full, and the others during the period between. If for reasons ....

By the way in which the English ships are set up in dock, it may be readily understood without my enlarging upon it greatly, that they float out their ships with greater facility and less labour than do we. They let the water rise in the dock, there are no shores to be removed, nor to be put away, since as soon as the ship is afloat the outriggers fall away and remain hanging from the ship or from the dock side and they can be removed easily. I saw them do this in less than a quarter of an hour with 60 artificers when they floated out the **Royal Sovereign**.

91. As noted in the Introduction, this statement clearly contradicts my brief notes regarding the ships seen by Blaise Ollivier derived from Colledge [*op. cit.*] and the *Progress Books*, and it is evident that what the Navy Board described as a "rebuild" was in fact a new building. To take but one example, the *Boyne* was originally built in 1692 and rebuilt in 1708 and 1739; at this second rebuild she was "taken to pieces and the Dock cleared" in Portsmouth on January 7th 1733, and "ordered to be rebuilt at Deptford", where work did not start until two years later. The rebuild was to cost £27,310-13-6 by the time it was completed, and with the rebuild undertaken at Deptford so far from Portsmouth it is extremely unlikely that any of her original timbers were incorporated in the new ship. See the Introduction for a fuller discussion of this question.
92. This comment is somewhat puzzling; according to the *Progress Books* the *Royal Sovereign* was docked for her triennial trimming on April 4th 1737 and floated out on May 17th. It is possible that Ollivier meant to say 6 weeks rather than 6 months, but this would weaken the force of his argument, and his general statement is perfectly correct, but does not appear to apply in this instance to the ship in question. There seem to be two possible explanations: either that the *Progress Books* are inaccurate (which is not impossible), or else that she was in fact docked in April 1736 rather than 1737 – the English calendar can be confusing! – and had thus been in dock for a little over a year.
93. The ship was heeled over first on one side and then on the other using the enormous leverage of the masts, to which tackles were secured. Since ships in Ordinary in France did not have their lower masts in place, these had first to be stepped before the ship could be heeled.
It is perhaps worth noting that not all English ships were graved in dry-dock, and that the old practice of breaming at least small ships on the shore, on mudbanks or on gridirons was still practised, as the following entry in a letter from Commissioner Hughes to the Admiralty shows [POR/H/4, July 17th 1737]: "*Swift sloop was grounded yesterday in the Forenoon, Clean'd, and Halled off again in the Night Tide*".

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Fig. 34

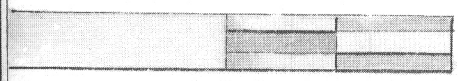


Fig. 35

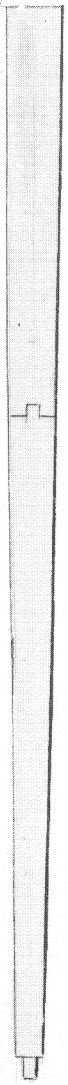


Fig. 36

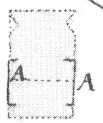


Fig. 37

Fig. 38

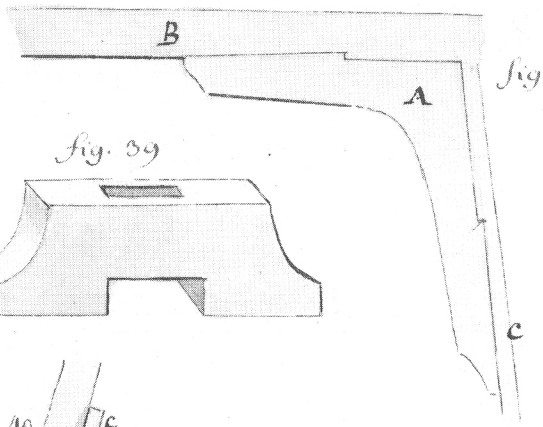


Fig. 39

Fig. 40

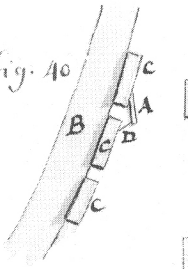


Fig. 41

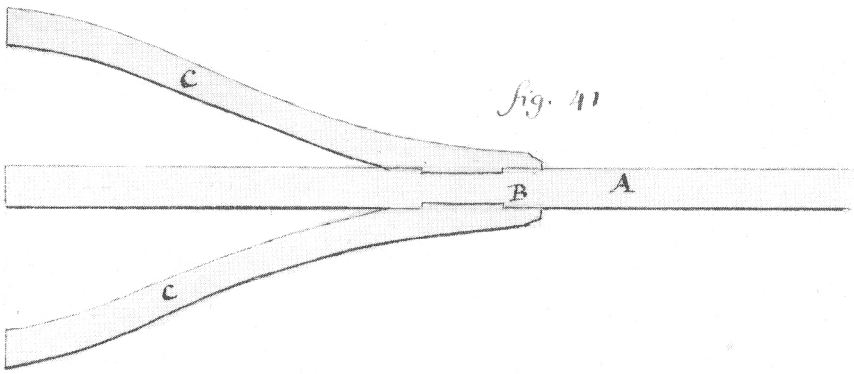


Fig. 42

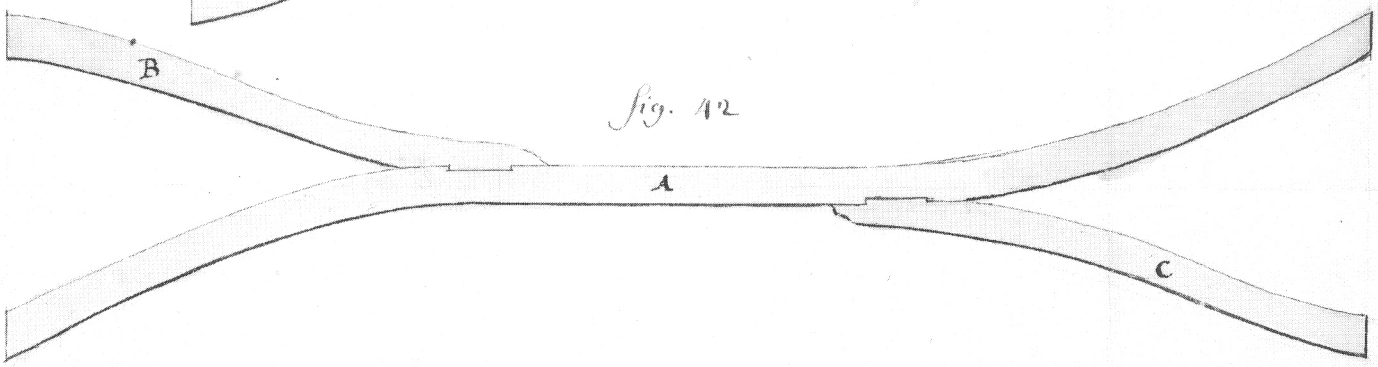


Fig. 43

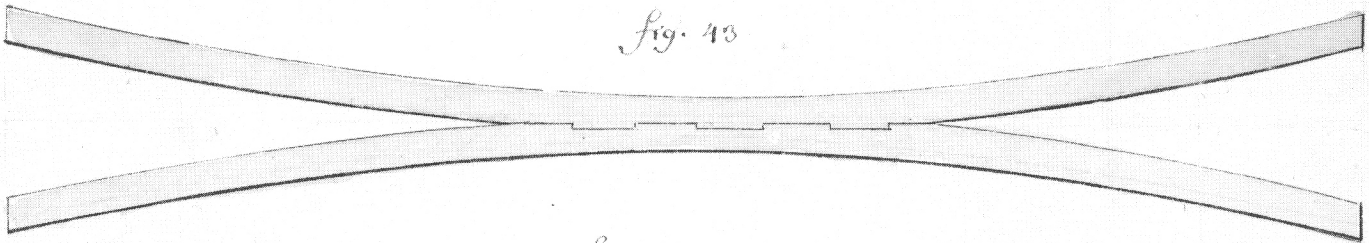
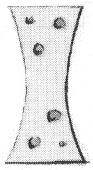


Fig. 44



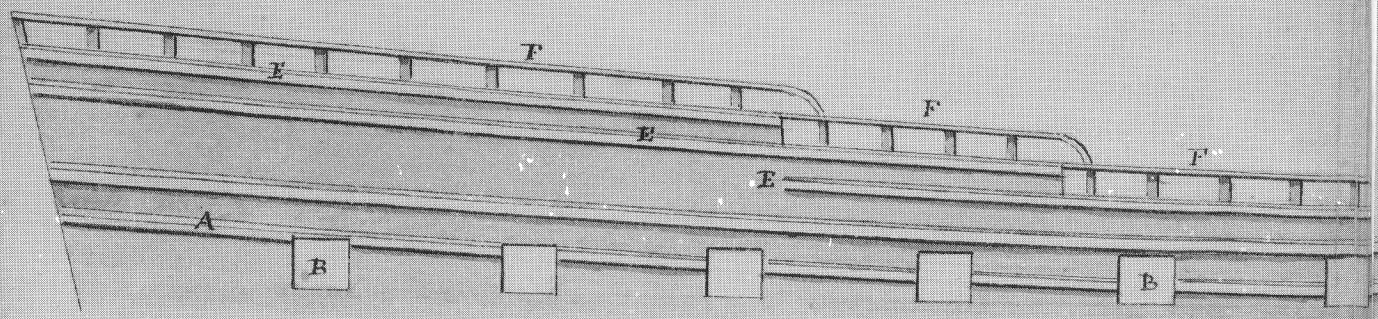


fig. 46

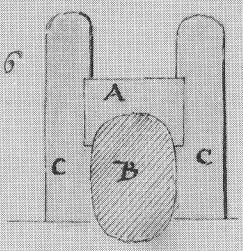


fig. 47

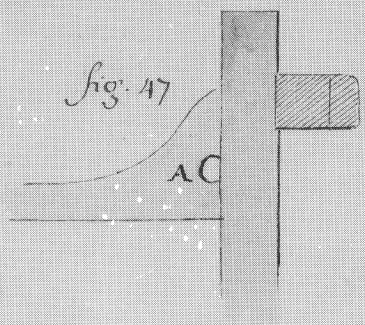


fig. 48

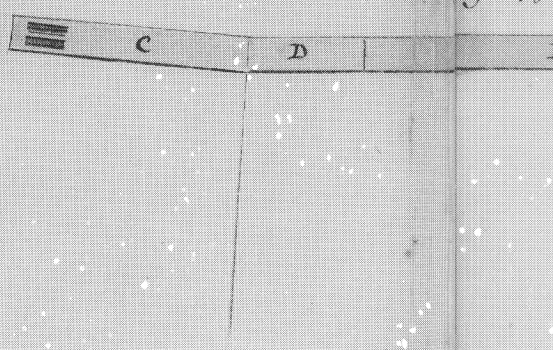
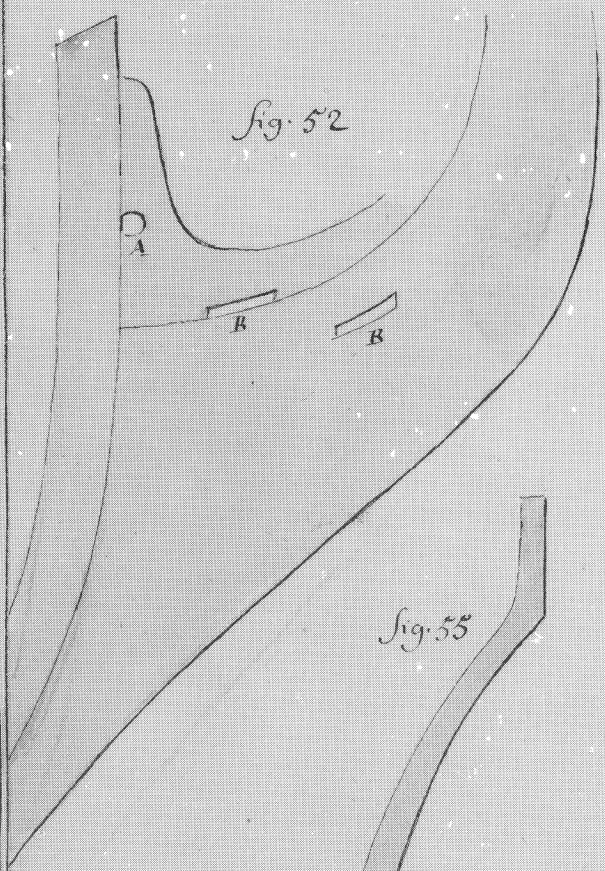


fig. 52



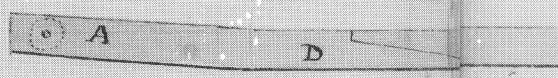


fig. 49

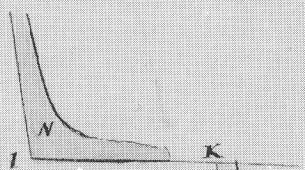


fig. 53

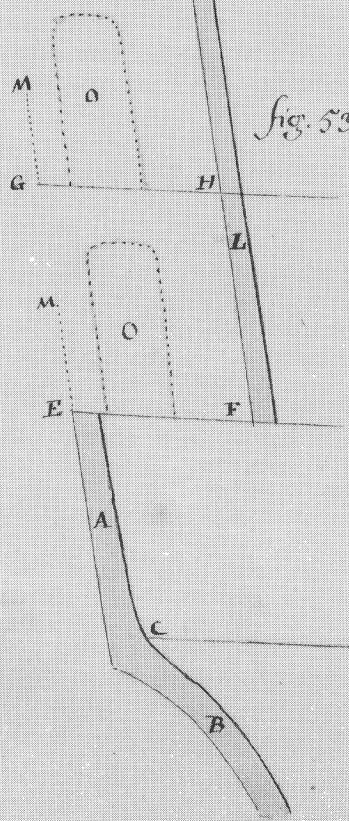


fig. 55

fig. 54

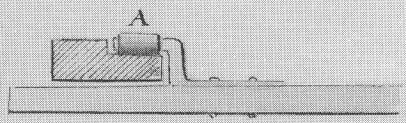


fig. 61

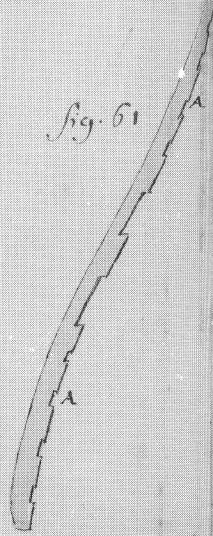
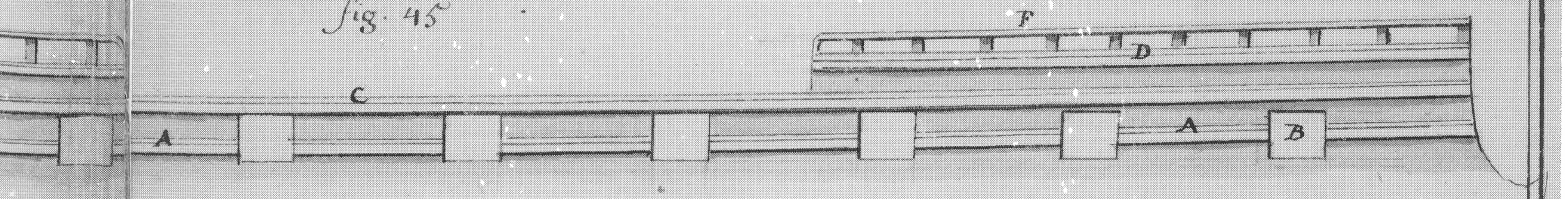


fig. 45



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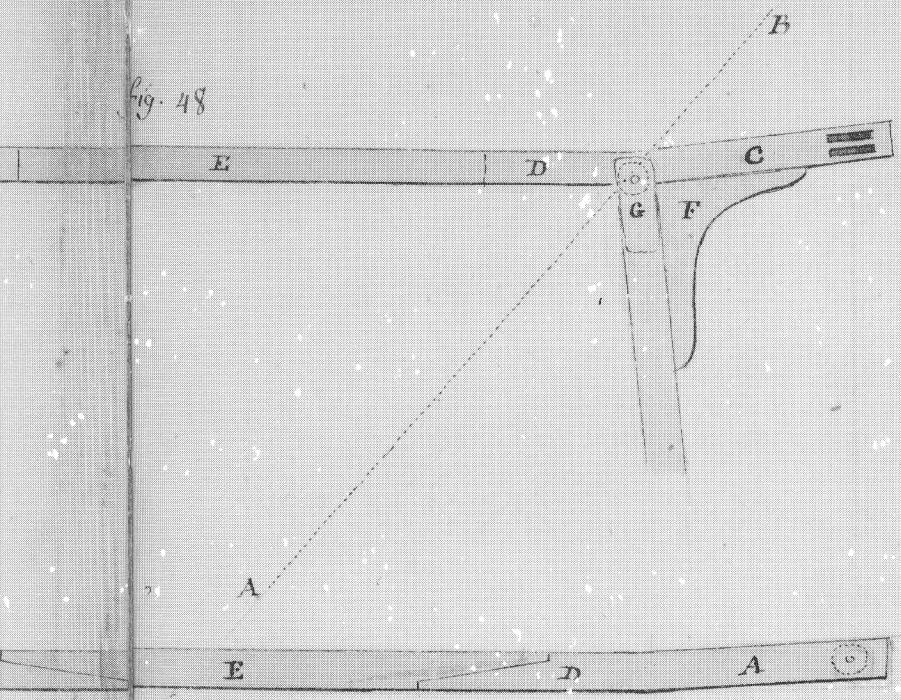

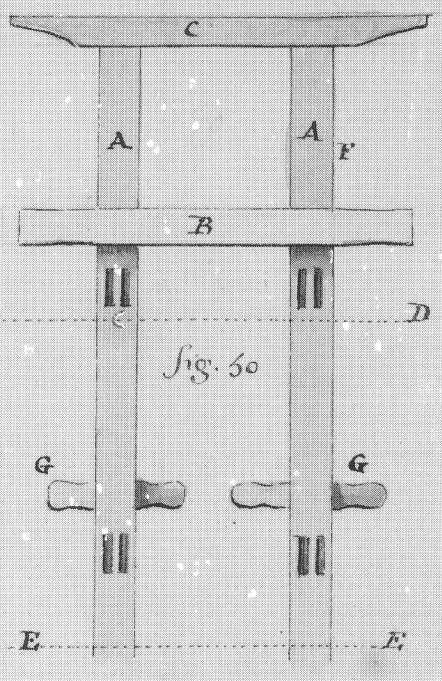

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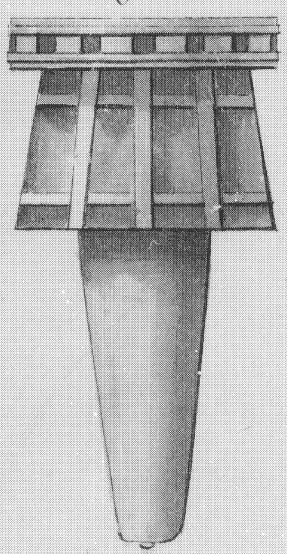

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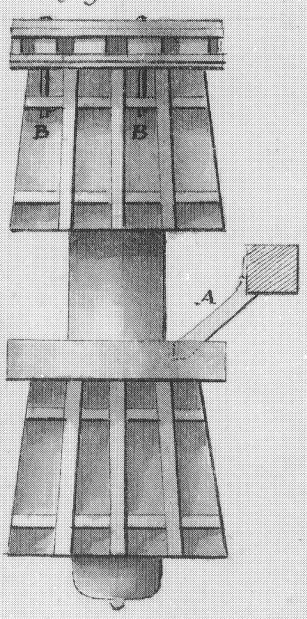

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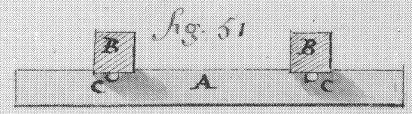

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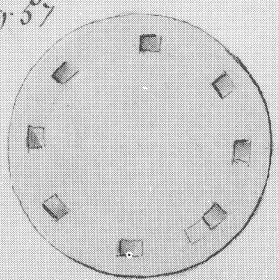

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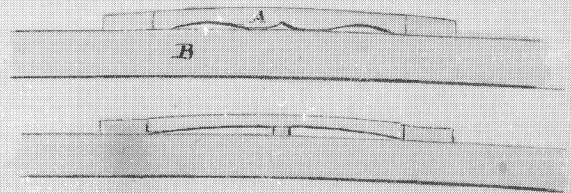

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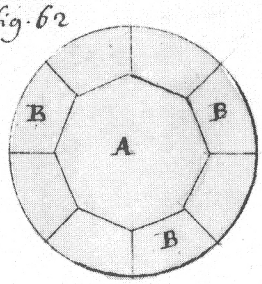

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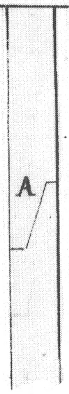

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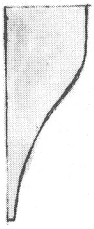

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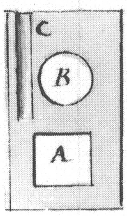

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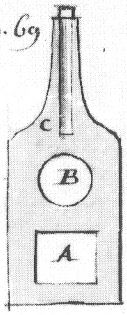

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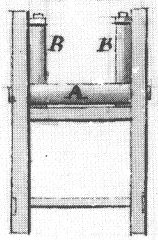

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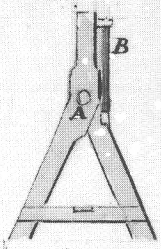

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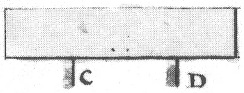

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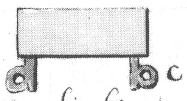

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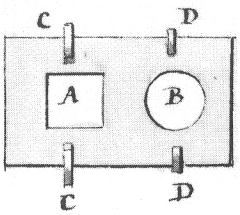

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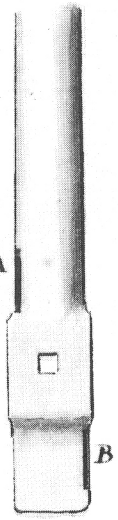

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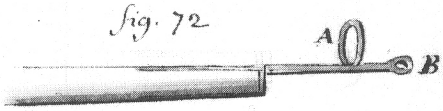

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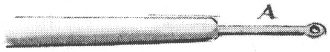

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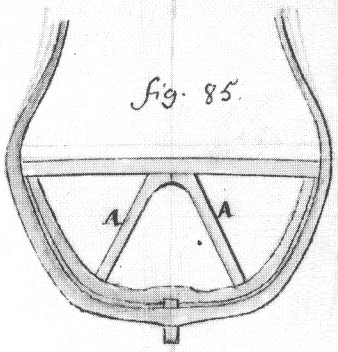

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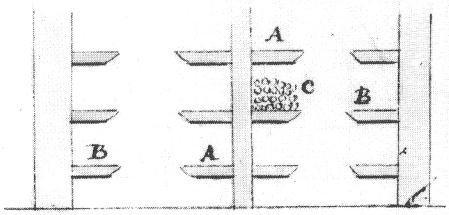

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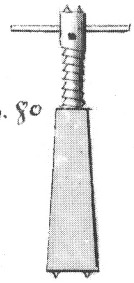

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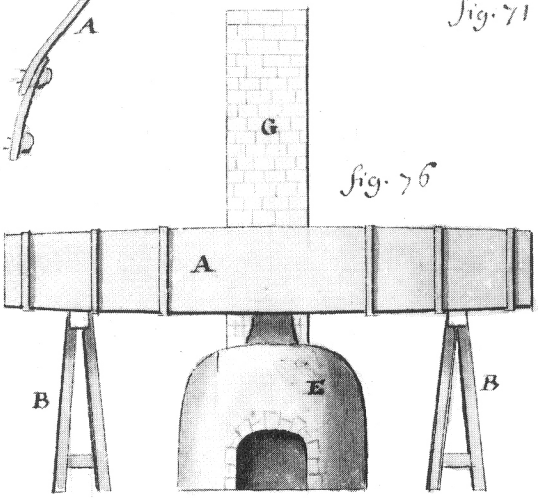

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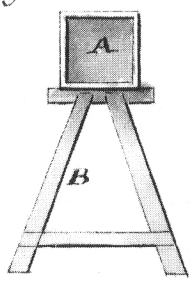

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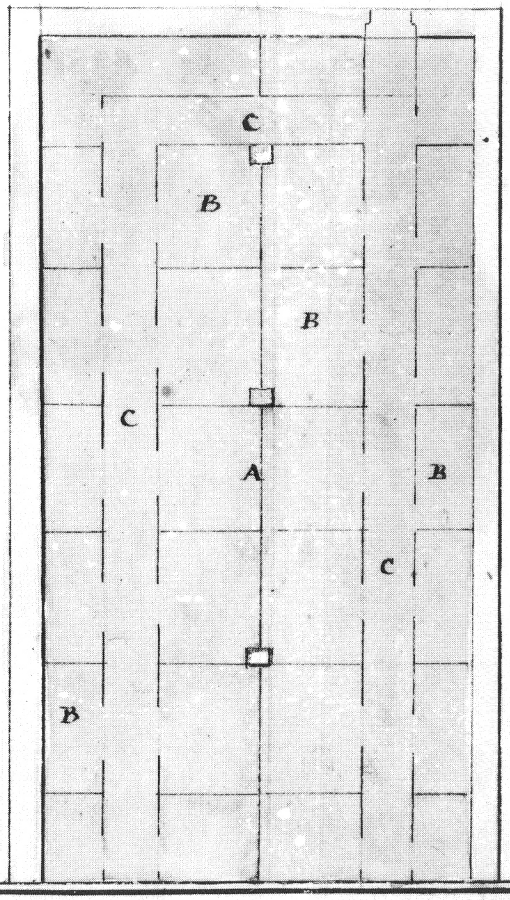

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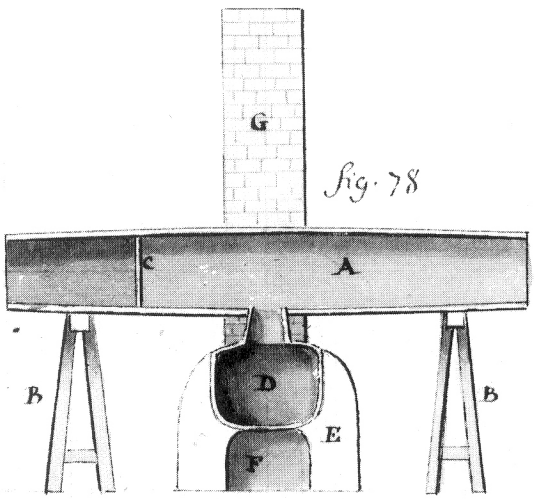

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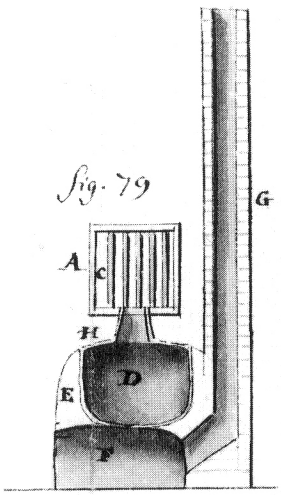

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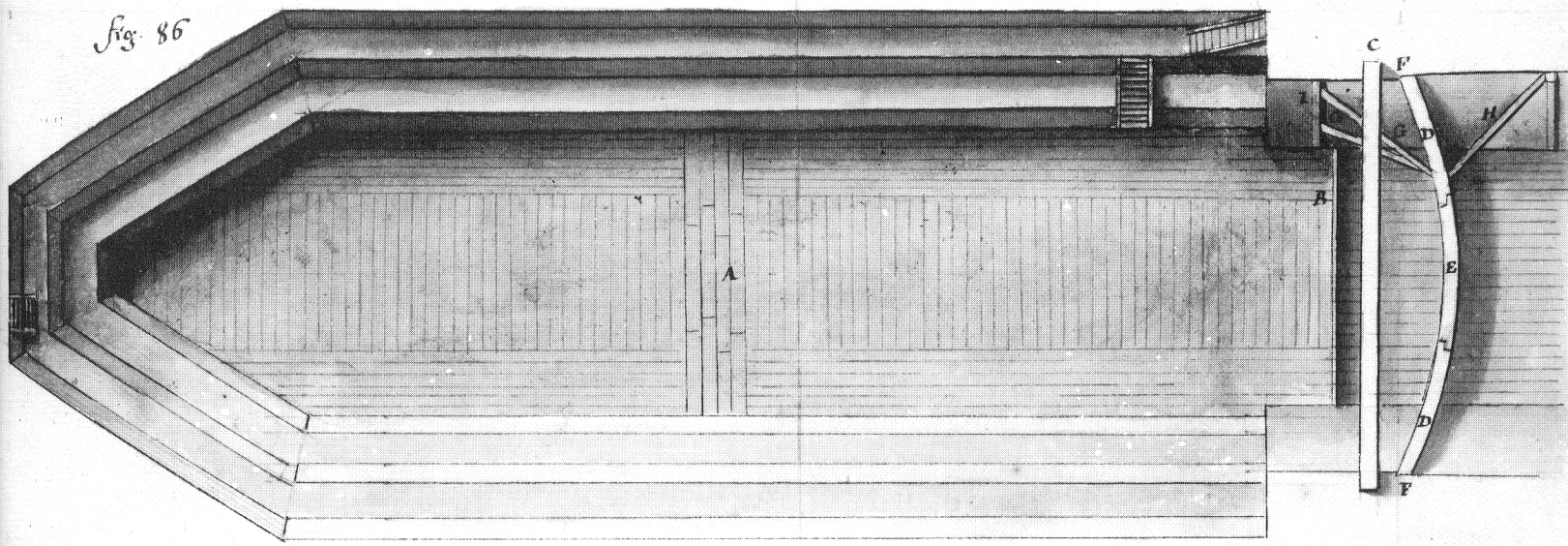
Fig. 86



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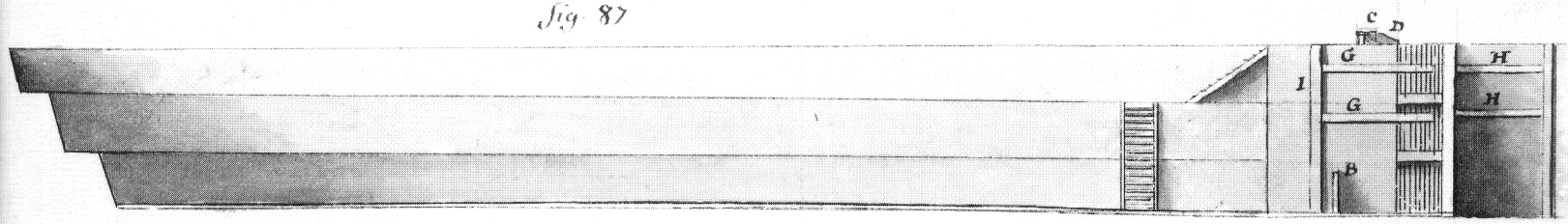

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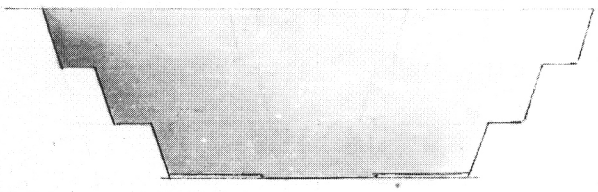

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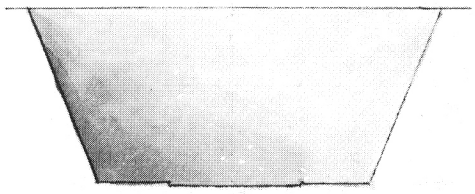
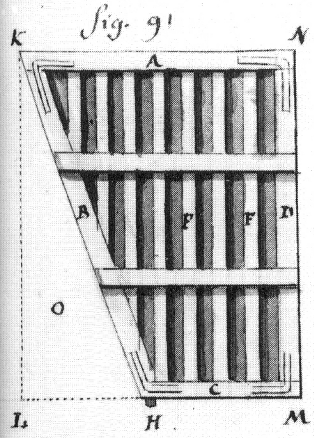


Fig. 91



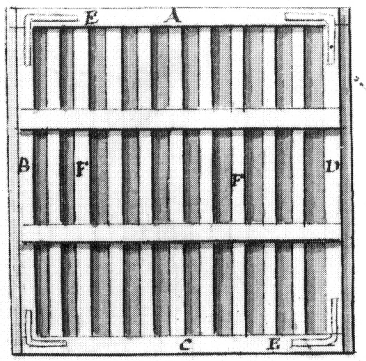
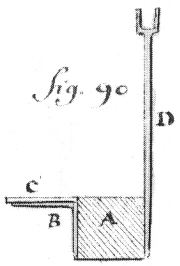


Fig. 92

Fig. 90





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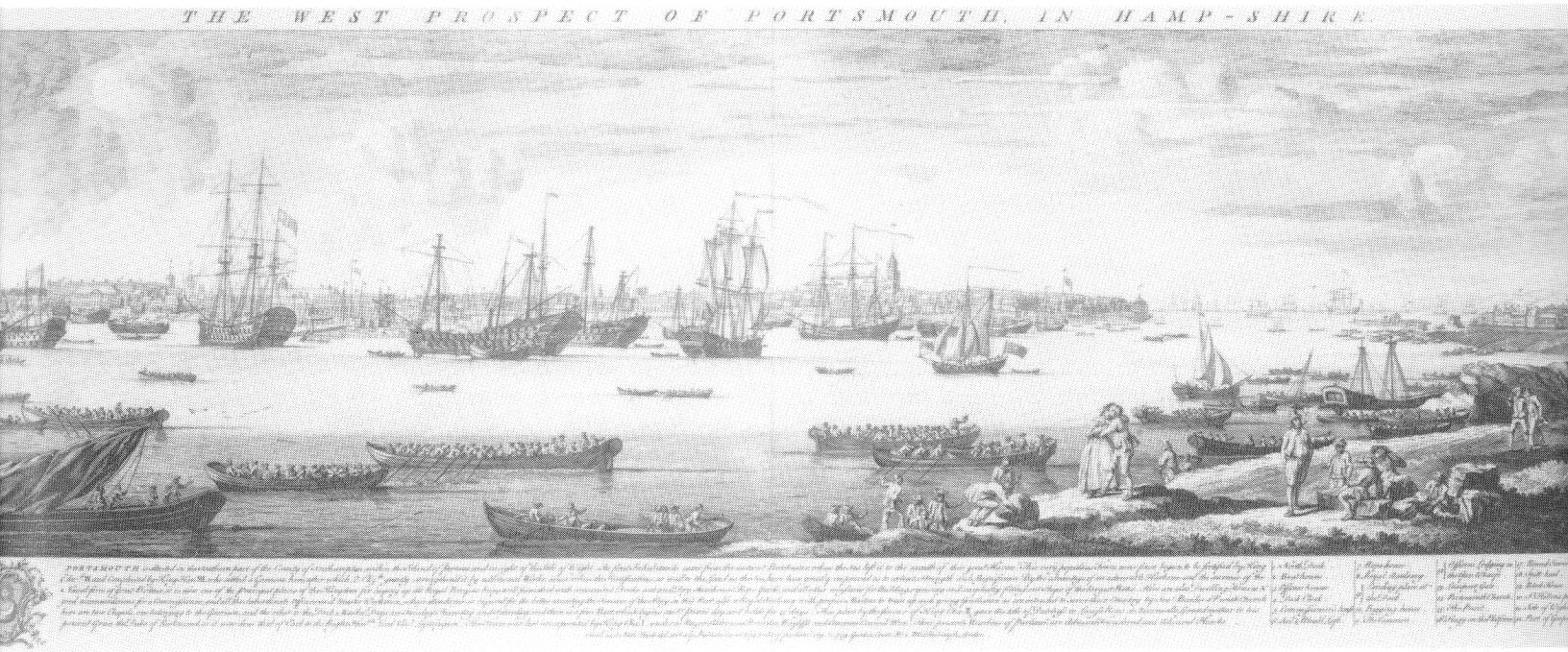
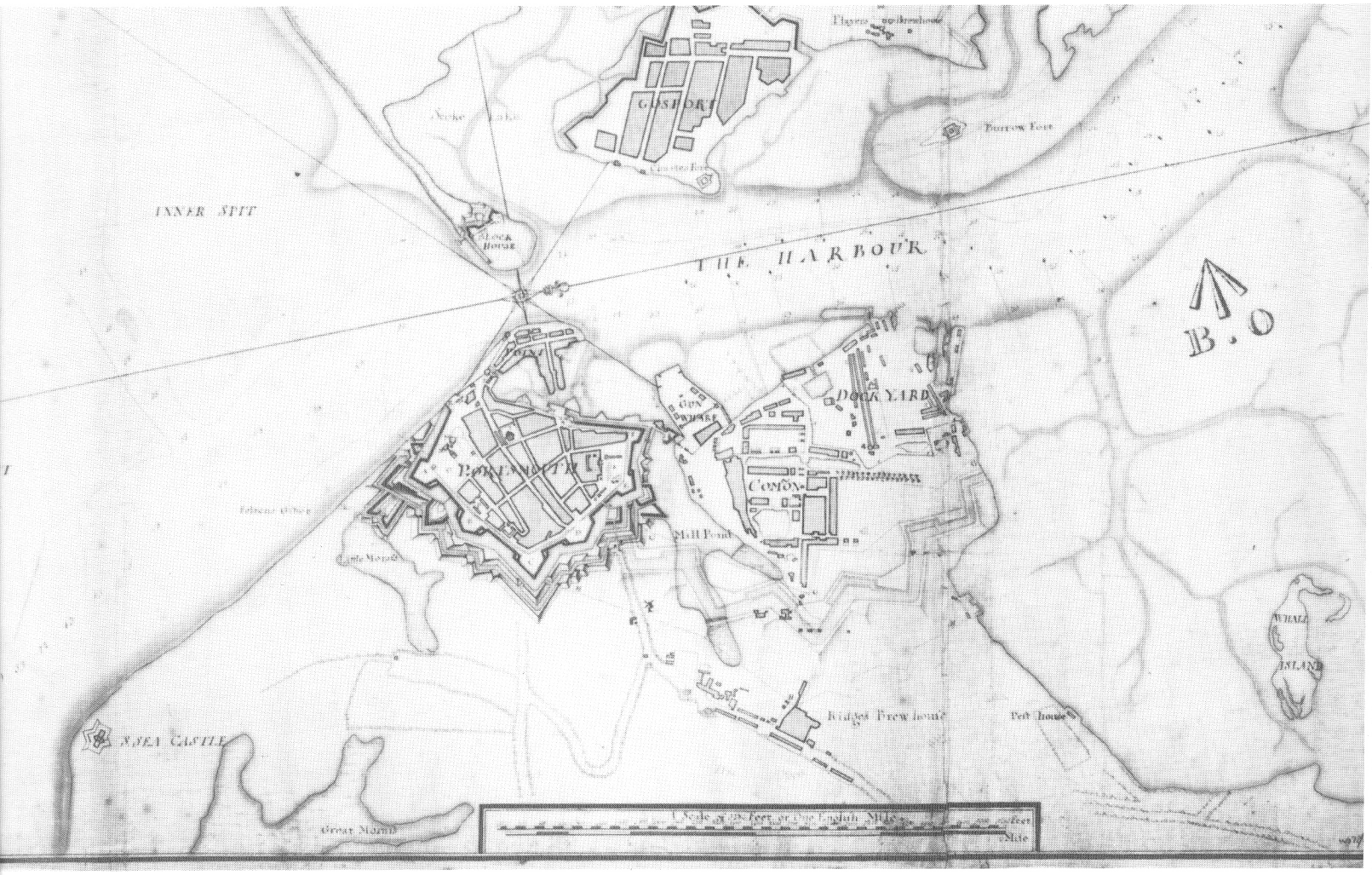


45. *View of Portsmouth, engraved by Samuel & Nathaniel Buck and dated 1749.*
(Courtesy National Maritime Museum, Greenwich)



46. *Plan of Portsmouth and the surroundings dated 1734.*
(Courtesy Public Record Office, Kew)

Further Remarks on the English Navy

Portsmouth Dockyard

CXXII. The English have a Naval Dockyard at Portsmouth[94], a town situated by the sea 24 leagues south-west of London. The dockyard has one building-slip and five docks[95] for repairing and graving their ships.

Building-Slip

The building-slip is about 160 feet [*52 m*] long and 36 feet [*11.70 m*] in breadth. Its depth at the water's edge is about 10 feet [*3.25 m*], and its upper end is level with the surrounding ground. They are building there at the moment* a ship of 70 guns which they began a month ago.

In May 1737.

Dry-Docks

One of the dry-docks is about 300 feet [*97.6 m*] long, 60 feet [*19.5 m*] broad, and 18 feet [*5.85 m*] deep; it is occupied by the **Victory**, a ship of 100 guns which is building. The second dry-dock is 250 feet [*81.3 m*] long, 55 feet† [*17.90 m*] broad and 14 feet [*4.55 m*] deep; they are building therein the **St George**, a ship of 90 guns.

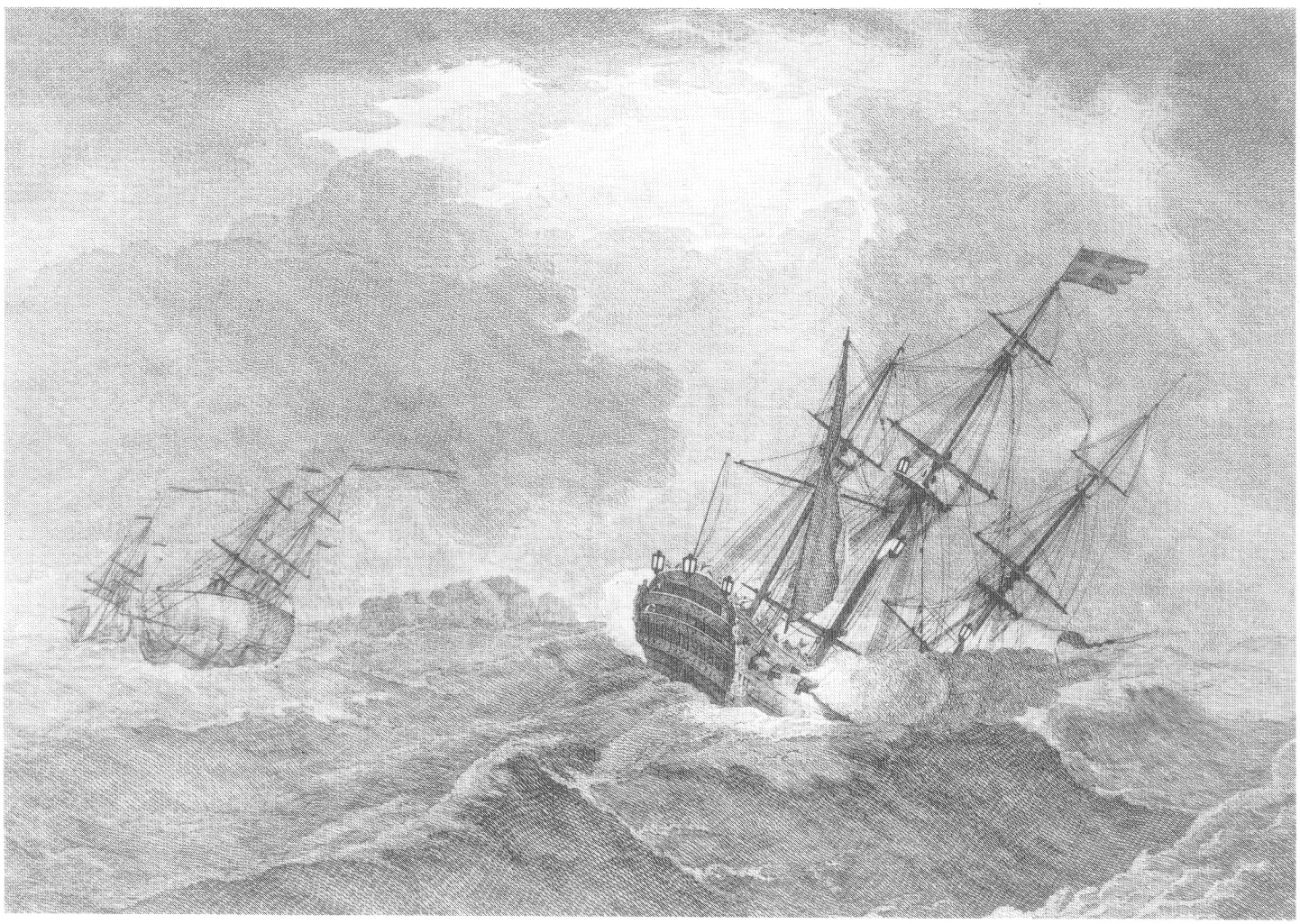
†.... 65 feet ....

The third dry-dock is 160 feet [*52 m*] long, 52 feet [*16.90 m*] boad, and 18 feet [*5.85 m*] deep. They are currently breaking up there a 60-gun ship. The fourth and fifth docks are each 150 feet long [*48.8 m*], 50 feet broad [*16.26 m*] and 18 feet [*5.85 m*] deep; in one of them they are repairing a ship of 50 guns, and in the other a frigate of 40 guns.

Three of these dry-docks have their walls built of dressed stone, and in the others they are lined with planks of oak; the gates are made up of three panels like those at Chatham, but the side-panels are fastened to the walls of the dock with hinges.

94. Of Portsmouth Daniel Defoe [*op.cit.*] writes: "*There is also this note to be put upon the two great arsenals of England, Portsmouth, and Chatham; namely, that they thrive by a war, as the war respects their situation (viz.) that when a war with France happens, or with Spain, then Portsmouth grows rich, and when a war with Holland, or any of the powers of the north, then Chatham, and Woolwich, and Deptford are in request.*"

95. We have not been able to establish with certainty the precise docks to which Blaise Ollivier refers; contemporary plans suggest that there were only four docks at Portsmouth, of which one was a double dock; these would appear to have been referred to as the South Dock, the Great Dock, the Great Stone Dock and the North Dock. Nor does the description tally exactly with what is known of the repair activities going on at the time, from which we know that the North Dock was occupied by the *Bedford* (60) from September 1736 until 1741, the Great Dock by the *Oxford* (50) from May 19th 1737 to June 16th, and the South Dock by the *Hector* (44) from April 5th to July 19th. However, leaving aside these questions, we are able to date with some accuracy Blaise Ollivier's visit as being sometime between May 19th (when the *Oxford* was taken into dock) and June 16th (when she was taken out again); since we know that he was at Chatham on May 2nd (when the *Union* was docked) and on May 17th (when the *Royal Sovereign* was floated out), it seems probable that he visited Portsmouth for perhaps two weeks beginning around May 20th to 25th. As explained in the Introduction, all these dates are according to the English rather than the French calendar, so that for Ollivier this would have been the fortnight beginning around May 9th to 14th, which accords well with the marginal note on this page.



47. Victory *in a storm. Anonymous engraving. This probably depicts the earlier vessel, burned in 1721. (Courtesy National Maritime Museum, Greenwich).*

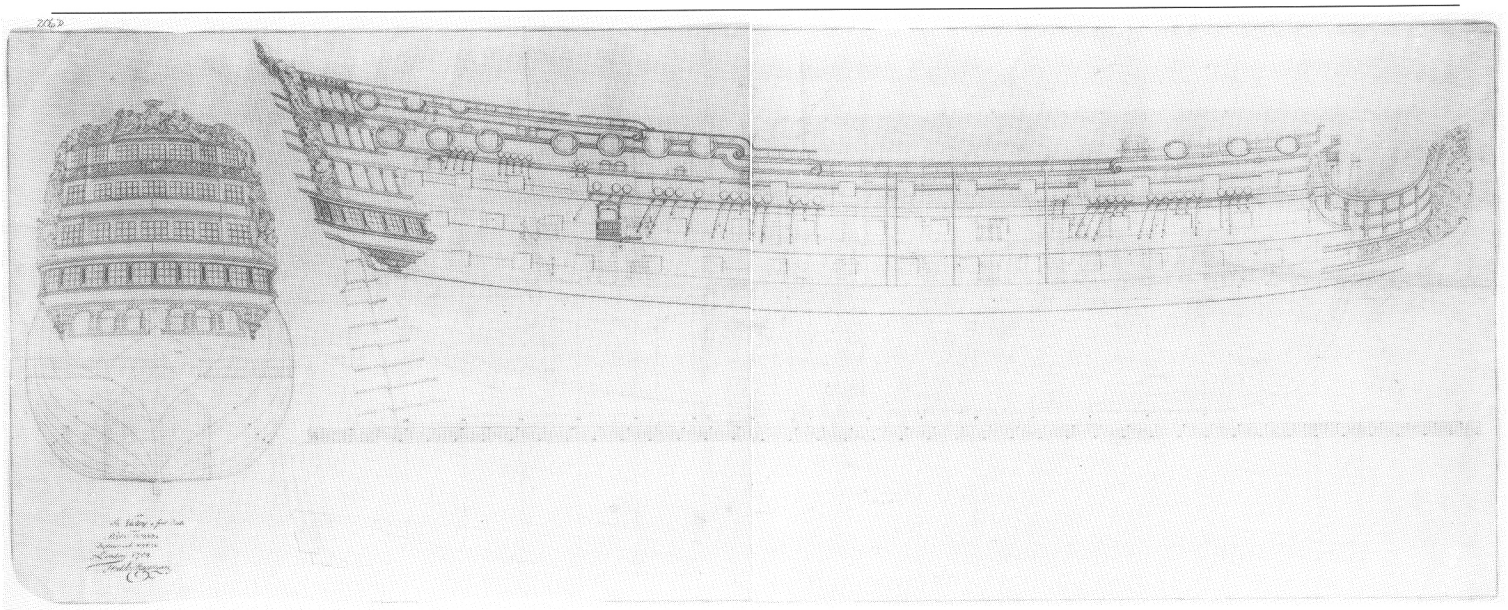
Apart from these docks there are three other basins which each measure about 300 feet [*97.6 m*] square, and which serve as mast-ponds for mast-timber; they also leave shipbuilding-timber there to soak, as I explained in my Remarks concerning Chatham Dockyard.

The store-houses at Portsmouth are well constructed and are larger than those at Chatham; as in the other Dockyards, there are several covered areas where plank is stacked, and where divers workshops are also set up, such as mast-houses, houses for building cutters and ships' boats, etc[a].

The *Victory*, Ship of 100 Guns

CXXIII. The ship of 100 guns called the **Victory**[96] which they are building in one of the dry-docks at Portsmouth has the same length, the same breadth and the same depth in hold as the **Royal Sovereign**. She has 14 gunports on either side on the gundeck, 15 gunports on the middle deck and on the upper deck, 3 on the forecastle, 7 on the quarterdeck and 2 on the poop[97].

96. **Victory**: Not Nelson's *Victory*, which was launched in May 1765, but her predecessor; originally launched at Portsmouth in 1675 as the *Royal James* (1st Rate, 100), 163′0″ x 45′6″, 1486 tons b.m., she was renamed the *Victory* in 1691. She was rebuilt in Chatham in 1695, renamed the *Royal George* on October 27th 1714 but reverted to her former name of *Victory* on September 9th 1715. Accidentally burnt, she was taken to pieces in April 1721, and her rebuild was started five years later. According to the *Progress Books*, she had therefore been on the stocks not for three years but since March 6th 1726, and she was launched on February 23rd 1737 (i.e. in February 1738 by Ollivier's reckoning – see Introduction); her builder was Joseph Allen, and she measured 1921 tons b.m. and 174′6″ x 50′6″. She was wrecked on October 5th 1744 on the Casquets.
97. On either side.



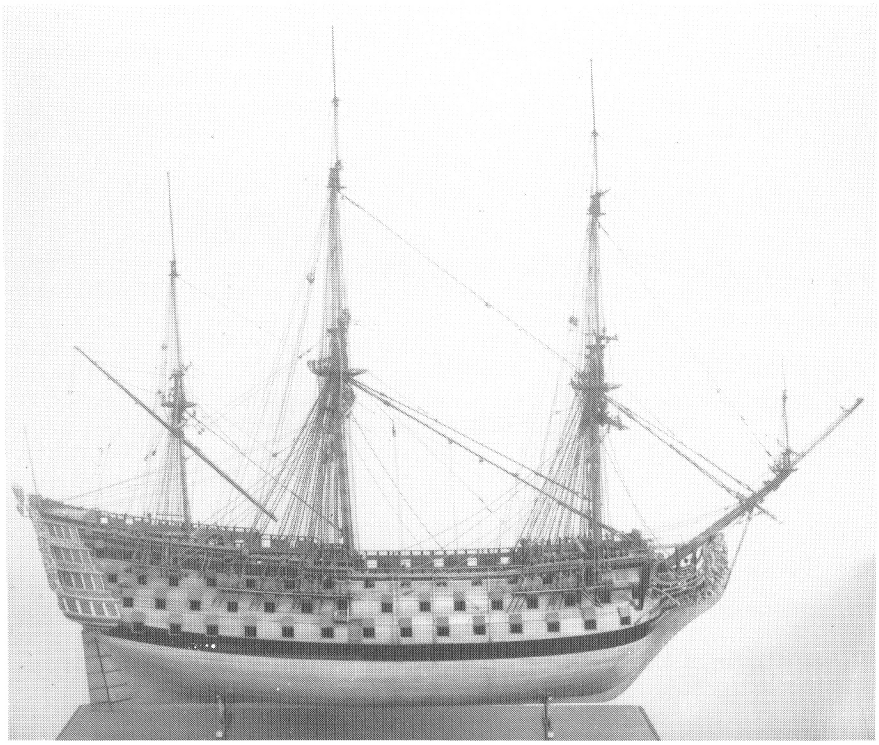
48. *Draughts of the* Victory *of 1737, showing the four galleries to which Ollivier refers. Interestingly, these draughts bear the signature of Fredrik af Chapman, and the date 1754 (when he was in England). Since the* Victory *was wrecked in 1744, these are presumably copies of her original draughts. (Courtesy National Maritime Museum, Greenwich)*

This ship has been three years on the stocks and is now nearly finished. They are fitting out her hold and upper works; her upper deck, forecastle and quarterdeck and poop are complete and caulked, as are her sides and upper works. They have not yet started to caulk her bottom.

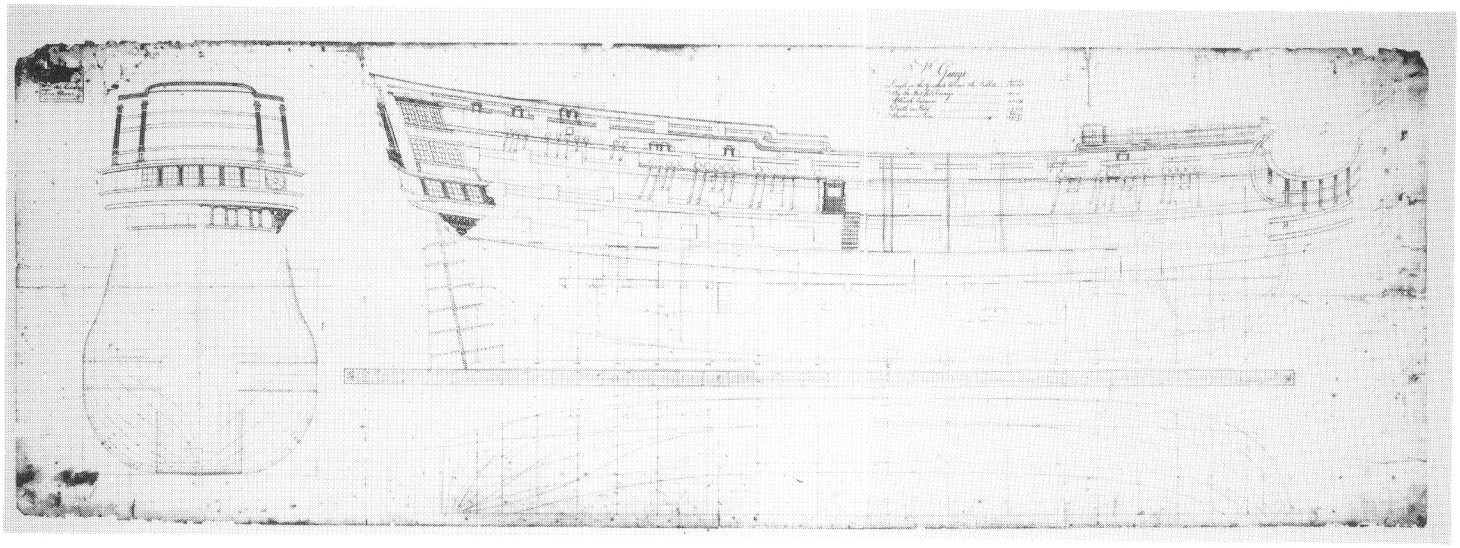
The midship bend of this ship is rounded; her floors are full and have a fair run; she has great fullness at her height of breadth; her capacity is very great, yet her upper works are scarce suitable for her lower body, for she is deep-waisted with much sheer†. The headroom between the gundeck and the middle deck is 5 feet 8 inches [*1.84 m*], between the middle and the upper deck 6 feet 2 or 3 inches [*2.00 - 2.03 m*]. There is 6 feet 8 inches [*2.17 m*] beneath the quarterdeck, 6 feet [*1.95 m*] beneath the forecastle, 6 feet 2 inches [*2.00 m*] beneath the poop, and 5 feet 4 inches [*1.73 m*] beneath the poop-royal. Above the poop-royal is an escutcheon of which the height is not yet fixed†, yet from the height of the taffarel-standards set up on the poop-royal and which will form part of its framework I judge that it will rise three feet [*97.5 cms*] at the least. Adding all these heights one to the other I find that the poop of the **Victory** is two feet and

†.... for they are too high, with too much sheer, and do not have a fair curve....

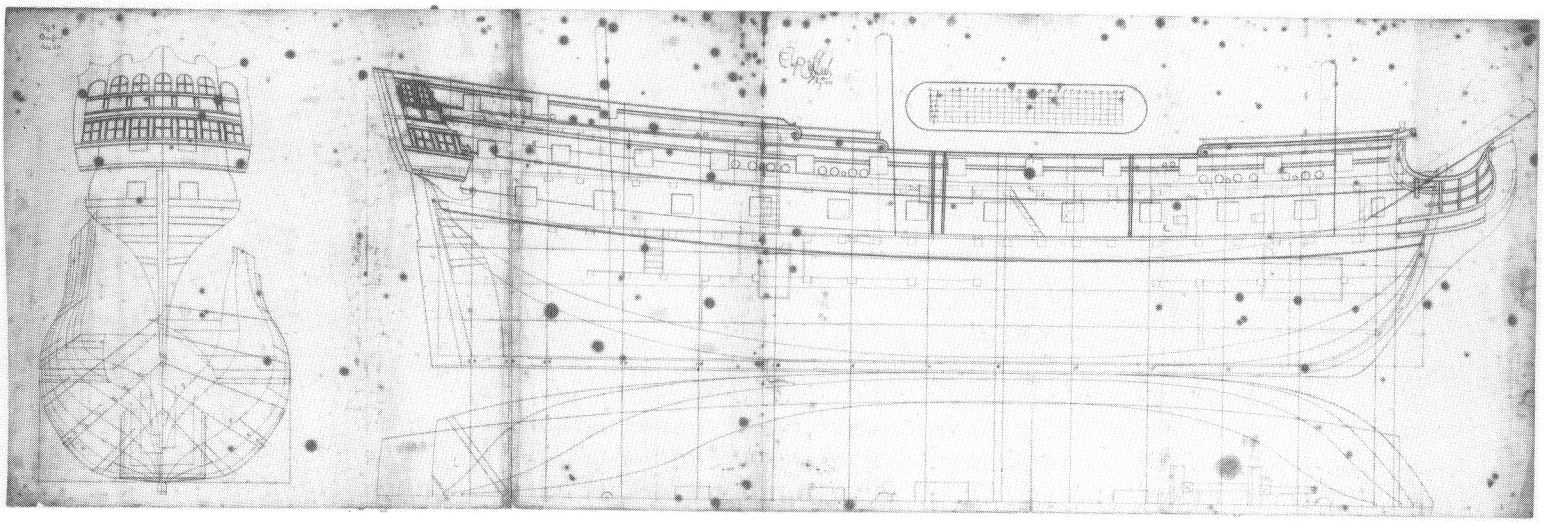
†.... an escutcheon the height of which I do not as yet know ....



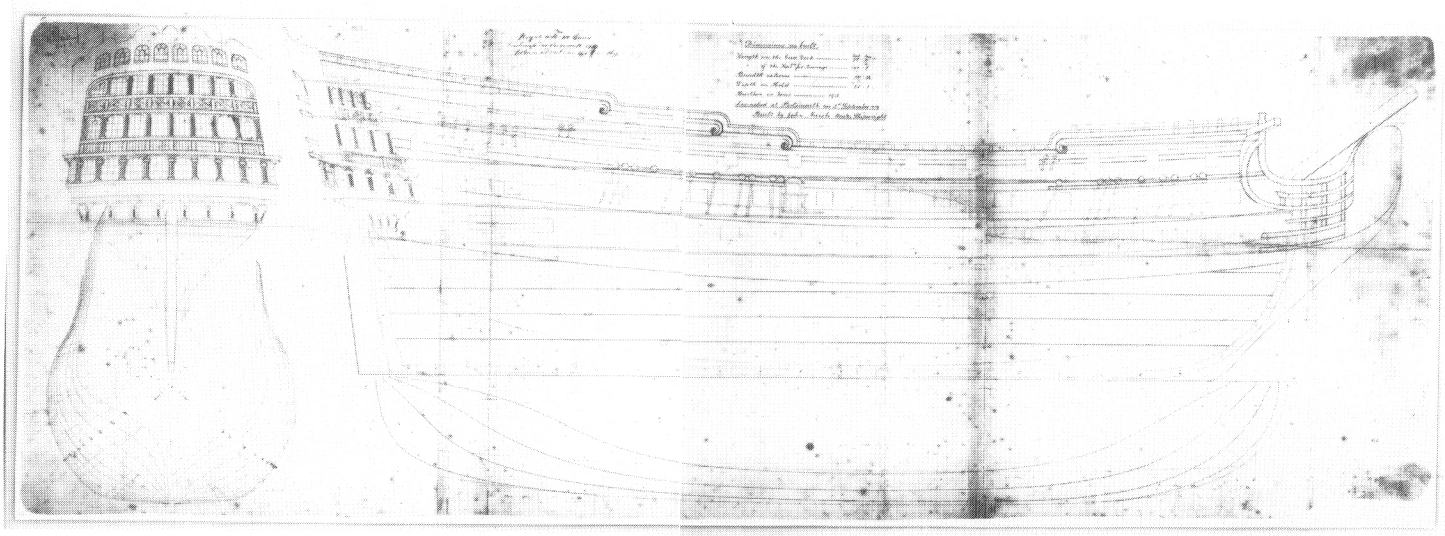
49. *Model of* Victory *as built in 1737. (Courtesy National Maritime Museum, Greenwich)*



50. *Draughts of the* St George *of 1733. (Courtesy National Maritime Museum, Greenwich)*



51. *Draughts of the* Oxford, *identified as being the 50-gun ship seen by Ollivier. (Courtesy National Maritime Museum, Greenwich)*



52. *Draughts of the* Royal William *of 1719. (Courtesy National Maritime Museum, Greenwich)*

a half [*81 cms*] higher above the gundeck than was that of the **Royal-Louis**[98]. The wales and still more the drift rails have a steep sheer at the stern and also forward, so that the bulwarks of the forecastle at the beakhead bulkhead are more than a foot higher than at the entry-port. The quarterdeck extends forward to within 8 feet [*2.60 m*] of the mainmast; the poop runs 3 feet [*97.5 cms*] forward of the mizen, the forecastle is about 30 feet [*9.75 m*] long, and the poop-royal 17 feet [*5.52 m*].

The St George, Ship of 90 Guns

The 90-gun ship called the **St George**[99] which is also on the stocks at Portsmouth is fully timbered. They are planking her up slowly to allow time for her frames to dry out. Her underwater lines seem to me to be good, and even superior to those of the **Victory**.

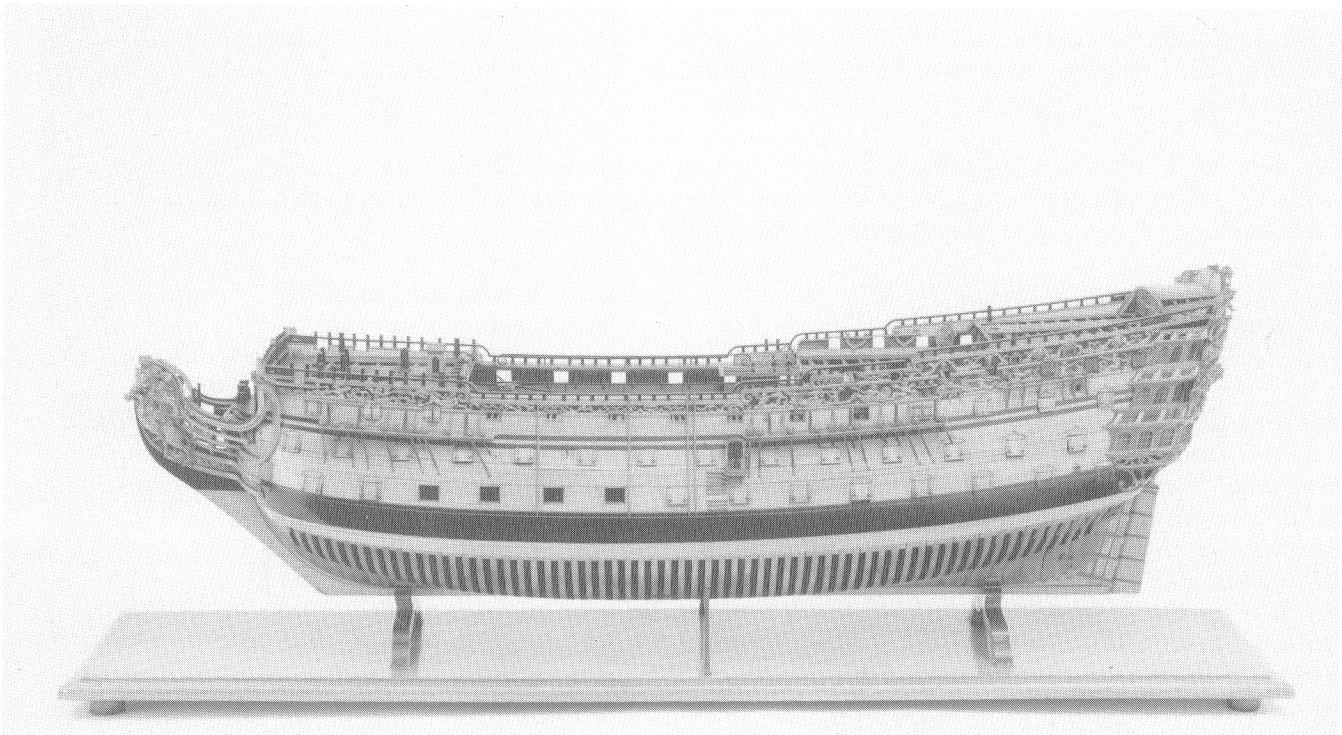
Ship of 50 Guns and Frigate of 40

The 50-gun ship[100] and the 40-gun frigate[101] which they are repairing in dock at Portsmouth seemed to me to be very poorly built. In both vessels the floors are excessively full, particularly in the rising-floors of the afterbody.

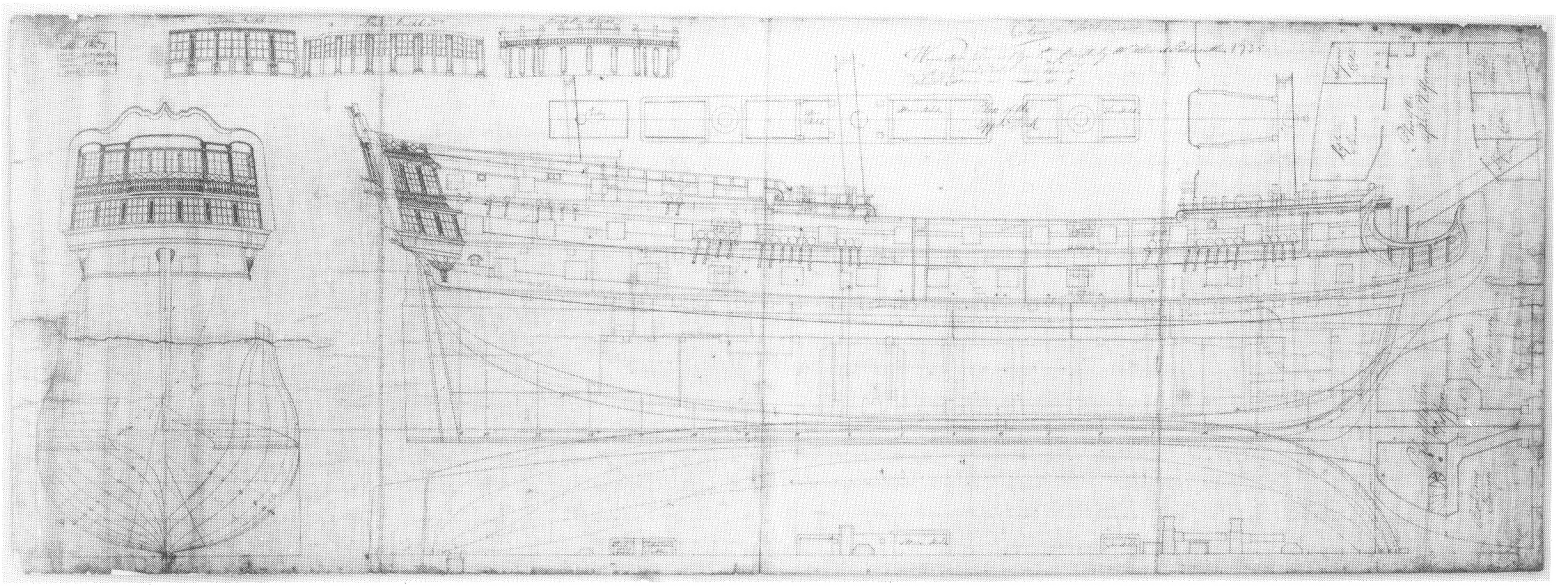
Other Vessels

Among the ships which are off Portsmouth and on board which I have been, those with which I was the most satisfied are the **Royal William**[102] of 100 guns, the **Lancaster**[103] of 80 guns, and the **Worcester**[104] of 60 guns. The **Royal William** has never been to sea. I was told that she is similar in her underwater lines to the **Victory**. I found her upper works much better executed; she is less deep-waisted, her wales have a better hanging, and she is not so high in her deadworks. The **Lancaster** is at present ready for sea; her lower battery is rather high out of the water, and a foot [*32.5 cms*] higher forward than aft. Her upper works are well executed; she has above her quarterdeck but a poop which is 10 feet [*3.25 m*] long and 5 feet [*1.63 m*] high, so that she appears flush-decked, even though she has three decks shorter than those of our 74-gun ships. The **Worcester** has but recently[105] been launched; she is completely fitted out. She is the English ship whose upper works, stern, bow, and indeed every thing which can be seen above the water satisfied me the most. They have a high opinion here of her underwater lines.

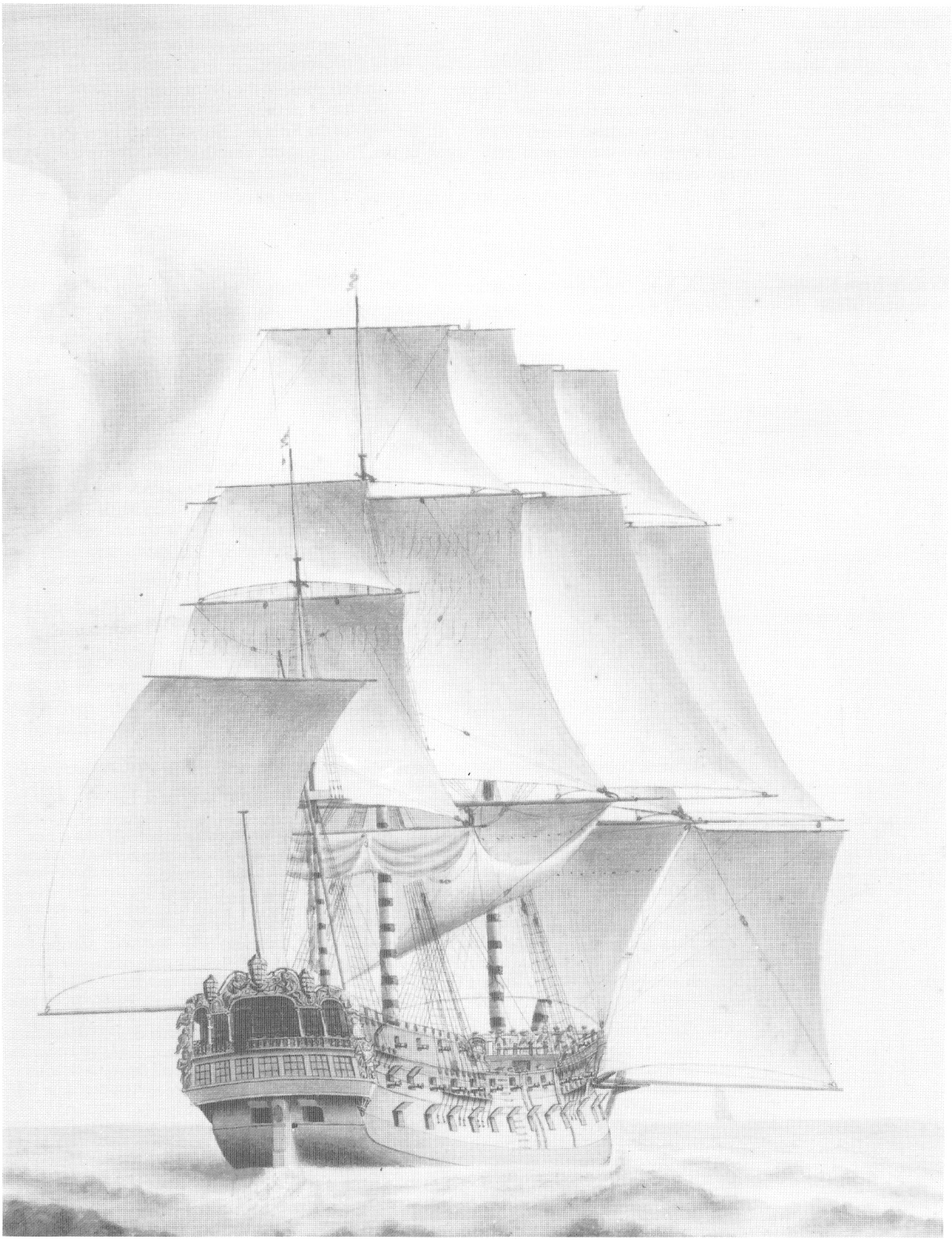
98. **Royal-Louis**: First Rate, 124 guns, built by Blaise Ollivier himself at Brest. Length 61.75m, breadth 17.28m, depth in hold 7.80m. Armed with 32 36-pdrs (i.e. with 16 gunports on the lower deck), 34 24-pdrs, 34 12-pdrs, and 16 8-pdrs on the quarterdeck and forecastle. The ship was never completed, but caught fire and burned on the stocks in 1742.
99. **St George**: formerly the *Charles* (1st Rate, 96), she was launched at Deptford Dockyard on March 3rd 1668 as 1129 tons b.m., 163′0″ x 42′6″. Renamed the *St George* in 1687, she was rebuilt at Portsmouth in 1701 as 1470 tons b.m. Taken to pieces in November 1726, her "rebuild" began at Portsmouth on February 2nd 1733, the builder being Joseph Allen; when this rebuild was completed on April 3rd 1740, she measured 1655 tons b.m., 166′0″ x 48′6″, and had cost £33,899-11-2. She was finally broken up in September 1774.
100. Ship of 50 guns: according to the *Progress Books*, this was the *Oxford*, 4th Rate (54), 677 tons b.m., 127′0″ x 34′6″. Originally built by Bailey of Bristol in 1674, she was rebuilt at Deptford in 1702 as 675 tons b.m. and then rebuilt again at Portsmouth in 1727 as 767 tons b.m. and 50 guns. She was finally broken up at Plymouth in October 1758.
101. Frigate of 40 guns: Again according to the *Progress Books*, this was the *Hector*, built by Burchett of Rotherhithe and launched on February 13th 1702 as a 5th Rate (44), 493 tons b.m., 116′6″ x 31′0″. She was rebuilt in 1721 at Plymouth as 607 tons b.m. and broken up in 1742.
102. **Royal William**: formerly the *Prince*, (1st Rate, 100), built at Chatham in 1670 as 1395 tons b.m., 167′0″ x 45′6″; she was rebuilt in 1692 and renamed the *Royal William*, as 1568 tons b.m. and 167′6″ x 47′0″. She was rebuilt again at Portsmouth in 1719 as 1918 tons b.m. and reduced to 84 guns; she became a guardship in about 1790 and was finally broken up in August 1813.
103. **Lancaster**: launched by Wyatt of Bursledon on April 3rd 1694, she measured 1198 tons b.m and 156′0″ x 42′0″. She was rebuilt at Portsmouth in 1722 as 1366 tons b.m. According to Colledge [*op.cit.*], her ultimate fate is unknown unless she was rebuilt at Woolwich as the next *Lancaster* in 1749.
104. **Worcester** 4th Rate (60), launched Portsmouth Dockyard December 20th 1735 as 1061 tons b.m. and 144′0″ x 41′6″. She was broken up in Plymouth in 1765.
105. In fact, some 18 months previously. See previous Note.



53. *Model of the* Royal William. *(Courtesy National Maritime Museum, Greenwich)*



54. *Exceptionally detailed draught of the* Worcester *of 1735.*
Close examination with a glass reveals the deck plans, and arrangement of the galleries.
(Courtesy National Maritime Museum, Greenwich)



55. *Watercolour (c. 1745) of the* Worcester, *attributed to John Hood. (Courtesy National Maritime Museum, Greenwich).*

Concerning the Strength and Rate of the English Ships

†.... for two, three or four more guns ....

CXXIV. The English distinguish their ships as having 100 guns, 90, 80, 70, 60, 50, 40, 30, and 20, although they always pierce them for one or two† more guns on either side above this number. As we do, they also divide their ships into several Rates. In the First Rate are the ships of 100 guns, in the Second Rate those of 90 and 80 guns; in the Third Rate are those of 70 and 60; in the Fourth Rate those of 50 and 40 guns; they call these last ships frigates[106], as they do also their vessels of 30 and 20 guns. All the ships of the First and Second Rates have three decks and three complete tiers of guns; those of the Third and the Fourth Rates have two decks and two complete tiers of guns; the frigates of 30 guns have a half-battery on the gundeck and a complete battery on the upper deck, while those of 20 guns have but a battery on the upper deck.

Length from Rabbet to Rabbet of the English Ships

CXXV. The English measure the length of their ships from the rabbet of the stem to the rabbet of the sternpost on the gundeck, as many Builders do in France today, and they call that length as we do the length from rabbet to rabbet.

The English ships of 100 guns are 174 feet [*53.04 m*] from rabbet to rabbet, English measure.

Those of 90 guns,	166 feet
Those of 80 guns,	156 feet
Those of 70 guns,	151 feet
Those of 60 guns,	144 feet
Those of 50 guns,	134 feet
Their frigates of 40 guns,	124 feet
Those of 30 guns,	114 feet
And those of 20 guns,	106 feet

These measurements[107] were given to me by Mr Ward, Master Shipwright at Chatham, by Mr Allen[108], Master Shipwright at Portsmouth, and by Mr Fellows[109], Assistant Shipwright at Portsmouth. I have reduced them to French feet in the following table. The English foot is to our foot as 500 is to 533.

106. **Frigates**: These were distinguished as "frigates" and "light frigates" respectively the same appellations beiing adopted in France at this time. They were not what we would call "true" frigates, vessels with only one full tier of guns on the "upper" deck, the prototype of which was the *Médée*, designed by Ollivier himself, and launched in 1744. The first English frigates of this type were the *Lyme* and the *Unicorn*, ordered on the lines of the captured French privateer *Tygre* in 1747. The term frigate here denotes merely a light, fast cruiser.
107. The list of dimensions given by Ollivier makes interesting reading when compared with those laid down by the Establishments (see Introduction). The lengths correspond to those laid down in the 1719 Establishment, and unchanged by the 1733 Proposals, except for those of 90-gun ships (1733) and 80-gun ships (1706). As will be seeen from the footnotes on the following pages, the dimensions which he collected are something of a mixture (lengths from one Establishment, breadths or depths in hold from another.
108. **Allen**: Joseph Allen, also spelt Allin. He is sometimes confused with another Joseph Allen, who may have been his father, and who was Master Shipwright at Deptford until 1715. Joseph Allen junior is first recorded as Assistant to the Master Shipwright at Deptford from December 4th 1722 to November 2nd 1726; his next position was as Master Shipwright at Plymouth, a post which he held for only six weeks, before being appointed to the position in which Ollivier found him as Master Shipwright at Portsmouth. He appears to have held this post until August 1st 1742, when he moved back to Deptford as Master Shipwright, the position his father (?) had occupied thirty years previously. Deptford was the "senior" Dockyard, but Allen did not stop there and was promoted on July 11th 1746 to the most senior position of all, that of Surveyor of the Navy, initially jointly with and finally (in 1749) succeeding Sir Jacob Ackworth who had held the post since 1715.
109. **Fellows**: Thomas Fellowes was Assistant to the Master Shipwright at Woolwich from August 16th 1718 to December 3rd 1722. He then became Second Assistant to the Master Shipwright at Portsmouth, and was promoted to the position in which Ollivier knew him on December 14th 1726. From Portsmouth he was promoted to the position of Master Shipwright at Plymouth on August 1st 1742, then to be Master Shipwright at Woolwich on June 11th 1746, and finally to the senior position at Deptford on May 27th 1752, a post which he held until his death on March 11th 1753.

Length of the English ships, measured on the gundeck, from rabbet to rabbet, French measure

Ship of 100 guns	163′ 1½″	[*53.04 m*]
of 90 guns	155′ 6″	[*50.60 m*]
of 80 guns	146′ 3″	[*47.55 m*]
of 70 guns	141′ 7″	[*46.02 m*]
of 60 guns	135′ 0″	[*43.89 m*]
of 50 guns	125′ 8″	[*40.84 m*]
of 40 guns	116′ 3″	[*37.80 m*]
of 30 guns	106′ 10″	[*34.75 m*]
of 20 guns	97′ 8″	[*32.31 m*]

It may be seen from these dimensions that the largest English ships are about 9 feet [*2.93 m*] shorter than our First Rates of the First Class, such as the **Royal-Louis** was, and as the **Foudroyant**[110] is today, whose length from rabbet to rabbet, measured as the English do it, and supposing the rabbet of the stem to be flush with the inner face of this timber, is about 172 feet [*55.93 m*].

The length which we give to our ships of 100 guns and of 90 is the same as in the English ships of the same strength. We build our 74-gun ships 5 or 6 feet [*1.62 - 1.95 m*] longer than the English 80-gun ships; our 60-gun ships the same length or 2 or 3 feet [*66 - 97 cms*] longer than the English ships of 70 guns. We give to most of our ships of 50 guns the length which the English give to their 60-gun ships. Our frigates of 40 and 30 guns are about 2 or 3 feet longer than those of the English. We are nearly in agreement on the length of our frigates of 20 guns.

Length of Keel

CXXVI. We measure the length of the keel from the angle of the forefoot to outside the heel of the sternpost as in **A** to **B**, **Fig. 93**. The English measure it from the point where the rabbet of the stem meets the rabbet of the keel to the rabbet of the sternpost, as in **C** to **D**. This length is in their ships of all Rates and in their frigates about 9 ½ inches for every foot of the length from rabbet to rabbet on the gundeck, and in consequence greatly shorter in proportion to that of most of our ships.

The English ships which measure 174 English feet from rabbet to rabbet are 147 feet 7 inches† [*44.98 m*] in the keel as they measure it in the manner I have explained.

†.... *140 feet 7 inches* .... [this the correct figure. Ed.]

Those of 166 feet are	132′ 5″	[*40.36 m*] in the keel
Those of 156 feet are	128′ 2″†	[*39.06 m*]
Those of 151 feet are	123′ 2″	[*37.54 m*]
Those of 144 feet are	117′ 7″	[*35.84 m*]
Those of 134 feet are	109′ 6″[111]	[*33.38 m*]
Those of 124 feet are	101′ 6″	[*30.94 m*]
Those of 114 feet are	90′ 6″	[*27.58 m*]
Those of 106 feet are	87′ 9″	[*26.75 m*]

†.... *128 feet 10 inches* .... [the figure in the table is the correct one. Ed.]

These dimensions were given to me by the Shipwrights named in the previous Article.

Our ships which have the shortest keels are longer in the keel than the English ships by a 30th part, and we have ships which are a 12th part longer in the keel when measured from the angle of the forefoot, but this difference is not quite so great if measured as the English do it.

110. **Foudroyant**: First Rate of 110 guns, and the only 3-decker in the French Navy at this time. She was built at Brest by Hélie in 1724. Length 173′10″ (French measure), breadth 47′0″, depth in hold 22′10″. Armed with 30 36-pdrs (originally intended for 30 48-pdrs!), 32 18-pdrs and 28 12-pdrs, plus 16 8-pdrs and 4 6-pdrs on the quarterdeck and forecastle. She was struck from the lists in 1742, without ever having served.

111. Both this and the next figure are incorrect: they should read 109′8″ and 101′8″. All of these dimensions correspond to those laid down by the 1719 Establishment.

Rake of the Stem and of the Sternpost

CXXVII. The keels of our ships being proportionately longer than those of the English ships, the latter have necessarily a greater rake of the stem and of the sternpost. The English shipwrights divide the difference between the length in the keel and the length from rabbet to rabbet into five or six equal parts, of which one is allowed for the rake of the sternpost and the other parts are taken together for the rake of the stem. Thus a ship measuring 144 feet from rabbet to rabbet and 117 feet 7 inches in the keel will rake 22 feet [*6.71 m*] in the stem and 5 feet 5 inches [*1.65 m*] in the sternpost, and so on for the other ships. Yet this rake of the stem and of the sternpost are measured from the rabbet, and not from the end of the keel, so that they will be found to be somewhat less when measured as we measure it. Nevertheless, they are both much greater than in most of our ships, and we do not know this in France, since I have been told for the last twenty years that the English rake their stems and sternposts less than we do.

I should not presume to say that the scant rake of the stem and sternpost in our French ships is to be preferred to the rake found in the English ships, since we have in France excellent ships of all sizes where these dimensions have been pushed still further than in the English ships . Nor would I say that the English are right to give as much rake to stem and sternpost as they do, for that would be to criticise those French Builders who have reduced this rake to the degree which is to be found in most of our French ships today. Yet since after long investigation which I started many years ago I have never found any solid reason upon which to base the need for either a great or a small raking[112], I will leave this question for discussion by those Builders who have decided on one or on the other dimension. I have sought here only to report the rake which the English shipwrights give to stem and sternpost, in order to contradict the opinion which we have in France that the English ships have less rake than do ours.

Breadth of the English Ships

CXXVIII. The English measure the breadth of their ships at the midship bend on the gundeck to inside of plank, as many Builders do in France,

Their ships of 174 feet length from rabbet to rabbet measure 50 feet [*15.24 m*] in breadth.
Those of 166 feet, 47 feet 9 inches [*14.55 m*].
Those of 156 feet, 44 feet 6 inches [*13.56 m*].
Those of 151 feet, 41 feet 6 inches [*12.65 m*] according to the old manner of building, and 43 feet [*13.11 m*] according to the new.
Those of 144 feet, 39 feet 6 inches [*12.04 m*] according to the old manner of building, and 41 feet 5 inches [*12.62 m*] according to the new.
Those of 134 feet, 36 feet [*10.97 m*] according to the old manner of building and 38 feet 6 inches [*11.73 m*] according to the new.
Those of 124 feet, 33 feet 2 inches [*10.11 m*] according to the old manner of building, and 35 feet 8 inches [*10.87 m*] according to the new.
Those of 114 feet, 30 feet 6 inches [*9.30 m*].
Those of 106 feet, 28 feet [*8.53 m*].[113]

When I compare these breadths to those which we give to our ships, I find that the English ships measuring 156 feet to 174 feet on the gundeck are proportionately $\frac{1}{24}^{th}$ broader in the beam than our ships of the same strength; that those of the old manner of building of 151 feet on the gundeck are the same or near the same breadth as our ships of the same length, but that those of the new manner of building are $\frac{1}{28}^{th}$ broader. I find that the English ships of the old manner of building of 144 feet on the gundeck are the same breadth as some of our ships and $\frac{1}{36}^{th}$ broader than most of our ships of that Rate†; and those of the new manner of building are as broad in proportion as those of 156 feet to 174 feet on the gundeck. I find that the English ships of 124 feet to 134 feet on the gundeck of the old manner of building are the same breadth as our own ships, while those of the new are about $\frac{1}{14}^{th}$ more broad. The English frigates of 106 to 114 feet are about the same breadth as are our ships.

†.... than most of our ships of that length ....

112. As noted in the Introduction, Ollivier in fact built two ships (the *Mars* in 1739 and the *Alcide* in 1742), in which he did away entirely with the rake of the stem and post.
113. This last figure should read 28′4″. Similarly, ships of 144 feet (60-gun ships) measured 39′0″ in breadth, not 39′6″, and new ships of 151 feet (70's) measured 43′5″, not 43′0″. All the "old" dimensions in this table correspond to the 1719 Establishment, the "new" to the 1733 Proposals.

The English are right to build their three deck ships broader than we do, especially those of 156 feet on the gundeck, since their upper works being much higher than those of our ships, and likewise the guns of the forecastle, the quarterdeck and the poop, these ships would be crank did they not have a great breadth to give them support. Yet from this great beam arises an inevitable disadvantage: which is a great tendency to crab with the wind and thus to make leeway when sailing close-hauled. It would be yet more desirable to impart the opposite qualities to the English ships than to our own, which since they stand less high out of the water present a smaller surface to the wind. I should explain that what I have called in this Article the old manner of building is a manner of building which they have followed for about the last 30 years, and upon which most of the English ships which exist today are built. Before that time the English gave less beam to their ships, and they have even built some ships since that time of lesser beam; but I have called the manner which they have practised for about the last 30 years the old manner of building, since in the last few years there is a new manner of building about which I shall speak in a separate Article.[114]

CXXIX. The English shipwrights measure as we do the depth in hold from the top of the keel to the horizontal line of deck at the top of the beams. They give 20 English feet to 20 feet 6 inches[115] [*6.10 - 6.25 m*] depth in hold to their ships of 100 guns;

Depth in Hold Amidships

19 feet	6 inches [*5.94 m*]	to their ships of 90 guns;
18 feet	2 inches [*5.54 m*]	to those of 80 guns;
17 feet	4 inches [*5.28 m*]	to those of 70 guns;
16 feet	11 inches [*5.16 m*]	to those of 60 guns;
15 feet	2 inches [*4.62 m*]	to those of 50 guns;
14 feet	[*4.27 m*]	to those of 40 guns;
12 feet	[*3.66 m*]	to those of 30 guns;
9 feet	2 inches [*2.79 m*]	to those of 20 guns.

In order to give an accurate idea of the ratio of depth in hold to length on the gundeck and to beam, I have drawn up the following Table in which I have marked these three dimensions, reduced to French feet[116].

	Length on the Gundeck	**Breadth Amidships**	**Depth-in-Hold**
Ship of 100 guns	163′ 1″ 6‴	46′ 10″ 6‴	18′ 9″ 0‴
			19′ 2″ 6‴
Ship of 90 guns	155′ 6″	44′ 9″	18′ 3″ 3‴
Ship of 80 guns	146′ 3″	41′ 9″	17′ 0″ 6‴
Ship of 70 guns	141′ 7″	38′ 11″ 6‴	16′ 7″ 8‴
New Building		40′ 3″ 9‴	
Ship of 60 guns	135′ 0″	37′ 6″ 6‴	15′ 11″ 7‴
New Building		28′ 10″ 2‴	
Ship of 50 guns	125′ 8″	33′ 9″	14′ 2″ 9‴
New Building		36′ 1″ 6‴	
Frigate of 40 guns	116′ 3″	31′ 1″ 4‴	13′ 1″ 6‴
New Building		33′ 5″10‴	
Frigate of 30 guns	106′ 10″	28′ 7″ 3‴	11′ 3″
Frigate of 20 guns	97′ 8″	25′ 5″	8′ 7″ 4‴

There is a great difference between the depth in hold of the English ships and that of our own. We use the same proportion in all our ships from 50 to 100 guns, either at one half of the beam, or at the least $^{18}/_{39}{}^{ths}$ of the beam; thus those of our ships which have the least depth in hold are

114. See Remark CXCVII, p. 181.
115. The two figures are respectively those of the 1719 Establishment and the 1733 Proposals. Similarly, the figures that follow are mixed, those for 90-gun and 60-gun ships being the 1733 figures, the remainder from 1719.
116. In fact, French *pieds*, *pouces* and *lignes*, designated respectively here by the symbols ′, ″, ‴.

in one case 1/8th and in the other 1/10th deeper than the English ships. This same difference or a difference near as great is to be found between the depth in hold of our frigates and that of the English frigates. Hence our ships draw more water than do the English ships, without the greater depth in hold giving any greater height of gundeck sill, for it is lost beneath the waterline, and serves only to slow the ship's progress.

Depth in Hold Forward and Aft, and the Sheer on the Gundeck

CXXX. The depth in hold of the English ships forward and aft, in proportion to that amidships, is greater than in our ships, since the gundeck has greater sheer than we are in the habit of giving it ordinarily. I say that it has more sheer, for so it has appeared to me in all the ships which I have seen on the stocks and afloat. I have not measured this sheer, and I have not found it written down among the dimensions given to me by Messrs Allen, Ward and Fellows, yet I estimate it at 20 to 21 lines [*45 - 47 mm*] for every foot [*325 mm*] of length on the gundeck†. I asked the English Shipwrights why they put so much sheer in their decks, and they replied that it is so that the hogging to which the keel is subject as the ship grows old will be less visible in the part of the ship which is above the waterline. For however great the hogging, the sheer of the deck in the opposite direction will always be greater.

†... *yet I estimate it at 1 line and 3/4 or5/6 for every foot of length on the gundeck* .... [This is clearly an error, and should read "for every inch of length". Ed.]

It is true that a sheer which exceeds the hogging to which a ship is subject as she grows older, makes it appear as if the ship were whole, and the hogging is not apparent, yet this very sheer becomes a cause of hogging, and to give a great sheer to the gundeck is to choose an imaginary benefit in favour of a true one. I call an imaginary benefit that which is to be found in the aspect of a ship which appears not to hog when in fact she does. There are three faults in a sheer which seeks to procure this imaginary benefit: 1st, let **ABC**, **Fig. 94**[117], be the deck of a ship running in a straight line or with but little sheer, and **DBE** be the same deck with a sheer such as the English give their decks; there is in the ship with the deck-line **DBE** the whole part **ABD** and the part **CBE** more than in the ship with the deck-line **ABC**. Both the one and the other part are needless in all respects; they do not increase the displacement since they are out of the water, yet they weigh down the ship with all their weight. It follows that since every thing which weighs down a ship above her waterline is an obstacle to her speed, the deck-line **ABC** is to be preferred to the deck-line **DBE**. 2nd, in the ship where the deck has much sheer the bow and the stern are more weighed down than in the other ship, the stern by the part **ABD**, and the bow by the part **EBC**, from which it follows that this ship is more likely to hog. 3rd, the upper works of the ship with the deck-line **DBE** are higher than those of the other ship by all the height **AD** at one end and the height **CE** at the other, and in consequence they present a greater surface to the wind, which is always prejudicial when sailing close-hauled.

It might further be said that for two ships with the same lines, the ship with a greater sheer to her decks will necessarily be less weatherly than the other, since the forward and after guns, and the weight at the bow and at the stern of the decks, of the forecastle and the quarterdeck, and of the poop, are further removed from the centre of motion.

Floor and Deadrise

CXXXI. The length of floor of the midship bend of the English ships is equal to 13/24ths of the beam, whereas in our ships this length is equal to half of the beam or but 23/48ths of the beam. The deadrise or rising of the floors at the outboard end of this distance is in the English three deck ships three quarters less than in our ships. But in their ships of a lesser Rate, the English vary this dimension as we do, which is the most ill-understood of all those which serve to determine the lines of a ship. To some they give 15 inches [41 cms] of deadrise, to others 20, 24, and up to 26 inches [54 - 70 cms].

Rise of Floor

CXXXII. The rise of floor at the bow in the English ships is a quarter greater than in our ships; the rise of floor aft seemed to me equal to the rise of floor which we ordinarily give our ships, yet the runghead ribband becomes so convex as it nears the stem and the sternpost that it might be said that the English ships have a third less height of floor than our own, since if this ribband were continued from the last floor timber of the afterbody to the sternpost, and from the first floor timber of the fore body to the stem as in our ships, it would meet the sternpost and the stem a third lower than it does at present. We are already familiar with this English practice

117. See Plate 8, following page 184.

from the ships which were captured from them and which have since then been graved in our Dockyards; we have seen their great fullness in the floors which means that with but a middling depth in hold their gundeck battery is high out of the water and with but little ballast they carry their sail well. Yet the prejudice which we have in favour of sharp floors, which seem to us more apt to cleave the water than a full floor, has prevented us from perceiving all the advantages which the English obtain from their great convexity of the runghead ribband. We have preferred to swamp the gundeck sill, or else to avoid swamping it we have increased excessively the depth in hold, rather than have recourse to such a simple expedient as that practised by the English shipwrights. In consequence, we are obliged to use much ballast in our ships, so that through our desire to make them fast sailers we in fact place an obstacle in the way of their sailing by making them heavier by the whole weight of this ballast which our sharp floors demand.

Breadth at the Wing-Transom

CXXXIII. The breadth at the wing-transom in all English ships both large and small is equal to $^{7}/_{12}^{ths}$ of the breadth at the midship frame, or at most $^{43}/_{72}$. In our First Rates this same dimension is equal to or greater than two thirds of the breadth at the midship frame, and in smaller ships it is either equal to two thirds of the breadth or at the least $^{5}/_{8}^{ths}$ of the breadth. We should be unwilling to concede to the English that the short wing-transom of their ships were to be preferred to the greater length which we give to the wing-transoms of our own, for we are prejudiced in favour of a wide stern, to which we have attached† a certain grace and which we do not find in a stern where the wing-transom is shorter, yet there are merits in the latter which are greatly more solid than any vaunted grace. The stern of the ship is less heavy, and stronger, for the two ends do not project so far beyond the waterline. Thus for example in **Fig. 95**, let **A** be the plan view of the load waterline of a ship, **BC** the wing-transom, and **CD** the height of breadth. It will be evident that the less the line **BC** projects towards **C**, the smaller will be the area **E**; yet this part **E** being out of the water and not perpendicular to the waterline, tends to weigh the ship down, and much more in our ships where the wing-transom is long than in the English ships where it is short. I am not saying that in ships with a shorter wing-transom the water meets better at the rudder, since the load waterline and the other waterlines may be the same in two ships, one of which has a wing-transom which is extremely long while the other's is extremely short; and in this respect the English have no advantage over us; although our wing-transoms are long, all our ships have a run aft at the load waterline and in the underwater body which is much better than that of the English ships, to facilitate the joining of the water at the rudder. The short length which the English give to their wing-transoms does not lose them the breadth needed at the gundeck for the recoil of the aftermost guns, since by making the extreme breadth line very convex in the area about the mizen-mast and abaft, their ships have the same breadth in the way of the aftermost gunport or near the same as we obtain in the same place from having a longer wing-transom.

†.... in which we believe we see a certain grace ....

Tumblehome

CXXXIV. The English ships have at the midship bend near the same tumblehome as our own ships, yet they have much more in the toptimbers at the bows, and thus they are less suitable for boarding from[118]. Their tumblehome at the quarters is about half as great as in our ships; yet it does not follow from that that their ships are broader at the taffarel, since having but little breadth in the wing-transom this scant tumblehome in the toptimbers of the fashion-pieces gives them but the same breadth or a breadth which is a few inches less than that which is found in our ships at the level of the taffarel.

Height on the Gundeck, Forecastle, Quarterdeck & Poop

CXXXV. The height on the gundeck is 5 feet 8 to 10 inches [*1.84 - 1.90 m*] beneath the beams in the English ships of 100 guns; 5 feet 8 inches in those of 90; 5 feet 7 to 8 inches [*1.81 - 1.84 m*] in those of 80 and 70 guns; 5 feet 6 inches [*1.79m*] in their ships of 60 and 50 guns; 5 feet 5 inches [*1.76 m*] in their frigates of 40 guns, 4 feet 10 inches [*1.57 m*] in their frigates of 30 guns and 4 feet 6 inches [*1.46 m*] in those of 20 guns. These heights are within an inch more or less equal to the heights we allow on the lower decks of our own ships. Yet in the English ships the height is the same forward, aft and amidships, whereas we increase the headroom aft by 2, 3 or 4 inches [*5.4 - 10.8 cms*] and diminish it forward by an inch [*2.7 cms*].

118. This argument is one which is frequently encountered in French writings of the period, and yet, in view of the relative rarity of boarding, it must be treated with some scepticism.

The height between the middle deck and the upper deck is 6 feet 6 to 6 feet 9 inches [*2.11 - 2.20 m*] in the English ships of 100 guns, 6 feet 4 to 6 inches [*2.06 - 2.11 m*] in their ships of 90 guns, and 6 feet 2 to 6 feet 4 inches [*2.00 - 2.06 m*] in their ships of 80 guns. We allow but 5 feet 9 to 10 inches [*1.87 to 1.90 m*] of headroom between the middle and upper decks in our ships of 100 guns, and 5 feet 8 to 9 inches [*1.84 - 1.87 m*] in those of 80 to 90 guns, and I find these heights preferable to those in the English ships since the whole weight of the upper deck and of the upper tier of guns is raised less high above the centre of motion. It is true that by reason of the great height between the decks they are less incommoded by the smoke in battle; yet our ships have always served usefully with lesser heights between decks.

The height of the quarterdeck is 6 feet 6 to 9 inches [*2.11 - 2.20 m*] in the English ships of 100 guns; 6 feet 4 to 6 feet 6 inches [*2.06 - 2.11 m*] in those of 90 guns; 6 feet 2 to 6 feet 4 inches [*2.00 - 2.06 m*] in those of 80 and of 70 guns; 6 feet to 6 feet 2 inches [*1.95 - 2.00 m*] in those of 60 guns; 5 feet 10 inches to 6 feet [*1.90 - 1.95 m*] in those of 50 guns; 5 feet 8 to 10 inches [*1.84 - 1.90 m*] in those of 40 guns; 5 feet 6 inches [*1.79 m*] in their frigates of 30 guns and those of 20 guns. This height is 6 to 7 inches [*16 - 19 cms*] less in our own ships, and this is to be preferred, in that it brings the quarterdeck and the guns borne on the quarterdeck closer to the centre of motion. The forecastle and the poop are also three to four inches [*8 - 10 cms*] higher in the English ships than in our own ships.

If two ships of the same size had similar underwater lines in all their parts, and one of the two had the height between the middle and upper decks, the height beneath the quarterdeck and the forecastle and beneath the poop of the English ships, and the other had these three heights as they are to be found in our ships, then the latter would sail better, would be more weatherly, and would carry her gundeck guns higher out of the water. I say that she would sail better 1st, because having upper works which are less high she would be lighter; 2nd, because her upper works would offer a smaller area to the wind when sailing an oblique course; 3rd, because she would heel less and in consequence the thrust of the wind on her sails would be less oblique. I say that this latter ship would be more weatherly because her upper works would be less heavy, and her upper deck, forecastle, quarterdeck and poop would be closer to the centre of motion. Finally, I say that she would have a better height of gundeck sill, since by diminishing the weight of the upper works and bringing this weight closer to the centre of motion a part of the ballast can be done away with. It follows from this that whatever the underwater lines of a ship it is always advantageous to never exceed the height on the gundeck, beneath the forecastle and quarterdeck and beneath the poop necessary for serving the guns and for the cabins, since in exceeding this height a portion of the vessel's speed is lost and she will sail with less safety.

Height of the Bulwarks

CXXXVI. The English gain by the low height of their bulwarks about what they lose through the excessive headroom on the gundeck, beneath the quarterdeck and the poop. I have seen but two of their ships of 100 guns where the bulwarks are about 5 feet 10 inches [*1.90 m*] above the upper deck in the waist. In their other three deck ships the bulwarks at the waist finish at the wale which runs in the way of the upper sills of the upper deck gunports; so that there is but 4 feet 10 inches or at the most 5 feet [*1.57 - 1.63 m*] of height in the bulwarks. In their ships of between 30 and 70 guns these same bulwarks finish likewise at the wale running above the upper deck gunports, and are but 4 feet 6 to 4 feet 10 inches in height [*1.46 - 1.57 m*]. In their 20-gun frigates the bulwarks finish in a rail which serves as the upper port-sill for the gunports. On the quarterdeck, the forecastle and on the poop of the English ships, there is the same height of bulwarks as in our ships if I include in this height the plank sheer which the English lay over the top of the drift-rails of which I spoke in Remark **LXXXVI**, yet excluding this plank sheer their bulwarks are 12 to 18 inches [*32 - 49 cms*] less high than those of our ships. These low bulwarks are a detail which is not to be found in most of our ships, and it is true that we should be unable to reduce them to the height which is found in the English ships without losing the advantage of the gangboards which run from the quarterdeck to the forecastle.

Curve of the Stem

CXXXVII. The stem of the English ships describes a sweep from the end of the keel to the gundeck, the radius of which is equal to the depth in hold forward plus the height of the keel; and above the gundeck it describes a straight line which passes through the perpendicular where the length between the stem and the sternpost finishes. It has the same form in some of the King's ships, and in others the arc described has a longer radius, and the line curves inward by a few inches at the head of the stem, abaft the perpendicular.

CXXXVIII. I have seen two different forms of midship bend in the English ships. One describes a sweep from the flat of the floor to the waterline; the other describes in this same area a curve which is nearly an ellipse. The English shipwrights esteem the latter form above the first and they are right. It is this form which is most commonly found in our own ships, and the one which gives the gentlest rolling motion.

Midship Bend

The English shipwrights work in the following manner to trace the midship bend which describes the sweep of a circle. Let **AB** in **Fig. 96** be the half-breadth of the ship, **AC** the half-breadth of the flat of the floor, **CD** the deadrise, **BE** the vertical height from the top of the keel to the load waterline; they describe from **D** to **E** the sweep **DE** of which the radius is equal to **BE** or $^{23}/_{24}{}^{ths}$ of **BE**; they mark from **A** to **F** the half-breadth of the keel; they divide **AC** in two equal parts at **G**; they strike the perpendicular **GH** and then extend the sweep **ED** as far as **H**. Then drawing from **H** to **F** a second sweep of which the radius is six, seven or 8 times **HF**, they complete the part which is still lacking from the mould down to the keel. Following this method of draughting the midship bend, the bend has proportionately no greater fullness in ships of the First Rate than in ships of lesser Rates save by the amount that there be less deadrise or a greater breadth to the flat of the floor.

I have not seen how the English shipwrights draught the midship bend which describes part of an ellipse from the end of the floor to the load waterline, but by draughting it in the following manner it is possible to give it the same shape as is to be found in their ships. Let **AB**, in **Fig. 97**, be the half-breadth of the ship, **AC** the half-breadth of the flat of the floor, **CD** the deadrise, **BE** the height from the keel to the load waterline. Draw the sweep **EC** of which you will make the radius equal to one and a half times **EB**. Divide this sweep into three equal parts, and draw in one from **C** to **F**; draw the sweep **DF**, of which the radius should be equal to one and a quarter or one and a half times **CF**. Mark from **A** to **G** the half-breadth of the keel, and strike a straight line **DG** which will complete the mould of the midship bend as far as the keel, or else a curved sweep **DG** (either are to be found in the English ships). Thus the midship bend will describe to the waterline the curve **AGDFE**. It is possible to increase or to diminish the fullness of this bend by making the radius of the sweep **FE** equal to one and a half times **EB** and cutting this sweep at **F** to a 6th or 7th part of its length. It can also be achieved by letting the sweep **CE** finish at a point **H** or **I** instead of ending it at **C**.

The English shipwrights complete the part of the midship bend between the load waterline and the planksheer with a vertical line which they strike from the waterline to the gundeck, and from the gundeck to the planksheer they describe two opposing sweeps, as most of our Builders do in France.

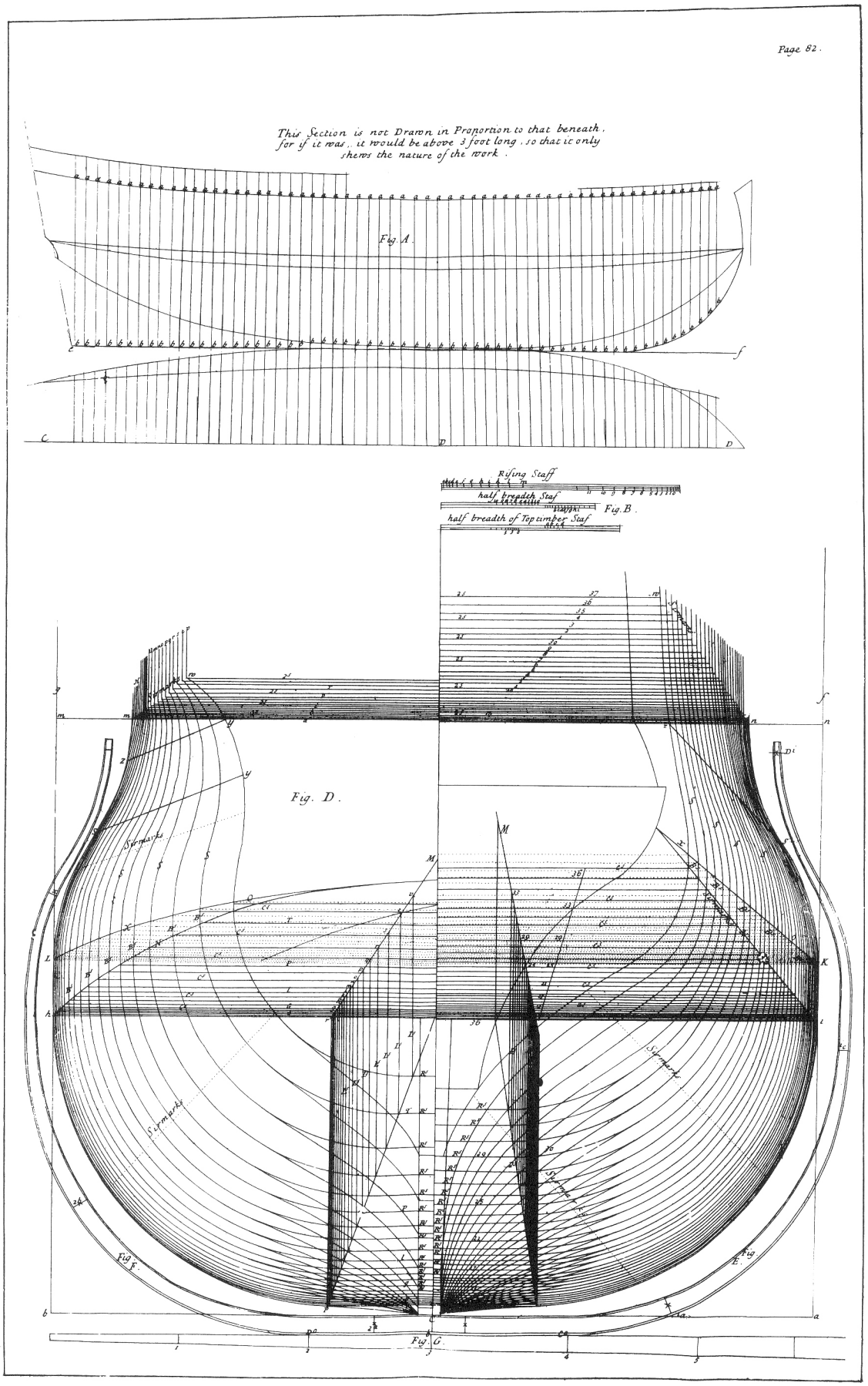
CXXXIX. The midship bend in the English ships is situated one tenth part of the length from stem to sternpost forward of the middle point of this length, yet the deadrise of the floors placed abaft the midship bend differs so little from the deadrise of the midship bend that the midship bend can be considered to be situated more or less one 20th or 24th part of the length from stem to sternpost forward of the middle point of this length. The English shipwrights take off four or six frames to the mould of the midship bend and raise them half afore and half abaft the midship bend. Some Builders follow this method in France.

Position of the Midship Bend

CXL. The English have as we do various methods for determining the shape of the fore body and the afterbody of their ships. One of the methods employed by the English is as follows. Let **AB** in **Fig. 98**[119] be the keel of a ship, ending aft at the rabbet of the sternpost **A**, and forward at **B**, the point where the rabbet of the keel meets the rabbet of the stem. Let **BC** be the rabbet of the stem, and **AD** be the rabbet of the sternpost, and **M** the point where the midship bend is to be situated. The load waterline **DC** is struck, and the line **ME** perpendicular to it along **DC**. The midship bend **ABCD**, **Fig. 99**, is drawn out from the keel to the load waterline; **AC** the half-breadth of the flat of the floor is divided into two equal parts at **B**; the perpendicular **BE** is struck from the point **B**, and the length of this perpendicular **BE** is transferred to the line **MF** in **Fig. 98**.

Moulds of the Fore Body and Afterbody

119. See Plate 9, following p. 184.



56. *Plate from William Sutherland's* Ship-builders Assistant *(1711), in the chapter entitled "Some Considerations of Moulding Ship's Timbers". (Private collection)*

Mark out on the line **CD**, **Fig. 98**, the bends to be placed afore and abaft the midship bend, spaced equally or unequally one from the other, which is of no importance provided that there be the same number of divisions between **E** and **D** and **E** and **C**, and the same proportion between each point in the one or the other division. I have marked these divisions with the numbers **1**, **2**, **3** etc[a]. Mark the quadrant **FG**, of which the centre point is at **E** and the radius equal to **EF**; divide **EG** into the same number of parts as there are bends afore or abaft the midship bend, and in the same proportion which was followed in the division of the bends, by which I mean to say in equal parts if the bends are divided by equal distances along the line **CD**; and from these dividing points strike the lines **H1**, **H2**, **H3** etc[a] perpendicular to **DC**. Then strike the lines **1K**, **2K**, **3K** etc[a] perpendicular to the points **1**, **2**, **3** etc[a] along **DC**, so that the first be equal to **1H**, the second to **2H**, the 3rd to **3H** etc[a], thus striking the curve **FKC** and the curve **FKD**.

Extend the perpendiculars **1K**, **2K**, **3K** etc[a] to the keel **AB**, as in **KL**, and transfer to **Fig. 99** where the midship bend is shown the heights **LK** from **Fig. 98**, marking the first one, that is to say that taken from the line **1K**, from **A** to **1**, the second from **A** to **2**, the third from **A** to **3**, etc[a]. Mark also from **A** to **F** the height where the line of the load waterline intersects the rabbet of the stem if it is desired to draught the bends of the fore body. Strike the line **BF** and the lines **1K**, **2K**, **3K** etc[a] parallel to **AE**, which lines meet the line **BF**.

Strike on **Fig. 98** the curve **NEO** by means of a similar operation to that which I have described for the line **DFC**, by which I mean describe the quadrant **EP** of which the radius is equal to **CO** and divide **PQ** into the same number of parts as there are bends, and dropping from each division the perpendiculars **1R**, **2R** etc[a], make **1S** equal to **1R**, **2S** equal to **2R**, etc[a]. Take off the different heights above the keel of the curve **NEO** at the place of each bend, and mark those of the fore body on the body plan where the bends of the fore body are to be draughted, and those of the afterbody on the body plan of the afterbody, as I have done at **G** in **Fig. 99**; and from each of these points **G** strike the lines **GH** parallel to **AE** and equal to the breadths which each bend is to have at the height of the lines **GH**.

To find these breadths, draw out the half-breadth plan represented by **Fig. 100**. Divide this plan by the same number of bends as were divided in **Fig. 98**. Mark the midship bend at **M** and the half-breadth from **M** to **A**, the half-breadth at the wing-transom at **B**, and use a geometrical progression to draught the curve **AC** and an arithmetical progression to draught the curve **AB**, these progressions being composed of a greater or lesser number of steps according to whether you wish to impart more or less convexity to the curve, without regard to the number of bends; and the points where the curve **BAC** cuts the perpendiculars **1**, **2**, **3** etc[a] which denote the place of the bends will determine the breadth at each bend, as they should be pricked on the lines **GH**, **Fig. 99**.

After pricking these breadths from **G** to **H**, draw the sweep **KH**, **Fig. 99**, making its radius equal to **GH** less **1K**, if it be the first bend; equal to **GH** less **2K** if it be the second, and so for the others. Mark from **A** to **L** the half-breadth at the heel of the frame and draw the sweep **LM**, of which the radius is twice that of the sweep **KH**. It is by experiment that the point will be found where the sweep **LM** is tangential to the sweep **KH**. The curve given by these two sweeps describes the bend required. I have drawn but one only in **Fig. 99** in order to make this Figure more readily intelligible. Yet when the part of the bend contained between the beginning of the deadrise and the waterline describes part of an ellipse, then use a part of an ellipse rather than a circle for **KH**.

The English Shipwrights who employ the method I have just described to draught their bends use this method to determine the shape of all the frames between the midship bend and the hawse-pieces, so that every frame is a moulded bend. They work in the same manner for the frames of the afterbody, yet only as far as 4, 5 or 6 frames short of the fashion-pieces, and these 4, 5 or 6 frames are draughted by trial and error, having a form which is part-way between that of the fashion-pieces and that of the last square frame draughted.

Another method which the English employ in order to determine the underwater lines of a ship is the following. Let **AB**, in **Fig. 101**, be the length at the load waterline, and **M** the place of the midship bend. They strike the perpendicular **MC** which is equal to the half-breadth; they prick off from **M** to **B** the number of bends which will form the fore body, and from **M** to **A** a

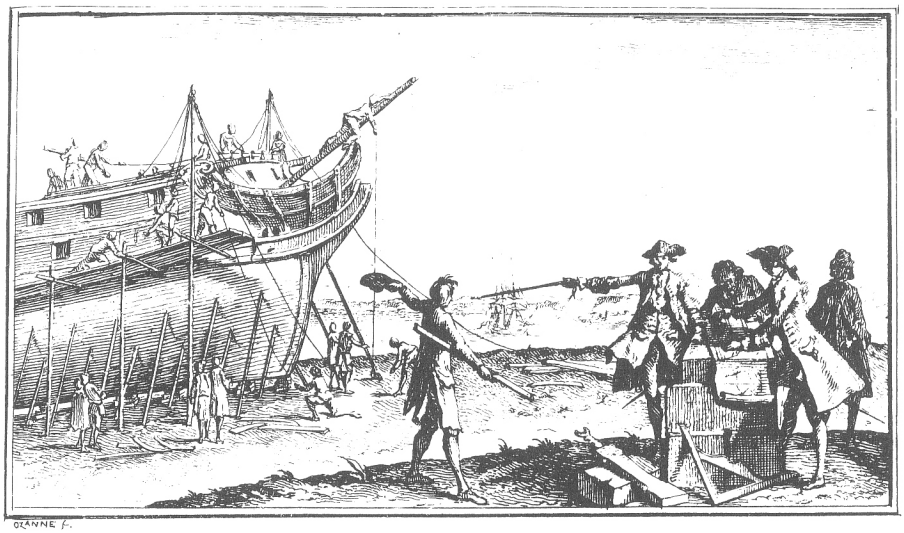


57. *Vignette by Ozanne from Duhamel du Monceau's* Élémens de l'Architecture Navale *(1758)*
(Private collection)

like number of bends for the afterbody, as I have shown them with the numbers **1**, **2**, **3** etc[a], and from these divisions they strike the perpendiculars **1D**, **2D**, **3D** etc[a]. They describe the sweep **CE** whose centre is at **M** and radius equal to **MC**; they divide **ME** into as many parts as there are bends from **M** to **B**, and at each of these points they strike the perpendiculars **1F**, **2F**, **3F** etc[a]. They make the lines **1D**, **2D**, **3D** etc[a] equal to **1F**, **2F**, **3F** etc[a], and running a line through the points **D**, this line is taken as the plan of the load waterline, in such a manner that **1D** is the breadth at the load waterline of the first bend of the fore body, **2D** the breadth at the second bend, etc[a]. But if they wish to increase the fullness of the ship, as for example with a three deck ship, they employ a geometrical progression in order to draught the load waterline, and then the lines **CDB** and **CDA** represent the waterline at $\frac{4}{5}^{ths}$, $\frac{5}{6}^{ths}$, $\frac{6}{7}^{ths}$ or $\frac{7}{8}^{ths}$ of the height of the load waterline above the keel; in which case they make **CM** equal to the half-breadth of the midship bend at the point where it is intersected by this waterline, and **MB** and **MA** equal to the length of the vessel at this same height.

They draught several more waterlines, always parallel to the load waterline **DC**, in **Fig. 98**; the first is a fifth or a sixth part of the height of the load waterline above the keel, and the others spaced equally between the first and the load waterline or that other waterline parallel to it which was used to describe the curve **ACB**, **Fig. 101**. The first waterline[120] is draughted in the following manner: let **AB**, **Fig. 102**, be equal to the length of the ship from the midship bend to the rabbet of the stem, or from the midship bend to the rabbet of the sternpost, at the height of the proposed waterline; they strike the perpendicular **AC** equal to the half-breadth of the midship bend at this same height. They divide this perpendicular into two equal parts at the point **D**, and strike the line **DE** parallel and equal to **AB**. They describe the semicircle **AFC**, whose centre is at **D**; they divide it into 4, 5 or 6 parts according to whether they desire to impart more or less convexity to the required curve. These divisions are marked in **Fig. 102** with the numbers **1**, **2**, **3** etc[a]. They divide the line **DE** by the same number of points as there are pricked on the semicircle **AFC**, all equally spaced one from the other, save that between the last point and the point **E** the distance should be twice as great as that between the other points. I have likewise marked these divisions with the numbers **1**, **2**, **3** etc[a]. From the divisions of the semicircle they strike the lines **1G**, **2G**, **3G** etc[a] parallel to **AB**, and describe the sweeps **HG**, whose centres are to be found as follows: the first at the division marked **1** on the line **DE**, the second at the second division of this same line, etc[a]. The radius of these sweeps is equal to the radius of the semicircle **AD**, and the points where they bisect the lines **1G**, **2G**, **3G** etc[a] are those through which the desired waterline passes, as **BGC**. Then dividing **AB** by the number of bends from **M** to **A**, in **Fig. 101**, or from **M** to **B**, and striking at these divisions the perpendiculars **1K**, **2K**, **3K** etc[a], the lengths **1K**, **2K** etc[a] are taken as the half-breadths of the bends at the height at which it is proposed to situate this waterline.

120. i.e. the half-breadth plan corresponding to the first waterline.



58. *Vignette by Ozanne from Duhamel du Monceau's* Élémens de l'Architecture Navale *(1758)*
(Private collection)

And when they employ this same method to draw other waterlines above this one, they always make **AC** equal to the half-breadth of the midship bend at the height above the keel of the projected waterline, and divide the sweep **AFC** into a greater number of parts than it was divided into for the first waterline, and likewise in consequence the line **DE**, since the more divisions there are, the greater the convexity of the curve **BKGC**.

This method can only be employed for the waterlines between the first and the load waterline, or between the first and the penultimate, by trial end error and by frequently pricking off on the body plan the breadths indicated by the second, third and fourth waterlines in order to correct them or to increase or diminish accordingly the number of divisions of the semicircle **AFC**, **Fig. 102**.

In the other methods employed by the English Shipwrights to determine the underwater lines of their ships, they strike lines on the body plan at the points where the ribbands will be laid; they divide these lines into as many parts as there are to be bends of the fore body and of the afterbody, and employ in these divisions the same progressions as do those builders in France who make use of methods of this kind.

This then is the sum of the theory of the English Shipwrights when they draught the bends of the fore and afterbody; I have examined their draughts, and even those of ships of the new manner of building; I have seen some of those who are esteemed the more skilful draughting their bends; I have asked many questions of them concerning it; I have read through the English authors[121] who have written about shipbuilding and who are held in some regard in England, and I have found that all their theory can be reduced to a few working practices, such as those I have described or others of like description, which lead to no demonstrated method nor are founded on any principle.

The English Shipwrights claim that the French know no more than they; and I believe that that is true, and yet in England as in France a distinction is made between the work of a skilful Builder and that of a mediocre one. We have inherited from the Builders who went before us a certain number of draughts of ships whose good qualities and faults are known to us from long experience. A skilful shipwright knows how to take up from these what is good, and correct that which is bad; he knows how to increase them or reduce them according to his need, to learn from what is good and what is defective in the ships which he sees built as well as those which he builds himself, and if he is unable to demonstrate that such and such a sweep which he employs is the best that he could employ in order to give to the ship the desired qualities, at least he can demonstrate that it is better than such and such a different sweep for which he has

121. See Remark CXCVIII, p. 187.

substituted it. Yet in order to arrive at perfection in following this course he must have a nice judgement, capable of consideration and divorced of all prejudice.

I should not ignore the fact that some English Builders claim to have brought to the ships of their new manner of building the shape of least possible resistance for dividing the water; which I shall examine in the Article on this new manner of building.

I shall not stay to describe the method which the English Shipwrights use to draught the upper works; they use the same progressions as we do, applied to the ribbands, and the shape of their upper works does not differ from those of our own ships save in the last frames at the bow where the toptimbers finish in a vertical line, as I have already commented in some of my Remarks.

Number and Spacing of Deck-Beams

†.... There are 5 to 6 beams more ....

CXLI. On the gundeck the English ships have fewer deck-beams than do ours. I counted but 28 in their 100-gun ships, 27 or 28 in their ships of 90 guns, 26 in those of 80 guns, 25 in the ships of 70 and 60 guns, and 23 to 24 in the ships of 50 guns. There are 5 to 8† beams more on the gundeck of our ships. The deck-beams in the English ships are distributed as follows. They place one beam forward of the mainmast and another abaft, separated from each other by a distance equal to 2¼ or 2½ times the diameter of the mast. The first forms the head-beam for the main hatchway, and is marked by the letter **A**, in **Fig. 103**[122], and the other is designated by the letter **B**. Forward of beam **A** is another beam marked by the letter **C**, and between these two beams is the main hatchway: they are separated one from the other about ⅙ more than in our ships built at Brest, and near the same as in our ships built at Toulon. They place two beams, one forward of the foremast and the other abaft, such as those marked by the letter **D**, and two others, one afore and the other abaft the mizen-mast, designated by the letter **E**. The former are separated one from the other by about one and a half times the diameter of the mast, and those about the mizen-mast by twice or two and a half times the diameter of that mast. Between the deck-hook and the beam forward of the foremast is another beam designated by the letter **F**. Situated at one twelfth or one thirteenth part of the length from rabbet to rabbet abaft the middle point of the foremast, is the beam for the bitts, marked by the letter **G**, with the thickness of the bitts abaft. And at a fifteenth or sixteenth part of this same length abaft the beam for the bitts, is a beam to brace the second pair of bitts; it is designated by the letter **H**. The forward one of the two beams **I** forming the partners of the main capstern is situated one-twelfth part of the length from rabbet to rabbet abaft the mainmast, and the distance between these two beams is equal to one and a quarter to one and a half times the diameter of the capstern. There is a beam between the foremast and the beam for the bitts, designated by the letter **K**, one between the beam for the bitts and the beam for the second pair of bitts, and one between the beam abaft the mainmast and the forward beam of the capstern, also marked with the letter **K**. In all their ships above 40 guns these fifteen beams are always spaced out in the order which I have marked. The remaining beams are spaced equally one from the other between the second pair of bitts and the main hatchway, between the main capstern and the mizen-mast, and between the mizen-mast and the deck-transom, as those marked by the letter **L**. They ensure only that between the first and the second beam at the stern and between the first and the second beam forward of the mizen-mast they leave sufficient room to open a hatchway.

On the middle deck of the English ships there is one more beam than on the gundeck, as in our own ships. This additional beam is placed abaft the mizen-mast. The other beams are placed above the beams of the gundeck, or nearly so, as we place them.

The upper deck has one or two beams more than the middle deck, as in our own ships. All those forward of the main capstern are placed directly over the beams of the middle deck, save only those two which are one forward and the other abaft the galley, or else one of them only. Abaft the main capstern their spacing is interrupted by the ladderway marked by the letter **M**, whereof the two beams **N** mark the opening on the upper deck. From thence aft they are in the same order as in our own ships.

122. See Plate 10, following p. 184.

There are but 16 or 17 small beams beneath the quarterdeck of their ships of 90 to one hundred guns; 15 in those of 80 guns, 14 or 15 in those of 80[123] guns, and 12 to 13 in those of 50 to 60 guns. They are spaced evenly one from the other. The forecastle has but seven small beams in their three deck ships and 5 or 6 in their other ships; they are spaced near the same as in our own ships. The poop has 13 or 14 small beams in their three deck ships, and 10 or 11 in their ships of lesser Rate.

We believe that since the decks, forecastle and quarterdeck of our ships are supported by a greater number of beams than are those of the English ships, they are thereby made more strong, while the English on the other hand believe that we weaken the fastening-together of our ships with the weight of the unnecessary beams which we employ. The sides of a ship must bear the weight of the guns which are upon the deck as well as the weight of the deck itself. The weight of both the one and the other are already sufficiently great, and if in this last respect we exceed that which is necessary, all that extra weight, far from strengthening the ship, will serve but to weigh her down. One cannot argue with the English that the small number of beams which they employ are insufficient, since their ships put to sea and carry proportionately more guns than our own ships, and this without any inconvenience, whereby they demonstrate to us that there are too many beams in our ships, and we are forced to agree with them. By doing away with them, we should save timber and build our ships more lightly. I should add here that we have ships of the same strength and the same size, where some have three and even four or five beams more in each deck than do the others; yet they carry the same guns, by which I mean that their decks must bear the same burden. The success of those of our ships which have the least beams proves that there are too many in the others.

Spacing of the Orlop-Beams

CXLII. I have stated that the English ships have more orlop-beams than do our ships. I counted 16 of them in their ships of 80 to 100 guns, 14 to 15 in their ships of 60 to 70 guns, 13 in their ships of 50 guns and 11 in their frigates of 40 guns. They are spaced as follows. There is one orlop-beam beneath each of the gundeck beams at the mainmast, the foremast, the main hatchway, the first and the second pair of cable-bitts, and the main capstern. These nine orlop-beams are marked with the letter **O** in **Fig. 103**. The 10th orlop-beam is placed beneath the second gundeck beam abaft the mizen- mast, like that designated by the letter **P**, and the 11th more or less beneath the beam which lies between the main hatchway and the second pair of cable-bitts, as in **Q**. In those ships where there are more than eleven orlop-beams, the remainder are placed between the orlop-beam abaft the mizen-mast and that which is abaft the main capstern, and between the orlop-beam forward of the main hatchway and that in the way of the second pair of cable-bitts, like those marked with the letter **R**, **Fig. 103**.

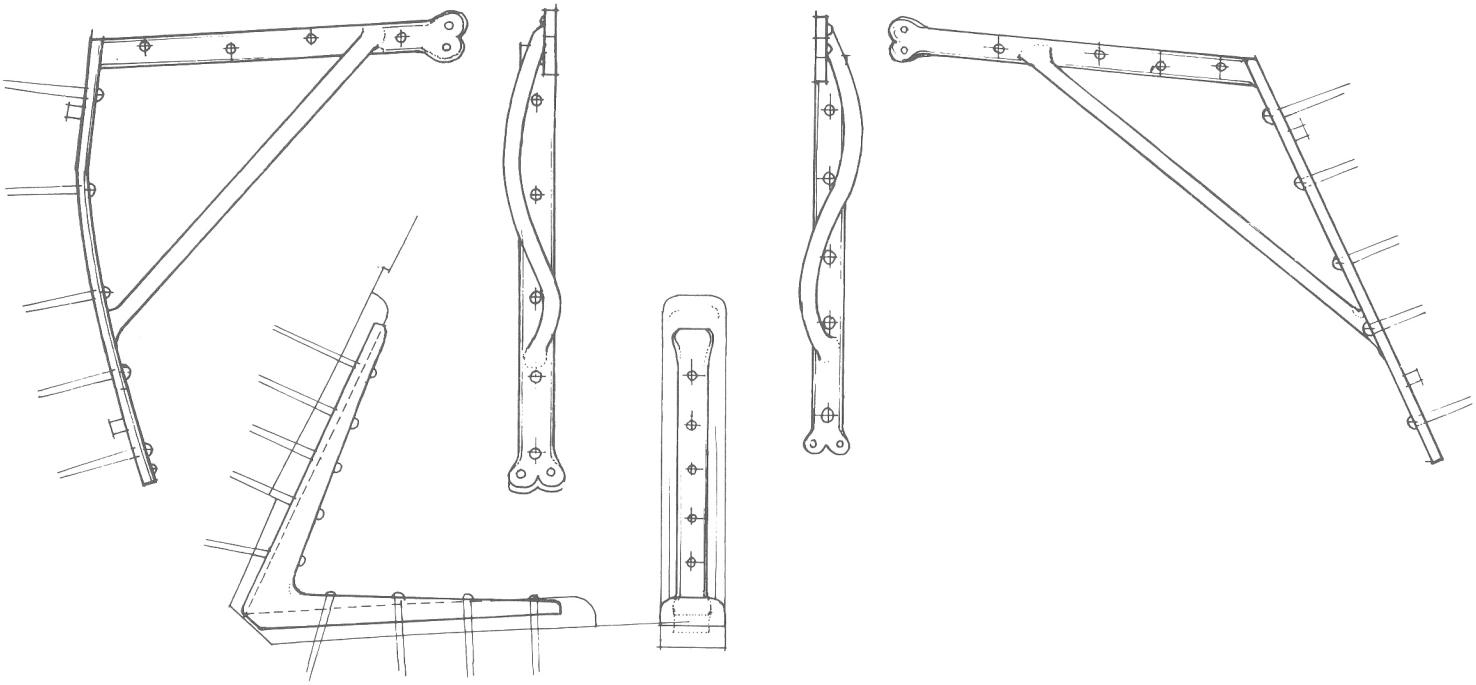
The orlop-beams in the English three deck ships are placed 5 feet [*1.63 m*] below the beams of the gundeck, and those of their other ships 4 feet 7 or 8 inches below [*1.49 - 1.52 m*]; we make this distance greater by some inches† since our ships have greater depth in hold than do the English ships.

†.... greater by 2, 3 or 4 inches ....

Orlop

CXLIII. There is in all the English ships an orlop of a kind not to be found in our own ships. This orlop, in their three deck ships and those of 60 to 70 guns, runs from the aftermost orlop-beam as far as the first pair of cable-bitts. In their ships of 50 and 40 guns it ends somewhere between the second pair of cable-bitts and the main hatchway, and then runs between the second and the first pair of cable-bitts. The decking of this orlop, from a few feet forward of the mizen-mast to near the second pair of cable-bitts, is formed of two-inch planks which run only from one beam to the next, the butts of which rest on ledges placed next to the orlop-beams, so that instead of being laid over the beams as is the practice with the planking of the decks, the planks lie flush with the top of the orlop-beams. The English shipwrights have two reasons for laying the planks of the orlop in this manner: the first in order not to forfeit the two inches of headroom which the thickness of the plank would make them lose if they were to lay them over the beams, and the second in order that the planks may be easily removed whenever it is necessary to shift them in certain places for the stowage of the hold. Forward of the second pair of cable-bitts and abaft the mizen-mast the orlop is planked like the other decks, by which I

123. *Sic*: Ollivier means ships of 70 guns.



Scale: 1:24

59. *Iron knees as fitted in French ships.*
(J. Boudriot, Bonhomme Richard 1779*)*

mean that the planks are laid over the beams. Outside of this space the orlop is formed for a part of the breadth of the vessel by a row of gratings which run down each side between the orlop-beams and touching the ceiling planking to allow air to the hold. In addition to the beams, the orlop is also made up of ledges and carlings of the same scantling as those of the gundeck.

Standard Knees

CXLIV. I stated, in Remark **LXXI**, on the subject of the riders, that the English fashion some of them (namely those at the bow and at the stern) of but one floor-rider, while the others rise but as far as the gundeck, such that the upper futtock-riders which are to be found in our ships between each of the gunports of the gundeck are not to be found at all in the English ships. In place of this upper futtock-rider there is a standard knee of timber or of iron, of which the lodging part is bolted down to the deck, while the standing part runs up against the ship's side. An iron standard knee is shown in **Fig. 107**. It is certain that with the one or the other method the ship is fastened together equally well, since the ships in which either method is employed betray no weakness at this point. For all that, there are advantages in the English method which are not to be found with our own, so that it is to be preferred, particularly in employing standard knees of iron. Firstly an iron standard knee weighs less than an upper futtock-rider, and the iron bolts used are shorter. 2nd, the iron standard knee after 15 or 20 years will have cost less than the rider, for during this period the rider will have had to be shifted at the least once, whereas the iron standard knee will last forever. 3rd, if it is needed to shift a rider, it can only be done by first shifting the two strakes of the waterway which are scored down over the beams in the way of the riders, and in order to shift these, the deck must be unplanked as far as the binding-strake so as to leave room enough to drive out the bolts fastening the waterways. By putting iron standard knees on the deck in the place of our riders, the English are never faced with such a repair. It is true that if the deck-planks to which the standard knees are fastened are spoiled, the standard knees must first be removed before they can be shifted, but nothing is more easy, no other timber need be removed to shift them and all that is required is to drive out the bolts. 4th, should the waterway be spoiled the riders must first be removed before it can be shifted, and this labour is greater than but to remove the standard knees; it is even at times a more difficult

task, such as can only be achieved by heaving the ship down, if the lower end of the futtock-rider should lie beneath the waterline. 5th, should it be necessary to shift a deck-clamp beneath the gundeck or the middle deck, we must needs first remove the futtock-riders, which since they are not to be found in the English ships relieves their shipwrights of this obligation.

The standard knees on the gundeck do not obstruct the flow of water along the waterway, for there is a hollowing at their throat like that marked by the letter **A** in **Fig. 107**. Nor do they encumber the deck, for the brace at the throat is curved, as may be seen in the Figure showing this standard knee. I find but one disadvantage only, which is that the planking may be easily spoiled underneath the arm which is fastened to the deck, insofar as the water which runs along the deck tends to linger at this place, yet this inconvenience should in no way outweigh the advantages procured elsewhere by this standard knee.

In addition to these standard knees which the English shipwrights place on the gundeck in the place of our upper futtock-riders, they also employ on this same deck in their ships of 80 to 100 guns two further standards, one at the bow and the other at the stern. The horizontal arm of the latter runs forward over the deck amidships, while the standing part butts up against the sternpost. The horizontal arm of the standard at the bow also extends aft over the deck amidships, while the standing part runs up against the stem. These standards are of timber and are fastened with iron bolts. The English shipwrights claim that they resist the hogging of the ship, and this would be true if they weighed nothing, yet since they weigh down the bows and the stern they destroy thereby all the good effect which they achieve through their fastening together of the deck with the stem and the sternpost. Whatever may be the case, our ships of the First Rate, and even ships larger than those built by the English, have put to sea successfully without these standards, and I believe it therefore to be more advantageous to leave them off, since that is so much weight the less above the waterline, and at the extremities of the ship.

The English shipwrights do not only fit standard knees at the gundeck. There are also 4, 5 or 6 on either side on the middle deck of their three deck ships, and these are of timber or of iron. They fit them also on the upper deck of ships of a lower Rate when they are old, and fit only to serve one or two commissions more, as I shall explain in one of my later Remarks, when speaking of repairs.

Pump-Well

CXLV. The pump-well in English ships, designated by the letter **S**, **Fig. 103**, is of the same size or somewhat longer and broader than in our own ships. I speak only of the space occupied by the pumps. It is also formed by stantions and berthed up on all four sides, but only up to the height of the orlop. From thence to the lower deck it is shut off with small boards 4 or 5† inches [*10.8 - 13.6 cms*] wide, and one inch [*2.7 cms*] thick, laid 2, 3 or 4 inches apart [*5 - 8 cms*] apart, and canted, as may be seen at **A**, **Fig. 108**. The English shipwrights louvre them thus in order to provide air to the well, and cant across their breadth so that nothing can be thrown down into the well through the gaps between the boards. In the forward bulkhead of the well there is a scuttle, midway between the orlop and the gundeck. The English ships have no after well[124].

†.... *3 or 4 inches* ....

Magazine

CXLVI. The magazine in English ships is set up in the forward part of the ship rather than towards the stern as in our ships. The English form this magazine in the following manner. The main bulkhead in the forward part of their ships is erected athwart the second pair of cable-bitts, or more commonly against the after face of these timbers, as at **T**, **Fig. 103** and at **A**, **Fig. 104**. Forward of this bulkhead they lay a flat, one foot [*32.5 cms*] above the keelson, as in **V**, **Fig. 103**, which runs as far forward as the main bitts and the full breadth of the ship; and on this flat they stow the barrels of powder, in such a manner that all the space **X**, which is limited aft by the main bulkhead and forward by the bitts, and which is enclosed between the flat **V** and the orlop deckhead, forms in English ships what we call the magazine in our ships, and situate it forward of the after well. The flat of this storeroom is formed, in the English ships as in in our own, of planks laid over beams, but in the place of the slit deal which we lay over these planks the English shipwrights fashion palletting hatches 2 feet [*65 cms*] square and 4 to 5 inches deep

124. Larger French ships had four suction pumps in the main well and a further two placed in a separate well surrounding the mizen-mast. The latter pumps were of particular use in ships which had hogged significantly.

[*11 - 14 cms*], framed by palletting beams 4 to 5 inches square, and after filling these compartments with ballast or else with bricks, they cover them in with hatches which drop into rabbets cut in the edge of the palletting beams. In our ships the bulkheads of the magazine are lined with slit deal, while the English ships merely have at the sides battens 4 inches [*10.8 cms*] wide and one inch [*2.7 cms*] thick, nailed vertically over the ceiling planking and separated 4, 5 or 6 inches [*10.8 - 16.3 cms*] one from the other.

Forward of the magazine is a second flat which runs to within about two feet [*65 cms*] of the foremast; it is designated by the letter **Y**, **Fig. 103**, and is raised 2, 3 or 4 feet [*65 - 130 cms*] above the level of the palletting of the magazine, depending on the rise of floor at the bow. It is on this flat that the Gunner and his mates work when filling the cartridges. It runs the full breadth of the ship. Over this flat on the starboard side, or in large ships on both the larboard and the starboard sides, is a hanging-deck as in **Z**, which stretches for only a third or half of the breadth of the ship and from the magazine to 1 or 2 feet† [*32 - 65 cms*] forward of the foremast. They place the cartridges on this hanging-deck which is surrounded by a guard-rail formed of baulks of timber. This space takes the place of the powder-rooms which are to be found in our ships abaft the magazine. It is shut off forward by a bulkhead designated by the letter **a**, **Fig. 103**, situated amidships and within one or two feet [*32 - 65 cms*] of the foremast, in order to leave this mast outside the filling-room; this bulkhead is about 4 feet [*1.30 m*] in breadth, and turns on either side of the mast to meet at **b** a bulkhead which runs athwartships, as in **B**, **Fig. 104**. The space where they keep the cartridges is covered by a hanging-deck like that designated by the letter **d** in **Fig. 103** and **C** in **Fig. 104**. This deck runs fore-and-aft from the bitts to the bulkhead **b**, **Fig. 103** and **B**, **Fig. 104**, and athwartships as far as the carpenter's walks designated by the letter **D**, **Fig. 104**. It is raised 2 feet or 2 feet and a half [*65 - 81 cms*] above the level of the orlop in their larger ships, as is shown in **Fig. 103**, and in their ships of fewer than 60 guns it is placed within one foot [*32.5 cms*] of the deck-beams. In certain of their ships this hanging-deck is divided amidships by the passageway **E**, **Fig. 104**, the deck of which is at the level of the orlop.

†.... 2 or 3 feet ....

Access to the magazine is by way of a passage 26 inches wide [*70.5 cms*] set up on the orlop, like that designated by the letters **EF**, **Fig. 104**. The entrance to this passageway is either between or next to the second pair of cable-bitts; it ends in a doorway at **F** on the starboard side, where there is a ladder as shown at **e**, **Fig. 103**, by which one climbs down to the level of the cartridge-room. There is a second ladder at **f** leading down to the filling-room **Y**, and finally one at **g** to go down into the magazine **V**. Access to the magazine is also provided by a scuttle cut in the gundeck at **h**; below this scuttle is another, cut in the deck **d**. The powder is passed through these two scuttles when being taken on board or disembarked, but in action it is served by means of the passageway **E**, **Fig. 104**, and it is carried up on deck by way of a scuttle opened abaft the second pair of bitts.

There is a light-room in the magazine; it is set up on the larboard side opposite the cable-bitts and somewhat above the level of the deck **Z**, **Fig. 103**, as is shown by the pricked line **G**, **Fig. 104**. In order to light the candles which are in this light-room, one passes along a walkway on the orlop such as that designated by the letter **H**, or those designated in one case by the letter **I** and in the other by the letter **K**. The walkway ends at **L**, where there is a ladder leading to the light-room.

All the planks which make up the bulkheads of the magazine, and those forming the deck **d**, **Fig. 103**, are cyphered on both edges, and coated in the way of these rebates, both inside and out, with a plaster made of lime and tallow.

Comparing the magazines of our ships to those of the English ships, I find the latter to be larger, yet less well set up. They occupy to no good purpose a larger area of the hold, and there is by no means the same safety against accidents with fire, for the several areas surrounding the magazines are used for the Boatswain's stores and for those of the Carpenter and the Caulker, which can only be fetched by carrying a lanthorn there, whereas above our magazines there are only the bread-rooms, where for the most part we go in without a lanthorn. It is perhaps not out of place to report what I saw of the lack of precaution against fire taken by the English in their magazines. Being on board the **Lancaster**, a ship of 80 guns fitted out and moored off Portsmouth*, I asked to see the magazines; I was led there by the Gunner's Mate and by three

In May 1737

seamen, each holding a lighted candle. It is true that there was at that time no powder in the magazines, yet there had been, and there were still several grains of powder to be seen on the floors of the various magazines, which had been badly swept; moreover, the bulkheads and the ship's side were covered with fine powder dust so that the least spark might have set fire to the ship.

With the magazine set up in the stern of our ships, we have one or two powder-rooms forward, situated beneath† the deck of the Boatswain's storeroom, where filled cartridges are stored when preparing for action. Similarly the English, who have their magazine in the forward part of the ship, have in the stern a powder-room where they keep charges for several guns, especially for signals and saluting. This powder-room is situated amidships between the two beams placed one afore and the other abaft the mizen-mast, or rather from the forward side of one of these beams to the after side of the other, as is indicated by the letter **m**, **Fig. 103**; its breadth athwartships is 6 to 8 feet [*1.95 - 2.60 m*], and its height from top to bottom exceeds by the whole thickness of the orlop-beams the height between the orlop and the gundeck, in such a manner that its deck is level with the lower face of the orlop-beams. This powder-room is made up from oak planks two and a half inches thick [*6.8 cms*], cyphered on both edges and coated with plaster inside and out. Access is by way of a door cut in one or other of the sides, but more commonly on the larboard side. In those ships where the mizen-mast runs down into the hold[125], it passes through the middle of this powder-room.

†.... *situated on the deck* ....

CXLVII. In our ships we have but one shot-locker situated forward of the well, and the English have two of which one is forward of the well and the other abaft, like those designated by the letter **n**, **Fig. 103**. This arrangement is to be preferred to that which we employ, since not only is the weight of the shot divided, but it is also much less high. There are for example 50 tons[126] of shot in a ship of 74 guns; stowing these 50 tons in a single shot-locker as we do in our ships, a part of the shot will be above the centre of motion, since the locker being small both in length and breadth, it can only take all the shot when it is filled to three quarters of its height. Yet by dividing up these shot into two parts and stowing them in two lockers as the English do, they are all well below the centre of motion of the ship; they serve to ballast her, to make her stiffer under sail, and to ease her rolling. This is a reflexion which I made long before I saw what the English shipwrights practise in this regard, and for this reason I drew the shot-locker of the ship the **Dauphin-Royal** larger than in other ships of her Rate, so that all the shot could be stowed there below the centre of motion. Yet it is better still to make two shot-lockers as the English do.

Shot-Locker

Each of these two lockers is divided into two compartments and shut with two lids, like that shown by the letter **p**, **Fig. 103**. Their length fore-and-aft is the same as for our shot-locker, and the same applies to their breadth athwartships.

CXLVIII. There is but one bread-room in the English ships; it is situated abaft the mizen-mast and separated from the hold by the bulkhead designated by the letter **q**, **Fig. 103**. This storeroom encloses in length all the space between the bulkhead **q** and the stern; it occupies the full height from the keelson to the gundeck, and it runs athwartships from one side of the ship to the other; it is designated by the letter **r** in **Fig. 103**. Entry is by means of a doorway cut in the bulkhead **q** on the larboard side above the level of the orlop, and by a scuttle cut in the gundeck between the deck-transom and the last deck-beam in the stern. The orlop extends aft 2, 3 or 4 feet [*65 - 130 cms*] into this bread-room.

Bread-Room

In our ships the bread-room is better arranged; it is divided into five or six parts separated by bulkheads. These are the advantages which derive from this division. By virtue of this arrangement, if biscuit of different quality is to be taken on, which happens from time to time, it can be separated. If fresh biscuit be shipped before the old biscuit on board has been consumed, it is placed in one of the bread-rooms which is already empty. If the trim of the ship should be disturbed as the biscuit is consumed it is possible to put a number of items in the empty

125. i.e. as opposed to being stepped on the gundeck.
126. French tons of 2000 French pounds or 978 kgs.

bread-rooms to restore the trim. These advantages are not to be procured, or are to be procured with more difficulty, if there be only one bread-room for all the bread taken on for a commission, as is the case in the English ships. A further advantage of our bread-rooms is that they are situated 6, 7, 8 or 9 feet [*1.95 - 2.93 m*] above the keelson, and in the English ships the bottom of the ship itself serves as the deck of the bread-room, and in consequence the bread absorbs more damp.

Boatswain's Store-room

CXLIX. The place in the hold which is forward of the magazine in the English ships, and which is designated by the letter **t**, **Fig. 103**, and by the letter **M** in **Fig. 104**, takes the place in the English ships of our Boatswain's storeroom. This space is divided into two parts by a hanging-deck set up at the level of the orlop, formed of gratings as appears in **M**, but since it is not large enough to contain all the Boatswain's stores, a part of them are stowed in a storeroom set up on the orlop on the larboard side of the passageway to the magazine and marked with the letter **N**, **Fig. 104**. Some are also stowed over the hanging-deck **d**, **Fig. 103**, in large ships where the height between this deck and the deckhead allows.

Cable-Tier

CL. There is no cable-tier in the English ships; the cables are laid out along the orlop on the larboard and starboard sides, from the second pair of cable-bitts to athwart the mainmast. This method has been practised on occasions in some of the King's ships, especially when sailing under letters of marque[127].

Sail-Room

CLI. The sail-room in the English ships is set up fore-and-aft, whereas we place ours athwartships. It is situated on the orlop amidships, forward of the main hatch, and it extends over half or two thirds of the distance between the main hatch and the second pair of cable-bitts.

Issuing Room & other Rooms

CLII. The issuing room in English ships is to be found forward of the mizen-mast; it is formed by the orlop at **x**, **Fig. 103**. In this area on the starboard side is a storeroom for the Captain, and another for the Surgeon, and on the larboard side is a cabin for the steward and a storeroom for vegetables. Access to the issuing room is by way of a scuttle cut in the gundeck at **y**, **Fig. 103**, and in most of their ships this area is illuminated by a grating let into the deck at **z**.

The Carpenter has a storeroom on the part of the orlop which is between the first and the second pair of bitts, on the larboard side; it is designated by the letter **O**, **Fig. 104**. As I said when talking of the Boatswain's storeroom in the forepeak, the storeroom **N** which is opposite that of the Carpenter is used for the Boatswain's stores.

Carpenter's Walks

CLIII. In the hold of the English ships is a carpenter's walk on either side as in our own ships; it is marked by the letter **D**, **Fig. 104**. This walkway stretches from the forepeak to the bulkhead set up abaft the mizen-mast and marked by the letter **q**, **Fig. 103**. It is about 3 feet [*97.5 cms*] broad. It is separated from the hold by a pillar erected on each of the orlop-beams and reaching up to the beams of the gundeck.

Distance between Gunports

CLIV. All the English ships of 100 guns have 14 gunports on either side on the gundeck, which as in our own ships are pierced 7 feet 6 or 7 inches [*2.44 - 2.47 m*] one from the other. The first gunport at the bow is the same distance from the stem as in our own ships, as the last gunport at the stern is the same distance from the wing-transom. These ships have 14 and in some cases 15 gunports on the middle deck, pierced as in our own ships over the space between the gundeck ports. They also have 14 ports on the upper deck, placed above those of the gundeck. The **Victory** is the only English ship of 100 guns which has 15 gunports on the upper deck. This 15th port is situated aft between the side counter timber and the perpendicular corresponding to the aftermost gunport on the gundeck. There are in their ships of 100 guns 6 or 7 gunports on either side on the quarterdeck, and 2 or 3 on the forecastle, and in some ships two gunports on the poop. Yet although the number of gunports exceeds the number of one hundred guns, it is rare that they are armed with more than 100 guns.

127. Presumably because they carried larger crews, both for boarding and for manning prizes. This would have required more space for victuals and water.

Their ships of 90 guns have some of them 14 gunports on the gundeck and mostly only 13. In the former case the ports are cut 7 feet ½ [*2.44 m*] one from the other and the foremost gunport at the bow is too close to the stem. In their other ships of 90 guns where there are but 13 ports they are spaced 7 feet 7 or 8 inches [*2.47 - 2.49 m*] apart, and there is the same distance between the foremost gunport and the stem as there is in our own ships.

All their ships of 90 guns have 14 gunports on the middle deck, 13 gunports on the upper deck, and 5, 6, or 7 ports on the quarterdeck. Their ships of 80 guns have 13 gunports on either side on the gundeck, cut 7 feet 5 or 6 inches [*2.41 - 2.44 m*] apart, and the distance between the foremost port and the forward face of the stem, and between the aftermost port and the sternpost is near the same as in our own ships. Some of their ships of 80 guns have 14 gunports on the middle deck, and others only 13. All have 13 gunports on the upper deck, and most have one or two ports on the quarterdeck.

There are also 13 gunports on the gundeck of their ships of 70 guns, cut 7 feet 3 or 4 inches [*2.36 - 2.38 m*] one from the other, with about the same distance from the stem and from the sternpost as in our own ships. Some of the ships of this Rate have 13 gunports on the upper deck, and others 14; they have 5, 6, or 7 ports on the quarterdeck and one or two on the forecastle.

There are 13 gunports on the gundeck of their ships of 60 guns, spaced 7 feet 2 or 3 inches [*2.33 - 2.36 m*] apart, but the foremost gunport is closer to the stem than in our ships and there is scarce room enough for the gun to recoil. These same ships have 13 gunports on the upper deck and 4 or 5 gunports on the quarterdeck.

Their ships of 50 guns have 12 gunports on the gundeck, spaced 7 feet 2 or 3 inches [*2.33 - 2.36 m*] one from the other. The foremost gunport is not armed, and is even five, six or eight inches [*13.6 - 21.7 cms*] narrower than the others, and serves only as a chase-port, which is to say that a gun is moved there from one of the other gunports when giving chase. The second gunport is the same distance from the stem as the bow port in our ships of this strength, and there is sufficient space for the recoil of the gun which is placed there. Their 50-gun ships have 12 gunports on the upper deck and 2 or 3 on the quarterdeck.

Their frigates of 40 guns have eleven gunports on either side on the lower deck, separated 7 feet 2 or 3 inches [*2.33 - 2.36 m*] one from the other. The first gunport in the bow serves as a bow-chase port, in the way I have explained for their ships of 50 guns. These frigates have 10 or 11 gunports on the gundeck. There are 4 or 5 gunports on either side on the lower deck of their frigates of 30 guns and 10 or 11 on the gundeck, separated 7 feet [*2.28 m*] one from the other. Their frigates of 20 guns have 10 or 11 ports on either side on the gundeck.

In the English three deck ships there are four gunports in the gunroom, and in their other ships but two. The stern-lights or the doors to the stern-gallery may be readily armed in the English ships for stern-chase guns, but I have seen in none of their ships the ringbolts and hooks necessary for the breechings and guntackles. It is probable that they fit them in wartime.

There are four bow-chase ports in the beakhead bulkhead of the English ships, as there are in our own, of which two are beneath the forecastle and the two others above. The two latter ports are armed with guns, while for the two others they move guns from the broadside.

We used to have in all our ships a bow-chase port on the gundeck, as the English do in their ships of 40 and 50 guns, but we did away with it about 45 years ago because we believed that it prejudiced the strength of the ship. Yet we should perhaps have done better to have left it there, and to have found some means for avoiding any weakness to the structure occasioned thereby. For it is almost always from the bow that an attack is launched; a ship must receive several shots fired from the enemy's stern, and is unable to return the fire equally. In order to fight, it is necessary to luff or fall off, hastily fire a few ill-aimed shots†, and while this time is lost the enemy shoots ahead. There are sufficient examples of this happening. If therefore we had bow-chase ports on the gundeck forward we could bring our heavy guns to bear without deviating from our proper course to overhaul him, and we should be sooner able to take him. It is not impossible to fashion these gunports without affecting the strength of the structure.

†... a few shots which are difficult to aim accurately...

The English frigates of 30 guns and more commonly those of 20 guns have 14 to 18 oar-ports on either side on the lower deck, cut 2 feet 10 inches to 3 feet [*92.1 - 97.5 cms*] apart. Their lids open forward, whereas in most of our frigates they open aft.

Hatches

CLV. There are seven hatchways in the gundeck of the English ships. The main hatchway designated by the number **1**, **Fig. 103**, situated afore the first beam forward of the mainmast. I have spoken of its length fore-and-aft in the Remark on the distance between the beams[128]; its width athwartships is near the same as in our own ships. The after hatchway, designated by the letter **y** and situated afore the first beam forward of the mizen-mast; it is about a quarter less big than the corresponding hatchway in our own ships. The hatch to the bread-room situated between the last and the next-to-last beams in the stern and designated by the number **2**; it is about 2 feet and a half square [*81 cms*]. A hatchway situated between the first and the second beams abaft the second pair of cable-bitts and designated by the number **3**; it is about the same size as the after hatchway in our own ships; it is used for taking on board some of the firewood, the sails, spares, and sometimes the water. A hatchway two and a half feet square [*81 cms*] between the second pair of cable-bitts and the next beam aft; it is designated by the number **4**. This is the hatchway used for issuing the powder to the guns when the ship is in action. The hatchway to the Boatswain's stores is 28 to 30 inches [*76 - 81 cms*] square, situated forward of the second pair of cable-bitts, and designated by the number **5**. And finally the hatchway to the magazine, also 28 to 30 inches square, situated between the first and the second beams abaft the foremast and designated by the letter **h**. It is the arrangement of the apartments of the hold which dictates the difference which exists in the positions of the hatchways, in our ships and in those of the English.

Gunroom

CLVI. The gunroom of the English ships is set up on the gundeck at the stern, as it is in our own ships; its bulkhead rests against the deck-beam abaft the mizen-mast and stretches but half or two thirds the breadth of the ship; in such a manner that to larboard and to starboard there remains a space between the bulkhead and the sides of the ship which is 7 or 8 or 10 feet [*2.28 - 3.25 m*]. The English also arrange two cabins in the gunroom abaft the aftermost gunport, one on either side: the starboard cabin for the Gunner and the other for the junior Lieutenant; yet these cabins are not built with the same forethought as in our ships. We make them with canvas screens or with panel bulkheads, and in the latter case we leave in most of our ships sufficient space between the gunport and the cabin to allow the gun to be served, but the English extend these cabins right up to the gunport and form them of bulkheads so solid as to make one believe that they could never be struck down to allow the guns to be served, though they stand in their way.

Manger

CLVII. The manger is set up on the gundeck in the English ships as in our own; yet with this difference, that we finish ours at a few inches below the level of the hawseholes, whereas the English finish theirs in the way of the hawseholes at the same height or one or two inches higher, but raise them about a foot and a half [*49 cms*] higher at the ship's sides, in such a manner that the assembly of the manger-boards takes the form represented in **Fig. 109**.

Cabins

CLVIII. The officers' quarters in the English three deck ships are arranged in the following manner. In place of the wardroom which we set up on the middle deck of our ships of this Rate, the English have on this deck three officers' cabins which are set up one on either side, and run from the stern-timbers, or from the doorway to the quarter-galleries, to the aftermost gunport. The third cabin is situated amidships abaft the mizen-mast, so that there remains to larboard and to starboard of this cabin a space just about large enough for the recoil of the middle deck guns.

The Captain's quarters are arranged on the upper deck as we do in our own ships, yet it occupies a much larger space. I have shown it in plan in **Fig. 105**. In these quarters is a cabin which runs the full breadth of the ship, and from the stern-timbers to within 4 or 5 feet [*1.30 - 1.63 m*] of the mizen-mast; it is identified by the number **6** in **Fig. 103** and by the letter **A** in **Fig. 105**. The English call it as we do the "council chamber". Forward of this cabin on the

128. Remark CXLI, p. 144.

starboard side is a cabin containing the Captain's bunk; it is marked with the letter **B**, **Fig. 105**; it measures about 10 feet [*3.25 m*] fore-and-aft, and its breadth athwartships takes in near the full distance from the ship's side to the mizen-mast. On the other side of the ship from this cabin is an antechamber, designated by the letter **C**, and between the sleeping-cabin and the antechamber are enclosed the mizen-mast and the tiller-ropes, as appears in **D**. There is a stairway in the antechamber at **G**, providing access up to the quarterdeck.

Forward of these cabins is a space about 20 feet [*6.50 m*] long, marked with the letter **E**, and closed off by the bulkhead **F**. In this area they set up the Captain's dining-table, and on the starboard side there is a pantry as is shown[129] by the letter **H**, while on the larboard side is a cabin which the Captain can allocate as he wishes. This cabin and the pantry are about 8 feet [*2.60 m*] long and 6 or 7 feet [*1.95 - 2.28 m*] wide.

The Captain's quarters in our own ships of three decks are not nearly so extensive as these, but they are better suited to the needs of war. Since we do away with but one gun on the upper deck, or two at most, if we should leave off the gun in the great cabin; and in the English ships there are four guns on either side which cannot be served by reason of the bulkheads of the cabins. I have observed this to be the case in all their three deck ships. It is true that the bulkheads can be struck down, but if they are dismantled with the care necessary to avoid breaking them, then much time must be expended, and if these precautions are not taken, then when the action is over it is extremely difficult to put back everything in the same state in which it was before; thus it were better to have, as we do in our ships, quarters which were a little smaller for the Captain, but which did not require to be cleared for action.

In their ships of 100 and of 90 guns, the cabins of the Captain, the Second Captain and of the First Lieutenant are to be found on the quarterdeck. These cabins are set out as shown in plan in **Fig. 106**, where **A** represents the Captain's cabin, **B** that of the Second Captain, **C** that of the First Lieutenant, **D** the stairway down to the upper deck, and **E** an area for the Captain's dining-table. This area is closed off from the remainder of the quarterdeck by a bulkhead placed abaft the mizen-mast and designated by the letter **F**.

The quarters which we arrange on the quarterdeck of our ships of the same strength seem to me to be greatly more convenient in that they contain more cabins, for the most part of the same size as those in the English ships. It is true that the area **E** does not exist, except in our ships of 110 guns, where there is a great cabin which occupies the room of the area **E**. On the quarterdeck of the English ships of 80 guns there are but two cabins at the stern, as there are on the poop of their ships of 100 and of 90 guns. These cabins are larger than they are in our own ships, since we make a greater number of cabins in the same space.

In the English ships of less than three decks the Captain's quarters are arranged on the upper deck as I have explained of the Captain's quarters on the upper deck of their three deck ships. They are laid out in the same manner, which is to say that at the stern there is a great cabin which takes up near all the room between the stern and the mizen-mast. Forward of this cabin is the Captain's sleeping-cabin on the starboard side, and an antechamber on the larboard side, and further forward is an area which takes up more than half of the distance from the mizen-mast to the mainmast, and where there is a pantry and the Captain's dining-table. On the quarterdeck of their ships of 70 guns there are the same arrangements as on the quarterdeck of their 100-gun ships, and in their ships of 40 to 60 guns these quarters are the same as in their ships of 80 guns, or as on the poop of their ships of 100 guns, by which I mean that there are but two cabins against the stern.

There are neither cabins nor deck-cabins on the poop of their ships of less than 90 guns.

It may be seen from this arrangement of the cabins that in the English ships of 100 and 90 guns there are but ten officers' cabins apart from the Captain's quarters: one on the larboard side in the gunroom, 3 on the middle deck, one on the upper deck, three on the quarterdeck and two

129. It is not in fact identified by any letter, and **H** indicates the coal-burning stove (see overleaf).

on the poop; and that in their ships of 80 guns there are but seven; in their 70-gun ships, but five; and in their ships of 50 to 60 guns but three or four. In all the English ships one of these cabins is given over to the Boatswain, for there are no deck-cabins on either the quarterdeck or the poop.

All these cabins must be struck down when the ship is cleared for action, with the exception of the two stern-cabins on the quarterdeck of their ships of 50 to 80 guns and of the two which are on the poop of their ships of 90 to 100 guns, and of the cabin set up on the middle deck amidships. We have in addition to the Captain's quarters 26 cabins in our ships of 110 guns, about 22 in those of 100 guns, 18 in our 80-gun ships, 11 to 13† in our 74-gun ships, 9 or 11† in those of 64 guns, and 5, 7 or 9 in those of 50 to 56 guns. More than half of these cabins need not be struck down when the ship is cleared for action.

†.... 14 to 16 in our 74-gun ships ....

†.... 11 to 13 in those of 64 guns ....

Comparing this arrangement with that on board the English ships I find that the advantage lies with us. The English have cabins which are larger and more convenient than ours, but which become most inconvenient when the ship goes into action. I will say nothing of the number of cabins, since we need to have many in our ships by reason of the greater number of officers than in the English ships; for this same reason it would serve no purpose to set up as many cabins in the English ships as in our own since they do not have enough officers to occupy them. The only thing that I should wish to adopt from the English arrangement of the cabins would be to set aside as they do, beneath the quarterdeck and forward of the mizen-mast, an area for the Captain's dining-table. We would then be able to set up against the stern officers' cabins which would not need to be cleared for action, as must the cabins in our ships which are situated off the great cabin, and which would be better lit. I stated in one of my Remarks[130] that doing away with the second barrel of the main capstern would ease this establishment, yet if it were found difficult to do away with this barrel, then it would be easy so to place the main capstern that it did not prevent carrying the bulkhead of the great cabin far enough forward of the mizen-mast to allow the Captain's dining-table to be set up there.

†.... in the commander's cabin and in that of the Captain ....

I should not omit to say that there is in the great cabin† of most English ships a stove where they burn coals. This stove is shown by the letter **H**, **Fig. 105**; it is of cast iron, and decorated with copper plates, and has a copper pipe which runs up to above the poop.

Apart from the cabins in the stern, there are in the English ships four cabins beneath the forecastle which we do not have in our ships. These cabins are occupied one by the Carpenter, and the others by divers petty officers; they are 6 feet ½ to seven feet [*2.11 - 2.28 m*] long, and must be struck down when the ship is cleared for action, since by the way in which they are made they stand in the way of several guns being served.

Quarterdeck, Forecastle & Poop

CLIX. In all the English ships of 40 to 100 guns the forecastle is about a quarter less long than in our own ships, and in their frigates of 20 and of 30 guns this same forecastle is but half the length that we give to it in our frigates of this strength.

The quarterdeck of all the English ships of 40 to 100 guns extends forward but to within 6, 7 or 8 feet [*1.95 - 2.60 m*] of the mainmast, and at the forward end of the quarterdeck is a gangway 4 or 5 feet [*1.30 - 1.62 m*] in breadth, situated amidships; this gangway runs forward as far as the mainmast and is formed by two carlings running from the breast-beam of the quarterdeck to the head of the knights of the topsail-sheet bitts, over which are laid gratings which form the walk of the gangway. In their frigates of 30 and 20 guns the quarterdeck finishes some few feet forward of the mizen-mast.

The poop of their ships of 100 guns and of some of their 90-gun ships extends 2, 3 or 4 feet [*65 - 130 cms*] forward of the mizen-mast. In most of their 90-gun ships it finishes at the mizen-mast. It is but 10 to 14 feet [*3.25 - 4.55 m*] long in their ships of 80 guns; in some of their 70-gun ships it runs as far as one beam forward of the mizen-mast, and in others it finishes at

130. Remark CVI, p. 100.

the mast as in their 60-gun ships. In their 50-gun ships it is about 12 feet [*3.90 m*] long, and 8 feet [*2.60 m*] in their 40-gun frigates. There is no poop in their frigates of less than 40 guns.

There is a poop-royal only in their ships of 100 guns, and in some of their 90-gun ships; it is eight to seventeen feet [*2.60 - 5.52 m*] in length.

Gangboards

CLX. I have seen gangboards in but one English ship: this is the **Victory**, a 100-gun ship building at Portsmouth. There are none in any of the other ships whether large or small. Since the English do not fit gangboards between the quarterdeck and the forecastle they are able to lower the waist considerably in their ships, and they find thereby advantages which are perhaps to be preferred to the usefulness which we derive from our gangboards. The side of the ship is not so high; it is lighter, and catches the wind less when sailing close-hauled. From the deck everything which lies outside the ship may be readily discovered, whereas from the deck of our ships the bulwarks are much above our line of sight. There is less labour in hoisting in and out the longboat and all that must be taken on board ship, since these burdens do not have to be hoisted so high, the gunwale being a foot and a half [*49 cms*] lower. The ship is lightened by the weight of the gangboards, of the knees which support them, and of the iron stantions and the planks which form the breastrail of the gangboards.

Poop-Awning

CLXI. All the English ships of 80 guns, and those of 50 and of 40 guns as well, have a poop-awning, because the poop being of but middling length and the space beneath being entirely taken up by the cabins at the stern, there would be no shelter to be had on the quarterdeck without this poop-awning. It runs forward as far as the mizen-mast and from one side of the ship to the other, and is formed of light beams of 2 inch [*5.4 cms*] scantling, and of boards of one inch [*2.7 cms*]. The sides are not closed as they are in our ships; there is but a canvas curtain which is let down from the awning to the plankshеer, so that this curtain being raised when the ship is sailing close-hauled, the poop-awning presents almost no obstacle to the progress of the ship[131]. The height of the poop-awning in their 80-gun ships is 6 feet [*1.95 m*], and in their other ships 5 feet 6 to 8 inches [*1.79 - 1.84 m*].

Ladderways

CLXII. The ladderways in the English ships are established otherwise than in our ships. There are two in the hold, designated by the number **7**, **Fig. 103**, which are formed by samson's posts with notches cut in them to serve as steps, just as we do†. Forward of the mizen-mast is a ladderway in the after hatch which goes down as far as the orlop. This ladderway is designated by the number **8**, **Fig. 103**, and takes the same form as the after ladderway on the gundeck of our own ships. There is a similar ladderway only less broad situated abaft the second pair of bitts, providing access to the orlop also; it is marked with the number **9**.

†.... to serve as steps, like some of the pillars in our own ships ....

To get from the gundeck to the middle deck in the English ships there are two ladderways, one situated forward of the mizen-mast and facing either forward or to starboard, and the other situated between the first and the second deck-beams afore the main hatch. This second ladderway faces forward; it is marked by the number **10**; its width is 5 to 7 feet [*1.63 - 2.28 m*] and it is made up of two ladders placed side by side, like the ladders about the mainmast in our own ships; the other ladderway takes the same form also, and is marked by the number **11**; its width is 4 feet to 4 feet and a half [*1.30 - 1.46 m*]. I find our ladderways which are abaft the main hatch greatly more convenient than that which in the English ships they place forward of this hatchway, especially in ships other than those of three decks, since when the longboat is hoisted in it prevents the use of this ladderway almost entirely, but the English cannot place it abaft the hatchway since there is insufficient space between the hatchway and the mast.

131. This comparatively light structure appears to be relatively recent, to judge by a letter from the Navy Board to the dockyards dated February 16th 1728 (NMM.POR/B/5). With reference to sloops, we read: "*Therefore for that purpose for the future, and particularly where any of them have heavy awning frames, you are to take them down and fit them with light ones, which are not to exceed six feet in length, before the after cabin, to be covered with tarred canvas only so as that upon occasion it may be rolled up to the middle of the awning.*"

To get from the middle deck to the upper deck in the English ships there are three ladderways. The first is placed amidships between the mainmast and the mizen-mast, facing forward. It can be seen in profile at **M, Fig. 105**[132], and I have shown a plan view in **Fig. 110**. The opening where the ladderway emerges on the upper deck is 8 feet long [*2.60 m*] fore-and-aft, and 4 feet and a half to 5 feet [*1.46 - 1.63 m*] wide, and it is surrounded both forward and on either side by a balustrade 3 and a half feet [*1.14 m*] high. In place of a ladderway of this kind we have in our three deck ships a ladder with two handrails which is just as convenient and yet which does not, like the ladderway in the English ships, demand a distance of 8 feet between the beams but only 4 feet or 4 feet and a half [*1.30 - 1.46 m*], and in this it is to be preferred because the ship is less weakened thereby. There is yet a further advantage in our ladderway, in that it takes up less room. The second ladderway which is used in the English ships to go from the middle deck to the upper deck is situated forward of the mainhatch and over the ladderway leading from the lower to the middle deck; it is marked with the number **12**. It is of the same shape and width, and is also divided into two parts. It is scarce possible to use this ladderway when the longboat is hoisted in, and it must also be struck down each time that they wish to make use of the fore jeer capstern. Our ladderways which are placed abaft the main hatchway are much more convenient and there is never any need to strike them down in such cases. The third ladderway which in the English ships leads from the lower to the middle deck† is placed forward of the foremast and is designated by the number **13**. It faces to larboard; its breadth is about 3 feet [*97.5 cms*]. We do not have such a ladderway at all in our ships.

†*...from the middle to the upper deck...*
[The Brest manuscript is clearly correct in this instance. Ed.]

In the English three deck ships there are three ladderways by which to reach the quarterdeck. One is placed next to the ship's side in the form of a spiral staircase in the Captain's antechamber and designated by the letter **G** in **Fig. 105** and by the letter **D** in **Fig. 106**. The two others are fashioned in the same manner, and are also placed against the ship's sides, at the break of the quarterdeck, as in that designated by the number **14, Fig. 103**. These two staircases are extremely heavy, take up much room, and are difficult to shift, yet for all that they take them down when clearing for action since each one obstructs the working of one gun.

In most of their ships of 60 and 70 guns there is one ladderway in the antechamber to the Captain's quarters, leading up to the quarterdeck, and a second amidships between the breast-beam and the second beam of the quarterdeck, or else between the second and the third beams, and which faces either to larboard or to starboard, or forward. In some of their ships of this strength the ladders leading to the quarterdeck are set up in the same manner as in their three deck ships.

In some ships of 50 guns they are set up as in most of their 70-gun ships; in others there is but one ladderway placed amidships between the breast-beam and the second beam, and the same is true of their frigates of 40 guns.

In the English three deck ships there are two ladders leading from the upper deck to the forecastle; they are situated at the break of the forecastle and on either side like the quarterdeck ladders, and each stands in the way of one gun being served, but they are shifted when the ship is cleared for action. In their ships other than those of three decks there is a movable ladder on either side, as we have in our ships which do not have gangboards.

Access to the poop is by way of two winding staircases set up on the quarterdeck of three deck ships, one on either side, and in other ships by way of two movable ladders.

The English three deck ships have an entering-port cut in either side of the upper works between the gundeck and the middle deck; in some of their ships it is placed abaft the main channels, in others directly below the middle of these channels, and in most ships forward of the channels. Below this port is an entering-ladder fayed to the sides of the ship and running down to within 2 feet [*65 cms*] of the waterline. In their other ships they have a series of cleats placed forward of the mainmast and fastened to the upper works so as to form a ladder similar to that which is to be found in the same place in our own ships, with the difference that our cleats

132. sic: **Fig. 103.**

are morticed into two skids, whereas in the English ships they are simply nailed to the ship's side. The port where the ladder finishes in their three deck ships does not exist at all in our ships, but it is better to dispense with this convenience and that the integrity of the hull be not disturbed, as it is in the English ships, where this opening cuts through all the quickwork and the planking of the side in the space between one deck and the next.

In place of an iron breast-rail, covered by a canvas hood 5 to 6 feet [*1.63 - 1.95 m*] high such as we erect above the after ladderway on the quarterdeck of our ships, the English construct above this ladderway in those of their ships where it is to be found, a berthing approximately 3 feet [*97.5 cms*] high, the lower half of which is fixed in place permanently, while the other half opens and closes by means of two hinged straps. This method of covering the ladderway is to be preferred to our own, since the wind has less purchase on this berthing than on the breast-rail and hood covering the ladderway in our ships*.

Since I made this Remark I had the hood of the after ladderway constructed in this manner in the .... (deleted).

CLXIII. There is a breastwork in the English ships at the break of the forecastle, of the quarterdeck and of the poop as there is in our own ships, which runs up to the height of the bulwarks, and which is fashioned with stantions tennanted into the breast-beam and with a breastrail laid over the head of these stantions. The breastworks are decorated with a carved frieze or more commonly simply with a balustrade.

Breastworks

CLXIV. There are quarter-galleries at either side of the stern of the English ships as there are in our own, yet they are of very different construction. The stools of the English quarter-galleries are but the same length as the lower stools in our quarter-galleries, so that they form a gallery which measures near the same distance fore-and-aft at the top as at the bottom. The breadth of these stools at the after end is 6 feet [*1.95 m*] in their three deck ships, 5½ feet [*1.79 m*] in their 70-gun ships, 5 feet [*1.63 m*] in their 60-gun ships, and 4 feet [*1.30 m*] in their ships of 50 guns. They are shown in plan at **K**, **Fig. 105**. I will confess that I was surprised by the excessive breadth of the stools of their quarter-galleries, which is more than double the breadth which we give them; and indeed it is surprising that the English, who in many parts of their ships do away with any thing which might present an obstacle to sailing close to the wind, should construct against the sides of their ships stools which give such a great breadth to the quarter-galleries that they are made to act like a backed sail. The only advantage which they derive from it is that they are enabled to situate on each stool a privy, as in **L**, **Fig. 105**, and outboard of this privy a gallery on the quarters like that designated by the letter **M**. These arrangements seem fair and practical when judged from on board. I do not say that from without-board they appear mis-shapen, for were I accustomed to see quarter-galleries so broad I should find these as fair as do the English, and our narrow quarter-galleries would seem absurd. Yet to consider their breadth only in terms of its effect on the sailing qualities of the ship, it is clear that our quarter-galleries are to be preferred, in that they present a smaller and more oblique surface to the wind when sailing close-hauled, and because they weigh two thirds less than the quarter-galleries in the English ships. I asked Mr Ward, Master Shipwright at Chatham, and Mr Fellows, Assistant at Portsmouth, if it were really necessary to build their quarter-galleries so broad as they do; both of them replied that nothing could be less necessary; that they are built thus broad because it is a long-standing practice which they should not dare to abandon by reason of the privies obtained thereby. Mr Fellows did not expound any further, perhaps because he supposed that I should not understand his meaning if he were to explain to me the inconveniences which result from quarter-galleries which are too broad, but Mr Ward added the remark that with galleries of this bigness they weigh down disproportionately the stern of the ship, and restrict her speed when sailing close to the wind.

Quarter-Galleries

The stools of the English quarter-galleries are composed of 2, 3, or 4 timbers laid athwartships and assembled with hooked scarphs in the same way as we assemble these timbers in our own ships. They are fastened to the ship's sides with iron bolts and are supported by knees which are twice as large as those which we employ since they must support stools which are greatly heavier. They are covered over on top with sheet-lead.

The privies set up on the stools laid at the level of the upper deck and of the quarterdeck are separated from the winding gallery set up on these same stools by a bulkhead such as that

designated by the letter **N**, **Fig. 105**. This bulkhead rises to about 3 feet [*97.5 cms*] above the stool and finishes in a row of lights 2½ to 3 feet [*81 - 97 cms*] wide, divided by munions 5 inches [*13.6 cms*] square.

Galley

CLXV. The galley is arranged on the middle deck[133] of the English three deck ships and on the upper deck of their two-deck ships, and on the lower deck of their frigates of 20 to 30 guns. This practice differs from our own only with regard to three deck ships and frigates. We place the galley on the upper deck† both of the former, and of the latter frigates of 30 guns. In the English ships it is situated amidships as in our own ships, and it is 4 or 5 feet [*1.30 - 1.63 m*] closer to the foremast. The construction of their galley is quite different from that which we see in our ships. We build into the same casing the galley fire for the Captain on one side and that for the crew in the other side; whereas the English on the contrary make an enclosed galley which is 7, 8 or 9 feet long [*2.28 - 2.93 m*] and 7 or 8 feet broad [*2.28 - 2. 60 m*], containing a range facing aft upon which they prepare the meat for the Captain's table. I have shown the galley in plan in **Fig. 111**, and in fore-and-aft profile in **Fig. 112**, the vertical section being taken along the line **XX** in **Fig. 111**. The letter **A** denotes the doorways opening one to larboard and the other to starboard, **B** is a bench, **C** the galley table and **D** the range. Backing onto this range is a fireback of brickwork which measures 5 to 8 feet [*1.63 - 2.60 m*] athwartships, and which runs forward 2 feet and a half to 4 feet [*81 - 130 cms*] to enclose two coppers for the crew, each fitted with a spigot at the bottom. These coppers are marked with the letter **E**; they are never removed throughout the ship's commission and it is very difficult to keep them properly clean. The flue which rises up over the range is of copper, and it protrudes 2 and a half or three feet [*81 - 97 cms*] above the forecastle. This galley takes up more space than that which is to be found in our ships[134], and I find it less convenient in that it is less well lit and in that the crew's coppers cannot be removed for cleaning. In the English three deck ships where the galley is situated on the middle deck as I have shown by the number **15** in **Fig. 103**, there is an opening in the upper deck at **16**. This opening is covered over, one foot [*32.5 cms*] above the deck, and between the deck and the hood, in the side facing aft, is a light glazed with panes of glass.

†.... on the middle deck of the former and on the upper deck of the latter ....

In the English ships there is no bread-oven, neither have I seen any other oven.

Rail-Stantions

CLXVI. In some English ships there are timber rail-stantions which are four times thicker than those in our ships, nailed to the ship's side, and supported by two braces, like the stantion which I have shown in **Fig. 113**. There is a score cut in the head of these stantions to receive the rail, as with the stantions in our ships. I sought for a long time to work out the reason for the English making these stantions so thick, and having found no answer I was constrained to ask; I was given no reason, other than that this is the way they are made when they are made of timber. This practice is bad, for stantions three fourths less thick suffice for the breast-rails in our ships, and that without the support of any brace. In other English ships there are iron cranes[135] with two arms, like that which I have shown in **Fig. 114**. At the end of these two arms there are eyes, through which a rope is rove, taking the place of a guard-rail, and to which two nettings are secured, allowing them to barricade atop the bulwarks between the two nettings much better than in our ships.

Stern-Lights & Scuttles

CLXVII. There are five or six stern-lights in the stern of the English three deck ships, in the wardroom, and the same in the great cabin. Their ships of 60 and 70 guns have 4 or 5, and their ships of 40 and 50 guns have but four. These stern-lights are composed each of two sliding sashes, one glazed with panes of glass and the other a deadlight. These sashes are counter-balanced with two lead weights which rise and fall in a channel cut in the thickness of the munion, as I have shown in **Fig. 115**. This practice saves all the hooks and window-bolts with which we fit the stern-lights of our ships, and makes them easier to open and to close.

133. The French original is more economical at this point: "*second pont*" means both the upper deck of two-deckers and the middle deck of three-deckers. [Trans.]
134. By now iron fire hearths were being fitted to the smaller vessels in order to relieve them of the weight of the brickwork.
135. Hammock-cranes.

The scuttles cut in the ship's sides to illuminate the wardroom and the great cabin are about 2 feet long [*65 cms*] and but 10 to 12 inches high [*27 - 32 cms*]. They are larger in our ships. There are also similar lights in the English ships cut in the side beneath the quarterdeck in the way of the dining place. This same place is lit by a grating which is fitted overhead with window-frames glazed with panes of glass which slide between two munions in such a manner that they can be removed if required. The stern-lights in the taffarel which provide light to the cabins on the poop-royal are about 20 inches [*54.2 cms*] square in the English ships; we make them much smaller†.

†.... *we make them much larger.*

CLXVIII. There are but four pumps in the English three deck ships, and two only in their ships other than those of three decks. In the former they are situated two afore and two abaft the mainmast, in the pump-well, as they are in our own ships, and in those ships where there are but two pumps they are placed abaft the mainmast. In all our ships we have four pumps in the pump-well, and two further pumps or one only in the after well.

Pumps

The pumps in the English ships are each composed of two pipes, placed side by side; one of these pipes is square and the other is bored round. Through the former passes an iron chain fitted with leather plates which have been cut circular, and placed at intervals of 12 to 15 inches [*32 - 41 cms*]; this chain runs up through the other barrel and in so doing pulls with it the water which is at the snifting-hole of the pump. This water discharges into a wooden cistern which surrounds the pumps 18 inches away [*49 cms*] on the gundeck, and is led off outboard by a wooden dale of which one end fits in the cistern and the other in the ship's side at a height corresponding to midway up the port-sill. The chain is moved by a wheel placed athwartships on the gundeck above the pump barrels. This wheel is fitted with iron spokes forming double sprockets over which the chain passes, and has an iron winch extending fore-and-aft to which the men are put for pumping.

I shall not describe further the construction of this pump since it is already known to us in France. The English also know the pump which we employ, and esteem it not at all. They claim that it yields less water, that it is more tiring for the crew, that it takes up more room on deck, and that its construction, its maintenance and its repair are more difficult. I have compared it in all its parts with the English pump, and I find that the English are wrong to prefer their pump over ours. I have seen them working the English pump, and I have seen less water come from it than from our own bronze barrelled pump. It seemed to me that the seamen were more fatigued than with our pumps.

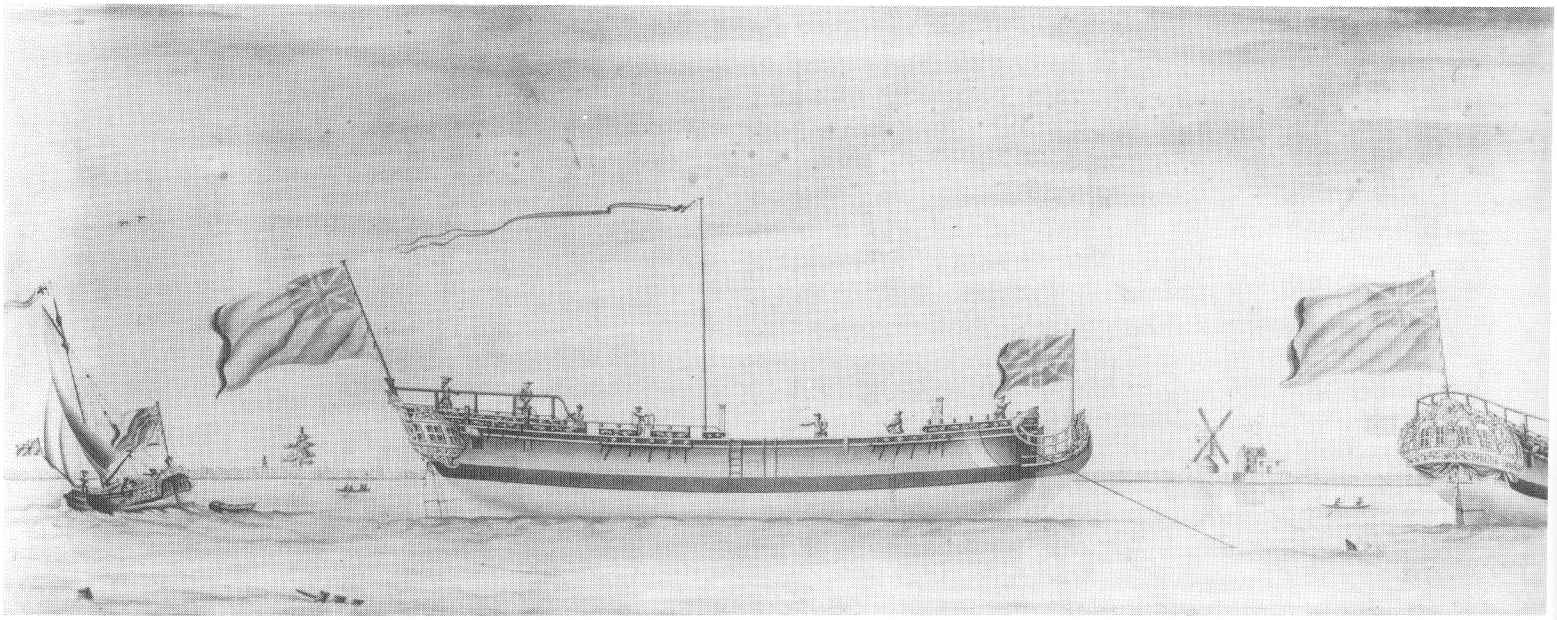
Nor do I agree with the English that their pump takes up less room on the deck, for the cistern and the dales take up a considerable space: the gun opposite the mainmast can only be served by shifting these dales. The cranks which are used to move the chain also take up much room. It is not true that our pump is harder to maintain and to repair than the English pump: with a spare lower box and upper box it is but the work of a moment to repair our pump if something should happen to the lower or the upper box, and this is not the case with the English pump which being made up of many pieces, which are more difficult to fit, may break down in many places and only be repaired with greater difficulty. Their pump is subject to greater hazards in battle, since its parts offer a larger target than do our pumps. The English count as an advantage† for their pumps that they may be worked on the gundeck, whereas we esteem our own in that they are worked on the upper deck and under the eye of the officers.

†.... *The English count among the advantages which they claim for their pumps ....*

CLXIX. The ensign-staff in the English ships is not seated in a step on the poop as in our ships, but in a rotating rowle, the two ends of which fit into the taffarel timbers as in **Fig. 116**. This rowle is set up 7 or 8 inches [*19 - 22 cms*] above the poop, and is designated by the letter **A**[136]. It has a mortice into which the heel of the ensign-staff is fitted, so that when it is desired to lower the staff they take hold of it at its head and strike it down along the poop without removing it from the mortice in the rowle.

Ensign-Staff

136. *sic*: not in fact so marked.



60. *English Sloop immediately after Launching. c. 1730. Wash, J. Hood. (Courtesy National Maritime Museum, Greenwich)*

Divers Practices of the English

CLXX. The English employ about three or four years in building a three deck ship, two and a half in building their ships of 70 and 60 guns, and rarely less than two years in building a ship of 40 or 50 guns. The **Victory** which I saw building at Portsmouth was begun three years ago and will scarce be launched before another year[137]. The **Elizabeth** which is building at Chatham was begun two years ago and will only be launched in September next[138], and the same is true of the other ships which I have seen building. The English shipwrights frame their ships first and leave them in that state while they work slowly on the deck-beams, the wales and the ceiling &ca. They take extreme care not to instal any timber which is not purged of its sap, unless it occupy a place in the ship where it can dry out before it is berthed up. The frame timbers are considered thus in the time before they are covered by the planks of the ceiling and of the hull.

The English finish their building on the stocks; they complete the apartments of the hold and of the upper works before the ship is launched; they fit out the head and fashion the quarter-galleries*. They caulk the upper works as soon as they are planked, and also the upper deck and the quarterdeck and forecastle, before they caulk the bottom. They only fasten finally in place the margin-planks of the gundeck which serve as waterways when the ship is made ready for sea; until that time these strakes and the two strakes of the spirketting beneath the gundeck port-sills are left off. This practice is excellent, since it preserves the ends of the deck-beams better and allows air into the hold. We cannot quite follow the same practice in our ships since the waterways and the upper futtock-riders are timbers which cannot be other than permanently fastened, yet we could refrain from nailing down the deck-planks next the waterways, shift them once the ship is built, and leave them in that state until the ship is first fitted out for sea.*

**Following the example of the English .... (deleted).*

**I followed this practice .... (deleted).*

The method employed by the English shipwrights of finishing their ships on the stocks and caulking them completely before they are launched is one of the means which contributes most effectively to preventing early hogging in their ships. As for us, we launch a ship as soon as her middle deck is planked or even with but her binding-strakes in place, and as soon as her upper works are finished to the height of the middle deck gunports. In some of our yards we do not

137. The *Progress Books* indicate as already stated that she was launched on February 23rd 1737, which accords roughly with Ollivier's prediction: by Ollivier's reckoning February 1737 was February 1738 – see the note on dates in the Introduction.
138. In fact she was not launched until November 29th.

even caulk as far as the load waterline†, and thus our ships hog from the moment they are launched. We can advance no good reason in favour of this practice of launching our ships before they are finished, for whether or not we are in a hurry our ships can be finished with as much speed or as much slowness afloat as on land. Whether the ship weighs 1,000 tons [*978,000 kgs*] when she is launched or 1,500 tons it is no more difficult to launch her in one state or the other; on the contrary we are more assured of a successful launch when she weighs more, since any body moving on an inclined plane will gain the more speed the more it weighs.

†.... In some of our yards we caulk them no higher than the load waterline ....

Since our method in this respect is thus sanctioned only by custom we could give it up and conform to that of the English shipwrights, and we should find thereby the advantage of slowing the hogging of our ships. The **Victory** of 100 guns which I have already mentioned and which is building at Portsmouth already has her beakhead in place, her channels, the stools of her quarter-galleries. I see nothing more simple or more natural than to thus finish a ship ashore, and I cannot conceive how or why the practice was introduced into our yards of dividing the building of a ship into two parts, to accomplish two thirds ashore and the other third afloat. It costs us more labour, more care, and our ships are launched with insufficient stiffness to resist the hogging to which the bows and the stern are prone†.

†.... are launched before they are properly stiffened.

CLXXI. The English claim that their ships hog less readily than do ours, and that is true. Many causes contribute to delay this hogging in the English ships. 1st, the treenails which fasten the planking and the ceiling to the frames provide a more solid fastening than do our nails. 2nd, the bow and the stern of the English ships weigh proportionately less than those of our ships, since the riders forward and aft have neither lower nor upper futtocks; and since the counter and the stern-galleries extend less beyond the perpendicular of the sternpost, and since the head is burdened with a bowsprit which is less thick and with rigging which is less weighty than is the case with our ships. 3rd, the English ships are finished and caulked up to the waist when they are launched, whereas our ships are caulked but as far as the load waterline or at most to the middle deck ports. See the preceding Remark. 4th, they are never lightened of all their ballast as are ours each time they are graved.

Hogging

CLXXII. The English ships of 50 to 100 guns draw two feet to two feet and a half [*65 - 81 cms*] less water than do our ships, and this is the advantage which they obtain from their full lines and the small quantity of ballast which the middling height of their masts and the lightness of their rigging permits them to take on board. From this lesser draught derives the result that their ships find less obstacle to their cleaving the water, and while it is true that they make more leeway when sailing close-hauled, they gain when running more than they lose in leeway. The difference in draught fore and aft is less great in the English ships than in our own. This difference is but 14 inches [*38 cms*] in the **Britannia**, 100 guns, which I have already mentioned, and I have observed it to be between 10 and 12 inches [*27 - 32 cms*] in their ships of 60 to 70 guns.

Draught of Water

CLXXIII. I stated, when talking of their dry-docks, Remark **CXXI**, that the English grave their ships there always, and that this practice is to be preferred to that of hauling them down on pontoons because it is less costly, it can be carried out more expeditiously, and the ships suffer less strain thereby. I would add here that by means of this practice of graving their ships in dry-dock the English are dispensed of having recourse to careening-pontoons, to floating stages and to pitch-boats, the maintaining of which is a considerable burden in our ports. Nor do they have need of so many boats, barges and ballast-lighters as we have. This inclines me to think that the cost of constructing two or three dry-docks such as the English have would be paid back in but a few years through the saving which we should achieve in the building of all the various vessels which are needed for graving on pontoons.

Graving and Caulking

The English caulkers open up the seams with horsing-irons as we used to do in France, and as I believe is still the practice in certain ports in France; yet they know the use of the reaming-iron, for I have seen some caulkers employ it in place of a horsing-iron. The oakum which they employ is of the same quality as that which we employ; they also have the same caulking-irons, but their caulking-irons are all about one inch [*2.7 cms*] longer and ¼ to ½ an inch [*7 - 14 mm*] wider than those used by our caulkers, especially their crease-irons.

Mr de Champlain's Composition

The following note is preserved in the Duhamel du Monceau Papers, and is transcribed by kind permission of the Peabody Museum of Salem, Salem, Mass. It is undated, but from another (dated) manuscript which accompanies it, it may be supposed to have been written in 1692, when Phélypeaux de Pontchartrain was Minister for the Navy (he was succeeded in 1699 by his son Jérôme). It cannot be affirmed categorically that this is the "bittume noire" to which Ollivier refers, since he talks about it having been introduced recently, but in view of its presence among the Duhamel Papers, which contain little 17th century material, it seems probable.

Remarks for Shortening and Facilitating the Manufacture of the Tar used for the Preservation of His Majesty's Ships, presented to Monseigneur de Pontchartrain by Mr Sauvage de Champlain.

The cauldron in which the said tar is made must be proportionately three times the volume of that in which the sulphur is to be melted, so as to facilitate its more rapid union and fixing with the common tar before the other materials are mixed with it.

Thus the first step is to place your tar in the larger cauldron, and let it bubble over the wood fire which must be employed; during which time you will melt the sulphur in your small cauldron, which must be used only for this purpose, and once it is melted you will throw it into the large cauldron. You will boil the said two materials over a slow fire, for fear of it bubbling over, and when after a good quarter of an hour or half an hour more or less you begin to see bubbles like soap suds which will rise gradually with a humming sound, which is a sign that the said materials have joined and fixed themselves one to the other, remove them for the time completely from the fire, and spread some of the mixture with the stirrer on a piece of wood. The said mixture should be even and transparent like a mirror. See when it is cold that it runs like glue, the two materials being now but one which is completely homogeneous. It must be allowed to cool for a good half hour, by reason of the bubbling which would otherwise be too great when the other materials are added.

Next, using a large sieve, you will add your alum and umber, or ochre if that be lacking, so that these substances be reduced to an imperceptible powder. The said substances must be well mixed and stirred, and then add your glue, which must be melted only with such a quantity of water as to render it a little more liquid than that used by carpenters; and which must be hot when it is mixed. Then continue to stir well so that your mixture be perfect, and ensure that the fire be very low during all the time that these are being mixed. Once all the substances are well united, pour off the composition while it is still hot so that the cauldron will be clean for the next boiling, and always do thus.

No boiling will take longer than three hours; this composition can be made more or less hard according to its different uses; save for tarring ropes, for which the mixture is quite different; and not less useful.

It is better that this composition should rather be too thick than too liquid, since you can always add tar which is as liquid as oil (which is that which I have heard used in this mixture) when it is to be used for tarring.

The sulphur must never be added after the powders have been mixed, nor the powders after the glue has been added, for then the mixture would never be perfect. If it should be too liquid, simply add it to some of the composition which has been made too hard.

When the tar has been well made and of the correct consistency, it becomes so firm, and that without flaking, that it can be used as a medium for paint distempers. Yellow for example can be made with ochre and the common gums, and it will adhere better to the wood or at least as well, by reason of the affinity of the gums with the glue and the other ingredients; which will be but a modest expense.

It is of no advantage to crush the sulphur; as for the glue , it can be left to soak in water for 24 hours beforehand in order to facilitate its fusion, but it should not be boiled; the vessel in which it is melted should serve only for this purpose.

Note that once the sulphur has liquified and become a single gum-like substance with the ordinary tar, so that it penetrates intimately into all the parts of the timber so as to coat it and preserve it from all types of rot and attck from the worm, because it dissolves and yet resists the action of fire, which is one of its principal qualities. Therein lies its merit, and not otherwise, by which I mean all that is ordinarily practised.

The umber, by reason of its moisture from the ground is made impermeable by the aqueous dryness of the alum, thereby forming a body which is proper to conserve and retain the unctuousness of the sulphur and of the common tar which become compacted by means of the glue which unites and keeps the composition hard and adhering, and protecting it from the effects of fire.

The present dearness of the ingredients is not such as to cause concern, if one but takes the trouble to consider that a single coat of this composition will last at least three times as long as ordinary stuff, which is probable.

Divers advantages might be drawn from the said composition and its uses, which I will not dwell on, in order to be brief; suffice to say in conclusion that Nature offers us remedies but she leaves to the care of Man the glory of cultivating them and perfecting them.

This Composition was made in the presence of Mr Bignon, who did me the honour of examining it thoroughly.

M. Sauvage de Champlain.

They pay the seams in the English ships with the same pitch as we employ for this purpose; they bream their ships with straw or with reeds and they pay the hull generally with stuff composed of the same materials and in the same quantity as with our white stuff. They have no knowledge here of the black bitumen of which Mr de Champlain[139] has explained the composition, but since they have not found in their white stuff all the qualities necessary to preserve the underwater hull from the attacks of the worm they have tried out a new black stuff which they claim has succeeded well. I saw them pay the hull of the **Royal Sovereign** with this black stuff without being able to learn of what materials it was composed, for the inventor[140] has told the secret of it to no one; he shuts himself away when he mixes the chemicals which go into it. I presume that it is sulphur dissolved in oil or tar, and that they also mix in with it glass which has been crushed and reduced to a powder. I found all these materials in the place where they make this new black stuff. It seemed to me to adhere to the planking better than the white stuff, yet to adhere less well than Mr de Champlain's black stuff.

From the waterline to the lower sills of the gundeck ports, which is to say as far as the strake of the upper works laid over the lower wale, the English ships are payed with black pitch mixed with tar, and from the gundeck port-sills to the waist-rail they are payed with resin mixed with a quarter or a fifth† part of tallow, and it is not only the hull-planking which is thus payed, but also the wales situated between each tier of gunports. This resin feeds the timber better and lasts longer than the tar which is used in some of our ports for the upper works of our ships.

†.... a quarter or a sixth part of tallow ....

CLXXIV. The masts of the English ships are less taunt than those of our ships. The mainmast of their three deck ships is but 2 and $\frac{7}{25}^{th}$ times the breadth, and the mainmast of their ships of less than three decks never exceeds two and a third times the breadth. The foremast and the mizen-mast are proportioned in respect to the mainmast as they are in our own ships. The projection of the bowsprit beyond the stem is equal to $\frac{7}{8}^{ths}$ of the ship's breadth.

Masts and Yards

The length of the main topmast is equal to one and a half times the breadth and never exceeds this dimension; on the contrary it is smaller in some ships, especially in their three deck ships. The fore-topmast is proportioned to the main topmast as it is in our own ships. I was not able to learn anything positive regarding the length of their topgallant-masts[141], but they appeared to me to be $\frac{1}{6}^{th}$† shorter than in our ships.

†.... they appeared to me to be 1/4 shorter ....

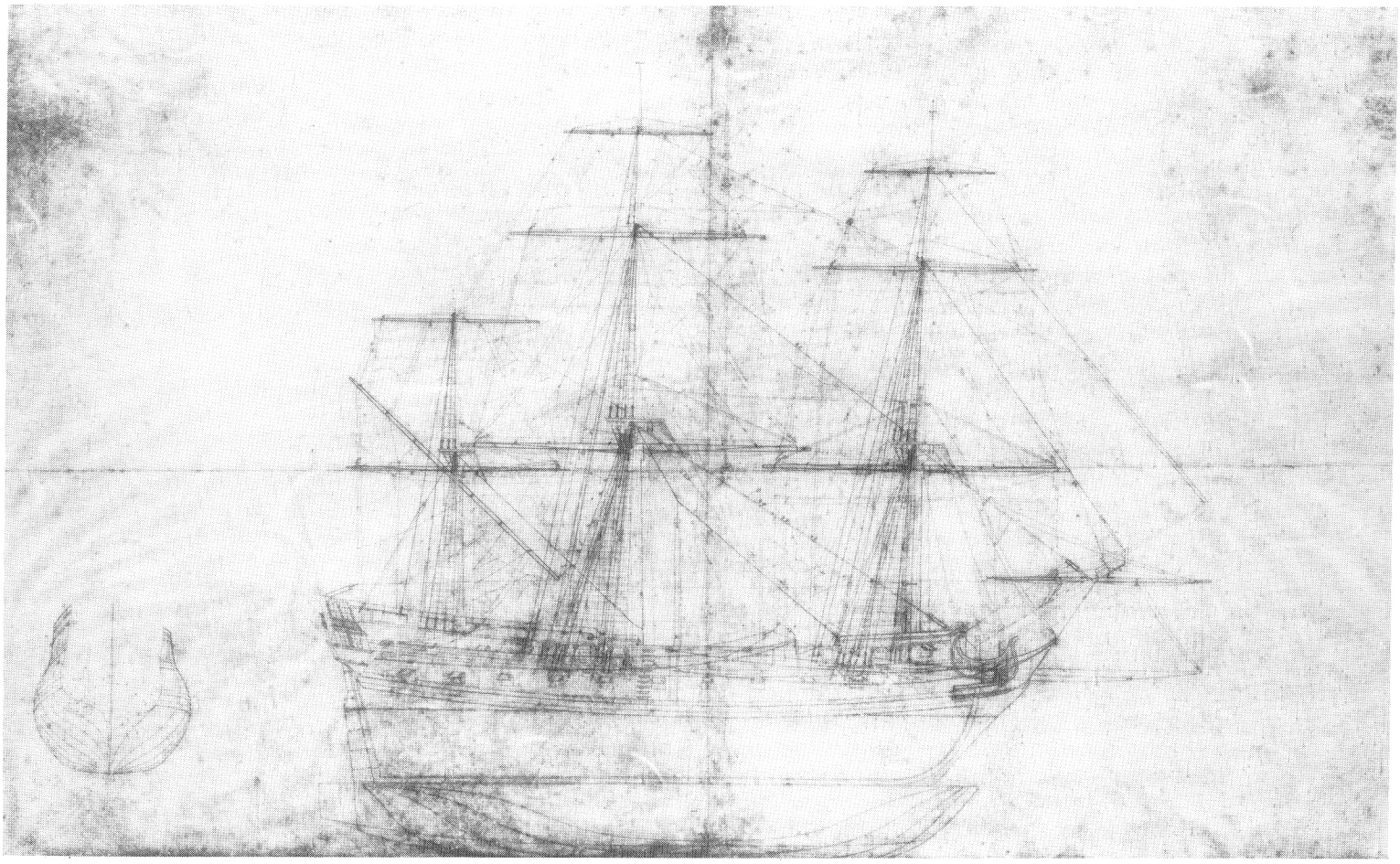
The mainyard of the English ships is in length, including the yard-arms, but twice the breadth of the ship, and the other yards are proportioned to the mainyard as they are in our own ships, save only the mizen-yard which we make the same length as the fore-yard and which is here about $\frac{1}{8}^{th}$ shorter. The diameter of the masts and yards in the English ships is proportioned to their length as in our own ships.

Comparing the lesser dimension of their masts and yards to those of our own ships, I find that the sails carried by the English ships are greatly smaller than are our sails, yet it does not follow from that that they necessarily sail any less fast, for the English ships being less weighed down than our own by their masts and yards, their rigging and their sails, and by reason of these smaller

139. **de Champlain**: see note opposite.

140. See on this subject, John Fincham (*op. cit.*): "*Several sorts of graving were used upon the bottoms of ships; one of these, which was a composition prepared by Mr. Lee, the master caulker of Portsmouth dockyard, was found very efficacious in resisting the action of the sea-worm. It was made of pitch, tar, and brimstone. This composition was tried at Portsmouth in 1737, in comparison with the white and black gravings, and other preparations made by colonel Gashry, captain Jacob Rowe, and Mr. Hammond: and it was found that after two years, the worm had not penetrated Mr. Lee's composition, whilst the others were in various degrees destroyed. After this experiment had been made, Mr. Lee's composition was generally used for graving.*" From Ollivier's description it is clear that he did not see Mr. Lee's composition, but one of the others. It should be noted that the Navy Board was also experimenting in May 1737 at Woolwich, as two entries from the *Progress Books* indicate: of the *Seaford*, "*graved the bottom with a new Composition*"; and of the *Shoreham*, "*grav'd with a new Composition*".

141. It would appear that Ollivier was able to obtain the rules for the proportions of topmasts, but not for topgallants. Fore and main topgallants were in fact 0.49 times the length of their respective topmasts, and mizen-topgallants 0.63 of the mizen-topmast.



61. *Rigging plan for the 1719 Establishment: 70-gun Ship. (Courtesy National Maritime Museum, Greenwich)*

spars having no need of all the ballast which our ships carry, their smaller sail area acts just as effectively as do the sails of our ships.

Placing of the Masts

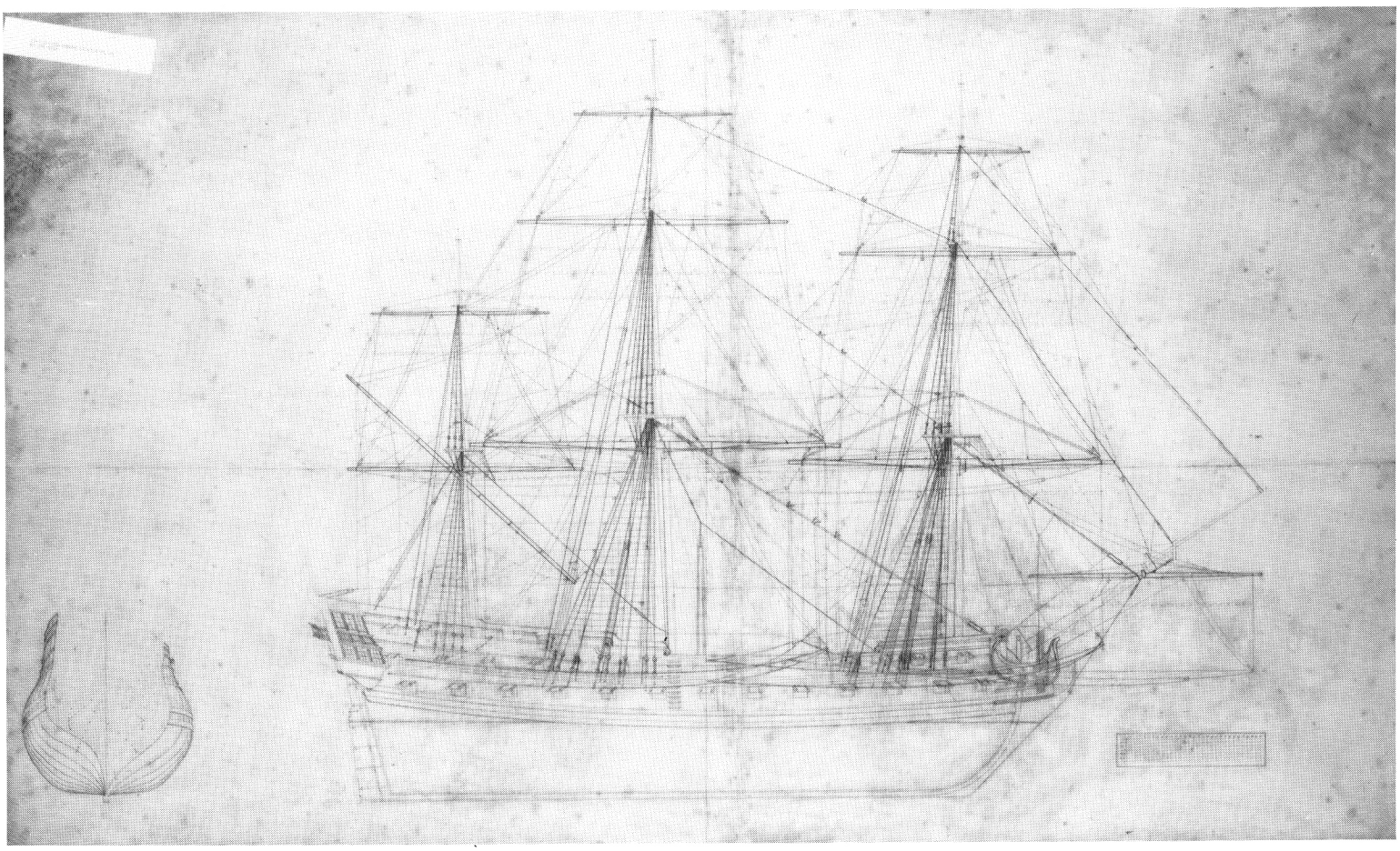
CLXXV. In the English ships the mainmast is placed one twenty-fifth part of the length from rabbet to rabbet abaft the middle point along this length; the centre of the foremast is placed 2/21 of the length from rabbet to rabbet abaft the rabbet of the stem; and the mizen-mast is situated approximately as in our own ships, by which I mean between the second and the third† gunports from the stern on the gundeck. The bowsprit in their three deck ships has its heel stepped midway between the lower and the middle decks, and it rests on the stem somewhat below the level of the upper deck, in such a manner that the English shipwrights occupy in this regard a middle position between the practice which we used to employ in earlier days of stepping the heel of the bowsprit in our three deck ships on the gundeck, and that which we employ today in stepping it on the middle deck.

†.... between the first and the second gunport ....

The mainmast in the English ships seemed to me to be perpendicular to the keel, the fore [*sic*] foremast to be perpendicular to the waterline, the mizen-mast raked aft and the bowsprit steeved 33 to 35 degrees.

Cables and Rigging

CLXXVI. The cables in the English ships are less heavy than the cables in our own ships. At Chatham I measured those of the **Royal Sovereign** and at Portsmouth those of the **Royal George** and of the **Victory**, all ships of 100 guns; they measure 23 English inches or 21⅔ French inches [*58.5 cms*]. The breadth of these ships is 46 feet 10½ inches French measure or 50 English feet [*15.24 m*]. To ships of this breadth we would give cables of 23 French inches [*62.3 cms*]. I found that the circumference of the cables of the **Britannia**, which is of the same breadth as



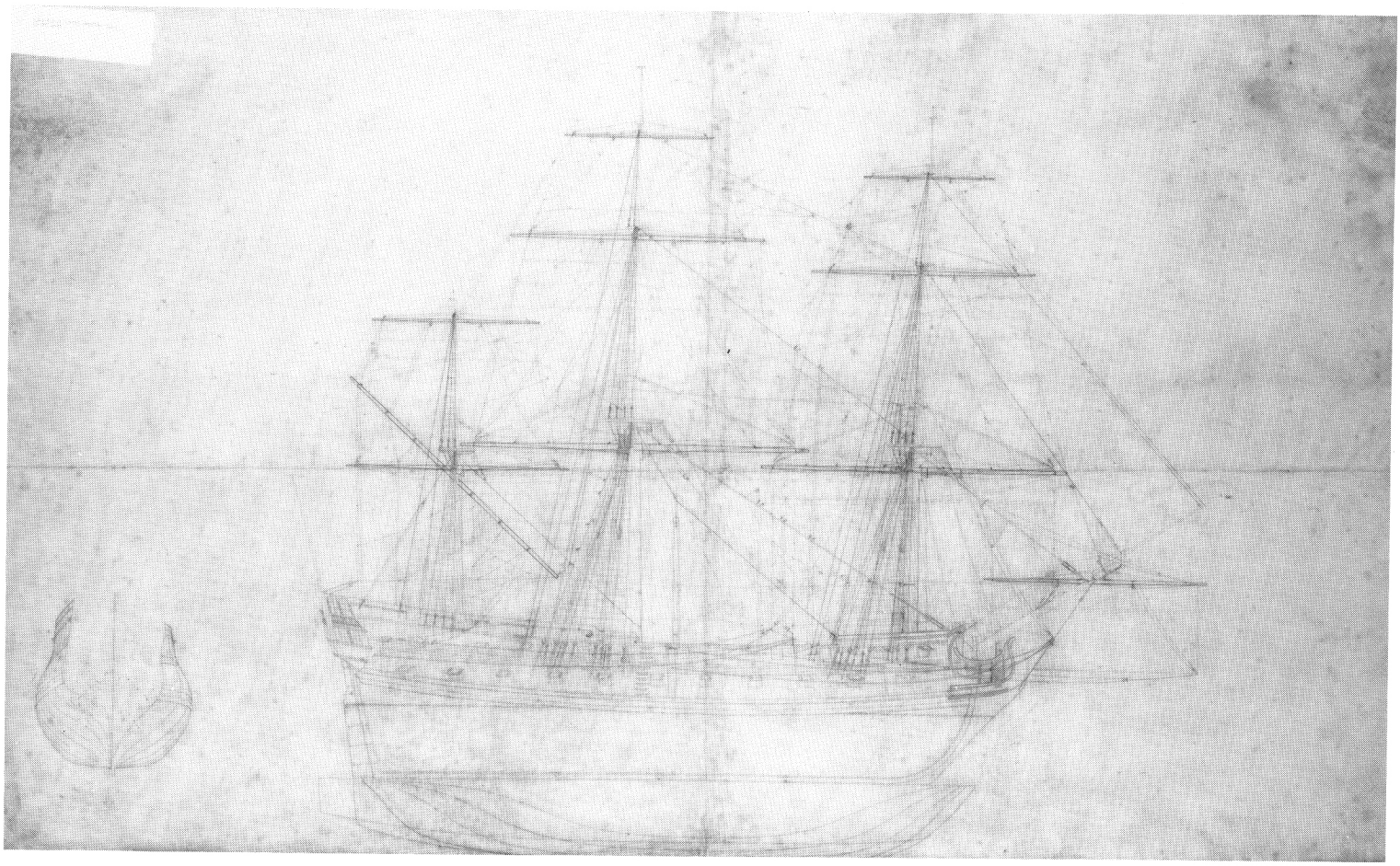
62. *Rigging plan for the 1719 Establishment: 60-gun Ship.*
(Courtesy National Maritime Museum, Greenwich)

those which I have named, was but 22½ inches, but I believe that they were laid like the others at 23 inches. I speak of English inches. I also measured the cables of the **Nottingham**, 70 guns, and 38 feet 11½ inches in breadth, French measure [*12.67 m*]. Her cables are 19 English inches, which make 17⅚ inches French measure [*48.3 cms*]. To a ship of this breadth we would give cables of 19 to 19½ inches [*51.5 - 52.8 cms*], and so to other ships in proportion. The warps of the English ships are proportioned to the cables as they are in our own ships.[142] The length of the cables and warps is 120 English fathoms, which are 3¾ inches shorter than our fathoms[143]

The mainstay in the three deck ships which I have named measures 15 English inches or 14½ French inches [*38.2 cms*]: I measured it; and the main shrouds are 10½ English inches or 9¾ French inches [*26.7 cms*]. The mainstay and the shrouds of the **Nottingham** are in the same relation to her cables. I measured no other rigging, yet all the ropes, especially the running rigging, seemed to me to be lighter than those of our own ships, as are those which I measured.

From this lesser size of their rigging divers advantages result: it is less costly, it allows the ship to carry her sail better, to sail faster, and to be quicker handled.

142. In the French Navy, warps (*grelins*) were half the thickness of their respective cables (*câbles*).
143. **Fathom**: a French fathom (*brasse*) was 5 French feet or 1.63 metres, while an English fathom was 6 English feet or 1.83 metres. Ollivier was presumably confused, and believed that there were five English feet to a fathom (i.e. 1.52 metres), which would then indeed be 10 centimetres or 3 3/4 French inches shorter than a French fathom.



63. *Rigging plan for the 1719 Establishment: 50-gun Ship.*
(Courtesy National Maritime Museum, Greenwich)

Anchors

CLXXVII. The English three deck ships have two sheet anchors which are in proportion the same weight as our own great anchors, three other anchors which each weigh 80 to 150 pounds[144] [*39 - 73 kgs*] less than one of the sheet anchors; a sixth anchor which is 5/8ths of the weight of the sheet anchor, a seventh anchor weighing 1/8th of the sheet anchor and finally an eighth anchor weighing 1/15th of the sheet anchor. In their ships of 50 to 70 guns there are also two sheet anchors, two other great anchors and three middling anchors like the 6th, 7th and 8th anchors of their three deck ships. Of these anchors they stow two in the hold, which are one of the sheet anchors and one of the great anchors.

Fish Davit

On the forecastle of the English ships they have a piece of fir which they call a fish Davit (they pronounce it David[145]). This timber is placed athwartships abaft the foremast; its length is equal to the ship's breadth extreme in the waist and its scantling is 17 inches [*46.1 cms*] in their three deck ships, and from 13 to 16 inches [*35.2 - 43.4 cms*] in their other ships; its two ends rest on the ship's sides and have each a large sheave through which a tackle is rove which serves to fish the anchor. When they wish to make use of the Davit they extend it outboard by about a third of its length, and make fast its inboard end with ropes secured to span-shackles let into the forecastle. We do not have this timber in our ships. We use the fore-tackle to fish the anchor. I do not know whether they fish their anchors with greater speed or facility with the Davit, for I have not seen them carry out this operation in the English ships, yet supposing this advantage to pertain, still it does not compensate for the place taken up by such a timber on the forecastle.

144. **Pounds**: French pounds of 489 grammes.
145. **David**: The original reads: "....*nommée Daveed (on prononce David)*..."

Blocks

CLXXVIII. I found nothing in the blocks of the English ships which differed from the blocks in our own ships.

Sails

CLXXIX. The sailcloth which the English employ to make their sails and for which their principal storehouse is at Deptford, is less tightly woven than that which we employ. The English acknowledge this, yet they claim that their sails are better cut than those of our ships, and I think that they are right, for one does not see in their sails that paunch which is in our sails and which causes them to lose a considerable part of the thrust of the wind. Indeed we know very well how to cut them as the English do, and several ships' captains have already ordered it to be done, yet it is commonly believed in our yards that giving the sails what sailmakers call belly, which is to say so cutting and arranging the cloths that the sails have a concave surface, makes them better than if they were flat. This is an error which is easy to prove.

Guns

CLXXX. I saw no brass guns at the gun wharf at Portsmouth, and there are very few in the stores at Chatham. Recently most of the iron guns have been coated with a varnish, the composition of which is still kept secret by the inventor. They polish the guns to a high gloss before applying the varnish, which is applied hot; it is brown in colour and has almost no body to it. I believe that the ingredient which predominates in this varnish is refined tar; I also believe that there is verdigris in it[146]. It does not melt in the sunshine; I examined it on the hottest days.

The calibre of the gundeck guns of their First Rates is 44 English pounds, which is rather more than 32 French pounds (*sic*)[147]. The middle deck guns fire a ball weighing 18¼ French pounds [*8.9 kgs*], and the upper deck guns a ball weighing 9⅛ pounds [*4.5 kgs*]. Their ships of 80 and 90 guns carry the same weight of metal. Their 60 and 70-gun ships have on their gundeck guns firing a ball weighing 22 French pounds [*10.76 kgs*] and on the upper deck they fire a ball weighing 12⅛ pounds [*5.93 kgs*]. Their 50-gun ships have 18¼ and 9⅛ pounders [*8.92 and 4.46 kgs*]; their frigates of 40 guns have 12⅛† and 6 pounders [*5.93 & 2.93 kgs*]; those of 30 guns 6 pounders, and their frigates of 20 guns 4½ pounders [*2.2 kgs*]. Their carriages are shorter than our own by the full length of the cascabel.

†.... their frigates of 40 guns have 12 1/4 and 6 pounders ....

Ballast

CLXXXI. The English ballast their ships with earth which I believe to be as weighty as our gravel ballast. They stow it in a straight line and parallel to the keel from the main forward bulkhead to the main after bulkhead, and also in a straight line athwartships. They do not use iron kentledge to ballast their ships save for long commissions, and in those ships which have insufficient space in the hold to accommodate earth ballast. I confess that when I saw at Deptford Dockyard that great quantity of kentledge of which I spoke in Remark **XXXIV**, I believed that the English knew how to make good use of it. I have learned since that they employ it only in the cases which I have mentioned. I have asked the reason of several officers; they replied that iron ballast stiffens all the movements of the ship, especially the rolling. Upon receiving this reply I enquired as to how the ballast is stowed, and was shown it on either side of the keelson to larboard and to starboard of this timber. We used to find the same inconvenience in our own ships when we stowed the ballast as the English do, but now that we lay it along the rungheads our ships have an easier motion. The English admit that if iron kentledge did not make the movement of their ships so harsh it would be more advantageous to ballast their ships with

146. There is a "recipe" for a composition of this type to be found in WO 55-740, dated July 4th 1825. Although nearly 100 years later, Adrian Caruana, who kindly brought it to my attention, believes that it may well be the same or a very similar substance. The entry reads: "*Mixture of Ingredients for Coating and Lacquering Iron Ordnance. Anticorrosion* [probably verdigris]*: lbs 40; Grant's Black, ground in oil: lbs 4; Red Lead, as a drier: lbs 3; Linseed oil: galls 4; Spirits of Turpentine: pints 1. This mixture, when well stirred and incorporated, will be fit for use, but as by long keeping in this state it becomes hard, no more should be mixed than is required for present use.*"

147. Ollivier is completely mistaken, first of all in the calibre of guns borne by each Rate (see table overleaf), and then in the conversion of French and English pounds. The French pound was equal to 1.077 English pounds, but Ollivier appears to have done his calculations on the basis of 1.315, which should have given him equivalents of 42 (and not 44) English pounds, 24, 12, 29 (?), 16 (?), 8 and 6 – incorrect, but in all events closer to reality. I can find no explanation for this error.

Establishment of Guns in the Royal Navy

The table which follows shows the Establishment of guns for each Class in the Royal Navy, by Order of the King in Council, July 6th 1716. This Establishment continued in force until April 25th 1743, despite recommendations made in 1733 to change it. These recommendations were to increase the weight of most of the guns on two deckers by one calibre: 6-pdrs were to be changed for 9-pdrs, 9-pdrs for 12, 12-pdrs for 18. Likewise, lower deck guns would be changed from 12-pdrs to 18, from 18-pdrs to 24, and the 24-pdrs in 70-gun ships to 32-pdrs.

Classes of Ships	Lower Deck		Middle Deck		Upper Deck		Quarter-deck		Forecastle	
	No.	Prs	No.	Prs	No.	Prs	No.	Prs	No.	Prs
100 guns	28	42 or 32	28	24	28	12	12	6	4	6
90	26	32	26	18	26	9	10	6	2	6
80	26	32	26	12	24	6	4	6		
70	26	24	26	12			14	6	4	6
60	24	24	26	9			8	6	2	6
50	22	18	22	9			4	6	2	6
40	20	12	20	6						
30	8	9	20	6			2	4		
20	20	6								

Source: Charles Derrick, *Memoirs of the Rise and Progress of the Royal Navy*, London, 1806.

Tonnage of Ships of War

Various methods for determining the length of the Keel for Tonnage, *as part of the data by which to ascertain the* Tonnage *of a Ship, and different rules for calculating the* Tonnage, *have been adopted at different periods.–The following is an account of some of the said rules and methods.*

1st.— Mr Willett says, "The old mode of calculating the Tonnage of Men of war was by multiplying the length of the Keel by the extreme breadth, and the product by the depth in Hold, and then dividing by 96."

2nd.— In the year 1719, the following method of determining the length of the Keel for Tonnage, and rule for casting the Tonnage, were settled by the Lords Commissioners of the Admiralty, viz.

On a straight line with the lower part of the Rabbit of the Keel, erect a perpendicular or square line to the upper edge of the Wing Transom, at the after part of the plank, and at the Stem to the fore part of the plank at 5/6 parts of the height of the Wing Transom; the length between the said perpendiculars added to 1/24 of the extreme breadth (allowing for the Stem and Stern Post without the Rabbits), from which subtract 6/25 of the height of the Wing Transom for the Rake abaft, and also 3/5 of the Main Breadth for the Rake afore, leaves the length of the Keel for Tonnage:– Which multiply by the breadth, and the product by half the breadth, and divide by 94, gives the Tonnage.

Source: Charles Derrick, *Memoirs of the Rise and Progress of the Royal Navy*, London, 1806.

kentledge than with gravel or earth, since the weight of the iron is farther removed from the centre of motion, and because the weight of the stores stowed atop the ballast is carried lower down. This is what we have found since we have employed successfully a method of placing our iron ballast in such a manner that no inconvenience results for the motion of the ship.

CLXXXII. The English ships carry much less weight of victuals than do our own ships. I have compared the quantity of victuals which they embark with that which we embark, and I find that for the same sized crew there is about the same weight of victuals, leaving aside the wine†. Each seaman receives in a week 7 pounds [*3.18 kgs*] of biscuit, 4 pounds [*1.81 kgs*] of beef, 2 pounds [*910 grs*] of pork, one pint [*0.93 litres*] of peas, 3 pints [*2.79 litres*] of gruel, 6 ounces [*170 grs*] of butter and 12 ounces [*340 grs*] of cheese[148].

Victuals

†.... *the same weight of victuals. The difference consists entirely in the wine, as I shall explain below. Each seaman receives ....*

In place of wine the English ships take on board a sufficient quantity of beer to be able to issue two quarts [*2.27 litres*] per day to each man for six weeks[149]. It is not possible to take on any more because it would not keep. The weight of this beer is equal to or exceeds by a very little the weight of the wine which we take on board for six months. Thus far the weight of victuals is equal or nearly so.

They take on board as many casks for water and for beer as we stow in our ships for water alone. In a proportion of these casks they ship beer, and water is only shipped in those casks which are still empty once all the beer has been stowed. The men will drink no water so long as they are supplied with beer, and thus water is only used in the coppers. In this way the victuals shipped on board the English ships are lighter than ours by the whole weight of the wine which we embark, and by the weight of the casks which contain this wine. This item is considerable and it may be readily calculated that it amounts to a large number of tons. The victuals weigh less also because in the English ships there is scarce the 20th part of the livestock, poultry, corn, hay, pens and coops which we ship on board our ships. We should find a difference of 30 tons [*29,340 kgs*] if we were to calculate in detail these same items.

CLXXXIII. For the same size, the English ships have a greater burthen than our own ships, because their underwater lines are fuller, whilst on the other hand for the same number of guns they have less burthen, since they have less length, breadth and depth in hold. Nevertheless, their burthen is always sufficient for the stores which they take on board, since their masts and spars are less taunt, their rigging is less heavy, and they carry less ballast and less victuals than do our own ships.

Tonnage

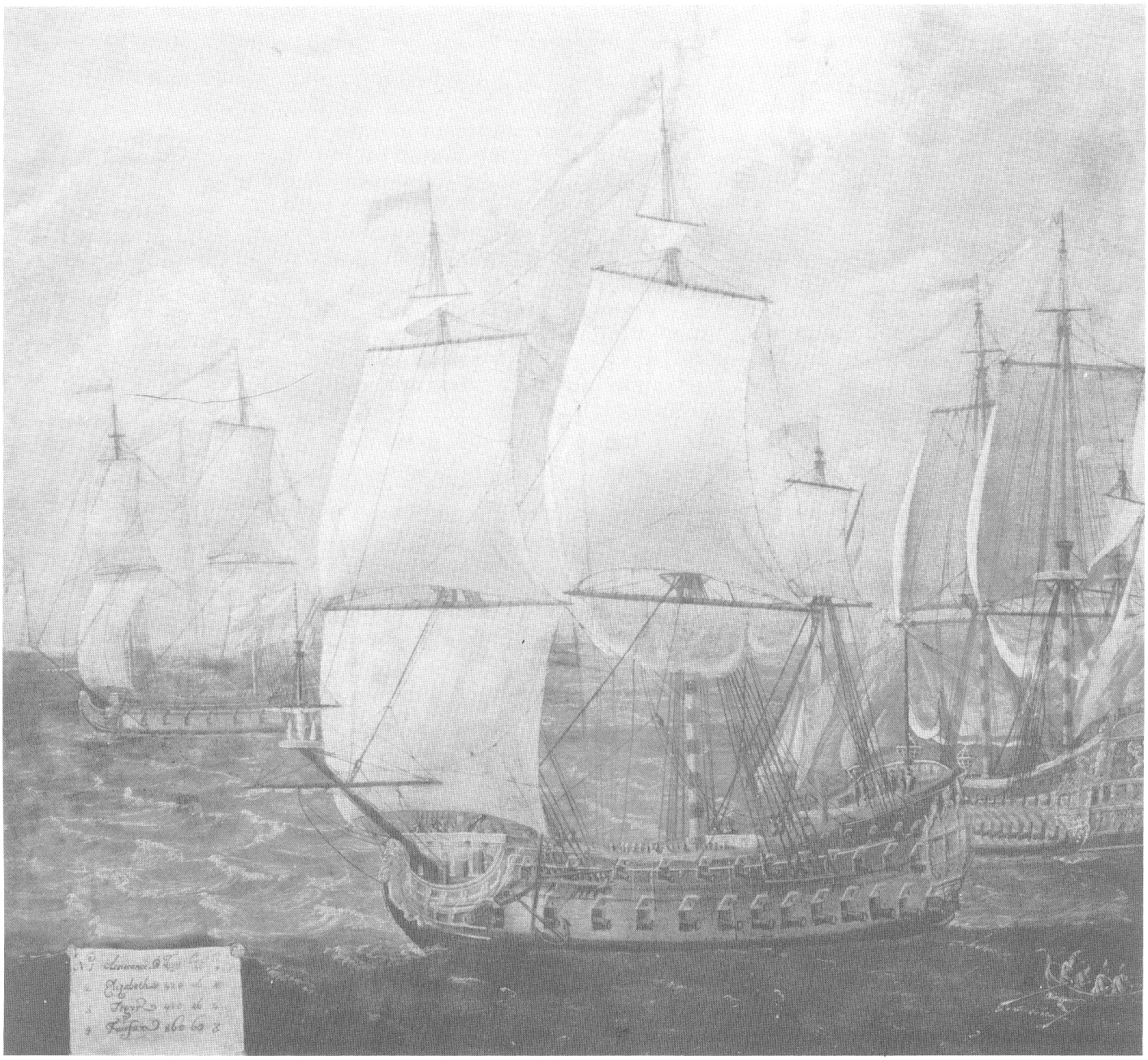
Very few English shipwrights calculate the tonnage of a ship from its displacement, as do all our shipwrights today in France[150]. Here they rely commonly on a few rules which are peculiar to themselves, and which have no foundation, such as to multiply the length by the breadth, or a certain part of the length by a certain part of the breadth, and the product by the depth in hold, or some like rule[151]. An English shipwright gave me a memorandum in order to prove to me that these rules are as accurate as the rules of displacement of water, and after having had it translated† I found that he had in no wise proved his case; as indeed I expected.

†.... *after translating this memorandum into French I found ....*

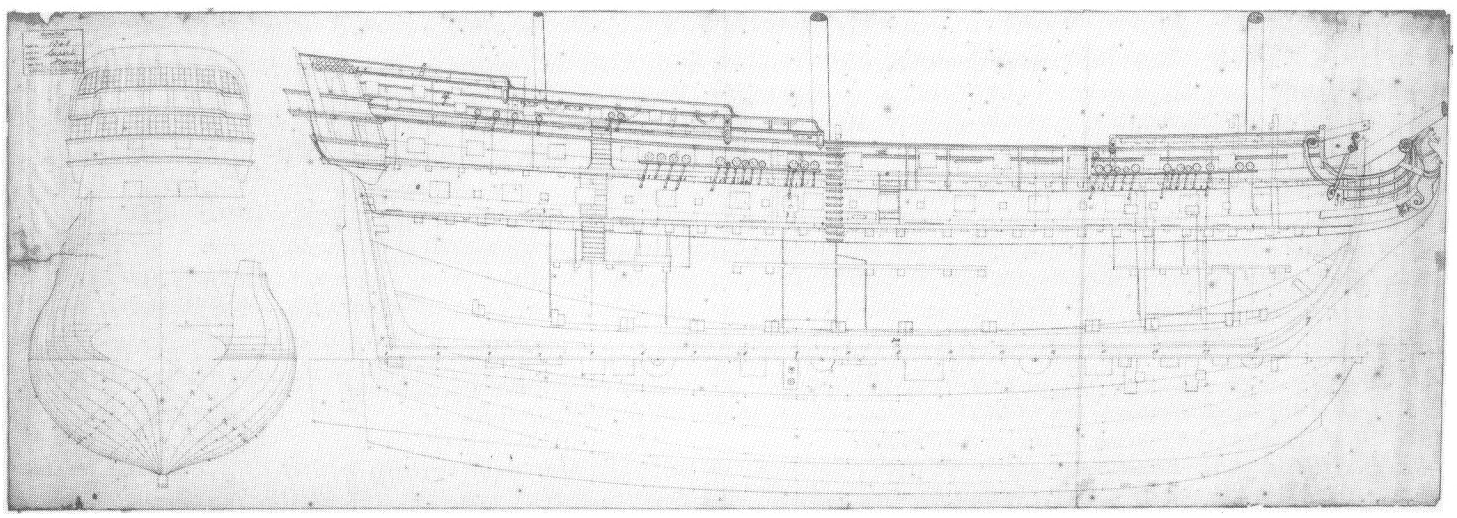
CLXXXIV. To judge the sailing qualities of the English ships from the reports given me by their sea officers, all or near all of their ships are fast sailers, handle well, and in a word are all perfect. I found the English shipwrights to be more honest. Among others, Mr Ward, Master Shipwright at Chatham and Mr Allen, Master Shipwright at Portsmouth, who in showing me the draughts of divers ships which they had built, declared of one that she is a fast sailer but not very weatherly; of another that she sails but middling well, but that she is excellent in a seaway; of others that they sail well on a reach but poorly close-hauled, or ply well but are mediocre when sailing large.

Sailing Qualities

148. Ollivier gives the quantities in English pounds and ounces, without converting to French measures. Note that oatmeal was served in place of fish, of which the allowance was 3/8 of a fish per man per week.
149. The ration was in fact 1 gallon of beer per man per day.
150. The French method was extremely complex. It is explained in detail in the MS by Morineau (see Bibliography).
151. See the Table opposite.



64. *Painting by Isaac Sailmaker, c. 1721, depicting* Assurance *ex-*Assuré. *(Courtesy National Maritime Museum, Greenwich)*



65. *Draught of* Superb *ex-*Superbe. *(Courtesy National Maritime Museum, Greenwich)*

What may be said with certainty of the English ships is that they all carry their lower battery high out of the water since they are full below the waterline and carry less weight than do our ships. It is scarce surprising that being full below the waterline they should roll comfortably, or that they should be easy under sail. As to their speed, I have certainly seen some ships which seem to be built for speed, and among others the **Suffolk** which is building at Woolwich, yet in general I find that the entry of our ships is better contrived to cleave the water than that of the English ships, and if this superiority is not always evident when we compare the speed of our ships to the speed of the English ships, it is because it is destroyed by the excessive weight of our sparring and of our rigging, since if every thing responded to the superiority of the lines of our ships over the lines of the English ships then we should have a great advantage over them in respect of our speed of sailing.

I should not remain silent, before I conclude this article, over the fact that several English Captains and Shipwrights have mentioned to me the ships **L'Assuré**[152] and **Le Superbe**[153], taken from us in the last war, as being the fastest ships which they ever had in England. They preserved them for as long as they could and only broke them up once they had taken off their lines. **L'Assuré** was built at Toulon in 1696 by Mr François Coulomb[154], and **Le Superbe** at Port Louis by Mr Pierre Coulomb[155] in the year — [*sic*[156]].

Repairs

CLXXXV. The English repair their ships for as long as they are able to do so without shifting the frames, but as soon as their ships begin to fail in the frame-timbers and they are no longer able to keep them in service without that they shift the frames, then they break them up, since the cost of such a repair exceeds that of building anew, and the work is never as well carried out. All their repairs consist but of shifting some of the planking of the underwater hull, some beams, knees, or ceiling-planks save those in the hold; they will also shift the keel if it be spoiled, and likewise the stem and the sternpost. These repairs are carried out in dry-dock without discharging the ballast and often without removing the masts. Here they do not condemn a ship when some of her frames are spoiled; they are content but to shift all the planking of the underwater hull in which the caulkers find any fault, to eke the forward and after riders with lower and upper futtocks; they increase the number of standards on the gundeck; they place similar standards on the middle and upper decks, and in this way they bring the ship to a state in which she will last a few years more, and indeed near as long as our own ships last after a rebuild which costs more than building a new ship.

Breaking their Ships

CLXXXVI. The English shipwrights break their ships as soon as they are no longer fit to put to sea and they judge that in order to repair them safely it would be necessary to shift the frames. They bring them into dock to break them; this work is carried out more swiftly than we are able to do, because we break our ships while they are yet afloat. Moreover, since the timbers which go to make up the frames are not fastened one to the other they fall apart of their own accord as the hull-planking is removed. They preserve here with great care all their old ship-timbers, and find a useful purpose for each timber, whether to build the dockyard buildings, or to line the sides and the building-platforms of their docks. I saw this economy at Portsmouth and at Chatham, where several sheds and other buildings are composed solely of old ship timbers.

152. **L'Assuré**: Launched in Toulon in 1697 as a 60-gun ship (50 24-pdrs and 10 6-pdrs), she was captured in May 1702 and renamed the *Assurance*. She was listed in the Royal Navy as a 3rd Rate (70) of 1102 tons b.m., 146′0″ x 42′0″ (English measure). She was broken up in April 1712 at Chatham.
153. **Le Superbe**: Built in Lorient in 1708, she was captured off the Lizard by the *Kent* on July 29th 1710. Listed in the Royal Navy as the *Superb*, 3rd Rate (64), 1029 tons b.m., 143′6″ x 40′0″ (English measure). She was rebuilt by Hayward at Woolwich in 1721 and broken up, also at Woolwich, in June 1732.
154. **François Coulomb**: There was a whole dynasty of Coulombs in the French dockyards throughout this period, and indeed Blaise Ollivier was related by marriage to the family. The builder of the *Assuré* was François, 1691-1751, son of another François, 1654-1717.
155. **Pierre Coulomb**: ?-1723, probably the brother of the elder François named above and therefore uncle of the younger François. They are not always easy to distinguish!
156. The date left blank by Ollivier. As indicated above, she was built in 1708.

Carved-Work

CLXXXVII. The English ships are more heavily decorated with carved-work than are our ships; at the beakhead of their three deck ships they have two, three or four figures each as large and as weighty as as the single figure which we use today. The trail-boards of the head are covered with carved-work running the whole way between the cheeks of the head; the head-rails and the head-timbers are also covered with carvings, and likewise the head of the catheads. In their other ships there is but a lion figurehead, larger than the figure on our own ships.

The terms at the stern are formed by two or three statues raised one over the other from the level of the middle deck to the taffarel, and which weigh more than the decorations which take the place of these terms in our own ships. The escutcheon, the taffarel and the quarter-galleries are laden with carved-work as these same parts in our own ships used to be. The upper works of most of the English ships of 100 guns are covered with carved-work from athwart the mainmast to the quarter-galleries; the gunports of the quarterdeck and the forecastle are also decorated with a port-wreath as they were 40 years ago in our own ships. All this carved-work is very poorly executed and arranged in a somewhat poor order. There is nought that is fair in the decoration of the English ships, save only the arrangement of the rails of the stern and the rails themselves bordering the stern-galleries and the stern-lights: these rails curve forward round the quarter-galleries with a symmetry which is most fair, especially in the **Royal Sovereign**, the **Royal George** and the **Worcester**, yet between these rails there is but a confused mass of carvings.

The carved-work of our own ships is to be preferred[157] to that of the English ships both because it is better executed and because it is lighter, for while it is an evil to load down a ship with carved-work without which she would be very well able to put to sea and fight, yet there is also a kind of need to decorate a ship, and in this case it is always advantageous to make the carvings extremely light.

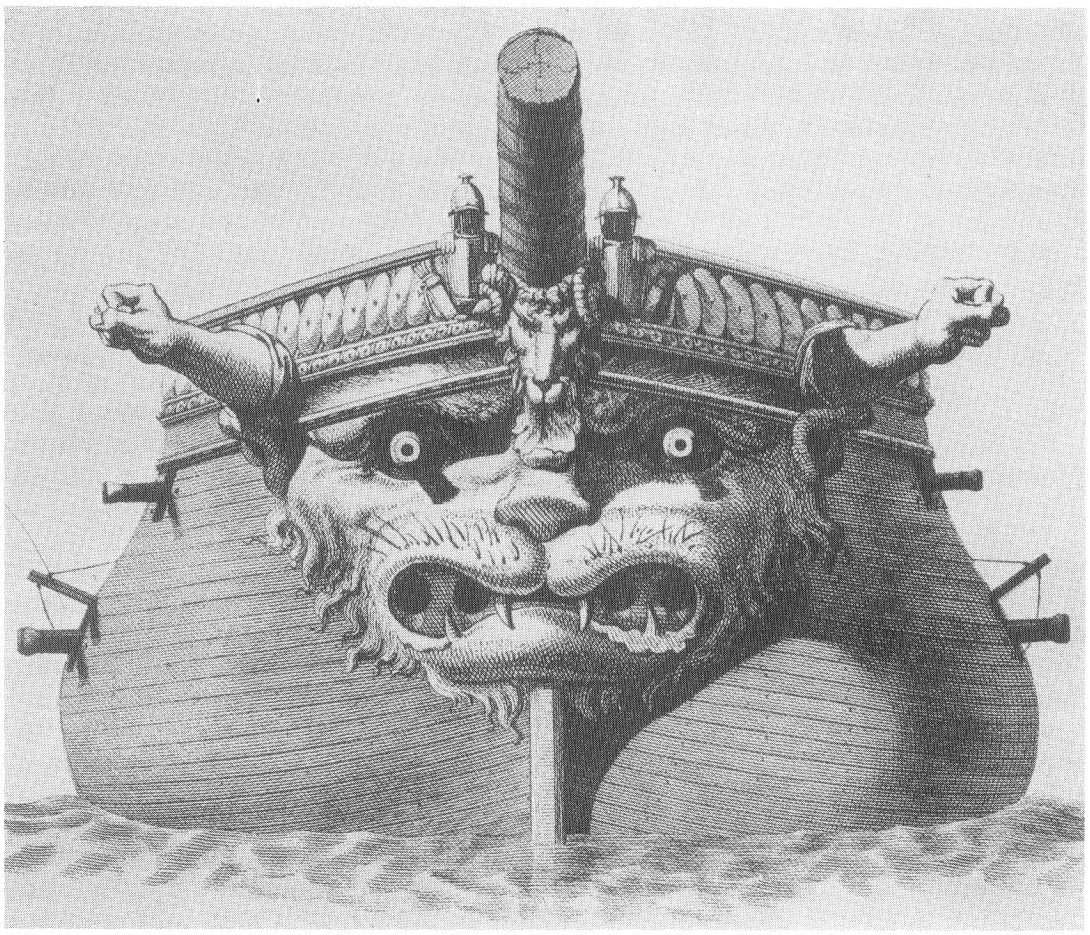
Yet leaving aside the fact that the carved-work of the English ships is heavy, it is surrounded in divers places by guard-irons such as I have represented by **A** in **Fig. 117**. These guard-irons surround the figure of the head and the terms at the stern; they are fashioned in both places of three, four or five iron bars of an inch to an inch and a quarter [*27 - 34 mm*] in diameter, which rise obliquely or vertically according to the shape of the part of the ship to which they are applied, and of several other iron bars of the same size which cross over the former and are laid at a distance of 2 feet and a half [*81 cms*] one above the other. We have in our ships nothing which resembles these guard-irons, and yet our carved-work is no less well-preserved there than in the English ships[158].

Joiner's Work

CLXXXVIII. In the hold of the English ships there is less joiner's work than in our own ships, as may be judged from what I have said concerning the storerooms; and on the gundecks, beneath the forecastle and the quarterdeck, and in the building of the cabins and of the quarter-galleries there is much more. All the pillars beneath the forecastle and the quarterdeck are turned; the edge of the plank bordering the gunports-sills is decorated with a quarter-round, and likewise the butts of the planks which finish at the gunports. The cabins are surrounded by a cornice which is 6 or 7 inches broad [*16 - 19 cms*], and in the bulkheads and against the ship's sides there are pilasters set three feet [*97.5 cms*] apart one from the other. The winding staircase by which one climbs up to the quarterdeck, and the winding ladderways leading up from the waist to the quarterdeck and to the forecastle are bordered by a balustrade, and the treads which are of oak are covered with slit deals and picked out with a decorative moulding. All the other parts of the joiner's work are carried out as they are in our own ships, yet everywhere with boards of greater thickness.

157. This criticism seems to have been accepted and indeed partially remedied during the next 30 years, if we are to judge by what William Falconer has to say in his *Universal Dictionary of the Marine* (1769). Under the article **Head** we find the following: "*The heads of many of our ships of war have undoubtedly great beauty and propriety; and candour must acknowledge that some of the most elegant and judicious have been borrowed from the French designs, which are never left to the invention of illiterate mechanics.*"

158. Yet they were evidently regarded as important for there are records of them being made at sea (correspondence with David White, formerly of the Draught Room, National Maritime Museum, Greenwich).



66. *A perhaps not very serious proposal by Nicolas Ozanne for a ship's figure. Late 18th century. (Reproduced in L.G. Carr Laughton,* Old Ship Figure-Heads & Sterns, *1925. Private collection)*

CLXXXIX. All the English ships are painted without in yellow and black, by which I mean that the ground is black and the raised parts yellow. The English use no other colour save only white for the cabins, the Admiral's cabin like that of the officers. They also paint in white the dining place and all that part in the betweendecks of their three deck ships which is abaft the mizen-mast. They employ a grey paint to prime the quickwork above the upper deck of their three deck ships and lesser ships. Their colours are finer and in consequence better mixed than those which we employ; they pass them through a fine screen before mixing them. Thus they adhere better to the timber and preserve it better. The English do not paint the betweendecks of their ships, and in this they do better than we do, for this painting encourages rot. Painting is only good in those places which are exposed to the ravages of the air. I saw in the paint-shop at Portsmouth and at Chatham a putty composed of white lead and oil like that which we make at Brest, and which the English employ as we do to fill the seams and the nail-heads in their ships' boats.

Paintwork

CXC. The door furniture in the English ships is inconsiderable, because there are fewer cabins than in our ships, and because the stern-lights have neither hooks nor window bolts nor hinges. For the most part the door locks in the English ships have brass cases.

Door Furniture

CXCI. The English use only stoneground glass[159] in the lights of their ships; they also use it in most of their cabin doors and in the sashes placed beneath the gratings on the quarterdeck. I believe that we should make a saving in imitating this usage; stoneground glass is more costly than the moulded panes which we employ, yet it is less liable to break.

Glazing

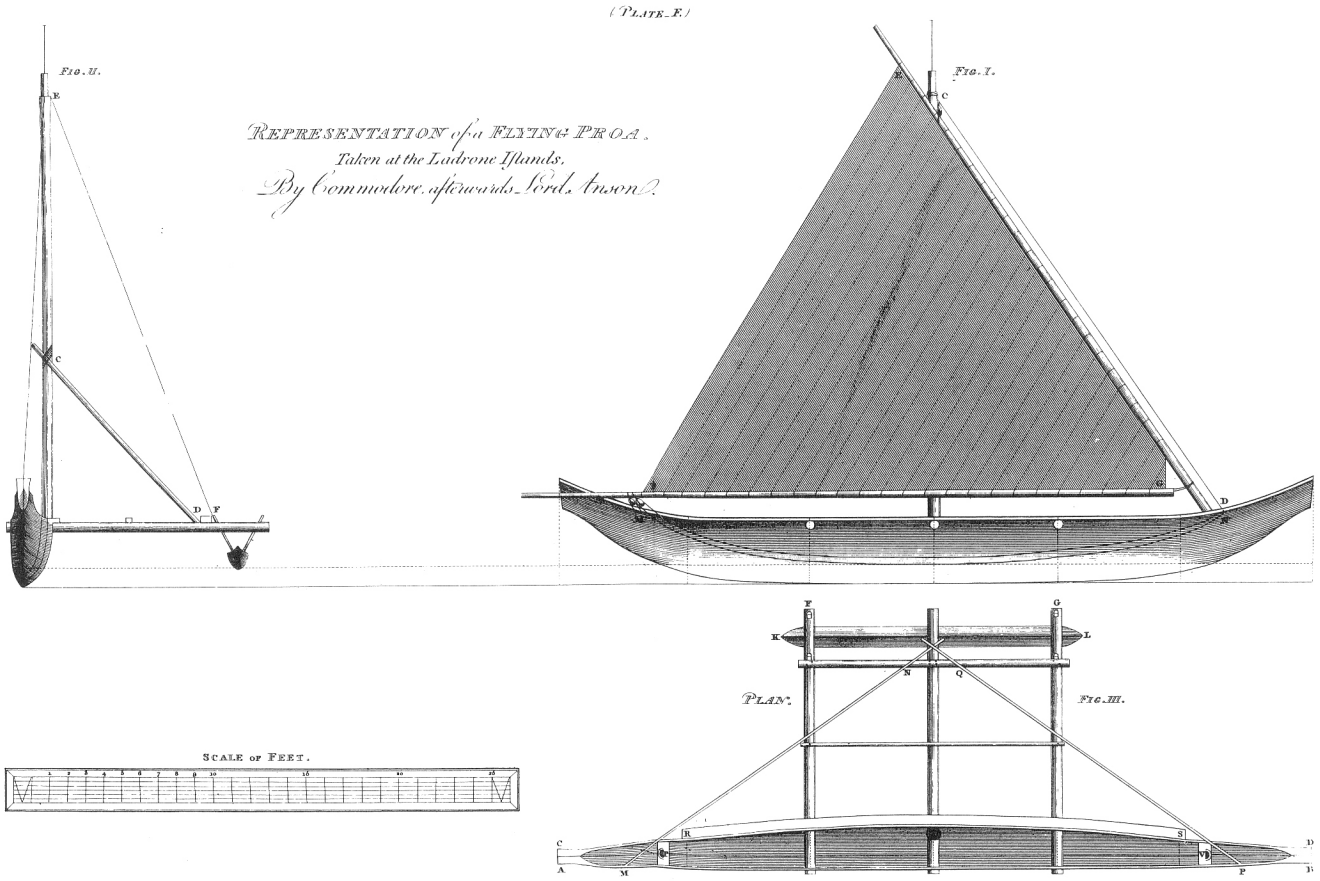
159. According to Derrick (*Rise and Progress of the Royal Navy*, 1806), "*stoneground, instead of Muscovia Glass* [mica], *was introduced into the Navy about the year 1700*". By implication, moulded panes were not used.

Stern-Lanthorns

CXCII The stern-lanthorns in the English ships are a little larger and in consequence heavier than those of our ships. The English place in them 4, 5 or 6 half-pound [*244 grs*] candles in place of the one or two fat candles which we place there. Their lanthorns are six-sided, the three forward sides being closed with tinplate, and the three aft-facing sashes being glazed with panes of stoneground glass. In earlier days they used to employ mica, and I was shown some old lanthorns which are still so glazed, but today they prefer to use stoneground glass since it enables them to make the panes larger than is possible with mica, so that the lanthorns give more light.

Longboats

CXCIII. The longboats of the English ships are constructed in such a manner that they raise the anchor over the bows; placed one third or half way aft there is a windlass which is used to raise the anchor. These longboats have ribs which are of thicker scantling than those in our boats, yet fewer in number; they are exceedingly well built. I have seen but few cutters or barges of which the same could be said.



67. *A flying proa. From Steel's* Naval Architecture, *3rd edition by John Knowles, 1822. (Private collection)*

Ladrone

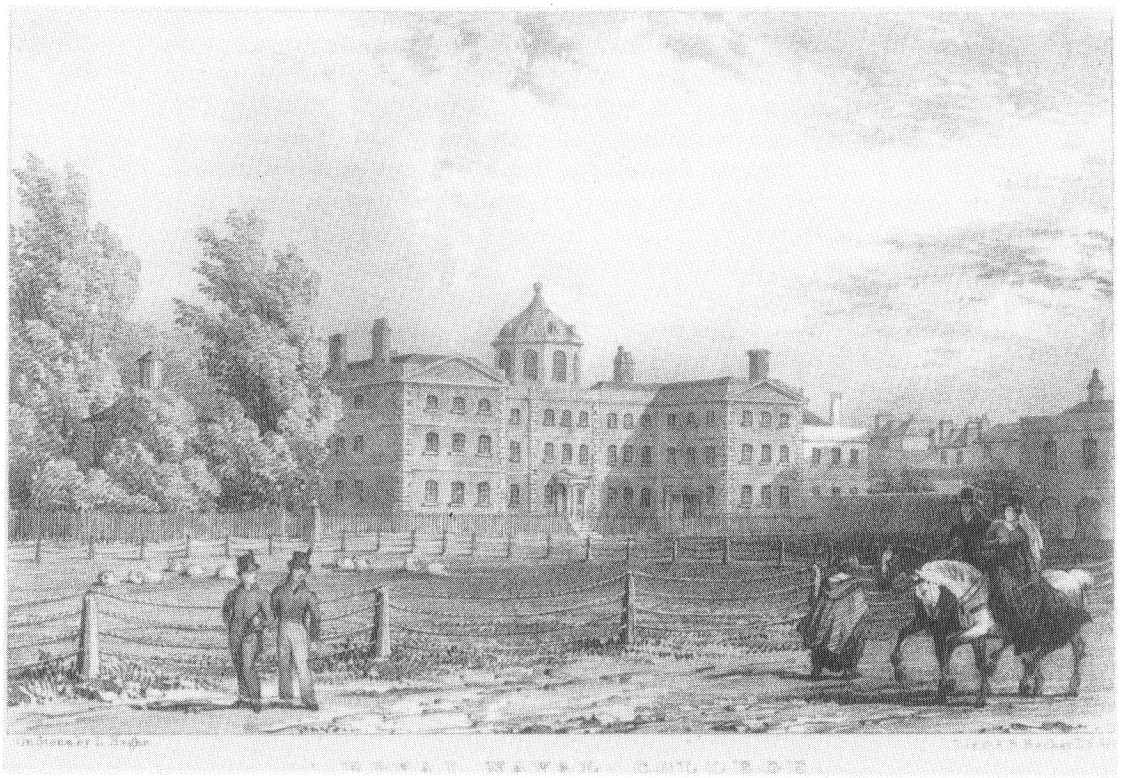
CXCIV. At Portsmouth I saw a small boat of singular build which I shall describe here, and of which the draughts are represented by the **Figs. 118, 119, 120**, and **121**[160], just as they were given to me by Mr Allen. This vessel is called **Ladrone**[161]; it measures 40 English feet [*12.19 m*] in length from stem to stern, 2 feet 4 inches [*71 cms*] in breadth to outside of plank and 3 feet 4 inches [*102 cms*] depth in hold. Her bow and her stern are finished as appears in **Fig. 119**. Her two sides are not at all alike; one of them, designated by the letter **A** in **Fig. 121**, forms an angle of 95 degrees with the horizon, while the other describes part of an ellipse as appears in **B**. The perpendicular passing through the centre of the keel divides the breadth into three parts of which one is to the side which is straight and the two others to the side which is curved. Half-way along her length is stepped a mast, the height of which is equal to $\frac{7}{8}^{ths}$ of her length; this mast is rigged with a sprit sail. Extending outboard from the rounded side is a sort of deck parallel to the horizon and designated by the letter **C** in **Figs. 119** and **121**. This deck is 13 ½ English feet long [*4.11 m*], and extends outboard 9½ feet [*2.90 m*]; it is supported by stays fastened at the masthead, and has at its outboard end a caisson, designated by the letter **D** in **Fig. 119** and **Fig. 121**, which is 22 feet [*6.70 m*] long and 2 feet 2 inches [*66 cms*] in diameter at its mid-point, and sharp at both ends. Inside this caisson they place whatever ballast is needed to balance the sail.

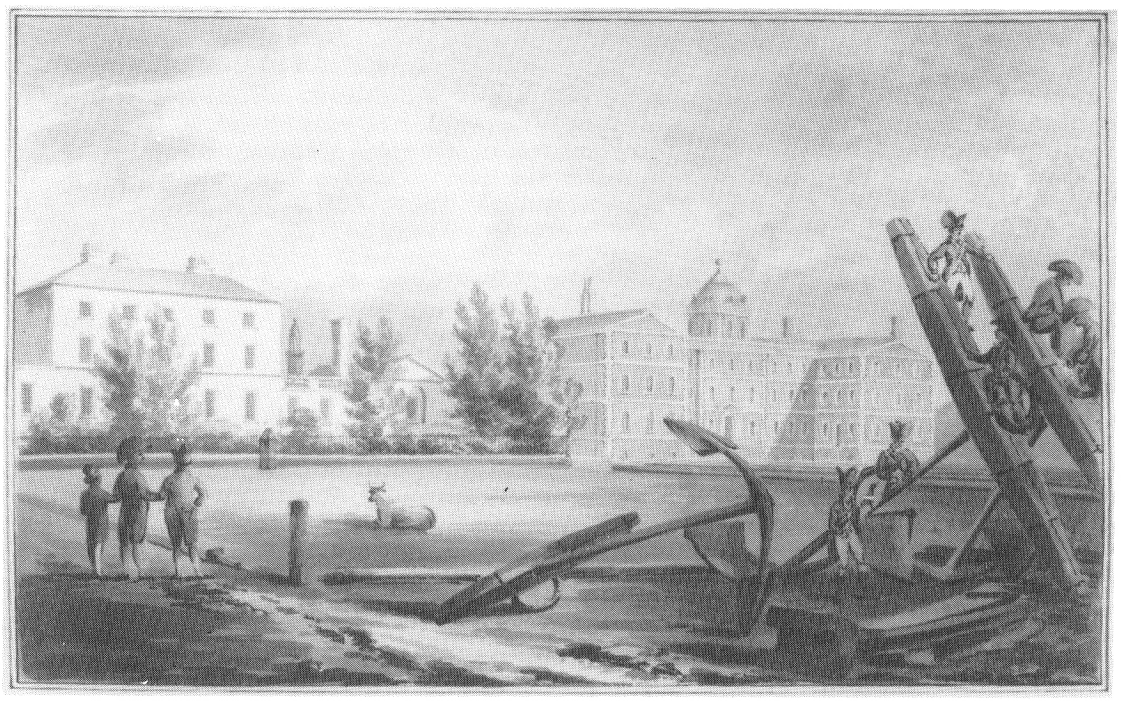
This vessel never sails on the flat side, by which I mean the side **A**, **Fig. 121**. She never puts about; they only bring the sail round the mast and use one or the other of the two rudders placed at either end. They showed me the distances which she covered when they were sailing her, and the time which she needed; from these trials it appears that she covered a league [*5565 m*] in six minutes[162], and this is probable enough if one compares the size of her sail with the small part of her surface which touches the water. She has more than once sent her crew, which is but of two men, into the water. She is extremely difficult to handle, and at the slightest mistake she oversets, for since it is necessary that the ballast caisson counterbalance the thrust of the sail, it needs only that the **Ladrone** dip into the water on the one side or on the other for this balance to be upset, either by a stronger or lighter gust of wind, or by the sail being badly trimmed, or by a wave which by submerging the ballast-caisson reduces its weight. The English admit that the vessel is more curious than useful, and make but little use of her.

160. See Plate 11, preceding p. 185.

161. **Ladrone**: named after the Ladrone Islands in the East Indies, visited by the expedition of Woodes Rogers in 1710; this type of craft is usually referred to as a proa or flying proa, because of its speed. A small mystery surrounds the Portsmouth "ladrone", for despite the fact that Woodes Rogers brought an example back with him, this one appears to have been built at Portsmouth from plans preserved (Cat. Nº. CMS 2934) in the Pepysian Library in Cambridge. Since Samuel Pepys died in 1703, these plans antedate the Woodes Rogers expedition, but careful examination of Ollivier's drawings by Mr Richard Shell (an expert in the flying proa, to whom I am happy to acknowledge my gratitude for his assistance) seems to confirm this source. I have found no reference to the craft among the Dockyard correspondence which might throw light on this fascinating experiment, but an extremely interesting reference is to be found in the account of Anson's circumnavigation by the Rev. Richard Walter, published in 1747; this is taken up and slightly modified in Steel's *Naval Architecture*, published in 1805: "*The name of **Flying Proa** has been given to this vessel on account of the extraordinary, and, in some measure, incredible velocity with which it is said, by various observers, on the positive evidence of their own sight, to pass through the water. 'The Spaniards', according to the ingenious author of Commodore Anson's voyage, 'assert such things of it as must appear altogether incredible to one who has never seen these vessels move'; nor are they the only people who recount such extraordinary tales of their celerity, for those who shall have the curiosity to enquire at Portsmouth Dock Yard, about an experiment tried there several years since, with a very imperfect proa, built at that place, will meet with accounts no less wonderful than those which have been reported by the Spaniards. 'Nevertheless', continues the author, 'by some rude estimations made by us, of the velocity with which they crossed the horizon at a distance, while we lay at Tinian, I cannot help believing, that, with a brisk trade wind, they will run nearly twenty miles in the hour, which, though greatly short of what the Spaniards report, is certainly a degree of velocity that, without the most positive evidence, might be considered incredible'.*"
It seems certain that the proa which Ollivier saw is indeed the one that the Rev. Walter referred to.

162. i.e. a speed of 55.65 kph! On the evidence of Ollivier at least, the claims of the Spaniards were perhaps not exaggerated.



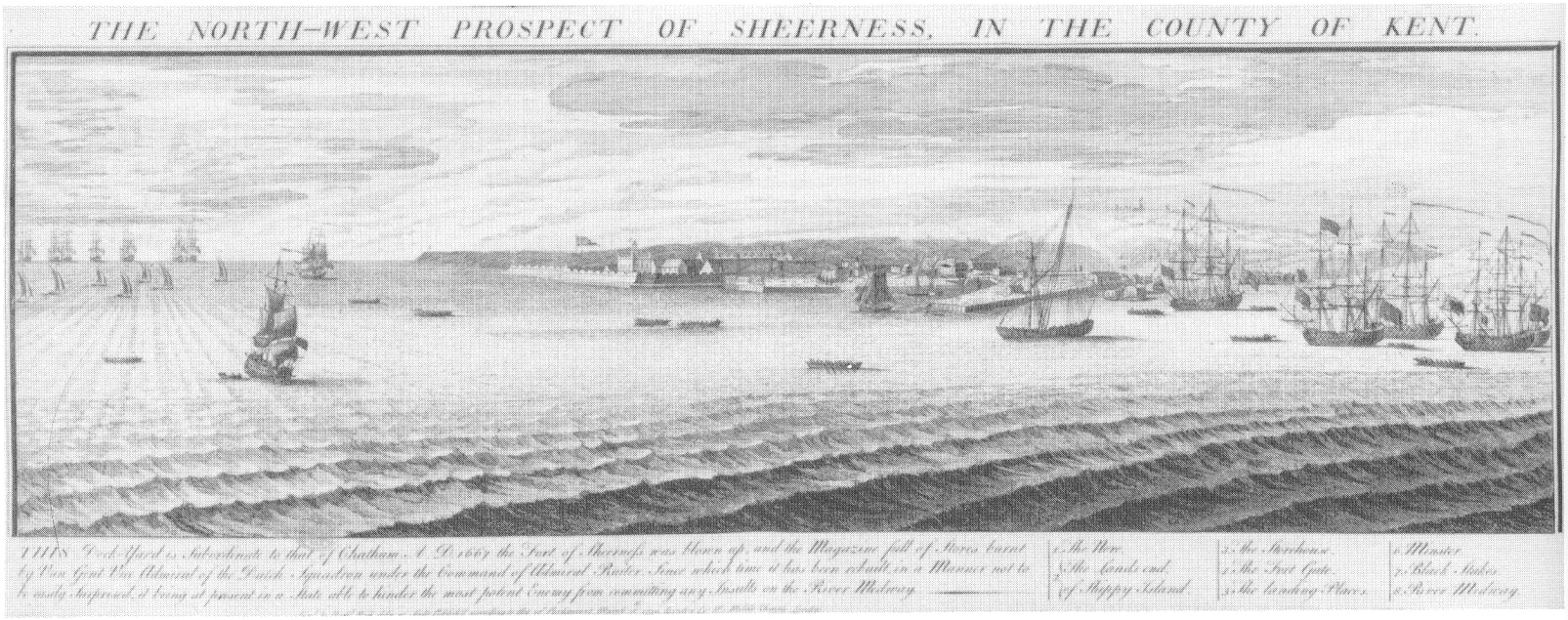


68. & 69. *Two views of the Royal Academy in Portsmouth. The caption of the upper picture, identifying the building as the "Royal Naval College", shows that it was drawn after 1806, while the second view is later still. However, the imposing style of the building can be clearly seen, basically unchanged from when Ollivier saw it.*
(Courtesy National Maritime Museum, Greenwich)

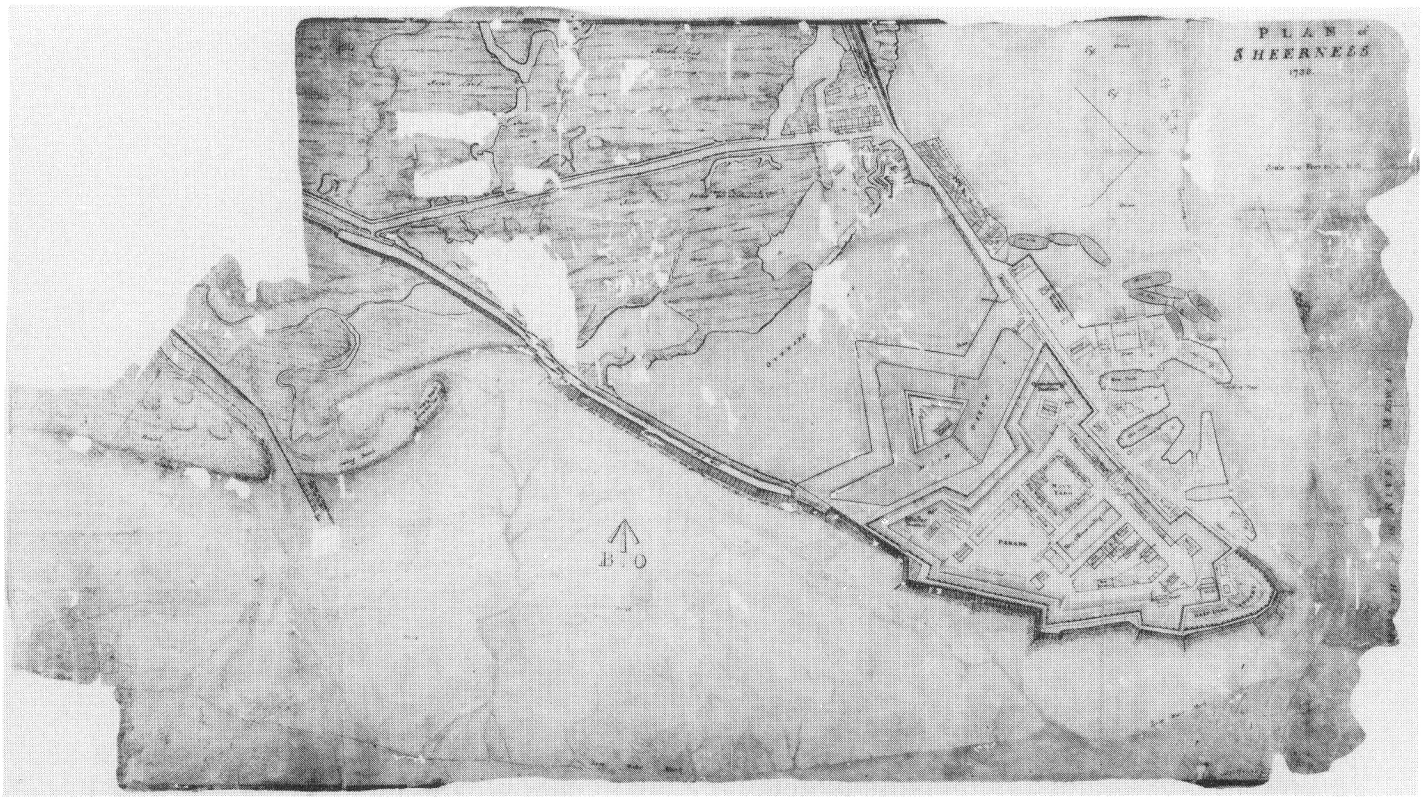
Naval Academy

CXCV. There is a Naval Academy[163] in Portsmouth set up recently for the education of 30 gentlemen destined for the King's service. This small number has not yet been filled; there are at present but fourteen. They have, at the King's charge, a mathematics master, a master who shows them writing and drawing, another who teaches them fencing and dancing, and a language master who teaches them French. The master of mathematics seems to be a skilful man. The language master is a French refugee who has almost forgotten his mother tongue. The two other masters who each teach two different subjects are very bad. The young gentlemen who are taught in this Academy are lodged with their masters in a very fair house built inside Portsmouth Dockyard, and are fed at their own expense by the masters or by one of the masters. The Commissioner of the Dockyard (what we would call the Intendant) is responsible for this Academy. They are taught from eight o'clock in the morning to midday, and from two in the afternoon to six o'clock in the evening; they are allowed holiday only on Saturday afternoons and Sundays. The three years which a young gentleman spends at these lessons are counted as three years of sea-service.

163. The Royal Academy at Portsmouth was instituted by an Order in Council of 21st February 1729, but did not actually open its doors until the summer of 1733 (Commissioner Hughes' appointment as Governor dates from June 26th 1733). As Governor, the Commissioner received £100, the Head Mathematical Master £150, two ushers £100 each, the French Language Master £100, and the Fencing Master £80. The school was open to the sons of noblemen and gentlemen between the ages of 12 and 15 years, who had to show some knowledge of Latin. The curriculum included arithmetic, drawing, fortification, gunnery, dancing, fencing, French, navigation, writing and the exercise of the firelock, as well as "other useful parts of the mathematics". The scholars had to pay £25 each per annum to the Head Master for their board. There is little doubt that the decision to open the school was influenced by the French, who had started similar schools in 1670, originally in Toulon and Rochefort, with a third school in Brest being added in 1686. These schools taught 200 young "*gardes de la marine*" in Brest and Toulon, and 150 in Rochefort, altogether a much more ambitious programme than the Academy in Portsmouth which was intended for 40 scholars, but in fact never attained that number, as Ollivier's comments bear witness, and it finally closed in 1806.
By 1737, Dockyard correspondence [POR/H/4] reveals that the Head Master was still Mr Haselden; a Mr Ferdinand le Rousseau had taught fencing and dancing, but he died on September 25th 1736, and he was replaced by John Henley (dancing) and Thomas Ball (fencing) by Warrant of July 16th 1737. It would appear therefore that the person filling the combined post was a temporary appointment. Of the 14 scholars, we have identified the following: Mark Milbank, Robert Fairfax Lawson, Mr Cholmley, Southent Hungerford Luttrell, Edward Vernon. At the end of April two scholars (Matteate Brady and Sir George Dalston) were discharged to serve in the *Gloucester*, a new 50-gun ship launched on March 22nd at Sheerness (see below).
For an interesting article on the Academy, see *The Royal Academy at Portsmouth 1729 - 1806* by F.B.Sullivan, *Mariner's Mirror*, 63, pp. 311-26.



70. *View of Sheerness Dockyard in 1739, engraved by Samuel & Nathaniel Buck. With a magnifying glass it is possible to make out one of the docks and the building slip, both of which are occupied; the second dock is empty. Note also the hulks used to house the dockyard shipwrights. (Private collection).*



71. *Plan of Sheerness Dockyard and surroundings, made by the Board of Ordnance in 1738. Like the map of Portsmouth on page 116, it was done with a view to assessing the defences of the Yard from attack. The hulks are clearly visible, and all the dockyard buildings are marked. (Courtesy Public Record Office, Kew).*

Sheerness Dockyard

CXCVI. There is in England a naval Dockyard at Sheerness, a small town situated 18 leagues from London on the coast at the mouth of the Medway. They have in this Dockyard one building-slip and two docks.

Building-Slip

The building-slip is about 140 feet [*45.5 m*] long, 40 feet broad [*13.0 m*], and 8 feet [*2.60 m*] deep at the water's edge.

Docks

The docks are both 150 feet long [*48 8 m*], 56 feet broad [*18,2 m*], and 18 feet [*5.8 m*] deep; they are built like those at Chatham and are about 40 feet [*13.0 m*] broad at the gates. There is 17 feet [*5.53 m*] of tide there. In one of these docks I saw the **Gloucester**, a ship of 50 guns, which had been graved there, and in the other a ship of the same strength which is being repaired there.

The storehouses at Sheerness are not extensive, and the Dockyard covers but a very small area; they never fit out more than 7 ships there, and these are ships of 50 guns and below.

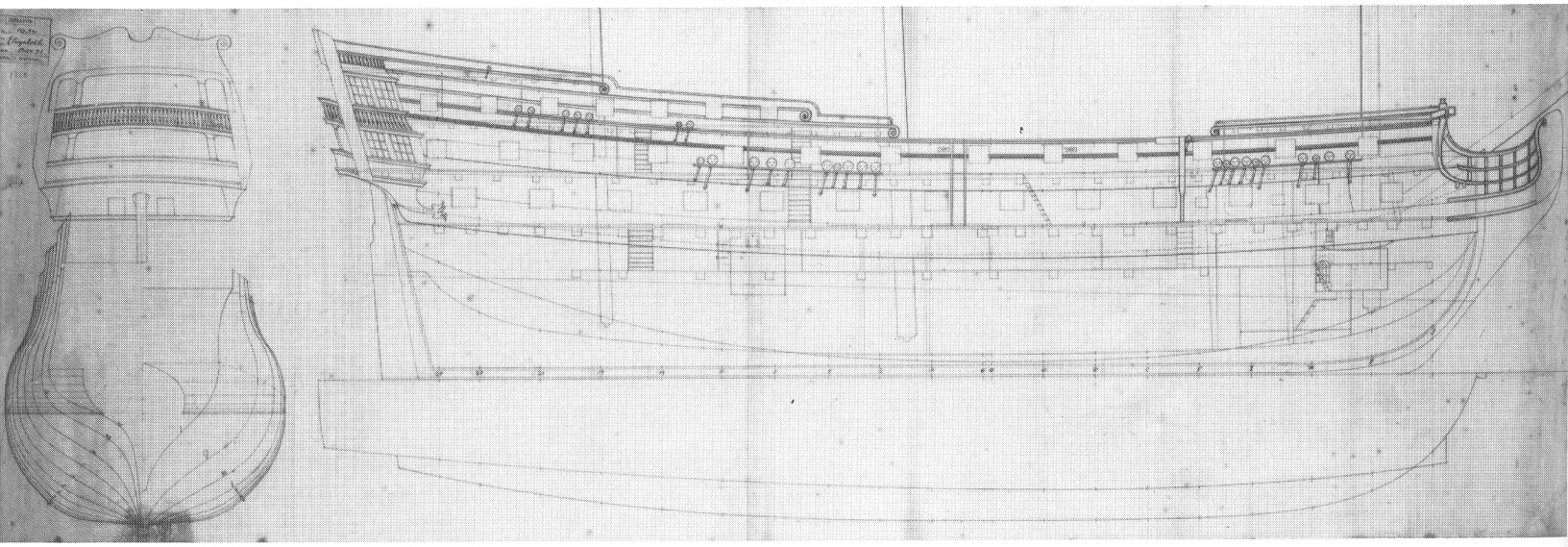
The **Gloucester**[164] is of the new manner of building; she is 125 feet [*40.65 m*] long from rabbet to rabbet, 36 feet 1 ½ inches [*11.75 m*] in breadth and 14 feet 2 ¾ inches [*4.62 m*] depth in hold, French measure. I shall say nothing here of her underwater lines; these will be found described in what I shall say concerning the new manner of building in England. Her upper works are well drawn, and she is shallow-waisted. She has a roundhouse on her quarterdeck which rises 5 feet 7 or 8 inches [*1.81 - 1.84 m*]. This ship has never been to sea. She is presently being commissioned for a cruise in the Mediterranean.

Ship of 50 Guns

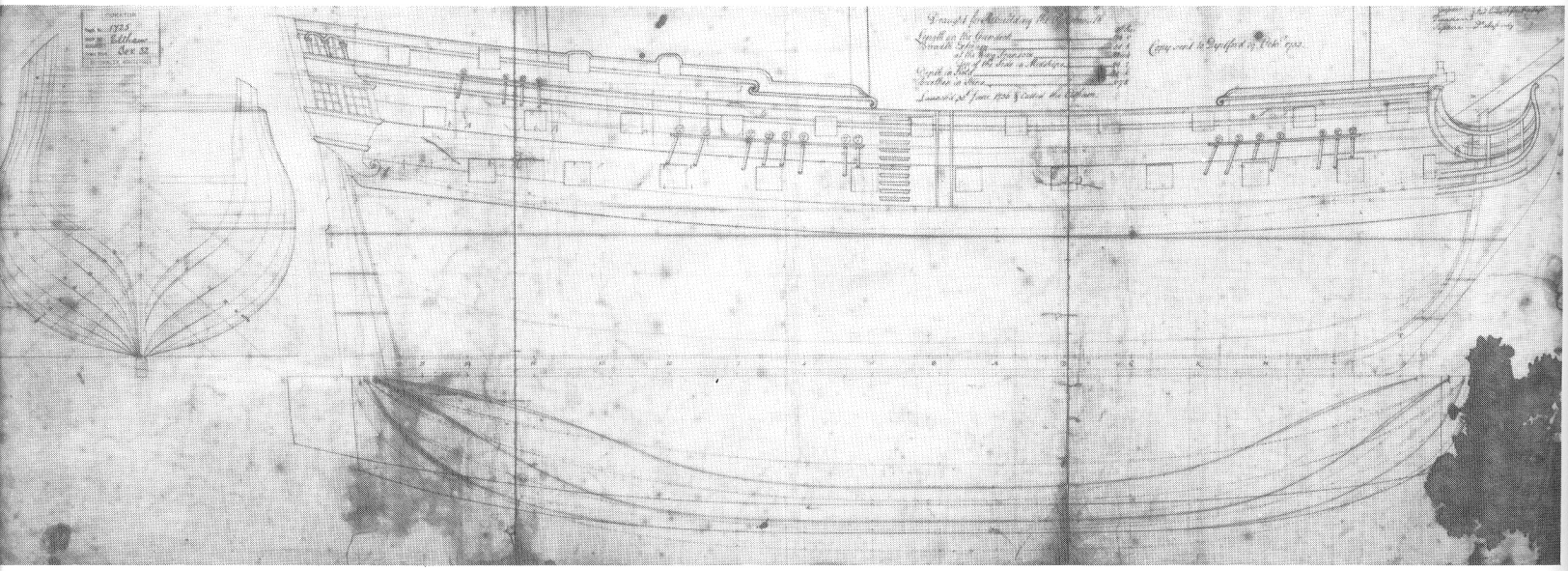
The 50-gun ship which they are repairing[165] in one of the docks at Sheerness is rotten in most of her frames and they are shifting almost all of her bottom-planking to put her in condition to last four or five years more, as the English always do in such cases.

164. **Gloucester**: see Remark LXV, page 82. The fact that Ollivier saw this ship in dock allows us to pinpoint with considerable accuracy the dates of his visit to Sheerness, since she was taken into dock on May 3rd and floated out two days later. During this time she was "graved with a new composition". She had originally been launched on March 22nd. Sheerness is no great distance from Chatham, and it seems probable that it was while he was visiting the latter dockyard that Ollivier took a day off to visit Sheerness. Since he does not mention the docking or undocking of the *Gloucester*, it is reasonable to presume that his visit took place on May 4th 1737.
Sheerness was the least important of the royal dockyards at this time, and was relatively small. While it had the merit of being closer to the sea than Chatham, which was beginning to suffer from the progressive silting of the River Medway, it was on the other hand more exposed to enemy attack. Its site moreover was on marshy ground, such that all buildings had to be piled. It was not a popular posting for shipwrights or artisans, who were lodged in hulks and suffered regularly from malaria.

165. We have been unable to identify this ship with certainty, since according to the *Progress Books* there were no 50-gun ships other than the *Gloucester* in dock on May 4th. The second dock was occupied by the *Anglesea* from February 4th to June 3rd, but she was rated as a 44 rather than a 50, undergoing a small repair. Another candidate might be the *Rupert* (60), which was rebuilt at Sheerness between 1737 and 1740, but according to the *Progress Books* work did not start until June 27th. A final possibility is the *Argyle*, which with 50 guns has the merit of conforming to Ollivier's description better than the two other candidates, but she was docked on June 4th and undocked on August 1st, having been sheathed only. On balance, the most likely candidate is the *Anglesea*, which Ollivier mistook for a 50-gun ship, an unusual error on his part. Alternatively, it is entirely possible that the *Progress Books* are in error.



72. *Draught of the* Elizabeth *(70) of 1737*
(Courtesy National Maritime Museum, Greenwich)



73. *Draught of the* Eltham *(40) of 1737*
(Courtesy National Maritime Museum, Greenwich)



74. *Vignette by Ozanne, from Duhamel du Monceau's* Élémens de l'Architecture Navale, *1758.*
(Private collection)

Concerning the new manner of building of the English

CXCVII. A few years ago[166] some of the English shipwrights put forward a new manner of building. They claim in following this method to build ships which will sail faster than ordinary ships, will be more weatherly, will answer better the helm, and will hog less. To this end they have increased the beam of their ships of 60 and 70 guns by about a 28th part, and that of their ships of 60 to 70 guns by a 16th part: see Remark **CXXVIII**. They have left unchanged the old length and depth in hold. They have made the floor at the midship-bend a 6th part longer than it was hitherto, and have given it one and three quarters or twice the deadrise which there is in their ordinary ships. They have fashioned the lines at bow and stern much less fine than in the previous manner of building, have fastened a double false keel, in such a manner that the keel and the two false keels project together beyond the planking one and three quarter times more than in our own ships; they have increased the height of the masts in proportion to the increase which they have given to the breadth, and claim to have employed in this new manner of building the principle of the solid or the curve of least possible resistance in cleaving the water as propounded by Mr Newton.

The new manner of building has already been tried on three ships which are the **Elizabeth**[167] of 70 guns, the **Gloucester** of 50 guns, and the **Eltham**[168] of 40 guns. The latter is currently at sea; she was commissioned once before; I was given conflicting reports of her sailing qualities, yet the common opinion is that she is very speedy and that she is not weatherly. As I stated in my earlier Remarks, the **Elizabeth** is still building at Chatham, and the **Gloucester** is in dock at Sheerness.

All the English Shipwrights and sea officers with whom I have spoken concerning this new manner of building seemed to me to have high hopes of it, yet the Commissioners of the Admiralty have ordered that the old manner of building should not be abandoned until the new

166. In about 1732. There would appear to be some confusion: in Remark CXXVIII (p. 135), Ollivier is clearly referring to the 1733 Proposals, which were however, so far as can be ascertained, entirely separate from the limited experiments carried out to test Newton's theory of the solid of least resistance. Ollivier's Remarks on the following pages refer however to both as if they were one and the same thing.
167. **Elizabeth**: see Remark LXV, p. 81.
168. **Eltham**: see Remark LXV, p. 82.

manner has been tried in one ship of each Rate. While awaiting this trial, of which it will be simple to obtain information later, I will dare to write down what I think of it.

An increase in the beam of their ships, such as the English have given them, is a sure means of making them more weatherly, and thus far the English have thought wisely. Yet in giving the new ships masts and spars, and in consequence sails, which are proportionate to the new breadth as they were to the former breadth, these ships will be found to be in the same condition as the former ships; they will be weatherly so long as they find sufficient support in their underwater lines, or will not be weatherly so soon as this support be lacking, just as happens with the former English ships which are narrow and with but a mediocre height in their masts and spars. The increase in the beam of the new ships will in no wise contribute to their being more weatherly, since the additional support which is occasioned by their breadth is brought to nought by the increased tauntness of their masts and spars.

The English have in their new manner of building increased the length of their floors, yet in increasing at the same time the deadrise they have lost all or near all the advantages which might have resulted from increasing the length of the floors. The midship bend of the new ships is no fuller at the height of breadth than it was in the former ships, and I believe indeed that it is less full. Therefore since the increased fullness which should have resulted from a longer floor is not to be found, I cannot see that any advantage can be gained from this change; on the contrary, I see only that there must be less resistance to the thrust of the sails so soon as their area is increased by reason of the greater breadth.

That which the English shipwrights have executed in their new manner of building by making their ships less fine at the bow and at the stern than formerly will certainly slow down their tendency towards hogging, since ships only hog by reason of the difference between their fullness at the waist and their fullness at bow and stern; the smaller the difference, the less easily does a ship hog. Yet although it is important to prevent a ship from hogging, it is still more important to build vessels which are speedy; and in adding still greater fullness at the bow and at the stern to the former English ships which are already sufficiently full therein, it is to be

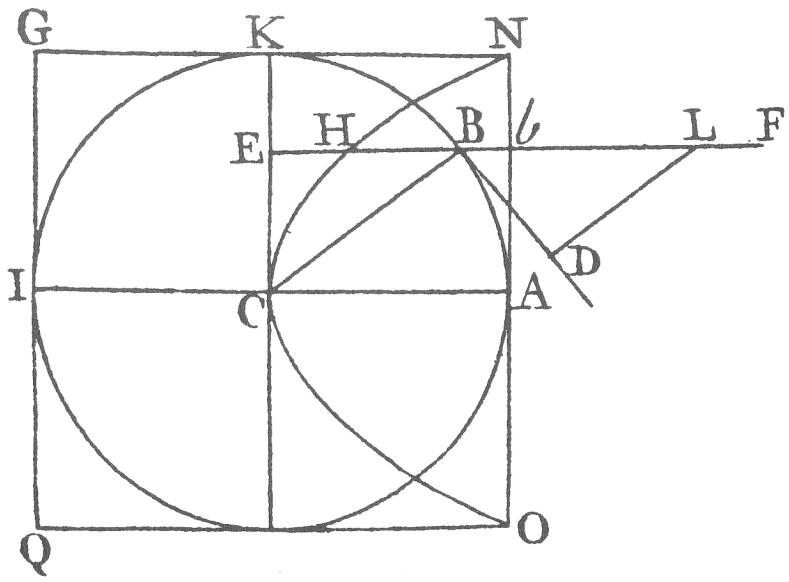
75. *Part of Newton's 34th Proposition, reproduced from the English translation of 1729 by Andrew Motte.*

Proposition XXXIV. Theorem XXVIII.

If in a rare medium, conſiſting of equal particles freely diſpoſed at equal diſtances from each other, a globe and a cylinder deſcribed on equal diameters move with equal velocities, in the direction of the axis of the cylinder: the reſiſtance of the globe will be but half ſo great as that of the cylinder.

For ſince the action of the medium upon the body is the ſame (by Cor. 5. of the laws) whether the body move in a quieſcent medium, or whether the particles of the medium impinge with the ſame velocity upon the quieſcent body: let us conſider the body as if it were quieſcent, and ſee with what force it would be impelled by the moving medium. Let therefore *ABKI* (*Pl. 6. Fig. 2.*) repreſent a ſpherical body deſcribed from the centre *C* with the ſemidiameter *CA*, and let the particles of the medium impinge with a given

Fig. 2. p. 117.



feared that they have now so much that they will be slowed down thereby. This is not the opinion of the English shipwrights in this regard; they believe that by means of the new lines the ship will cleave the water better, since at whatever height a section is made, the curves of their various waterlines have no inflexion; they are all regular, Mr Ward showed me it on the draughts of the **Elizabeth**. Whereas in the normal lines of the English ships, and still more in the lines of our own ships, all the horizontal planes save only those which are closest to the load waterline have considerable inflexion, and thus offer to the water a much larger surface area, and in consequence offer a greater resistance. This reasoning is that of Mr Ward; it is true, but it is not well applied. For the water offers no resistance in the horizontal plane but rather in the vertical plane, and while it is true that irregular† curves offer a greater resistance, it is not true that they should never be employed in the building of ships, where they are unavoidably necessary in the waterlines closest to the keel; it is with the help of these sweeps that those shipwrights who know how to employ them correctly give to a ship a shape such as is formed in the vertical direction only by regular curves upon which the water acts with less power than it does upon those same curves in the new English ships.

†.... and while it is true that regular curves offer a greater resistance ....

There is no doubt that the ships of the new manner of building will answer the helm better than the former ships, for it is the property of all broad ships to answer the helm well, and the reason is clear to be seen.

The English have given a double false keel to their ships because they feel that in increasing their beam they give them a greater disposition to make leeway, and reduce their disposition to sail in a straight line. They think that by means of this false keel they place an obstacle against the ship's making leeway, and this is true, yet since the false keel has no improving effect on the difficulty which the new ships have in cleaving the water because of their great beam, and because on the contrary it becomes itself an obstacle thereto, it is of no use in certain respects, and is prejudicial in others. For considering the false keel when running free, by which I mean when sailing before the wind or large, it hinders the ship's sailing by all the surface area which it presents to the water on the forward side, and in this it is prejudicial. Considering it when sailing close-hauled, it prevents the ship from making headway as much as it prevents her from making leeway, and in this case it is of no use. The only effect which it can have to the ship's advantage with regard to her making leeway is to mitigate the disadvantage which it itself gives the ship by restricting her headway, yet it does not entirely make up for the tendency which the new ships have acquired of making leeway by reason of their great breadth, and nor does it give back to them that ability to cleave the water which they have lost by this same greater breadth. From which it follows that the English shipwrights were mistaken when they thought to gain some advantage from this false keel.

The English claim, as I have already reported, that they have given to their new ships the shape of the solid of least resistance proposed by Mr Newton, and it is on this in particular that they found their hopes that the new ships will be faster sailers than the old. This solid of Mr Newton's is to be found in the 34th Proposition of his work entitled *Philosophiae Naturalis Principia Mathematica*[169]. It is similar to that which has been proposed by several other teachers of geometry, and is formed by the revolution of a certain sweep about its axis. Such a solid cannot on its own form the shape of the bow, or else the ship would roll excessively and would carry such a weather helm as to be unable to sail. It can therefore be employed only to form a part of the bow, and even then it cannot wholly be employed, for that which must be added in order to complete the lower part of the bow obscures a large part of the solid and in consequence destroys a part of its properties. The English Master Shipwrights discovered these difficulties when they sought to employ the solid of least resistance, and believe that they have overcome them, by divers experiments which they have carried out in the dock at Deptford, where they floated and drew through the water pieces of wood of different shapes, all of which had the shape of the solid of least resistance, insofar as it can be used in the building of a ship, and

169. Sir Isaac Newton (1642 - 1727). His famous work was first published in Latin in 1687; an English translation by Andrew Motte was published in 1729. The first French translation, by the Marquise de Chastellet, and entitled *Principes Mathématiques de la Philosophie Naturelle* did not appear until 1756, which suggests that Blaise Ollivier had read it in Latin. The opening part of the 34th Proposition (Theorem XXVIII), together with the relevant diagram, is reproduced opposite.

finished off by different sweeps. They determined the new manner of building from that shape which moved through the water with the most ease. If such experiments are to be relied upon, which I do not believe, the new English ships ought to sail faster than those ships to which all this art has not been applied.

When I compared the shape of these new ships with that of two of our own ships, wherein I know from sure science that the solid of least resistance makes up the greater part of their bow, I found such a great difference that I should have doubted whether this solid had been applied at all to the new English ships, had I not discovered the reason for this difference. It derives from the fact that their midship bend is placed considerably farther forward than in the two ships to which I compared them, so that from an equal base the solid of least resistance applied to the English ships has less height than that applied to the two other ships; from which a greater resistance must necessarily follow.

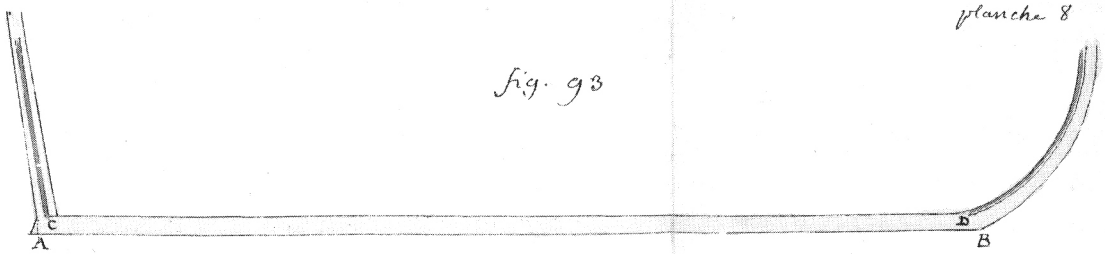
The English shipwrights claim also that the new ships will sail faster than ordinary ships because they have increased their masts and spars, and thus the spread of their sails. This advantage would have been achieved, had they not in increasing the masts and spars also increased the breadth of their ships, the ballast, and the weight of these masts and spars, but since all these things are increased in proportion to the masts and spars, it is but a case of greater power applied to a greater weight, and it is more probable that they have lost through this change than it is probable that they have gained thereby.

Thus the English have made, with their new manner of building, ships which cost them much more than did their former ships, since they are larger, yet which will be no more weatherly nor sail any faster than their ordinary ships. The success which this method has achieved in the **Eltham**, which is said to sail to perfection, proves nothing against the opinion which I have of this new manner of building, for: 1st, she has never sailed trials against a fast sailer of the old manner of building, which is a fact of which I was careful to enquire; 2nd, she was unweatherly during her first commission[170]; they have increased the ballast for her current commission, from which it may reasonably be presumed that she will sail less fast than formerly.

170. The following report headed "*Eltham at Longreach, 10th January 1736*" gives some indication of the problems experienced: "*By the Remarks & Observations We have made of the Sailing of His Majesty's Ship Eltham, from our leaving Helvoitsluys, & her present working under Jury Masts; We offer it as our full Opinion, that she was at first, either over Masted, or not down enough in the Water, for when it Blew hard she was extreamly Crank, and when we worked with our Jury Masts, the Ship answered beyond all expectation, as we weather'd upon and headed every Ship in Company. In justification of Which, We have hereunto set our hands. 1st Lieut. Rowland Frogmere, Master James Strong*" [ADM/A/2255 NMM]. Evidently it was decided to increase the amount of ballast rather than reduce the height of the masts.

planche 8

fig. 93



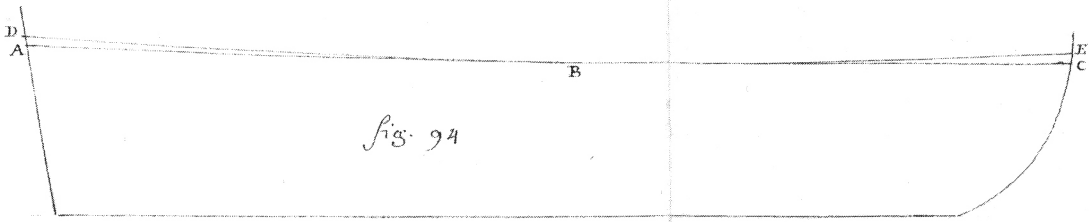


fig. 94

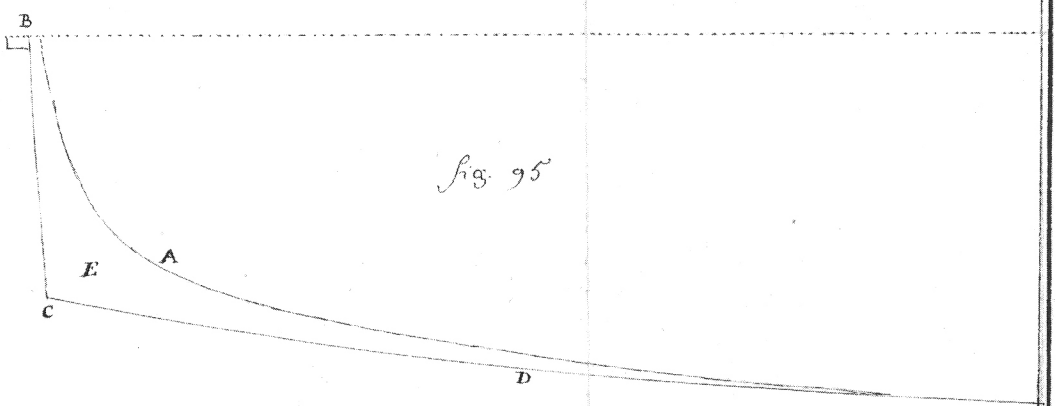
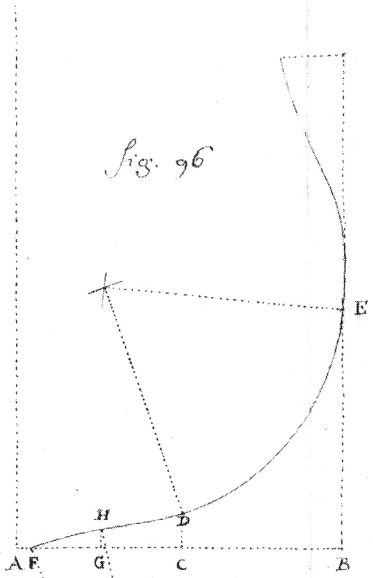


fig. 95



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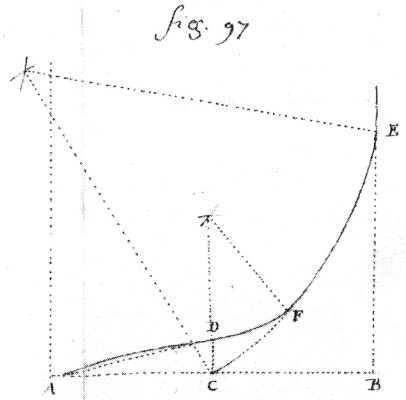

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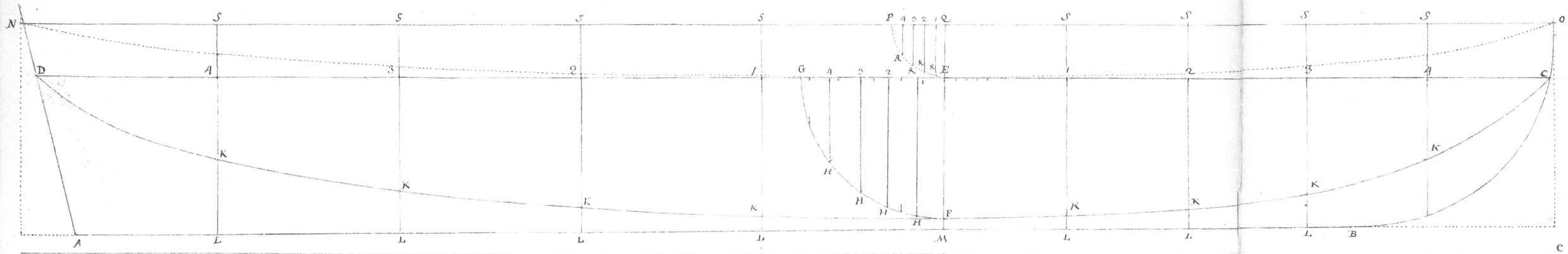

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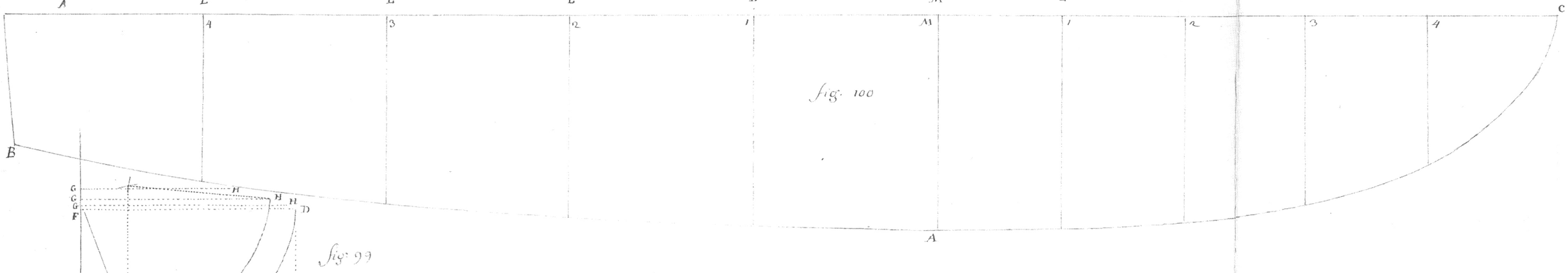

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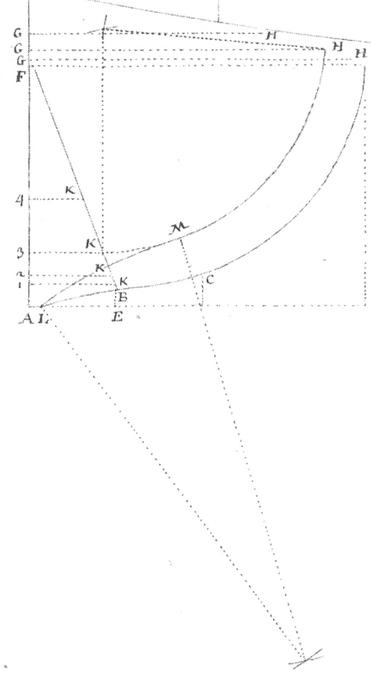

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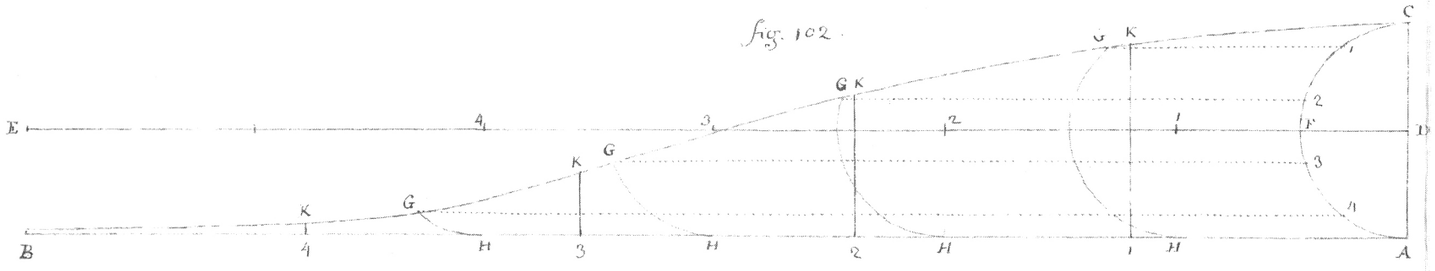

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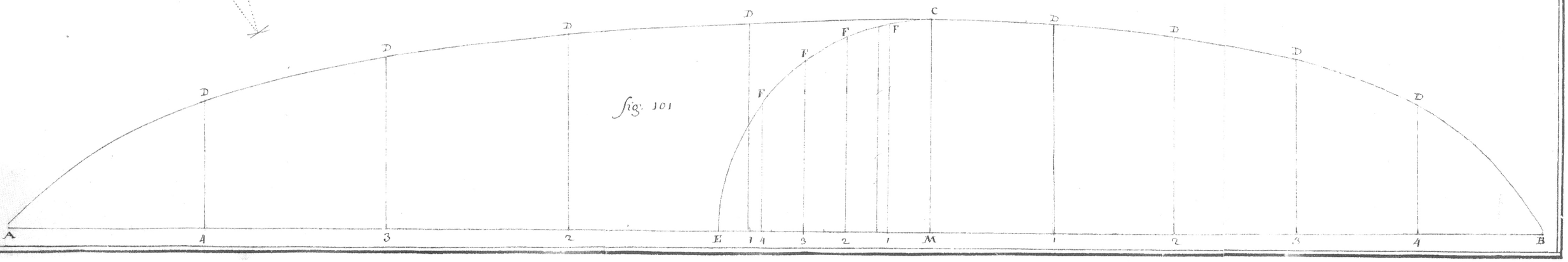

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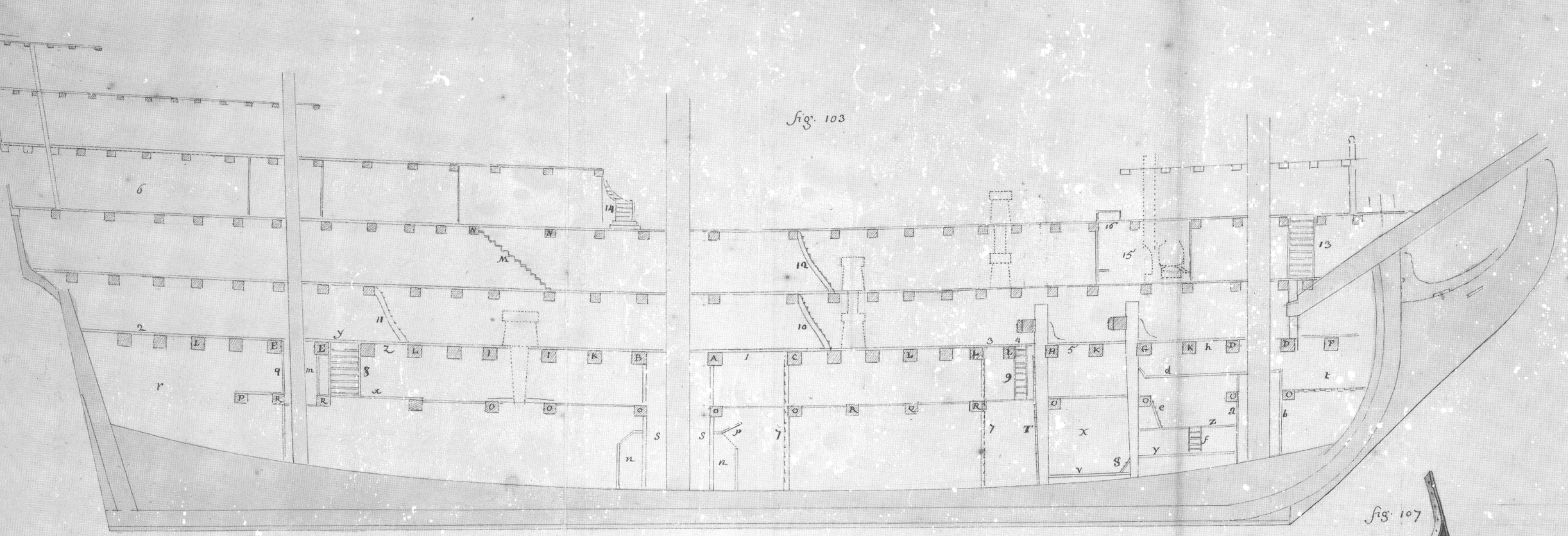

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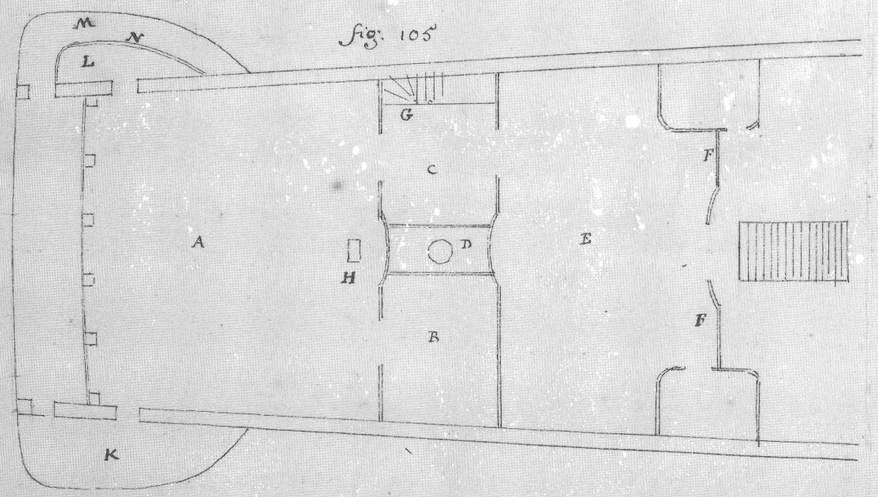

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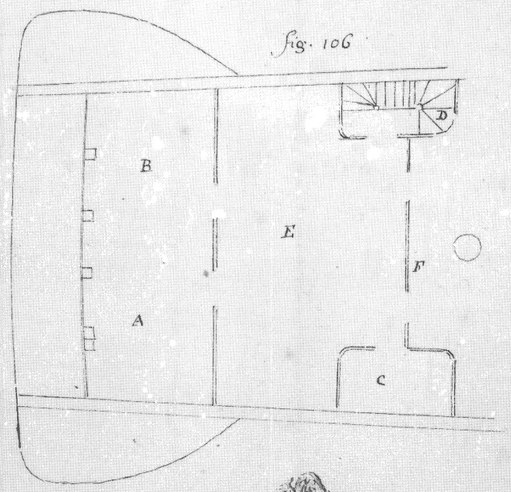

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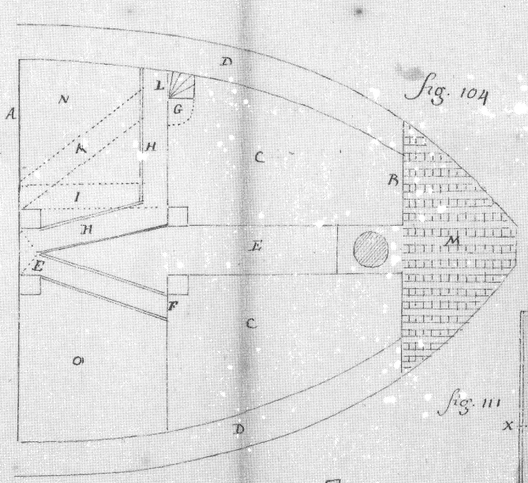

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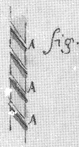

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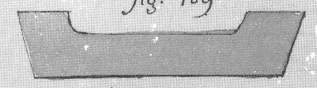

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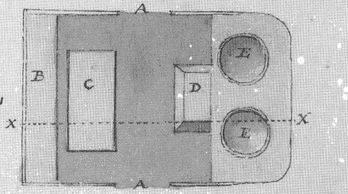

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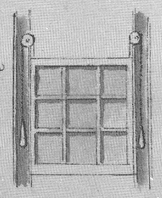

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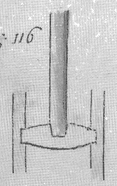

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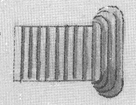

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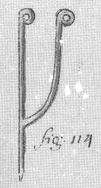

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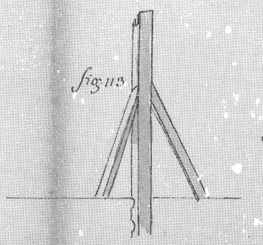

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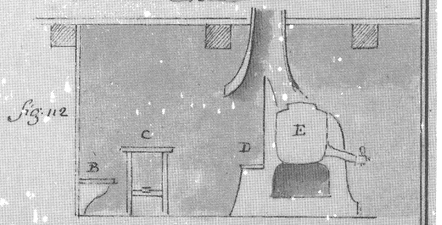

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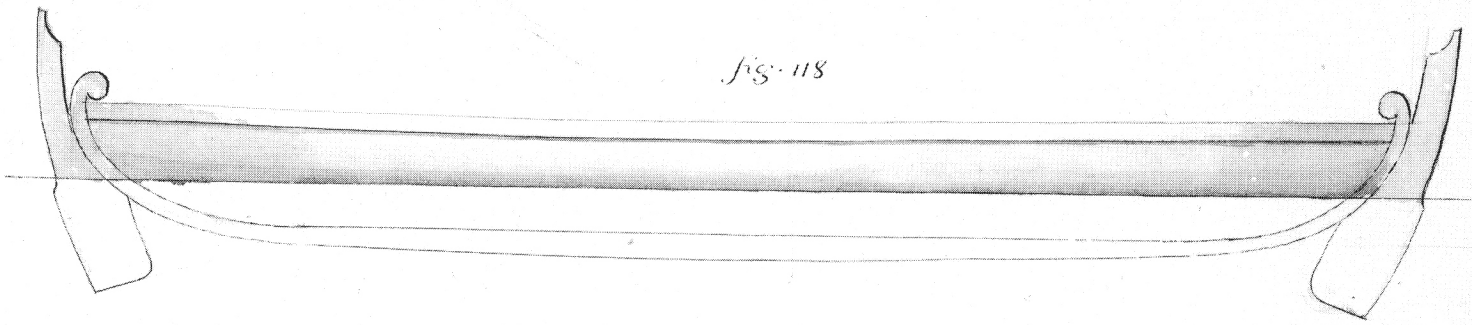

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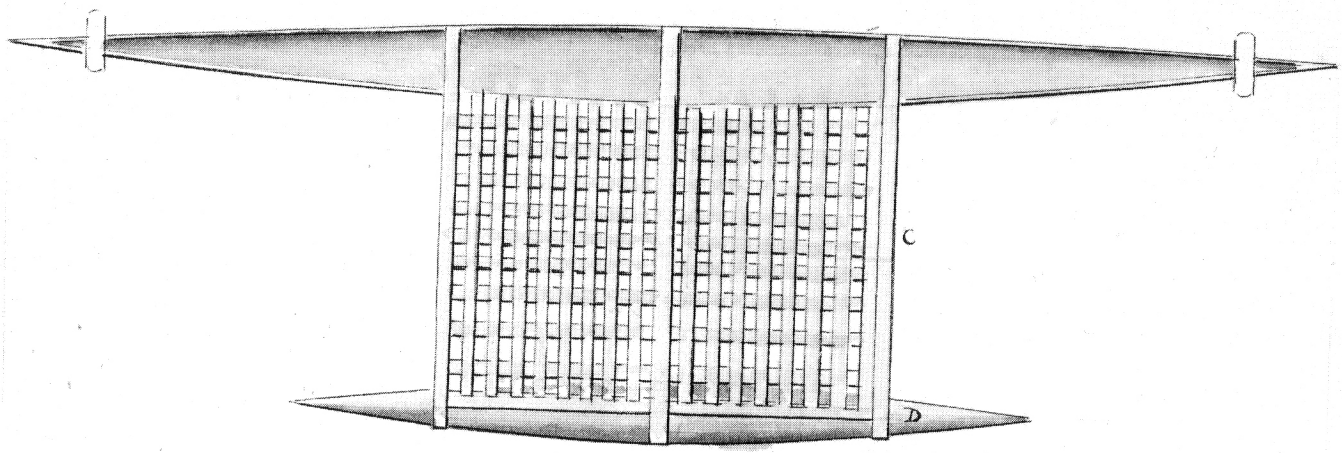



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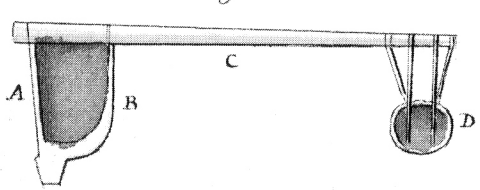
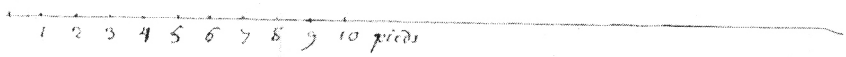
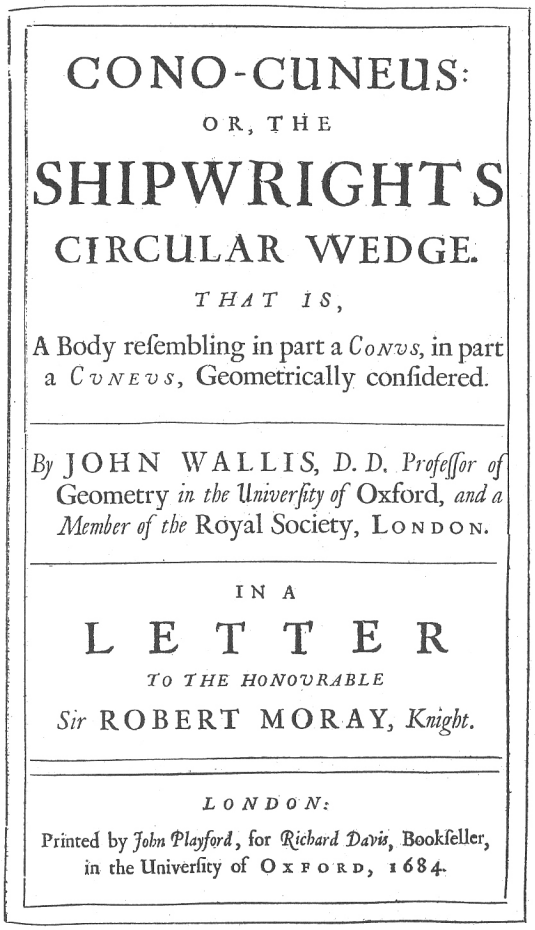






Engraving of John Wallis, from the frontispiece of his Treatise of Algebra, *of which the* Treatise of the Cono-Cuneus *(see overleaf) formed a part. (Courtesy Royal Society)*



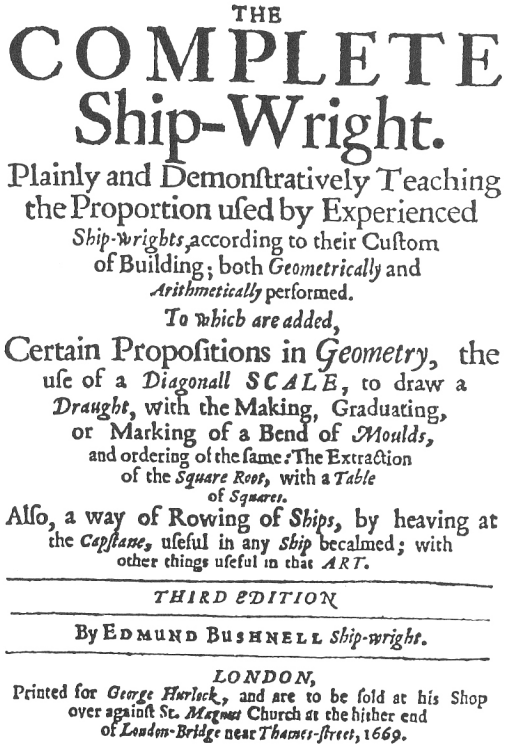
CONO-CUNEUS:
OR, THE
SHIPWRIGHTS
CIRCULAR WEDGE.
THAT IS,
A Body resembling in part a CONVS, in part a CUNEUS, Geometrically considered.

By JOHN WALLIS, D. D. Professor of Geometry in the University of Oxford, and a Member of the Royal Society, LONDON.

IN A
LETTER
TO THE HONOURABLE
Sir ROBERT MORAY, Knight.

LONDON:
Printed by John Playford, for Richard Davis, Bookseller, in the University of OXFORD, 1684.

76. *Title page from John Wallis's* Cono-Cuneus *(Courtesy: The Royal Society).*



THE
COMPLETE
Ship-Wright.
Plainly and Demonstratively Teaching the Proportion used by Experienced *Ship-wrights*, according to their Custom of Building; both *Geometrically* and *Arithmetically* performed.
To which are added,
Certain Propositions in *Geometry*, the use of a *Diagonall* SCALE, to draw a *Draught*, with the Making, Graduating, or Marking of a Bend of *Moulds*, and ordering of the same: The Extraction of the *Square Root*, with a *Table* of *Squares*.
Also, a way of Rowing of *Ships*, by heaving at the *Capstane*, useful in any *Ship* becalmed; with other things useful in that *ART*.

THIRD EDITION

By EDMUND BUSHNELL *Ship-wright.*

LONDON,
Printed for *George Hurlock*, and are to be sold at his Shop over against St. *Magnus* Church at the hither end of *London-Bridge* near *Thames-street*, 1669.

77. *Title page from the third edition of Bushnell's* Complete Shipwright *– note that the spelling was evidently different in the edition seen by Ollivier. (Private collection)*

Of English Books on Shipbuilding

CXCVIII. The English have some few books on shipbuilding, of which here are the titles.

Cono-cuneus, or the Shipwright's Circular Wedge[171] (*le cone en coin, ou le coin circulaire du Constructeur*), by John Wallis, Professor of Mathematics, printed in London in 1684. Copies of this work are extremely rare: I found none to purchase.

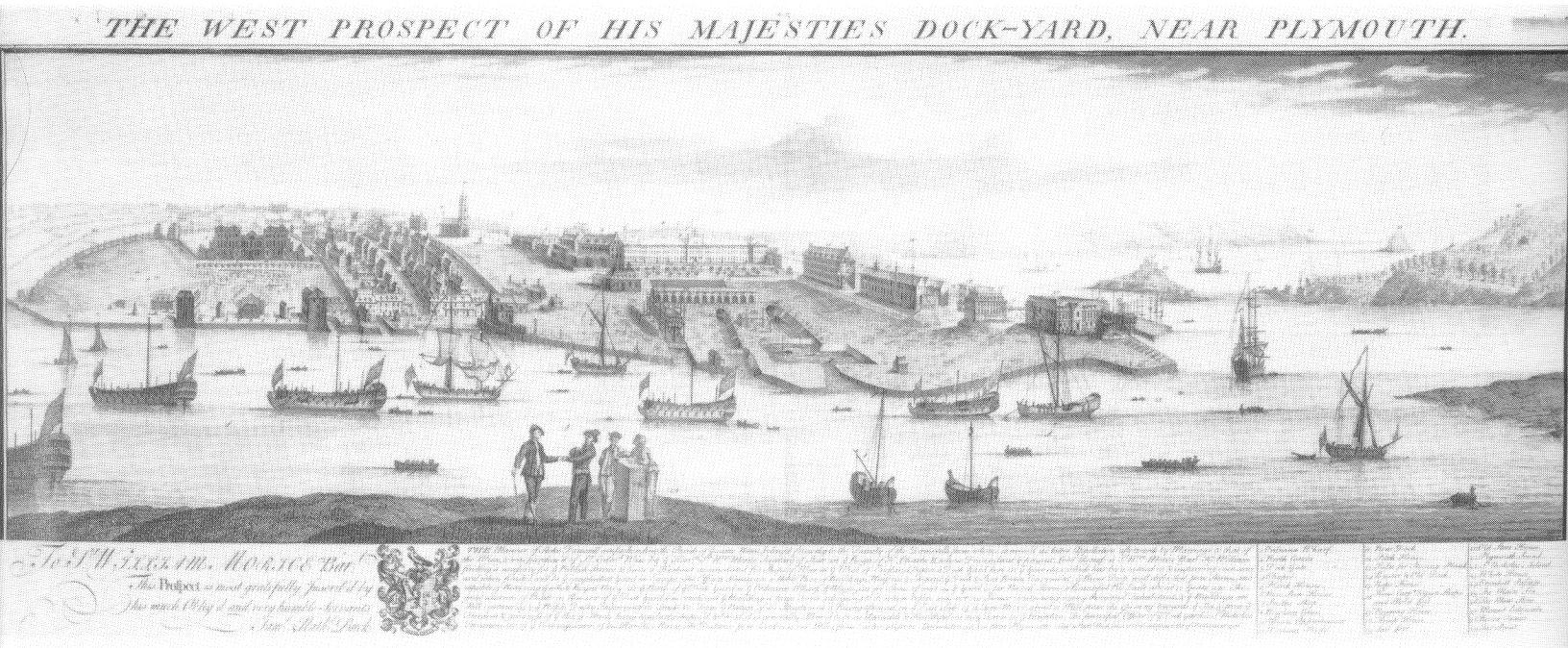
The Ship-builder's assistant, or, some essays towards compleating the art of marine architecture[172] (*L'aide du constructeur ou quelques essais pour perfectionner l'architecture navale*), by William Sutherland, Shipwright, printed in London in 1726. There have been other editions of this same work. I saw one from 1711.

The accomplished Ship-Wright[173] (*Le constructeur parfait*), by John Cardingham, printed in London in 1733. There were also earlier editions of this book.

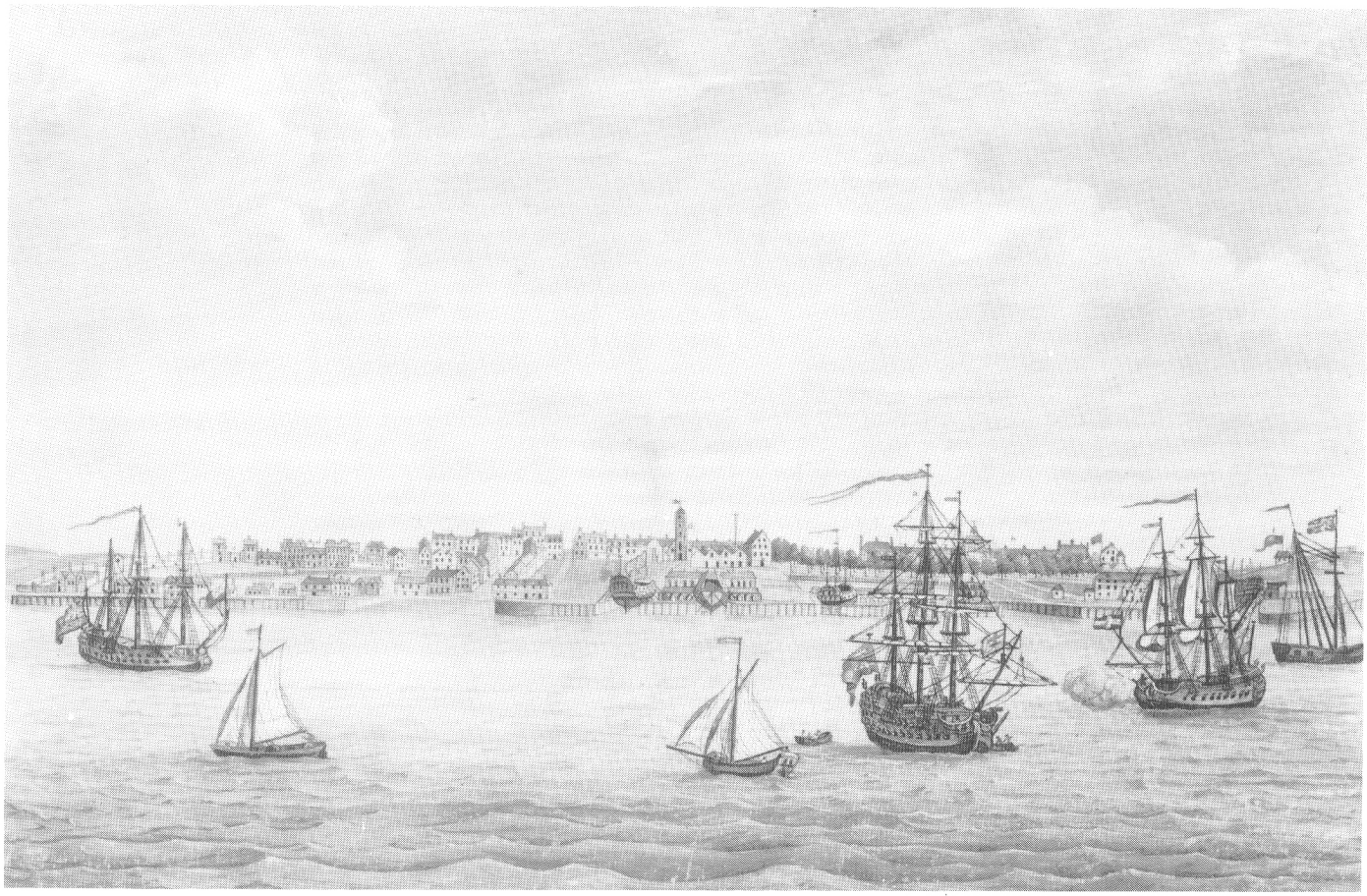
Marine Architecture (*L'architecture navale*), printed anonymously in London in 1736. I found this same book in the library of Mr Cromwell Mortimer[174], the Secretary of the Royal Society, printed in 1688 as the fifth edition, under the title **The Compleat Ship-Wright**, and the author is named there as Edmund Bushnell, Shipwright[175].

These last three books are for sale at William Mount's bookshop opposite the Tower of London. I shall translate into French whatever is good, so soon as my affairs allow me the leisure.

171. See the Bibliography for full details of all these titles. *Cono-cuneus*, although written in 1662, it was not in fact published until 1684. John Wallis was Professor of Geometry at Oxford; he was a Member of the Royal Society, and his book is still in the library of the Society in London, with annotations in Wallis's own hand; it is quite possibly the very copy that Ollivier examined. There is an interesting reference to the book in a manuscript by William Sutherland (MS 87/050), preserved at the National Maritime Museum: "*Sir Phineas [Pett] was counted the greatest Scholar, of a Shipwright that ever went before him, and I am apt to believe, as good, as most that came after him, and being Encouraged by the King, he first began to invent something to reconcile, and form our transverse lines, and by the Assistance of doctor Wallis a famous Mathematician they made A Cono-Cuneus, (by some called the Shipwrights Circular Wedge) and glueing a great number of thin pieces together formed it into a Cono-Cuneus, which being then the Base a Cone and vertex a wedg, so puting it into water, the glue parting, they had a true Sight of each curve.*
The use that Sir Phineas made of them patterns is unknown to me, but I know they was handed down, and is much admired by several material shipwrights at this day." It is unclear whether this indicates that tank trials were made, but if this is the case, it is to my knowledge the first recorded instance of such trials in England.
172. This is one of the best-known English books on shipbuilding, and has been reprinted in facsimile by Jean Boudriot Publications. It is perhaps surprising that Ollivier should not mention another book by Sutherland, *Britain's Glory: or, Ship-Building Unvail'd, being a General Director for Building and Compleating the said Machines*. The first edition dates from 1717, a second from 1726, with others published in 1729 and 1740.
173. The full title is *The Accomplish'd Ship-Wright and Mariner*, and the author is John *Hardingham* not Cardingham. The edition of 1733 to which Ollivier refers appears to be unknown to bibliographers.
174. There were two Secretaries of the Royal Society in 1737: John Machin and Cromwell Mortimer. The latter held wide correspondence and frequent meetings with foreigners, and it is not therefore surprising that he took the trouble to meet Ollivier. Clearly Ollivier was able to circulate freely among learned company in London, but there is no record in the Journal Book of the Royal Society to his having attended any meetings at this time, unless he did so under an assumed name (see Introduction).
175. Considered the first English book on naval architecture. It was originally published in 1664. A second edition was published of which no copies are known to survive. The third edition dates from 1669, and the fourth from 1678. A fifth edition is recorded in Pepys' *Bibliotheca Nautica*, and has been thought to date from 1685; if Ollivier is correct this date must be revised. Other editions are known from 1699 and 1716. The "pirated" edition of 1736 to which Ollivier refers is unknown to bibliographers. Bushnell's book was apparently never in the Society's library; it is evidently to Mortimer's private library that he refers.



78. *View of Plymouth Dockyard, engraved by Samuel & Nathaniel Buck and dated 1736. (Private collection)*



79. *Anonymous watercolour of Plymouth Dockyard, probably dating from then first quarter of the 18th century. (Courtesy Nationsl Maritime Museum, Greenwich)*

Plymouth Dockyard

CXCIX. Apart from the Dockyards of Portsmouth, Chatham, Deptford, Woolwich and Sheerness of which I have spoken, the English have another naval Dockyard at Plymouth, a town situated on the coast 75 leagues from London. I have not seen this Dockyard; I have learned only that it is less considerable than those of Portsmouth and Chatham and that it has several docks suitable for the repair and graving of ships of war, save those of three decks.

Of the Number of English Ships

CC. There are presently in the English Navy:

7 ships of	100 guns
13 of	90 guns
16 of	80 guns
24 of	70 guns
30 of	60 guns
34 of	50 guns
16 frigates of	40 guns
8 of	30 guns
30 of	20 guns
3 Fireships	
3 Bombs	
15 Sloops of War	
8 Yachts	

Of these ships, 13 are presently building, including 2 100-gun ships, 2 90-gun ships, 2 of 80 guns, 4 of 70 guns, 2 of 60 guns and one of 50 guns. I have spoken of these thirteen ships in my Remarks[176], and also of those which are being repaired.

Londres le 6.e juillet 1737

Ollivier

176. As discussed in the notes, these 13 ships were:
100 guns: *Victory* (Portsmouth), *Royal Anne* (Woolwich); 90 guns: *Duke* (Woolwich), *S[t]George* (Portsmouth); 80 guns: *Boyne* (Deptford), *Cumberland*, (Woolwich); 70 guns: *Elizabeth* (Chatham), *Suffolk* (Woolwich), *Prince Frederick* (Deptford), *Bedford* (Portsmouth); 60 guns: *Lion* (Deptford), *Essex* (Woolwich); 50 guns: *Guernsey* (Chatham).
Had Ollivier visited Plymouth, he would no doubt have seen the *S[t]Albans* (50), which was launched on August 30th 1737.

List of English ships in 1737

This list only appears in the Brest manuscript. Blaise Ollivier's spellings of many of the ship names is idiosyncratic to say the least (see the list in its original form on pp. 311-312), with some of the names translated into French. The names in the following list have accordingly been corrected, with modern spellings substituted. In some cases it has not proved easy to identify with certainty the vessels to which Ollivier refers, and these are marked with a (?) in brackets. The fact that the list is drawn up broadly in alphabetical order suggests a printed source, perhaps James Love's *Mariner's Jewel*, of which there was a 7th enlarged edition in 1735 containing a similar list. (Ed.)

ships of 100 guns

Royal Anne
Britannia
Royal George
London
Royal Sovereign
Victory
Royal William

ships of 90 guns

Barfleur
Blenheim
S^{t}George
Prince George
Marlborough
Namur
Neptune
Prince
Princess Royal
Ramillies
Sandwich
Union
Duke

ships of 80 guns

Princess Amelia
Boyne
Princess Caroline
Cambridge
Chichester
Cornwall
Cumberland
Devonshire
Dorsetshire
Lancaster
Newark
Norfolk
Russel
Shrewsbury
Somerset
Torbay

ships of 70 guns

Berwick
Bedford
Breda
Burford
Buckingham
Captain
Elizabeth
Essex
Edinburgh
Prin^{ce} Frederick
Grafton
Hampton Court
Ipswich
Kent
Lennox
Monmouth
Nassau
Northumberland
Royal Oak
Oxford
Revenge
Suffolk
Sterling Castle
Yarmouth

ships of 60 guns

Canterbury
Dunkirk
Dreadnought
Defiance
Exeter
Kingston
Lion
Princess Mary
Medway
Montague
Nottingham
Plymouth
Rupert
Ripon
Sunderland
Superb
Windsor
York
Centurion
Deptford
Pembroke
Swallow
Tilbury
Warwick
Burlington
Dragon
Jersey
Stafford
Weymouth
Worcester

ships of 50 guns

Advice
Assistance
S[t]Albans
Antelope
Argyle
Bristol
Chatham
Colchester
Chester
Dartmouth
Falkland
Falmouth
Greenwich
Gloucester
Guernsey
Hampshire
Litchfield
Leopard
Newcastle
Nonsuch
Norwich
Oxford
Portland
Preston
Panther
Romney
Ruby
Rochester
Salisbury
Severn
Sutherland
Tiger
Woolwich
Winchester

frigates of 40 guns

Adventure
Torrington
Diamond
Dover
Enterprise
Folkstone
Fowey
Feversham
Gosport
Hastings
Ludlow Castle
Love
Lark
Princess Louise
Princess Louise (sic)
Eltham
Lion

frigates of 30 guns

Mary Galley
Pearl
Roebuck
Sapphire
Southsea Castle
Portsmouth
Southampton
Kinsale

frigates of 20 guns

Lymington (?)
Dauphin
Experience
Lowestoft
Tartar
Aldborough (?)
Blandford
Bideford
Deal Castle
Dursley Galley
Flamborough
Fox
Gibraltar
Greyhound
Garland
Lyme
Phoenix
Rose
Rye
Seahorse
Seaford
Scarborough
Shoreham
Squirrel
Winchelsea
Lively
Port Mahon
Solebay
Success

Fireships

Bridgwater
Griffin
Poole

Bomb vessels

Salamander
Terrible
Thunder

Sloops of war

Bonetta
Cruiser
Drake
Fly
Harwich
Otter
Shark
Swift
Spy
Tryall
Wolf
Grampus
Hound
Saltash
Spence

Yachts

Royal Caroline
Charlotte
Dublin
Fubbs
Catherine
Mary
William and Mary
Royal Escape

* * *

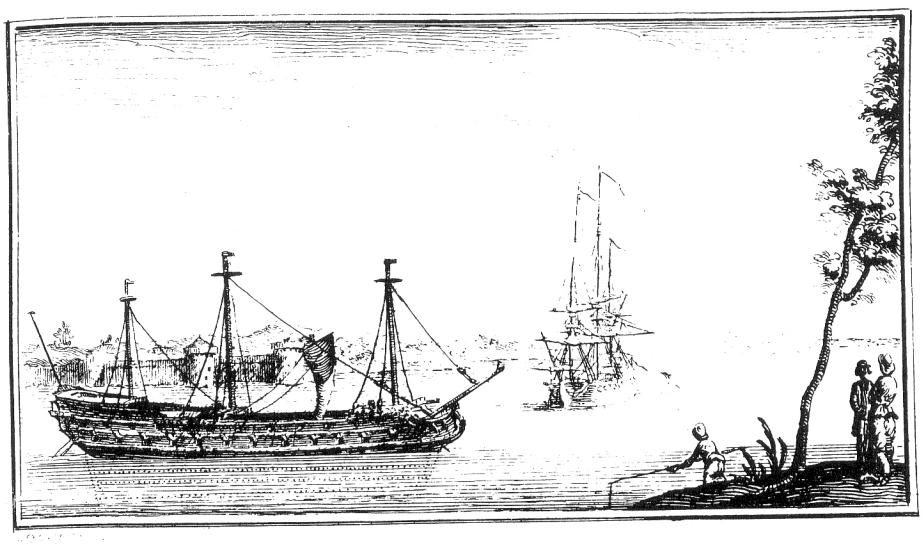


TABLE
of the Subjects Contained in the Remarks on the English Navy.

[This is the "alphabetical index" composed by Ollivier "to remedy somewhat the order which is missing", referred to in the Notice on page 41. It is incomplete, and sometimes in error, but has been reproduced unchanged, apart from re-ordering it alphabetically. Ed.]

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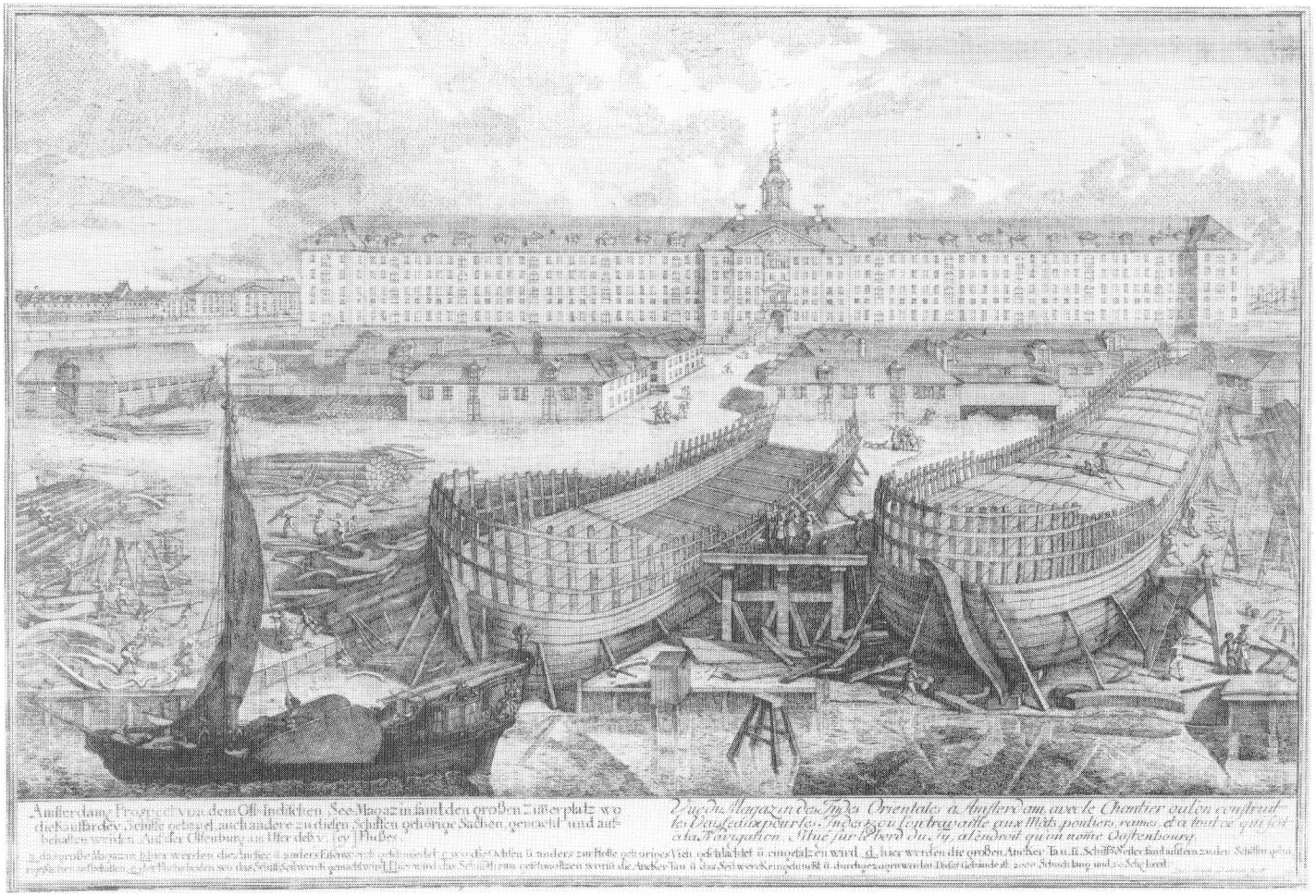


80. *View of the VOC Storehouse in Amsterdam (the building houses the Scheepvaart Museum today), and the Dockyard. (Courtesy Nederlandsch Historisch Scheepvaart Museum, Amsterdam)*

Remarks on the Dutch Navy

Dockyards

I. The Dutch have seven Naval Dockyards; they call them Admiralty Dockyards. The greatest is at Amsterdam, the others are at Rotterdam, Flushing, Veere, Hellevœtsluijs, Hoorn and at Enkhuijzen[177]. I saw the first five.

Amsterdam Dockyard

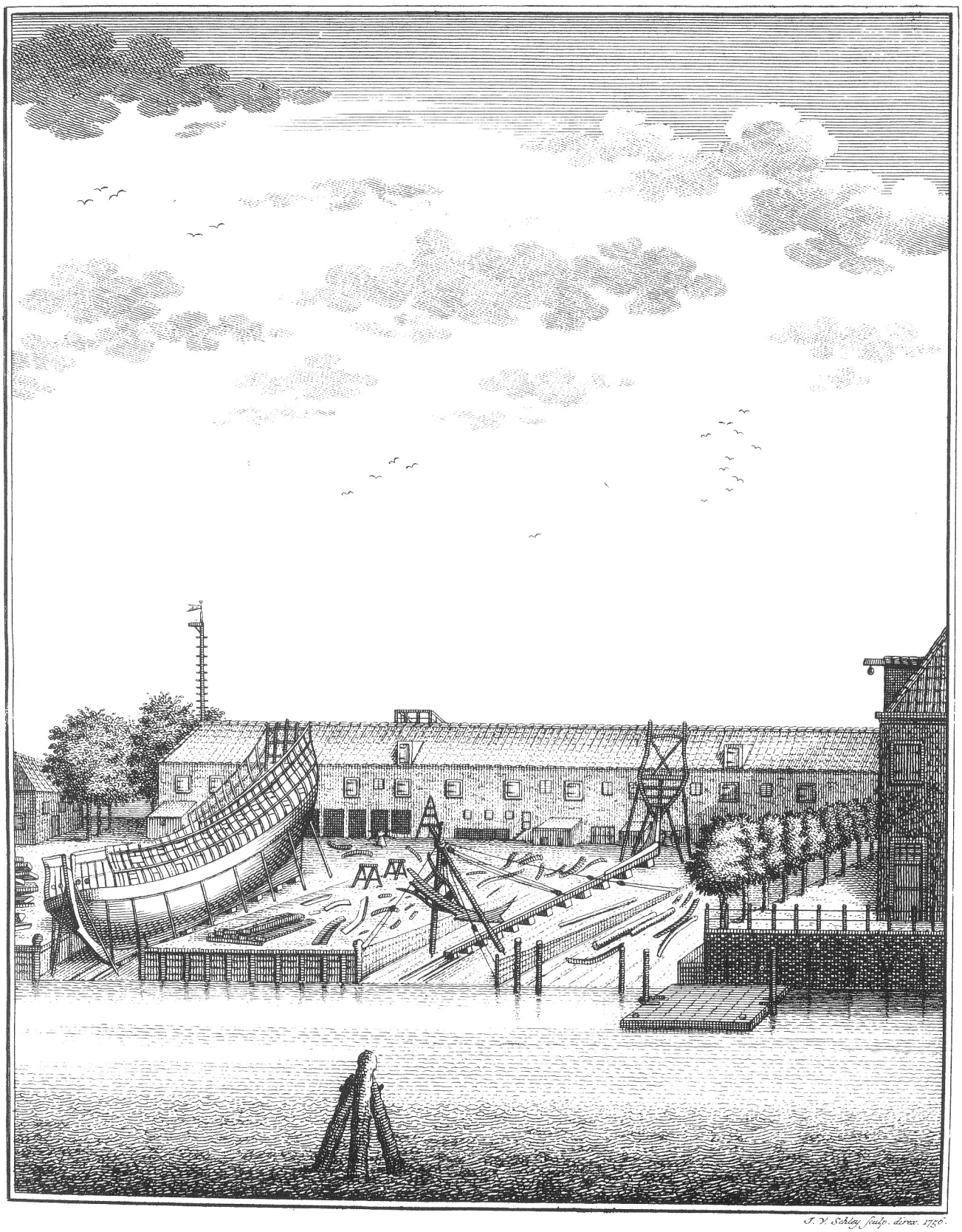
There are four building-slips in Amsterdam Dockyard, one of which is presently* occupied by a 74-gun ship which they are building and the others by yachts which are being repaired. These slips are about 160 feet [*52 m*] long and 40 feet [*13 m*] broad; at their lower end they are 2 or 3 feet [*65 - 97 cms*] below high water; they have but 5 or 6 feet [*1.63 - 1.95 m*] of declivity, and are situated 40 feet [*13 m*] apart. The storehouses of the Dockyard are large and well-built; there are some covered areas beneath which they have set up divers workshops and where they build longboats and ships' boats. There are also ponds where they keep beneath the water masts and all their shipbuilding timber save only their plank.

**in August 1737*

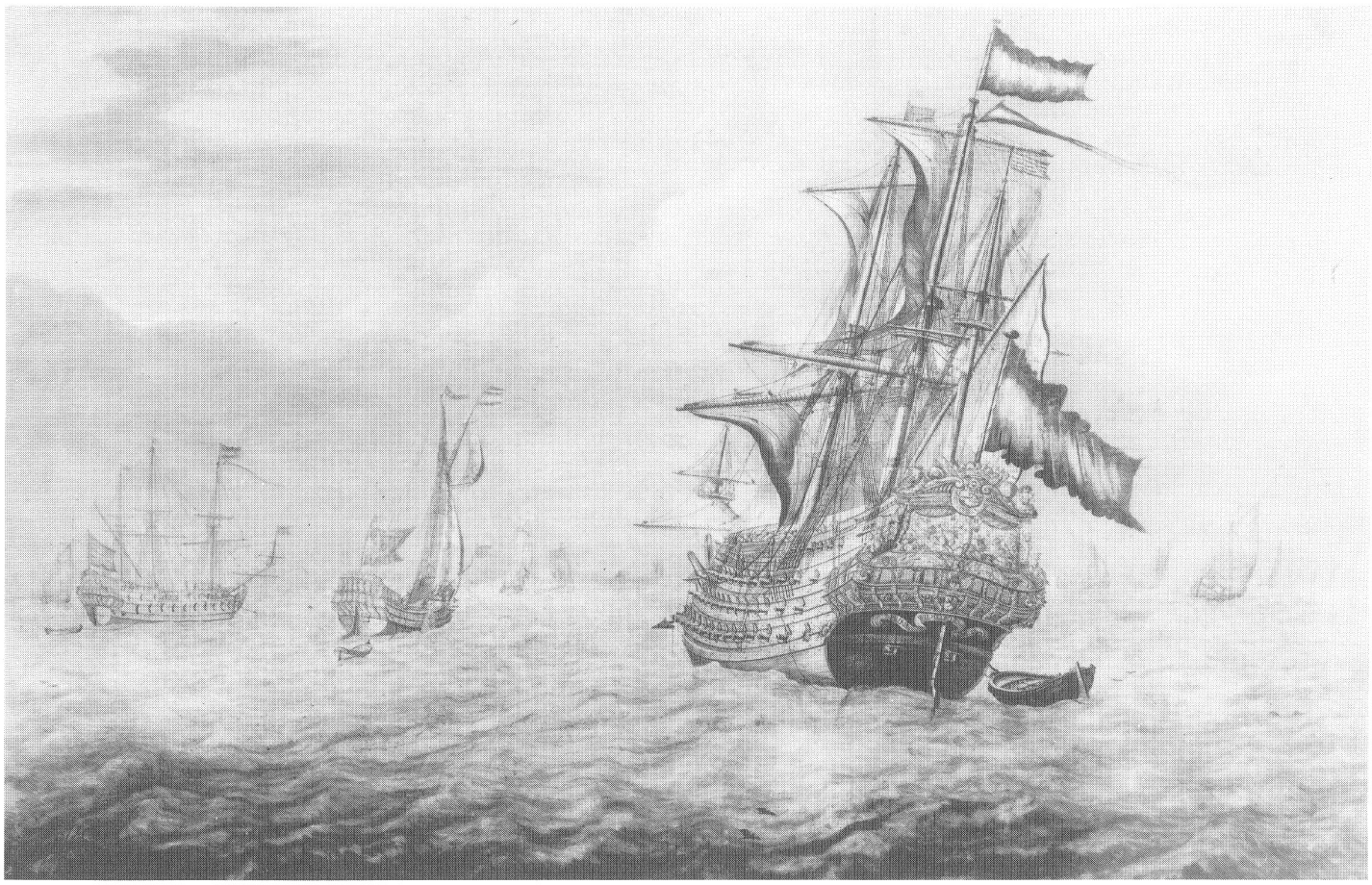
The 74-gun ship which is building at Amsterdam Dockyard has not yet been named[178]. It is an English Shipwright who is building her. The beams of her gundeck are in place; she is planked in the ceiling as far as the gundeck and planked without as far as the gundeck ports. I have no good opinion of her underwater lines; they are ill-conceived and excessively full at the bows at the level of the floorhead ribband, and above the extreme breadth line at the stern.

There are 37 ships[179] in the port of Amsterdam of which one of 96 guns, four of 72 to 74, eight of 64, thirteen of 52, five of 44, and six of 32 to 38 guns. Most of these ships and especially those of 64 guns and more have hogged greatly and appear to be in poor repair. They almost all have their principal masts stepped.

177. There were five Admiralties in Holland at the time: Amsterdam (by far the most important); the Maas or Maze (Rotterdam); the Noorderkwartier; Zealand; and Friesland. Almost all the ships for the Admiralty of Amsterdam were built in Amsterdam itself; those of the Maas, mainly in Rotterdam (Hellevœtsluijs was also a Maas port, but no ships were built there, as Ollivier confirms); Zealand ships were built mainly in Flushing, but also in Veere ("Weere" in the French), Zierikzee and other ports; Noorderkwartier ships were built in Monnikendam, Hoorn, Enkhuijzen and Medemblik, while those of Friesland were built in Harlingen.
178. This was the *Haarlem* (72), built by Bentham (see below).
179. We have been unable to identify all the ships. However, the following are probable or possible candidates:
96 guns: *Amsterdam*
72 guns: *Leiden, Gelderland, Gouda, Vrijheid* (apart from *Haarlem*: building)
64 guns: *Loosdregt, Boetzelaar, de Purmer, Roozendaal, Souterwoude, Heemstede, Proventie van Utrecht*; plus perhaps another from one of the other Admiralties..
52 guns: *Ter Meer, Polaanen, Damiaten, Valkenburg, Beemsterlust, Boekenrode, Brederode, Moriaanshoofd, Watervlied, Assendelft, Prins Friso;* the *Duinveld* was hulked in 1736, but may be included, leaving one other unidentified vessel.
44 guns: impossible to identify as there are 17 possible candidates, some of which would no doubt have been at sea.
32 - 38: Maarsen, Langeveld, Wageningen; the others cannot be identified.
See the list of Dutch ships in the Appendix, page 337.



81. *Frontispiece from Leendert van Zwijndregt's* Verhandeling van den Hollandschen Scheepsbouw *(1757). The view akmost certainly depicts Rotterdam Dockyard. (Private collection)*



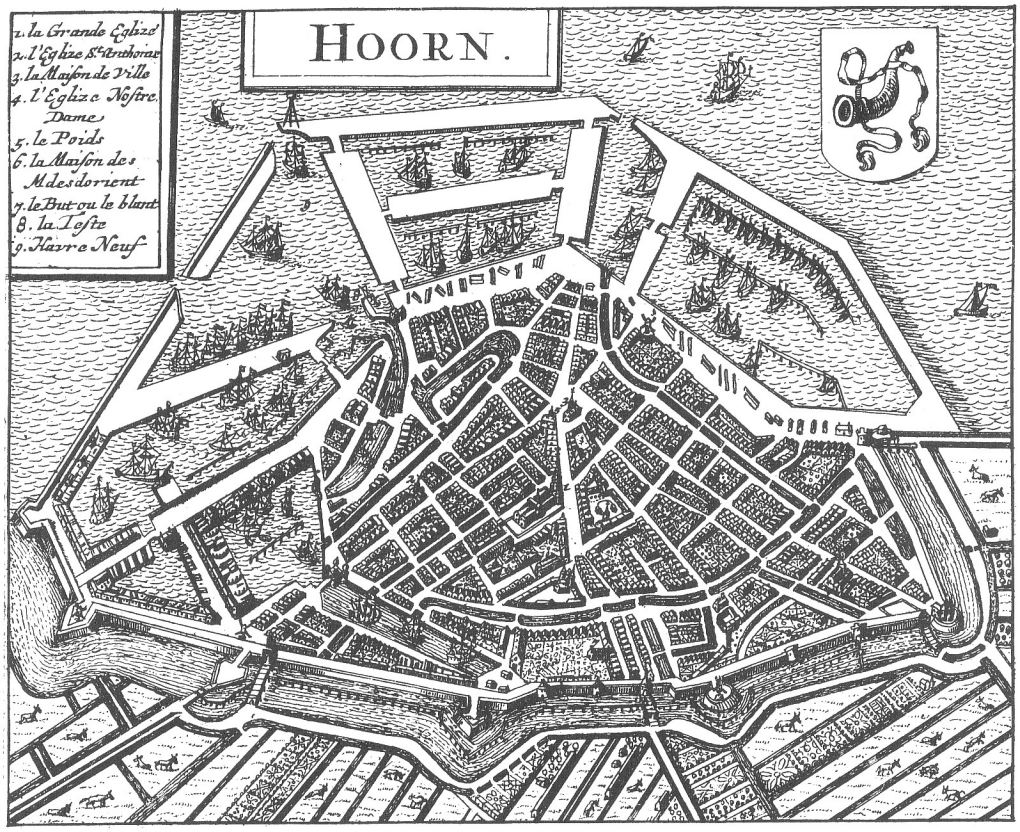
82. *The Dutch three-decker* Prins Willem III *Although Ollivier refers to there being four three-deckers in the Dutch Navy in 1737, in practice probably only the* Middelburg *(88) came near to the size of the* Prins Willem, *which was struck from the lists in 1718; however, in terms of the general style of her decoration she is typical of Dutch ships of the latter part of the 17th century, and many of those seen by Ollivier must have resembled her. (Courtesy National Maritime Museum, Greenwich.)*

Rotterdam Dockyard

Rotterdam Dockyard covers but a very small area; there are three building-slips 140 feet to 150 feet long [*45 - 49 m*], and 40 feet broad [*13 m*], situated 40 feet apart. The lower part of these slips is 4 feet† [*1.30 m*] below high water level, and the upper part is level with the surrounding ground; they have about eight feet [*2.60 m*] of declivity. The storehouses are not large; there are some covered sheds. Beneath some of them are situated divers workshops and in others are stored the plank, the deals and the treenails. The shipbuilding timber is stacked in the water below the low-tide mark, and the stacks are edged with pilings. There is at present in this Dockyard no other work being carried out than the repair of two yachts[180]. I saw there a frigate of 44 guns called the **Rossene**[181], built according to the old manner of building and recently repaired. She is 113 feet long [*36.75 m*] from stem to sternpost, 31 feet 6 inches [*10.24 m*] in the beam, and has 13 ½ feet [*4.39 m*] of depth in hold. Her bottom is nearly flat, her bow is extremely bluff, she has a square tuck, her deadworks are fairly well executed, and her upper works are near a foot [*32 cms*] higher than they are in our own frigates of the same strength. This frigate has 4 feet 8 inches [*1.52 m*] of height on the gundeck, 5 feet 1 inch [*1.65 m*] of height beneath the quarterdeck and also beneath her forecastle; she has four cabins on the quarterdeck.

†.... The lower part of these slips is 2 feet below high water level ....

180. We have been unable to identify the yachts.
181. In fact the **Rossem**: built 1702 in Rotterdam by Pieter van Zwijndrecht senior. She measured according to surviving records in Holland 126 (Amsterdam) feet by 34 1/2 feet, depth in hold 15 feet [*35.67 x 9.77 x 4.25 m*]. Ollivier's measurements in French feet are thus substantially correct, the Amsterdam foot being equal to 283.1 mm.



83. *Plan of Hoorn in about 1750, showing the harbour and inner harbour where ships are being built. (Private collection)*



84. *Plan of Enkhuizen in about 1750. These are the two "Dockyards" which Ollivier did not visit, presumably because he was advised that they were not worth the journey! (Private collection)*

Flushing Dockyard

There are three building-slips and a dry-dock at Flushing Dockyard. The dock is 180 feet long [*59 m*], 64 feet broad [*21 m*] and 16 feet [*5.20 m*] deep; its walls are lined with oak plank in a very poor state of repair; there is no gate, and it is closed only by a coffer-dam which allows the water to enter at every tide. They are presently repairing in this dock a ship called the **Middelburg**[182], formerly a three deck ship of 100 guns, which they are cutting down to two decks because she was not weatherly. She is 157 feet [*51.06 m*] long from stem to sternpost, French measure, 42 feet [*13.66 m*] in the beam, and has 20 feet [*6.50 m*] of depth in hold. Her beam is a foot† [*32.5 cms*] less great than in the other Dutch ships of this same Rate, by reason of the fact that the lock through which the ships must pass to come out from Flushing will allow no more than 42 feet. The lines of this ship are extremely well-drawn, but there is little support at the waterline. She is pierced for 15 guns on either side on the gundeck, without counting the chase-port, so that her ports are less than 7 feet [*2.28 m*] apart.

†.... *Her beam is a little less great* ....[The French reads "un peu" as opposed to "un pied", and could therefore be a copying error. Ed.]

Apart from this ship there are nine others[183] at Flushing, of which one 90-gun ship in poor repair, three of 72 guns, and three of 62 guns newly built or recently repaired, and two frigates of 44 guns which are near beyond repair. One of the ships of 62 guns, called the **Taulen**[184], is housed over by a tiled roof, another of the same strength has been sunk in order to preserve her timbers. I shall speak elsewhere of this roof and the reasons which the Dutch have for sinking their ships.

Flushing Dockyard is very small, the storehouses there are small and in poor repair. The ships there take the ground at every tide.

Veere Dockyard

In the Dockyard at Veere there is but the room needed for the building of two ships; this space is surrounded by small storehouses. In the channel facing this Dockyard are three ships, of which one is of 62 guns called the **Goes**[185] and newly-built, housed over by a tiled roof; one is of 50 guns and one of 30, both hogged and in poor repair. These ships take the ground at every tide.

182. **Middelburg**: built 1699 (1705 according to Ollivier) in Vlissingen (Flushing) originally as a three-decker 88, she was later enlarged to carry 96 guns. Following this rebuild she measured 180 Dutch feet by 48, depth in hold 20 feet [*50.96 x 13.59 x 5.66 m*]. She continued in service until 1741, but nothing is known about her being cut down a deck in 1737. See also Remark LXVIII on the Dutch Navy below, page 223.
183. I have been unable to identify the older ships, but the "new or recently repaired" Third Rates were probably the *Vlissingen* (58), the *Zierikzee* (64) or the *Nassauw*, rebuilt in 1736, apart from the *Taulen* (62) referred to below. The 90-gun ship may have been the *Eendragt*, although she is last mentioned in the Dutch archives in 1712. Two of the 44-gun ships may have been the *Vredenhof* and the *Beken Vliet*; the third has not been identified.
184. **Taulen**: The *Tholen*, built at Flushing in 1723 and listed in the Dutch archives as being armed with 64 guns. Length 156 (Amsterdam) feet, breadth 44 1/4, Depth in hold 18 3/4. Her fate is unknown.
185. **Goes**: the *ter Goes* of the Admiralty of Zealand, 58 (or 64?) guns, built 1733 in Vlissingen by Hendrik Raas. She measured 156 Dutch feet by 44 [*44.16 x 12.46 m*], depth in hold 18 1/2 feet [*5.24 m*]. The 50-gun ship may have been the *ter Veere*, built in Flushing in 1697 and sold in 1740. I have been unable to identify the 30-gun ship.

Dimensions of Dutch Ships

The Table which follows shows the dimensions given by Ollivier in what he calls "Dutch" feet and inches (presumably Amsterdam, rather than Rotterdam or "Rhineland" measure), and in metres:

	Length		Breadth		Depth	
	ft.	m.	ft.	m.	ft.	m.
96-100 guns	180′7½″	51.16	49′4″	13.97	23′3½″	6.60
80-84 guns	170′7″	48.31	47′0½″	13.32	21′2″	6.00
74 guns	162′7″	46.04	44′1½″	12.50	20′0¾″	5.68
62-64 guns	156′7″	44.34	43′1½″	12.22	19′5½″	5.52
52-56 guns	145′5½″	41.19	40′1½″	11.37	17′8½″	5.03
40-44 guns	130′2¼″	36.86	36′1½″	10.23	15′8½″	4.47

If we compare this table with the dimensions given in the Appendix on page 335, *List of Ships in the Dutch Navy in 1737*, it will be seen that:

— for the 74-gun ships, the dimensions correspond approximately to those of the *Gouda*, *Gelderland* and *Leyden*, which were built between 1715 and 1719 by van Reenen, but bear no relation to those of the *Haarlem*, which was building in 1737;

— as far as 64's are concerned, only the *Proventie van Utrecht* of 1728 corresponds roughly, while every other vessel built after 1723 is 44 feet in the beam and has less than 19 feet of depth in hold;

— the 52- to 62-gun ships built by Davis in Amsterdam (those "of the English manner of building") are approximately correct as to length and depth in hold, but their breadth is too narrow by 1½ feet;

— the dimensions of the 44-gun ships bear no relation whatsoever to those given by Ollivier.

There does not appear to be any arithmetical error, and we can only presume that Ollivier was given information which was either deliberately false, or else purely theoretical, and furthermore, inexact.

Hellevœtsluijs Dockyard

There is no building-slip in the Dockyard at Hellevœtsluijs, but only a few storehouses and a large basin in which there are seven ships, of which three of 74 guns, three of 62 and one of 54, in excellent repair.

Different Manners of Building

I found among the warships of the Admiralty three different manners of building which they distinguish here as the old manner, the new manner and the English manner. An English Master Shipwright called Mr Bentem[187] has been practising the latter for about ten years at the Admiralty Dockyard of Amsterdam, and his method is the same as the English employ as regards the fastening and the putting together of most of the timbers, but as regards their lines they are not worthy of the English ships. The old manner of building is practised in the Dockyards of Flushing, Veere, Hoorn and Enkhuijzen; it differs from the other manners of building in that the floors of the ships above 40 guns are flat or nearly so, with a square tuck; the wing-transom is set up above the gunports of the gunroom; and in several other parts which I shall describe in my later Remarks.

The new manner of building is practised only in the Dockyard of Rotterdam. Mr van Zwijndrecht[188] is the author of it, and started to put it into practice some ten years ago; his ships are more highly esteemed than those of the old manner of building, and most sea officers also prefer them to those of the English manner of building. I shall explain in my Remarks how this new manner differs from the others.

Rates of their Ships

II. The Dutch distinguish their ships as being those of 96 to 100 guns, those of 80 to 84, of 72 to 74, of 62 to 64, of 52 to 56, of 40 to 44, of 32 to 38, and of 20 to 26. They also distinguish them by Rate. In the First Rate are all the ships of 80 to 100 guns; in the Second Rate those of 72 to 74; in the Third Rate those of 62 to 64; in the Fourth Rate those of 52 to 56 and in the Fifth Rate the frigates of 20 to 44 guns.

All the Dutch ships of 80 to 100 guns have three decks and three full tiers of guns. Their other ships have but two decks.

Length from Stem to Sternpost

III. The Dutch shipwrights measure the length from stem to sternpost from the outside to the outside, by which I mean from the outside of the stem to the outside of the sternpost at the head of both timbers. They gives to their ships of 96 to 100 guns a length of 157 feet 6 inches [*51.22 m*] from stem to sternpost, French measure.

187. **Bentem**: Charles Bentham. Ollivier's chronology is correct. Bentham arrived in Amsterdam in March 1727 from Portsmouth, leaving his post without permission, and being marked "Run" in the dockyard records. He obtained at once, no doubt by previous agreement, the position of Assistant to another English shipwright, Thomas Davis, who had just been appointed Master Shipwright to the Amsterdam Admiralty. They were joined in the same year by a third Englishman, John May, who had been working in Toulon. Davis resigned in 1735, and his position was taken over by Bentham, who was thus Master Shipwright when Ollivier visited the Yard in 1737. He occupied this position until his death in 1758, when John May took over from him until 1779. The English influence on Dutch shipbuilding was thus paramount for a period of over 50 years, although to what extent the three Englishmen were able to keep abreast of developments in England during their long absence is unclear.

188. **van Zwijndrecht**: There was a dynasty of van Zwijndrechts (or van Zwijndregts), starting with Pieter, who was active in Rotterdam between 1702 and 1709. Pieter was followed by his son Paulus, whose period of activity lasted from 1725 to 1747. The best-known members of the family are however Paulus' two sons Leendert (who wrote an important book on shipbuilding in 1757), and Pieter Pauluszoon, especially the latter: both were shipwrights at Rotterdam, the elder from 1751 to 1761, the younger from 1766 to 1783, although the latter had also worked as a private builder ("*particulier Baas*") from 1735 to 1743, and for the VOC (Dutch East India Company) from 1745 to 1764.
The man Ollivier met was Paulus van Zwijndrecht, who seems to have been a man of considerable originality. In all he built 12 ships for the Maas (Rotterdam) Admiralty: in 1725 the *Twikkelo* (56) and the *Oud Teilingen* (46); in 1728, the *Maas* (74) and the *Gorinchem* (46); in 1731, the *Delft* (56); in 1733, the *Hof S[t]Jans Kerke* (36); in 1739, the *Dordregt* (56); in 1741, the *Rotterdam* (56); in 1744, the *Schiedam* (56); and in 1747, the *Wel Vaaren* (20), the *Prins Willem* (70), and the *Prinses Carolina* (50).

To their ships of 80 guns or 84,	148 feet 9 inches	[*48.37 m*]
To their ships of 72 to 74 guns,	141 feet 9 inches	[*46.10 m*]
To their ships of 62 to 64 guns,	136 feet 6 inches	[*44.39 m*]
To their ships of 52 to 56 guns,	126 feet 10 inches	[*41.24 m*]
To their ships of 40 to 44 guns,	113 feet 6 inches	[*36.91 m*]

This length is less great than that of our ships, and also less great than the length of the English ships, yet the Dutch arm them with the same number of guns as we do, but for that they leave less distance between the gunports and cut the aftermost port but a short distance from the wing-transom.

Length on the Keel

IV. The length on the keel of the Dutch ships of the old manner of building and of the new is equal to nine tenth-parts of the length from stem to sternpost, so that it is proportionately longer than in most of our ships. If the difference between the length on the keel and the length between the stem and the sternpost is divided into seven equal parts, one of these parts gives the rake of the sternpost of the Dutch ships, and the six others the rake of the stem. In the Dutch ships built after the English manner, the length on the keel, the rake of the stem and of the sternpost are ordered as in the English ships.

Breadth

V. The Dutch measure the breadth of their ships at the midship bend, at the height of the gundeck and from inside of plank to inside of plank.

They give to their ships of 157 feet 6 inches length from from stem to sternpost[189] a breadth of 43 feet [*13.98 m*].

To those of 148 feet 9 inches,	41 feet	[*13.33 m*]
To those of 141 feet 9 inches,	38 feet 6 inches	[*12.52 m*]
To those of 136 feet 6 inches,	37 feet 7 ½ inches	[*12.24 m*]
To those of 126 feet 10 inches,	35 feet	[*11.38 m*]
To those of 113 feet 6 inches,	31 feet 6 inches	[*10.24 m*]

Comparing these breadths with those of our own ships I find that the Dutch three deck ships and those of 141 feet[190] are proportionately the same breadth as our own ships of the same length, and that the ships of 113 to 136 feet[191] are 1/16th to 1/24th part broader in the beam.

Depth in Hold

VI. The depth in hold of the Dutch ships is proportionately less than that of our own ships, whether in comparison to their length or to their breadth. I have marked these three dimensions in the following table, reduced to French feet in order to be able to compare the relation they bear to each other. The Dutch foot is to the French foot as 7 is to 8; it is divided into 11 inches[192].

	Length from Stem to Post	**Breadth**	**Depth in Hold**	[*m*]
Ships of				
96 to 100 guns	157′ 6″	43′ 0″	20′ 4″	[*6.61*]
80 to 84 guns	148′ 9″	41′ 0″	18′ 6″	[*6.02*]
72 to 74 guns	141′ 9″	38′ 6″	17′ 6″	[*5.69*]
62 to 64 guns	136′ 6″	37′ 7½″	17′ 0″	[*5.53*]
52 to 56 guns	126′ 10″	35′ 0″	15′ 6″	[*5.04*]
40 to 44 guns	113′ 6″	31′ 6″	13′ 9″	[*4.47*]

189. i.e. First Rates of 96 to 100 guns.
190. i.e. Second Rates of 72 to 74 guns.
191. i.e. Third, Fourth and Fifth Rates.
192. In fact, 1 Amsterdam foot equals 283.1 mm, and is divided into 11 inches of 25.73 mm. However, the rule of thumb used by Ollivier is relatively exact, since it gives 284.2 mm for the foot and 25.84 mm for the inch. This said, Ollivier's dimensions are very far from reality, and can only correspond to notional ideals: Dutch shipbuilding in the 1730's was reduced to such a pitiful level that no generalisations are possible, almost every vessel being built to different dimensions. See the Table and comments on page 202.

I have already explained in my Remarks on the English Navy the advantages which result from this shallow depth in hold.

VII. The depth in hold fore and aft in the Dutch ships of the old manner of building and of the English manner of building is ordered as it is in the English ships, but in their ships of the new manner of building the depth in hold forward exceeds by about 1½ inches for every foot of length from stem to the sternpost the depth in hold amidships, and the depth in hold aft is equal to the depth in hold forward; in such a manner that the sheer of the deck is equal to or a little greater than that of our own ships. The Dutch ships built after the new manner are the only ones of their ships where the two ends of the deck are at the same height above the keel, thus they are the only ships in which there is no difference between the draught forward and the draught at the stern. While under way their keel is parallel with the horizon. I shall expand upon this further when I come to speak of their draught.

Depth in Hold Fore and Aft

VIII. The length of the flat of the floor in the Dutch ships of three decks is equal to three fifths of their beam, and to but half of the beam in their other ships. With this length of floor the midship bend of their three deck ships has 3 or 4 inches [*8.1 - 10.8 cms*] of deadrise, and that of their ships of 52 to 74 guns of the old manner of building has 7, 8 or 9 inches [*19 - 24 cms*] of deadrise.

Flat of the Floor and Deadrise

This deadrise is 24 to 26 inches [*65 - 70 cms*] in their ships of 62 to 74 guns of the new manner of bulding, 26, 28 and 30 inches [*70 -81 cms*] in those of 50 guns and in their frigates. It may be seen from these two dimensions, by which I mean the length of the flat of the floor and the deadrise, that the older Dutch ships have bottoms which are nearly flat, and that those of the new manner of building have greater deadrise at the midship bend than do most of our ships. Mr van Zwijndrecht, the author of this new manner of building, attributes in part to the great deadrise of his ships the advantages which they have over the older ships, yet I believe that he is in error in this regard and that if the lines of his new ships, however well draughted they may be, were to retain the floors of the older manner of building they would then be still better.

IX. The wing transom of the Dutch ships is of the same length as that of the English ships, and in consequence less long than that of our own ships. This timber is placed over the stern-chase ports of the gunroom in the older ships, and below these same gunports in the new ships, as has been our practice in France these 40 years, and as the English practise it also.

Breadth at the Wing Transom

X. The tumblehome at the midship bend in the Dutch ships is equal to or a few inches greater than the tumblehome at the midship bend of our own ships, so that proportionately they have the same breadth at the waist-rail. The Dutch give less tumblehome than do we at the side counter timbers, yet their ships do not for all that have any greater breadth at the taffarel than do our own, on account of the fact that their wing transom is less long. They have less breadth than do our ships at the beakhead frame because the toptimbers at the bow have little flare beyond the perpendicular of the height of breadth forward.

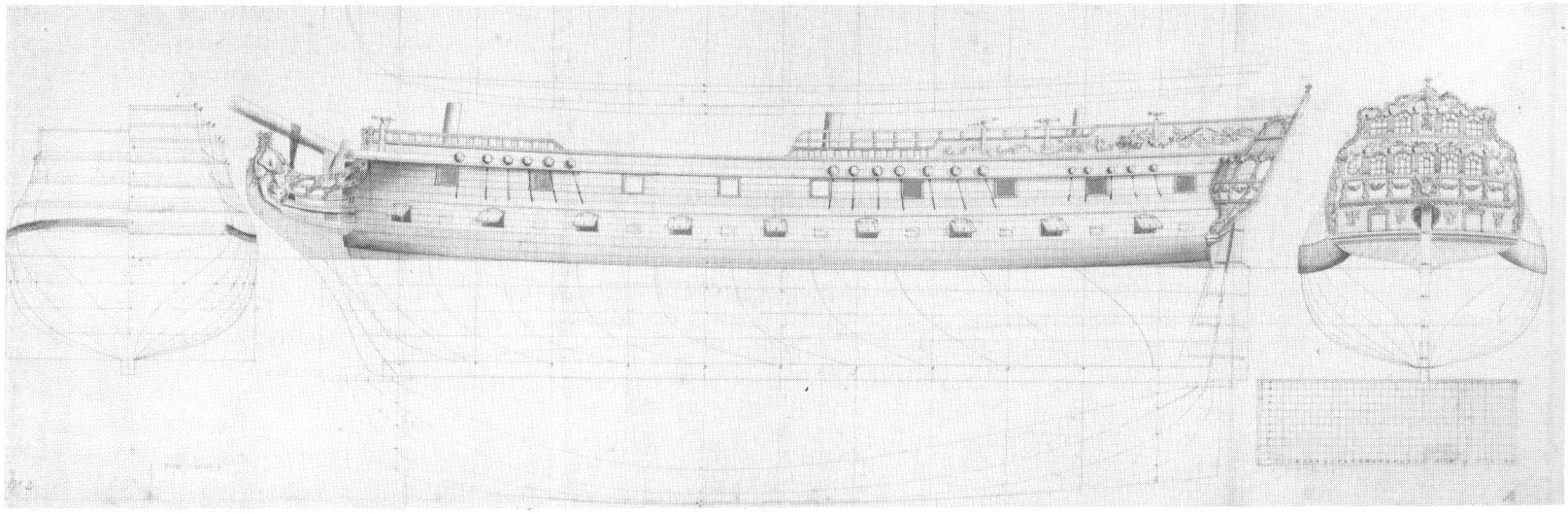
Tumblehome

XI. The height between decks in the Dutch ships is the same as in our own ships in the way of the mainmast; it is one or two inches [*3 - 5 cms*] less at the bow and two or three inches [*5 - 8 cms*] greater aft. The height beneath the quarterdeck is the same as in our ships or an inch greater, as is the height beneath the forecastle. The poop is but 5 feet to 5 feet 6 inches high [*1.63 - 1.79 m*].

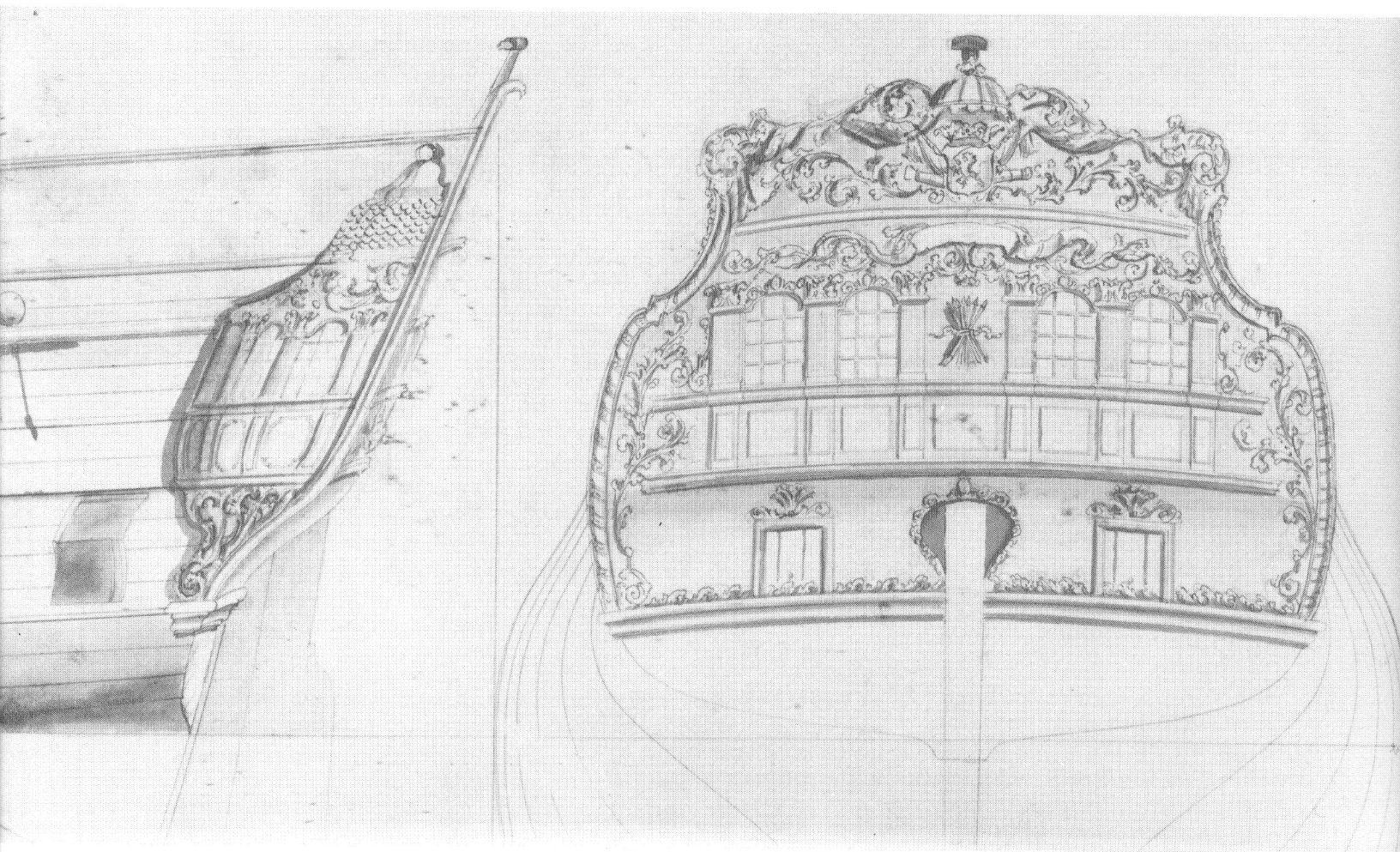
Height between Decks, Quarterdeck and Forecastle

The quarterdeck of the Dutch three deck ships extends forward but as far as the main capstern. In some of their ships of 62 to 64† guns it also finishes at the main capstern, in others at the mainmast as in our own ships, and in most it extends as far as one beam afore the mainmast.

†.... *In some of their ships of 62 to 74 guns ....*



85. *Draughts of the* 't Hof St Janskerke *(36), built by Paulus van Zwijndregt in Rotterdam in 1733*
(Courtesy Maritiem Museum Prins Hendrik, Rotterdam)



86. *Head and stern decoration of the* 't Hof St Janskerke.
(Courtesy Maritiem Museum Prins Hendrik, Rotterdam)

The forecastle in some of the Dutch ships has the same length as we accord it, yet in most of their ships, and especially in those of three decks, it has but a half or even a third of that length. The poop is but 10 to 16 feet long [*3.25 - 5.20 m*]. There is no poop-royal in the Dutch ships.

Gunwale

XII. The gunwale athwart the midship bend and above the upper deck in the Dutch three deck ships and other ships rises but 8 or 9 inches [*22 - 24 cms*] above the gunports, so that the bulwarks are 18 to 24 inches [*49 - 65 cms*] lower than in our ships. Above the forecastle and at the break of the quarterdeck of the Dutch ships of the old manner of building the bulwarks are 2 feet 10 inches to three feet 2 inches high [*92 - 103 cms*]; the upper works rise above the gunports of the forecastle and quarterdeck, but in their ships of the new manner of building, and in those built after the English manner, the bulwarks at these places are such as are to be found in our own ships.

Mould of the Stem

XIII. The stem of the Dutch ships describes an arc of a circle, of which the radius is nearly equal to its vertical height above the keel; and whereas in our ships and in the English ships the greatest projection of the stem beyond the perpendicular of the end of the keel is to be found at the level of the gundeck, in the Dutch ships the greatest projection is to be found at the head of the stem. In former days we followed that practice in our own Dockyards, and it is less good than that which we follow today.

Midship Bend and Moulds of the Fore and Afterbodies

XIV. The Dutch build their three deck ships with floors which are nearly flat in order that they may draw but little water and so enter the harbours of Holland. For the same reason they give them but little rise of floor, and give great fullness to their bows, so that the great capacity of their underwater lines is maintained as far as the load waterline. They have ships of 60 and 74 guns built in this same manner, yet in their new manner of building, the ships of this Rate, those of 50 guns and their frigates have much deadrise at their midship bend, and more even than in our own ships or in the English ships with steep floors. This new manner of building is very close to the new manner of building of the English; their lines forward and aft are so full and the midship bend has so little capacity by reason of its steep floors that the curve of the first waterline, taken at a quarter the height of the load waterline has no inflexion at all, neither at the bow, nor at the stern. Among the draughts which I was shown by Mr van Zwijndrecht and from which I made this observation, he pointed out in particular those of a ship of 74 guns and of a frigate of 26 guns[193] which have performed very well at sea and which have the reputation of being fast sailers. But perhaps the trials of these ships were conducted against ships which were but indifferent sailers, for although their underwater lines are beyond compare superior to those of the old manner of building and to those built after the English manner at Amsterdam, they are yet far removed from having the lines needed for a fast sailing ship. The preference of this Shipwright Mr van Zwijndrecht in favour of steep floors is extreme; he has seen the ships in which he has employed them sail better than the ships with flat floors. This experience, and the lines of the French and English ships in which he has found floors of the same kind, have persuaded him that therein lies the part of perfection which was lacking in the Dutch ships for them to be fast sailers. He is aware that the other changes which he has made from the old manner of building have also contributed to the success of his new manner of building, yet far from conceding that his sharp floors have done away with a part of the improvements which he has added to the old manner of building, he claims that it is his floors which have contributed the most effectively to the success of his new method. There would be no purpose in reporting here his reasoning, for it is the same as that which Builders in France give in preferring steep floors to flat floors. Certain other Shipwrights of the Admiralty have attempted to make use of steep floors like Mr van Zwijndrecht, and they have failed. Their ships are slow sailers, are unweatherly, and have insufficient height of gundeck sill. We have seen near enough the same occurrence in France on the same subject. Mr Blaise Pangalot[194] has built excellent ships with extremely steep floors; most of the Builders who have imitated him in this aspect of his building have not succeeded near as well because it was not this aspect alone which they should have

193. The 74 was probably the *Maas*, the only 74 built by Paulus van Zwijndrecht, launched in 1728. As for the frigate, we are unable to identify it with certainty, since he appears only to have built one vessel of less than 46 guns, the *'t Hof S'Jans Kerke*, launched in 1733, but armed only with 36 guns (see opposite). Perhaps Ollivier simply wrote 26 for 36 in error.

194. **Blaise Pangalot**: See Introduction for details of this distinguished shipwright, whom Ollivier much admired.

imitated, but rather the whole lines of his ships.

Mr van Zwijndrecht has in his new manner of building diminished greatly the excessive bluffness of the bows of the former Dutch ships, and in consequence the roundness of the horizontal sections at the waterline. In this he has given his ships a greater facility to cleave the water especially when sailing close-hauled, and has also made them easier in their motion. He has likewise reduced the roundness of the quarters athwart the mizen and given them an English stern, so that the water meets together more easily in his ships than in the former Dutch ships, and there is none of that turbulence which always accompanies a square tuck.

The Dutch shipwrights use the same method as the English shipwrights to draught the midship bend and the bends of the fore body and of the afterbody. I have come to this conclusion from all the explanations given me by various shipwrights regarding the draughts they showed me. Yet when they space out the moulded frames along the keel and place the ribbands they are less careful to follow the points which they have fixed at their draughting board than to ensure a fair run of the ribbands by eye, and they excel in this aspect of shipbuilding. All their ships both great and small, whether canal boats or sea-boats, have their underwater lines drawn with complete perfection.

The deadworks of the Dutch ships of the old manner of building are very full at the gundeck and near perpendicular above the middle deck, but in their ships built after the new manner they have the same shape as in our own ships.

Draught of Water

XV. The Dutch ships draw about two feet [*65 cms*] less water than our ships. In those of the old manner of building and those built after the English manner, the difference in draught fore and aft is of 10 to 18 inches [*27 - 49 cms*], but the ships of the new manner of building draw as much water forward as aft, so that these ships are not trimmed by the stern. It is difficult to reconcile this manner of building with the opinion we hold concerning the need for a greater draught aft than forward. This seems to us indispensably necessary if a ship is to steer well, have a weatherly helm and be quick in stays, and although some Builders have considerably reduced this difference in draught, not one has yet dared to suppress it entirely as Mr van Zwijndrecht has done in his ships of the new maner of building; nevertheless we see how our own ships where it is reduced to 15 or 18 inches [*41 - 49 cms*] steer well, have a weatherly helm and are quick in stays, no less so than those ships which draw 3 or 4† feet [*97 - 130 cms*] more water aft; all of which goes to prove that this trimming by the stern is unnecessary. With this difference in draught done away with, the Builder finds it easier to balance his ship, the ship draws less water to the extent of half the former difference in draught; she encounters less obstacle to her cleaving the water, since the keel presents to the water no other surface than that which is made up of its breadth and height, whereas in those ships which draw more water aft than forward the keel presents to the water a surface area of which the height exceeds the height of the keel by the whole difference in draught. This element of Mr van Zwijndrecht's new manner of building is that which has encountered the least disapproval in Holland, especially since they have seen his ships sail successfully, yet it has succeeded ill in the hands of certain Builders who have sought to imitate him. They have even built ships which draw more water forward than aft.

†.... which draw 4 or 5 feet....

Keel

XVI. The keel of the Dutch ships is about 2 inches [*5.4 cms*] wider and two inches thicker than the keels of our own ships; its thickness is diminished by a quarter at the skeg. The timbers of which it is made up are assembled as they are in our own ships, and the foremost timber is scarphed to the stem as the English do it, so that there is no projecting forefoot. The rabbet of the keel is flush with the upper face of this timber.

The Dutch give a round up to their keels; they raise the two ends by a few inches as we used to do it in France and as some of our Builders still do especially in the building of galleys. I see in that neither good nor ill. They do it so that when the ship is old the hogging is less apparent.

I saw keels of elm[195] in several Dutch ships.

195. Elm was commonly used for keels in the English Navy, since it is a timber which lasts well under water, but elm was less common in the French Navy.

Stem

XVII. The stem of the Dutch ships is about 2 inches [*5.4 cms*] thicker than that of our ships, and 3 or 4 inches broader [*8 - 10 cms*]. The timbers of which it is made up are scarphed together as in our own ships. I stated in the preceding Remark that the first timber of the stem is scarphed to the keel as in the English ships. The rabbet of the stem is flush with the inner face of this timber whereas we place it in the middle or near the middle of its breadth. I have explained in my Remarks concerning the English Navy[196] that our practice is to be preferred.

In the Dutch ships the stem is about a third broader fore-and-aft at its head than elsewhere along its length, and this extra breadth is on the outside of the rabbet, as is shown in **Fig. 1**[197], where the line **A** designates the rabbet, and **B** the outside of the stem. The Dutch claim that the part marked **C** of this timber is useful in supporting the bowsprit, but since it projects a long way forward they strengthen it with one or two knees on either side placed horizontally, of which one arm extends along the ship's side over the hull planking and the other arm braces the side of the stem, as in **Fig. 2**, where **A** shows the head of the stem in plan and **B** the knees. This practice is less good than that which we follow, for we have no need of such knees since the stem projects very little outside the rabbet.

Sternpost

XVIII. The sternpost of the Dutch ships is composed of two timbers as it is in the English ships, or more commonly of three timbers arranged as they appear in **Fig. 3**. There is no false post. These three timbers are tennanted into the keel; the timber marked **A** has a rabbet as shown at **B**, and thus receives as do the two other timbers, in two scores cut one in either side, the garboard strake and the strake next the garboard, as is the practice in our own ships. These scores are not to be found in the Dutch ships which are built after the English manner.

Rising Wood and False Keel

XIX. The rising wood in the Dutch ships is similar to that in the English ships save that it is made up but of two timbers at the stern laid one over the other, whereas in most of the English ships there are three timbers. The Dutch ships have a false keel beneath the keel which is 4 inches [*10.8 cms*] thick as in the English ships, and it is placed there with a view to preventing their ships making leeway.

Apron; Sternpost Knee

XX. The apron in the Dutch ships is about six inches [*16 cms*] thicker athwartships than the stem, as is the the apron in the English ships, and it is about 3 inches [*8 cms*] thicker than in our ships.
The lower arm of the sternpost knee in the Dutch ships is fayed to the second timber of the rising wood or scarphed to this timber as in the English ships, and the upper arm runs up against the sternpost as in our own ships.

Fashion Pieces

XXI. In the Dutch ships with a round tuck the fashion pieces are set up as in our own ships, while in those with a square tuck their heel is fayed to the sternpost and strengthened by a chock fastened to each fashion piece. The fashion pieces here are one or two inches [*3 - 5 cms*] thicker than in our ships.

Frame Timbers

XXII. The frame timbers of the Dutch ships are about two inches greater than those of our own ships in their moulded dimension only. The floors, futtocks and toptimbers which go to make up the frames are not fastened with bolts as they are in our ships; they are simply placed one next to the other as they are in the English ships. This practice which must be allowed by virtue of the successful building of all the English and Dutch ships can leave no more room for doubt as to the needlessness of the iron bolts which we employ in fastening together the frame timbers of our ships.

The Dutch arrange their floors along the keel room and space, so that the first futtock fills the space between the floors; in the same way the second futtocks fill the space between the first futtocks, yet in their ships the second futtocks do not meet the rungheads, neither do the third futtocks meet the first futtocks; all of these timber overlap each other by at most 4 feet [*1.30 m*],

196. See Remark VI on the English Navy, p. 46.
197. The numbering of the figures in the Brest manuscript is different, continuing on from those relating to the English Navy, so that this is identified as Figure 122, etc. See Plate 12, page 231.

leaving above and below this overlap single timbers separated by a space, the breadth of which is equal to the sided dimension of the frames, as is shown by **Fig. 4**, where **A** marks the floor-timbers, **B** the first futtocks, **C** the second futtocks, and **D** the third and fourth futtocks. Our practice in this regard and that of the English seem to me preferable to the practice of the Dutch.

In the new manner of building of Mr van Zwijndrecht the moulded and sided dimensions of the floors are one and a half times greater than in the other Dutch ships. He has given them this bigness in order to dispense with floor riders, as I shall explain when speaking of the riders.

In the Dutch ships which are built after the English manner, there are no crotches; the lower futtocks are fastened directly to the rising wood as in the English ships.

Furrings between the Frames

XXIII. The Dutch fashion from fir all the filling pieces which they use to cover any lack in the frame timbers in those places where furrings are needed so that the planking of the hull and the ceiling lies fair. We use oak in its place, but the Dutch claim that a slender piece of oak such as is used for the furrings, once affected by the damp from the frames and from the planking, lasts a very short while, whereas on the contrary fir is preserved for a long time. I was shown in a 100-gun ship called the **Haarlem**[198] which they are breaking at Amsterdam fir chocks which were still in reasonably good state on oak frame timbers which were more or less rotten. I should wish us to make trials with such furrings in our own building*.

***I made this trial in 1738 in the Dauphin Royal*

Hawse-Pieces

XXIV. The hawse-pieces of the Dutch ships are arranged as in our own ships, save in their three deck ships, which have extremely bluff bows. In these ships there are crotches which rise to half the height of the stem and which form near a right-angle with the stem; these crotches are composed of one lower futtock and a second futtock. The hawse-pieces have their heel resting on these timbers. There would be an economy to be found in imitating this practice in the building of our merchant ships.

Keelson

XXV. In the Dutch ships built after the old manner there is a keelson which is set up as in our own ships, yet is about 3 inches [*8 cms*] greater in breadth; it is scored down and runs from the bow to the stern. In their ships which are built after the new manner of building there are two sister keelsons also running from the bow to the stern but laid the full diameter of the mast apart. Mr van Zwijndrecht claims that these sister keelsons resist better than one the hogging of the ship, and this is true, yet it is but a feeble resource in preventing the ships from hogging, and it is more costly than it is useful for there is twice the expense.

Planking of the Ceiling

XXVI. All the Dutch ships are planked in full in the ceiling, and the strakes are laid horizontally[199]. The footwaling is of the same thickness as in our own ships and is fayed to the frame-timbers without being scored down, save only in their ships which are built after the new manner of building. These have two strakes laid one or two feet [*32 - 65 cms*] above the rungheads which are let down over the frames in the manner of those timbers which are called the thickstuff in the building of galleys, and those which used to be fitted in ships built in Toulon before we began to use diagonal strakes in the ceiling.

The Dutch have an excellent practice in planking up the ceiling of their ships which is used neither in France nor in England; they use planks which have the full breadth of the timbers from which they are sawn; they do not attempt to make them of a uniform breadth throughout their full length and by this method they make a considerable saving. They employ near as many nails as we do to fasten the footwaling to the frame timbers.

198. ***Haarlem***: 1st Rate built in Amsterdam in 1721 by Jan van Reenen. She had an extremely short career for a First Rate, and completed breaking in 1738; her timbers were sold for 1,225 guilders. Her measurements were 176 (Amsterdam) feet by 49 1/2, depth in hold 18 feet (*49.83 x 14.01 x 5.10 m*). It sounds as if the oak used was too green for the frames to be rotten within 16 years of building, and the comparison with the fir chocks may therefore not be very conclusive in this instance.

199. As opposed to diagonally, which was the French practice (see the Glossary on page 354 for a detailed explanation). The ceiling strakes were thus laid in the English manner, but without the air-strakes.

On the gundeck and above the middle and upper decks the quickwork is of the same scantling as in our own ships. There are air-strakes similar to those which I remarked in the English ships to provide air to the frame timbers. The strake of the spirketting which finishes at the lower port-sills of the gundeck and which runs from the stem to two feet [*65 cms*] abaft the second gunport at the bow is three times as thick as the other planks, and it is scored down over the frame timbers by a quarter of its thickness. The Dutch employ this fastening to strengthen the bows which are weakened by the foremost gunport which is opened close to the hawseholes and which serves as a bow-chase port.

Riders

XXVII. In the Dutch ships which are built after the old manner of building there are two or three more riders than there are in our own ships. The foremost riders are composed but of a floor rider, while the others have a first futtock on either side above the floor rider, and a second futtock. This second futtock rider runs up as far as the middle deck like our upper futtock riders, whereas in our ships we fit three futtock riders on either side. This difference arises from the fact that we always scarph together our futtock riders for half their length, and the Dutch scarph their floor riders but 3 feet or 3 feet and a half [*97 - 114 cms*] to their first futtock riders, and the same with the first and second futtock riders. In these scarphs they follow the method employed by the English shipwrights, by which I mean that they use none of the iron bolts which we employ. This practice would be good to follow. The thickness of their floor riders exceeds by three inches [*8.1 cms*] that which we ordinarily give to ours, and the thickness of their futtock riders is also one or two inches [*3 - 5 cms*] greater than in our ships.

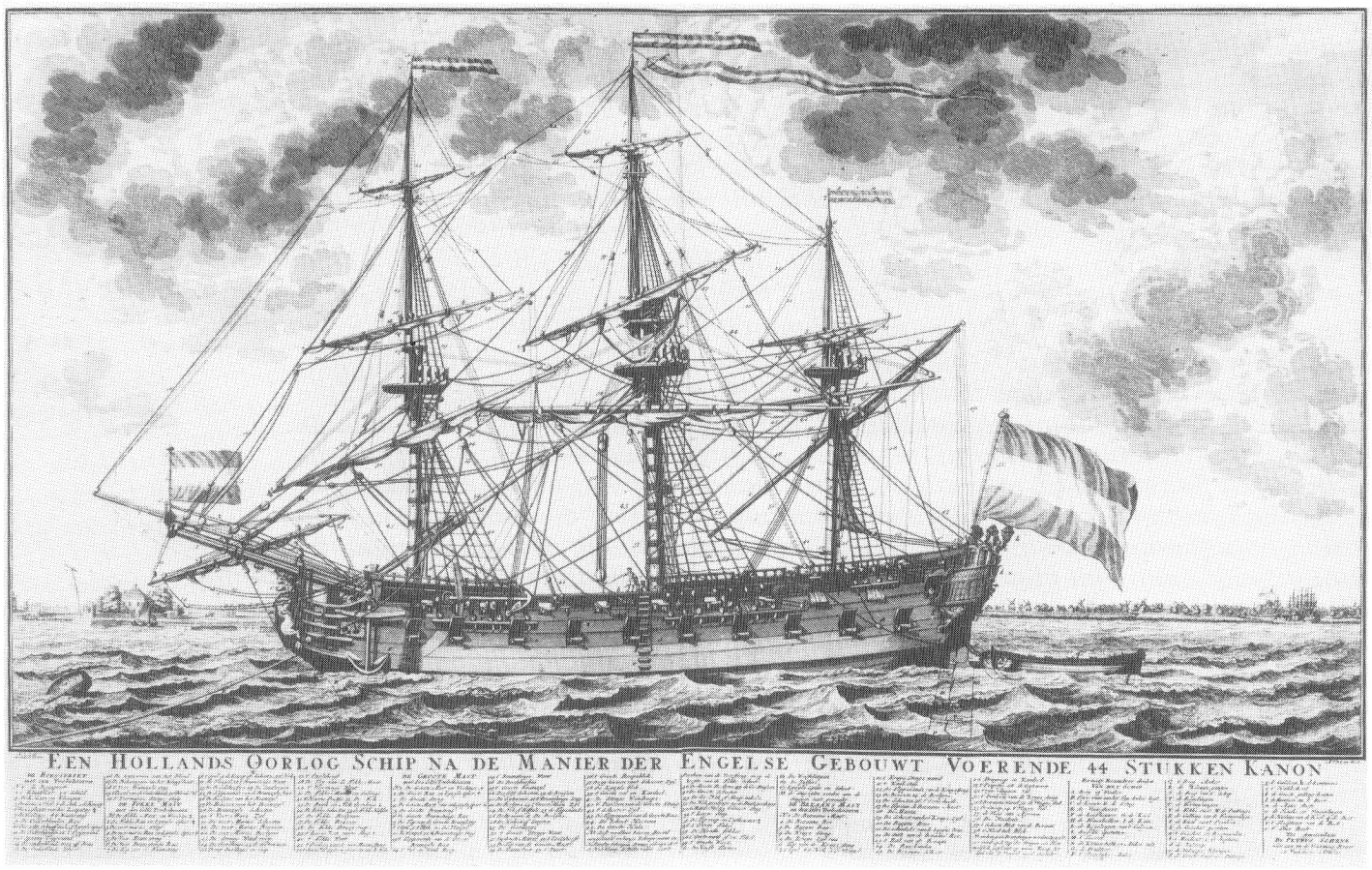
There are no floor riders in the Dutch ships built after the new manner of building; there is but a lower futtock rider which runs down one or two feet [*32 - 65 cms*] below the rungheads of the floors or crotches, scarphed to an upper futtock rider which runs up to the middle deck. Mr van Zwijndrecht, the author of this new manner of building, claims that the thickness of the floors which he has employed in the bottom of his ships and the extra fastening given by the sister keelsons and the two strakes of thickstuff in the ceiling scored down over the frames at the rungheads render his ships stronger than if there were floor riders, and leave space for stowage which is lost through the fitting of floor riders.

Mast-Steps

XXVIII. The step of the mainmast in the Dutch three deck ships, and that of the foremast, are fashioned as they are in our own ships. This step is formed from a single timber in their lesser ships, as in the English ships, and as we fashion our mizen-mast step. I have already stated in my Remarks concerning the English ships that this method is to be preferred to that of using side-pieces, butt-pieces and chocks which we employ in building our mast-steps. In the Dutch ships which are built after the new manner of building the step of the mainmast is established in the following manner and as is shown by **A** in **Fig. 5**. Three or four feet [*97 - 130 cms*] forward of the mast is a filling timber, laid between the two keelsons of which I have spoken, Remark **XXV**. This filling timber is fastened to the bottom of the ship and scored down two inches [*5.4 cms*] into the two keelsons. The mast-step is laid between the two keelsons and has a lug on either side which fits into a score cut in the inner face of the keelsons, so that the step can be slid forward or aft by means of a screw applied to one or the other of the filling pieces, and they move it in this manner when seeking to trim the ship by raking the mast forward or aft. Although I find this arrangement good, I would not wish that we should imitate in our own ships this manner of placing the mast-step; it is far better to give a fixed position to the heel of the mast, and the shipwright must seek out this position on his draughting board by studying the lines of his ship, and not at sea where it is impossible to find save by trial and error[200].

The step of the mizen-mast in the Dutch ships is set up as in our own ships on the gundeck, with this difference that it is scored down for half of its thickness between the two beams upon which it rests.

200. There was in fact a French frigate, the *Résistance* (44), built in 1793, which was fitted with the remarkable device of an adjustable mast step operated by means of a large screw. She was captured off Brest on March 9th 1797 and taken into the (English) Royal Navy as the *Fisgard*; the draughts taken off at the time are to be found in the collection at the National Maritime Museum at Greenwich. Furthermore, the system of wedges used in all French ships (see *74-G. S.*, Vol. I, p.103), allowed rake to be adjusted at sea, however rarely this may in fact have been done.



87. *Engraving entitled "Dutch warship built after the English manner, armed with 44 guns". (Courtesy Maritiem Museum Prins Hendrik, Rotterdam)*

Orlop Beams

XXIX. There are no orlop beams in the Dutch ships. The Builders whom I have seen here claim that they are needless for the essential fastening-together of ships, and have proved it to me by all their ships which being built without orlop beams put to sea like our own ships and furthermore take the ground often. There is nothing to be said in the face of this proof, yet since our ships have frame timbers of lesser scantling, and knees on the gundeck which are shorter, and most have greater depth in hold than the Dutch ships, the orlop beams which we employ may not be without purpose, but I do not believe that it is necessary to fit such a large number of them as there are in some of our ships. We have ships of the same Rate where some have 8 or 9 orlop beams and others 14 or 15.

Breasthooks and Sleepers

XXX. There are in the Dutch ships the same number of breasthooks as in our own ships, and they are 2 or 3 inches [*5 - 8 cms*] greater than those which we employ. There are also four transom-knees and four sleepers. These are laid horizontally as in the English ships.

Deck Beams

XXXI. The deck beams of the Dutch ships are of the same scantling as in our own ships, and they are only scored down over the clamps of the gundeck†. On the middle deck, the forecastle and on the quarterdeck they are simply laid over the top of the clamps. The scarphing together of those beams which are made up of two timbers[201] is done in Holland as it is in our own Dockyards. The Dutch fit just as few beams in their ships as the English do, and arrange them so that they are spaced near evenly one from the other, save for the two which form the main hatchway where this distance is near a fifth part less great than in our own ships. They fit but two beams between the mainmast and the main hatchway, as was formerly our practice in

†.... as in our own ships, and only those of the gun-deck are scored down two inches and dovetailed into the clamps. On the middle deck....

201. See the note accompanying Remark XIX on the English Navy, p. 51.

France. Each beam is strengthened by two knees, one at either end. These knees have a lodging part which is one and a half times longer than that of our timber knees; the bolts which fasten them to the beams are neither clenched nor forelocked[202]. In the Dutch ships which are built after the English manner, each beam is strengthened by four knees, arranged in the same manner as in the English ships.

The spacing of the beams of the middle and upper decks, and the small beams of the quarterdeck and forecastle, is arranged in the Dutch ships as it is in our own ships.

Deck Clamps

XXXII. The deck clamps in the Dutch ships are of the same depth and 2 or 3 inches [*5 - 8 cms*] broader than those of our ships. The timbers which go to make them up are joined together by long scarphs, which are hooked in the middle like the scarphs of the wales of the ships which we build in the Dockyard at Toulon, or else they have a coak like that marked by the letter **A** in **Fig. 6**.

Binding Strakes

XXXIII. In the gundecks, the forecastle and in the quarterdeck of the Dutch ships there are two double[203] lines of binding-strakes, placed the same distance apart in the gundeck as are the binding-strakes on either side of the hatchways in our ships, and one or two feet [*32 - 65 cms*] further apart than in our ships in the middle and upper decks. The Dutch do not fit the second row of binding-strakes which in our ships is situated between the first row which borders the hatchways and the waterways. In this the Dutch take a middle position between our practice and that of the English, for the English employ no binding-strakes, we employ four rows of them, and the Dutch two. The binding-strakes in the Dutch ships are scored down over the beams as they are in our own ships, yet they are scored but two inches [*5.4 cms*] in their largest ships and one inch or an inch and a half [*2.7 - 4.0 cms*] in their ships of 50 guns or less.

Waterways

XXXIV. In all the Dutch ships save those built after the English manner the waterways are laid as they are in our own ships, and they are scored down over the beams but two inches [*5.4 cms*] in their largest ships. These waterways are bolted to the ship's side. In the Dutch ships built after the English manner of building, the waterways are neither scored down over the beams nor bolted . The waterways of the quarterdeck and forecastle in the ships which are building at Flushing and at Veere are not scored down over the beams.

Carlings

XXXV. The carlings and the ledges of the gundecks, of the forecastle and of the quarterdeck in the Dutch ships of both the old and the new manner of building are of the same scantling and are set up as they are in our own ships, save only that whereas we snape the ends of the ledges where they rest on the rabbet of the binding-strakes, the Dutch fit them with a lug which is fayed to the under side of the binding-strake. They claim that this is better, but I believe it to be the same, save that with the Dutch method of building they are obliged to execute it thus by reason of the slight thickness of their binding-strakes.

Wales

XXXVI. The Dutch ships, like our own, have two wales beneath the gundeck ports, two between the gundeck and the middle deck ports, and two more between the middle and the upper deck. These wales have the same breadth and an inch [*2.7 cms*] more thickness than in our own ships; in their ships of the old manner of building the wales rise so steeply at the stern that they are entirely cut through by the aftermost gunports, while on the contrary in their ships built after the new manner the wales have so little sheer that they are not cut into by any gunport. This latter method is good, yet we cannot imitate it too far since the cabins which we fashion in our

202. Presumably these were ragged bolts, but that would have made it difficult to shift the knees; in general these timbers were fastened with clenched bolts, since this made it easier to drive them out when making repairs.
203. A tautology; these are in fact single lines, as the rest of the Remark makes clear. See Glossary, page 351.

ships oblige us to give some hanging to the wales in order to find in the upper works the height of deck which these cabins demand. The filling strakes between the wales in the Dutch ships are of the same thickness as the wales.

Rails

XXXVII. The waist-rail of the Dutch ships is established as in our own ships, and above this rail there is no sheer-rail, so that the waist rises but a little way above the upper deck, as I stated, in Remark **XII**. There are three drift-rails at the stern and one or two at the bows; in their ships which are built after the new manner of building these rails are placed more or less at the same height as in our own ships, while in their ships which are built after the old manner the rails which form the fore drift and the main drift are placed more than two feet and a half [*81 cms*] above the waist-rail. In their ships of less than 60 guns there is a row of washboards on brackets above the gunwale between the drifts, which rises to the height of the drift-rails, and in these washboards they cut loopholes to provide defense against boarders.

Hull Planking

XXXVIII. In the Dutch ships the planking of the bottom and about the waterline is of the same thickness as in our own ships, as is that of the upper works and of the decks; they are for the most part broader than those which we employ, especially the latter. The Dutch fasten them to the frames with treenails as the English do, and they also employ some nails, whereas the English use none at all. The planking of the bottom and of the deadworks of the Dutch ships is laid over the timbers only after the ceiling is planked up, as is our practice in our own yards. They heat the planks which they wish to bend here over a fire of chips using iron fire-dogs, and this method is reasonably successful.

Fenders

XXXIX. The fenders in the Dutch ships are of the same number as in our own ships; they are also of the same scantling as we give them, and two of these fenders are employed on either side as entering ladders fastened to the hull.

Counter

XL. The counter in the Dutch ships of both the old and the new manner of building projects less far than in our ships. There is scarce room enough between the tuck-rail and the sternpost for the rudderhead to move. There is no upper counter. The taffarel timbers have near a quarter less rake than in our ships. In this the Dutch do greatly better than we do, for the counter weighs down the stern of the vessel, and it is always advantageous to reduce the projection and the rake of its timbers since its weight is thereby reduced.

In the Dutch ships which are built after the English manner of building the counter has the same projection and is as concave as in the English ships. In the ships built at Flushing and at Veere, the counter has the shape represented by the profile in **Fig. 7**, where **A** is the counter, **B** the wing-transom, and **C** the base of the stern-lights of the wardroom. There is no tuck-rail in this counter. The Dutch allow their counter-timbers to finish at the middle deck, and they are not fastened at all to the taffarel timbers above.

Head

XLI. The head of the Dutch ships has the same projection as in our own ships and is made up of the same timbers, which are fastened together in the same manner as we do it, save that there is no gammoning knee. In place of this knee there is a piece of compass timber such as is shown by **A** in **Fig. 8**. This compass timber achieves the same effect as a gammoning knee and costs much less. It consists of a timber which is but slightly curved and readily to be found, whereas our gammoning knee is one of the timbers which is hardest to find.

Beakhead Bulkhead

XLII. The beakhead bulkhead in the Dutch ships is fashioned as in our own ships, save that the bulkhead is curved in its vertical plane as I have represented it at **A** in **Fig. 9**. The beakhead is raised above the deck at the height of the port-sills, and is about a third smaller fore-and-aft than in our own ships. As in our own ships, there are two doorways in the beakhead bulkhead which serve as bow-chase gunports.

Scuppers

XLIII. The Dutch cut six to eight scuppers in either side of the ship at the level of the gundeck. In some ships these scuppers are round and in others they are square. They fashion each one in a piece of timber 8 or 9 inches square [*22 - 24 cms*], which cuts right through the frame timber, the spirketting and the hull-planking. This piece of timber projects 5 or 6 inches [*14 - 16 cms*] outboard, and when the ship puts to sea for the first time they trim it flush with the hull-planking or with the sheathing if there be any. This practice of fashioning the scuppers in a piece of timber which cuts through the frame timbers, the hull-planking and the spirketting seems to me less good than that of simply cutting the scupper in the side as we do it.

The scuppers on the middle and upper decks and those of the forecastle and quarterdeck in the Dutch ships measure 6 or 7 inches [*16 - 19 cms*] wide fore-and- aft, and are 3 to 4 inches high [*8 - 11 cms*]; they are fashioned from four deals and lined with lead. We used to fashion them thus in France, but for many years now we merely line with lead the hole intended to serve as a scupper, and this method is to be preferred to that of the Dutch since the ship's side is less cut into.

Rudder

XLIV. The rudder in the Dutch ships is set up as in our own ships and with the same number of googings; yet whereas we continue the rudder down until it be level with bottom of the keel, the Dutch place it two inches [*5.4 cms*] above this level, so that when the ship takes the ground the rudder will not be unshipped by the grounding. This practice is good when the rudder is considered only in this single circumstance, yet considering it in the light of the use for which it is intended, it loses a part of its effect by these two inches which are lacking in its depth in the water.

The rudder of the Dutch ships is half as broad again as that of our own ships, and this breadth is necessary because it does not hang so deep in the water and because their ships have but little draught and are round in the buttocks. The tiller, the sweep and the wheel are set up as they are in our own ships. The Dutch use no axiometer[203]: this instrument is as yet unknown to them.

Bitts

XLV. The bitts in the Dutch ships of the old manner of building and in those built after the English manner are set up as in our own ships. In those of the new manner of building they run down but one foot and a half [*49 cms*] below the gundeck beams, like the bitts designated by the letter **A**, **Fig. 10**, and pass through a step which is fayed and bolted to the under side of the deck beams, as designated by the letter **B**; the bitts are fastened to this step by two iron bolts. They have found these bitts to be as solid as those which run down into the hold, and there is this advantage, namely that the bitts are fashioned with but two timbers, and from timber which is readily obtained.

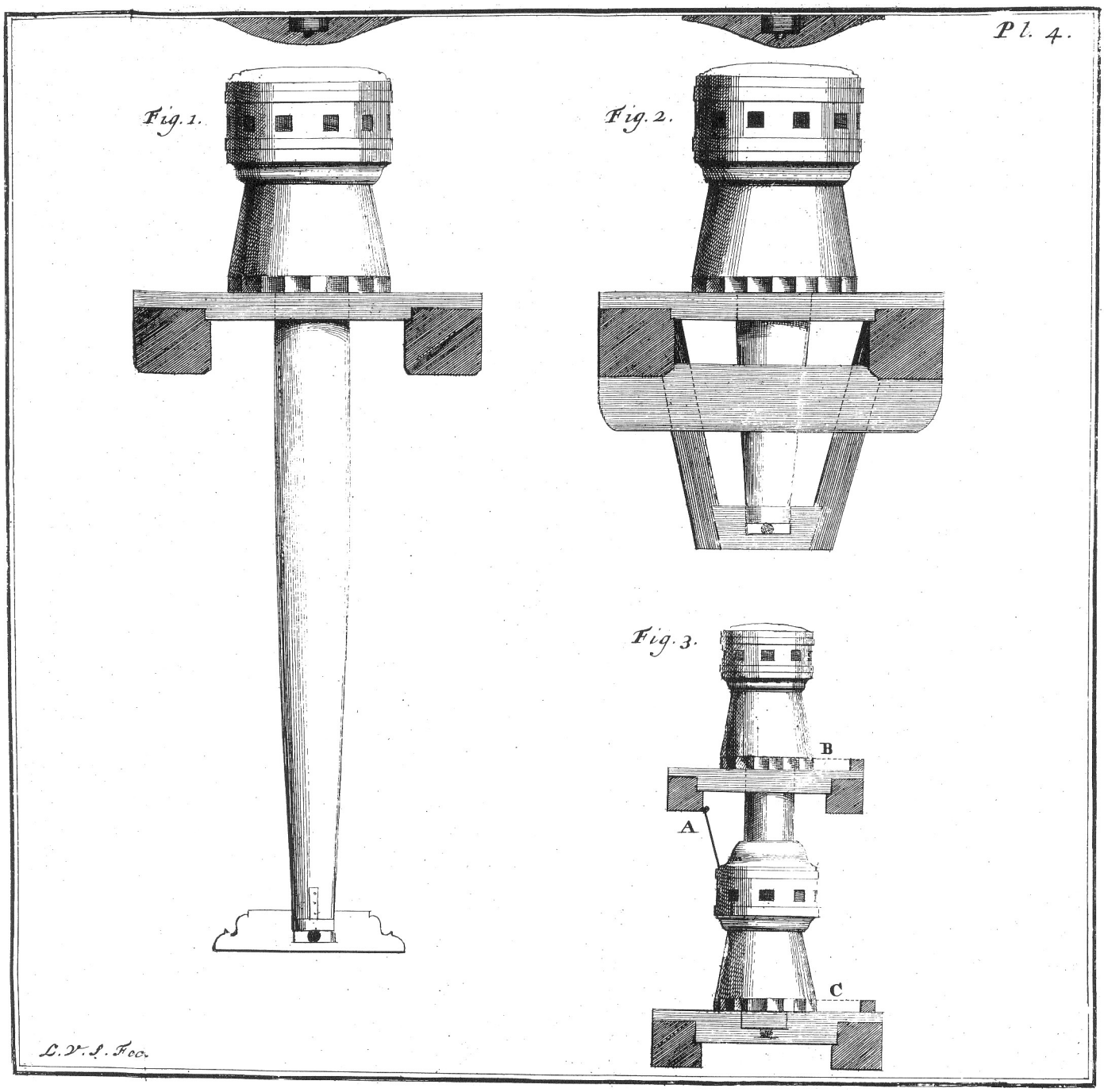
In place of bitt-standards, there is in the Dutch ships of the new manner of building a spur which runs forward in a straight line, one end of which butts against the forward face of the bitts at the level of the cross-piece, while the other end rests against the planking of the ceiling at the bow, as I have represented it at **C** in **Fig. 10**. This method is to be preferred to that which is ordinarily employed; it is stronger, and furthermore it is easier to build and it costs less to fashion this spur than bitt-standards.

Jeer-Bitts and Topsail-Sheet Bitts

XLVI. The jeer-bitts in the Dutch ships are the same size and are set up in the same manner as they are in our own ships; they also take the same form, save that their head is worked in the fashion shown in **Fig. 11**.

The topsail-sheet bitts run down in a straight line, whereas we curve them in the part which lies beneath the deck. In this I prefer the Dutch manner of building them, since the timbers required to make topsail-sheet bitts which are straight are more readily to be obtained and demand less labour than those which we ordinarily employ to fashion them. The main topsail-

203. **Axiometer**: see the Note against Remark CII on the English Navy, p. 99, and the Glossary.



88. *The Dutch method of stepping capstans beneath the beams, which Ollivier admired. From Leendert van Zwijndregt's* Verhandeling van den Hollandschen Scheepsbouw, *1757. (Private collection)*

sheet bitts are raised to the level of the quarterdeck in those ships where the quarterdeck finishes abaft the mainmast, and are capped with a cross-piece which serves to support the spare topmasts, as I stated in my Remarks on the English ships. In those ships where the quarterdeck extends forward of the mainmast the topsail-sheet bitts rise no higher than in our own ships. I have seen some Dutch ships where the main topsail-sheet bitts are placed abaft the mainmast.

The foretopsail-sheet bitts in the Dutch ships do not rise as far as the forecastle as they do in our ships, but only to above the upper deck of three deck ships and other ships alike, as in the English ships.

Capsterns

XLVII. There is in the Dutch ships a main capstern with a single barrel, situated in the same position as the main capstern in our own ships. Its heel runs down to about a foot [*32 cms*] below the beams of the gundeck and turns in a step fastened beneath the beams in the manner shown by **Fig. 12**[205], where **A** designates the capstern, **B** the step, and **C** the beams of the gundeck. This single barrelled capstern is about one and a half times the diameter of our main capstern, and is used like ours for raising the anchor, even though it has but one barrel. This practice which conforms to that of the English proves that the second barrel which we add to the main capstern is not necessary.

Above the main capstern in the Dutch ships, or situated one beam forward or abaft this capstern, is a second capstern, a third or a quarter less big, which is placed on the middle deck; its heel rests in a step fastened beneath the beams of the middle deck in the same manner as the step of the main capstern is fastened beneath the beams of the gundeck. This second capstern which can almost be considered as a second barrel of the main capstern serves like the latter the same purposes to which we put our main capstern, save that of raising the anchor. The Dutch prefer these two capsterns to a main capstern with two barrels since they can rig the voyal more readily on the barrel situated on the gundeck, by reason that they are not incommoded by the spindle which with our main capstern fills the space between the two barrels.

The Dutch three deck ships have like our ships of the same strength a capstern situated on the middle deck forward of the main hatchway, and this capstern, instead of having a spindle running down to the gundeck, is supported in most ships by a step in which it turns fastened beneath the beams of the middle deck as I have described for the main capstern.

The fore jeer capstern is situated, in their three deck ships on the upper deck and likewise in their lesser ships, abaft the forecastle as in the English ships, whereas we place it on the forecastle. In some of their ships this capstern has a spindle as in our own ships, and in others it has simply a heel which rests in a step fastened beneath the beams. The method of setting up the capstern in this manner in a step beneath the deck seems to me to be good, and preferable to that whereby a long spindle is used as we do with our capsterns, nevertheless we could make use of this method employed by the Dutch only in respect of the second capstern in our three deck ships unless we were to reduce to a single barrel our main capstern; in this case it would be right to support it as the Dutch do, in preference to the practice of the English, who run the spindle of their single-barrelled capstern down to the orlop.

The capsterns of the Dutch ships are not whelped; the filling-pieces placed between the whelps which surround the spindle are level with the whelps, and leave none of those spaces between the whelps which are to be found in our capsterns, and which render it easier to handle the voyal when it becomes necessary to surge it up.

Catheads

XLVIII. The catheads in the Dutch ships are of the same scantling as in our own ships, and are set up in such a manner that those parts of them which are inboard are beneath the deck beams of the forecastle or extended aft along the clamps of the forecastle. The outboard end has the same alignment as we give it, and rests on a cathead supporter.

Channels

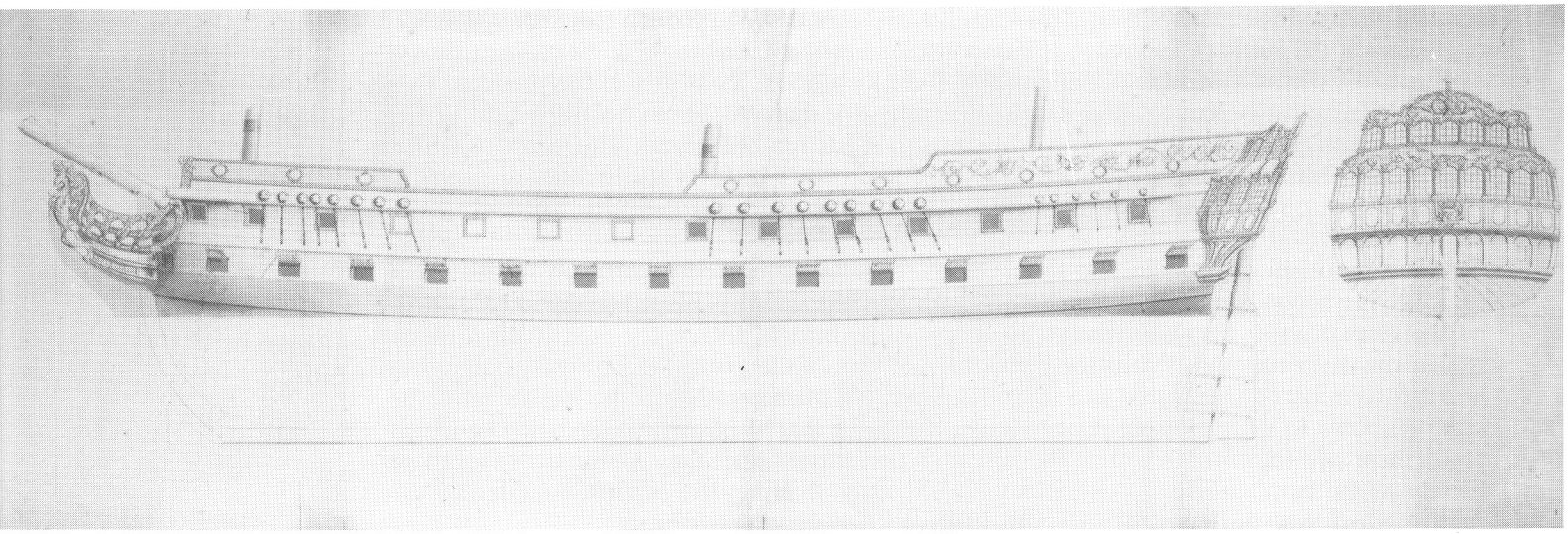
XLIX. In the Dutch ships the channels are about a third less broad than in our own ships, and the main and fore channels are situated above the middle deck gunports. They are reinforced in some of their ships by iron or timber knees, and in most of their ships by cranes like that designated by the letter **A** in **Fig. 13**.

In many Dutch ships, and especially those built at Flushing and at Veere, the main channels and the mizen channels run aft in the same line and form together but a single channel. I was given no reason for this practice, and I cannot see what purpose it might serve.

Gunports

L. In all the Dutch ships the foremost gunport on the gundeck is situated in the same position as we situate it in our ships. The aftermost gunport is situated a foot and a half or two feet [*49*

205. See Plate 13, pp. 232-3.



89. *Draughts of what is thought to be the* Maas *(74), built by Paulus van Zwijndregt in 1727.*
(Courtesy Maritiem Museum Prins Hendrik, Rotterdam)

- 65 cms] nearer the wing transom than in our own ships, and the other gunports are spaced equally one from the other. Between the foremost gunport and the hawseholes is another gunport at the same level as the gundeck ports and of the same dimensions. This is a bow-chase port, to which they move one of the broadside guns, as the English do. I stated in my Remarks[206] concerning the English ships that our ships formerly had a similar gunport which was done away with out of concern for the fastening of the ship, but that it would be desirable to restore this gunport, since it can be done without the least prejudice to the ship's fastening.

The Dutch ships of 96 to 100 guns have 15 gunports on the gundeck, without counting the bow-chase port; they are but 7 feet or 6 feet 10 inches apart [*2.22 - 2.28 m*]. Their ships of 80 guns have 14 gunports; those of 72 guns, 13; those of 62 guns, 12 gunports, those of 50 guns, eleven gunports and their frigates of 40 guns ten gunports. Some frigates of 30 to 32 guns have 4 or 5 gunports on the lower deck[207].

The middle deck of the Dutch ships is pierced for the same number of guns or for one less than the gundeck, and these gunports are staggered as they are in our own ships between the gundeck ports. There are the same number of gunports on the upper deck of their three deck ships as on the gundeck. Few Dutch ships have gunports on the forecastle, and almost all have more on their quarterdeck than do our ships, since with the poop being so short, there remains in the Dutch ships more room on the quarterdeck to extend the battery without the guns being encumbered by the cabins. None of the Dutch ships have gunports on their poop.

The gunports are the same size as those of our own ships, and the lower sills of the gundeck ports are at the same height or an inch lower, while they are 2 or 3 inches [*5 - 8 cms*] higher on the other decks. They are furnished with hookbolts and ringbolts as they are in our own ships.

The lower port-sills of the Dutch ships are cut into the quickwork, but not the hull-planking; they butt against the planks of the hull and have no lug resting against the frame timbers; they are but fitted into rabbets of their own thickness. The upper port-sills are arranged as they are in our own ships.

206. Remark CLIV, p. 150.
207. At the stern; unlike the "true" frigate of a few years later which had only one gundeck, these early cruisers had some (often heavier) armament on a lower deck, usually at the stern where they were higher out of the water because of the sheer of the deck; the full tier of guns was carried on the upper deck.

The port-lids withoutboard take the shape of the upper works, yet withinboard they run in a straight line from top to bottom, so that since the upper works are very rounded at the level of the gundeck, the port-lids are thicker in their middle than they are at top and bottom.

There are stern-chase ports in all the Dutch ships, level with the middle and upper deck ports, and with those of the quarterdeck. These gunports are masked by the carved-work and are scarce visible from withoutboard. As I stated when speaking of the beakhead bulkhead and of the gundeck gunports, there are bow-chase ports at the bow.

All the gunports of the upper deck of the Dutch three deck ships and likewise of their two deck ships, and the quarterdeck gunports, are surrounded by port-wreaths. It is many years since we did away with this needless decoration in our own ships.

Forepeak

LI. The Boatswain's storeroom in the Dutch ships is established forward of the riding bitts as it is in our own ships: I have marked it with the letter **A** in **Fig. 14**. It is separated from the cable-tier by a bulkhead which is flush with the after face of the bitts, and in which there is no doorway. This area is divided into two levels by the hanging-deck **B**, which is situated as in our own ships 5 feet or 5 feet and a few inches [*1.62 m +*] below the gundeck. There are magazines situated beneath this hanging-deck, and above is the Boatswain's storeroom and a cabin for the Boatswain's mate. The Dutch stow the Boatswain's spares as we do in this storeroom; access to it is afforded by a hatchway cut in the deck between the two pairs of bitts.

Cable-Tier

LII. The cable-tier in the Dutch ships is situated abaft the Boatsain's storeroom as it is in our own ships and it is separated from the hold by a bulkhead erected in near the same place as we do. I have marked the cable-tier with the letter **C** in **Fig. 14**.

Pump Wells

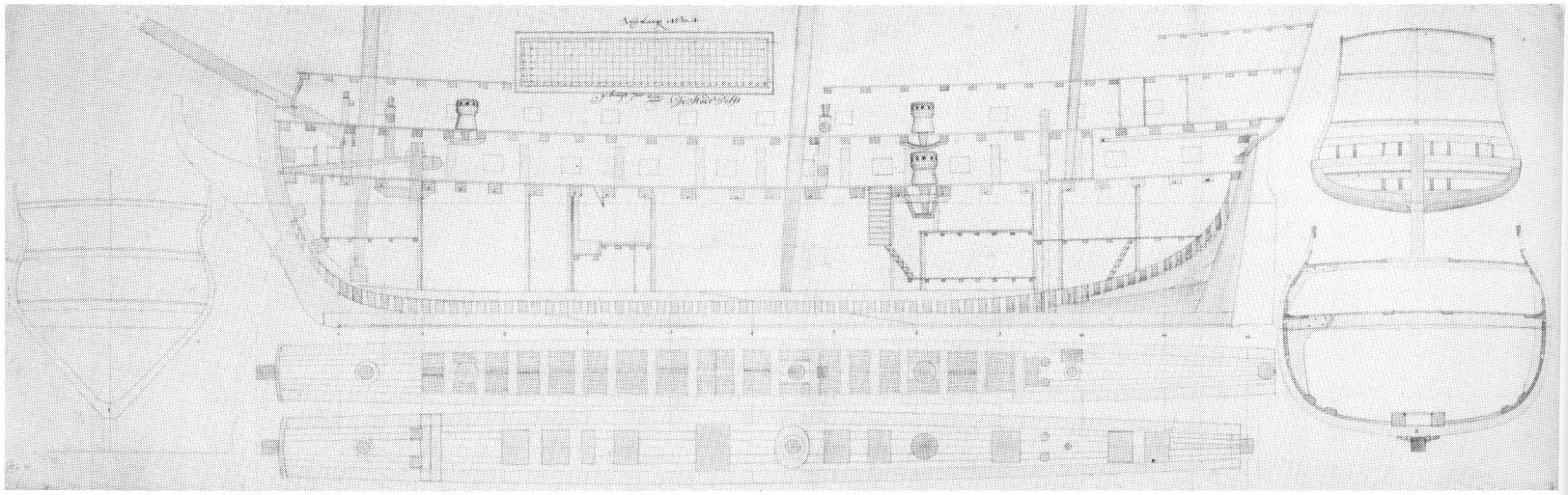
LIII. The Dutch have as we do two pump wells in all their ships above 40 guns: the main well marked by the letter **D** in **Fig. 14**, and the after well marked by the letter **E**; and in their ships of 40 guns and less they build only the after well, although there are two pumps athwart the mainmast. The main well has the same breadth athwartships as in our own ships and it is about a quarter less long fore-and-aft because they never fit more than two pumps. The after well in their ships of 50 to 100 guns is of the same size as that in our own ships, but in their ships of less than 50 guns it is about a quarter wider than that of our ships, because the Dutch place two pumps there whereas we fit but one only.

There are in all the Dutch ships four pumps similar to those in our own ships. Two are situated abaft the mainmast and two others in the after well; these pumps are of elm sheathed with tarred canvas, and over the top of the canvas they wind two-inch rope[208]. This is an excellent precaution to prevent air leaking into the pump. The pumps about the mainmast discharge as they do in our ships through a hose on the middle deck, and the after pumps discharge into a lead cistern placed beneath the gundeck in their ships built after the old manner of building and beneath the middle deck in their ships built after the new manner. From this cistern the water is led overside through a lead pipe running between two beams and touching the deck-planking. This practice seems good to me.

Bread Rooms

LIV. The bread rooms in the Dutch ships are situated in the stern below the gundeck as they are in our own ships, but they are arranged differently. There are two in their ships of the old manner of building, one situated against the stern-timbers which takes up all the space occupied in our own ships by the Gunner's storeroom and by the aftermost bread-room. The other is established forward of the first on the larboard side. There are also two bread rooms in the Dutch ships of the new manner of building, situated one on either side 8 or 9 feet [*2.60 - 2.93 m*] forward of the deck-transom and separated one from the other amidships by a passageway. These bread rooms are marked by the letter **F** in **Fig. 14**. They are proportionately less roomy than those in our own ships, yet for all that they suffice, because the Dutch ships carry a smaller crew. Entry to the bread rooms is provided by means of a sliding door opening onto the passageway.

208. i.e. rope with a circumference (rather than diameter) of 5.4 cms.



90. *Extremely detailed draught of the* Delft *(56), built by Pieter van Zwijndregt in 1730/31. Many of the items commented on by Ollivier can be seen: steps of capstans and bitts, hearth in the hold, the magazines, the sharply raking masts suggesting the absence of difference in draught fore and aft, etc. (Courtesy Maritiem Museum Prins Hendrik, Rotterdam)*

Magazine

LV. The magazine in the Dutch ships is established as it is in our own ships, save that whereas we get down to it by the passageway between the bread rooms abaft the after well, the Dutch have a ladder arranged as shown by the letter **G** in **Fig. 14**. It is by this ladderway that they take the powder on board and pass it up when the ship is in action. The magazine is lit by candles placed in the after well as in our own ships; abaft this well are the powder rooms where they place the filled cartridges. The hanging deck situated over the magazine which forms the deck of the bread rooms, is double, by which I mean that it is clad as in our own ships with slit deal. The seams of this lining are caulked.

Shot Locker

LVI. In the Dutch ships the shot locker is situated beneath the galley; I have shown it with the letter **H**, in **Fig. 14**. It stretches from one side of the ship to the other and fore-and-aft between the two bulkheads which separate the galley from the hold. This shot locker is divided into as many compartments as there are different calibres of shot; entry is by means of two small scuttles cut in the deck of the galley and designated by the letter **A** in **Fig. 17**. There is also in most of the Dutch ships a shot-rack next to each gunport in which they place 20 or 30† shot, or a greater number when they are preparing for action.[209]

†.... in which they place 20 or 25 shot ....

Other Storerooms

LVII. The storerooms for dried vegetables in the Dutch ships are situated in the hold and running athwartships, abaft the galley bulkhead. I have marked them with the letter **I** in **Fig. 14**. They are arranged like the sail room in our own ships, save that the vegetable storerooms rise but one or two feet [*32 - 65 cms*] above the deck.

There are in the Dutch ships two storerooms for the use of the Captain situated over the magazine forward of the after well, one on either side of the ship, and marked by the letter **A** in **Fig. 15**. The Surgeon's storeroom and that of the Carpenter are situated in line with the vegetable storerooms, the latter on the larboard side and the former to starboard. I have already stated that the Boatswain's storeroom is situated in the forepeak.

Carpenter's Walks

LVIII. In the Dutch ships of 60 to 100 guns there is a carpenter's walk on either side of the hold which runs from the aftermost storeroom to the cable-tier, as it does in our own ships. There are no carpenter's walks in their ships of less than 60 guns.

209. 20 to 30 shot per gun must have weighed between 10 and 20 tons, and this very considerable weight carried against the ship's side must have caused real difficulties in handling, particularly if only one side of the ship was engaged, as was more usually the case.

Sail Room

LIX. The sail room in the Dutch ships of the old manner of building is set up on the starboard side opposite the second bread room and separated from it by a passageway situated amidships. In their ships of the new manner of building the sail room occupies the space which is set aside in our own ships for the Gunner's stores. I have marked it with the letter **K** in **Fig. 14**. One enters and stows the sails by means of a doorway at the end of the passageway between the bread rooms, in the bulkhead which separates the sail room from the bread rooms. Mr van Zwijndrecht, the Shipwright responsible for this new manner of building, claims that the sails are better preserved in this place than anywhere else in the hold since it is possible to air them in harbour by means of the gunports cut in the stern.

Galley

LX. The galley in the Dutch ships is set up in the hold abaft the cable-tier in the following manner, and as I have shown it in **Figs. 16, 17** and **18**.

6 ½ feet or 7 feet [*1.95 - 2.28 m*] below the gundeck is a flat measuring 8 to 10 feet [*2.60 - 3.25 m*] long fore-and-aft and running the full breadth of the ship; it is marked by the letter **L** in **Figs. 14** and **18** (*sic*: **14** and **17**). This flat runs up against the bulkhead of the cable-tier in their ships of the old manner of building and is situated 6 or 8 feet [*1.95 - 2.60 m*] abaft the bulkhead in their ships which are built after the new manner. The galley fire takes up about two-thirds of the area of this flat athwartships, as shown by **A** in **Fig. 16**. For part of the breadth of the deck there is a double row of bricks laid on their sides, as appears at **A** in **Fig. 18**, and outside this area it is covered by a single layer of bricks laid flat. The four sides of the galley are bounded by bulkheads; the forward bulkhead in their ships of the old manner of building is lined with bricks, whereas in their ships of the new manner of building it is on the contrary the after bulkhead which is so lined. Over this brick lining are laid several iron straps to which are fastened rings, also of iron, as shown at **B** in **Fig. 16**. On the starboard side against the bulkhead which is lined with bricks is a copper for the crew, set in masonry and marked with the letter **C** in **Figs. 16** and **17**, and on the larboard side is an oven shown with the letter **D**. Between the oven and the copper they prepare the meats for the Captain's table. Over this space and mid-way along its length they erect a flue lined with copper which allows the smoke to escape. This flue runs vertically upwards to one or two feet [*32 - 65 cms*] above the middle deck in their three deck ships and to one foot above the upper deck in their lesser ships: there it divides into two branches, as is shown at **E** in **Fig. 16**. They go down into the galley through a scuttle cut in the gundeck.

When the ship is in action the deck of the galley is used as a cockpit for the wounded. The establishment of the galley in the hold greatly reduces the space needed for stowage, yet it has in other respects great advantages over the practice which we employ of establishing the galley beneath the forecastle. First, the galley being in the hold its weight is below the waterline, whereas in our ships it is far above it. 2nd, when the ship is in action the galley is not exposed to the enemy's fire and they never find themselves unable to use it after an action. 3rd, the galley fire may be used while the ship is in action, which is sometimes necessary for the relief of the wounded. It is these considerations which have induced the Dutch for many years to place the galley in the hold.

Hatchways

LXI. There are seven hatchways in the gundeck of the Dutch ships of the old manner of building and eight in those built after the new manner. The main hatchway, the cable hatchway, the hatchway leading to the Boatswain's storeroom, and the after hatchway to the victuals are situated as they are in our own ships, save only that the main hatchway is closer to the mainmast, there being but two beams between the hatchway and the mast. The magazine hatchway is situated forward of the mizen-mast, whereas in our ships it is abaft the mizen. There is in the Dutch ships a sixth hatchway in place of our powder hatchway, to provide access to the passageway between the bread rooms. The seventh hatchway is situated one beam abaft the cable hatchway in their ships of the old manner of building, and three beams abaft it in those built after the new manner; this is the hatchway through which they go down to the galley. The eighth hatchway in their ships of the new manner of building, and which is not to be found at all in their ships built after the old manner, is situated between the hatchway to the galley and the cable hatchway. It provides access to that part of the hold which is between the cable-tier and the galley which is marked by the letter **M** in **Fig. 14**.

The hatchways in the Dutch ships are bordered by a coaming and covered by hatches as in our own ships.

Manger

LXII. In the Dutch ships of the old manner of building the manger is arranged as in our own ships, and in those built after the new manner the deck of the manger is raised 9 or 10 inches [*24 - 27 cms*] above the deck and sloping towards the bow. The manger scuppers are level with this floor instead of being cut at the level of the deck. I find this arrangement of the manger excellent because the water which comes in does not linger on the deck and because since the manger scuppers are raised up higher it is rare for them to be submerged. This manger is struck down when the ship puts to sea as in our own ships.

Gunroom

LXIII. There is a gunroom in the Dutch ships as there is in our own ships, separated from the gundeck by a bulkhead placed abaft the mizen-mast, and against which are arranged the racks for the cartridge boxes. There are no sleeping cabins in the gunroom.

Cabins

LXIV. There is a wardroom situated on the middle deck of the Dutch three deck ships as in our own ships, which finishes at a bulkhead placed abaft the mizen-mast, and in this wardroom they arrange but two officers' cabins. The Captain's quarters are set up in their three deck ships on the upper deck; these quarters consist of a stateroom of the same length fore-and-aft as in our own ships; of a sleeping cabin situated forward of the stateroom on the starboard side, and of an antechamber to larboard. The sleeping cabin and the antechamber take up between them the full breadth of the ship, and are about 10 feet [*3.25 m*] long. In their ships other than those of three decks the Captain's quarters are likewise on the upper deck as in the English ships, and they are arranged in the same manner as the Captain's quarters in their three deck ships. There are three cabins on the quarterdeck in all the Dutch ships of 40 guns and above; they are arranged as in **Fig. 19**, which shows them in plan. The cabin marked with the letter **A** serves for two officers; there is a bunk on either side against the ship's side. In the wardroom or in the stateroom of many Dutch ships there is a vertical bulkhead arranged against the ship's side to hide the tumblehome of the upper works; I have marked it with the letter **A** in **Fig. 20**. They instal wardrobes in the space between this bulkhead and the ship's side.

Ladderways

LXV. The ladderways in the hold of the Dutch ships are more easily used than those which we employ. In our ships they are formed of steps cut in the edge of the samson's posts, and in the Dutch ships there are two stringers placed amidships and 3 feet [*97.5 cms*] apart, and across these stringers they nail stretchers every foot [*32.5 cms*], which form a ladder. The ladderway leading to the cable-tier, to the main hold, to the Boatswain's storeroom, to the galley and to the after hold are fashioned in this manner. The ladderway leading to the magazine is fashioned like our gundeck ladderways and in the manner shown by **G** in **Fig. 14**.

On the gundeck of the Dutch ships between the two beams situated forward of the mainmast or between the two beams afore the main hatchway there is a ladderway 6 or 7 feet [*1.95 - 2.28 m*] wide, and facing aft, in place of the two ladderways which we place athwart the mainmast, one facing to larboard and the other to starboard. The after ladderway giving access from the gundeck to the middle deck is situated in most of the Dutch ships as in our own ships, save that it faces aft, and in the other ships it is situated on the starboard side midway between the middle line of the deck and the ship's side. Access from the middle to the upper deck in the Dutch ships is by means of a single ladderway placed abaft the main capstern, and facing aft. The quarterdeck ladders are arranged as in our own ships.

Gratings

LXVI. The gratings on the middle and upper decks of the Dutch ships stretch one or two beams farther forward than in our ships, and they are, like those on the quarterdeck, one and a half to two feet [*49 - 65 cms*] broader athwartships than we allow. In this the Dutch do better than we, for the gundeck of their ships is thereby better aired. These gratings have the same fault which I observed in the gratings of the English ships; they are formed of bars and slats which are an inch and a half [*4 cms*] broader than in our ships, and spaced 4 inches [*10.8 cms*] apart so that they are difficult to walk on.

Quarter-Galleries and Stern-Gallery

LXVII. The quarter-galleries in the Dutch ships are near the same length fore-and-aft as the quarter-galleries in our own ships, and are fashioned with their stools as broad as the stools

of the galleries in the English ships. These stools are as much as six feet [*1.95 m*] broad in their three deck ships, 5 feet [*1.63 m*] broad in their 74-gun ships, 4 feet and a half [*1.46 m*] in their 62-gun ships and 3 feet 9 inches to 4 feet [*1.22 - 1.30 m*] in their ships of 50 guns. Their quarter-galleries are thereby made more spacious than those of our own ships, yet they weigh down the stern more and place a great obstacle in the way of their sailing close-hauled as I stated in my Remarks on the English ships.

There is no stern-gallery in the Dutch ships of the old manner of building nor yet in those built after the new manner, but in their ships which are built after the English manner there is a gallery on the middle deck and a second on the quarterdeck, set up as in the English ships of the old manner of building.

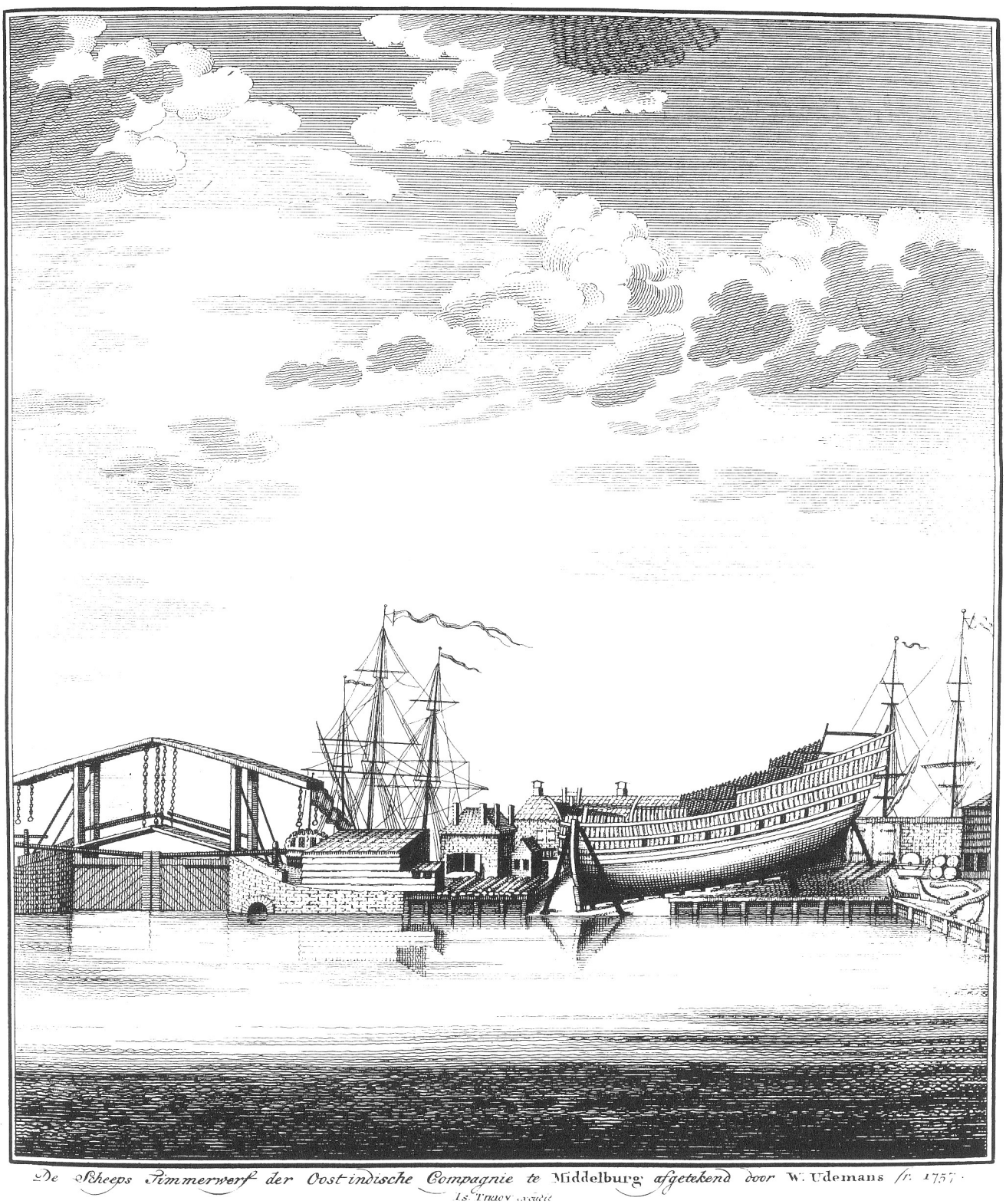
Divers Practices of the Dutch

LXVIII. The Dutch build their ships slowly, in the same way as I have explained regarding the English ships which are building; they leave the sap to dry out of the frame timbers for six or eight months before planking up the hull and the ceiling, and this practice is also used in Holland in building their merchant ships. They launch their ships here as we do in our dockyards as soon as the middle deck is in place and the deadworks are planked up to the middle deck gunports, and they then finish them afloat. They pay with tar the quickwork on the gundeck and the beams of the middle and upper decks save those which are placed abaft the mizen, whereas in our ships we employ paint; and in this the Dutch do no better than we do, nor yet as well as the English who use there neither tar nor paint.

In the Dockyards of Flushing and Veere of the Admiralty of Zealand, once they have launched a ship, they plank her up as far as the waist, and before they instal the forecastle and quarterdeck and plank up the ceiling above the middle deck, they submerge her to the level of the gundeck or half-way up the gundeck ports and leave her in that state for a year[210]. After that time they refloat her again, complete her building, and open up a few planks at her stern and along the waterline or else cut holes 3 feet [*97.5 cms*] long and 8 inches [*22 cms*] broad, to allow air into the hold. Mr Raers[211], Master Shipwright of the Admiralty of Zealand and author of this method which he has employed for more than thirty years, believes that timber which has been left in the water before being used and which then dries out more or less while the ship is on the stocks, is not yet sufficiently purged of its sap, and that in order to purge it completely the timber must be submerged a second time and allowed to dry out again; yet if this be true it would be preferable to carry out this operation on the individual timbers before they be employed rather than on the ship herself, since it seems impossible that after being joined one to the other as they are that the timbers could ever dry out completely the water which they absorb while the ship is sunk. I made this objection to Mr Raers and found him far from ready to agree that this were true; he claims that timber only rots as long as the sap remains; that seawater, or the dampness which remains thereafter in the timbers, prevents the sap from fermenting; this Builder leaves his ships on the stocks for a long time only so that the timbers may thereby be able to absorb more water; he lets in the air at the waterline after they have been raised from the bottom in order to allow the timber to take in more moisture when the ships are fitted out and all their hull is in the water. Finally he claims that by this means he purges the sap entirely from the timber or that at the least he prevents the fermentation of that sap which may still remain after all the measures taken to rid the timbers of it. He has noted the time between repairs and the life of the ships of the

210. It is interesting to note in this context that this was not an isolated case: similar methods had been tried in England, as we are informed by Fincham [*op. cit.*]: "*In 1719, when the preservation of ships was again brought under consideration, the master-shipwrights of the several dockyards proposed that about seven feet of water should be let into ships' holds by means of pipes or plugs through the bottom, in the month of April, and remain in till August, that it might produce a general coolness in the hold, and preserve the fore and after bodies, which were seldom impregnated with bilge-water; and that after the water had remained in the ships about four months, it should be pumped out. It was recommended that the experiment should be made upon the ships which had been recently built or rebuilt. But it does not appear that this means was ever extensively used in the navy; or if it was, that the use of it was anything beyond an experiment. It may, however, be supposed that the experiment was made; as particular instructions were given, that the water should not be admitted into ships lying in such positions in the harbours, that they were in danger of taking the ground.*"

211. **Raers**: Hendrik Raas, who was responsible for building (apart from the *Middelburg*), *ter Goes*, *Tholen*, *Vlissingen*, and the *Zierikzee* mentioned above.



91. *Frontispiece from Willem Udemans'* Korte Verhandeling van den Nederlandschen Scheepsbouw *(1757), depicting the East India Company Dockyard in Middelburg, where Hendrik Raas had built ships for the VOC before working for the Admiralty (see preceding page).*
(Private collection)

Admiralty which he has sunk in the water, and also the time between repairs and the life of the ships which he has built at Middelburg for the East India Company[211], which put to sea without having first been sunk. He showed me from his notes that the ships of the Admiralty last a third longer than the others. They are presently repairing one of these ships at Flushing; this is the **Middelburg**[212]. She was built 32 years ago; her frames are of oak drawn from the banks of the Main, the quality of which is equal to or inferior to the timber of Lorraine, and most of them are still sound. Her riders are of East country oak of but mediocre quality; they have only shifted the upper futtocks. Her ceiling and her beams are also of East country oak, and are still in as good a state as new timber. Mr Raers, who insisted I feel† all these timbers, claims that the **Middelburg** has been preserved in this condition because since her first building he has sunk her on three different occasions. He draws a similar proof from the poor state of the upper works of this vessel, which have never been submerged like the hull.

†.... who pointed out all these things ....

This same Shipwright has recently proposed to house over the ships with a roof after they have spent a year in the water. This proposal has been carried out on two 62-gun ships which I have already mentioned, in Remark **I**, one of which is at Flushing and the other at Veere, and they are just about to house over all the other ships anchored in these two ports. This roof is constructed in the following manner. Every 7 feet [*2.28 m*] there is a roof-truss composed of several timbers like that shown in **Fig. 21**. The letter **A** in this Figure indicates two pieces of fir 7 to 8 inches [*19 - 22 cms*] in diameter, which meet at an angle of 45 degrees†, resting on the upper deck or on the forecastle and quarterdeck and half-lapped together at the other end. **B** and **B** are two pieces of fir, also 7 or 8 inches in diameter, laid horizontally, one half way up the truss and the other three quarters of the way up, fastened with spikes to timber **A** and resting on chocks nailed to these same timbers and on shores marked **C**. The roof-purlins **D** run from one end of the roof to the other, resting on the timbers marked **B**, and support the rafters **E** spaced 16 inches [*43 cms*] apart. To these rafters laths are nailed which support the tiles. The lower end of the rafters rests on the eaves-timber **F** which is supported by several shores running down to one of the wales, like that marked by the letter **G**. There is a gutter at **H** which runs from one end of the roof to the other, and this gutter is hollowed out from a piece of fir 6 inches [*16 cms*] square. It slopes somewhat towards the bow, as does the roof. This roof runs fore-and-aft to a foot [*32.5 cms*] beyond the head and the taffarel, and athwartships to two feet [*65 cms*] beyond the maximum breadth of the ship. It shelters the ship from the sun and the rain, and must necessarily help to preserve it. I believe that it would be to the good of the service to cover in this manner the King's ships; the tiles could be brought from Holland for the ships at Brest, or we could employ slates, and for the ships at Toulon we could make tiles on the spot, not like those which they employ in Provence, but like the Dutch roof-tiles which they call Flemish tiles, the shape of which is represented by **Fig. 22**. They are lighter, and they are laid singly[213].

†.... which meet at an angle of about 90 degrees ....

LXIX. In all the Dockyards of Holland they grave their ships afloat, save only in Flushing where there is a graving-dock. It is rare that when carrying out repairs they touch the lower frame timbers; if these timbers are all spoiled the ship is condemned, and if they are not all in a poor state, rather than shift the timbers which are defective, they are content but to increase the number of riders and to lengthen their upper futtocks as far as the waist or the clamps of the forecastle and quarterdeck. I have seen several Dutch ships in this condition.

Repairs and Graving

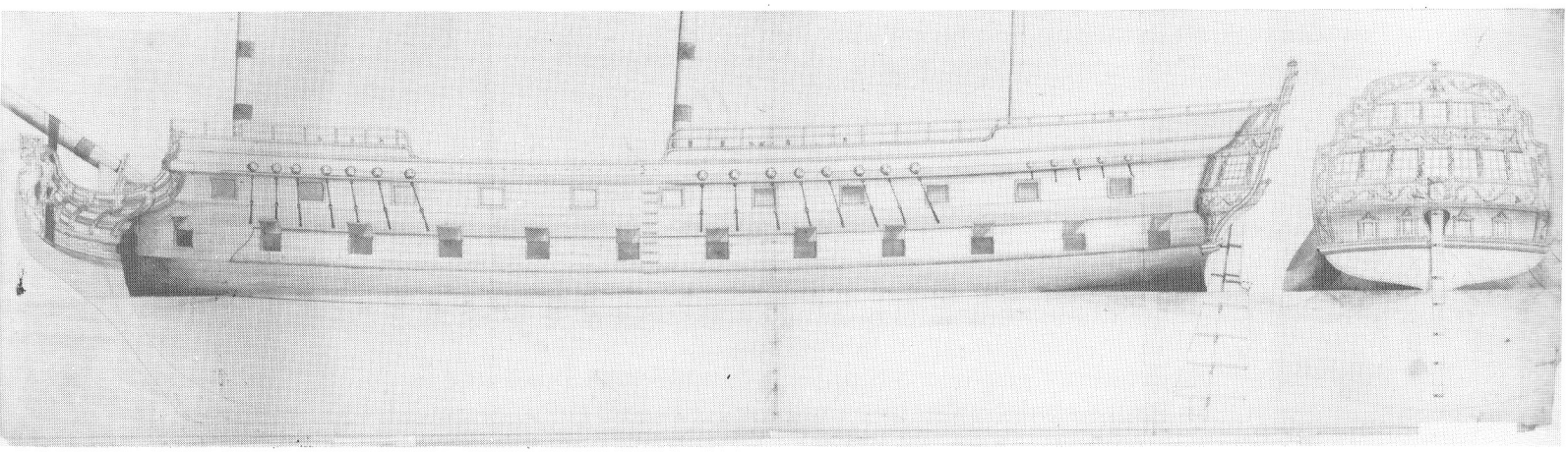
They grave their ships in Holland by heaving them down on pontoons as we do in our Dockyards, save only that the Dutch seize the masthead with a hawser or other heavy rope which they make fast to two lengths of timber passed through the two gundeck gunports which are nearest to the mainmast, so that they project outboard about four feet [*1.30 m*].

When they sheathe a ship in Holland they lay between the planking of the hull and the sheathing-boards two or three layers of brown paper coated with tar.

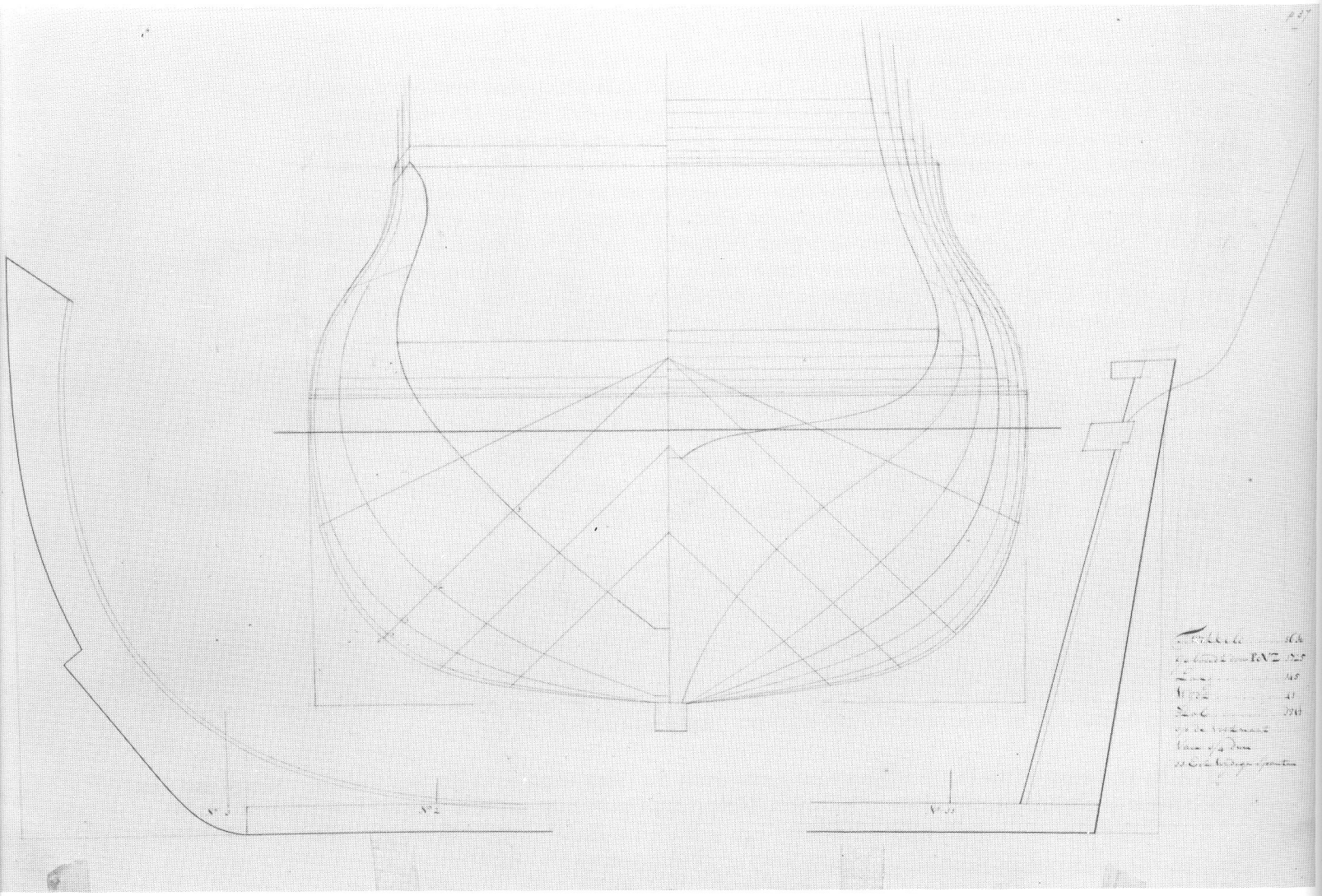
LXX. The masts of the Dutch ships are proportionately the same height as in our own ships. Their made-masts are assembled as we assemble them in our Dockyards, yet here they are less

Masts and Spars

211. The Vereenigde Oostindische Compagnie or V.O.C. for short.
212. **Middelburg**: see Remark I on the Dutch Navy above.
213. i.e. with little overlap, whereas Provençal roof-tiles form practically a double layer.



92. & **93.** *Profiles of the* Twikkelo *(56), built in 1725.*
According to the "Algemene Staat van 's Lands Scheepen" *(MS Nº G44), her builder was Pieter van Zwijndregt. However, a manuscript list of ships* "Geboudt aan het Colegie ter Adtmiraliteijdt op de Maze" *(MS Nº H52), indicates that she was in fact built by Paulus. This is confirmed by his initials on the draught.*
(Courtesy Maritiem Museum Prins Hendrik, Rotterdam)



usual, for the Dutch esteem masts of a single stick more highly than those made of several sticks, and they are mindful to bring from the Baltic the largest sticks which can be found. I noted no other difference in the masts of the Dutch ships compared with the masts of our own ships, save only that the tennant for the mast-cap is cut six-sided, whereas on our masts it is four-square; and likewise the mortice of the mast-cap is cut six-sided. The fittings of the heeling of the topmast are let into the mast as appears in **Fig. 23**, which shows the heeling of a topmast seen from its end. There is no dead-sheave cut in the heeling of the topmast in the Dutch ships.

The mainmast in the Dutch ships is stepped more or less in the same position as the mainmast in our own ships, and it has a considerable rake aft; I was given no good reason for this. The foremast is stepped one or two feet [*32 - 65 cms*] nearer the stem than we situate it ordinarily: this mast is perpendicular. The mizen-mast rakes aft like the mainmast, and the bowsprit is steeved 33 or 34 degrees.

All the ships anchored in the ports of the Admiralty have their lower masts in place, and even one of those which is roofed over, for there is no mast-house in their Dockyards for them to store their masts.

The Dutch stow their spare topmasts and topsail yards between the forecastle and the quarterdeck as the English do, and rest them on the forecastle breast-beam and on the head of the topsail-sheet bitts. In those ships where the forecastle is too short to receive the topmasts there is a skid-beam 5 or 6 feet [*1.63 - 1.95 m*] abaft the forecastle which is strengthened by two knees like the forecastle beams.

Rigging

LXXI. The cables and all the rigging of the Dutch ships are the same thickness as in the English ships; I measured the cables of the **Middelburg**, a ship of 48 feet in the beam Dutch measure, or 42 feet French measure [*13.66 m*][214]; they are 19⅓ inches French measure [*52.4 cms*], and the stays and shrouds in proportion. The hemp which they use for them is of the same quality as that which comes to us from the Baltic and the tar with which it is impregnated is more refined than that which we employ. This tar comes from Archangel in small barrels of 200 pounds [*97.8 kgs*], and from Friedrichshafen in barrels of 280 to 300 pounds [*137 - 147 kgs*]; they refine it in Holland. It is more suitable for ropes than the Stockholm tar which we employ; it feeds the hemp better and weighs it down less. It would be to the benefit of the service to have some of this refined tar in our Dockyards, especially that from Archangel which is still better than the tar from Friedrichshafen. It would serve better than the ordinary tar composed of black bitumen invented by Mr de Champlain[215] with which we pay the hulls of our ships today in preference to white stuff.

All the blocks in the rigging of the Dutch ships are, for the same size of rope, about a quarter greater in diameter of sheave than those in our own ships, and the swallow of these blocks is also a quarter wider. This makes them heavier, but also the ropes may be hauled more easily.

Engines

LXXII. In order to set to their planks the Dutch employ a sort of wrain-bolt which is not at all known in France, and which I have shown in **Fig. 24**. This wrain-bolt is of iron and has a ring at one end which turns about the shank of the bolt; the other end is bent back on itself in two places and has a sharp point. A few inches from this end there is a second piece which branches out, also bent back on itself twice and sharpened at the point. When they wish to rig a wrain-tackle with this bolt they insert it between the frame timbers, they bring one or other of the points **A** up to the frame according to whether the frame be of greater or lesser thickness, and pass the wrain-staff through the iron ring. I find this wrain-bolt preferable to the iron wedges and lashings which we employ to set to our planks. I prefer it also to the wrain-bolts employed by the English, because it is more quickly set in place and because since it is never in the way of the frame timber there is always room to nail the plank in place.

214. 48 Amsterdam feet equal in fact 13.59 m.
215. **Mr de Champlain**; see Note against Remark CLXXIII on the English Navy (p.162).

In place of the hook which is to be found on the lower block of the gins which we employ, the Dutch fit two hooks to it as I have shown at **A** in **Fig. 25**. They secure an iron chain round the object which they wish to lift. The two ends of this chain each have a ring which is placed over the two hooks. This arrangement is more simple and quicker to use than our own and costs no more to set up.

We use a dog to secure those timbers which are to be hauled along by main strength in our Dockyards; in place of this dog the Dutch have a strop of middling length made fast to the end of a rope, and on this strop are two small cant-hooks which they fasten one on either side of the timber to be moved as shown in **Fig. 26**, and in this manner the timber is better secured; the operation takes longer yet it is more certain.

The Dutch have skeets which they employ for wetting the sails. These skeets take the form shown by **Fig. 27**; they are about 10 feet [*3.25 m*] long; the hollow part of the skeet is 4 inches [*10.8 cms*] deep and one inch [*2.7 cms*] wide.

Timber

LXXIII. The Dutch employ in the building of their ships oak of three different qualities. They have some which comes from the banks of the Saar and the Mosel, which is the same timber as we call Lorraine oak. They also take oak from the banks of the Main, which is of a quality inferior to Lorraine oak, and East country oak of indifferent quality. They stack this timber in the water below low-tide level, drive pilings beside these stacks to prevent them from being swept away by the tide, and leave them in this condition until the time comes for their working. When a new ship is ordered to be built, they begin by taking out of the water the timbers for sawing, and after converting them to plank, wales, deck-clamps and others of like nature, they stack this plank under cover while the ship remains several months on the stocks in frame only.

All the oak shipbuilding timber which they bring to Holland is rough-hewn in the forest; they leave about 3 or 4 inches [*8 - 11 cms*] on each face rather than cut to a finished edge. They convert it here with the saw at but little cost, and they even find a use for the slab-cuts once they are sawn.

The East country masts which I have seen in the Dutch Dockyards are better selected and of more recent felling than those which are ordinarily supplied to our Royal Dockyards. This derives from the fact that the Dutch merchants who supply the masts to the Dutch Navy are better able than our contractors to take the necessary care to ensure that they are freshly felled, and because they have the opportunity to sell in Holland the trees of lesser quality at prices proportionate to their value; they make very considerable purchases in the Baltic, amongst which they always find sufficient quantity of choice masts for the ships of the Admiralty[216].

The same may be said of their plank, which is here of better quality, cleaner and better chosen, and clearer of sapwood than that which is supplied to our Royal Dockyards. Both long and short lengths are sawn with clean edges, of uniform width along their full length, and suitable to be used with great economy.

They use in the Dockyards of Holland plank of fir from the upper Rhine which they call whitewood in order to distinguish it from East country plank which is known by the name redwood. This plank is less costly than East country plank, and is just as suitable as the latter

216. Baltic mast-timber was auctioned in lots, particularly in Riga and S[t]Petersburg, and each lot contained a selection of the larger masts (the most sought-after) and smaller, lower quality spars. The English and Dutch, because of their large domestic markets for merchant shipping, were able to absorb these smaller spars and consistently bought in larger volumes than the French, thereby securing the choicest lots containing the largest trees which alone were suitable for lower masts and bowsprits in warships. Furthermore, the ability of the Dutch and English to pay cash for what was always an imbalanced trade swayed Russian suppliers in their favour. For what is still the best treatment of this trade, see R. G. Albion's *Forests and Sea Power: the Timber Problem of the Royal Navy, 1652 - 1862* (Harvard University Press, 1926), and also P.W. Bamford's *Forests and French Sea Power, 1660 - 1789* (University of Toronto Press, 1956).

for divers uses such as staging, moulds, bulkheads, sheep-pens, carpenter's walks etc[a]. It is indeed more suitable than East country plank because it is lighter. They use in the Dutch ships scantlings of fir for most of the purposes for which at Brest† we employ scantlings of oak, such as for the stantions of the storerooms and the sheep-pens, cross-timbers of the bulkheads in the hold etc[a]. It would be a good thing to make use of these scantlings in our own ships, since they are less costly and because they weigh less.

†....for which in some of our Dockyards we employ....

LXXIV. There are presently in the Dutch Navy in 1737[217]

1 ship	of	96 guns
2 ships	of	90 guns
1	of	80 guns
13	of	72 to 74 guns
21	of	62 to 64 guns
22	of	52 to 56 guns
10	of	44 guns
9	of	32 to 38 guns
3	of	24 guns

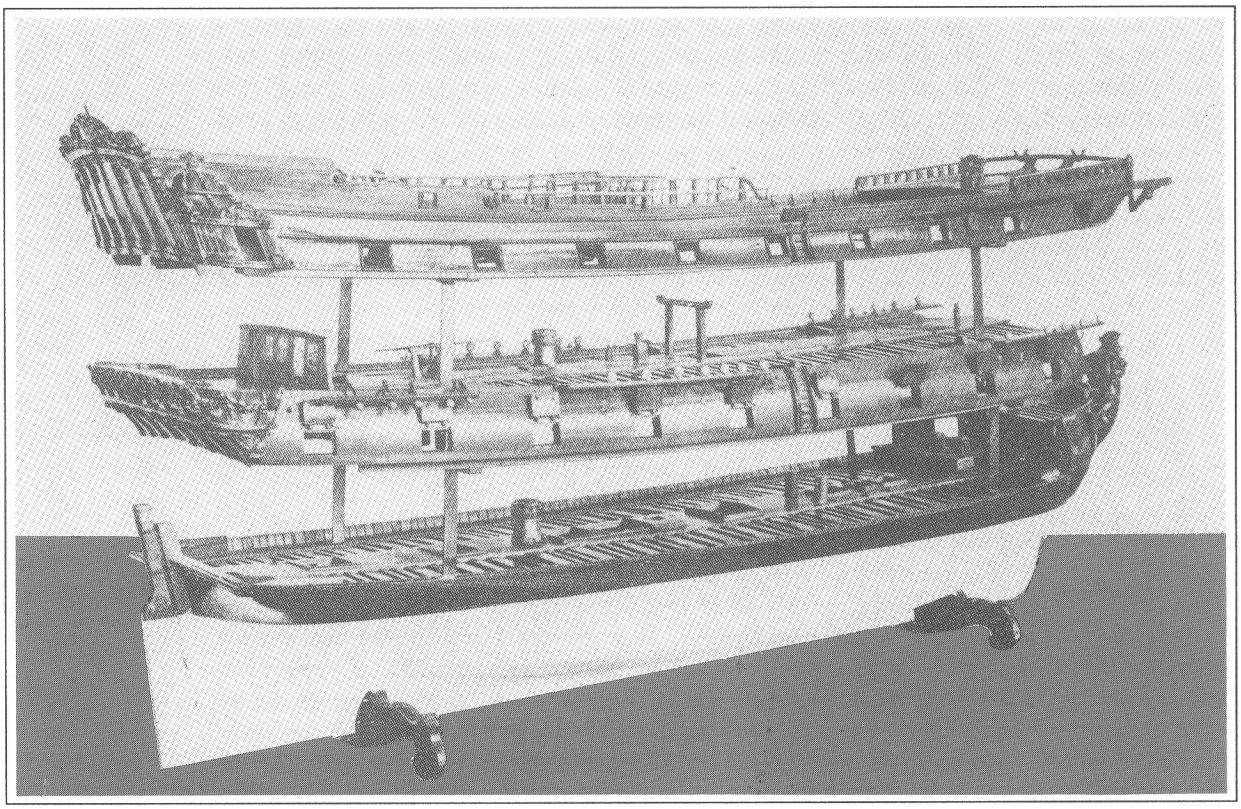
Of these ships there is one of 74 guns which is building; and one of 80 guns, 2 of 72, and one of 62 being repaired[218]. Most of their other ships, especially those of the Amsterdam Admiralty, are in poor state of repair. See what I have said in that regard, Rem. I.

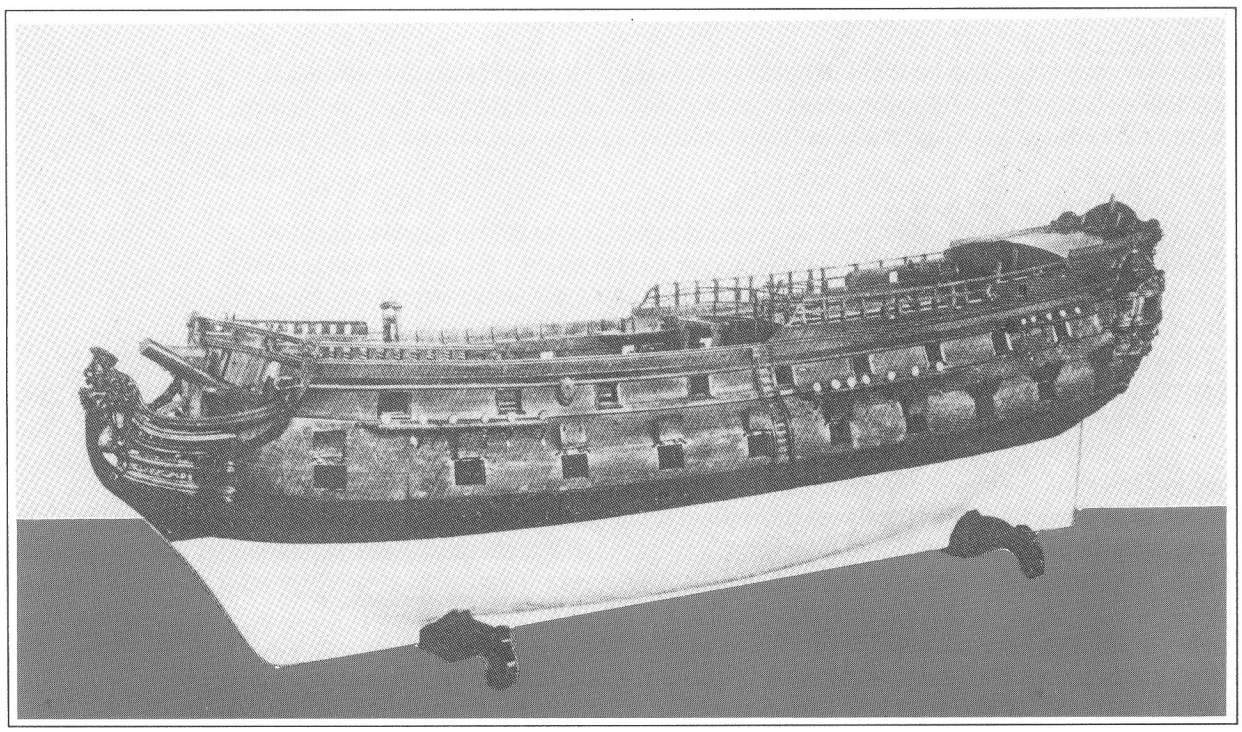
Rotterdam, August 29th 1737

Ollivier

217. The total number of ships given by Ollivier is difficult to believe: even allowing for those that were in very poor repair, scarcely half the numbers given could have been seaworthy or capable of being made so. See the *List of Dutch Ships* in the Appendix on p. 337.

218. It is not possible to identify all these ships from the information given in the Remarks. The 74 building was the *Haarlem*, and presumably the 80-gun ship was the *Middelburg*, but he mentions no 72's or 62's repairing, unless this work was being carried out in one or other of the ports which he did not visit. It is just possible that the 62 was the *Nassauw*, rebuilt in 1736, assuming her rebuild was not yet completed.





Just as this book was going to press, the above photographs were received from Mr A. Lemmers, formerly of the Rijksmuseum, Amsterdam. They depict a hitherto incorrectly identified model in the Rijksmuseum's reserve collections of a 40-gun (?) ship built by Paulus van Zwijndregt. The model is known to have existed in 1738, but it has not proved possible to identify the vessel in question, and indeed she may never have been built: according to the lists available (and given in the footnote on page 203), Paulus van Zwijndregt built no 40-gun ships, but allowing for confusion with bow-chase and stern-chase ports, this could represent the Gorinchem *(46) of 1728; if so, she was probably the first vessel on which van Zwijndregt had experimented with his "new manner of building", which Ollivier says he had "started to put into practice some ten years ago"; it could therefore have been a model designed to demonstrate his new ideas for the benefit of the Maze Admiralty officials. We apologise of the poor quality of the reproductions, taken from a photocopy of a 1928 catalogue of an exhibition at the Scheepvaartmuseum. It is however possible to distinguish some of the features which Ollivier describes: the riding-bitts and bitt standards, and the raised manger. Furthermore, the model has sister keelsons, no riders in the hold, and waterlines drawn on the hull in pencil which indicate that she had no difference in draught fore and aft. (Courtesy Scheepvaartmuseum, Amsterdam)*

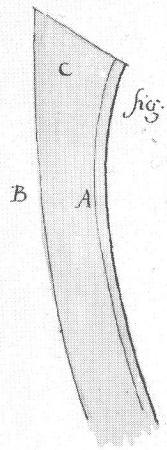
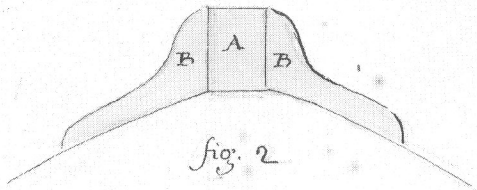


fig. 1



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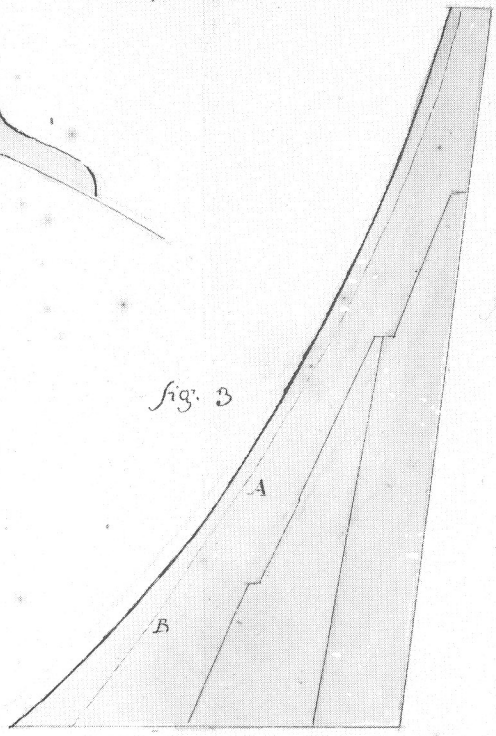

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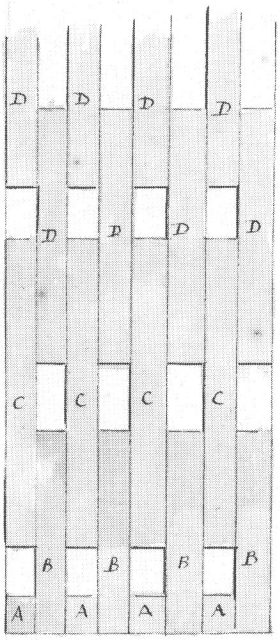

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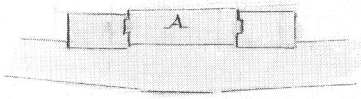

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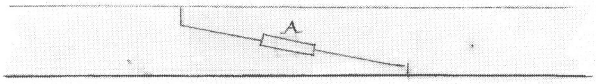

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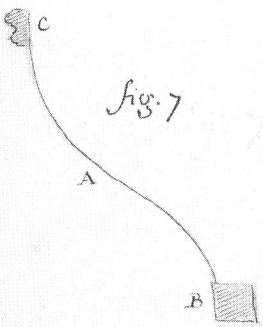

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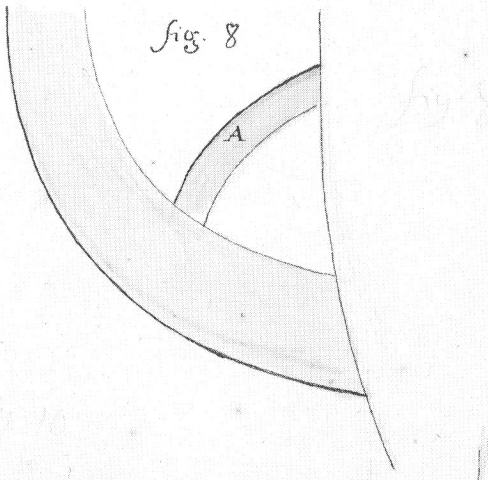

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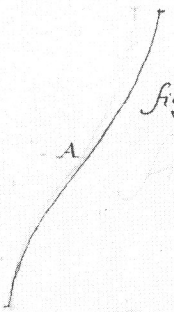

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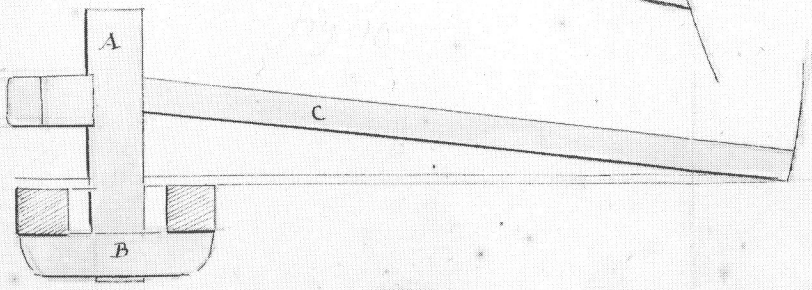

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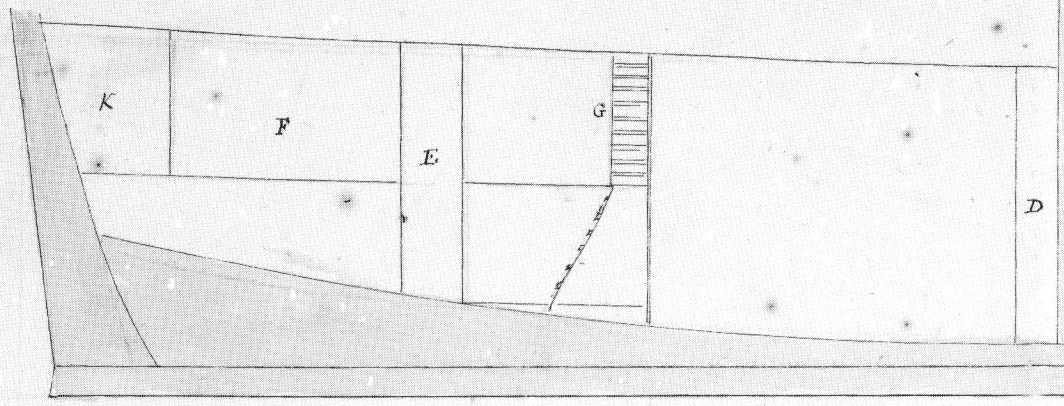

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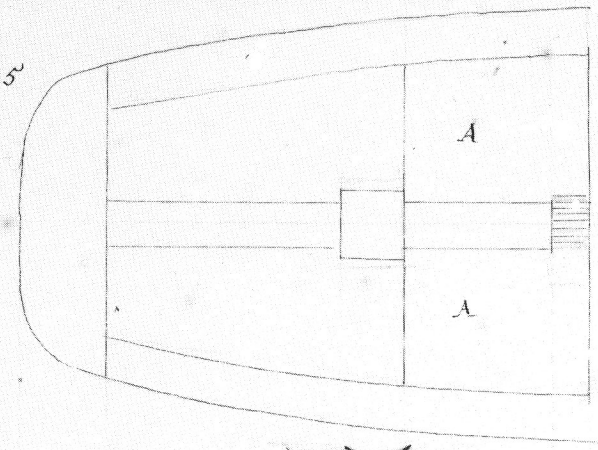

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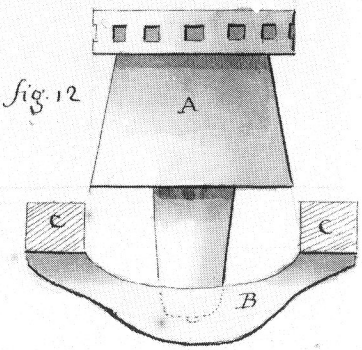

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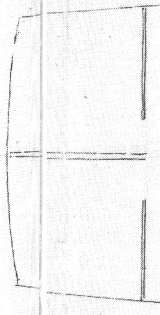

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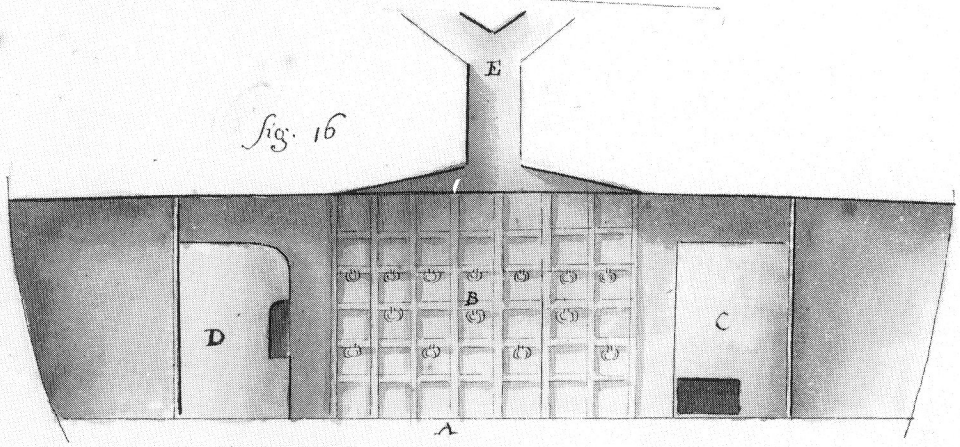

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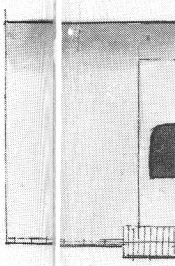

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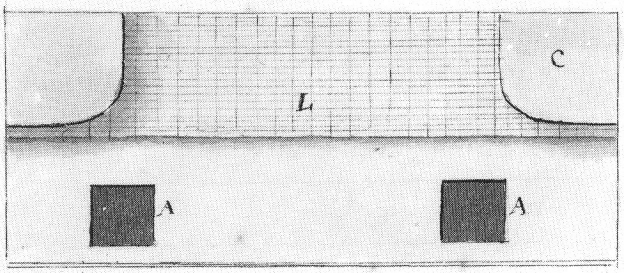

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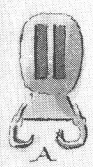

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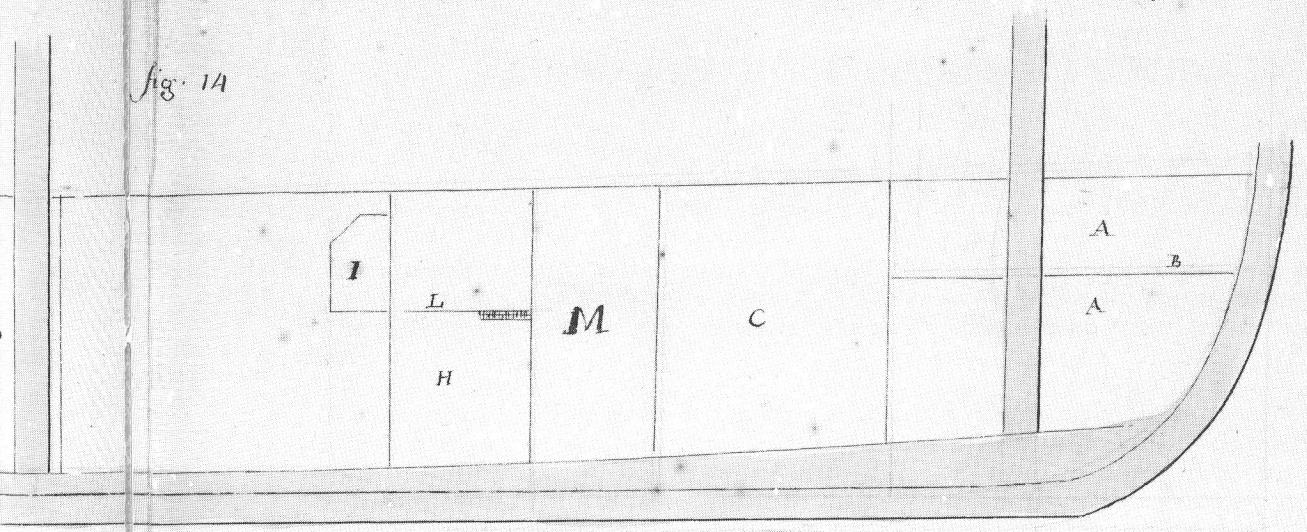

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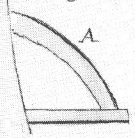

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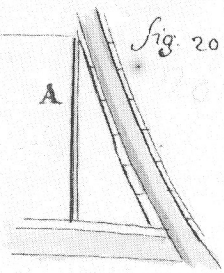

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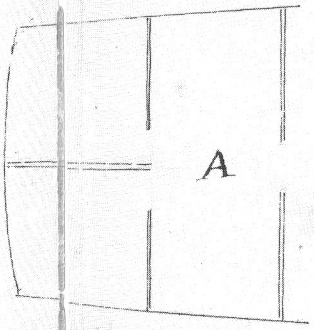

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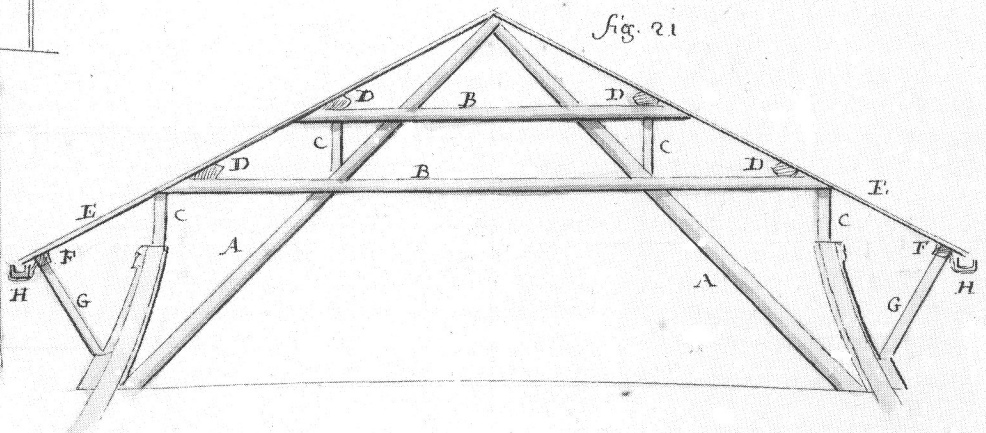


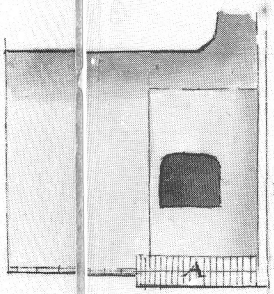
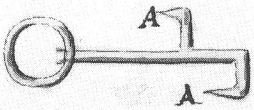


fig. 25



fig. 24



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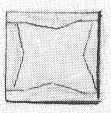

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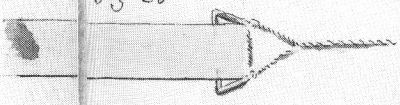

fig. 27



APPENDICES

APPENDIX I: LIST OF SHIPS IN THE DUTCH NAVY IN 1737
APPENDIX II: BIBLIOGRAPHY AND SOURCES
APPENDIX III: GLOSSARY OF SHIPBUILDING TERMS

Appendix I:
LIST OF SHIPS IN THE DUTCH NAVY IN 1737

(Dimensions in Dutch feet and inches)

It has proved impossible to find in the archives a reliable list of ships in the Dutch Navy in 1737. The following list has been prepared from a manuscript (G44) preserved at the Scheepvaartmuseum in Amsterdam, entitled *Algemene Staat van s'Lands Schepen en Vaartuigen welke zedert den Jaaren 1654 in de Nederlanden zijn Aangebouwd.* Similar in many respects to the English Admiralty *Progress Books*, the manuscript is however far from being so complete, and it contains a number of duplications and inaccuracies. This information was then checked against the lists given in *Ships of the United Netherlands 1648-1702*, compiled in 1938 by A. Vreugdenhil (*Society for Nautical Research Occasional Publications No. 5 Pt. IV*, Cambridge University Press), which gives the fate of most ships built before the last-named date. I gratefully acknowledge the assistance given in checking these lists by Professor Jaap Bruijn of the University of Leiden, who was kind enough to consult his own voluminous notes gathered over many years in the Dutch archives. The final list must however be treated with extreme caution. The list is laid out according to the table given by Ollivier on page 229, the numbers in brackets after each Rate indicating the total claimed by him. As can be seen, in nearly every case the numbers do not correspond, and one can only conclude that he was deliberately misinformed.

Name	Guns	Length	Breadth	Depth	Built	Builder	Year
96 Guns (1)							
Amsterdam	96	176	49½	17½	Amsterdam	v. Reenen	1712

Name	Guns	Length	Breadth	Depth	Built	Builder	Year
90 Guns (2)							

It has proved impossible to identify any 90-gun ships still in existence in the Dutch Navy in 1737.

Name	Guns	Length	Breadth	Depth	Built	Builder	Year
80 Guns (1)							
Middelburg	88	180	48	20	Flushing	?	1699

As noted by Ollivier, the Middelburg was rebuilding in 1737.

Name	Guns	Length	Breadth	Depth	Built	Builder	Year
74 Guns (13)							
Leyden	72	164	44	17	Amsterdam	v. Reenen	1715
Gelderland	72	161	44½	18	Amsterdam	v. Reenen	1716
Gouda	72	165	44½	17	Amsterdam	v. Reenen	1719
Maas	74	160	45	20	Rotterdam	Pau. v. Zwijndregt	1727
Vrijheid	72	165	47	19½	Amsterdam	Davis	1731
Haarlem (building)	72	167	46'5"	20	Amsterdam	Bentham	1737

There appear to have been only six 74-gun at this time. Ollivier's total of 13 ships seems to have been a figment of somebody's imagination!

Name	Guns	Length	Breadth	Depth	Built	Builder	Year
62-64 Guns (21)							
Nassauw	64	147½	47½	16½	Flushing	W. Schaak	1698
Starrenberg	64	153	42	17¾	Rotterdam	Pr. v. Zwijndregt	1708
Loosdregt	64	152	41	16½	Amsterdam	v. Reenen	1710
Boetzelaer	64	152	41	16½	Amsterdam	v. Reenen	1711
de Purmer	64	152	41	16½	Amsterdam	v. Reenen	1714
Roozendaal	64	152	41½	16¾	Amsterdam	v. Reenen	1717
Souterwoude	64	152	42	16¾	Amsterdam	v. Reenen	1719
Kasteel van Egmont	64	150	42	16¼	Hoorn	?	1722
Tholen	64	156	44¼	18¾	Flushing	?	1723
Heemstede	64	155	44	17	Amsterdam	Gerb. Slegt	1724
Kasteel v. Medenblick	64*	145	42	16¼	Hoorn	?	1725
Proventie Utrecht	64	156¾	44	19	Amsterdam	Davis	1728
Zierikzee	64	156	44	18½	Flushing	H. Raas	1733
ter Goes	64	156	44	18½	Flushing	H. Raas	1733
Vlissingen	58	146	41½	17½	Flushing	H. Raas	1733
Buis?	62?	150	?	?	Enkhuizen	R. Koek	1708

*Perhaps 52 guns.
The *Starrenberg* was rebuilt in 1732 and the *Nassauw* in 1736. The *Buis* may well have no longer existed at this time, so that a full list of 21 ships cannot be established.

Name	Guns	Length	Breadth	Depth	Built	Builder	Year
52-56 Guns (22)							
te Veere	52	143	42	15½	Flushing	?	1697
Matenes	54	146	38¼	16¼	Rotterdam	Pr. v. Zwijndregt	1704
Wolfswinkel	50	140	?	?	Enkhuizen	R. Koek	1708
't Huis te Nek	52	140	40	16	Hoorn	?	1710
Ter Meer	52	143	38½	15	Amsterdam	v. Reenen	1712
*Duinveld**	52	142	38½	15	Amsterdam	v. Reenen	1713
Polaanen	52	146	39′9″	16¼	Amsterdam	Gerb. Slegt	1722
Damiaten	52	145	39′7″	16	Amsterdam	Gerb. Slegt	1723
Valkenburg	52	143	40′2″	16½	Amsterdam	Gerb. Slegt	1725
Beemsterlust	52	143	40′2″	16½	Amsterdam	Gerb. Slegt	1725
Twikkelo	56	145	41	18	Rotterdam	Paulus v. Zwijndregt	1725
Ramhorst	52	140	40	16	Hoorn	Jan Pool	1728
Prins Friso	50	144	42	17	Amsterdam	Davis	1728
Boekenroode	52	146	41′8″	17′5″	Amsterdam	Davis	1729
Delft	56	145	40	18	Rotterdam	Pr. v. Zwijndregt	1731
Brederode	52	146	41′8″	17′5″	Amsterdam	Davis	1731
Moriaanshoofd	52	146	41′8″	17′5″	Amsterdam	Davis	1733
Watervlied	52	146	41′8″	17′5″	Amsterdam	Davis	1733
Assendelft	52	150	41′6″	18	Amsterdam	Davis	1736

*Hulked in 1736, but may for all that be included.
The *Wolfswinkel* was sold in 1738 and the *te Veere* in 1740. The *Twikkelo* and the *Matenes* were both rebuilt in 1732. Once again, the full list of 22 vessels cannot be established with certainty: even with the addition of the *Kasteel van Medenblick*, which as noted above may have carried 52 rather than 64 guns, the total still only comes to 20.

Name	Guns	Length	Breadth	Depth	Built	Builder	Year
44 Guns (10)							
Edam	44	134	36	15¼	Amsterdam	v. Reenen	1711
Rossum	44	126	34½	15	Rotterdam	Pr. v. Zwijndregt	1712
Burgvlied	44	135	37	15¼	Amsterdam	v. Reenen	1722
Vredenhof	44	132	38½	16	Hoorn	?	1724
Meervlied	44	135	38½	15¼	Amsterdam	Gerb. Slegt	1724
Pallas	44	135	38½	15¼	Amsterdam	Gerb. Slegt	1724
Beken Vliet (Beekvliet)	44	126	36	15½	Hoorn	Jan Pool	1726
Noordwijk op Zee	44	135	37	15	Amsterdam	Papegaay	1726
Oud Teilingen	46	135	39	17½	Rotterdam	Pr. v. Zwijndregt	1726
Gorinchem	46	130	38	17	Rotterdam	Pau. v. Zwijndregt	1727
Westerdijkshorn	44	136	39′7″	16′9″	Amsterdam	Davis	1728
Hilverbeek	44	136	39′7″	16′9″	Amsterdam	Davis	1729
Leyderdorp	44	136	39′7″	16′9″	Amsterdam	Davis	1730
Gouderak	44	136	39′7″	16′9″	Amsterdam	Davis	1733
Middelburg	44	136	39′7″	16¾	Amsterdam	Davis	1734
Beschermer	44	139	38′4″	16′8″	Amsterdam	Bentham	1735
Teilingen	44	139	38′8″	16′8″	Amsterdam	Bentham	1735

There appear to have been 17 rather than 10 44-gun ships in the Dutch Navy at this time. Presumably some of them could fill in "gaps" in some of the other categories. Note that the *Rossum* was rebuilt in 1732 and the *Oud Teilingen* in 1733.

Name	Guns	Length	Breadth	Depth	Built	Builder	Year
32-38 Guns (9)							
Maarsen	38	122	35	14½	Amsterdam	v. Reenen	1718
Langeveld	38	123	35½	14½	Amsterdam	v. Reenen	1720
Wageningen	36	131	36′8"	16½	Amsterdam	Gerb. Slegt	1723
Hof S^{t}Jans Kerke	36	130	36	16	Rotterdam	Pau. v. Zwijndregt	1733

As noted above, some of the six missing 32- to 38-gun ships may appear in the list of 44-gun ships, especially older vessels which had been reduced.

Name	Guns	Length	Breadth	Depth	Built	Builder	Year
24 Guns (3)							
Hartekamp	20	116′8″	32	20	Amsterdam	Davis	1731
Spiegel-bos	20	116′8″	32	20	Amsterdam	Davis	1731
Zeepaard	22	117	32	11′10″	Amsterdam	Davis	1733
*Windhond**	22	120	32	12	Amsterdam	Bentham	1737

*The *Windhond* was building in Amsterdam in 1737, although she is not mentioned by Ollivier. Presumably however she is not one of the three 24-gun frigates reported.

Appendix II:

BIBLIOGRAPHY AND SOURCES

In drawing up the bibliographic details of the works consulted during the preparation of this book, I relied mainly on two remarkable works: Jean Polak's *Bibliographie Maritime Française depuis les temps les plus reculés jusqu'à 1914*, and the as yet unpublished but no less ambitious *Bibliography of Books on Naval Architecture, Rigging and Seamanship Printed 1600-1919*, compiled by my friend Lars Bruzelius. For the non-French maritime dictionaries, which are listed in neither work, I have delved into my own considerable collection of these often neglected but precious sources of information on the vanished navies of the age of sail.

17th Century Works.

Carel Allard: Nieuwe hollandsche scheepsbouw; waar in vertoond word een volmaakt schip, met alle des zelfs uitterlijke deelen, met een verklaaring der naamen van dien; als mede van alle de touwen, zijlen, &c.: benevens de afbeeldingen van alle de voornaamste vlaggen, die men in zee onmoet; in meer als tachtig kopere plaaten; daar in (door de arceeringen volgens de blazoen-kunde) niet alleen de koleuren der vlaggen, maar ook der wapeningen, die daar op-staan, vertoond worden; met een beschrijving van de oorsprong der zelve. Beneffens een beschrijving van het bouwen en toetakelen van allerlij soorten van scheepen, volgens een gestelde maat. 1695, *Amsterdam*, sm. 4to, 56 pp., 84 Pl. Other editions: 1705 (second part); 1716 (both parts reprinted).

Anonymous: Construction des vaisseaux du roy, et le nom de toutes les pièces qui y entrent, marquées en la table par numéro. Avec toutes les proportions des rangs, leur explication, et l'exercice du Canon. 1691, *Le Havre, J. Hubault*, 8vo, 140 pp., 1 fldg. Plate. Other editions: 1692; 1693; 1693 (another); 1703; 1723; 1754; 1775.

Anonymous: Hollandsche scheepsbouw: waer in vertoont wert hoedanigh alle sheepstouwen en andere delen in een volmaeckt schip geplaetst zijn, en genaemt wereden: beneffens het bouwen en toetakelen van alle schepen, en dat volgens een gestelde maat. 1678, *Amsterdam, Jacobus Robijn,* sm. 4to, 20 pp., 1 Pl. Other editions: 1692, 1696.

Edmund Bushnell: The complete ship-wright. Plainly and demonstratively teaching the proportions used by experienced ship-wrights, according to their custom of building .... 1664, *London, by W. Leyburn for George Hurlock.* 4to, (8), 68 pp., 1 Pl. Other editions: 1669; 1669 (another); 1678; 1685; 1688 (fifth; only known from the list given by Blaise Ollivier in this volume); 1699; 1716; 1736 (only known from the list given by Blaise Ollivier in this volume); 1739; 1748.

F. Dassié: L'architecture navale, contenant la manière de construire des navires . . . Avec . . . l'explication des termes de la marine. 1677, *Paris, Jean de la Caille*, 4to, 288 pp., 8 Plates, 1 fldg. Table. **Plus**: Le routier des Indes orientales et occidentales, 209 pp. Other editions: 1695.

Paul Hoste: Théorie de la construction des vaisseaux, qui contient plusieurs traitez de mathématiques sur des matières nouvelles et curieuses. 1697, *Lyon, Anisson & Posuel*, folio, 172 pp., 11 fldg. Pl. Invariably bound together with (by the same author): L'art des armées navales, ou traité des évolutions navales, qui contient des règles utiles aux officiers généraux & particuliers d'une armée navale; avec des exemples tirez de ce qui s'est passé de plus considérable sur la mer depuis cinquante ans. Enrichi de figures en taille douce. Same date and publisher, (6), 424 pp., 130 Pl. Other editions: 1727.

Thomas Miller: The complete modellist, or art of rigging. 1660, *London, R. & W. Leybourn*, 4to. Other editions: 1664; 1667; 1676; 1684; 1699; 1714; 1716.

Admiral Sir John Narborough: The mariner's jewel: or, a pocket companion for the ingenious. Being of more general use for officers, seamen, carpenters, boatswains, pursers and stewards, then any thing yet published, containing an alphabetical dictionary of all the naval terms; a general pay table; with a table of boatswain stores for each rank of ship; the proportion of prizes, with many other useful things both decimal and vulgarly demonstrated from a manuscript of Sir John Narbrough's, and methodiz'd by James Lightbody P.M. 1695, *London, Robert Whitledge*, 12mo, 125 pp. Other editions: 1697 (2nd); 1701; 1724 (6th).

Cornelis van IJk: De nederlandsche scheeps-bouw-konst open gestelt; vertoonende naar wat regel, of evenredenheijd, in Nederland meest alle scheepen werden gebouwd; mitgaders masten, zeijlen, ankers en touwen, enz. daar aan gepast. 1697, *Amsterdam, Ian ten Hoorn.* 4to, (14), 354, (8) pp., 23 Pl. Facsimile reprint 1979, *Rotterdam, Langerveld.* Other editions: No known later editions, but at least two variants of the 1697 edition can be identified.

John Wallis: Cono-cuneus or, the shipwright's circular wedge; that is, a body resembling in part a conus, in part a cuneus, geometrically considered. 1684, *Oxford, John Playford for Richard Davis*, 4to, (2), 17 pp., 7 Plates (XXII figures).

Nicolaes Witsen: Aeloude en hedendaegse scheeps-bouw en bestier: waarin wydtloopigh wer verhandelt de wyze van scheeps-timmeren, zoo als de zelve eertydts by de Grieken, en Romeinen, in gebruik was: scheeps-oeffeningen, stryden, tucht, wetten en gewoonten. Beneffens eevenmaatige grootheden van de scheepen onzes tydts, ontleedt in alle haare deelen: verschil van bouwen tusschen verscheide landtaart: Indisch en Russisch vaar-tuigh: galey-bouw, en hedendaaghsche scheeps-plichten: verrykt met een reeks verklaarde zeemans spreek-woorden en benaamingen. 1671, *Amsterdam, Casparus Commelijn & Broer en Jan Appelaer*, 4to, (16), 516, 40, (4) pp., 116 Pl. Other editions: 1671 (*Christoffel Cunsalus*), 1690. Facsimile reprint 1970, *Amsterdam, Uitgeverij Graphic.*

18th Century Works

Carel Allard: L'art de bâtir les vaisseaux, et d'en perfectionner la construction; de les garnir de leurs apparaux, les mettre en funin, les manœuvrer, &c. Avec la coupe d'un vaisseau de premier rang, les devis de plusieurs sortes de vaisseaux, les outils & machines des ateliers de construction, les instrumens de mathématique servans à la navigation, leurs descriptions & figures; diverses listes & tables concernant la construction, l'équipement, &c. Outre les pavillons de divers Etats. Le tout tiré des meilleurs auteurs hollandois, comme Witsen, van Eyk, Allard, etc. 1719, *Amsterdam, David Mortier*, 4to, (4), 82, 34, 101 pp., & (viii), 175 pp., ill., 23 Pl., 90 Pl of flags. (Other collations exist). Facsimile reprint 1990, *Nice, Éditions Oméga.*

Anonymous: The shipbuilder's repository; or, a treatise on marine architecture, wherein are contained, the principles of the art, with the theory and practical parts fully explained; and every instruction required in the building and completing a ship, of every class, from the forming of the draught, to the launching into the water. Calculated to the capacity of young beginners: compiled and digested in a manner entirely new, and laid down different from what has hitherto appeared on the subject. The whole being intended as a complete companion for those naval architects desirous of attaining a competent knowledge of that important art. 1788, *London, for the author*, 4to, (8), (viii), 9-472, (iv), (2) pp., 2 Pl. on 1 sheet. 1992, facsimile reprint, *Jean Boudriot Publications*, with additional draughts.

Jean Bernoulli, Daniel Bernoulli, M. le Marquis Poleni, M. Trésaguet: Pièces qui ont remporté les prix de l'Académie Royale des Sciences en 1737. I. Discours sur les ancres (Jean Bernoulli). II. Mémoire sur la fabrique des ancres (M. Trésaguet). III. Réflexions sur la meilleure figure à donner aux ancres et la meilleure manière des les essayer (Daniel Bernoulli). IV. De praestabiliori figura qua anchorae formari queant. V. De artificio praestantiore anchoras ad ustrinam fabrefaciendi. VI. De meliore modo experiundi anchorum vires, seu resistentiam (Marquis Poleni). *Paris, Imprimerie Royale*, 4to, all six papers bound together. (4), [I]: 32 pp., 3 Pl. [II]: 14 pp., 11 Pl. [III]: 38 pp., 1 Pl. [IV]: 50 pp., 9 Pl. [V]: 13 pp. [VI]: 11 pp. Paginated as (4), 158 pp.

Jacques Bourdé de Villehuët: Le manœuvrier, ou essai sur la théorie et la pratique des mouvemens du navire et des évolutions navales. 1765. *Paris, H.L. Guérin & L.F. Delatour*, 8^{vo,} xii, 407 pp., 8 engr. Pl. Other editions: 1769, 1800, 1804, 1814, 1832. Translated into English (J.N. Jouin de Sauseuil) 1788.

Édouard Jacques Burgues de Missiessy: Arrimage des vaisseaux. 1789. *Paris, Imprimerie Royale*, 4to, (2), 152 pp., 6 fldg. Pl.

Édouard Jacques Burgues de Missiessy: Installation des vaisseaux. 1798 (An VI). *Paris, Imprimerie de la République*, 4to, xii, 403 pp., 9 fldg. Pl.

Fredrik Henrik af Chapman: Tractat om skepps-byggeriet, tillika med förklaring och bevis öfver Architectura Navalis Mercatoria &c. 1775, *Stockholm, Johan Pfeffer*, 4to, (xvi), 248 pp., 16 Pl., 8 Tables.
Transl. into French by **Vial du Clairbois**: Traité de la construction des vaisseaux. Avec des éclaircissemens & démonstrations touchant l'ouvrage intitulé: Architectura Navalis Mercatoria, &c. Traduit du suédois. Publié avec quelques notes et additions pour en rendre la lecture indépendante du grand ouvrage en planches du même auteur, architectura, &c., mentionné ci-dessus. 1781, *Brest, R. Malassis* and *Paris, Durand, and Jombert*, 4to, (xxv), (3), 220 pp., 20 fldg. Pl.

John Cowley: The sailor's companion, and merchantman's convoy. Shewing the military power of the Lord High-Admiral, and the duty and conduct of all superior and inferior officers of the Royal Navy of Great Britain; also . . . etc. The whole very necessary for all persons concerned or interested in maritime affairs of any kind soever. 1740, *London, T. Cooper*, 12mo, 232 pp. Other editions: 1741; 1756.

John Davis: The seaman's speculum or compleat school-master: containing the most ready and exact manner of rigging of a ship, after a more easy way than has been hitherto practiced, suited to the capacity of every seaman, tho' he knows nothing of numbers. Shewing, the exact way of rigging the Royal Navy of Great Britain, and merchant ships. I. By the length of masts, yards, and breadth of the main beam, how to rig a ship of any burthen, either for the Royal Navy, or a Merchant-man, in every particular part. II. By the length of the beam from outside without anything else, never fails in giving the true proportions of the rigging. III. You have a table of the proportions of all the ropes and rigging of a ship. Whereunto is added, a treatise of sea-gunnery, the working of a ship at sea, a man of war in battle, the duty of the clerk, pilot, mate, surgeon, and seaman: likewise the duty of the boatswain and purser. With directions, how to take in the stores or provisions from the clerk of the cheque or victualling-office, and how to distribute them to the seamen, according to the Queen's allowance, with a table of sea provisions ready cast up, from a week to a month, and from 10 to 700 men. 1711, *London, Ebenezer Tracy*, 4to, (4), 164 pp., ill.

Daniel Defoe: A tour through the whole island of Great Britain. 1724-6 (3 vols). Revised, 1738. Revised, Samuel Richardson, 1742 (4 vols). Several other editions, concluding with ninth, 1779.

Henri-Louis Duhamel du Monceau: Elémens de l'architecture navale, ou traité pratique de la construction des vaisseaux. 1752, *Paris, Ch.-A. Jombert*, 4to, (4), lvi, 420, (4) pp., frontispiece and 24 fldg. Pl. Other editions: 1758, "Seconde édition revue, corrigée & augmentée par l'auteur". *Paris, Ch.-A. Jombert*, 4to, xliv, 49, xxviii, 434 pp., frontispiece and 24 fldg. Pl.; translated into Dutch in 1757 (reprinted 1759, 1791, 1793), German in 1791 (reprinted 1792). There was no English translation, but Mungo Murray (see below) included part of it in his Naval Architecture (1754).

Henri-Louis Duhamel du Monceau: Traité de la fabrique des manoeuvres pour les vaisseaux, ou l'art de la corderie perfectionnée. 1747, *Paris, Imprimerie Royale*, 4to, xl, 464 pp., 7 fldg. Plates. Other editions: 1769.

de Duranti de Lironcourt: Instruction élémentaire et raisonnée sur la construction pratique des vaisseaux, en forme de dictionnaire. 1771. *Paris, J.B.G. Musier fils*, 8vo, xxxii, 271 pp., 2 fldg. Tables. 1985, facsimile reprint, *Nice, Éditions Oméga.*

Léonard Euler: Théorie complète de la construction et de la manœuvre des vaisseaux, mise à la portée de ceux qui s'appliquent à la navigation. 1773. *St Petersburg*, 8vo, (14), 354 pp., 11 Pl. Other editions: 1776 (with 6 Pl. only); 1776: English translation by H. Watson: A compleat theory of the construction and properties of vessels, with practical conclusions for the management of ships, made easy to navigators. *London, P. Elmsley*, 8vo, (16), 281 pp., 11 Pl. (reprinted 1798); 1776 Italian translation by Simone Stratico; 1778, Russian translation by Golovin; 1780 Second Italian translation (not by Stratico?), presumably from the second French edition, 6 Pl. only.

Pierre Alexandre Laurent Forfait: Traité élémentaire de la mâture des vaisseaux, à l'usage des élèves de la Marine. 1788. *Paris, Clousier*, 4to, xl, 294 pp., 24 fldg. Pl. Other editions: 1815. 1979, facsimile reprint (of first), *Grenoble, Éds. des Quatre Seigneurs.*

John Hardingham: The accomplish'd ship-wright and mariner. 1706, *London, printed for J. Thornton and H. White*, 4to, (12), 406 pp., Plates.

William Hutchinson: A treatise on practical seamanship; with hints and remarks relating thereto: designed to contribute something towards fixing rules upon philosophical and rational principles; to make ships, and the management of them; and also navigation, in general, more perfect, and consequently less dangerous and destructive to health, lives, and property. 1777, *Liverpool, printed for the author* 4to, xiv, 213 pp., 10 Pl. Other editions: 1979, facsimile reprint (of first), *London, Scolar Press.* 1781 (reprinted 1787); 1791; 1794 "fourth edition enlarged and improved", with changed title: A treatise on naval architecture. Founded upon philosophical and rational principles, towards establishing fixed rules for the best form and proportional dimensions in length, breadth and depth, of merchants ships in general, and also the management of them to the greatest advantage, by practical seamanship; with important hints and remarks relating thereto, especially both for defence and attacks in war at sea, from long approved experience. *Liverpool, T. Billinge*, 4to, frontispiece, xvi, 304 pp., 12 Pl. (1 fldg). 1970, facsimile reprint (of fourth), *Greenwich, Conway Maritime Press.*

Daniel Lescallier: Traité pratique du gréement des vaisseaux et autres batimens de mer. 1791. *Paris, Clousier & Firmin Didot; London, P. Elmsley; Amsterdam, Gabriel Dufour*, 2 vols 4to; I: xxiv, 488 pp.; II: 83 pp., 34 Pl., 23 pp. 1968 Facsimile reprint, *Grenoble, Éds. des Quatre Seigneurs.*

Christoffel Middagten: Nieuw bericht der scheeps-bouw, van 's lands oorlog- en vergat-scheepen: aantoonende, hoe dat derselbe op dusdanige manier tot meerder dienst voor den landen zouden kunnen en moeten gebouwd worden: mitsgaders van derselver toetakeling, bemanninge, regeringe in zee, zoo in't zeilen drijven, en ten anker leggen, beide in goed en onstuijmig weer. Als meede, een seer nutte onderrichtinge aan kooplieden, reeders, en schippers voornamenlijk die op d'Oost zee handel drijven, om haare schepen tot meerder behoud, profijt en voordeel deselve te doen bevaren. Nog, een noodige waarschouwinge aan de stuurlieden, tot oppassinge, en goede opmerkinge der zeekaarten. En een onderwijs om van een jong matroos een goed zeeman en stuurman te worden. Eindelijk, eenige vragen en antwoorden tusschen een meester en discipel der navigatie, zeer nuttig voor en goed stuurman om te weeten. 1712 (?). Other editions: 1714, *Harlingen, Fredrik Schotsman*, 4to, 36 pp.; 1717, 1721.

Mungo Murray: A treatise on ship-building and navigation. To which is added by way of appendix, an English abridgement of another treatise on naval architecture, lately published at Paris by M. Duhamel, Mem. of the R. Acad. of Sciences, Fellow of the Royal Society of London, and Surveyor General of the French Marine....To which is now added a supplement, containing a translation of what M. Bouguer, another French author has written on that subject: and M. Duhamel's method of finding the centre of gravity, with some remarks by the author. The whole illustrated with twenty-three copper-plates. 1765, *London, A. Millar*, 4to, (12), 3-344, (2), 70, (6), (iv), 116, (2) pp. advert., 23 Pl.

Mungo Murray: References and explanation of four prints exhibiting the different views of a sixty gun ship; together with the length, and proper shift of all the planks, both outside and inside. 1768, *London, T. Cadell*, 8vo, 26 pp., 4 Pl. on 2 fldg. sheets.

Nicolas-Charles Romme: Description de l'art de la mâture. 1778. *Paris, Impr. Delatour*, folio, 82 pp., 8 Pl. Facsimile reprints: 1972, *Grenoble, Éds. des Quatre Seigneurs*, and 1984, *Geneva, Slatkine Reprints.*

Nicolas-Charles Romme: L'art de la voilure. 1781. *Paris, Impr. Moutard*, folio, 68 pp., 9 Pl. Facsimile reprints: 1972, *Grenoble, Éds. des Quatre Seigneurs*, and 1984, *Geneva, Slatkine Reprints.*

Marmaduke Stalkartt: Naval architecture; or, the rudiments and rules of ship building exemplified in a series of draughts and plans, with observations tending to the further improvement of that important art. 1781, *London, for the author.* 2 vols., text folio, (8), iv, (2), 231, (1), (4) pp.; plates lge folio atlas or tube, containing 14 or 17 Pl. (3 largest bound as 6). Other editions: 1787; 1803. 1991, facsimile reprint (of second), *Rotherfield, Jean Boudriot Publications.*

David Steel (ed.): The elements and practice of rigging, seamanship, and naval tactics. 4 vols. I. The art of making masts, yards, etc. II. The art of sailmaking. III. The art of rigging. IV. Seamanship; both in theory and practice. A system of naval tactics. 1800. *London, David Steel.* Other editions: numerous. For a detailed description, see the excellent bibliography of Steel's works by Mario M. Witt, 1991, *Greenwich Maritime Monographs.*

William Sutherland: The ship-builder's assistant: or, some essays towards completing the art of marine architecture .... to which is annexed, an explication of the principal terms used in this art. The whole illustrated with many schemes proper to each part, most of them from copper plates. 1711, *London, R. Mount, A. Bell, & R. Smith*, 8vo, (12), 165 pp., 13 fldg. Pl., of which 5 coloured. Other editions: 1755; 1766; 1784; 1794; 1840. 1990, facsimile reprint (of first), *Rotherfield, Jean Boudriot Publications.*

William Sutherland: Britain's glory: or, shipbuilding unvail'd, being a general director for building and completing the said machines. 1717, *London, Tho. Norris, Eben. Tracy, Arthur Bettesworth & Benj. Pickard*, folio, (xxvi), 134, (4) pp., ill., 4 fldg Pl. Other editions: 1726; 1729; 1740.

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Honoré Sébastien Vial du Clairbois: Traité Elémentaire de la Construction des Vaisseaux & Vocabulaire des Termes de Construction et, en général, de Marine, dont on fait usage dans ce traité. 1787, *Paris, Clousier*, 4to, 2 pp. unn., 308 pp., 5 pp. unn., 20 fldg. Plates numbered 1 to 20.

Honoré Sébastien Vial du Clairbois (ed.): Encyclopédie méthodique, partie Marine. 1783, *Paris, Panckoucke*, 4to, 4 vols: I: xvi, 712 pp., 1 fldg. Table; II: (4), 784 pp.; III: (4), 897 pp.; IV: 156 + xvi Pl. Other editions: 1784, *Padua*; 1789-90, *Padua*; 1798 (An VI), *Paris, H. Agasse*, with changed title: "Dictionnaire raisonné de la marine ...." (otherwise identical). 1986-7. Facsimile reprint (of first), *Nice, Éditions Oméga.*

Leendert van Zwijndregt & C. de Ruiter: Verhandeling van den hollandschen Scheepsbouw, raakende de verschillende charters der orlogschepen; tot 's lands dienst, en ter betrachting van alle bespiegelende en werkdagige liefdhebberen der hollandsche scheepsbouwkunde, in 't neerduits beschreven. Waarbij, tot een Aanhangsel, gevoegd is eene verhandeling van 't bouwen der koopvaardijschepen door C. de Ruiter. 1757, *The Hague, P. Hondt & H. Scheurleer, F.Z.*, 4to, (2), Frontispiece, (6), viii, 126 pp., 8 Pl.

19th Century Works

J.B.A. Babron: Précis des pratiques de l'art naval en France, Espagne et en Angleterre, donnant, pour les trois marines, les termes techniques, les commandements et des vocabulaires en français, espagnol et anglais; etc. 1817, *Brest, Michel*, 8vo, (vii), 498 pp., 1 Plate, ill. in text.

John Charnock: An history of marine architecture. Including an enlarged and progressive view of the nautical regulations and naval history, both civil and military, of all nations, especially of Great Britain; derived chiefly from original manuscripts, as well in private collections as in the great public repositories: and deduced from the earliest period to the present time. 1800-1802. *London, R. Faulder*, 3 vols lge 4to. I: frontispiece, (2), c. 368 pp., 17 Pl.; II: 496 pp., 36 Pl.; III: 436 pp., 46 Pl.

Charles Derrick: Memoirs of the rise and progress of the Royal Navy. 1806, *London, Blacks & Parry, Cadell & Davies, G. & W. Nicol.* Lge 4to, (2), Frontispiece, (6), ii, 3-309 , (26) pp.

Charles Dupin: Mémoires sur la marine et les ponts et chaussées de France et d'Angleterre, contenant deux voyages faits par l'auteur dans les ports d'Angleterre, d'Ecosse et d'Irlande, dans les années 1816, 1817, et 1818; la description de la jetée de Plymouth, du canal Calédonien, etc. 1818, *Paris, Bachelier*, 8vo, (6), (xiv), 468 pp.

Charles Dupin: Voyages dans la Grande-Bretagne, entrepris relativement aux services publics de la guerre, de la marine, et des ponts et chaussées, en 1816, 1817, 1818, 1819 et 1820. 1821, *Paris, Bachelier*, 6 vols 4to, plus atlas of Plates lge 4to. I. "Force Militaire" - vol. I: (xvi), 280 pp.; vol. II: (viii), (1), 274 pp. II. "Force Navale" - vol. I: (xvi), 280 pp.; vol. II: (vi), (1), 284 pp. III. "Force commerciale" - vol. I: (xxxii), 290 pp.; vol. II: (ix), 288 pp. Atlas: 36 double page Pl.: 10 Militaires, 11 Navales, 15 Commerciales.

Charles Dupin: A tour through the naval and military establishments of Great Britain, in the years 1816-17-18-19 and 1820. Translated from the French. 1822, *London, Sir Richard Phillips & Co.*, 8vo, iv, 116 pp., 2 Pl.

John Fincham: An introductory outline to the practice of ship-building. 1821, *Portsea, William Woodward*, 8vo, 312 pp., 8 Plates. Other editions: 1825 (2nd), 9 Pl.; 1851 (3rd), 6 Pl.; 1852 (3rd enlarged), 2 vols, incl. 17 Pl. & tables, + 22 folio Pl. 1930, facsimile reprint (of third), *Ship Model Society of Rhode Island.*

John Fincham: A history of naval architecture: to which is prefixed, an introductory dissertation on the application of the mathematical science to the art of naval construction. 1851, *London, Whittaker & Co.*, 8vo, viii, (16), ix-lxxxiv, 415 pp., 58 Pl. 1979, facsimile reprint, *London, Scolar Press.*

J.C. Rijk: Handleiding tot de kennis van den scheepsbouw, ten dienste der jonge officieren en adelborsten, van de Koninklijke Nederlandsche Marine. 1822, *Rotterdam, Arbon & Krap*, 4to, (18), 298 pp., 6 Pl.

David Steel (ed.): The elements and practice of naval architecture. 1805, *London, P. Steel*, 2 vols: 4to, (xvi), 438, (139) pp., ill., 9 Pl.; Atlas folio 38 Pl., some fldg.

David Steel (ed.): The shipwright's vade-mecum; a clear and familiar introduction to the principles and practice of ship-building: including the more complex rules of arithmetic made use of in that art; with so much of the principles of practical geometry and mensuration as are required in the practice thereof; also a description of the sliding rule; rules for the admeasurement of timber, etc. .... with view of launch of a 40-gun frigate. 1805, *London, P. Steel*, 1 vol. lge 8vo, 360 pp., frontispiece 40-gun frigate; separate Atlas 4 lge Plates. Facsimile reprint shortly to be published by *Jean Boudriot Publications.*

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Robert G. Albion: Forests and sea power: the timber problem of the Royal Navy, 1652 - 1862. 1926, *Harvard University Press.*

P.W. Bamford: Forests and French sea power, 1660 - 1789. 1956, *University of Toronto Press.*

Daniel A. Baugh: British naval administration in the age of Walpole. 1965. *Princeton University Press.*

Daniel A. Baugh (editor): Naval administration 1715-1750. 1977. *Navy Records Society, vol. 120.*

Jean Boudriot: Le vaisseau de 74 canons, 4 vols. 1970-1973. *Paris, Jean Boudriot Auteur-Editeur.*
English translation by **David H. Roberts**: The seventy-four gun ship: Vol. I: Hull Construction; Vol. II: Fitting out the Hull; Vol. III: Masts - Sails - Rigging; Vol. IV: Manning, Shiphandling, Life on Board. 1985-1988, *Paris, Jean Boudriot Auteur-Editeur.*

Jean Boudriot: Collection Archéologie Navale Française. Some 15 volumes describing the ships of the French Royal Navy and the merchant service. *Paris, Jean Boudriot Auteur-Editeur* and *A.N.C.R.E.* See the back flap of the dust jacket of the present volume for a complete list.

Jaap R. Bruijn: De Admiraliteit van Amsterdam in rustige jaren, 1713-1751: Regenten en financiën, schepen en zeevarenden. 1970, *Amsterdam, Scheltema & Holkema.*

Jonathan G. Coad: Historic architecture of the Royal Navy. 1983. *London, Victor Gollancz.*

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G. Lacour-Gayet: La marine militaire de la France sous la règne de Louis XV. 1902, *Paris, Champion.*

J.O. Lindsay (editor): The Old Régime, 1713-1763. 1957. *Cambridge University Press.*

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Nicholas A.M. Rodger: The wooden world: An anatomy of the Georgian Navy. 1986. *London, Wm. Collins.*

A. Vreugdenhil: Ships of the United Netherlands 1648-1702. 1938, *Society for Nautical Research Occasional Publications No. 5 Pt. IV, Cambridge University Press.*

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Anonymous: Termes desquels on use sur mer dans le parler. Avec les pièces et parties d'un vaisseau et de ses manœuvres. Le tout par ordre alphabétique, tiré des plus habiles auteurs, pilotes et matelots. 1681, *Le Havre de Grâce, Jacques Gruchet*, 12mo, 50 pp., 1 Plate: "Description d'un navire royal"; pp. 1-45 contain "Termes", and 46-50 "Livrées ou couleurs des Pavillons ou Bannières pour la connoissance ou instruction de chaque Nation qui met des Navires en Mer".

Anonymous: The gentleman's dictionary. In three parts, viz. I. The art of riding the great horse . . . II. The military art . . . III. The art of navigation; explaining the terms of naval affairs; as building, rigging, working and fighting of ships; the post and duty of sea-officers, &c. With historical examples taken from the actions of our fleet. Each part done alphabetically, from the sixteenth edition of the original French, published by the Sieur Guillet, and dedicated to the Dauphin. With large additions, alterations and improvements, adapted to the customs and actions of the English; and above forty curious cuts, that were not in the original. 1705, *London, H. Bonwicke et al.*, 376 pp., 3 fldg. Plates, 1 fldg. Table.

Nicolas Aubin: Dictionnaire de marine, contenant les termes de la navigation et de l'architecture navale, avec les règles & proportions qui doivent y être observées. Ouvrage enrichi de figures, représentant divers vaisseaux, les principales pièces servant à leur construction, les différens pavillons des nations, les instrumens de mathématique, outils de la charpenterie & menuiserie concernant la fabrique; avec les diverses fonctions des officiers. 1702, *Amsterdam, P.Brunel*, 4to, 776 pp., 30 Plates, incl. 12 of flags.

Thomas Riley Blanckley: A naval expositor shewing and explaining the words and terms of art belonging to the parts, qualities and proportions of building, rigging, furnishing & fitting a ship for sea. Also all species that are received into the magazines and on what services they are used and issued. Together with the titles of all the inferior officers belonging to a ship with an abridgement of their respective duties. 1750, *London, E.Owen*, 4to, 191 pp., 337 engr. in margin by Paul Fourdrinier. 1988, Facs. reprint. *Rotherfield, Jean Boudriot Publications.*

Dr William Burney: Falconer's marine dictionary improved and enlarged. A new universal dictionary of the marine; being, a copious explanation of the technical terms and phrases usually employed in the construction, equipment, machinery, movements, and military, as well as naval, operations of ships; with such parts of astronomy, and navigation, as will be found useful to practical navigators. Illustrated with a variety of modern designs of shipping, &c., together with separate views of the masts, yards, sails, and rigging. To which is annexed, a vocabulary of French sea-phrases and terms of art, collected from the best authorities. 1815. *London, T. Cadell & W. Davies and J. Murray*, 4to, xvi, 708, 88 pp., 35 Pl. Other editions: 1830 (identical). 1974, facsimile reprint (of first), *London, Macdonald & Jane's.*

Dignus Jacobus Boom: Zeemans woordenboek ten gebruike van zee-officieren .... Dictionnaire de marine .... Naval dictionary .... 1879, *The Hague, van Cleef*, 12mo, 364 pp.

Jacques Bourdé de Villehuët: Manuel des marins, ou explication des termes de marine. 1773, *L'Orient, J. Le Jeune fils*, 2 vols 8vo, 271 & 278 pp., 1 p. unn.

Sr. Desroches: Dictionnaire des termes propres de marine. 1687, *Paris, Amable Auroy*, small 8vo, (xii), 576 pp., 21 Plates (18 of which depicting "Enseignes et pavillons que chaque nation porte à la mer").

William Falconer: An universal dictionary of the marine: or, a copious explanation of the technical terms and phrases employed in the construction, equipment, furniture, machinery, movements, and military operations of a ship .... to which is annexed, a translation of the French sea-terms and phrases, collected from the works of Mess. Du Hamel, Aubin, Saverien, &c. 1769, *London, T.Cadell*, 4to, 12 Plates, pages unnumbered. Other editions: 1771, 2nd; 1776, 3rd; 1779, 4th; 1780, 4th revised; 1784, 5th; 1787, 6th; 1789, 7th; 1802, 8th revised (by Norie – see also that entry). 1970, facsimile reprint (of 4th revised), *Newton Abbott, David & Charles*. See also under Burney.

Georges Guillet de Saint-George: Les arts de l'homme d'épée ou le dictionnaire du gentilhomme, divisé en trois parties. 1. L'art de monter à cheval. 2. L'art militaire. 3. L'art de la navigation. 1678, *Paris, G. Clouzier*, 12mo, 354 pp., 3 Plates. (See also *The Gentleman's Dictionary* above.)

Daniel Lescallier: Vocabulaire des termes de marine, anglois et françois, en deux parties; orné de planches, avec une explication des figures, & définition de quelques termes de marine, principalement ceux de gréement. 1777, *Paris, Imp. Royale*, 4to, (xvii), 287 pp., 31 Plates.

Daniel Lescallier: Vocabulaire des termes de marine anglais et français en deux parties, dont la seconde présente un dictionnaire de définitions, en français, orné de gravures auquel est joint un calepin des principaux termes de commerce maritime, de denrées et productions exotiques et autres accessoires à la marine, en anglais et en français, pour faciliter l'intelligence des voyages maritimes. 1797/8 (An VI), *Paris, F. Didot etc.*, 3 vols 4to, (xxxii), 27, 965 pp., 3 pp. unn., 3 fldg. Tables, 20 double-page Plates.

John William Norie: Falconer improved and modernised. The mariner's new and complete naval dictionary, in two parts: Part I being a copious vocabulary of the British marine; containing a copious explanation of all the technical terms and sea phrases employed in the construction, equipment, furniture, machinery, movements, management, and military as well as naval operations

of a ship; together with a full account of every thing relating to masts, sails, yards, rigging &c., &c. Part II. A modern French marine dictionary; containing all the sea phrases and technical terms used in the marine of the French Republic, and the same faithfully translated into the English language. The whole including all the modern improvements and alterations in the British and French naval tactics, &c. Described as the "Third edition, revised, corrected, and improved". Second title page, which reads "The British mariner's encyclopædia, or, a new, universal, and complete naval dictionary. 1804 (but with dedication dated 1802). *London, , John Baldock; Harrison & Co., Hogg & Thurgood*, 8vo, viii, 484 pp., 12 Pl.

Jacques Ozanam: Dictionnaire mathématique; ou, idée générale des sciences. Dans lequel l'on trouve, outre les termes de cette science, plusieurs termes des arts et des autres sciences; avec des raisonnemens qui conduisent peu à peu l'esprit à une connoissance universelle des mathématiques. 1691, *Paris, Estienne Michallet*, and *Amsterdam*. 4to, 672 pp., 24 Pl., tables, 68 unn. pp. index.

Nicolas-Charles Romme: Dictionnaire de la marine françoise. 1792, *Paris, Barrois*, 8vo, xii, 627 pp., 7 Pl. numbered A, C, M, V, E, G, P. Other editions: 1813 (2nd, "revue et corrigée"). *Paris, Barrois*, 8vo, viii, 564 pp., 7 Pl. numbered as first.

Nicolas-Charles Romme: Dictionnaire de la marine anglaise. In two volumes (sometimes 2 in 1), first volume with subtitle "...., et traduction des termes de la marine anglaise en français; avec des notes et des figures." Second volume with subtitle "...., et traduction des termes de la marine française en anglais; avec des notes et des figures." 1804 (An XII), *Paris, Firmin Didot*, 2 vols, 8vo, xii, 374, (4), 253 pp., 3 pp. adverts, 2 fldg. Pl (numbered Pl. I & Pl. 1ère).

Alexandre Savérien: Dictionnaire historique, théorique et pratique de marine. 1758, *Paris, Ch-A. Jombert*, 2 vols 12mo, pp. 434, 385, (xxiv) pp., 4 Plates. Other editions: 1781, 2nd "corrigée et considérablement augmentée", *Paris, L. Cellot & Ch.-Ant. Jombert*, 2 vols 12mo, (xxxvi), 471, 416 pp., 1 Table, 4 Pl.

Jean-Baptiste Philibert Willaumez: Dictionnaire de marine, suivi d'une appendice sur un modèle de frégate de 1er rang, dont la construction est ordonnée à Brest. 1820. *Paris, Bachelier*, 8vo, vi, (2), 410 pp., 8 fldg. Pl. (2 in colour), numbered A to H. Other editions: 1825, 7 Pl. (none in colour); 1831, "troisième édition, corrigée et considérablement augmentée", 10 Pl. (of which 3 of flags in colour), numbered A, B, C, D, D′, E, F + G, G, H.

Manuscripts.

Anonymous: Procédé que l'on suit ordinairement dans l'assemblage des pièces qui entrent dans la construction d'un vaisseau de guerre. 102 articles on 42 pp. c. 1750. *Service Historique de la Marine, Vincennes.*

Anonymous: Algemene Staat van s'Lands Schepen en Vaartuigen welke zedert den Jaaren 1654 in de Nederlanden zijn Aangebouwd. Catalogue Nº G44, *Nederlandsch Historisch Scheepvaartmuseum, Amsterdam.*

Anonymous: List of ships "Geboudt aan het Colegie ter Adtmiraliteijdt op de Maze". Catalogue Nº H52, *Nederlandsch Historisch Scheepvaartmuseum, Amsterdam.*

Anonymous: Admiralty Progress and Dimension Books. Large folio, 11 vols., Catalogue Nº ADM/180. *Public Record Office, Kew.*

Anonymous: Correspondence between the Admiralty and the Navy Board, Series ADM/A/2256, *National Maritime Museum.*

Anonymous: Portsmouth Dockyard correspondence. Series POR/H/4 and POR/B/5, *National Maritime Museum.*

Sébastien François Bigot de Morogues: Traité de construction. 135 + 2 pp., 13 Pl. 1748? (inscribed with date in another hand, and probably somewhat later - 1755?). Catalogue Nº. M80, *Service Historique de la Marine, Brest* (shortly to be included *in extenso* in a forthcoming book to be published by *Jean Boudriot, Auteur-Editeur*, "Marine Royale: Historique du Vaisseau de 64 canons", with an English edition roughly simultaneously).

Bigot de la Mothe: Correspondance de l'Intendant de la Marine au Ministre de la Marine, Maurepas. Série 1.E.515 *et seq. Service Historique de la Marine, Brest.*

Le Sieur Geslain: various manuscripts, notably : I. 3 avril 1729. Ordre du Roy portant instruction au Sr Geslain son constructeur pour passer en Angleterre. II. 9 avril 1734. Mémoire d'observation sur la construction de la flutte du Roy l'Orox par lequel l'on fait voir la différence qu'il y a dans les ouvrages qui y sont pratiqués d'avec ceux à l'usage ordinaire. Sçavoir les raisons cy aprés observées fezant connoitre que ce vaisseau ne differe en aucun point tant en reduction de la coupe que des liaisons des parties qui le composent aux usages et principes qui s'observent dans les ports du Roy d'Angleterre. *Service Historique de la Marine, Vincennes*. III: 14 février 1731; Rapport concernant son voyage en Angleterre. Duhamel du Monceau Papers, Cat. Nº 8 (9.1), *Peabody Museum of Salem, Salem, Mass.* IV: 10 juillet 1732. Extrait des ouvrages qui ont este le sujet de mon sejour en Angleterre et de ceux dont j'ay rendu compte. Maurepas Papers, Cat. Nº 60 (3), *Cornell University Library, Ithaca, New York.*

Henri-Louis Duhamel du Monceau: Papers in the collections of the Phillips Library, Peabody Museum of Salem, Salem, Mass. The collection contains a number of papers by Ollivier (and much else of interest besides).

Daniel Lescallier & Pierre Alexandre Laurent Forfait: Mémoire de MM. Lescallier et Forfait par lequel ils rendent compte à M^{r} le comte de Luzerne de leurs observations sur la marine pendant leur séjour en Angleterre. 1789, 4to, 129 pp. Several copies in existence, preserved in private collections, *National Maritime Museum, Greenwich, Service Historique de la Marine, Vincennes.*

Maurepas, Ministre de la Marine: Correspondance du Ministre à l'Intendant de la Marine à Brest. Série 1.E.85 *et seq. Service Historique de la Marine, Brest.*

Maurepas: Papers in various libraries in the United States, notably Olin Library, Cornell University Library, Ithaca, New York; Ohio State University, Columbus, Ohio; Rush Rhees Library, University of Rochester, Rochester, New York.

Pierre Morineau: Traité de construction. c. 1740, Catalogue N^{o}. G.246, *Archives Nationales, Fonds Marine.*

Blaise-Joseph Ollivier: Traité de construction, ... etc. Pour servir d'instruction à ses enfans. c. 1733-7. Catalogue N^{o}. B.276, *Musée de la Marine, Paris.*

Blaise-Joseph Ollivier: Remarques sur la marine des Anglois et des Hollandois, faites sur les lieux en 1737. 4to, 362 unn. pp., Pl. *Collection Jean Boudriot.*
Another copy (incomplete, not identical): folio, 262 pp., Plates missing. Catalogue N^{o}. M.68, *Service Historique de la Marine, Brest.*

Blaise-Joseph Ollivier: Traité de construction, contenant par ordre alphabétique la description des vaisseaux de tout rang, galères, frégates, galiottes à bombes, brulots, corvette, flutes et autres batimens de mer qui servent à la guerre, au commerce et dans les ports.... etc. c. 1736, c. 1000 unn. pp. Catalogue N°. 310, *Service Historique de la Marine, Vincennes.* Published 1992, *Nice, Éditions Oméga.*

Blaise-Joseph Ollivier: Le Fleuron. Vaisseau du 3e rang. 1727. Catalogue N^{o}. MS.273, *Service Historique de la Marine, Vincennes.* Published 1992, *Nice, Éditions Oméga*, bound with previous item.

Appendix III:
GLOSSARY OF SHIPBUILDING TERMS

This Glossary of Shipbuilding Terms is translated directly from Blaise Ollivier's manuscript Traité de Construction, *which is preserved at the Service Historique de la Marine at Vincennes (Ref. SHM 310). It was written sometime between 1733 and 1737, in all probability in the period immediately preceding Ollivier's mission to England and Holland. It was published for the first time in 1992 by Éditions Oméga, Nice*. Despite the title, the manuscript takes the form of a dictionary of shipbuilding terminology, an arrangement that was also followed by Duranti de Lironcourt in 1771. The full dictionary runs to over 1,000 manuscript pages (350 pp. in the Oméga edition), and it was clearly not reasonable to attempt to translate all of it here. I have accordingly made a selection of the principal terms, essentially those which form the titles of the Remarks, and certain other terms of particular relevance. Space constraints have made it necessary to abbreviate some of the definitions, especially where detailed dimensions are given. Abridged text is shown in the conventional manner by a series of dots [....], and where dimensions have been omitted, this is indicated by the formula [.... dimensions ....].*

It should be noted that **French** *dimensions are used throughout, and in order to save space these have not been converted.*

It is hoped that even this brief extract (about 10% of the original), will serve both to explain some of the technicalities in terms of practices in the French Navy of the period, and at the same time alert the reader to the existence of this quite extraordinary mine of information assembled by Blaise Ollivier. Despite its somewhat offputting alphabetical format, the content is at least as rich as that of the Remarks, of which it is in some ways the French "equivalent".

David H. Roberts

*The full text in French can be obtained from Jean Boudriot Publications.

APRON [*Contre étrave*]: It is a timber which is fayed to the inner face of the stem of a ship in order to strengthen it and overlaunch its scarphs. It is composed of four timbers in ships of the First Rate and of three in other ships and in frigates and these timbers are arranged in such a manner that their scarphs give shift to those of the stem. The first timber of the apron is scarphed to the rising wood at the bow and to the second timber of the apron; this in turn is scarphed to the third, and the third to the fourth, which runs up to the head of the stem. The breadth of the apron is the same as that of the stem, its thickness is half an inch for every inch of its breadth, save in the part which is above the angle of the forefoot, where the full thickness that the timber will furnish is left on. The scarphs of the timbers of which the apron is fashioned are 2½ to 3 feet long. The apron is fastened to the stem by means of nails at the ends of each timber and with iron bolts driven from without the stem and clenched over roves on the inner face of the apron; it is also made fast by the bolts of the stemson and by those of the hooks which lie over the stem and apron. The apron is always made of oak....

AXIOMETER see **TELL-TALE OF THE TILLER**

BALLAST [*Lest*]: This is a counterweight of stones or of iron which is placed in the hold of a ship to prevent it from oversetting and to give it stiffness under sail. There are two types of ballast, shingle ballast and iron ballast. Shingle ballast is composed of small pebbles and iron ballast of old guns, shells and shot. Many ships are ballasted only with shingle, others have a quarter, a third or a half of their ballast as iron and the remainder as shingle, and in that case the iron ballast is placed first in the hold and the shingle ballast is spread out over the top. There are divers methods of stowing the ballast athwartships: some spread it horizontally, others raise it at the sides, and there are even stowages where it is arranged hog's-back fashion, in other words the ballast is shallower at the sides. The first method has always been the most common, save that in most ships in recent years the iron ballast is placed at the rungheads, which has the same effect as if the ballast were raised up the sides of the ship. As for the stowage fore-and-aft, it is determined by the vessel's lines. There are ships which require that most of the ballast be stowed against the forward bulkhead, and others where on the contrary it is necessary to bring it aft as far as the after bulkhead; finally, there are ships where in order to trim them correctly it is necessary to stow the ballast about the midship bend and to spread it evenly afore and abaft that point. It was formerly held as a general rule that the ballast should be spread fore-and-aft parallel with the lower deck in order to achieve the best trim, but experience has shown that this rule is not adapted to all ships. The shape of the vessel, the ordnance and the stores which it must carry, determine the quantity of ballast which is needed. The shape, because depending on whether the underwater lines are more or less sharp, more or less ballast is required; the ordnance and stores, because depending on how great or small their weight is, more or less ballast is needed to weigh down the vessel to a certain point, even when the ballast needed for the vessel to be stiff enough is greater than the weight of the ordnance and stores permit, which happens in most ships where the underwater lines are very fine. The ballast is loaded nevertheless, because the essential point is for the ship to sail with safety, but the lower deck ports are near awash. I have seen cases of 110-gun ships carrying as much as 600 tons of ballast when stored for 6 months, and others with but 4 to 500. There are 74-gun ships where more than 300 tons of ballast are needed when stored for 6 months, and others where 200 tons and even 170 or 180 tons suffice.... I should not neglect to mention that I have seen one 74-gun ship where only 40 tons of ballast were required: it is the *Grand*, built by Mr Malu at Rochefort.

BEAMS. Gundeck Beams [*Baux du premier pont*]: These are the beams over which are laid the planking, the binding-strakes and the waterways which form the lower deck of a ship.... There are 34 to 36 beams in the lower deck of First Rates, 30 to 34 in Second Rates, 30 to 32 in Third Rates, 28 to 29 in Fourth Rates and 25 to 27 in frigates. These beams are spaced as follows. One beam is placed afore and another abaft the mainmast to form the partners of this mast. They are spaced apart by the full diameter of the mast, plus a fifth part, a quarter or a third of this diameter. Likewise, two beams are placed one afore and the other abaft the foremast, to form the partners of this mast. They are spaced apart the full diameter of the mast plus a fifth or a fourth part of the diameter. Two beams are placed to form the main-hatch. The after beam is placed about 6 feet afore the the forward beam of the mainmast in ships, and about 5 to 5½ feet in frigates, plus the width of one beam. The forward beam of the main-hatch is separated from the after beam by the whole length fore-and-aft of the hatchway. A beam is placed to support the bitts, which is called the bitt beam. This beam is placed 2½ feet or 3 feet abaft the foremast. Two beams are placed to form the cable-hatch. The forward beam of these two beams is 12 to 13 feet from the bitt beam in First Rates, 10 to 11 feet in Second Rates, 9 to 10 feet in Third Rates and 8 to 9 feet in Fourth Rates and frigates. The second beam is distanced from the first by the full length fore-and-aft of the hatchway. Two beams are placed to form the after-hatch. The forward beam of the two is placed about 6 feet plus the thickness of one beam abaft the after beam of the mainmast in First Rates, where there are usually three beams between the mainmast and the after-hatch, but in all other ships save those of the First Rate and in those of the First Rate where there are but two beams between the mainmast and the after-hatch, and likewise in frigates, the distance between the forward beam of the after-hatch and the beam abaft the mainmast is no more than about 3 feet. The after beam of the after-hatch is distanced from the forward beam by the whole length fore-and-aft of the hatchway. Two beams are placed to support the step of the mizen-mast. These two beams are about 3 feet apart, and spaced equally or nearly so from the axis of the mast. This same arrangement of the beams is observed in the same manner in frigates with only 24 beams, and in First Rates where there are 36 beams. The 13 beams which I have listed are always installed in the order which I have described. The other beams of the lower deck are arranged between the beams which form the partners of the masts and the hatchways. There are one or two between the forward foremast beam and the deck-hook, two, three or four between the bitt beam and the forward beam of the cable-hatch, three, four or five between the after beam of the cable-hatch and the forward beam of the main-hatch, one between the after mainmast beam and the forward beam of the after-hatch (this latter beam is found only in First Rates). The other beams are placed equal distances apart between the after beam of the after-hatch and the beams of the mizen-mast and between these and the deck-transom. The distance between the beams of the lower deck, save those which form the hatchways and the partners of the masts, is 2 feet 10 inches to 3 feet 2 inches in both ships and frigates alike. The beams of the lower deck are always made of oak. Their length is determined by the breadth of the ship to inside of frame, in the different places in which they are put. They are 16 to 17 inches square in First Rates, 14 to 15 inches in Second Rates, 13 to 14 inches in Third Rates, 12 to 13 inches in Fourth Rates and 10 to 11 inches in frigates. Some Builders give them 3 lines of round up for every foot of length, others but 2 lines or 1 and ¾. Many Builders diminish the scantling of the foremost and aftermost beams by one or two inches. The lower deck beams are supported at their ends and scored down 3 or 3 ½ inches culver-tail fashion in the clamps which are called the gundeck clamps. They are also strengthened at each end by means of a timber or iron knee, and supported for the most part at their middle by pillars in the hold. A number of scores are cut into the beams of the lower deck, some to receive the binding-strakes and inner waterway and others to allow the ends of the carlings to be let down into them. Their lower edges are chamfered by one inch to within 4 or 5 feet of their ends.

Middle Deck Beams [*Baux du second pont*]: These are the beams over which are laid the planking, the binding-strakes and the waterways which form the [middle deck of three-decked ships and the] upper deck of a ship and of a frigate. There are two beams more on this deck than on the lower deck; they are placed directly over those of the lower deck .... , save those in the way of the bitts and the bitts abaft the bitts, which are set further forward by the full beam's width or nearly so, to leave space to bitt and unbitt the cables. The second beam forward of the mizen-mast is also set a foot further forward than the lower deck beam, to leave sufficient opening for the after ladderway. From the mizen-mast to the stern the beams are spaced equal distances apart. It is in this area that the two extra beams of the upper deck are placed. The aftermost beam is set immediately over the helm-port transom. Most Builders place the beams which are over the cable tier equal distances apart between the beam which is over the lower deck beam abaft the cable-hatch and the beam which is above the lower deck beam abaft the bitts, with no regard for the arrangement of the lower deck beams below. Others place them directly over the lower deck beams, inserting in three decked ships one extra beam between those which are overhead those forming the fore and after sides of the hatchway. These beams are always made of oak, save only in frigates where they are sometimes of fir. Their length is determined by the breadth of the vessel to inside of frame when

they are in the way of a frame timber, and to inside of plank when they are between two frame timbers. They are 13 inches square in First Rates, 12 inches in Second Rates, 11 inches in Third Rates, 10 inches and ½ in Fourth Rates, and 7, 8, or 9 inches in frigates.... The round up of the beams of the upper deck is 2 lines and a half to 3 lines and a half for every foot of length.....

Upper Deck Beams [*Baux du troisième pont*]: These are the beams over which are laid the planking, the binding-strakes and the waterways which form the upper deck of a ship of the First Rate. There are two beams more than in the middle deck.

Made-Beams [*Baux armés*]: These are beams composed of three pieces and which serve as beams for the upper deck in ships of all Rates and for the beams of the quarterdeck and forecastle. One of the pieces of a made-beam is called the middle piece, and the two other pieces are called the arms. The middle piece extends from one end of the beam to the other, and the arms are each half the length of the beam. In their assembly with the middle piece there are a large number of hooks and this assembly is strengthened with bolts driven in from above and clenched over roves beneath. Made-beams keep their round up longer than beams of a single piece, so that it is not strictly for lack of timber of sufficient size that made-beams are used, it is almost always in order to have beams which do not lose their round up so soon. Many Builders make no use at all of made-beams.

Beams of Pieces [*Baux de pièces*]: These are beams of 2 or 3 pieces which serve for the decks, forecastle and quarterdeck of ships in place of beams of a single piece. The scarphs of the timbers of a beam of two pieces are about one third the length of the beam, and the scarphs of the timbers which make up a beam of three pieces are about a quarter the length of the beam. In these scarphs there is a hook of about one inch and their ends are cut obliquely. The assembly of the pieces is strengthened with several bolts clenched over roves and by two nails at the lips of the scarph.

Orlop-Beams [*Faux baux*]: These are the beams which are laid athwartships in the hold in ships and frigates to strengthen and bind together the two sides of the vessel by means of the knees which are fastened at their ends, and to serve as a support for some of the platforms. There are 9 to 12 orlop-beams in First and Second Rates, 7, 8 or 9 in Third Rates, 6 to 8 in Fourth Rates, and 4 or 5 in frigates of the first order. It is rare to fit orlop-beams in frigates of the second or third order. The orlop-beams are distributed as follows. One beam is placed against the forward face of the bitts, which is to say beneath the bitt beam; one in the way of the forward bulkhead, one forward of the well and one in the way of the after bulkhead. If there be a fifth beam to be placed, it is set abaft the well, and if there be several more, they are arranged between the beams of the forward bulkhead and the well, and between the beams of the well and the after bulkhead, taking care only that they do not obstruct any of the openings in the lower deck. In First Rates, one of these beams is in the way of the bitts abaft the bitts. Recently, many ships have an orlop-beam in the cable-tier to support the platform for the small bower cable. All the orlop-beams are set 5 feet 3 or 4 inches below the beams of the lower deck in First Rates, 5 feet 1 or 2 inches in Second Rates and 5 feet in Third and Fourth Rates and in frigates. Their ends are snaped to fit the shape of the hull and butt against the planking of the ceiling; their length is determined by the vessel's breadth where they are placed; their scantling is within 1 or 2 inches of that of the lower deck beams and their round up is equal to that of those same beams. The orlop-beams are made of oak, of a single piece or of two pieces scarphed together as indicated in the article on made-beams. They have at each end a knee which called an orlop knee. Most Builders omit the knee under the beam of the issuing room, and support the beam instead by means of a cleat nailed to the ceiling.

BINDING STRAKES [*Iloires ou Hilloires*]: These are pieces of timber laid fore-and-aft and scored down into the beams of the decks to fasten the ship from bow to stern.... They are distinguished as the middle binding strakes and the side binding strakes, double and single binding strakes.

Middle Binding Strakes [*Iloires du milieu*]: These are two strakes of timbers 4, 5, 6, 7 or 8 feet apart in the middle of the deck, and which, on the lower deck, border the hatchways and on the middle and upper decks border the gratings.

Side Binding Strakes [*Iloires des côtés*]: These are two rows of binding strakes, one on either side, between the middle binding strake and the waterway.

Double Binding Strakes [*Iloires doubles*]: These are binding strakes laid double, two strakes wide.

Single Binding Strakes [*Iloires simples*]: These are binding strakes composed of a single run of plank.

Binding Strakes of the Gundeck [*Iloires du premier pont*]: These are the binding strakes laid over the beams of the gundeck. There are four rows of double strakes in the decks of ships, frigates and fireships, of which two border the hatchways, which are the middle binding strakes, and the others are laid between the middle binding strakes and the waterway, one on the larboard side and one to starboard. The distance between the middle binding strakes in the way of the main-hatch is equal to the breadth of this hatchway. This distance is reduced aft by about a third, and is fixed forward by the distance from outside to outside of the pins of the bitts. The binding strakes of the gundeck run all the way from the deck transom to the deck hook. They are composed of pieces of oak 25 to 50 feet long, butted end to end so that the butts of the two strakes give shift to each other. In First Rates, the planks are scored down 3½ inches and lapped over the beams, 3 inches in Second and Third Rates, 2¾ inches in Fourth Rates, and 2½ inches in frigates. They are 11 to 12 inches wide in First and Second Rates, 10 to 11 inches in Third and Fourth Rates, and about 10 inches in frigates. Their thickness is equal to the thickness of the planking of the deck plus that of the scores. They are dubbed flush with the upper face of the planking of the deck, and they are fastened to the beams with nails. In some ports the strakes are fastened together with treenails. There is a rabbet cut into the sides of the side binding strakes to receive the butts of the ledges. This rabbet is covered by the deck planks.

BITTS [*Bittes*]: These are two timbers raised upright in a ship and crossed by a third timber which is called the cross-piece and around which the cable is wound when the ship is at anchor. In both ships and frigates the bitts butt against the after face of the second beam of the gundeck abaft the foremast, into which they are scored and let down by one or two inches; this beam is called the bitt beam. They also butt against the after face of the first orlop-beam, called the bitt orlop-beam, and they are fastened to both the beam and the orlop-beam with fore-locked bolts. The bitts rise up from the bottom of the ship to about six inches short of the lower face of the upper deck beams; their heel is supported by the ceiling and strengthened by a standard or by a half floor-rider. Each bitt-pin is reinforced above the level of the deck by a timber called the standard of the bitts, which runs forward along the deck. The bitts are 19 to 20 inches square in First Rates, 17 to 18 inches in Second Rates, 15 inches in Third Rates, 13 to 14 inches in Fourth Rates and 12 inches in frigates. This scantling is maintained from the head of the pins to about one foot or one foot and a half below the beams of the gundeck, and then reduces to half or three fifths at the heel. The distance between the pins is equal to twice or one and three quarters times the circumference of the cable.... In warships, there is at the head of the pins a hole through which an iron pin is passed when the cable is bitted to prevent it from riding off. This pin is called a norman.... The bitts are made of oak in both ships and galleys.

Bitts abaft the Bitts [*Contre-bittes, Secondes bittes*]: These bitts are installed against the after face of the third beam abaft the cable-hatch in First Rates.... They serve the same purpose, have the same shape, the same scantlings, the same fastenings and the same strengthening as the bitts which are the subject of the preceding article. They are also crossed by a cross-piece. There are bitts abaft the bitts only in First Rates.

BLACK STUFF [*Bitume*]: This is a composition of sulphur and tar which has been employed recently to pay the underwater hull of ships in the place of white stuff. Black stuff differs from white stuff in that it is better mixed and enters the pores of the wood more readily and is preserved longer....

BO'SUN'S STOREROOM [*Fosse aux lions*]: This is an apartment formed afore the bitts in the hold of warships and frigates where spare rope, blocks and other items are stowed. Its length is determined by the distance between the bitts and the stem, its breadth is limited by the two sides of the ship, and its depth includes all the space between the keelson and the deckhead. There is a flat in the storeroom which is erected 5 feet or 5 feet and a few inches below the beams of the gundeck, and beneath this flat there is a powder room on either side in ships of the First, Second and Third Rates. Also in the Bo'sun's storeroom, and to larboard or to starboard, there is a second storeroom s into which all the smaller spares

are put. Access to the main storeroom is by way of a scuttle cut in the lower deck afore the bitts, and access to the area beneath the flat is by way of a another scuttle placed below the first. Both scuttles are called the scuttles of the Bo'sun's storeroom.

BREADROOMS [*Soutes à pain*]: These are the storerooms in which the biscuit is stowed. They are situated below the gundeck abaft the after main bulkhead, and stretch as far as the bulkhead of the Gunner's storeroom. There are five breadrooms in ships and frigates, of which two are placed on the larboard side and two to starboard of the passageway arranged in the middle, and the fifth is placed abaft the former storerooms and runs athwartships. The breadrooms are separated by planked bulkheads. Entry is by way of a sliding scuttle cut in the bulkheads forming the passageway, or else by a similar scuttle in the after main bulkhead, and access from one breadroom to the next is by means of other sliding scuttles in the bulkheads separating the breadrooms. The breadrooms which are situated closest to the after main bulkhead are called the first breadrooms. The two others are called the second breadrooms, and the last the fifth or transverse breadroom. The breadrooms do not reach to the sides of the ship, for they are separated from them by the full width of the carpenter's walks. They are tarred on the inside, and in some ships lined with knittles or with tin-plate. They are heated before the biscuit is stowed, in order to dry out the dampness of the timber. There is a hole one foot square in the deck over each of the breadrooms which is used for passing down the biscuit as it is stowed. These holes are sealed and caulked once the biscuit has been taken on board, and the biscuit is removed as required by means of the scuttles which I have described. The area of the breadrooms is determined by the quantity of biscuit needed to feed the crew for six months. Sometimes, in ships commissioned for long cruises, other breadrooms are made in the between decks if those in the hold are insufficiently large for such campaigns. Such new breadrooms are set up abaft the main capstan or abaft the mizen-mast, one on either side, divided up into two or three parts depending on their size. Their size is determined by the amount of biscuit to be stowed, on the basis of one cubic foot for every 20 pounds of biscuit. It is in these same places that the breadrooms are set up in storeships and other transports where all the space in the hold is needed for them to carry as much cargo as possible.

BREADTH [*Largeur du vaisseau*]: This is the distance from one side of a ship to the other to inside of plank in the way of the midship bend and at the height of breadth. The terms breadth extreme, breadth at the midship bend, and breadth amidships are also used, but the word breadth used on its own is the most common. When the thickness of the timbers is not included in the breadth, it is called the breadth to inside of frame, and when the thickness of the hull planking is to be included it is called breadth to outside of plank, but it is always understood that this breadth is measured at the midship bend and at the height of breadth. Shipwrights only measure the breadth to inside of plank, save that some take it at the height of breadth and others at the load waterline, disregarding the breadth at the height of breadth, but in such cases it is called the breadth at the waterline, for the word breadth on its own implies breadth at the height of breadth. The breadth of First and Second Rates is 39 to 40 lines for every foot of length from stem to post. The breadth of Third Rates is 38 to 39 lines, and that of Fourth Rates and frigates is 37 to 38 lines.... Ships which have a great breadth are more suitable for battle than those which are narrow, because there is more room for their guns, but narrow ships sail better and are faster, especially close-hauled.

Breadth at the Beakhead Bulkhead [*Largeur au coltis*]: This is the breadth of a ship of war at the bulwarks in the way of the beakhead bulkhead. The breadth at the beakhead bulkhead is 10 to 10 and a half inches for every foot of the breadth at the bulwarks at the midship bend. The greater this breadth, the more apt is the ship for boarding, for it allows the ship to approach the enemy more closely in the upper works so that the men can jump aboard the enemy with less difficulty.

Breadth at the Height of the Fashion-pieces [*Largeur à la tête des contre-cornières*]: This is the breadth of the ship to inside of plank at the top of the fashion-pieces. It exceeds the breadth at the taffarel fife rail by about 6 inches on either side.

Breadth at the Taffarel Fife Rail [*Largeur au couronnement*]: This is the breadth of the ship to inside of plank at the highest point of the stern, in the place where the taffarel fife rail is to be found. Ships and frigates have a breadth at the taffarel fife rail which is 7 or 8 inches for every foot of the breadth at the wing transom.

Breadth at the Waist [*Largeur au vibord au milieu*]: This is the breadth of a ship to inside of plank at the height of the waist-rail at the midship bend. This breadth is equal to the breadth of the ship, less the amount of the tumbling home at the midship bend. Ships of war which have a great breadth in the waist are much esteemed because this gives space for fighting.

Breadth at the Wing Transom [*Largeur à la lisse d'hourdis*]: This is the breadth to inside of plank at the height of the wing transom. It is also called the length of the wing transom. It is 8 to 8 and a half inches for every foot of breadth in First Rates, 7 and three quarters to 8 inches in Second Rates, 7 and a half inches to 7 and three quarters in Third and Fourth Rates and in frigates....

BREAM, TO [*Caréner un vaisseau, donner la carène à un vaisseau*]: It is to caulk the seams of the bottom of a ship or to go over the seams which have already been caulked, and to pay the underwater hull with black stuff or white stuff. A new ship is breamed while on the stocks before she is launched; she is also breamed every three years when laid up and not commissioned, and every time that she is commissioned. To bream a ship which is on the stocks they start by caulking the all seams of the bottom up to the load waterline; they are payed with pitch, and then the ship is graved, and to prevent any accidents of fire, tubs of water are placed all round the ship and on deck; and by placing a fire board below the lower wales. Once the ship has been graved the scaffolding is erected on which the caulkers work to go over the caulking and to pay the bottom. The breaming of a ship which is afloat is either done by hauling her out in a dock or else while floating. When it is in a dock the arrangements are the same as those described for ships on the stocks, and when it is floating the vessel is hauled down on one of her sides until the keel is out of the water on the other side; she is graved progressively as she comes out of the water, in two or three stages, and she is righted in seven or eight stages as her seams are caulked and her bottom paid with stuff. The same operation is repeated for the other side. The workmen who labour at this work are on rafts which are made fast with iron chains. Whenever a ship is hauled down, some planks are prepared in advance, of the same thickness as the ship's bottom planking, so as to be able to shift any plank which is found to be spoiled.

CABINS [*Chambres*]: These are the apartments which are made in ships to quarter the officers. In ships of war and frigates they are distinguished as the wardroom, great cabin, stateroom, captain's and second captain's quarters, officers' cabins. They are distinguished furthermore by their location, thus wardroom cabins, upper deck cabins, quarterdeck cabins, poop cabins.

Great Cabin [*Chambre de conseil*]: This is a cabin set up abaft the mizen-mast on the upper deck in First Rates and on the quarterdeck in other ships, and which runs from one side of the ship to the other. It measures about 20 feet fore-and-aft in First Rates, measured from the stern-timbers, 15 to 16 feet in Second Rates, 13 to 14 feet in Third Rates. Most Fourth Rates do not have a great cabin, and there is never one in frigates. The great cabin is illumined by the stern-lights and by one or two lights cut in the ship's side larboard and starboard. Access, in ships of the First Rate, first order, is by way of an antechamber, and in other ships from a passageway. In ships of the line there is a stern gallery flush with the deck of the great cabin, and there are two doorways leading to it in First Rates, and one or two doorways in smaller ships. Ships of the First Rate, first order, have a second great cabin on the quarterdeck, as I shall explain below when talking of the quarterdeck cabins.

Stateroom [*Chambre de commandant*]: These are the quarters accorded to an Admiral, Vice-Admiral or Rear-Admiral commanding a fleet. These quarters are set up on the upper deck in First Rates.... In those of the second and third order the stateroom includes the great cabin, a day cabin, a bureau situated to starboard of the day cabin, a passageway and the stern gallery. [.... *dimensions* ....]

Wardroom [*Grand chambre*]: It is an apartment which is set up on the upper deck of two-deckers and frigates, situated 3, 4 or 5 feet abaft the mizen-mast, in which there is the Captain's table and cabins for several of the officers. It is lit by the stern-lights and access is by way of a doorway in the bulkhead which separates the wardroom from the rest of the deck.

Captain's Sleeping Cabin [*Chambre du capitaine*]: This is where the Captain berths in a ship of war. It is situated on the starboard side of the quarterdeck in First, Second and Third Rates. It is situated forward of the great cabin in ships of the First Rate, first order, which usually have

a second great cabin on the quarterdeck. It is in the same place in Second and Third Rates, but in First Rates of the second and third order where the quarterdeck cabins are separated by a passageway as far as the stern gallery, the Captain's sleeping cabin is that which is nearest to the stern on the starboard side. If there is no flag officer on board, the Captain berths in the cabin on the upper deck. Access to the Captain's sleeping cabin is by way of a doorway opening onto the great cabin, and it is lit by a scuttle cut in the ship's side.... [*dimensions* ....]

Second captain's cabin [*Chambre du capitaine en second*]: This is the cabin in ship of war where the second captain berths. It is situated on the larboard side opposite the Captain's sleeping cabin and separated from it by a passageway. Access is by way of a doorway giving onto the quarterdeck or the passageway, and it is illumined by a scuttle cut in the ship's side. This cabin is the same length as the Captain's sleeping cabin, but is narrower by the full width of the passageway which separates them, or else only by two thirds or half the width of this passageway.

Officers' cabins [*Chambres d'officiers*]: These are the cabins which are set up in ships of war to house the officers, some in the wardroom, others on the quarterdeck, and on the poop. These cabins are at least 5 feet 6 inches long and 4 feet wide. There are 8 cabins in the wardroom in First Rates of the first order, of which four are set up against the bulkhead and the other four against the sides of the ship, 2 on either side. In these same ships there are several officers' cabins on the quarterdeck, separated amidships by a passageway. The number of these cabins is greater or less according to the size of the quarterdeck abaft the mizen-mast. First Rates of the first order have 8 cabins on the poop, separated by a passageway. Those of the second order have no more than 3 or 4. Those of the third order have no officers' cabins on the poop, or if there be any, they are arranged as in First Rates of the second order. In First Rates where the stateroom has no antechamber, an officer's cabin is set up in place of this antechamber. In some of these ships there are two officers' cabins forward of the stateroom, placed against the ship's side to larboard and to starboard. Second Rates have 7 officers' cabins in the wardroom, of which three are against the bulkhead and the four others against the sides, two and two. They also have four officers' cabins on the quarterdeck, two forward of the second captain's cabin and two forward of the Captain's sleeping cabin. On the poop, there are four cabins, or else only three. Third Rates have 6 officers' cabins in the wardroom, two against the bulkhead and the four others against the sides, two and two. On the quarterdeck there is an officer's cabin on either side, one forward of the Captain's sleeping cabin and the other forward of the second captain's cabin, or, more commonly, four cabins as in Second Rates. Some Third Rates have 3 officers' cabins on the poop, but most ships of this Rate have none. 20 years ago they all had, and they have been done away with since we lowered the height of the upper works. Fourth Rates which have no great cabin have no officers' cabins save on the quarterdeck, but when they have a great cabin the arrangement of the cabins is as in Third Rates, save that there is but a single cabin on the quarterdeck forward of the Captain's sleeping cabin and another forward of the second captain's cabin. Frigates have four officers' cabins on the quarterdeck or more commonly three cabins. The officers' cabins set up in the wardroom are formed with canvas screens or panels of fir which are simply held in place with hooks so that they can be struck down when clearing for action. They were formerly only separated one from the other by canvas curtains and these are still to be seen in some ships; in this state they are less inconvenient in wartime. These cabins are illumined by windows opened in their bulkheads or in their doors, and these windows receive the light from the cabin lights of the wardroom. The officers' cabins on the upper deck of three-deckers have scuttles in the ship's side, as have those on the quarterdeck which are next to the side, otherwise they have windows in their doors or in their bulkheads. It often happens that the officers' cabins on the quarterdeck are in the way of a gunport, in which case the guns are struck down in peacetime, or else the cabins are done away with in wartime. The officers' cabins set up on the poop are lit by windows in the stern or else in their doors. There are ships which have an officer's cabin on either side in the wardroom abaft the doorways to the quarter galleries.

Deck cabins [*Cabanes*]: These are small lodgings erected on the poop of ships of the line and on the quarterdeck of frigates for the bo'sun's mates or the master's mates or only for the Bo'sun or the Master. They are built fore-and-aft along the sides of the ship, or else athwartships against the stern. In ships where there are officers' cabins on the poop, and on the quarterdeck of frigates, the deck cabins are placed fore-and-aft afore these cabins, but in ships where there are no officers' cabins on the poop, the deck cabins run back as far as the stern, and it is in such cases that they are ordinarily set up athwartships. The length of these cabins is about 6 feet, their breadth is 3 feet 3 inches to 3 feet ½ and they have all the height that the bulwarks allow them but this height never exceeds 3 feet 9 inches, for when it is higher officers' cabins are built, unless the number of officers' cabins be already sufficient. The deck cabins are formed of scantlings of oak, and with pine or fir deals one inch thick which are cyphered or laid clinker-fashion. These deals are then covered with tarred canvas. Each cabin has a sliding door 26 to 30 inches square.

CABLE-TIER [*Fosse aux câbles*]: It is the place where the cables are stowed in ships of war, frigates, fireships and bombs. It is situated in the hold abaft the bitts between the bo'sun's storeroom and the main hold and separated from the bo'sun's storeroom by the latter's bulkhead and from the main hold by the forward main bulkhead. Its length fore-and-aft is determined by the distance separating the bitts from the after beam of the cable-hatch; its breadth is limited on either side by the ship's sides, and in height it occupies all the space between the keelson and the deckhead, less the height of the flat built at the bottom. Access to the cable-tier is by way of a scuttle cut in the lower deck and called the cable-hatch, and it is by way of this same hatchway that the cables are passed up or down. There are a number of stopper rings in the cable-tier fastened in the riders which serve to stopper the cables. In most warships there is also a flat for the small bower cable. The cable-tier is done away with on occasion in Third and Fourth Rates and in frigates when they are cruising, in which case the cables are stretched out over the top of the stores in the hold between the bitts and the mainmast. This practice used also to be employed on occasion in First and Second Rates in ordinary commissions, with a view to relieving the bow of the great weight of the cables.

CAPSTAN [*Cabestan*]: It is a wooden cylinder placed vertically, and which is turned round by main strength by means of several levers which are applied to it, to raise the anchor or other burdens, to haul ships ashore, and for heaving them down when breaming them.... Capstans are distinguished as double barrelled capstans, main capstans, fore jeer capstans, spindle capstans and flying capstans or crabs.

Main capstan [*Grand cabestan*]: This is the largest capstan in a ship, which is established on the gundeck between the mainmast and the mizen. It is also called the double barrelled capstan because it has two barrels. The parts of the main capstan are the spindle, the heel of the spindle, the lower barrel, the upper barrel, the whelps, the whelp chocks, the fillings, the pin, the bar-holes, the bars, the pawl-holes, the hoops and the bar-hole plates. The main capstan is placed amidships, equidistant or near equidistant from the main jeer-bitts and the after ladderway, in such a way that neither the main jeer-bitts nor the after ladderway interfere with the turning of the bars, which would be sure to happen if care were not taken over this matter, not so much in large ships, where there is always more than enough room, but in Fourth Rates and frigates where there is only just enough room. This capstan runs up from the lower deck to 4 feet 3, 4, 5 or 6 inches above the deck above, so that the lower barrel turns on the lower deck and the upper barrel on the deck above. The height of the barrels is about 4 feet or 4 feet 2, 3, 4, 5 or 6 inches in big ships. The diameter of the spindle is equal to the circumference of the main bower cable, or else exceeds this circumference by one or 2 inches. The diameter of the lower barrel is equal to one and two thirds or one and three quarter times the circumference of the main bower cable. The diameter of the upper barrel is one or two inches smaller than that of the lower barrel to make it easier to drive on the hoops. The heel of the spindle is 2 or 3 inches smaller in diameter than the spindle and 2 or 3 inches shorter than this same diameter and it is let down for the whole of its length into a step at the level of the lower deck so that the lower face of the lower barrel is only a few lines above the step. The iron pivot which is placed at the end of the heel of the spindle rests on a plate which is also of iron called the saucer and let down into the bottom of the step. The main capstan in First Rates has ten bar-holes in each drumhead, into which are inserted the same number of bars, of about 10 feet in length. There are 8 to 10 bar-holes in the drumheads the main capstan in Second Rates, for the same number of bars measuring 9 to 10 feet; 8 in each drumhead in Third Rates and 6 or 8 in Fourth Rates and frigates, for bars measuring 8½ to 9 feet. These bar-holes are placed 3½ feet above the deck and are all at the same level, and they are bounded at their top and bottom by iron hoops; their walls are lined with

metal plates called bar-hole plates. Similar iron plates are applied to the spindle where it passes down through the upper deck, and to the heel where it passes through the lower deck; these plates are scored down into the timber by their whole thickness.... The main capstan serves to raise the anchor by means of a rope called the messenger which is made fast to the cable and is passed round the lower barrel; it also serves to hoist the topmasts, to hoist the mainyard, and for divers other tasks. Care is always taken to leave a space between the beams of the middle deck, the upper deck and the quarterdeck which is overhead the main capstan, of 2 or 3 inches more than the diameter of the lower barrel so that it can be stepped and unstepped without difficulty.

Fore Gear or Jeer Capstan [*Petit cabestan*]: This is the capstan which is installed forward of the galley fires on the upper deck of ships, and which extends to 4 feet or 4 feet and a few inches above the forecastle. Its parts are the same as for the main capstan, save that it has but a single bar-hole in the lower barrel and at most 6 or 8 in the upper barrel. The fore jeer capstan is situated amidships, equidistant from the forecastle breastwork and the fore jeer bitts. The diameters of the spindle and of the upper barrel are equal to three fifths or two thirds of the diameters of the spindle and of the lower barrel respectively of the main capstan. The lower barrel is about a quarter less in diameter than the upper barrel, and in most ships it is fashioned to an eight-square. The heel of the spindle is furnished like that of the main capstan with an iron pivot, and the heel drops into a step placed on the planking of the upper deck. The fore jeer capstan has but a single bar about 15 inches long in the lower barrel, which serves to make fast the lines which are being turned round the capstan; the upper barrel has 6 or 8 bars about 6 feet long. This upper barrel is hooped with two iron hoops and the drumhead is covered by a sheet of lead. The fore jeer capstan serves to haul down the tack of the maincourse and the forecourse, to send up the fore topmast, to hoist the foreyard, and for divers other uses.

CARLINGS OF THE DECK [*Arc-boutants des baux*]: These are the small pieces of timber which are laid fore-and-aft between the beams of the decks, of the forecastle and of the quarterdeck, to hold them in place and at the same time to serve as support for the ledges.... There are two rows of carlings on either side on each deck, and a third down the middle, but only between those beams which do not form the hatchways. They are let down about 1 inch into the beams and their upper face is placed the full thickness of the ledges below the upper face of the beams so that when the ledges are laid on top of the carlings they lie flush with the beams. The breadth and thickness of the carlings is equal to or nearly equal to one third of the breadth and thickness of the beams between which they are laid. They are usually made of oak. A half-inch chamfer is taken off the corners of the lower face of the carlings of the lower deck and in place of this chamfer they work a quarter-round moulding in the same edges of the carlings of the middle and upper decks, the forecastle and quarterdeck. Many Builders omit the middle line of carlings, using only those on either side.

CARPENTER'S WALK [*Galerie de combat*]: It is a passage 2 feet and a half to three feet in width which runs along the side of the ship in the hold of a warship from stem to stern on either side. When the ship is in action men are stationed here to stop any leaks which might be occasioned at the waterline by the enemy's guns. The carpenter's walk is set up over the orlop-beams; its deck is formed by planks resting on the orlop-beams or on other scantlings; its sides are formed on the one side by the ship's side and on the other by the bulkheads of the storerooms in the hold and by upright timbers crossed by a few planks in the area to which the storerooms do not extend. Walks of the same kind are set up in frigates and fireships....

CEILING [*Vaigrage*]: This is the cladding of planks inside the hull of a ship laid over the frame timbers to join them one to the other and to strengthen them.... The ceiling is described as being plain, let down, horizontal, oblique, parallel to the keel, planked full, and with air strakes....

Plain Ceiling [*Vaigrage simple*]: Describes the planking when it is laid over the timbers without hooks.

Let down ceiling [*Vaigrage de liaison*]: Describes the ceiling when the strakes are let down over the frame timbers. In former times many Builders used to employ this form in the sides of the hold of warships ...., but they were abandoned 15 years ago in favour of oblique planking. For all that, the latter are today esteemed less by most Builders than a let down ceiling. The type which was used in warships consisted of eight or ten strakes assembled in pairs one over the other and arranged so that the plain butts of one strake made shift with the butts of the other. The first pair of strakes ran at the height of the rungheads and the others were distributed between the first pair and the shelf, so that there was a space of 10 to 13 inches between each pair of strakes. They were scarphed at their forward end to the breasthooks and aft to the sleepers and the transom knees, thus forming a continuous belt running right round the ship; they were let down 3 inches with a square mortice over the frame timbers, fastened with bolts driven through the outer planking of the hull and clenched over roves set against the planking on the inside. The timber used for this thickstuff was of oak and measured 25 to 50 feet long. Their breadth was 13 to 14 inches in First and Second Rates, 12 to 13 inches in Third Rates, 11 to 12 inches in Fourth Rates and 10 to 11 inches in frigates. Their thickness was equal to the bottom planking, plus 3 inches....

Horizontal Ceiling [*vaigres horizontales*]: This is when the strakes of the ceiling are laid parallel to the ribbands and the clamps....

Oblique Ceiling [*Vaigres obliques*]: This is composed of plain strakes laid obliquely across the frame timbers. They came into use about 30 years ago; they were invented by the Sieur Goubert, Deputy Inspector of Shipbuilding, to be laid in the sides of the hold of ships of war in place of the plain horizontal planking of the ceiling which some Builders used at that time and which provided insufficient resistance against the hogging of the ship. And since that time oblique planking has also been laid in place of the let down strakes, so that there are now no other kind in the sides of the hold of warships. It is claimed that they prevent the hogging to which all parts of a ship are exposed, or that at least they delay that hogging. Nevertheless, today there are some Builders who hold a contrary opinion, and while they certainly give a preference to oblique planking over horizontal strakes, they prefer let down strakes more. The oblique strakes run from the rungheads or from the last strake of the footwaling as far up as the strakes immediately below the clamps, and they form an angle of about 36 degrees with the frames. Those of the fore-body are sloped forward and those of the afterbody slope aft. They are butted at their ends by two timbers called binding strakes, one of which forms part of the planking of the floor and the other lies beneath the clamps. They are notched to receive the ends of the oblique strakes, or else lie over them. These oblique strakes do not replace the horizontal strakes entirely, since they must needs leave between them, in the middle part of the length of the ship, a long area where the strakes are laid horizontal, but which are not fastened in any way to the oblique strakes.

Strakes Parallel to the Keel [*Vaigres parallèles à la quille*]: These are plain strakes laid in the bottom and in the sides of a ship, parallel to the keel, and which run from bow to stern like the horizontal strakes. The use of strakes parallel to the keel is new; as yet they have been employed only in the ships of the East India Company where they appear to give a better fastening than horizontal strakes.

Footwaling [*Vaigres du fond*]: These are the strakes of the ceiling which form the bottom of the hold. They are plain and are laid flat over the floors and crotches; they run from bow to stern in several strakes of oak plank joined by plain scarphs. There are several strakes laid side by side so that the butts give shift. The first strake is laid 8 or 9 inches from the keelson so as to leave sufficient space between this strake and the keelson for the limbers, and the last strake is at the rungheads [.... *dimensions* ....]. They are fastened to the frames with nails and by means of the treenails of the bottom planking of the hull which run right through the ship's bottom. In ships which are planked obliquely in the ceiling, the strakes of the footwaling which are furthest from the keelson do not run like the other strakes as far as the stemson and the sternson knee but are shorter, the first by 6 to 8 feet at either end, the second by 12 to 15 feet and the last by 18 to 20 feet, and their butts serve to chock some of the oblique strakes at the bow and the stern.

CHAINS [*Chaînes d'hauban*]: These are the iron chains which are fastened to the wales of a ship and which run up to the edge of the channels to secure the shrouds of the mainmast, the foremast and the mizen-mast.... Each of the chains of the fore- and mainmast is composed of two links, one preventer-plate and a deadeye strap. The preventer-plate is fastened to the ship's side at either end by bolts which are clenched or forelocked on the inside of the hull. The toe-link is also fastened to the ship's side by one of these bolts. The upper link is threaded through the toe-link and the deadeye strap which passes round the deadeye. The deadeye strap is sunk into a score which is made in the

channel. The mizen chains are similar to the main chains, save that they have no preventer-plate; their toe-link is fastened directly to the ship's side with a bolt. There are 10 chains for the main shrouds in First Rates, 9 to 10 for Second Rates, 8 to 9 for Third Rates, 8 for Fourth Rates and 6 or 7 for frigates. For the fore shrouds there is one less chain on either side. There are 5 or 6 chains for the mizen shrouds on either side in First and Second Rates, 5 in Third and Fourth Rates and 3 or 4 in frigates. Care must be taken to distribute the chains in such a way that they do not obscure the gunports, nor that they get in the way of the serving of the guns situated above the channels. Care is also taken when building a ship to ensure that the frames or the filling-timbers are placed at all the points where the bolts of the chains pass, so that they do not fall in a space and thus have all the solidity necessary. The chains are made of the best iron which it is possible to find. Several spares are stowed on board.

CLAMPS [*Serre-bauquières*]: These are long timbers fayed to the frame timbers of a ship on the inside like plank and which run from bow to stern to serve as a support for the ends of the beams. In ships of war they are distinguished as the clamp of the gundeck, of the middle deck, of the upper deck, of the quarterdeck and forecastle and of the poop.... **Gundeck Clamps** [*Serre-bauquières du premier pont*]: These are the clamps on which the gundeck beams rest, being scored down culvertail fashion. They run from bow to stern, one on either side of the ship, from the middle of the apron to the deck transom in several timbers measuring 25 to 50 feet in length, joined by flat scarphs 2½ to 3 feet long, in the middle of which there is a hook. [.... *dimensions* ....]. The gundeck clamps are fastened to the frame timbers by the bolts of the riders and of the knees and by two nails in each timber where there are no bolts. The gundeck clamps are made of oak. [*Similar description and dimensions for other clamps.*]

CROSS-PILLARS [*Enrayures*]: This is an assembly of several timbers which radiate like spokes from the hold of a ship as far as the gundeck beams. There are two cross-pillars in some warships, one in the way of the main forward bulkhead, the other in the way of the main after bulkhead. Each is composed of two timbers called scantlings or uprights, four timbers called the arms, and of a filling piece. The scantlings measure 8 to 9 inches square and are tennanted into a false rider. They run up vertically to a gundeck beam to which they are fastened with bolts. The arms are 8 to 9 inches broad and 6 to 7 inches thick, they are tennanted into the false rider and run diagonally to the gundeck beam to which they are bolted. The filling piece is 2½ to 3 feet in length, 18 to 20 inches thick from top to bottom and 5 to 6 inches broad; its end is sunk into a channel cut in the scantling on the inner face and driven in with a sledge. The practice of fitting cross-pillars in warships was introduced only 35 years ago, and most Builders no longer use them today, by reason of the fact that the bolts which secure them to the beam sheer at the first heavy sea so that thereafter the cross-pillars are of no further service to the ship.

DEADRISE [*Acculement*]: The deadrise is the distance measured at the rising line of floor above the keel. It is important not to confuse the ends of the floors with the rising line of floor. These two points do not always coincide at the same height, for the floors are allowed to run up higher than the rising line if the timber permits, whereas the rising line of floor at the midship bend is always fixed by the length of the flat of the floor and at the other bends by the point through which the first runghead ribband passes. Thus the deadrise runs in all the floors from the upper face of the keel to the level of the first runghead ribband without regard for the ends of the timbers themselves, which may rise higher to a greater or lesser extent and which may not even rise by the same amount on either side (see **Floors**). When a ship is described as having 1 or 2 feet of deadrise, this means that it is the midship bend which displays that amount of deadrise. The midship bend is always that which has the least deadrise, in the other floors the deadrise increases nearly in arithmetical progression, the further they are from the midship bend, and this increase is greater with the floors of the afterbody than with those of the fore-body, so that the stern of the ship may sink deeper into the water than the bow (see **Draught of Water**). The common opinion is that the greater the deadrise in ships of war and frigates, the more fit this makes them for sailing close to the wind, for giving the vessel a great draught of water has the effect of making her less leewardly. The extreme deadrise in the ships built by Me Pangalot has been remarked upon. This Builder gave up to 3 feet of deadrise to his ships and even to his frigates, and he was so skilled in placing in the entry and in the run aft that capacity which he did away with by virtue of the steep deadrise that not only were his vessels fast sailers but for the most part they also had a good height of gundeck sill, had easy rolling and pitching motions, and carried their sail well. No other Builder has employed such a great deadrise, many have come close to it and have failed. A middling deadrise on the other hand cannot but give a sufficient capacity and all the stiffness necessary to carry sail well, it can result in easy motions; whereas it is difficult when allowing a steep deadrise to build a ship which will be a fast sailer, it is apparent that it is yet more difficult when allowing but a middling deadrise which gives lines in the underwater body which are less apt to cleave the water, and which makes the ship more leewardly because it reduce the draught of water. Most Builders hold the middle ground between the deadrise of 3 feet such as Me Pangalot gave his ships with such success, and that of 5 to 7 inches which is to be found in certain ships which have been built recently and with equal success, and they give 16 to 24 inches of deadrise to First Rates, 18 to 24 inches to Second Rates, 17 to 24 inches to Third Rates, 16 to 20 inches to Fourth Rates, 16 to 24 inches in frigates. I likewise sought the middle ground in the deadrise of the ships for which I give the plans. The rule which I have imposed upon myself to simply report the practices without favouring one in particular prevents me from elaborating further in this article, which is however one of the most important in all shipbuilding; and I am constrained yet further in that having been myself the first to reduce the deadrise and having reduced it in my first ships to but a quarter of what was usual and then to a fifth part, that which I have to say on the subject might be suspected of partiality....

DISPLACEMENT [*Déplacement d'eau d'un vaisseau*]: It is the room occupied by a ship in the water, or the volume of water which it displaces when she is loaded to her load waterline. The reader will know that a ship sinks into the water until it has displaced a volume of water of a weight equal to that of the ship and everything aboard. It is as a consequence of this principle that Builders calculate the weight of a warship, of its rigging and munitions before determining the shape of its underwater hull, so that it will displace at its load waterline the exact mass of water equal to this weight. If the Builder errs in his calculation and the ship sinks deeper than its load waterline, the height of gundeck sill will be insufficient, for with warships things are not the same as with merchant ships. In the latter they load but 500 tons if it be unable to carry more than 500, even though designed for 550 or 600. Its load waterline can vary by as much as the height of breadth allows, and it is of no consequence if this merchant ship sinks 6 inches or a foot deeper than its planned load waterline, or, if of some consequence, it can always be remedied by loading it with a smaller burden. But in a warship the objects which make up its burden are such that they cannot be reduced if the displacement at the load waterline should prove insufficient, and yet this load waterline cannot be allowed deeper else one will lose entirely or in part the advantage of being able to serve the guns of the lower deck. Thus it is absolutely necessary to know the laden weight of a ship of war before determining the shape of her hull.Thus, if one has a 64-gun ship to design, it is allowed the length and breadth usual for 64-gun ships. It is not possible to deviate much from this length or breadth, for then one would build a ship to carry a greater number of guns, or else one unable to carry 64. A length of about 142 feet is thus allowed, which is, within 1 or 2 feet more or less, the length necessary for the distribution of 64 guns. A breadth is allowed of 38 feet or 38 feet and a half, which is the breadth appropriate to the recoil of the guns which the ship must bear. Thus, whatever the lines of her underwater hull, she is pierced for 64 guns and her burthen in gear, guns, munitions and victuals is always the same. And if these lines should not displace a volume of water of a weight equal to that of the ship and her burthen, she will carry her load waterline deeper and the gundeck tier of guns will be useless or nearly so. But if by a contrary error the lines of her hull displace too great a quantity of water, this is once again a defect, for she must be weighed down by a greater quantity of ballast to bring her to her correct trim and she will then sail less well.

DRAUGHT OF WATER [*Tirant d'eau*]: This is the vertical height of the part of the ship which is in the water, measured from the top of the keel. The draught of water is marked on the side of the stem and on the side of the sternpost in feet and half feet. A distinction is made between two draughts of water in ships, the draught afore and the draught astern,

and when only the term draught of water is used it is the draught astern which is meant.

Draught of Water Astern [*Tirant d'eau de l'arrière*]: .... The draught of water astern alone determines the number of feet of water needed to float a ship because it is always the greatest draught of a ship.

Draught of Water Afore [*Tirant d'eau de l'avant*]: .... The draught of water afore is always less than the draught of water astern by the whole amount of what is called the difference.

Difference between the Draught Afore and the Draught Astern [*Différence de tirant d'eau*]: .... This difference is of 1½ to 3½ feet in ships of war when correctly trimmed, and between 4 and 30 inches in other ships. It helps to make the ship responsive to the helm and quick in stays, for when the rudder is used to bring the ship about from her proper course, it must necessarily occur that the bow forces the water to the side, to a lesser or greater degree, according to whether she is to deviate more or less from her former course; thus, if the bow is less deep in the water than the stern, it has much greater ease in moving to the side than if it were at the same depth of water. Likewise, a ship is unable to go about without that the bow must turn to the side and in the same space of time by a greater amount than the stern, for the headsails and the impact of the water on the rudder produce this effect, but she will put about the more quickly the less the bow is deep in the water than the stern, for this part, by which I mean the bow, presents a greater surface area to the water than the stern and thus moves more easily and more quickly through the water, whereas, if we disregard the effect of the headsails and of the rudder, the bow and the stern would be equally moved to the side were they equally deep in the water. But if this difference in draught makes the ship more responsive to the helm and quicker in stays, it also has the effect and for the same reasons which I have described, of making her yaw; moreover, it opposes her speed through the water for it gives her a greater draught than would be the case if the draught afore and the draught astern were the same, and it may make her gripe. It is these considerations which have occasioned most Builders, in recent years, to reduce greatly the difference, and we see ships today of the Second and Third Rate where this difference is but 18 inches whereas in former times it was 3, 4 or even 5 feet, as it still is in certain ships, and since it has been found that reducing the difference to half or a third of what was for so many years the practice leaves sufficient for ships to handle well and be quick in stays, it is probable that to take advantage of the benefits of a mediocre difference in draught it would be possible to diminish it yet further in the future. Most Builders determine the difference in draught before draughting the ship so as to balance her at that difference. Without this precaution it can certainly be found by trial and error once the ship is built at what difference of draught she sails best, but the decks are never placed relative to this difference, and it follows therefrom that the height of gundeck sill is too little forward or aft. But whether the Builder has trimmed the ship to a known difference of draught, or whether he has not sought so to do, it is always the ship's lines once she is built which determine the difference in her draught afore and astern, and even though it is possible to increase it or diminish it by moving forward or aft enough weight to increase the depth either forward or aft, it does not follow therefrom that she will sail well with a difference in draught other than that which her lines impose. For example, a ship which is built for a difference of 3 feet can be trimmed so that it is no more than 2 feet, but then she will scend by the stern because she has insufficient support in that part. Likewise, she may be trimmed so as to draw 4 feet more astern, but she will then pitch, because her bow will have insufficient support, and in both the one and the other case she will sail badly and be unresponsive to her helm because the meeting of the water astern will be insufficiently rapid. In order for her to sail well, to answer the helm and to have as easy a motion as is possible taking due regard for her lines, she must be trimmed so that she draws 3 feet more than aft as her lines dictate, and this is what is called trimming a ship to her correct trim. It is true that it is difficult to know what should be the difference in draught afore and astern before the ship has put to sea, but in such case the Builder will propose the trim which seems to suit her best, trimming her to this difference first of all, and a skilful captain will then try, by trimming her to other draughts, sometimes more, sometimes less, to discover whether the trim which the Builder gave her is right for her, or whether it must be increased or diminished by a few inches. As for the difference in draught for a ship which has already been to sea, it is known by the experience which has been made, yet for a second commission the same difference will not be adopted until it has been tried whether a more perfect trim cannot be achieved with a greater or lesser difference.

DRY-DOCK [*Bassin ou Forme*]: This is an excavation into which is taken at high tide a ship which is to be graved or repaired, and where it is left dry after the gates are closed. The parts of a dry-dock are the platform, the aulters, the apron, the flood-gates, the keel-blocks, the stairs, the cisterns and the gullies. The platform of the dock at Brest is 192 feet long, 50 feet wide and has 1½ feet of declivity, towards the apron; it is lined with oak plank. The apron is 22 feet long and 50 feet broad. The first aulter is 3 feet wide and is situated 7 feet above the platform. The slope of the sides of the dock, from the platform to this aulter, is about 20 inches. The second aulter is also 3 feet wide and is situated 8 feet and a half above the first. The slope of the sides between the first and the second aulters is about 20 inches. The edges of the dock are about 9 feet above the second aulter, and the slope of the sides between the second aulter and the edge is once again 20 inches. The full length of the dock, from the gates to the staircase at the back, is 228 feet, its width from one edge to the other is 72 feet, save at the apron and gate, where it is but 50 feet. The flood gate is of two leaves which, when closed, form an obtuse angle together. The keel-blocks of the dock are of timber like the stocks of ships which are building, and they are set out in the same order, but with less declivity. There is an oak plank on the aulters to receive the heels of the shores. The cisterns serve to contain water for when the ships are being breamed; they are 3 feet long, 2 and a half feet wide, and 2 and a half feet deep; the gullies serve to bring the water to the cisterns. When it is desired to bring a ship into dock to repair her or to bream her, shores are prepared such as the size of the vessel requires, and they are raised up on the aulters. Other shores are also prepared to provide a horizontal support to the ship's sides. The ship is taken into the dock as soon as the tide gives enough depth of water for it to be done. It is placed in the middle of the dock and held in this position until the water ahs dropped enough for the keel to touch. As soon as the ship begins to bear her weight on the keel-blocks, the horizontal shores which run from the ship's sides to the sides of the dock are quickly set in place, save that they must be short by about an inch; into this space large slices are introduced with the help of mauls. Next the shores which have already been raised on the aulters are allowed to fall against the ship, and those at the bow and the stern are chocked first. Those amidships are left until the ship has ceased to hog and the keel bears for its whole length on the keel-blocks. The shores are set to support the ship by means of wooden chocks which are nailed to the sides of the ship above the head of each shore. When these operations have been completed, the other shores are put in place as the falling tide exposes the aulters and the platform, and the gates of the dock are closed so that the water no longer enters throughout the time that the men are working to bream or repair the ship. When the vessel has been breamed, the gate is opened, the shores are struck away progressively as the tide rises around the ship, and once it is afloat it is hauled out of the dock.

EKEINGS [*Allonges*]: These are divers timbers which are used in the building of ships and which serve to lengthen other timbers.

FASHION PIECES [*Estains*]: These are two timbers with a double curvature which form, one on either side, the last frame timbers at the stern of a ship.... The length of the fashion pieces is determined by their mould, which some Builders arrange in warships to run from the wing transom and others from the helm-port transom. Their shape is likewise determined by their mould. Their breadth exceeds by one inch the breadth of the frame timbers, and their thickness is the same as that of the frame timbers. In some ships, especially those with a square tuck, the two fashion pieces are joined at their heels, where they are fayed and bolted to the inner face of the sternpost or to the inner post if there be one. In others, the heels of the fashion pieces are separated by one or two feet from the inner face of the post and scarphed to the arms of a crotch placed between the post and the fashion piece and which runs down to meet the sternson knee. Finally, there are some ships where the heels of the fashion pieces are placed 3 or 3 and a half feet forward of the post, resting against the lowermost transom and scarphed to the arms of the last crotch of the run aft. Whatever the manner in which their heel is positioned, their head always rises to the two ends of the wing transom to which it is scored down and fastened with one or two bolts. The fashion pieces are fastened in like manner to the helm-port transom when they run up that far, which is rare, save in certain ships built in the

Mediterranean ports. They are fastened in like manner to the deck transom and other transoms. In most ships with a round tuck the fashion pieces are placed forward of these transoms, whereas with a square tuck they are invariably abaft the transoms. The fashion pieces are scarphed to the side counter timbers or form a square butt with these timbers, and in this case the fashion piece and the side counter timber are fastened together by means of a timber called the forward fashion piece, which is scarphed and bolted to both the timbers. The fashion pieces are made of oak.

FLOOR [*Varangue*]: This is the first and the principal timber which goes into the construction of all the frames save those in the narrowing forward and aft, that part which rests on the keel and which serves as the framing of the ship's bottom.... There is a floor for each bend of timbers; a distinction is made between the crotches of the narrow body fore and aft and the floor timbers; they are laid athwartships and laid out at equal distances one from the other...., the distances including the thickness of the first futtock as well as the space between the frames which is called the room. The shape of the floors is determined by the figure of the ship; their length ends at the first floor ribband or, more commonly, a few inches above that ribband [.... *dimensions* ....]. In most ships their sided dimension is equal to their moulded dimension at their heads, but in a few recently-built ships this sided dimension exceeds the moulded dimension at the runghead by 2, 3 and even 4 inches and entirely or nearly entirely fills the room between the floors. In some ships the floors are simply laid across the keel and in others they are scored down 2 inches and half-lapped over the rising wood, but with one or the other method they are always fastened to the keel, each with a bolt driven up from underneath the keel and clenched over a rove on top of the floor, or more commonly on top of the keelson.... The floors are made of oak, and when the timber is not thick enough to provide the required deadrise, the heel of the floor is furred with a piece called a furring....

Half-Floor [*Demi-varangue*]: This is a piece of timber which goes to make up a frame, which is fayed to the forward or after face of the floor timber, and which runs from one side to the other to the heel of the lower futtocks.... Half-floors are only used in the frames situated between the narrowings of the bow and the stern because in the other frames the futtocks of either side meet and butt at the keel or else are separated by such a small distance that there would be no room to insert a half-floor. The practice of employing half-floors in the building of a frame is not followed by all Builders, some leave them out altogether and leave empty the space which is left between the heels of the first futtocks of each frame. The figure of the half-floors is determined by the mould of the ship; their length is equal to or nearly equal to half the length of the floors and their scantling is the same as that of the floors. They are laid flat over the keel or scored down into the rising wood like the floors and they are fastened to the floors by three iron bolts or more commonly by three treenails, and to the keel by a bolt driven up from below and clenched over a rove overhead the keelson. The half-floors are of oak.

Rising Floors [*Varangues acculées*]: These are the floors which are nearest to the narrowing of the entry and the run aft, those situated between the floors of the middle body and the crotches, the ends of which rise extremely high above the keel. The figure of the rising floors is determined by the mould of the ship; they finish at the first ribband or a few inches above or below this ribband, according to the length of timber which is available; their vertical thickness amidships is 2, 3, 4, 5 or 6 inches greater than that of the floors of the middle body, depending on how far away they are placed and the degree of their deadrise. Their moulded and sided dimensions at their ends are equal to those of the floors of the middle body....

FOREFOOT [*Brion*]: This is the first timber of the keel in a ship, that which forms part of the keel and part of the stem.... The forefoot describes a partial curve, the part which is joined to the keel being straight like the keel and the other curved following the curve of the stem. The length of the keel and the rake of the stem are both measured from the angle of the forefoot. The length of the forefoot is not fixed, for it is always made as long as the timber will allow. It has the same breadth and thickness as the keel, save that on its outer face it is dubbed away in some ships by about an inch. It is scarphed at one end to the heel timber of the stem and at the other end to the second timber of the keel; the scarphs measure 4 to 5 feet and are hooked, or else are plain. They are lined with kersey and strengthened by two nails at either end and by 3 or 4 bolts. On either side of the forefoot there is a rabbet similar to that of the keel, and which fairs with the rabbet of the stem into which are fitted the hooding ends of the planking of the bottom. The forefoot is always made of oak. Many storeships have no forefoot, and in the past warships were also built without one; in such cases, the end of the keel is half-lapped to the heel timber of the stem and this join is strengthened with bolts and crossed by the apron. This practice is no longer followed in France save in a few ports and then only in the building of ships' boats.

FRAMES [*Couples*]: This is an assembly of several timbers laid across the keel so as to form the vertical shape of the ship from the keel to the bulwarks. It is also called a mould or bend, but frame is more common. There are roughly the same number of frames in all ships of the line and frigates, even though the length of frigates differs by almost half from the length of a First Rate, but since the timbers which go to make up the frames of a frigate are of lighter scantling than those which are employed in big ships, the number of frames is always the same or nearly so and the difference resides only in their scantling; this number is between 60 and 70, according to whether the distance which is left between the frames be greater or smaller. This distance is called the room, it is of 3 to 4 inches in First Rates, 4, 5 or 6 inches in Second and Third Rates, 5, 6 or 7 inches in Fourth Rates and frigates. Each frame in a warship is made up of a floor or crotch, two first futtocks, two second futtocks, two third futtocks, two fourth futtocks and two toptimbers, and all these timbers are scarphed together for half their length. Often in First and Second Rates there are two fifth futtocks which are added to the frames, when the timber is not sufficiently long and of sufficient compass to furnish the whole height without fifth futtocks. Frames are distinguished as either moulded frames or filling frames.

Moulded frames [*Couples de gabarit*]: These are the frames the timbers of which are cut to a mould given by the Builder and assembled on these same moulds. The number of moulded frames is in no way determined, many Builders establish 15, 18 or 20 at equal distances one from the other along the whole length of the ship, so that enough room is left between for two or three filling frames. Others fashion as many moulded frames as there are frames in the middle body and then place three or four moulded frames spaced equally apart in the narrowing of the fore-body and the same number in the narrowing of the afterbody, with sufficient space between for two or three filling frames. With this method there are more moulded frames than filling frames, and with the other there are more filling frames. Some Builders only assemble the moulded frames to the height of the gundeck sills and then finish them after they have been crossed over the keel, but most Builders have all the timbers right up to the bulwarks cut and assembled at the same time. The construction of such a frame is done as follows. I will suppose that it is a moulded frame with fifth futtocks. All the timbers which make up the frame are shaped according to the moulds given by the Builder, the floor to the floor mould, the first futtocks to the first futtock mould and so on for the other timbers, and the timbers are marked with the same sirmarks as are to be found on the moulds. The assembly of the timbers is done on a piece of flat ground, or if the ground be uneven it is corrected by means of blocks, the upper faces of which are perfectly level over the whole area taken up by the frame. The floor timber is laid over these blocks with the second futtocks at the same level, one at either end of the floor, and the two fourth futtocks at the heads of the second futtocks and finally the two toptimbers at the heads of the fourth futtocks. The whole mould of the frame is offered up to the timbers laid out in this manner. A chalk line is set in the middle of the frame with the help of compasses and secured by a nail to the block. The rules for the opening of the height of breadth and bulwarks are offered up to the frame and the futtocks are moved in or out according to the requirements of the rules or of the mould, until the frame has in all its parts the external shape represented by the mould. The floor and the futtocks are then secured in position by means of nails which are driven one on the inside and the other on the outside of each timber into each block. The mould and the rules are removed. The first futtocks are laid on top, half over the floor and half over the second futtocks, the third futtocks next, half over the second futtocks and half over the fourth futtocks; and finally, the fifth futtocks, half over the fourth futtocks and half over the toptimbers. Once these timbers are position the rules are offered up again to check that the opening of the frame has remained exact, and once it is so, a plank is laid across at the level of the height of breadth or a little above which runs from one side to the other of the frame, which is called the cross-spale of the height of breadth; at the height of the bulwarks is placed another similar plank called the cross-spale of the bulwarks.

These two planks are lapped at their ends by about an inch over the frame timber and two or three holes are drilled in them which go down 1 or 2 inches into the frame timber. A saw kerf is made in the middle of each cross-spale to mark the middle of the frame as shown by the chalk line, and the cross-spales are numbered so that they can be put back in their place once the frame has been crossed over the keel. Once these operations have been completed, the timbers which make up the frame are fastened together by means of square bolts, and since the frame cannot be lifted whole, only some of the timbers are bolted together and only the holes are bored for the square bolts of the others so that the frame can be taken apart. Some Builders bolt the floor to the first and second futtocks, and fasten separately the third futtocks to the fourth, and the fifth futtocks to the toptimbers, so that the frame is in three parts. Others bolt the first futtocks to the floor, the second futtocks to the third and the fourth, and the fifth to the toptimbers, so that the frame is in five parts. Once the frame has been bolted and bored thus, it is taken apart so that the ground may be used for assembling another frame. When all the moulded frames have been built, the first part of each frame, by which I mean the floor or the the crotch to which are fastened the first futtocks and sometimes the second futtocks as described above, is crossed over the keel. The first ribband is set up. Shores are placed at this ribband, two for each frame, one on either side. A level is placed on a plank laid on its edge over the ribbands next to each frame and the shores are forced in on either side if the frame needs to be raised or lowered. When this operation is complete the futtocks which go to complete the frame are added. They are offered up to the pieces which they touch when the frame is assembled; iron pins called gauge-rods are inserted into the holes already bored for the square bolts and when all the holes are aligned with each other the gauge-rods are removed and the bolts are put in their place. The timbers forming the two sides of each frame are assembled simultaneously, and once they have been bolted the cross-spales are offered up and nailed to the frame timbers using the holes which were drilled when the frame was first assembled. Thus the frame takes up the same figure as it had when it was laid out on the ground. Once the cross-spales have been put in place, a plumbline is hung from the saw kerf marked in their middle and once all the shores are in place the frames where the plumbline does not fall true on the middle line of the keel are forced in or out. This practice of using a plumbline is not employed by all Builders.

Filling frames [*Couples de remplissage*]: These are the frames the timbers of which are shaped to the moulds of the ship itself, after the moulded frames and the ribbands are in place. They occupy the space which is left between the moulded frames. The filling frames are merely assembled timber by timber as the work progresses. Their floors are placed as soon as they have been shaped and they are chocked in place over the keel and against the ribbands; next, all the first futtocks are set up, followed by the other timbers up to the toptimbers. Care is taken when placing the filling frames to distribute their fourth and fifth futtocks and their toptimbers so that these timbers form the sides of the gunports.

FUTTOCKS [*Allonges*]: These are divers timbers .... which form the frames.

First Futtocks [*Genoux de fond*]: These are the timbers which go to the building of the frames.... The first futtocks are scarphed for half their length to the floors and for the other half to the second futtocks, and each scarph is strengthened with three square bolts which are clenched flat.... The shape of the first futtocks is determined by the mould of the ship.... Those which are scarphed to the floors of the middle body describe a curve which is nearly the arc of a circle and they are hard to procure, but those which are scarphed to the rising floors are less compassed and easily found. There are two to each floor, one on either side of the ship. Their length in warships is as great as the timber will allow, but care is always taken to ensure that this length be not less than 8 to 9 feet so that they scarph 4 or 4½ feet. [.... *dimensions* ....] The first futtocks are always made of oak.

Second Futtocks [*Allonges premières*]: These are the curved timbers which form part of a ship and which rise from the heads of the floors and crotches to meet the heel of the fourth futtocks. Each floor and crotch has two second futtocks, one on either side of the ship; they are scarphed for half of their length with the first futtocks and for the other half with the third futtocks; their scarphs are strengthened each with three square bolts, which have flat heads rivetted. Some Builders have a hook placed in the scarphs of the second futtocks. The length of the second futtocks is as great as the timber will allow, but timber is never employed which will not furnish futtocks at least 9 feet in ships and 8 feet in frigates, for the scarphs must not be less than 4 feet or 4 feet and a half in length. [.... *dimensions* ....] They are always fashioned of oak....

Third Futtocks [*Allonges secondes*]: These are pieces of compass timber which form part of the frames of a ship and which run from the head of the first futtocks to the heel of the fifth futtocks. They scarphed for half of their length to the second futtocks and for the other half to the fourth futtocks.... The third futtocks of ships where the frames are made up of but five futtocks on either side run up as far as the port sills of the lower deck ports, and when the frames are made of six futtocks the third futtocks finish 2 or 3 feet below the gundeck.

Fourth Futtocks [*Allonges troisièmes*]: These are the pieces of compass timber which form part of the frames of a ship and which rise up above the heads of the second futtocks. In each frame there is a fourth futtock on either side; they are scarphed for half of their length to the third futtocks and for the other half to the fifth futtocks or to the toptimbers.... Their scantling is the same as that of the third futtocks, save that they are sided about a fifth part less at their heads.... They are usually made of oak. The fourth futtocks of ships where the frames are made up of but five futtocks on either side run up until they lie flush with the upper face of the middle deck, and when the frames are made of six futtocks the fourth futtocks finish at the lower sills of the gundeck ports.

Fifth Futtocks [*Allonges quatrièmes*]: These are pieces of compass timber which form part of the frames of a ship and which are raised over the heads of the third futtocks. In frames which have but five timbers over the floors and where the fifth timber finishes the side of the ship, they are called the toptimbers; but in frames which have six timbers, the fifth futtock runs only as far as the surface of the upper deck. They are scarphed for half of their length to the fourth futtocks and for the other half of their length to the toptimbers. [.... *dimensions* ....] They are ordinarily made from oak. These fifth futtocks are only to be found in some First and Second Rates, in which the timbers were not to be procured in sufficient length to form the frames with five timbers above the floors.

GALLEY, or GALLEY FIRES [*Cuisine ou Cuisines*]: This is the place where the crew's meat is cooked. It is situated on the upper deck of First Rates, two deckers and frigates alike, beneath the break of the forecastle amidships. The galley fire is built inside a casing formed by four stanchions of oak the length of which is equal to the distance from the deck to the deckhead. These stanchions are set upright at the four corners of the casing. The fore and after faces of the casing are formed of oak planks about 2 inches thick nailed against these stanchions. These planks are reinforced on the outside by two other planks arranged to form a St Andrew's cross. The sides of the casing which face the ship's sides are also berthed up with oak planks 2 inches thick up to the height of the hearth. The bottom of the casing is formed by a floor raised 6 or 8 inches above the deck and made up of oak planks about 3 inches thick. A layer of gravel or salt a foot thick is laid over this floor, and the hearth is made over the top of this gravel or salt of bricks laid on edge. A wall of bricks is built in the middle of the hearth to separate the fire into two parts of which one is called the captain's fire and the other the crew's fire. The former faces to starboard and the latter to larboard. The inner faces of the casing are covered with a double layer of tin plate and several iron bars provided with hooks are set up across the walls to serve as anchorages for the coppers. The top of the casing is covered by a large plate of copper, placed a short distance from the hood and pierced by two square holes which correspond to the chimneys. The casing is fastened to the deck by four iron standards and made fast to the beams of the deckhead. The deckhead is lined with tin plate all about the galley fire. The masonry of the galley fires is broken up at the end of each commission so that it can be rebuilt anew at the beginning of the next. Ships which have no forecastle have their galley fires against the side of the ship between two gunports....

GANGBOARDS [*Passavant*]: This is a piece of deck 2½ to 3 feet wide which runs along the side of the ship from the quarterdeck to the forecastle, and 8, 10 or 12 inches lower than them.... There are gangboards on either side of the ship in all ships of the line and in most frigates. They are formed of fir boards 1¾ to 2 inches thick resting on iron or timber knees. The gangboards are arranged in such a manner that they can be struck down in the way of the mainmast in order to set up the spar-shores of this mast when the ship is to be careened. In most

ships the breadth of the gangboards is greater at the break of the forecastle and the quarterdeck than for the remainder of their length. Access to the gangboards is by means of one or two ladders. In frigates and even in some Third and Fourth Rates the gangboards are at the level of the gunwale, in which case they are narrower because the gunwale itself forms part of their width.

GRATINGS [*Caillebotis*]: These are trellises of wood placed in the middle and upper deck and in the quarterdeck of ships to provide ventilation to the between decks and to allow the smoke to escape when the ship is in action. There are gratings laid over all the beams of the middle and upper decks between the ladderways of the mainmast to that closing the after side of the cable hatch, and from the main jeer bitts to the after ladderway, save for the area occupied on the middle deck by the partners of the main capstan; on the quarterdeck of ships and frigates there are gratings laid over all the beams from the breast-beam to that closing the fore side of the after ladderway. The gratings in the decks and quarterdecks stretch athwartships in the middle of the deck between the two middle binding strakes, and the upper face of the gratings lies flush with the upper face of the binding strakes.... The gratings placed in the middle and upper decks overhead the main hatch are divided into four parts, and in some ships, the grating placed between these gratings and the main ladderway are divided into two parts. The timbers which make up the gratings are called the cross-battens and the ledges of the gratings. The cross-battens are laid athwartships 2¼ or 2½ inches apart and rest in a rabbet cut in the sides of the binding strakes. The ledges are laid fore-and-aft and scored down by their full thickness into the cross-battens and 2¼ to 2½ inches apart; the joints are strengthened by nails. The gratings of the decks and of the quarterdeck can be removed whenever necessary.

Cross-battens of the Gratings [*Lattes de caillebotis*]: These are small timbers 2 inches wide and half an inch thick laid fore-and-aft 2 inches apart over the ledges. The cross-battens are scored down into the ledges by their whole thickness and they are fastened by means of four small nails to each ledge.

Ledges of the Gratings [*Barrotins de caillebotis*]: These are the small timbers into which the cross-battens of the gratings are scored down. The ledges are placed athwartships between the middle binding strakes, 2 to 2½ inches apart. They have 1 inch or 1½ inches more round up than the round up of the beams of the deck between which they are laid. Their length is determined by the distance which separates the binding strakes. Their scantling is 2½ inches square in the gratings of the middle and upper decks and 2 inches in the gratings of the quarterdeck. They are bearded at their ends and rest in rabbets cut in the binding strakes. They are also supported in their middle by a carling which runs over the top of the beams. There are several scores cut in the ledges to receive the whole thickness of the cross-battens. The ledges of the gratings are made of oak or of fir.

GUNPORTS [*Sabords*]: These are the embrasures pierced in the dead-works and upper works of a ship for the guns. The gunports are distinguished by the calibre of the guns which are to be placed there; for example, a gunport is called a 36-pdr port if it is to be armed with a 36-pdr gun. They are also distinguished as the lower deck ports, middle deck ports, upper deck ports, forecastle or quarterdeck ports, poop ports, gunroom ports, bowchase and sternchase ports. There are three dimensions which are counted in gunports which are the height of sill, the width and the height. The height of sill is the perpendicular distance from the deck to the gunport, the width is the distance from one side of the port to the other and the height is the perpendicular distance from the lower to the upper sill. The distance between ports is the space from one port to the next.

48-pdr Ports [*Sabords de 48*]: These are the ports in which 48-pdr guns are placed. They have 2 feet 2 inches height of sill, 3 feet 2 inches width and 2 feet 10 inches height and they are only to be found on the lower deck of First Rates of the first order.

36-pdr Ports [*Sabords de 36*]: [.... *dimensions* ....] These ports are only made on the lower deck of First Rates of the second and third order and on the same deck of Second Rates. They are made wider in the former because the sides of the ship are thicker than in Second Rates so that the guns could not be aimed with the same facility if the width of the ports were the same.

24-pdr Ports [*Sabords de 24*]: [.... *dimensions* ....] These ports are pierced on the lower deck of Third Rates.

18-pdr Ports [*Sabords de 18*]: [.... *dimensions* ....] These ports are pierced on the middle deck of First and Second Rates, on the lower deck of some Third Rates and on the same deck of Fourth Rates. A greater height of sill is allowed to 18-pdr ports on the lower deck than to those on a higher deck in order to raise them higher above the water, which is unnecessary on a higher deck because it is always high enough. This height of sill was formerly 21 inches on the middle and upper decks of all ships, as it is yet today in many, and it is only recently that some Builders have reduced it to 19 inches in order to lower the height of this tier of guns and thus lower the centre of gravity of the ship. 18-pdr ports are larger in First Rates than in other ships for the same reasons which I have given in the article on 36-pdr ports.

12-pdr Ports [*Sabords de 12*]: [.... *dimensions* ....] These gunports are pierced on the upper deck of First Rates, the upper deck of Third and Fourth Rates and in frigates of the first order and in storeships of 8 to 900 tons. A greater height of sill is allowed for 12-pdr ports when they are pierced on a lower deck than is the case on a higher deck for the same reason as given in the article of 18-pdr ports.

8-pdr Ports [*Sabords de 8*]: [.... *dimensions* ....] These ports are pierced on the forecastle and quarterdeck of First and Second Rates, on the upper deck of Fourth Rates of the second order, on the lower deck of frigates of the second order, on the upper deck of frigates of the third order, on both decks of fireships or else only on the lower deck, and in bomb ketches....

6-pdr Ports [*Sabords de 6*]: These ports are pierced on the quarterdeck and forecastle of First Rates of the third order and on the upper deck of frigates and fireships.

4-pdr Ports [*Sabords de 4*]: [.... *dimensions* ....] These ports are pierced on the poop of First and Second Rates, on the quarterdeck and forecastle of Fourth Rates and in frigates, and on the gundeck of sloops-of-war.

Lower deck Gunports [*Sabords de la première batterie*]: These are the gunports cut in each side of the ship over the lower deck along a line parallel to this deck. The number of gunports on the lower deck is determined by the number of guns which compose this tier, and the ports have the height of sill, width and height appropriate to the calibre of these guns. Which is to say that if the lower deck guns are for 36 pounds weight of ball, the ports are given the dimensions marked under the article concerning 36-pdr ports, and likewise of the others. Lower deck ports for 48-, 36- and 24-pdrs are set 7 feet 6, 7 or 8 inches apart; for 18-pdrs, 7 feet 2 or 3 inches; and for 12-pdrs, 7 feet or 7 feet 1 inch. The first gunport at the bow is set back from the stem by an amount measured in a straight line equal to two gunports' distance, and the aftermost port is set back from the inside of the wing transom by about 6½ to 7 feet in ships and about 6 feet in frigates. The rule to leave two gunports' distance between the stem and the foremost port is only followed as long as the gun is able to find sufficient room to recoil in the breadth available up to the standards of the bitts, and when the room is not to be found, which is fairly common in ships other than First Rates, a lesser distance is allowed if the breadth permits, which is always to be found in First Rates and in some Second Rates when they are very bluff in the bows. The lower deck ports are closed by lids. They are furnished with ringbolts and hookbolts for securing the guns. These ports are kept closed when the ship is at sea and they are only opened when clearing for action, or when the weather is fine, in which case only the weather ports are opened, or if some of the lee ports are opened it is those towards the stern. In roadsteads and in harbour the lower deck ports are always kept open.

Upper deck Gunports [*Sabords de la seconde batterie*]: These are the ports cut in either side of a ship above the upper deck, along a line parallel with this deck. There is one more port on either side than on the lower deck in ships of every rate and in frigates of the first order. The number of ports on the upper deck is determined in other frigates by the number of guns in the battery. The height of sill, width and height of these ports is regulated by the calibre of the guns as I have explained for the ports of the lower deck. The upper deck ports are opened in the ship's side at equal or near equal distances one from the other and in the space between the ports of the deck below.... Thus, the distance between ports on the upper deck is greater than that between the lower deck ports by all the difference which there is between the width of the ports on the two decks.... But in frigates, which have no lower deck tier of guns, the gunports of the upper deck are cut 6 feet or 6½ feet apart. There are frigates where there is as much as 9 or 10 feet separating the aftermost gunport and the second to last, so that the captain's cabin, which is situated in this area, does not have to be struck down when clearing for

action. In many ships, the first gunport at the bow and the last at the stern on the upper deck are situated 6 to 9 inches closer to their neighbouring ports, so that they can find more room in the breadth of the ship for their recoil and also that they are sufficiently far from the beakhead bulkhead and from the stern to be served easily. In First Rates, the upper deck ports are closed by lids like the lower deck ports, but in all other ships and frigates they are closed by half-ports.

GUNROOM [*Sainte-Barbe*]: This is an apartment which is contrived in the between decks of warships and frigates abaft the mizen-mast. The gunroom is separated from the rest of the between decks by a bulkhead of panels which is placed against the middle deck beam which forms the after side of the partners of the mizen-mast, and in this bulkhead there is a door to larboard by way of which one enters the gunroom. The magazine scuttle is to be found in the gunroom as is the scuttle leading to the lady's hole. The scrivener and the gunner both have cabins in the gunroom, one to larboard and the other to starboard between the stern and the aftermost gunport. These cabins have canvas bulkheads or of planked panels so arranged that they may be struck down when the ship is cleared for action. The chaplain and the surgeon are also berthed in the gunroom between two guns behind canvas curtains. The cartridge cases are placed on racks on the gunroom bulkhead and this is struck down when the ship goes into action and its panels are placed in the hold where they serve as a table which is set up for the treatment of the wounded.

HAWSEHOLES [*Écubiers*]: These are round holes through which the cables pass when the ship is at anchor. There are four hawseholes in ships of war, frigates, fireships and generally in all square-rigged ships, save in a few small vessels where there are only two. Some hoys and fore-and-aft rigged vessels also have hawseholes. In ships two of the hawseholes are cut in the side close to the stem and to starboard and the two others to larboard, 3 feet 3 or 4 inches above the lower deck in First Rates, 3 feet 1 or 2 inches in Second Rates, 3 feet or 3 feet 1 inch in Third Rates, 2 feet 11 inches or 3 feet in Fourth Rates and 2 feet 9, 10 or 11 inches in frigates. Storeships and other vessels where the bitts rise above the upper deck have their hawseholes pierced flush with this deck, or else 2 feet 9 or 10 inches above the lower deck; and in that case, the cables are led to the hawseholes in a channel called a hawse-dale. Vessels other than those which have their bitts higher than the lower deck have their hawseholes raised above this deck by the whole distance between the deck and the upper surface of the cross-piece of the bitts. In bomb ketches, where the bitts are on the forecastle, the hawseholes are also at this level, and they are cut not in the ship's side as in all other vessels, but in two blocks of timber raised over the plankshеer and called hawse spectacles [*lunettes*]. The diameter of the hawseholes is equal to or nearly equal to three quarters of the circumference of the cable. This diameter is always sufficient for the cable splice to pass through with ease. The distance from the inner larboard hawsehole to the inner starboard hawsehole is double the circumference of the cable. Some Builders make this distance 2 or 3 inches greater and others 3 or 4 inches less great. A good rule is to set these hawseholes as close as possible to the stem so that the cable restrains the ship better in the eye of the wind. The distance between the two larboard or two starboard hawseholes is 12 inches when the scantling of the timbers is 12 inches, 10 inches when it is 10 inches, and likewise for other scantlings. The hawseholes are lined with a sheet of lead, and they are plugged when the ship is at sea with pieces of fir called hawse-plugs which are secured by means of triangular or round rings fastened to the inside of the ship. The hawse-holes give their name to the hawse-pieces in which they are cut.

HAWSE-PIECES [*Allonges d'écubier*]: These are the first frames at the bow of a ship, those through which the hawseholes are cut. They are also called knightheads or bollard timbers, but these are less common terms than hawse-pieces. There are in all ships eight or nine hawse-pieces on either side between the stem and the first square frame; they run up from the first or second timber of the apron to 18 or 20 inches above the upper deck, in three-deck ships and two deckers alike, and they are distinguished as the first, second, third hawse-piece, and so on, until the last. The first hawse-pieces are next to the stem, on either side. Some Builders raise the second ones about 18 inches more than the other hawse-pieces and higher than the stem, so as to form half-partners for the bowsprit. The second hawse-pieces are next to the first, and so on with the others until the last, which are next to the first square frame. The hawse-pieces are fastened to the stem and one to the other with several ragged bolts. Care is taken when placing these bolts that none are put in the way of where the hawseholes must be cut. The breadth of the hawse-pieces is 2 or 3 inches greater than that of the timbers which make up the frames, but in their moulded dimension they are the same size as the futtocks. They are always made of oak.....

HOOKS [*Guirlandes*]: These are pieces of timber which serve to strengthen the forward part of the ship. There are three parts to a hook, namely the belly and the two arms. The belly is fayed to the inside of the apron or the stemson and is fastened by means of one or two bolts driven from the outside of the stem and forelocked or clenched over a rove on the inside of the hook. The two arms form together an obtuse angle such as the bow of the ship requires, and run back along the sides of the ship, one to larboard and the other to starboard, to which they are fastened with several bolts driven in from the outside and clenched or forelocked. There are five breasthooks in First Rates, arranged along the stemson and evenly distributed between the first forward rider and the lower deck. There are four or five breasthooks in Second Rates, three or four in Third and Fourth Rates and three in frigates, storeships, fireships, hoys, sloops-of-war and other vessels of this kind. In all of these different ships there is also a deckhook at the level of the lower deck overhead which the planks of the deck rest, a hawse-hook beneath the hawse-holes, and another deck-hook beneath the middle or upper deck. First Rates have a third deck-hook beneath their upper deck. In all ships the bowsprit rests in the bag of the the upper deck deck-hook. The length of the hooks is not determined: they are made as long as the timber will allow.... [.... *dimensions* ....] These lengths are not absolutely necessary for the lower breasthooks in the hold, and indeed it is rare to find them so long. The longest are ordinarily reserved for the upper hooks. And when the arms of the deck-hooks do not reach as far as the first beam of the decks, ekeing pieces are added..... The scantling of the hooks is equal to that of the riders, or exceeds that scantling by an inch. They are made of oak. A few Builders employ iron hooks. They are fashioned like the iron gundeck knees, which is to say that they are composed of two arms and a cross-piece let down into a chock.

ISSUING ROOM [*Plancher du maître valet*]: This is the flat where the steward issues the victuals to the crew.... This flat is set up 5 feet below the lower deck, and it runs from the well to the main after bulkhead. It is formed of planks resting on the orlop-beams and on carlings. A scuttle is cut in this flat which is immediately below the after hatch in the lower deck. In those ships where there is a storeroom below the issuing room for the captain's sea-stock of wine, the scuttle leading to this storeroom is cut in the flat close to the after bulkhead. The captain's other store-rooms and the vegetable storerooms are arranged on the same flat.

JEER-BITTS [*Seps de drisse*]: This is a piece of timber fitted with several sheaves through which reeve the jeer-falls and the top-rope. There are two jeer-bitts in ships, frigates, fireships and large storeships, distinguished as the main jeer-bitts and the fore jeer-bitts....

Main Jeer-Bitts [*Grand sep de drisse*]: These are the bitts which serve for the jeer-falls of the mainyard and the top-rope of the main-topmast. The knight of the main jeer-bitts is set up abaft the mainmast and amidships. It touches the after face of the beams abaft the mainmast on the lower and upper decks, to which it is scored down 2 inches and fastened with two bolts. The heel runs down to lie flush with the lower face of the gundeck beams and the head is about 4 feet above the level of the upper deck. It is in this part which is above the deck that the mortices are cut to take the sheaves for the jeer-falls and the top-rope. There are six bronze sheaves in the knight of the main jeer-bitts of First Rates, 5 to 6 in Second Rates and 5 in Third Rates and 4 or 5 of Fourth Rates and frigates. Only one of the sheaves serves for the top-rope and all the others for the jeer-falls. They turn on a common iron pin secured in place by a forelock. [.... *dimensions* ....] The width of the knight of the main jeer-bitts, and its thickness likewise, reduce to half or ⅖ths at the heel, but this reduction starts from beneath the beams of the upper deck. The upper end of the knight is fashioned to a knighthead. The knight is made of oak, and when the timber is not of sufficient scantling to provide the width required, which sometimes happens in the case of big ships, it is increased by a filling piece running from below the upper deck beams to a few inches above the sheave-holes. This filling piece is bolted to the knight. Above the sheave-holes the knight is bound with an iron hoop which is fitted with two iron coaks, one on either side in

the place of the hole for the sheave-pin, and the knight is supported against the underside of the upper deck beam by a wooden knee which takes the strain against the beam when the lines are rove through the sheaves.

Fore Jeer-Bitts [*Sep de drisse de misaine*]: These are the bitts through which are rove the jeer-falls of the fore-yard and the fore-topmast top-rope.... The knight of the fore jeer-bitts is set up abaft the foremast and 1 or 1½ feet to starboard of the middle line of the ship so that neither the jeer-falls nor the top-rope chafe the mainstay. It is fayed and scored down 2 inches into the beams of the lower and upper decks immediately abaft the foremast, to which it is fastened with bolts. The knight runs up from beneath the lower deck beams to about 4 feet above the upper deck; it has one less sheave than that of the main jeer-bitts and is 3 or 4 inches narrower and 1 or 2 inches thinner. It has in all its parts the same shape as the knight of the main jeer-bitts and it is also made of oak. If the timber is not of sufficient scantling, it is made up with a filling piece. Some ships do not have a knight for the fore jeer-bitts but instead have two pins 9 to 11 inches square 2 feet 9 inches or 3 feet apart, with sheave-holes for two sheaves in each and a cross-piece. Jeer-bitts of this pattern are rare.

KEEL [*Quille*]: This is the first and the principal timber in a ship, that which extends along the bottom of the ship for the greater part of its length and on which the stem, the sternpost and the frames rest.... The keel in ships of war is composed of 3, 4 or 5 timbers, each 25 to 50 feet long. These timbers are assembled one to the other with long scarphs 4 to 5 feet long, which many Builders fashion with a hook. The scarphs of the keel are strengthened at either end by a nail and by three bolts driven up from below and clenched over roves on top. Some Builders drive the bolts right through the keelson as well. The first timber of the keel at the bow is called the forefoot and forms part of the stem. The length of the keel is one of the principal dimensions of a ship. This dimension must not be confused with the effective length of the keel, which is always greater by the full width of the false post and the bearding of the skeg. [.... *dimensions* ....] Its thickness athwartships is in all ships about 2 inches less [than the height]. Some Builders reduce this thickness by 2 inches at either end of the keel. The keel forms a straight line fore-and-aft in its athwartships dimension, but some Builders give it a hanging in the dimension of its height, which is to say that they raise the two ends. There is a rabbet in either side of the keel to receive the garboard strakes. A mortice is cut close to the after end of the keel for the tennant of the sternpost. The keel is usually made of oak; in former times beech was employed, but since this timber is more subject to attack from the worm than oak, this practice is no longer followed today....

False Keel [*Contre quille*]: .... This is a piece of timber which is fayed to the underside of the keel, either to preserve the keel or else to make the ship gripe less or else to correct the hogging of the keel. The false keel which is fayed to the underside to preserve the keel is a simple plank one or two inches thick, running from one end to the other and fastened with nails. The false keel which is fitted to make a ship gripe less is much thicker at the fore end than at the stern. Finally, that false keel which is employed to correct the hogging of the keel has the same thickness as the amount by which the keel has hogged.

KEELSON [*Carlingue*]: This is a piece of timber which runs from bow to stern in a ship over the top of the floors and crotches, as the keel runs beneath.... All ships have a keelson. In ships, frigates, fireships, bomb ketches and storeships it runs from the third crotch of the fore-body to the fourth or fifth crotch of the afterbody, and describes in its vertical plane a curve which is determined by the rising of the floors and crotches. The keelson is scored down 2 or 3 inches over the floors and crotches and forms a single body with the keel by means of the bolts which run through the keel, the floors and the keelson. There is one bolt in each floor or crotch, and they are driven from beneath the keel and clenched over roves on the keelson, or else, when the space between the keel and the dock is insufficient to drive the bolts from below, they are driven from above; they are driven to within 3 or 4 inches of the lower face of the keel and then the hole is filled with a plug of wood, but in such a case ragged bolts are employed. The breadth of the keelson is equal to that of the keel or exceeds it by 2 inches, its thickness is about 6 lines for every inch of its breadth; the timbers of which it is composed are 35 to 50 feet in length and give shift to the scarphs of the keel; they are joined by flat scarphs, and each scarph is 3½ to 4 feet long; but when the keelson is composed of two timbers laid side by side, which is the case in most ships, they are not scarphed together one to the other but the scarphs of the timber forming one side give shift to the scarphs of the timber forming the other. The keelson is scarphed at the stern to the sternson knee and at the bow to the stemson, or if there be no stemson, it simply butts against one of the crotches of the fore-body or is scarphed to the throat of an inclined crotch. In all ships where the mortice of the heel of the mainmast is cut in the keelson, the timber is wider and thicker at this place than at the two ends.... The keelson is usually made of oak.

KNEE [*Courbe*]: This is a piece of timber curved to a right angle or nearly so and which serves to bind together and strengthen different parts of a ship. Most knees are distinguished by the place in which they are placed.

Gundeck Knees [*Courbes du premier pont*]: These are the timber knees which join the gundeck beams to the side of the ship. There is one knee at either end of the beams of ships, frigates, fireships, bomb ketches and storeships. Its hanging arm is fayed to the innner planking of the hull and fastened with two nails at the end and 3, 4 or 5 iron bolts driven in through the outer planking of the hull and forelocked on rings on the inside. Its lodging arm is fayed to the fore or after face of the beam, where it is also fastened by two nails at the end and by three or four bolts. [.... *dimensions* ....] Scarce any timber knees are employed today for the lower decks of warships and in their place we put iron knees of which I shall speak later.

Middle Deck Knees [*Courbes du second pont*]: These are the knees which fasten the beams of the middle deck to the sides of the ship. There is one knee at either end.... Its hanging arm is set vertically against the inner planking of the hull and raking when it is above a gunport.... The middle deck knees are about a foot shorter than the gundeck knees and their scantling is equal to or within an inch of the scantling of the beams. Iron knees are also employed to fasten the middle deck beams, in place of timber knees.

Upper Deck Knees [*Courbes du troisième pont*]: These are the knees which fasten the the upper deck beams in First Rates to the sides of the ship. There is a knee at either end of the beams and fastened like the beams of the middle deck, save that from the mizen-mast to the stern some Builders use lodging knees in order to leave more room in the cabins. The upper deck knees are about 8 feet long and 10 inches square. Iron knees are also employed on the upper deck in place of timber knees.

Made-Knees [*Courbes de deux pièces*]: These are knees composed of two pieces of timber and an iron strap which serve well in place of knees of a single piece in the lower, middle and upper decks of ships. The two timbers which make up such knees are lapped over each other at the end, with a hook of 1½ inches. This join is strengthened by iron bolts which pass through the iron strap which is scored down into the face of the timber on one side. Made knees were invented 30 years ago by Mr Coulomb, Master Shipwright at Toulon, and they have been usefully employed since in many ships where they provide the same fastening as knees of a single piece.

Iron Knees [*Courbes de fer*]: These are knees made of three pieces of iron which some Builders employ for knees of the lower, middle and upper decks of ships for want of timber knees, and which others employ in preference to timber knees.These knees were invented 30 years ago by Mr Goubert, Deputy Inspector of Shipbuilding, and they are today employed in most of the King's ships where they take up less room than timber knees and provide a fastening which many Builders esteem to be more solid than that provided by timber knees. Iron knees are distinguished as triangular knees, Z-knees, and also as iron knees of the lower, middle and upper decks.

Triangular Iron Knees [*Courbes de fer triangulaires*]: These are iron knees which have the shape of a triangle of which two of the sides are extended. Various parts are distinguished in triangular knees: the hanging arm, the lodging arm, and the nuts.

Iron Z-Knees [*Courbes de fer en zède*]: These are iron knees which have more or less a Z-shape. Various parts are distinguished in Z-knees: the hanging arm, the lodging arm, the cross-piece, and the nuts.

Iron Gundeck Knees [*Courbes de fer du premier pont*]: These are triangular iron knees which serve to fasten the beams of the lower deck to the sides of the ship, in place of timber knees. The hanging arm is let down into a piece of timber called the chock which is fayed to the planking of the ceiling; this same arm is fastened to the ship's side by means of 4, 5, or 6 bolts which are driven right through the outer planking of the hull, the frame timbers, the ceiling and the chock, and they are

forelocked over roves on the inside of the hanging arm of the knee. This arm is also secured by means of two nails which are driven only into the chock. The lodging arm of gundeck knees is extended along the fore or after face of the beam, into which it is let down to half or three quarters of its thickness; this same arm is fastened by two nails and by 3, 4 or 5 bolts forelocked over roves. [.... *dimensions* ....]

Iron Middle Deck Knees [*Courbes de fer du second pont*]: These are triangular or Z-knees which serve to fasten the beams of the middle deck to the sides of the ship, in place of timber knees.... [.... *dimensions* ....] The cross-pieces of these knees are more commonly round in section.... [.... *dimensions* ....] When these cross-pieces are oblong in section, their width is about 3 lines greater than the diameter of round cross-pieces and their thickness is 3 lines less than this diameter. The hanging arms of Z-knees are placed flat and directly against the planking of the ceiling, into which they are let down; they are fastened to the ship's side by three bolts driven in from the outside and forelocked on the inside of the knee over roves. [.... *dimensions* ....] The lodging arms of the Z-knees are let down into the fore or after face of the middle deck beams and fastened with three bolts forelocked over roves.They are the same length, breadth and thickness as the hanging arms. The thickness of the cross-pieces in Z-knees is the same as those of the triangular knees. When iron Z-knees are used to knee the middle deck beams an iron knee-strap is fastened beneath the beam. Most of the King's ships have iron Z-knees on the middle deck and it is only recently that we have begun to put triangular iron knees in their place, like those of the gundeck. This latter practice is to be preferred.

Iron Upper Deck Knees [*Courbes de fer du troisième pont*]: These are iron triangular or Z-knees serving to fasten the upper deck beams to the ship's sides, in place of timber knees. They have the same shape and are fastened in the same manner as the knees of the middle deck. [.... *dimensions* ....]

Arms of Iron Knees [*Lattes de courbes de fer*]: These are two pieces of iron forming the lodging and the hanging arm of an iron knee....

Nuts of Iron Knees [*Tourillons d'une courbe de fer*]: These are two or three swellings which are to be found in the hanging arm of an iron knee and which are let down into the chock of the knee when it is a triangular knee and into the planking of the ceiling when it is a Z-knee. These nuts extend to the full width of the arm and have the same thickness or 1¼ times the thickness of the arm.

Iron Knee-Straps [*Pattes d'oie*]: These are pieces of iron which bind the beams to the sides of the ship. Knee-straps are only employed with Z-knees; they are placed in the angle formed by the beam and the shelf. The longer of their two arms is let down for its full thickness into the beam, to which it is fastened with two nails and three bolts, and the other arm is let down ½ an inch into the shelf, where it is secured by three bolts driven in from the outside and clenched on the inside over the strap.

Sternpost- or Deadwood Knee [*Courbe d'étambot*]: This is an oak knee which fastens the sternpost to the keel. One of the arms of the sternpost knee is fayed to the keel, forming a hook 1½ inches deep. This same arm is fastened to the keel with 3 or 4 bolts driven from beneath the keel insofar as that is possible, and it is scarphed 18 or 20 inches to the after deadwood, or more if the length of this arm allows. The other arm is nailed to the sternpost and fastened by means of 3, 4 or 5 bolts driven from the outer face of the post and clenched over roves on the inside; it is scarphed 20 to 24 inches to the inner post erected on the inside of the sternpost or else to the crotch which runs up to the heels of the fashion pieces, according to which of these two timbers is employed. The length of the sternpost knee is not laid down, the largest timber which can be found is always employed. The same applies to its breadth, but its thickness is equal to the thickness of the sternpost less the depth of the rabbet. Some Builders do not hook the scarph joining the lodging arm of the sternpost knee at the keel. The place where this knee is fayed to the keel and the post is usually lined with toppin or kersey.

Transom Knees [*Courbes d'arcasse*]: These are four knees of which two fasten the wing transom and two the helm-port transom to the sides of the ship. These knees are laid horizontally; one arm extends along the ship's side over the top of the planking of the ceiling, and is fastened by one or two nails at the end and by four or five bolts driven in from the outside of the ship and clenched over roves on the inside; the other arm extends along the forward face of the transom where it is fastened by means of one or two nails and four or five bolts driven in from the outside and clenched over roves on the inside. There are ships where hooks are employed where they are fayed to the transoms and to the ship's side. The transom knees are always made of oak. [.... *dimensions* ....]

LENGTH OF A SHIP [*Longueur d'un vaisseau*]: A distinction is made between two principal measurements of length, which are the length from stem to post and the tread of the keel; and when only the term length is employed, which is rare, this means the length from stem to post.

Length from Stem to Post [*Longueur de l'étrave à l'étambord*]: This is the length from the outside of the stem to the outside of the sternpost at its head. In ships of war this length is determined by adding all the distances between the gundeck ports, plus the width of these same ports, the distance between the foremost port and the outer face of the stem, and the distance between the aftermost port and the outer face of the sternpost; but without delaying in this calculation I will give the dimensions of ships of each Rate from stem to post. Ships of the First Rate and the first order, of 110 guns, with 15 gunports on either side on the gundeck for 48-pdrs measure 174 to 175 feet from stem to post. First Rates of the second order with 100 to 104 guns, pierced for 14 gunports on either side on the gundeck for 36-pdrs measure 164 to 166 feet. First Rates of the third order with 90 to 96 guns and pierced on the gundeck like those of the second order measure 158 to 160 feet. Second Rates of 70 to 76 guns, pierced for 13 36-pdr gunports, measure 151 to 154½ feet, and those which are pierced for 14 gunports are the same length or only 1 or 2 feet longer because their ports are closer than they are in other ships. Third Rates of 68 guns pierced for 13 24-pdrs measure 146 to 147 feet and those of 60 to 64 guns pierced for 12 guns are 140 to 144 feet in length. Fourth Rates of 50 to 55 guns pierced for 12 18-pdrs measure 136 to 140 feet and those of the same strength pierced for 11 guns measure 130 to 135 feet.... Ships were formerly shorter than they are today and their length has been increased in order to make more room and in consequence make it easier to serve the guns. Nevertheless, not all Builders have pursued this increase in length as much as others, so that there are today 2 or even 3 feet of difference in the length of ships of the same force built by different Builders. Recently many Builders have come to draw a distinction between the length from outside of stem to outside of post, the length from the rabbet of the stem to the rabbet of the post, and the length from stem to post on the waterline. The length from outside of stem to outside of post is the same as is called simply the length from stem to post. The length from the rabbet of the stem to the rabbet of the sternpost is measured from the rabbet of the stem at the point of greatest projection of this timber to the rabbet of the sternpost at the level of the wing transom, and this is also called the length from rabbet to rabbet. The length from stem to post on the waterline is measured from the rabbet of the stem to the rabbet of the post on the load waterline. This is the smallest of all the lengths from stem to post, and recently some Builders have come to consider it as the principal dimension of ships in place of the length from the outside of the stem to the outside of the post which hitherto has been taken for the first dimension, and which I have also considered in this work in order to conform to the most common usage, even though the method of measuring the length from stem to post on the waterline seems to me to be preferable to the older method.

Tread of the Keel [*Longueur de la quille portant sur terre*]: This is the length of the keel measured in a straight line from the angle of the forefoot to the angle of the keel with the sternpost. The term length of keel is also employed, or even the word keel on its own. It should not be confused with the effective length of the keel which exceeds the other by the the full width of the false post and the bearding of the skeg. The tread of the keel was formerly considered as the principal dimension of a ship and it was on this dimension that all the other dimensions were regulated, whereas today we take the length from stem to post. The tread of the keel is found by deducting from the length from stem to post the rake of the stem and the rake of the post, or if these two dimensions are not yet determined, the tread of the keel in warships, frigates and other vessels of this kind is 9½ to 10½ inches for every foot of length from stem to post. These two proportions give treads of the keel which are very different one from the other, but this same difference or one which is still greater is to be found in most ships of war which are in service today and which were built by different Builders. The keel was in earlier times commonly less long and in consequence the rake of the stem and of the sternpost was greater.

MAGAZINE [*Soute à poudre*]: This is the storeroom in which the powder is stowed. In all ships and in frigates alike it is set up abaft the main after bulkhead below the breadrooms. Its area is determined by the quantity of powder which must be taken aboard...., and there are three powder rooms abaft the mizen-mast where powder in cartridges is

stowed. The magazine is lined with slit deal, cyphered and laid over the planking of the ceiling, the main after bulkhead, and the planking which forms the palletting of the magazine. In warships there is a passageway in the magazine on either side of the mizen-well between the well and the powder-rooms, and in frigates there is a passageway on one side only. It is by way of this passage that access is provided from the part of the magazine where powder is stowed in barrels to that part where filled cartridges are kept. A way down to the magazine is provided by a hatchway in the lower deck called the powder hatch, and thence by another hatchway abaft the mizen-mast. Both these hatches are kept closed when the ship is in action and the powder is brought up by way of a scuttle cut in the deck forward of the well, whence it is carried up onto the gundeck by way of the after hatchway. The magazine is lit by one or two candles placed in the mizen-well.

MAST-STEP [*Carlingue de mât*]. **Mainmast Step** [*Carlingue du grand mât*]: This is a mortice formed in ships by the assembly of several timbers and into which the tennant of the heel of the mainmast fits. Its length fore-and-aft is 2 or 3 inches shorter than the diameter of the mast; its breadth athwartships is equal to three quarters of this same diameter and its depth is equal or nearly equal to its breadth. Its sides slope outwards by about an inch. The timbers which form this step are a floor rider, a false rider, two carlings, two filling pieces and two half-hooks. The floor rider and the half rider are laid over the footwaling 4, 5 or 6 feet apart; this distance may be greater or lesser provided that it exceeds by about a foot the given diameter of the mast. The carlings run from one rider to the other and are placed on edge over the footwaling; they form the sides of the step and are separated one from the other by the whole breadth required for the step; the filling pieces form the fore and after sides of the step and they are separated by the distance required to fit the heel of the mainmast.... In many merchant ships and all small vessels which are powered by oars the step consists only of a mortice cut in the keelson of which we have already spoken. The step then has the length and breadth which we have already determined, but about half or a third less depth.

Foremast Step [*Carlingue du mât de misaine*]: This is a mortice formed in ships by the assembly of several timbers to receive the tennant at the heel of the foremast. Its dimensions are determined by the given diameter of the mast, as the step of the mainmast is governed by the given diameter of the mainmast. The timbers which make up the foremast step have the same names and are arranged in the same manner as those forming the mainmast step. In some ships the foremast step is cut in a rider or in a raked hook laid over the keelson and in former times it was always made thus, as may still be seen in many merchant ships. There are also vessels where the foremast step is cut in the timber called the keelson as we have stated with regard to the mainmast step.

Mizen-Mast Step [*Carlingue du mât d'artimon*]: This is a block of oak placed on the lower deck in ships in which there is cut a mortice for the tennant of the heel of the mizen-mast. It is placed fore-and-aft on the planking of the lower deck or else supported and scored down at its ends over two of the beams of the deck. It is 5 to 6 feet long in First Rates, 4 to 5 feet in Second and Third Rates and 3½ to 4 feet long in frigates. Its breadth athwartships is equal to the diameter of the mizen-mast or an inch greater, and its thickness from top to bottom is equal to its breadth or one and a quarter or one and a third times its breadth. The mizen-mast step is fastened to the deck by means of four bolts which are forelocked beneath the beams, and in some ships also by two iron straps. The mortice cut into the step to take the heel of the mizen-mast is about three quarters the diameter of the mast in length; its width is two thirds of this same diameter, and its depth about the same as its width. Some Builders who score down the two ends of the step over the beams of the lower deck fay a piece of timber to the underside of the step which they call an under step. In ships where the mizen-mast reaches right down into the hold, the step is fayed to the keelson or else the mortice is cut in the keelson itself.

MIDSHIP BEAM [*Bau, Maître-bau*]: This is the gundeck beam which is situated at the position of the midship bend or closest thereto. When a ship is said to have a beam or a midship beam of 40 feet, this does not mean that the beam is 40 feet long, but that the ship measures 40 feet to inside of plank in the place where the midship beam is situated, unless it be stated that she is 40 feet length of beam, but the term is rarely employed.

ORLOP [*Faux pont*]: It is a deck which is laid in the hold of certain ships and resting on orlop-beams. There is no orlop in the King's ships, but only a few platforms and flats forward and aft.

OVEN [*Four*]: It is the place in ships of the line and frigates where the bread is baked for the captain's table and for the sick. It is made of bricks and lime mortar in a chest which is called the casing and its internal construction is the same as for ovens which are built in houses. They are set up in one of three different places on board ship. Some ships have their oven beneath the forecastle between the beakhead bulkhead and the fore-topsail sheet bitts, and opening either to larboard or to starboard, and this practice of placing it here is the oldest, yet today is the least followed, since it has been found that the weight of the oven strains the forward part of the ship. In many ships the oven is situated in the hold forward of the well and on the orlop-beams, with the opening facing forward. In others, the oven is placed in the between decks amidships between the main-hatch and the ladders about the mainmast. There are usually two ovens in First Rates, and these are placed one beneath the forecastle or in the between decks and the other in the hold. Second Rates also have two ovens when they are commanded by a flag officer, and all other ships and frigates have but one oven. There is none in bombs, sloops-of-war or other vessels. There is one set up in storeships, especially when they are to serve as hospital ships, and in such cases it is placed beneath the forecastle. The parts of the ship which adjoin the oven are covered with sheets of tin plate which is shifted at the beginning of each commission. The oven is also rebuilt, because when a ship pays off her oven is demolished.

POOP [*Dunette*]: This is a half deck situated above the quarterdeck in ships of the First, Second and Third Rates and in some Fourth Rates. The poop extends from the stern to 2, 3, 4 or 5 feet forward of the mizen-mast in First Rates of the first and second order and in Second Rates, but only as far as the mizen-mast in First Rates of the third order and in Third Rates. In Fourth Rates the poop is 13, 15 or 18 feet long or else extends to the mizen-mast. In frigates, where it is shorter, it is called a half poop. There are four or six 4-pdr guns on the poop of First Rates of the first and second orders and of Second Rates. [... *dimensions* ....] The poop is raised about 3 or 4 inches more at the stern than at the break. Officers' cabins and deck-cabins for petty officers are set up on the poop of First Rates of the first and second orders, of Second Rates and sometimes of Third Rates, but more commonly in the latter there are only deck-cabins for the petty officers there. On the poop of Fourth Rates there are neither cabins nor deck-cabins. The timbers which form the poop are the beams, the waterways, a binding strake and the planking. The planking of the poop is covered by a tarpaulin, and above the break is fashioned a breastwork which is usually decorated with carved work. Access to the poop is by way of two ladders resting one on either side of the ship against the breast-beam.

POOP-AWNING [*Tugue ou Teugue*]: this is a sort of false deck which is raised over the quarterdeck in some frigates and bombs abaft the mizen-mast. It is formed of one-inch planks running fore-and-aft over light beams laid athwartships which are supported at one end by a stanchion and at the other by a carling amidships. In frigates the poop-awning extends no further aft than the poop, and stops short of the sides of the ship by the full width of the deck cabins set up on the quarterdeck forward of the officers' cabins which are to be found at the same level; but in bomb ketches the awning is extended as far as the stern and runs from one side to the other. The awning is ordinarily raised 5 feet 6, 7 or 8 inches above the quarterdeck and when it is formed of planks, these are covered by a tarpaulin.

PORT-LID [*Mantelet de sabord*]: This is the shutter which serves to close a gunport. Each gunport on the lower and middle deck of First Rates has a port-lid; other ships only have port-lids on their lower decks. Gunroom ports, bowchase and sternchase ports, oar-ports and air-ports also have lids. The height of the lids is equal to or exceed by one inch the height of the ports, and this extra amount is let down into a rabbet which is cut in all four sides of the port in the planking of the hull. The thickness of the ports is ¾ or 1 inch less than that of the planking of the hull whose place they occupy; which is to say that if the planking between the ports of the lower deck is 5 inches thick, the port-lids of these same ports are 4 or 4¼ inches thick. Port-lids are made of several timbers of which some are called the lining of the lid and others the

planking of the lid. The former are laid up-and-down and are about ⅖ths of the thickness of the port-lid. The planking of the lids covers the lining on the outside and is laid fore-and-aft; it makes up all the thickness which the lining lacks so that the port-lids lie flush with the planking of the hull. The lining and the planking of the lids are fastened together by means of a large number of nails arranged lozenge-fashion and placed very close together. The lids are made from oak. The lid is attached to the ship with two port-hinges. Above each port-lid there are one or two iron rings passed through the eye of an eyebolt which is forelocked outside the lid. These rings serve to secure the lid once it has been dropped down into its place. There are two similar rings on the outside to which are fastened the laniards which serve to raise the lids. The rabbet in which the edges of the port-lid lie are lined with kersey to prevent the water entering when the ship heels to one side or the other. The port-lids are closed and caulked all round when the vessel is prepared for being hove down on a careen. Sometimes four to six spare port-lids are stowed on board in order to be able to replace any which might be lost through two ships running aboard each other.

Half-Lid [*Faux sabord*]: This is a wooden frame which entirely fills a gunport and in the middle of which there is an opening and a canvas sleeve into which the muzzle of the gun is passed. Half-lids are only fitted to the upper deck and quarterdeck ports, and only when the ship is at sea, to prevent water from coming aboard by way of the gunports.

Half-Port [*Mantelet brisé*]: This is a lid which opens in two halves and which serves to close the raft port in the stern of a storeship or transport. In some ships, the half-port has no hinges to hold it, and in others there are hinges as for port-lids. This type of port-lid is furnished with rings on the inside which serve to secure it once it has been put in place. When the gunroom ports used to be pierced below the wing transom, they had a half-port which was secured with hinges.

POWDER-ROOMS [*Coffres à poudre*]: These are compartments made in the magazine of ships and frigates where the filled cartridges are stowed. There is a powder room on either side of the mizen-well, up against the side of the ship. They run the full height from the palletting of the magazine to the flat of the breadrooms and stretch from the fore side of the mizen-well as far as a third powder-room which runs athwartships and back to the sternson knee. In most ships the powder rooms at the sides are divided in two. they are fashioned with stanchions of oak or fir 2½ inches square and of deals about 8 lines thick cyphered together and the planking of the ceiling is covered with slit deals throughout the whole area occupied by the powder rooms. These rooms are lined in many ships with sheet lead one line thick fastened with copper nails which have tinned heads. The practice of lining the powder rooms dates from the last 15 years, and it has been found that by means of this lining the powder is exposed to much less damp and keeps better and longer than was the case before the powder rooms were lined with lead. Each powder room has a small sliding door. First, Second and Third Rates have two other powder rooms, one on either side beneath the Bo'sun's storeroom. These rooms are set up like those in the stern, but they are only supplied with filled cartridges when the ship is being cleared for action.

PUMP [*Pompe*]: This is a machine which serves to draw up and raise the water which enters the hold of a ship and to lead it out to the scuppers whereby it is removed from the ship. The parts of a pump are the barrel, the upper box which is inside the barrel and which serves to raise the water, a lower box which is placed about half way up the barrel of the pump, two clapper-valves which are attached one to the upper box and one to the lower box, a spear which serves to move the upper box, and finally a hose by which the water raised by the pump flows out through the scupper. There are pumps in all decked vessels. Ships of war, frigates, fireships, storeships and other such vessels have four pumps which are placed around the mainmast in an area called the well. There are two other pumps, one on either side of the mizen-mast in ships, but only one, to starboard of the mizen-mast, in frigates. They are distinguished as the main pumps and the mizen pumps. They run up from the bottom of the hold to 2½ feet above the upper deck. The lower end of the barrel is covered by a plate of lead or copper pierced with several holes and called the rose, which prevents any filth from entering the barrel of the pump. Round holes are made at the bottom of the hold in the way of the pumps. The diameter of these holes is equal to the small end of the barrel of the pumps; their depth extends to ⅔ or only ½ of the thickness of the frame timber, and to prevent the action of the pumps from sucking the caulking from the seams, the space between the frames in the way of each pump is lined with a length of plank. Round or eight-square holes are cut in the decks to allow the pumps to pass; the diameter of these holes which are called the partners of the pumps exceeds by one or 2 inches the diameter of the pumps. There are pumps where the spear works in a tube of bronze and it is thus that most pumps the the King's ships are made. They are to be preferred to those pumps where the barrel is in a single piece because they last a long time and allow a greater volume of water to be pumped. The pumps of small vessels such as barks, ballast-lighters, pontoons and such like differ from other pumps in that their brake instead of being suspended from the mast works in the jaws of a gallows attached to the barrel of the pump.

Working Barrel of the Pump [*Tuyau de pompe*]: This is a bronze pipe placed in the middle of the barrel of a pump and in which the piston of the pump moves. The working barrel is about 3 feet long and 6 inches in diameter. It has a rim round it at either end and in this rim there are holes for the screw-bolts which fasten the working barrel to the body of the pump. Pumps which have such barrels are called bronze-barrelled pumps, and they have been employed for the last 25 years in the King's ships, where they are preferred to pumps where the body is of a single piece because these wear easily in the part where the piston works, whereas bronze-barrelled pumps never wear.

QUARTERDECK [*Gaillard d'arrière*]: This is a half deck situated abaft the mizen-mast and above the upper deck.... [.... *dimensions* ....] The timbers which form the quarterdeck are the clamps, the beams, the ledges, the carlings, the binding strakes, the waterways, the planking and the gratings. There is an opening in the quarterdeck for the after ladderway and for the partners of the mizen-mast. In many ships, especially in First, Second and Third Rates, the forward end of the quarterdeck ends in a crescent shape and extends 3, 4 or 5 feet along the ship's side, and in this case the part of the quarterdeck which projects forward of the breast beam along the side is so constructed that it can be struck down so as to make room for the spar-shores when the ship is hove down on a careen. Likewise, in ships where the quarterdeck extends forward of the mizen-mast there are openings in the deck in the way of the mizen-mast for these same spar-shores, like those in the way of the foremast.

QUARTER-GALLERIES [*Bouteilles*]: These are the ship's privies. The quarter-galleries are set up on either side of the stern on the outside, where they are berthed up and decorated with carved work. Their parts are the body of the gallery, the lower finishing, the gallery and the upper finishing. There are two galleries in First Rates and one only in Second and Third Rates. In Fourth Rates and frigates where the stern-gallery is situated at the level of the upper deck, this gallery does not curve round into the quarter-galleries. The body of the gallery is built round what are called the stools and other timbers forming the framework; these are berthed up on the outside with fir planks which are cyphered and over which tarred canvas or sheet lead is nailed before the carved work is applied....

Quarter-Badges [*Fausses galeries*]: These are carved decorations which may be seen on the quarters of vessels which have no gallery.

RABBET [*Rablure*]: This is a channel cut in the edge or more or less in the middle of a timber to receive the edge of a plank. In shipbuilding a distinction is made principally between the rabbet of the keel, that of the stem, the sternpost and the wing transom.

Rabbet of the Keel [*Rablure de la quille*]: This is a triangular channel cut in either side of the keel to receive the garboard or first strake of the bottom planking. Its breadth is equal to the thickness of the garboards and its depth equal to or nearly equal to four fifths of its width. This rabbet is situated in some ships flush with the upper face of the keel and in other it is 1 or 2 inches below. It meets the rabbet of the stem at the bow and the rabbet of the post at the stern.

Rabbet of the Stem [*Rablure de l'étrave*]: This is a rabbet similar to the rabbet of the keel which is cut on either side of the stem to receive the hooding ends of the planking of the hull and the wales which land there. In most ships it is to be found at the middle line of the breadth of the stem, and it runs up from the rabbet of the keel to the head of the stem. In other ships it is placed 1, 2 or 3 inches inside the middle line and runs up no further than the lower wales. The practice of placing the rabbet in the middle line of the stem and to make it run up as far as the stemhead is preferable to the other because the planking of the bow lands on a

greater part of the stem.

Rabbet of the Sternpost [*Rablure de l'étambord*]: This is a rabbet which is made on either side of the sternpost in the middle of its breadth and into which the hooding ends of the planking of the bottom and of the stern land. This rabbet runs from the rabbet of the keel to the wing transom. Its breadth is equal to half the breadth of the sternpost for the whole part of the narrowing of the lines aft and above it is reduced to the thickness of the planking of the stern. Its depth is to within half an inch of the thickness of the bottom planking.

Rabbet of the Wing Transom [*Rablure de la lisse d'hourdis*]: This is the rabbet which is formed in the lower angle of the external face of the wing transom into which the hooding ends of the planks of the stern land. Its breadth is equal to or exceeds by one or 2 inches the thickness of the planking of the stern and its depth is equal to this thickness.

RAKE OF THE STEM [*Élancement de l'étrave*]: It is part of the length of a ship, that which exceeds the length of the keel forward or the horizontal projection of the stem beyond the keel. Some Builders regulate the rake of the stem in ships of war by taking 18 to 20 lines for each foot of length between perpendiculars. Others take but 10 to 12 lines, but most keep to a middling position between these two proportions, and it is in this manner that I have determined the rake in the ships whose plans are appended, without for all that claiming that this be the best rule, but only the amount of rake which is most commonly given. The rake of the stem in galleys is much greater than in ships. Storeships and other transports have very little rake.... Opinion is divided on the effect of this rake. Some claim that it is of advantage when sailing close-hauled, others that it has a contrary effect. Experience does not favour one opinion or another, for there are ships which are excellent sailers close-hauled of which some have an excessive rake and others very little; and it is on this account that the argument is founded of those who say that it is of no account to a ship's sailing qualities whether the rake be great or small.

RAKE OF THE STERNPOST [*Quête de l'étambord*]: This is the projection of the sternpost beyond the perpendicular of the end of the keel, or the horizontal distance between the end of the keel and the perpendicular of the sternpost. In warships it is equal to ¼,⅕ or⅙ of the rake of the stem. Most Builders give less rake to the sternpost today than was formerly given.

RIDERS [*Porques*]: These are timbers similar to those of the frames and fayed to the inside of the ship over the planking of the ceiling to strengthen the ship's sides. They run from the bottom of the hold as far as the clamps of the middle deck. There are riders in all ships and in frigates of the first order, as many as there are gunports on the lower deck. They are arranged in such a manner that they pass between the gunports on this deck. Frigates of the second and third orders have but 3 or 4 riders of which one or two are placed athwart the mainmast and the two others one athwart the chestrees and the other between the main capstan and the mizen-mast. It is rare to find riders in vessels other than ships of the line and frigates, save in bomb ketches, fireships and storeships which have a lower tier of guns. Each rider is composed like the frames of several timbers which are a floor rider or a crotch rider, two first futtock riders, two second futtock riders, two third futtock riders and two upper futtock riders, and in some ships there are half floor riders. These timbers are fastened one to the other with square iron bolts, like those which go to make up a frame, and they are fastened to the side of the ship by bolts which are driven from outside the planking of the hull and which pass through this planking, the frame, the planking of the ceiling and the rider to be clenched on the inside over roves. The effect of the riders is to strengthen the frames of the ship, to secure the planking of the ceiling against the frames and to fasten by means of their bolts the outer planking of the hull to the frames and to the planking of the ceiling.

RISING WOOD [*Contre quille*]: This is a timber fayed to the keel of a ship and which runs from bow to stern from the apron to the deadwood knee to strengthen the keel and to overlaunch the scarphs of the timbers of which it is made up. A distinction is made between three parts of the rising wood, which are the rising wood of the fore-body, the rising wood of the afterbody and the rising wood of the middle body. The rising wood of the fore-body is scarphed at one end about 2½ feet with the apron and at the other end it butts squarely to the rising wood of the middle body. Its length is determined by the position of the last floor of the fore-body, its breadth athwartships is equal to the breadth of the keel, its thickness at the end which meets the apron is equal to that of the apron, and at the end where it meets the rising wood of the middle body it is about 5 inches in First and Second Rates, 4 inches in Third and Fourth Rates and 3 inches in frigates. The rising wood of the afterbody is scarphed at one end about 2½ feet to the deadwood knee, and at the other end it butts squarely to the rising wood of the middle body; its length is determined by the position of the last floor timber of the afterbody, its scantling is the same as that of the rising wood of the fore-body. The rising wood of the middle body runs in a single timber or in two or three timbers butted end to end from the rising wood of the fore-body to the rising wood of the afterbody. Its breadth is equal to the thickness of the keel and its thickness from top to bottom is 5 inches in First and Second Rates, 4 inches in Third and Fourth Rates and 3 inches in frigates. Many Builders only employ the rising woods of the fore-body and afterbody in warships and do not employ at all the rising wood of the middle body; this practice is older than the other. The joint line of the rising wood and the keel is lined with kersey and the rising wood is at first only fastened with nails or treenails, for it is later solidly fastened to the keel by means of the bolts of the floors, the keelson and the riders which all pass through the rising wood. Scores are cut in the rising wood to receive the floors and crotches. This timber is of oak....

RUDDER [*Gouvernail*]: This is a long, flat piece of timber fastened with iron hinges to the sternpost and which serves to turn the vessel in whichever direction is desired.... The heel of the rudder in ships of war and in all all vessels save those where the sternpost describes a curve runs down to the level of the lower face of the keel and is trimmed flush with the keel. In ships, frigates, fireships and other vessels which steer by means of a wheel or a whipstaff, its head runs up to about 1 foot or 14 inches above the head of the sternpost; it finishes about 1 foot above the quarterdeck in bomb ketches, sloops-of-war and other vessels of this type which are steered by a hand tiller.... The breadth of the rudder in ships, frigates, fireships, sloops-of-war, bomb ketches and other vessels, measured at the heel or at the lower pintle, is equal to a twelfth part of the vessel's breadth plus half the thickness of the sternpost. In storeships and other transports which have no fineness in their run aft, this breadth is increased by a quarter, a third or by a half.... The breadth of the rudder in all these vessels, measured at the load waterline, is equal to ⅔, ⅗ or ¾ of the breadth at the heel; finally, the breadth at the head is 19 to 20 inches in First Rates, 17 to 19 inches in Second Rates, 16 inches in Third Rates, 15 to 16 inches in Fourth Rates, 13 to 14 inches in frigates, 12 inches in bomb ketches, sloops-of-war and other vessels of like force, and 5, 6 7 or 8 inches in ship's longboats, cutters and other small vessels.The thickness of the rudder at the heel and for its whole length from the heel to above the load waterline is equal to the thickness of the sternpost; its thickness at the head is equal to its breadth.... The face of the rudder which lies against the sternpost is bearded on either side by an amount equal to half the thickness of the sternpost so that when the rudder is moved to one side or the other its two edges do not restrict its movement, which would be the case if this part retained its full thickness. Sufficient scores are cut in the rudder for the number of pintles which must be fitted to hang it on the sternpost. The length of these pintle-scores exceeds the length of the pintles by the whole thickness of the googings plus 1 inch or ½ an inch and their depth is equal to the projection of the googings beyond the sternpost. The turning movement is imparted to the rudder by a tiller, which in ships, frigates, bomb ketches, ... and other vessels of this type fits into a mortice in the head of the rudder. The sides of this mortice are lined with an iron plate on either side only.... The head of the rudder which is pierced by a tiller mortice is bound by 2 or 3 iron hoops fastened to the rudder by nails. A hole is pierced in the rudder of ships and of all other vessels save small vessels driven by oars, which is one foot or 15 inches above the load waterline, and through this hole is rove a length of rope called the pendants which are made fast at either end to two ringbolts set one on either side in the sternpost. This rope is left slack, and it serves to prevent the rudder from being lost should it be unshipped by a heavy sea or by some other accident. For the same reason there are also two ringbolts set in the rudder, one on either side; pendants may be made fast there if required, but their principal purpose is for hooking the tackles by means of which the rudder is hoisted into place. Apart from these ringbolts there is a double ringbolt in the after face of the rudder, above the water, and to which a tackle is made fast in order to move the rudder if the tiller

should break and while the spare tiller is being fitted. The rudder .... is composed of two timbers of which one is called the mainpiece and the other the after-piece. Some Builders fashion in the after face of the rudder a channel 3 or 4 inches wide and 3 or 4 inches deep, claiming that this channel increases the action of the rudder; others give it 1 or 2 inches greater thickness at the after face than at the forward face so that when the rudder is hard over it forms a smaller angle with the keel; others on the other hand diminish the thickness of the after face by one or 2 inches so that when the rudder is amidships it offers no impediment to the ship's progress.... It is not, as many authors have written, in casting the water to right and left that the rudder causes the ship to turn the way which is wanted, for the rudder causes this effect because the water being immobile or advancing slower than the ship strikes the rudder which is opposed to it with the same speed that the ship is making, or at the same speed which the ship is making more than the water, and it thus causes the ship to turn in the same direction as the side of the rudder which the water strikes.

SAIL LOCKER [*Chambre aux voiles*]: This is an apartment of the hold of a warship in which the spare sails are stowed. It is situated abaft the main forward bulkhead and stretches all the way athwartships as far as the carpenter's walks, or else as far as the carpenter's and the caulker's storerooms which are in many ships placed at either end of the sail locker. [.... *dimensions* ....] The flat of the sail locker rests on the orlop-beam of the main forward bulkhead and on another beam called the sail locker beam. It is separated from the cable tier by the main forward bulkhead, and from the main-hold by a bulkhead fashioned from planks nailed to one of the lower deck beams overhead and to the sail locker beam. Entry to the sail locker is by way of one or two sliding doors cut in the main forward bulkhead. There is no sail locker in those ships where the cables are laid out over the top of the hold, in which case the spare sails are placed in sail-bags and hung from the lower deck beams abaft the cable-hatch.

SCUPPERS [*Dalots*]: These are square or round holes cut in the sides of a ship at the level of the decks and of the forecastle and quarterdeck to allow the water to run off.... Ships of the line and frigates have a round scupper on either side on the lower deck in the way of the manger and sometimes a similar scupper opposite the mainmast and another in the way of the mizen pumps. The last-named is to be found in most ships which have hogged. The middle deck of ships and the upper deck of ships and frigates have eight or nine scuppers on either side, two of which are in the way of the main pumps, one in the way of the mizen pumps and the others are distributed equally along the length of the ship from the foremast to the mizen pump scupper. These latter scuppers are round while those which are opposite the main pumps are square in most ships. The quarterdeck has three or four round scuppers on either side, arranged an equal distance apart one from the other from the break of the quarterdeck to the mizen-mast. The forecastle has one or two round scuppers in many ships. Bomb ketches, fireships and storeships have scuppers like those to be found in warships; these scuppers are square in most sloops-of-war, transports, small merchant ships and in mud-lighters. Round scuppers are 3, 4 or 5 inches in diameter and square scuppers 6, 7 or 8 inches wide and 3 to 4 inches high. Both kinds are lined with a lead pipe which is bent back and nailed round the edges of the scupper. Care is always taken to distribute the scuppers in such a way that they are never overhead a gunport and that they never cut into the wales.

Scupper-block [*Dalot*]: Is the name given to a piece of timber which is inserted in the ship's side and in which a round scupper is cut or else into which is inserted the assembly of four lengths of plank which form a square scupper. It is many years now since such scupper-blocks were used in the King's ships: nowadays scuppers are cut directly in the ship's side and thus weaken the frame timbers less.

Scupper Lining [*Dalot*]: Is the name given to the lead pipe which lines a scupper.

Scupper Pipes [*Goutières de dalots*]: These are small spouts made from lengths of fir, 2½ to 3 feet long and which are placed in the scuppers of the upper deck, forecastle and quarterdeck of ships which are in harbour so that the water which discharges through the scuppers does not run down the ship's side.

SHEEP-PEN [*Parc à moutons*]: This is the place where the sheep are kept in ships and frigates. The sheep-pen is set up in the between decks amidships and stretches from the main-hatch to the cable-hatch. Its breadth is equal or nearly so the the breadth of the main-hatch or the cable-hatch. It is formed of stanchions running from deck to deckhead, 3 or 4 feet apart, with planks running fore-and-aft against these uprights and spaced 2 or 3 inches apart so as to provide ventilation for the sheep, beyond that which they receive through the gratings. The sheep-pen has its floor raised 1½ feet above the deck and the sheep are kept on this floor. When the sheep-pen is not sufficiently large to take all the sheep which must be embarked, which happens at the beginning of a long commission in foreign waters, further sheep-pens are set up between the guns on the lower deck.

SHOT-LOCKER [*Parc à boulets*]: This is the place where the shot is stowed in ships and frigates. The shot-locker is in the hold, afore the mainmast. It is enclosed within the well and is separated from the pumps by a bulkhead. A division is made in the middle and running fore-and-aft to separate the shot of different calibres. The width of the locker athwartships is determined by the width of the well. Its length fore-and-aft is about 5 feet in First Rates, 4½ feet in Second and Third Rates, 4 feet in Fourth Rates and 3 to 4 feet in frigates. The forward bulkhead of the locker is not planked up to the deckhead in order to leave room for an opening next to the deckhead to provide access to the shot-locker, and when the oven is placed forward of this bulkhead an opening is made on either side just below the deckhead. Not all the shot is invariably stowed in the shot-locker. In some ships part is stowed in tubs placed abaft the well over the top of the ballast or half-buried in the ballast.

SKIDS or FENDERS [*Allonges de défense ou Défenses*]: This is the name which is given to those pieces of timber which are curved in two opposing directions and which are fayed to the upper works and which run from the upper edge of the wale beneath the gundeck ports to the bulwarks. There are five on either side in ships and frigates alike. Two of these skids are placed forward of the mainmast, 20 to 22 inches apart and serving as stringers for the entering ladder. The others are distributed between these and the chestrees and serve to prevent the longboat, cutter and other objects which are being hoisted aboard from damaging the ship's side. The skids are cut away where they cross the vessel's wales. They are about 5 or 6 inches square in large ships and 4 inches in frigates. Their size diminishes by a third at their head. They are fastened to the planking of the upper works and to the wales by means of nails, after first placing a strip of canvas or lead over the seams which they cover. Skids are made of oak or elm. A quarter-round moulding is formed on the sharp edges of their inner surfaces.

STEER, TO [*Gouverner*]: To steer is to move the rudder so that the ship adopts the course required. There are three different manners of steering which are to steer with a whipstaff, to steer with a wheel and to steer by hand.

To steer with a whipstaff [*Gouverner à la manuelle*]: This is when a whipstaff is employed to push the tiller from one side to the other. The practice of steering with a whipstaff was formerly generally employed in all ships and frigates, but in the last few years these ships are steered with a wheel. Nevertheless, a gooseneck is fitted to the end of the tiller, a rowle is set in the middle deck and an opening is left in the quarterdeck as if a whipstaff were to be employed so as to be able to steer with a whipstaff if the wheel should be carried away by shot.

To steer with a wheel [*Gouverner à la roue*]: This is when a wheel is employed to move the tiller from one side to the other by means of a tiller-rope which winds and unwinds round a drum. Most ships, frigates and two-decked storeships are steered with a wheel.

Steering Wheel [*Roue de gouvernail*]: This is a machine which serves to move the rudder. The steering wheel is made of oak or elm. It is about 3½ feet in diameter and has nine spokes which extend 9 inches outside the wheel and are 15 lines in diameter and turned round so as to be more comfortable to the hands. Its spindle is about 3 feet long and 22 inches in diameter, save at the ends where this diameter is reduced to 3½ inches for a distance of about 4 inches. The two ends of the spindle are let down for half their thickness and turn in two pillars spaced 2½ feet apart. The steering wheel is set up on the quarterdeck abaft the mizen-mast and amidships. Several turns of white rope are made round the spindle and the two ends run down into the gunroom where they are made fast to the tiller after first reeving through two fixed blocks furnished with sheaves. So that when the wheel is turned the tiller is caused to move from larboard to starboard as the rope unwinds from the spindle of the wheel.

It is not very long that warships have been steered with a wheel, it has been substituted for a length of timber called the whipstaff which served the same purpose and which is still carried on board so that it can be used in the event that the wheel should be carried away by the enemy's fire. The movement of the rudder is gentler when steering with a wheel rather than a whipstaff, but the latter is quicker.

STEM [*Étrave*]: This is a timber curved to the arc of a circle, raised so that it projects beyond the end of the keel to form the head and complete the length of the ship.... The stem of a warship rises to 1½ feet above the upper deck.... Its projection forward of the end of the keel is called the rake of the stem. Its width fore-and-aft is equal to the height of the keel from top to bottom and its thickness is also equal to the thickness of the keel. The stem is composed of three timbers in First Rates and of two timbers only in other ships and frigates. The first of these timbers is scarphed to the second and likewise the second to the third when the stem is of three timbers. The scarphs are 4 to 6 feet long according to what the timber allows, and some Builders hook these scarphs. The scarphs are lined with toppin or kersey, and they are strengthened at each end by a nail and by bolts which also run through the apron. There is a rabbet on either side of the stem where the hooding ends of the planking of the hull and the wales land; this rabbet is the same width and depth as the rabbet of the keel. Most Builders fashion this rabbet in the middle of the thickness of the stem, others place it one or two inches inside the middle line in order to leave a greater projection of the stem beyond the planking of the hull. This is the older method and the least esteemed, because it allows the seas too great a hold on the stem. The stem is always made of oak. Its shape is determined by a mould called the mould of the stem. It is set up by means of a gin; it is then assembled with the apron and allowed to rest on 5 or 6 shores of which 3 or 4 are placed against the fore side and one on either side. These latter shores run up as high as the height of breadth while those on the fore side are arranged at varying heights between the head of the forefoot and the height of breadth. Each shore has a sole-plate and cleats hammered in fore-and-aft and athwartships. The practice of raising the head of the stem as far as the upper deck of First Rates has come about only since the heel of the bowsprit has been made to rest on the middle deck. In bomb ketches, sloops-of-war and other small vessels the stem rises to the height of the forecastle. There are storeships from the Northern lands where the stem is scarphed directly to the end of the keel; in former times, some Builders used to follow the same practice in warships.

STEMSON [*Marsouin de l'avant*]: This is the timber which is scarphed at the bow to the forward end of the keelson. The stemson runs up as far as the lower deckhook or else only as far as the breasthook placed below the level of this deck, and it is fayed to the last crotches of the fore-body and to the apron. [.... *dimensions* ....] The stemson is made of two timbers laid end to end if none can be found long enough to fashion it in a single piece, which is invariably the case in big ships; these two timbers are joined by a scarph 3 to 4 feet long and so arranged that the timbers overlaunch the scarphs of the apron and of the stem. The stemson is fastened to the keel and to the stem with bolts which are driven from the outside of the ship and clenched or forelocked over roves on the inside. It serves as a support for the foremast. This timber is still an innovation and there are yet some Builders who do not employ it at all.

STERN-GALLERY [*Galerie*]: This is a balcony constructed at the stern of ships. There are two galleries in First Rates, one at the level of the upper deck and another at the level of the quarterdeck. Second and Third Rates have but a single gallery, at the level of the quarterdeck. There is also one in Fourth Rates and in frigates of the first order, on the level of the upper deck, and in some Fourth Rates at the level of the quarterdeck. Frigates of the second and third orders have no gallery. Many square-sterned storeships and all fireships have a gallery at upper deck level. Many merchant ships may be seen to have a gallery at the level of their quarterdeck. The floor of the gallery is formed by the planking of the deck upon which it is situated. Its breadth, in other words its projection beyond the stern, is about 4 feet in First Rates, 3 feet and a half in Second Rates, 3 feet in Third Rates, and 2 feet 6, 8 or 9 inches in Fourth Rates and frigates. The height of the breast-rail is about 3 feet. The galleries are defined by a rail marking the deck and another the breast-rail. Between these two rails are a row of balusters, pilasters or other ornaments of carved work. They are supported by knees which are also decorated with carved work and strengthened in some ships by iron brackets of which one arm is fastened to the the stern of the ship and the other to the projecting floor of the gallery. In First Rates, the two galleries extend round to the quarter-galleries, with a walkway round the quarter. Second and Third Rates present the same features, but in most Fourth Rates and in frigates the gallery is confined to the stern. There are frigates where the stern-gallery is not built at the level of the upper deck but 6 or 8 inches above this level, in which case the floor of the gallery is formed by planks laid athwartships and supported by knees nailed to the stern. Such galleries are raised in this manner in order that they be less exposed to damage from striking seas. The stern-galleries of ships and frigates are covered by a canvas awning called a gallery awning. Galleries which are covered in such a manner should not be confused with covered galleries, of which I shall speak in the next article.

Covered Stern-Gallery [*Galerie couverte*]: This is a gallery which is covered by an overhanging arch in the stern of the ship at the level of the poop or a few inches higher. Most English ships have covered galleries, as do those of the East India Company which they are building at Lorient.This practice has never been adopted in the King's ships save in the building of the *Dauphin Royal*, a 74-gun ship built at Brest in 1735 where the gallery is partly covered by an overhanging arch formed by the timbering of the stern 6 inches above the poop.

Stern-Gallery Gratings [*Galerie à caillebotis*]: This is a stern-gallery where part of the floor is formed of gratings. Such galleries are to be found only in some Fourth Rates and in some frigates where they are set up in this manner in order to afford less purchase to a pooping sea when it rises so high.

STERNPOST [*Étambord*]: This is a timber raised obliquely on one end of the keel and which defines the end of the lower part of the hull at the stern. Its head lies flush with the upper face of the helm-port transom. Its vertical height is calculated by adding to the depth in hold aft the thickness of the plank of the lower deck, the round up of the deck transom, the height of sill of the lower deck ports, the height of the ports of the gunroom and the thickness of the helm-port transom. Its breadth at the heel is as great as the timber from which it is fashioned will furnish, its breadth at its head is equal to the breadth of the keel and its thickness is the same as the thickness of the keel. The slope of the sternpost aft is called the rake. The heel of the sternpost is morticed into the keel. The length of the tennant is about two fifths of the breadth of the keel; its width fore-and-aft is one and a half times its length and its thickness is roughly equal to a quarter of the thickness of the keel. In former times two tennants were fashioned at the heel of the sternpost, but for many years now these have been reduced to a single tennant. The tennant and the mortice are coated with tar before the sternpost is assembled with the keel and a bed of toppin is laid over that part of the keel on which the sternpost rests. In most ships, the wing transom, the helm-port transom, the deck transom and the lower transoms are half-lapped over the sternpost. In others, scores are cut in the sternpost only for the wing transom and the helm-port transom, where there is an inner post on the inside to receive the scores for the other transoms. On either side of the sternpost a rabbet is cut to receive the hooding ends of the planking of the bottom and of some of the planks of the stern. This rabbet extends only as far as the rabbet of the wing transom; its width is equal to the thickness of the bottom planking and its depth is about half an inch less than its width. On either side of the heel of the post is another score, to receive the garboards and the strake next the garboards. The sternpost is fastened to the keel by a timber called the sternson knee, one arm of which is bolted to the keel and the other to the sternpost; it is strengthened on the outside by a timber called the false post and in certain ships by another timber on the inside called the inner post. When the sternpost is raised up it is already assembled with the transoms, the wing transom and the fashion pieces and all these timbers are raised at the same time together with the toptimbers of the after fashion piece. A gin is used for this purpose, the winding-tackles of which are made fast to the sternpost and the lighter tackles to the ends of the wing transom. Once the sternpost has been raised it is supported by five shores before the tackles are cast off; three of these shores are abaft the sternpost and the two others are placed one on either side. The head of the first shore abaft the post rises to about a quarter of the height of the post; the head of the second shore reaches half way and the head of the third is within 2 or 3 feet of the wing transom. The heads of the lateral shores reach the wing transom. These shores are supported on sole plates and butted by cleats laid fore-and-aft and athwartships....

False Post [*Contre étambord*]: This is a plank fayed to the after face of

the sternpost in all vessels where the post is straight, save only longboats, small boats and other such vessels. The false post strengthens the sternpost and prevents it from being weakened by the cutting of the googing scores. [.... *dimensions* ....] The false post is fastened to the post with nails and blind bolts. It has a score cut at the heel on either side to receive the garboard and the strake next the garboard. In its after face it also has a number of scores for the googings of the rudder irons. The false post is made of oak, and in some ports the joint line between the false post and the sternpost is lined with toppin.

Inner Post [*Contre étambord*]: This is a timber which some Builders fay to the forward face of the sternpost in a warship to strengthen it and prevent it from being weakened by the scores for the deck transom and the other transoms.... It is scarphed at one end about 18 or 20 inches to the deadwood knee and rises as far as the wing transom. Its width is equal to the thickness of the sternpost, its thickness at the heel is equal to the width at the head of the upper arm of the deadwood knee and this thickness is reduced to 3, 4 or 5 inches at the other end. Scores are cut in this inner post to receive the lower transoms and the deck transom, and it is fastened to the sternpost with treenails because the bolts fastening the transoms pass through it, thereby providing all the fastening necessary to the sternpost. Many Builders do not employ this timber at all in their building. Some scarph to the deadwood knee an inner post which rises no higher than the heels of the fashion pieces, others scarph to this knee a crotch, the arms of which meet the heels of the fashion pieces, and with one or the other method the deck transom and the lower transoms are scored directly into the sternpost....

STERNSON KNEE [*Marsouin de l'arrière*]: This is the knee which is scarphed to the after end of the keelson. The sternson knee rises in two timbers to the deckhead of the lower deck. The first timber is laid over the top of the last crotches of the afterbody and finishes at the last of these crotches or at the heel of the fashion pieces; the second timber is scarphed 4, 5 or 6 feet to the first and is fayed to the lower transoms and the deck transom. It is fastened like the stemson with bolts, and has several cleats nailed to its upper timber in order to provide a ladder to descend into the lady's hole. All Builders have adopted the use of this timber for the last 45 years. It is made of oak.

TELL-TALE OF THE TILLER [*Oïacomètre*]: This is an instrument which moves at the same time and in the same direction as the rudder when steering with a wheel and which serves to show that the helmsman has carried out his orders. It is composed of an indicator, two slides, a small length of cordage, a small block with two sheaves turning on the same pin and two single blocks. The indicator of the tell-tale is a fleur-de-lys carved on a piece of wood 4 to 5 inches square which moves from larboard to starboard and from starboard to larboard between the two slides by means of the cordage. The slides are about 6 feet long, 2 to 3 inches wide and 1½ inches thick; they are laid athwartships 4½ to 5 feet above the forecastle, forward of the wheel and fastened at their ends to the pillars of the poop, 3 to 4 inches one above the other. The double block is placed beneath the breast beam of the poop amidships and the single blocks are let into the heads of the pillars to which the slides are fastened. The cordage takes several turns round a small spindle inserted in the end of the spindle of the wheel. From there it passes up in two legs to the double block, each leg reeving through one sheave and then to one of the single blocks, before being fastened to the indicator, one on either side, so that when the wheel is turned in order to move the rudder, the indicator moves to the side to which the rudder is turned or else to the side the tiller is moved, according to whether the tell-tale has been set to show the position of the tiller or the position of the rudder. And wherever one is standing on the quarterdeck, on the gangboards or on the forecastle, the movement or the position of the rudder can be seen from the movement or the static position of the indicator. The tell-tale has a number of graduations on one of the slides which mark the various angles which the rudder may make with the keel, or the traverse of the tiller over the sweep, and thus it can be seen when the needle moves or stops at the graduations of this scale the opening of the angle which the rudder makes with the keel or the position of the tiller on the sweep. This instrument is new. It was used for the first time in 1727 on board the *Achille*, commanded by Mr de Gencieu, and the success which it enjoyed has caused it to be fitted since then in all the King's ships.

TOPSAIL-SHEET BITTS [*Seps d'écoute*]: These are two timbers raised vertically in a ship, crossed by a cross-piece, and furnished with sheaves through which reeve the topsail sheets and the falls of the rolling-tackles. The topsail-sheet bitts are distinguished as the main topsail-sheet bitts and the fore topsail-sheet bitts....

Main Topsail-Sheet Bitts [*Seps d'écoute de grand hunier*]: These are the bitts through which the main topsail-sheets are rove and the falls of the main rolling-tackles. They are set up forward of the mainmast, amidships. In First Rates they are placed against the forward face of the middle and upper deck beams forward of the mainmast, and run up from below the middle deck beam to about 4½ feet above the upper deck. In other ships and frigates they butt against the lower and upper deck beams afore the mainmast and run from beneath the lower deck beam to 4 feet 2, 3 or 4 inches above the upper deck. The main topsail-sheet bitts are scored 1 or 2 inches into the beams and are fastened with bolts. [.... *dimensions* ....] The shape of the two pins is such that they meet at the heel. There are two lignum vitae sheaves in each pin, their sheave-holes being cut above the level of the upper deck. In some ships they are reinforced at their heel by small iron or timber standards fastened to the deck to larboard and starboard of the pins. The timber which crosses the head of the two pins above the sheave-holes is called the cross-piece. The main topsail-sheet bitts are made of oak or of elm and they are worked diagonally so that instead of facing the bow of the ship they face the corner of the forecastle, since when the boat is hoisted in the sheets cannot be hauled save in this direction.

Fore Topsail-Sheet Bitts [*Seps d'écoute de petit hunier*]: .... They have the same shape as the main topsail-sheet bitts, the same support, the same fastening, the same number of sheaves and are about 1 inch less in scantling. The sheave-holes for their sheaves are cut at the level of the forecastle.... They are made of oak or elm and they are worked square and not diagonally like the main topsail-sheet bitts.

TOPTIMBERS [*Allonges de revers*]: These are pieces of timber which present a double curvature in opposite directions and which form part of the frames from the gundeck port sills to the bulwarks. They are scarphed four or five feet to the fourth or fifth futtocks.... The length of the toptimbers is determined by the distance which separates the port sills from the bulwarks; their scantling at the heel is the same as that of the head of the third futtocks, and this is reduced by about a third at their head in both the sided and the moulded dimensions....They are ordinarily made of oak and sometimes of fir but in frigates only.

TREENAIL [*Gournable*]: This is a bolt fashioned of oak, pine or fir, which serves in the place of nails or iron bolts to fasten the planks to the frame timbers and to join together many other timbers. Treenails are square when they come from the forest. Their length is 2 to 4 feet and their thickness one and a quarter to two inches. When they are mooted in the Dockyards they are reduced to one and three quarters of an inch for First Rates, 1½ inches or only 13 to 14 lines for Second Rates, about 13 lines for Third Rates and 10 to 13 lines for Fourth Rates and frigates. Only the planking of the bottom is fastened with treenails, and they are alternated with nails. For the treenail, a hole is bored which runs right through the bottom plank, the frame timber and the plank of the ceiling, and a treenail is chosen to fill this hole which is about one foot longer than the hole and of exactly the same diameter, save at the head where the diameter of the treenail exceeds that of the hole by a few lines. The treenail is greased with tallow or else tarred. It is driven in with a mallet, and when it reaches the point where its diameter is greater than the hole so that the mallet must be wielded harder in order to drive it in, the head is wound round with a twist of spunyarn to prevent it splitting. Once the treenail has been driven in as far as it will go, it is cut off flush with the planking at either end and a small piece of wood called a treenail wedge or a spile is hammered into both ends to re-align the treenail with the sides of the hole. A thread of oakum is also inserted in a cross-shape or triangle in the head of each treenail for the same reason, and this is what is called crossing the treenails. When a treenail cannot be driven all the way through, which happens when the auger-men meet iron when boring which prevents them from continuing, the narrow end of the treenail is split, a spile is inserted into the split, and the treenail is inserted ready armed into the faulty hole. Treenails are used to fill all the faulty holes in a ship which are bored for the bolts. They are also used to fasten together the timbers forming a double binding strake, to nog keel-blocks, and many other timbers. All the treenails which are used in building the

King's ships are of oak. In Holland and in the countries of the North they are made of pine and fir, but they are always wedged with spiles of oak.

TUMBLEHOME or TUMBLING-HOME [*Rentrement du maître gabarit*]: This is the difference between the greatest breadth of a ship at the height of breadth and its greatest breadth at the bulwarks. The tumbling-home at the midship bend is 3 inches to 3 inches 4 lines for every foot of breadth in First Rates, and 2 inches 6 lines to 3 inches in all other ships and in frigates.

WATERWAYS [*Gouttières*]: These are two timbers which run one on either side of the ship from bow to stern in the angle formed by the deck with the sides, to strengthen the heads of the beams and fasten the beams one to the other and to the sides of the ship....

Inner Waterways [*Serre gouttières*]: These are timbers which run fore-and-aft and are scored down into the deck beams, the beams of the forecastle, quarterdeck and poop to provide a longitudinal fastening for the ship and to fasten the fasten the decks and the poop to the sides of the ship....

Inner Waterways of the Lower Deck [*Serre gouttières du premier pont*]: These are the strakes of thickstuff scored down over the beams of the lower deck. The lower deck inner waterways run from the first beam forward to the deck transom in two strakes, on either side of the ship, consisting of several timbers 25 to 50 feet in length laid end to end and so arranged that the butts of one strake give shift to the butts of the other. The first strake lies flush with the upper futtock riders and the timbers called the filling pieces of the waterways. It is scored down over the beams 3½ inches in First Rates, 3 inches to 3½ in Second and Third Rates, 3 inches in Fourth Rates and 2 to 2½ inches in frigates. The second strake lies flush with the first and is scored down by the same amount, but culvertail fashion. The upper face of both strakes is dubbed flush with the upper face of the planking of the deck and fastened to the beams with nails. In all the spaces which are to be found between the beams of the lower deck they are crossed by two, three or four bolts driven from outside the hull through the waterway and clenched over roves on the inner face of the second strake of the inner waterways. It is by means of these bolts and of their hooks that the inner waterways serve to bind the beams to the sides of the ship. The hooks also serve to fasten together the two ends of the ship, as do those of the binding strakes. The inner waterways on the lower deck are always made of oak. [.... *dimensions* ....] Their thickness is equal to that of the planking of the deck plus the thickness of their hooks. In many ships and frigates the two strakes of inner waterway fine away to a single strake afore and astern, or only at the bow, and in frigates which have no upper futtock riders the first strake of the inner waterway lies flush with the waterway.

Inner Waterways of the Middle Deck [*Serre gouttières du second pont*]: These are the inner waterways let down over the beam of the middle deck. They run from bow to stern in two strakes, the butts of the one giving shift to the butts of the other as described in the previous article. The first strake lies flush with the waterway and is let down over the beams by about 3 inches in First Rates [.... *etc* ....] The second strake lies flush with the first and is scored down by the same amount but culvertail fashion.... They are 1 inch less broad than the inner waterways of the lower deck.... In most ships the inner waterways fine away to a single strake at the bow.

Inner Waterways of the Upper Deck [*Serre gouttières du troisième pont*]: These are the inner waterways let down over the beams of the upper deck. There are two strakes on either side... [.... *dimensions* ....].

WELL [*Archipompe*]: This is a square compartment which is set up in the hold of a ship about the mainmast. It encloses the mainmast and four pumps and allows the pumps to be inspected, to be removed and to be replaced whenever this should be necessary after the ship has been stowed for sea, which would be impossible were the pumps not thus separated from the stowage. The well affords the same convenience for the mainmast. In the well there is a compartment for the shot. The well is enclosed by several stanchions raised vertically or nearly so from the planking of the ceiling to the beams, and by planks nailed across these stanchions. Particular care is taken to ensure that the well is long enough and wide enough to contain the four pumps and for their inspection, but no greater, since otherwise that would lose precious space for stowage. [.... *dimensions* ....] In the well of some ships there is a locker placed a little below the level of the gundeck in which the caulker keeps his tools, especially those which he needs to repair the pumps. On either side of the well, or only on one side, there is a sliding door about two feet square which provides access to the well. This door is placed a few inches below the deck.

Mizen-Well [*Archipompe d'artimon*]: This is a square compartment which is set up in the hold of a warship below the mizen-mast to enclose one or two pumps and to establish in safety a lighted candle in the middle of the magazines when the ship is in action or when powder is being loaded or unloaded. In some ports it is called the light room.... A window is cut in each of the four sides of the well in ships, and in three sides only in frigates. These windows are situated below the flat of the breadrooms, in other words opposite the magazines. They are glazed and covered with a wire mesh, and provide illumination from the candle in the well to the magazine and powder-rooms. [.... *dimensions* ....] It is narrower than it is long in frigates because it contains but a single pump, and whereas in ships the well is amidships, in frigates it is so placed that it extends further to larboard than to starboard. Entry to the well is by way of two doors, situated above the level of the flat of the breadrooms, one in the forward side and the other in the after side. The gunner uses the latter, and enters from the passageway in the magazines running from the powder hatch; the caulker uses the other, and enters by way of the passageway between the breadrooms.

WHIPSTAFF [*Manuelle*]: This is a long, thin piece of fir which serves to push the tiller from one side to the other of the ship. The whipstaff passes through a timber called the rowle which is set in the middle deck abaft the mizen-mast. This whipstaff has an iron ring at its lower end which fits over the gooseneck of the tiller, and the other end rises to the height of the upper deck in First Rates or the quarterdeck in other vessels. To this end, an opening is fashioned in the upper deck or in the quarterdeck, running athwartships, which is called the whipstaff hole. The length of the whipstaff exceeds by 2 to 3 feet the distance from the end of the tiller when it is right over against the side and the rowle. Its diameter is 3 to 4 inches. When the whipstaff is used to move the tiller and thus the rudder, this is called steering with the whipstaff, but this method is today little employed in warships, for a wheel is more commonly used to move the tiller by means of a rope which is fastened to it. Nevertheless, the tiller is always set up in such a way that it can be steered by a whipstaff, and the opening in the upper deck or the quarterdeck is made for the free movement of a whipstaff; the whipstaff is stowed on board so that it can serve in the event that the wheel should be shot away or dismounted. The whipstaff should not be confused with the tiller.

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In 1737 **Blaise Ollivier**, Master Shipwright at Brest, was ordered by Maurepas, the French Minister of the Navy, to go to England and Holland in order to find out everything possible about how ships were built there, and what France might usefully imitate. Ollivier's secret mission lasted nearly five months, during which time he visited all the major naval dockyards of both countries except Plymouth. At the conclusion he wrote a 360-page report entitled ***Remarks on the Navies of the English and the Dutch***, discussing everything he had seen in meticulous detail, evaluating English and Dutch practices and comparing them with techniques used in France, illustrating his findings with 13 sheets of drawings and plans.

Blaise Ollivier's report provides a remarkable insight into shipbuilding practice in the 1730's, a period about which relatively little is known (it is generally regarded as a time of conservatism and stagnation). While published writings – in any case few in number – tend to concentrate on theory, Ollivier's manuscript is intensely practical, and confounds many long-held beliefs. It highlights not only national differences, but also differences in practice between individual dockyards; it demonstrates that shipbuilding in England, far from being frozen in the practices of an earlier age and strangled by the detailed regulations imposed by the 1719 Establishment, was undergoing a continual process of change in the search for better solutions. Likewise, in Holland, Ollivier reports on the highly innovative shipbuilding techniques being applied by Paulus van Zwijndregt and Hendrik Raas. His report gives the lie to the commonly held belief that French ships were in every respect superior to their English or Dutch counterparts. And Ollivier makes some startling observations: compass-timber was not a prerequisite for framing ships in England; some Dutch ships were deliberately sunk in order to preserve their timbers; Dutch ships laid up in Ordinary were covered with a tiled roof; iron knees were already in use in English ships – to name but a few.

Blaise Ollivier was the most distinguished French shipwright of his age: he designed the first "true" frigate, which was imitated by the Navies of all the maritime powers, and he was responsible for a series of extremely successful other ships. Although all his work was done in peacetime, he laid the foundations for the technically formidable French fleet of the Seven Years' War. Were it not for his untimely death (he died less than ten years after his return, at the age of 46), he would undoubtedly have outshone Sané and even rivalled Chapman as the pre-eminent European shipwright of the 18th century. His ***Remarks*** carry the weight therefore of a keenly enquiring mind and a wealth of experience. There is no trace of chauvinism in his evaluation of foreign methods, and many of the practices which he admired were incorporated into ships built by him in the years following his return to Brest. Travelling almost certainly incognito, and charged with a mission of what today would be called "industrial espionage", Ollivier reports in the minutest detail on shipbuilding of the 1730's: timbering; steaming of plank; construction of dock gates; the abilities of the shipwrights he met; the quality of the carved-work; the rations of the crews; the English 1719 Establishment and the experimental ships built in accordance with Newton's "solid of least resistance", the difference between the techniques of the English shipwright Bentham in Amsterdam and those of Paulus van Zwijndregt and Hendrik Raas. Nothing escapes his eye.

Never before published, Ollivier's ***Remarks*** have lain dormant for 250 years and survive as a unique documentary account of 18th century shipbuilding, invaluable to student, historian, and modelmaker alike. Ollivier is no arcane theoretician, and it is no exaggeration to say that his manuscript ranks with the best published works of the age, and as a description of contemporary practice it outweighs even the works of Steel, Stalkartt or Duhamel du Monceau.

This book contains the full text of the ***Remarks*** in both the original French and in translation, fully annotated and with a lengthy explanatory Introduction. It is lavishly illustrated with nearly 100 contemporary engravings, plans, ships' draughts and other iconographic material. Also included is a 20-page translation of part of Ollivier's remarkable manuscript Dictionary of Shipbuilding Terms, in many ways the counterpart of the ***Remarks*** for contemporary practice in the French Navy. These two manuscripts constitute a unique eyewitness account which is essential reading for anyone with an interest in how ships were built by three of Europe's most powerful Navies on the eve of the Seven Years' War.

