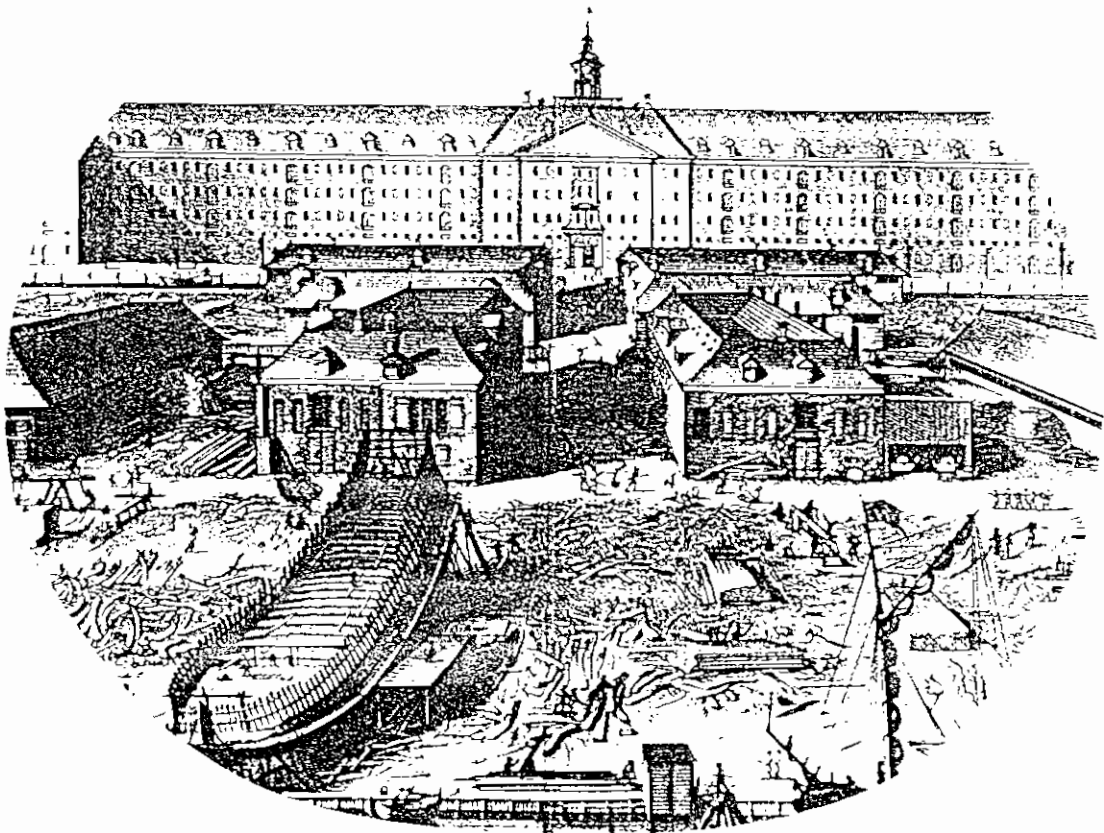


MIA

NICOLAES WITSEN

*Shipbuilding
and
Management
(1671)*



Edited by Marit van Huystee

Report
Department of Maritime Archaeology
Western Australian Maritime Museum No. 91
1994

Shipbuilding and Management

An edited translation from the original 17th century Dutch

of chapter eleven
of

Aeloude en Hedendaegsche Scheeps-bouw en Bestier

by Nicolaes Witsen
Amsterdam, Anno 1671

Containing a glossery of 17th century shipterms

by Marit van Huystee

Introduction

Translating a book or a chapter on 17th century shipbuilding, written in 17th century Dutch, is not an easy job. Therefore this English translation of Nicolaes Witsen's text must be seen as a very tentative attempt, which undoubtedly will keep many questions unanswered. The Dutch text itself is in many ways obscure and convoluted, and contains many unsolved problems. The English translation is consequently often even more vague and obscure. Translating the used terminology has proven to be very challenging at the least.

I decided therefore that only the most literate translation would be of any use to those who would like to get an insight into this extremely interesting work, but who do not master the Dutch language sufficiently.

SHIPBUILDING and Management by Nicolaes Witsen

Elfde Hoofstuck (Part 11)

[pp. 144]

How to assemble the ship-parts together.

The names of our ship-parts told and shown separate, and in their right places, and the proportion of it. In the end that will give us a 134 *voet* ship into the water. First there is a list of all the parts, which in order of the sequence in the building process follow each other. Although the keel is the first part to be laid down, here the first part to be built will be the stem, as the *besnoeien* of the keel comes out of the stem. And it doesn't matter which part is built first, as long as one doesn't forget to build a part, which is unlikely anyway.

Names of all the ship-parts that in the building process follow each other.

First:

You should make the keel, after this

2. the stem
3. the stern-post
4. the wing-transom
5. the fashion-pieces
6. the schoch bellow it
7. the lower transom
8. the other transom(s) (-beams)
9. top-timbers of the fashion-pieces
10. you should place the keel on the stocks
11. Take the take the top-timbers of the fashion-piece and the transoms from it
12. Raise the stem
13. Raise the stern-post and fix the transoms and the top-timbers of the fashion pieces
14. Make a knee on the keel and against the stern-post. After this you should
15. finish the stroke and the rabbet
16. Bore the stopwaters in the stern, the stem and the keel
17. Make the garboard strake
18. Make the bottom and level it
19. Place a *buickstuck* [FLOOR TIMBER] and a 1st futtock on each side of it
20. *Boei* the bilges. And
21. level it after it was *geschroot*
22. Make the timbers, the 2nd futtocks, and the gangboards on the lather
23. On which the scaffolding will rest
24. Make the *scheergang* , and level it beloft
25. As well as the at the top ends and the props
26. The floor-timbers, the 1st futtocks, the *stekers*, the *zogstukken* [CROTCHES] and the transoms
27. The *kalven* or *hecken* and *toonien*
28. The beams there
29. Make and level the *kimmen* [BILGES]
30. *Wagert* [TO PLACE THE THICK STUFF OF A SHIP'S CEILING] the bilges
31. Make the scaffolding on which will rest the *balkwagers*
32. Level or raise the 2nd futtocks
33. Secure the *balkwager*
34. Set the beams with a *wager* underneath
35. Get the scaffolding beloft

[pp. 145}

36. Set the *stutmallen*
37. Make the *wagers* between the bilges and beams
38. With the *spantstutten*
39. Make the ribbands, the props and the *swiepingen*
40. Make the knees, *wagert* the bottom, make the bands and the keelson with the *spoors*
41. Raise the top waterway
42. Set one or two *wagers*
44. Place the deck beams and the gun room
45. Subsequently you make the *balkwager*
46. Under which the other *wagers* are placed
47. Raze the nails and the bilges
48. Close the binding strakes of the deck *scheerstocken* and the stern
49. Make the knees and let the carlings be prepared
50. Get at the outside of the ship and make the *buik-houten* below the gun-ports
51. Caulk the bilges and the strake
52. Make the *huiddicht*

[pp 146]

Follows the way ship-parts are assembled together and built, starting at the stern-post.

To make a stern-post, take a piece of timber of desired length, thickness and width; place a ribband at the back from the top end of this stern-post at **a**, and place a other ribband at the foot of the stern-post between **f** and **e**. Connect both ribbands at **b** where they should form a right angle; after that make a notch in the stern-post at **d**, and stretch a line between **d** and **c** on the horizontal ribband, this makes the rake of the stern-post. **f** to **e** is the width of the base of the stern-post, **a** to **g** is the width of its top end, as can be seen in figure C.

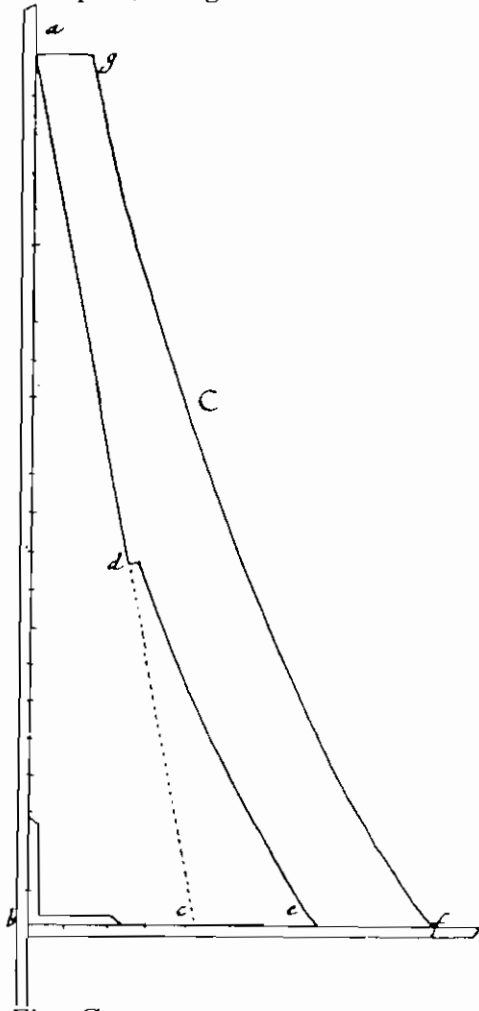


Fig. C

To find the rake of the stern-post reckon for each six *voet*¹ [FOOT] length of the stern-post, one *voet* for the rake. Find the length by measuring the ribband between **a** and **b**. The rake is the distance between **b** and **c**. Next place the back of the stern-post (**a-c**) parallel with the ribband **a-b**. To adjust or lay* the right angle of the stern-post keep the carpenter's square at **b** and mark the ribband at **f** and **e**²

¹ Amsterdamse voet: 11 duim. 0.283 m.

² To my thinking it seems a warning to mark **f** and **e** before placing **a-c** parallel with **a-b**. (RP)

For the cutting of the special parts you use moulds or patterns on which the timber is rested and cut in finale shape. As, for instance, by attaching a temporal sheer strake³ in order to determine the sheer and lines of the ship “to will and demand”, the way you like it.

When the stern-post is⁴ “square angled”, the inside and outside shaped according to the line, and “tightly cut in the lead” as shown with **a-b** and **d-c**. Then place it down, inside facing up and strike a line in the centre as from **g** to **h**. Measure on both sides the desired thickness of the stern-post, and cut it at a right angle on the level of the rabbet in the stern-post, as is shown with the lines **d** to **c** and **e** to **f**.⁵ When this is finished put the rear side facing up and attach the *skegs*⁶ as shown from **a** to **i** in **B**.

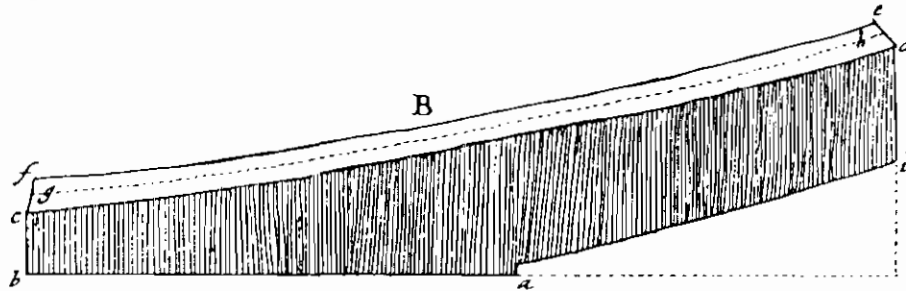


Fig. B

Figure A shows the stern-post standing on the keel.

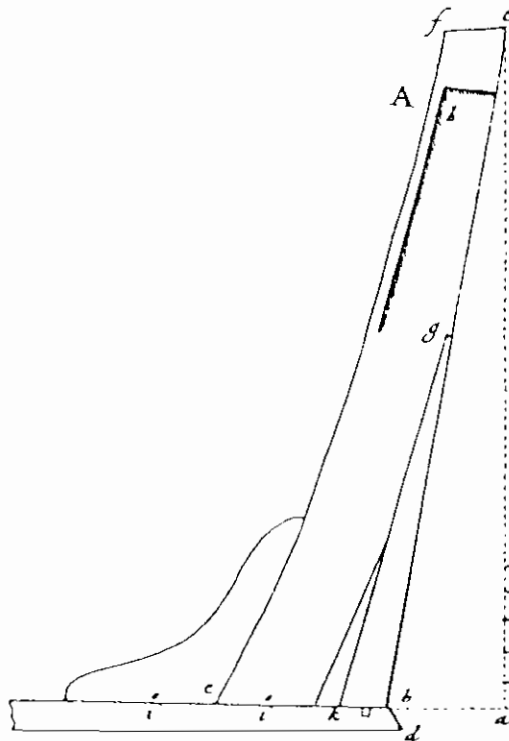


Fig. A

³ Strake determining the top view of the schip. Sometimes reused for other ships also with notes about for instance gunport, galley stairs etc.

See also: Van Yk p.71-73, 76, 79,101, Witsen (1671) p. 57,81,82, 152., Van Dam p. 457,497.

⁴ ‘in’ must be read as ‘is’

⁵ Although the text seems to indicate that the rabbet must be cut it is understand that the cutting of the rabbet comes after the placing of the

⁶ Van Beijlen, *Zeilvaartlexicon*. May-be filling-in-piece.

- ab The rake of the stern-post
- ac The height of the stern-post
- be The width at the base of the stern-post
- cf The width at the top of the stern-post
- gb The length of the stern-post *skeg*
- h The rabbet
- bd The heel of the keel and its thickness
- e The knee on the keel at the stern-post
- i The *stopwater* (wooden dowls to fit in a hole to make the joint watertide)
- o The markings where the *stopwater* were driven in
- k The pin of the sternpost that will fit in the keel

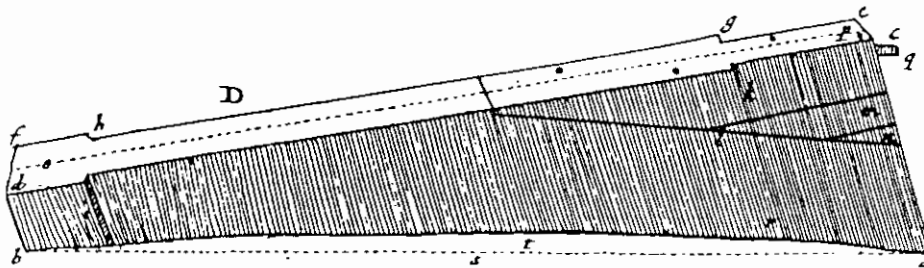


Fig. D

When the stern post is erected with its rear facing up, you fix the *skeg* **k** first on the stern-post and then at **l**. You secure the other parts **m** and **n** under the *skeg*.

After that you straighten the rear. Subsequently strike a line in the centre similar with the dotted line **o-p**. Carve out the thickness below and aloft, as can be seen in the figure at **g** to **k**; **i** to **h**; **f** to **d** and at **c** to **e**. Subsequently make the pin **q** about as thick as the rear of the stern-post, with its length one third of the keel's thickness. And thick⁷ one third of the stern-post. From **c** to **k** it is so much tinner as the planks of the garboard strake are thick, which have to be fixed there: [This rabbet becomes less deep to the inside of de stern-post at **r**] Secure the *skeg* with bolts and nails in the right places, see the dots in the figure.

[pp 147]

The inside (between **a** and **b**) and must have a slight bend as can be seen at **s** and **t** in the figure.

The broad part of the rear is 16.5 *duim* [INCH] long, and is called the *vierkant* [SQUARE]. It is 13 *duim* thick. Under this *vierkant* it is 9 *duim* thick. The inner part [of the stern-post] should be made of one piece of timber, as should be the outermost *skeg*. But the innermost *skeg* can be made of two pieces of wood. All of this can be seen in figure **D**. The stern-post is often built by many shipwrights a bit thicker on top than is shown right here.

⁷ literal thick but probably meant wide.

Follows the model of the wing-transom as can be seen in figure E.

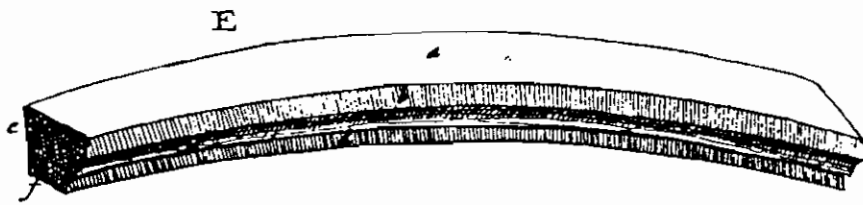


Fig. E

a is the topside, **b** is the rear, **e** the inside, **f** the base. At the rear it is made concave with a rabbet in which the planks of the stern have to be fitted later; **d** is the rabbet, **c** the ~~cavity~~ ^{depth}. When it is ready you place its rear on top of the inside of the stern-post, close to the top end and secure it with a dovetail. It should be levelled both on the inside and the topside on which the fashion-piece will come, which ends are tailed in the stern-post. The base should be on one level with the rabbet, and the stern-post remains without a peak at all. The base of the fashion-piece should have the same curve as the rabbet. If you are preparing the wing-transom, you should make the curve to the length it possess, as well as the width and the thickness, that is each ten *voet* length, eight *duim* till the curve, and to the width each *voet* length one *duim* to the width, the thickness a little less.

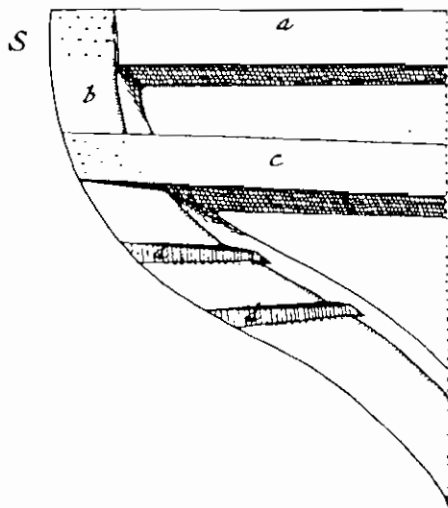


Fig. S

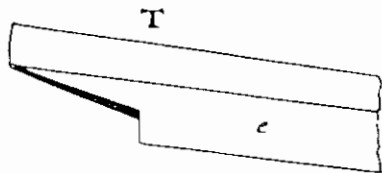


Fig. T

At figure S, **a** is the wing-transom and **b** is one side of the fashion-piece. **c** and **e** at T are transoms in the (lower)stern, **d** is the notch or dovetail, in which the ends of the transoms will fit. These transoms are fixed with a shoulder across the stern-post; and the wing-transom has to

be attached to the end of the stern-post with a dovetail, and you should fix it and the transoms with two bolts. At the ends of the dovetails, clinch it with nails until you have fixed the side counter timber over it.

When the stern has been erected straight, nail the bolts and hammer some nails as well through the centre of the side counter timber, and at the base.

About the fashion-piece at F.

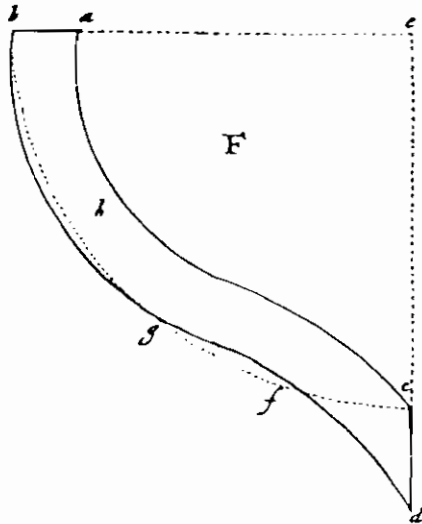


Fig. F

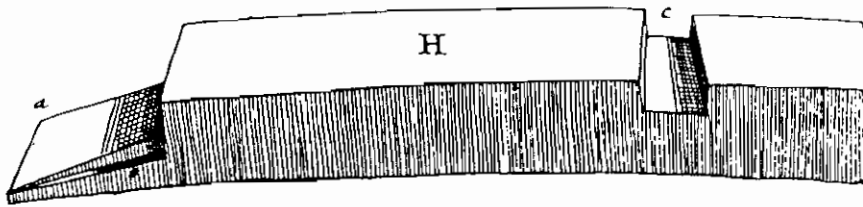
To make a fashion-piece, first make a square: from **a** and **e** to **c** and **d**, put a leg of a pair of compasses at **e** and measure the half of the stern/wing-transom from **e** to **b**. Pull a circle to **c**, and allow a slight slope inside the circle as can be seen at **g** and **f**, and allow a bit of the timber to get out of the circle at **h**, all this to get the curve and bend.

From **c** to **d** at the base is the width as is **b** to **a** at the top: this is the proportion of the inside of the fashion-piece (usually they use a mould). After this, place it with the end at **c** and **d** on the stern-post and place the other end at **a** and **b** at the end of the wing-transom. Fix the ends with *verlore lippen* or notches with tapering sides, both at the stern-post and the wing-transom, as can be seen in figure **G**. **a** is the fashion-piece notch or *verlore lip* at the stern.



Fig. G

Model of a transom resting upside down, as can be seen in figure H.



The dovetail at **a**, **b** and **c** is the shoulder notch across the stern.

If placing the transoms, hang a plumbob at the transom and see how much it is out of the perpendicular. Take half of the thickness of the fashion-piece on the inside, and let it lapse on the outside. Decrease the transom by half, and decrease the end of it as much as the transom in the fashion piece decreases on the inside, and that will make/form the dovetail; yet you should make the hole for the dovetail on the inside of the fashion piece

[pp 148]

half a duim narrower than on the outside. All the transoms have to be of the same size and they have to be hollowed out/scooped out as deep as the hole of the transom. This makes the ear of the transom, as can be seen at **b** in the figure. The transoms should not be fixed before the stern has been erected. Four holes should be bored in the wing-transom to fit the bolts in; 2 in the transoms, 13 or 14 in the lower-transom, 8 through the fashion-pieces, 5 or 6 in the stern-post. To keep the fashion-pieces together, drive 10 or 12 nails in [each of] them. The rabbet in the stern-post lapses at the bottom. The bolts of the transoms have to be placed about 2 duim through the stern-post.

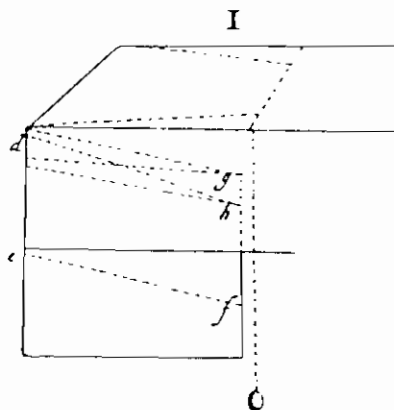


Fig. I

As can be seen in figure I, drop a perpendicular from the transom and mark the transom with chalk. Remove the wood between **f** and **g**, as between **e** and **d**. The part between **h** and **g** makes the ears and the hole of the dovetail, as can be seen in figure K at **k**.

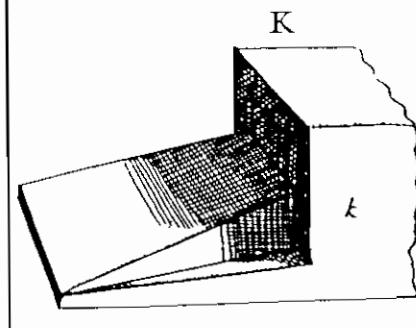


Fig. K

Model of the stern on the inside as is shown by figure L.

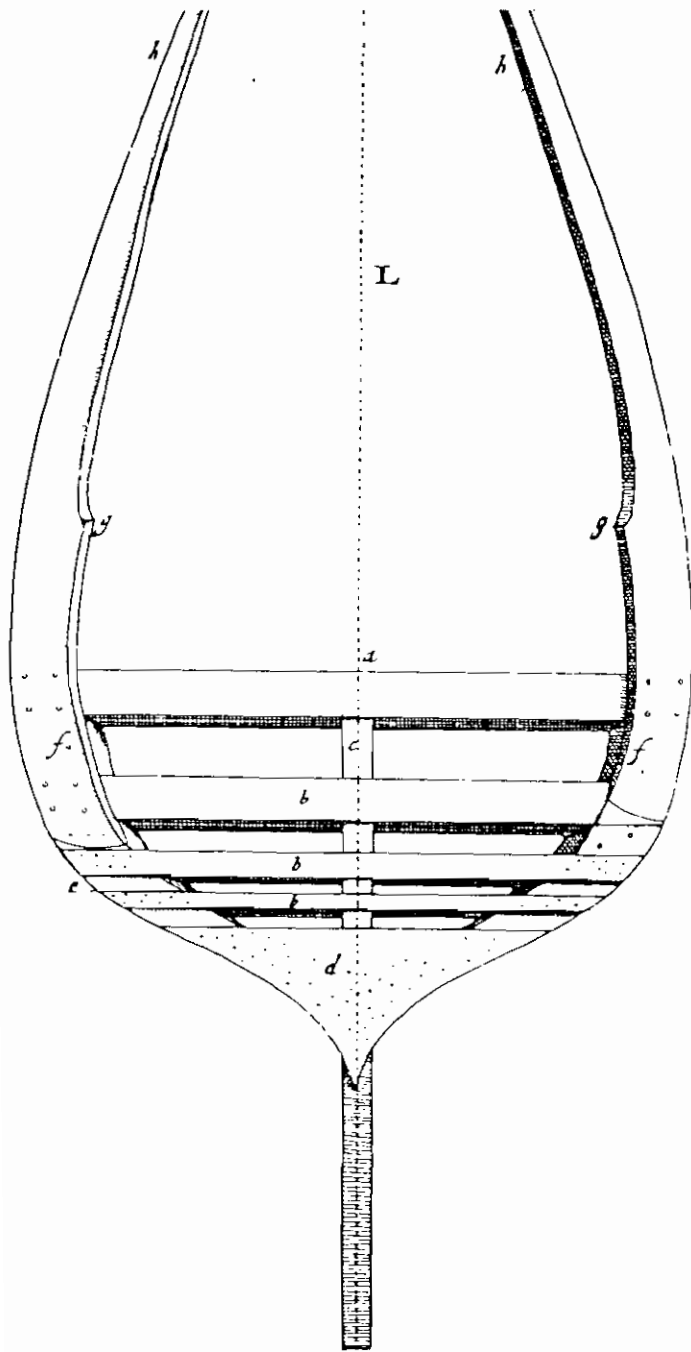


Fig. L

The terms are the following: **a** is the wing-transom, **b** the transoms, **c** is the stern-post, **d** is the lower-transom, **f** is the fashion-piece, **g** is the notch of the side counter timber, **h** is the width of the top-ends of the side counter timber of the fashion-pieces, and the side counter timber of the fashion-pieces themselves [**e** is not in the text]. The lower transom keeps the fashion-pieces together. At the bottom of the fashion-piece there will be a chock; the lower transom is fixed at each side of the stern with 4 bolts and with a few more in the centre, right in the stern-post. All the parts of the stern, the fashion-pieces, the transoms, lower transom, etc., were made on the floor and after that hoisted up and fitted in.

How to erect the sternpost.

To raise the sternpost, you take a mast twice as long as the stern-post and attach a pulley-block to the top end and an other one to the stern-post. The last one should be fixed in a way that the sternpost is in balance (without the fashion-pieces and the transoms). Tie six or seven ropes at the top of the mast to keep the mast straight. The mast rests on a plank with clamps and around it is wound an iron chain which is attached to the running block, which should be connected to the capstan. When the stern-post is erected, fit in the transoms and on top of them the side counter timber. In order to hoist these parts, use a cat-block and attach it to the top of the crane. Drive the bolts into the transoms and into the side counter timber and secure the stern-post at the bottom on the inside with big nails and with props at the back, which rest on the planks which are fixed in the earth and to the stern-post. The planks should be secured transverse to the stern for extra strength. As is shown in figure M, where

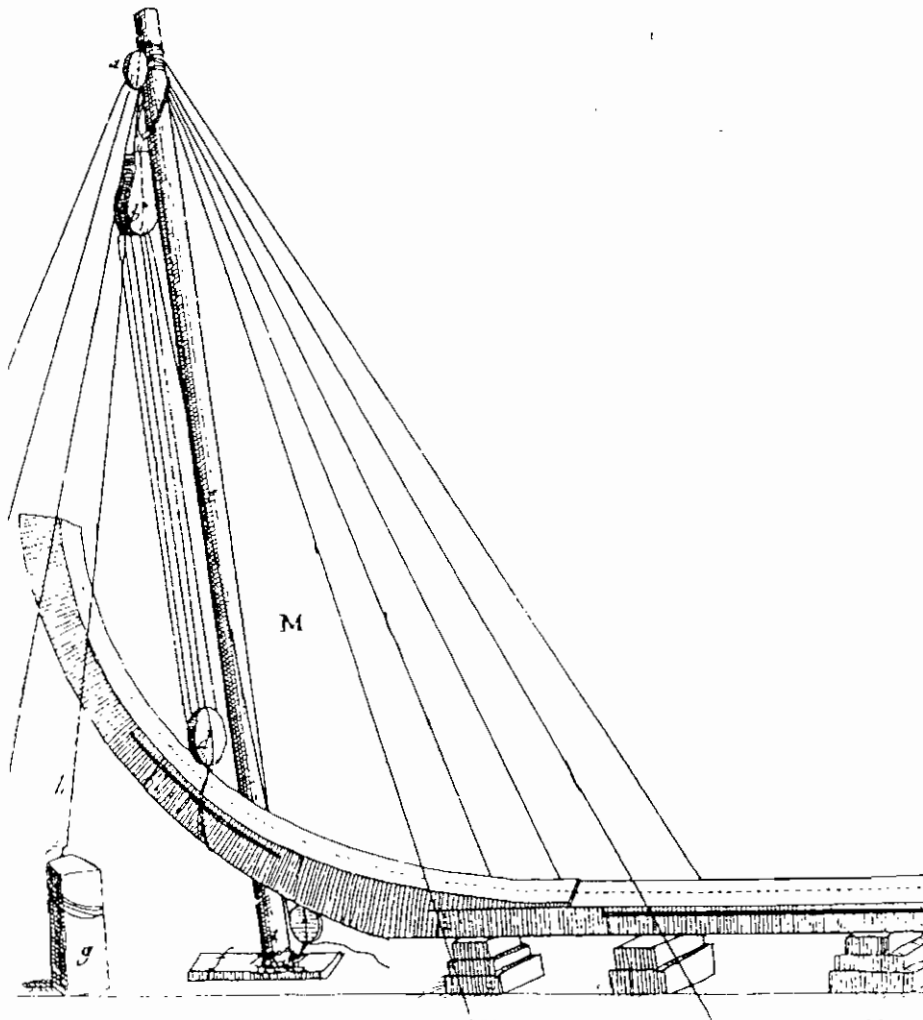


Fig. M

- a is the cat block
- b is a *gijnblok* [WINDING-TACKLE BLOCK WITH TWO OR THREE SHEAVES]
- d is a single block
- e is the crane
- f the plank
- g a supporting beam for the main ropes
- h main rope
- i *hel* [WRAIN STAFF CHAIN]

N shows the stern-post together with the lower-transom.

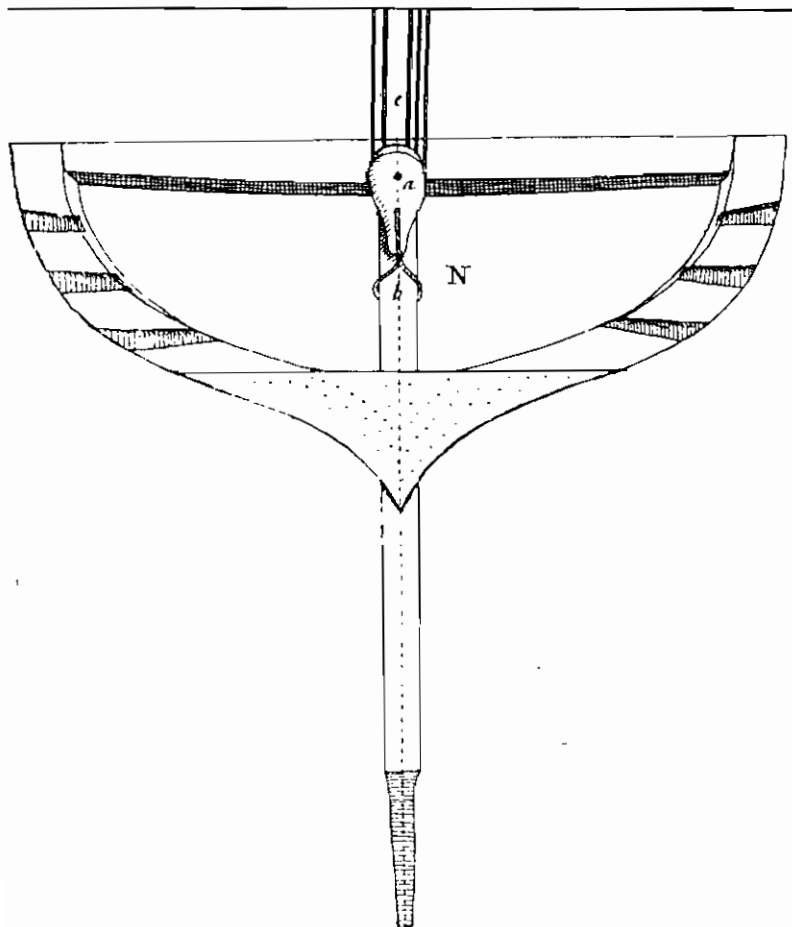


Fig. N

a is the winding-tackle block that is sewed to the stern-post with a rope. Beloft the rope a bolt sticks in the stern-post; this for preventing coiling of the rope during the erection; **b** is the rope, **c** is the *geschoren Jein*.

In **PP** **a** and **b** are the rabbets at the keel; this figure shows the way the planks were fixed.

[pp. 149]

Figure **QQ** shows with **c** and **d** the way the *kielstaschen* [KEEL SCARFS] were made.

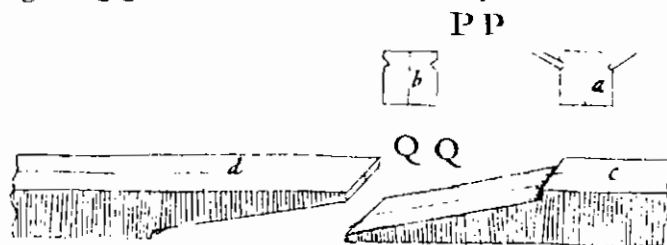


Fig. PP and QQ

When you are going to make the keel, take a fourth of the thickness of the stern-post, and the width should be a half wider then the stern-post; at the ends gaining some thickness towards the stern-post. Make the rabbet a fourth of the thickness of the stern-post; at the upper side of the keel, make it about a fourth deep and wide too. At the rear it should be kept straight, and when

the scarfs are fixed, bore from the bottom up a stopwater in the rabbet to prevent water coming in. When the scarf is fixed, place the keel on stocks, fore and aft half of the thickness of the stern-post on the inside, and keep it lower in the middle. Then drive a small clamp between the keel and the stocks, so that the keel can't shift when you fix the hull timbers. After that, make the head of the keel at the front of the keel and attach a *middel-krab* [HART OF THE KEEL] to the keel, which is a marking-line which will always help you to measure the centre of the ship. Four or 5 bolts were driven through the knee of the stern-post, which is placed against the stern-post and upon the keel. All the seams below have to be filled carefully with moss to prevent water coming in. You should take notice of the fact that you must make the keel a little longer than is required, because the head and the heel of the keel have to be attached to it.

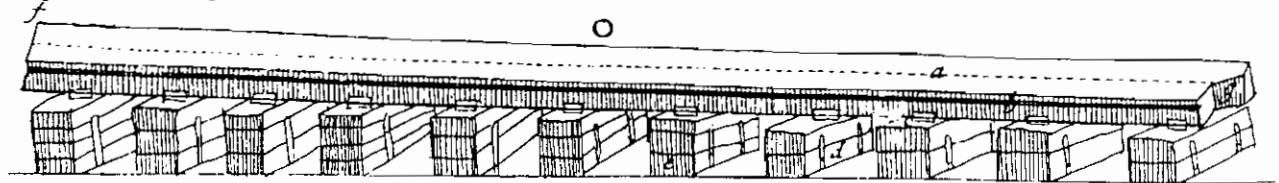


Fig. O

- a is the *middel-krab* or the hart of the keel
- b is the rabbet
- c the little clamps against the keel
- d a stake to fix the stocks
- e the stocks
- f the heel of the keel
- g the head of the keel

How to make a stem.

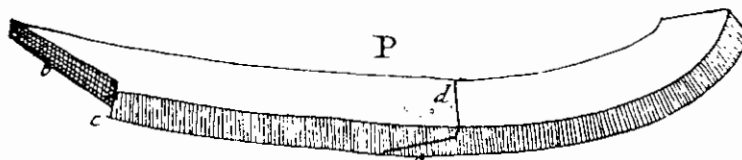


Fig. P

- a in figure **P** is the scarf
- b is the scarf that will fit in the keel
- c is the head of the keel
- d is the (small) bolt clinched with the (small) plate

The other spots are bolts, pins and nails which were used to fix the scarf.

When making a stem, take the two pieces and place them together in an angle to the desired height and rake of the stem, then fix the scarf, which should be marked/signed above and below. Transverse the ends of the scarfs, the thickness should be a fourth (1/4) of the total thickness. Rule/line the head of the keel next to the lowest clamp, which lays upon the keel, and when the scarf is attached and flushed you have to put moss between the parts before you fit it all together. Then nail it to the top end and further with 4 bolts with small plates clinched at one end and secured with nails: After that you should make the fore side 2/5 part thinner than the inside and close the inside and the outside. When making this you should place the parts on top of each other to secure its straightness. Therefore place on each end as well as in the centre a *rei* [STRAIGHTEDGE] on its side, and have a look below the *rei* to all the three ends of the *rei* on each side, and if there is something wrong, so improve it on the face of it; scrape off the scarfs.

To make progress with the stem place, as is stated before, the parts together and see if the rake is the required one. If this is the case, put a pole from a to b, which is the height of

the stem as can be seen in figure Q, and put a pole from **c** to **b**, which is the rake of the stem. After that you take a right angle and keep it on the inside of the poles at **b**, if it forms a right angle you draw the head of the heel in the angle at **c** and **e** as can be seen in the lines **d** and **c**, that is the *lip* of the keel, and as is drawn from **d** - **c** and from **c** - **e**. This remains the rake, the bolts in the scarfs of the stem were driven in from above and below.

When erecting a stem

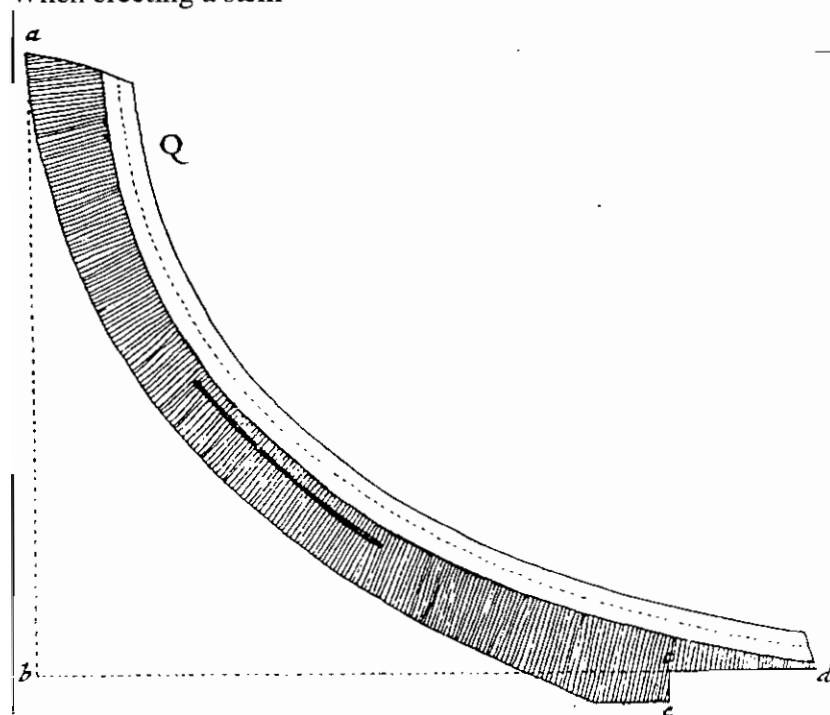


Fig. Q

[pp. 150]

you should make the pole 2 *voet* higher than the rake of the stem, or even 3 or 4 *voet*, as well as a bit more bent than is usual. The less the stem rakes, the longer the keel should be; the longer the keel, the bigger the bottom; the bigger the bottom, the more the ship is able to burden. Frigates have stems with a larger rake, and they are made above with a bit more curves and rake too ⁸.

Here after you make a part of the rabbet in the stem, as can be seen at **f** in the same figure [figure Q]. When the stem is attached to the keel, you should take a *rei* and bend it at the end of the rabbet towards the keel as is desirable. Draw, once this is done, the upper side as the *rei* [BATTEN] points out. Take a pair of compasses with a piece of chalk and draw with it from the *rei* the width of the rabbet, secure the *lip* and the fore-foot well.

At the front, upon the stem this time a scarf was made. Once the frame stands, you should start to *boeien* [FITTING THE PLANKS], the garboard strake and the rest of the bottom with the *kimmen* [BILGE-PLANKS]. When making the garboard strake, chisel here and there a hole in the plank, and take a *passer* [PAIR OF COMPASSES] and measure if the inside and the outside have the same thickness. Then you indicate with a pair of compasses along the keel on the planks the timber that should be removed. Then remove the planks and mark with a line at the inside what timber exactly should be removed as indicated by the chiselled holes. Once you have removed the marked timber, turn the planks and mark with the *passer* the places where you could not draw your line first; remove the timber at the first carved side *te niet af*, and bore away each 7 *duim* a hole, one *duim* from the side, outside and on the inside. After that you put moss

⁸ *lui* is in the Van Dale Dictionary: 1) lazy, 2) slightly raked, 3) *lui hout* [LAZY TIMBER], timber that is not bent properly

which is mixed with tar upon the carved side, and fit the planks and attach them to the keel; then line or cut the outside of the plank as is desired/as you like it, and place another one against the first one. After that you take a *krabhout* [SPILING-GAUGE] and line out the unequal/uneven spots below and above, and once you have removed excess timber and connected it all together again, you take several clamps which are used to secure the planks; place the clamps at the inside and at the outside about 3 or 4 *voet* apart and hammer as well a clamp on the keel and the garboard strake here and there, which comes across the keel and strickes both the keel and the garboard strake, and attach it to the keel. The stem should be built above quite deep, because at that spot one build inwards.

About the way one put on the first planks, as can be seen in figure R.

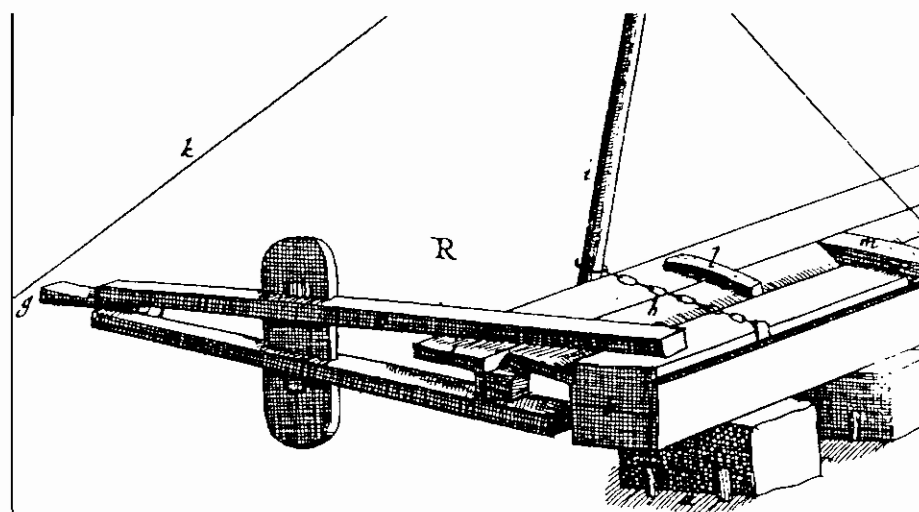


Fig. R

- a is the stock
- b is the keel
- c is the garboard strake
- d the plank at the garboard strake
- e the *boeitang*, a wooden tool formed like a pair of tongs and employed to confine the planks of a vessel in their places until they can be nailed or bolted to the timbers
- f the *oor-hout* ⁹
- g the wedges
- h the *hel* [WRAIN STAFF CHAIN]
- i the *hevel*
- k the *hevel* rope
- l the *boei-klamp* [clamp]
- m the clamp on the keel and the garboard strake

Here in Amsterdam as soon as the stem and the keel are ready you set the planks; the planks form the vessels hull. However at the River Maas they don not plank the bottom below on both sides but leave an opening, which they close just before the vessel gets launched. This to get rid of things like chips and shavings, etc. When the keel, stem and stern are set, tie a string alongship in order to know where exactly is the centre of the vessel, and to get the same amount of timber on each side.

When the bilge is *geboeid* [PLANKED] you should place the *tingel bij de kiel* [KEEL CLAMP], which is a filling piece of timber which is placed between the keel and garboard strake in order

⁹ Interestingly in the identical drawing in Röding (f. 495) the *oor-hout* has been left out!

to fill up the space on both sides, so that the bottom of the upper side extends to both sides. In general you put it a bit further from the keel if the keel rises above the garboard strake. This is called the *lock-gat/waterlozing* [DRAINING/DRAIN-HOLE] as can be seen at **l** in figure V.

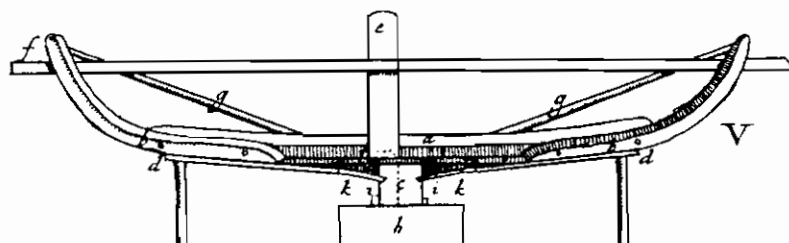


Fig. V

Where

[pp. 151]

- k** is the garboard strake
- c** the keel
- i** the clamps between which the keel is placed
- h** the stock, under the keel
- a** the *spant-buick-stuck* [FLOOR TIMBER]

The planks at the *boeizel* and at the top of the sides of the vessel which must bent, were set with (screw-)jacks after being burnt well.

When the bottom is planked well, you mark the well drawn proportion *evenmaat*, and level it at several places and put small props underneath in order to keep it fixed. After that mark with the chisel all the measured spots, in order to find them if necessary, as can be seen at the prop **d** in figure V.

Once the bottom has been levelled, you should make the *hals* [NECK] which is formed by a *buikstuk* and a *sitter* [FLOOR TIMBER and a FIRST FUTTOCK]; bore 2 bolts in each end of the floor timber, that will come right through the *sitters* in order to fix it as can be seen at **b** in the same figure.

After that you attach a piece of timber to the floor timber with one of its ends upon the *middelkrab* [CENTRE LINE] of the keel of which the side is level, to measure from there the parallelism of the *sitter* at the depth of the *boeizel* as in **e** in the figure.

After that attach a *zwieping* horizontal to the top ends of the *sitter* as shown in **f**. Hereafter you set small planks/poles [like **g**] to fix the *sitter* when building.

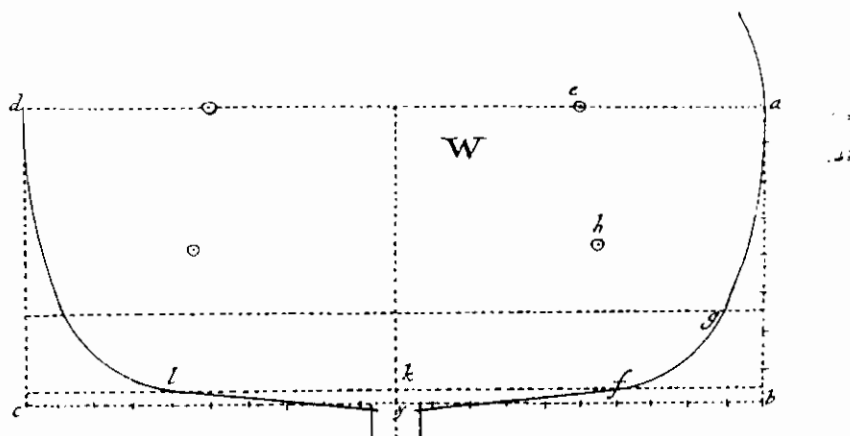


Fig. W

The figure **W** shows how to draw the dimensions on paper: **a, d** is the deck; from **e** and **h** the curves were drawn; **g** is the secant at the bilge, **f** and **l** are the height of the bottom; **y** is the keel; **k** is the spot where the *kolzem* [KELSON] and floor timbers are placed across.

To be sure of the rake of the futtocks and the bend of the bilge of a model or on paper: you draw a line on the depth and divide the width in 4 parts. Place the leg of a pair of compasses at 1/2 of the 4 parts and draw a circle a bit lower than 2/3 of the depth, as is done at **g** at the depth of the bilge; and when the bottom is wide and rises 3/5 like at **f** you place a leg of a pair of compasses at **f**, scratch a curve at **h**, and another one at **g** and scratch after this again at **h** and then place the leg at this centre point and draw the curve of the bilge as is done from **g** to **f**. The line **f** to **l** and **y** to **k** indicates the rising of the bottom.

After that the bottom and the bilges are planked, you should set the futtock on the marks of the level, and place a plank on the *boeizel* of the bilges and on some of the props as is shown at **r** in figure **X**.

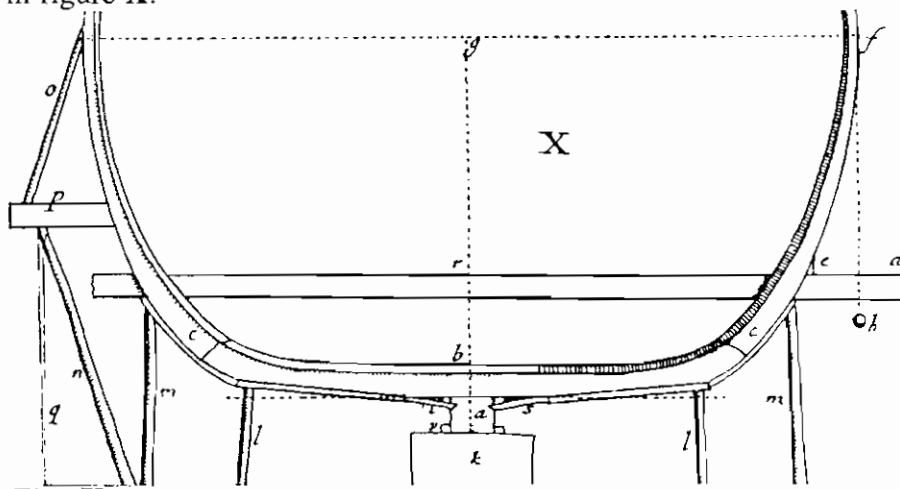


Fig. X

After this you nail a clamp on the outside of the futtocks on which it will rest on the *boeizel* as at **e**. Draw a rope from the stem till the stern on the *middelkrab* and drop it with another thin rope and secure it at the *middelkrab* of the keel as at **b** and **g**. Measure from thereon the parallelism of the futtocks as at **f**; hang on a nail a piece of rope this point with a plumbob over the whole depth of the hold as from **f** to **h**, and let it hang over the *boeizel* in order to measure the equality of the overhanging of the futtocks as is shown at **d** to **e**. There after you should attach to each frame timber a gangboard as is shown at **p** and put 2 stands underneath it in order to support the scaffold/gantry as can be seen at **n** and **g**, and a *zwieping* at **o**.

- m** is the bilge prop in figure **X**
- l** is a bottom prop
- k** is the keel¹⁰
- t** and **u** are the clamps between which the keel rested

[pp 152]

- a** is the keel
- i** is the garboard strake
- s** the *lock-gat* [DRAIN-HOLE]
- b** the floor timbers
- c** the 2nd futtock

¹⁰ This must be incorrect; **k** is a *kielstapelblok* [KEELSTOCK]

When you have measured the width of the futtocks on each side, attach a rope to the tension wire at **g** and draw it to the *middel-krab* of the keel, attach it there as well and measure the width at the 2nd futtocks and tension wire at **g**.

When the frame timbers are set you fix the *scheergang* and make the other floor timbers, *sitters* and the *stekers* (the futtocks at the bottom) and the other futtocks, after this you level/raze the *kimmen* and *wager* t them [PLACE THE PLANKS AND THICK-STUFF OF A SHIP'S CEILING]. As can be seen in figure **Z** at **b**; **m** is the *kimwager* [THE THICK STUFF AND CEILING PLACED ABOUT THE FLOOR-HEADS]. When the bilges are *wagerd* you take a plank and stick it between the futtocks with the sides upon the *boeizel* as you can see at **g** with two props below it in order to support the planks as at **h**, and you place a plank over the entire vessel, 6 or 7 voet apart as at **g** and **h**, to make a scaffolding on which you can set the *balkwager* [CLAMPS OF THE DECK-BEAMS] and after this the planks/beams. When placing the *balkwager*, you must first level the height on which you want to place it. After you have done this you secure the *balkwager* with a *plat lasch* [FLAT SCARF/LAP], with nails and you should set another two thin *wagers* underneath before placing the beams as is shown at **k**; **i** is the *balkwager*.

When the *balkwager* is fixed you should place the beams with *zwavels* [DOVETAILED] as at **a**; **l** is the beam.

When the beams are set you make the scaffolding on the beams, and place the frames as is shown in **X**.

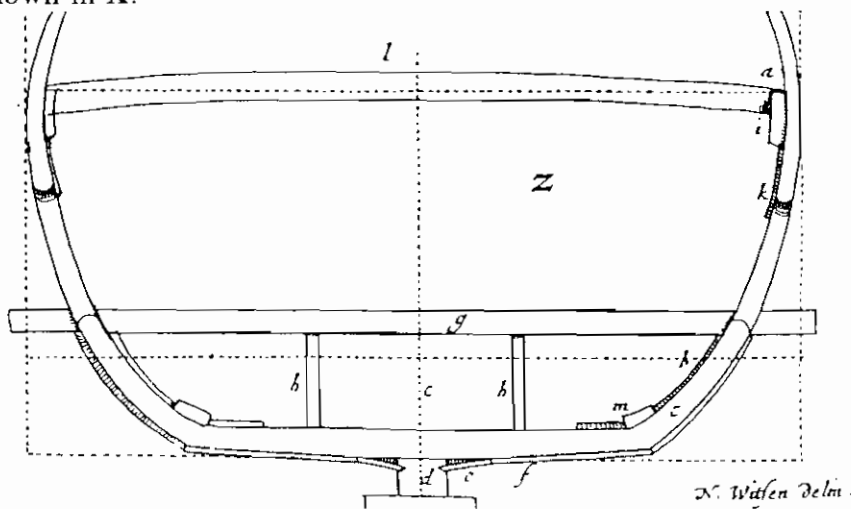


Fig. Z

- c** is the floor timber in the figure **Z**
- f** is the *vlak* [FLOOR/BOTTOM]
- e** is the garboard strake
- d** is the keel

When the beams are set you continue to *wager* between the *kinwager* and below the *balkwager* and you level it as is shown in AA at a. Then you should make the knees at the futtocks at b. Subsequently place the kelson e and the futtocks g, the waterways at c, and the binding strakes of the deck d.

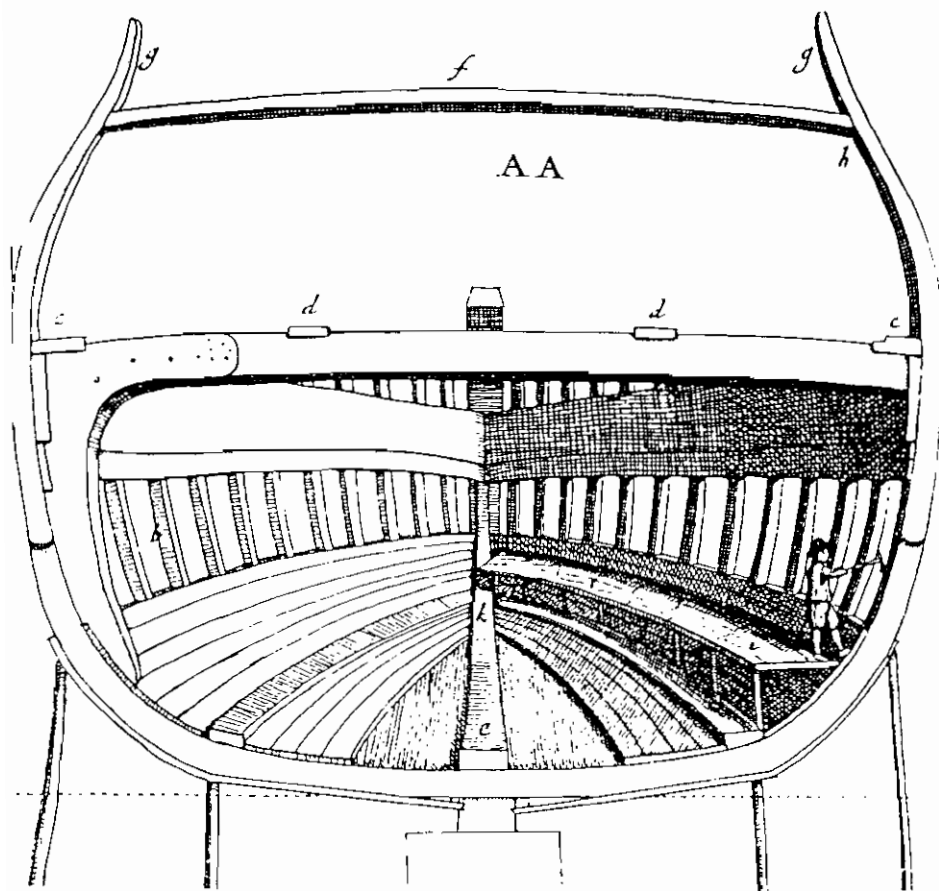


Fig. AA

Once you have all this done, place the deck-beams f. Place them first with the ends on the clamps and in the middle on the props and then place the *balkwagers* in there from below as at h without dovetails. Then continue to *wager* till you come to the planks of the waterway and set the knees at the beams; i is the scaffolding on which you can stand and level when you continue to *wager* below the *balkwager*.

At k you can see the inside of the stem: the ends of the planks must join together at this point. And when the band is made across the end of the waterway, you should place a piece of timber called the *slemphout* [KNEE OF THE STEM] across the ends of the planks below the step of the fore-mast against the band, this *slemphout* should be made like l in the figure BB.

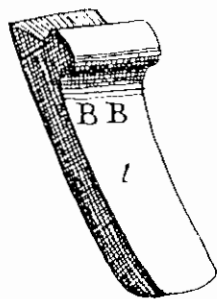


Fig. BB

The *scheerstokken* [PARTNERS/CARLINGS] should be sunken in the beams with a laps, which should be half the thickness of the *scheerstokken* and one *duim* from the side and upperside of the beam.

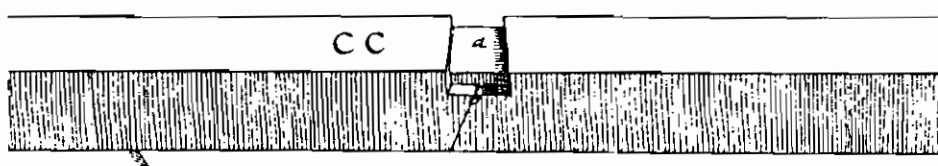


Fig. CC

- a in the figure CC is the laps facing up
- b is the base of the laps

When the futtocks are placed you should nail *zwiepingen* transverse and at the inside, with one end at the beam and the other end at the futtocks, and 'dan brengt men dees swiepinge daer om, nadien men de loop van 't Schips boven Barck en Raahouten meent te maecken, en oock de reegeling daer boven,...' place the waterway against the futtocks, and put half of the waterway in the beam, set the *scheerstokken* and continue to work around.

After this you even the 2nd futtocks and 3th futtocks at the height on which you like to place the first *barkhout* [WALE]. For this purpose you should use siphons, ropes and wedges in order to wedge behind the siphons. The eye-bolts are closed on the inside with fore-locks, fids and rings, yet to attach the fid to the stem you should use nails. When this is done, leave it to cool and harden, then remove the *lap* [CLOTH?] and leave half of the siphons secured in order to see if it has fitted together properly, if this is the case continue.

In figure DD you can see

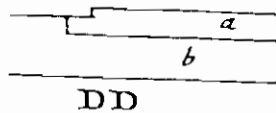


Fig. DD

- a is the waterway
- b the beam, which is made as is explained above, with a lap chiselled 1/2 a *duim* into the waterway

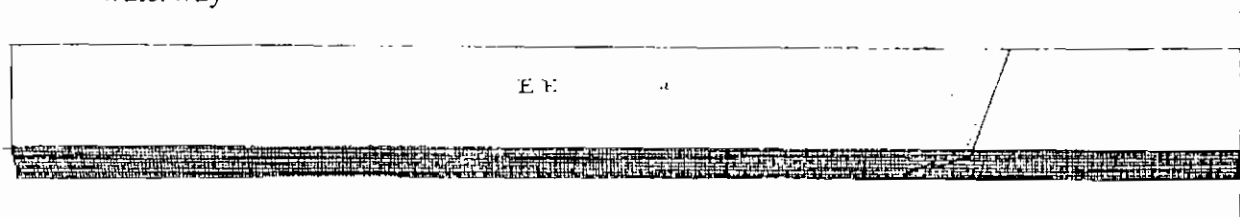


Fig. EE

In the meantime you make the kelson with a scarf similar to a in figure EE. Drive a bolt with a 'Italian head' in each or every two floor timbers, right through the kelson, the floor timber, and through the keel a 1.1/2 *duim* less. When after this the ship rests on its side you must drive in the ends of nails called *doffjes*, which are broken spikes to clinch, in the bolt-holes; they should be clinched very well in order to prevent leaking.

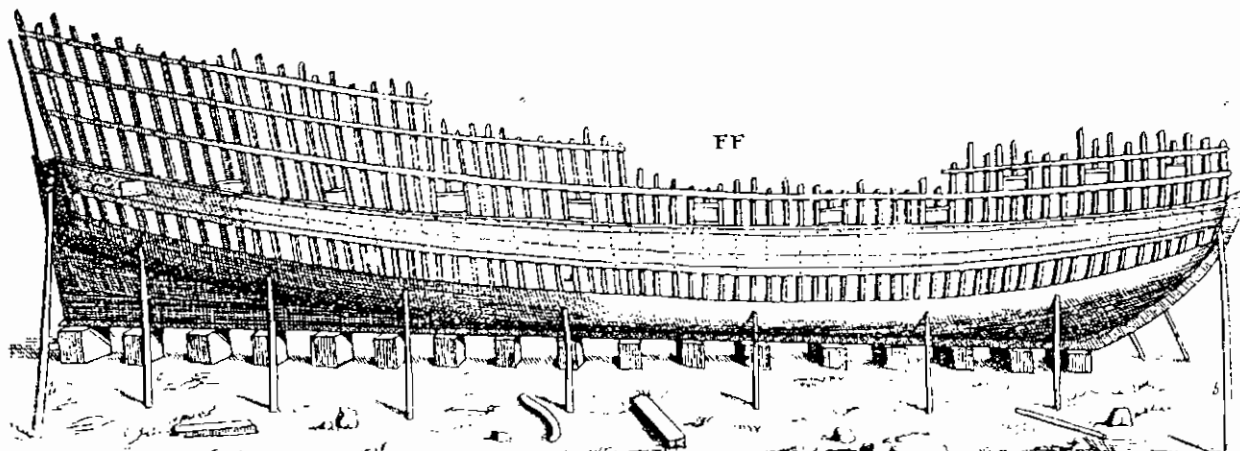


Fig. FF

In figure FF

- a is the *huidigt*
- b the stem-prop and stern-prop
- c is the 'bilge-level-prop'

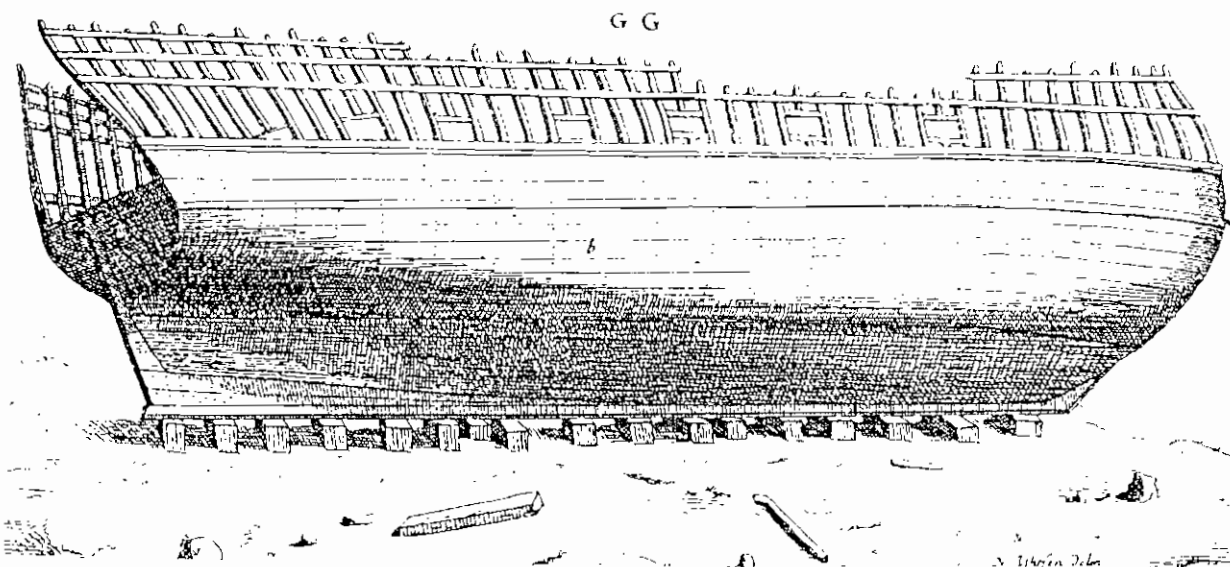


Fig. GG

At figure GG

- a is the bottom
- b is the *huidigt*

The planks of the ship were fitted from above downwards, but in Rotterdam they start below. When you are finished, build the scaffolding lower to caulk the *huidigt*, and place the scaffolding a bit under the top of the *boeizel* and later on below the wales to close it there. When this is done you should continue to nail, bolt and spike; when it is levelled, you caulk till the bilge, yet the bilge should be levelled, nailed and caulked a short time before. Then let the ship heel on its side, so you can nail and level/raise and caulk below at the bottom. You must divide the bottom in as many parts as there are workmen available. Allocate the portions depending on each individual skills in order to finish the job at the same time to minimise damaging the ship. Once this is done you should immediately straighten the ship and let it fall

on the other side and do the same to this side as explained before. Straighten the ship and place *vangbedden* and *smeerhouten*, this are wooden greased chocks used at the launching of a ship. Make everything ready for the launching.

The wedges under the keel are removed by pushing and ramming them with heavy beams. Everything is greased in order to make it smooth, when needed you could rock the ship by pushing with props, rock only when it is absolutely necessary, because it can harm the ship. Use ropes to pull the ship as it doesn't move smoothly or stops to glide. Place at rear on each side jacks to prevent capsizing. When all the chocks are driven away remove the props at the sides, and the ship will glide into the water.

HH is a ship to be launched.

't Schip of stapel. als 't of 'al lospen

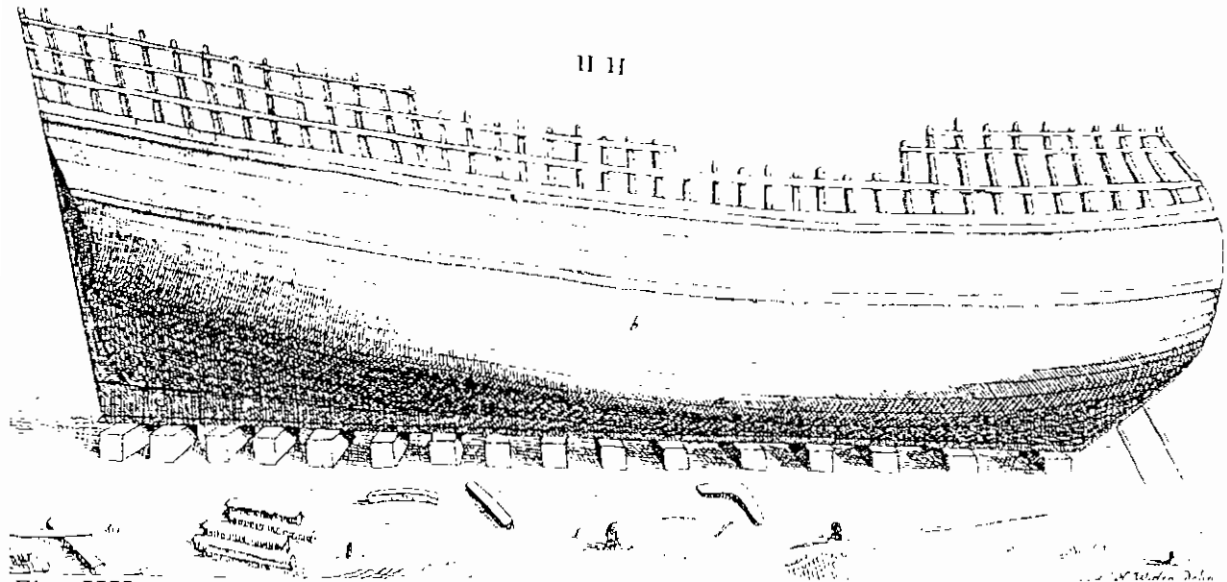


Fig. HH

The figure II shows the model of a ship to be launched and

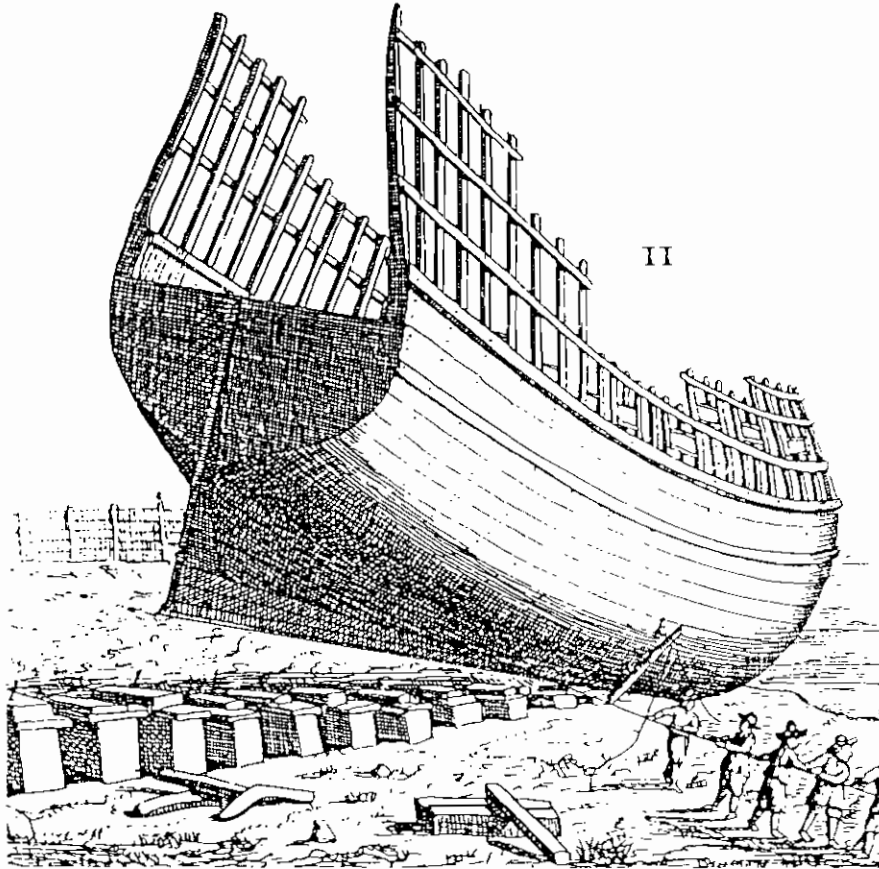


Fig. II

[pp 154]

how far it has to be built up before it get launched in this land [Holland, MvH]. In a lot of places in Europe the ships are almost ready when they are launched, but I [N. Witsen] think this can damage the ship to easily.

With fat greased planks are placed on each side of the ship on which it glides and which prevents capsizing. The men in the picture are pulling a strap with a rope and are helping to launch by doing this. And with the rope at *k* they rock the ship in order to make it glide again if it is stuck. It are wedges and *smeerhouten* which were driven under the ship to lift it up.

When launching a ship let a rope run out at the rear to steer and to keep it from sailing too far. When a ship is ready to be launched and stands at the shipyard, the props removed, you should launch it as soon as possible, because without props and resting only on the keel the ship is vulnerable and easy to damage. The *smeerhouten* and other timbers on which the ships glides, should be kept wet in order to prevent fire while launching. When the water is not wide you should attach ropes at the stern to prevent bumping against the other bank.

When in Sardam ships were pulled over the dike...

[This part is about the ways of launching a ship in Holland]

[pp 155]

When a ship is launched without any hickups, we serve beer to the workers to celebrate: for each one hundred guilders of the costs of the ship we serve one beer.

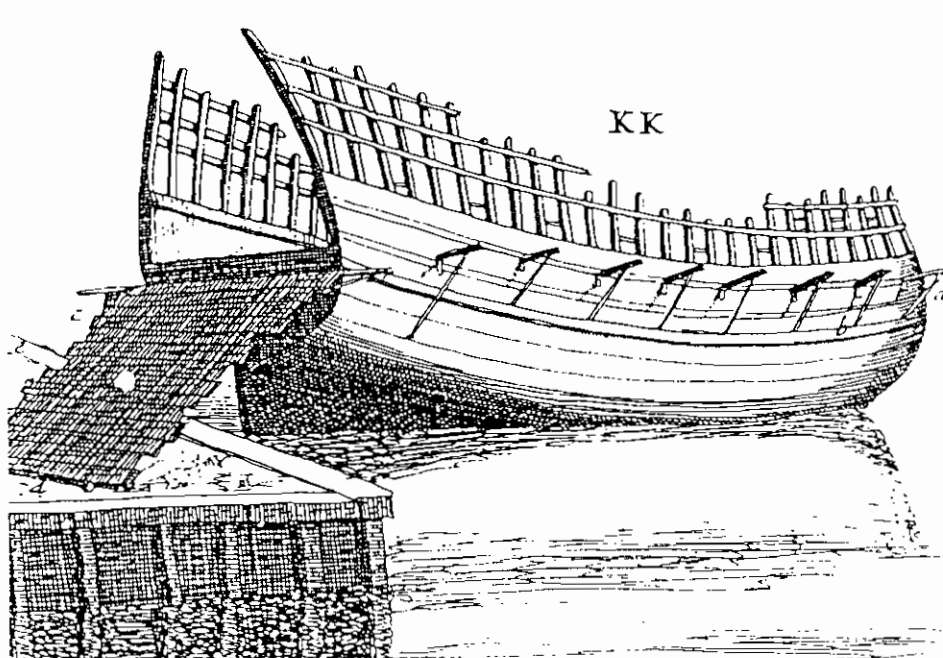


Fig. KK

At KK is shown a ship that was launched.

- a is the gangboard
- b is the 'gangboard-prop'
- c is the scaffolding to get inside the ship
- d the plank on which the scaffolding rests
- e is the quay on which the scaffolding rests

Notches are made in the garboards, in which the props fitted. The props are chopped off slantingly on one side and set against the ship with that side.

MM shows a gangboard with the underside facing up and the notch in it: a is the notch, b is the end at the ship. It should be attached to the wale or where it fits best.

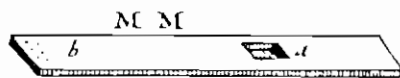


Fig. MM

- a in figure NN is a gangboard facing from below
- c is the end of the gangboard that rests on the wale
- b is the prop under the gangboard, one end is set in the notch of the garboard, yet nailed; and if the gangboards are longer than they are fore and aft, you must use two props.

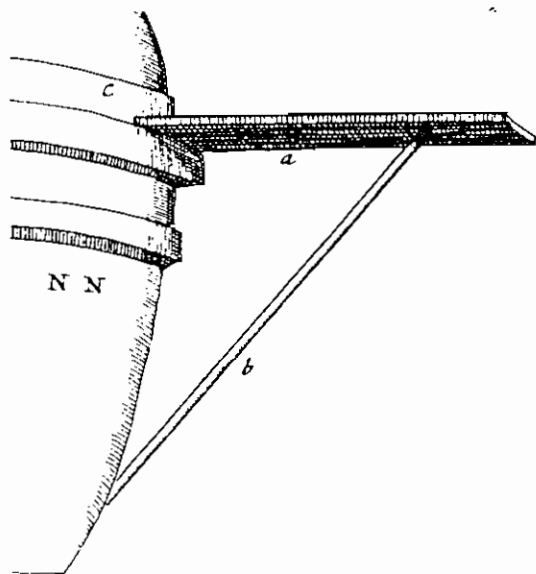


Fig. NN

After this you place the planks on the gangboard and when the scaffolding is ready, make the chocks above the gun-ports and the portells under them. Then make the upper wale and the filling and the *raa-hout* [WAIST-RAIL] the *halsmast* [WASH BOARD] and the *vertuiningen*, which are the 'upper works'¹¹. And make at the inside, the upper waterway, the *scheerstokken* [PARTNERS] and the *ribben* [CARLINGS]; set the deck, the ship's cabin and the gallery. Make the capstan, the knight heads too and the cross-piece of the bits, the *kevels* [CARVEL-WORK], which are small carlings put between the beams, the rails, after which the masts and the bowsprit.

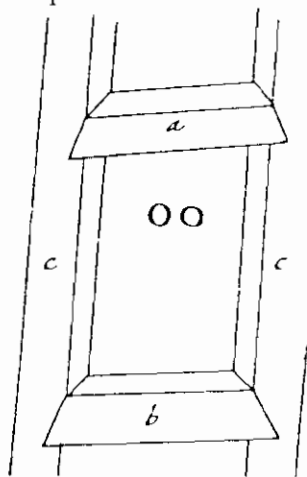


Fig. OO

In the figure OO is **a** the chock, which should be secured with a dovetail to the bottom so that the top side tapers; **b** is the portsell made with a dovetail in the futtockss; **c** are the futtocks. Attach the hinge of the gun-port to the futtocks; the googings in the chock of the port-hinges are made and closed at the inside. Depending of the slope of the decks you set the gun-ports.

¹¹ "a general name for the quarter deck, poop and forecastle" (Röding, II, pp 844)

Figure RR shows the way the ship is pulled at one side, a is the jack-screw, b is the head of the jack-screw, c is a handspike, d is the bowl and the jack-screw.

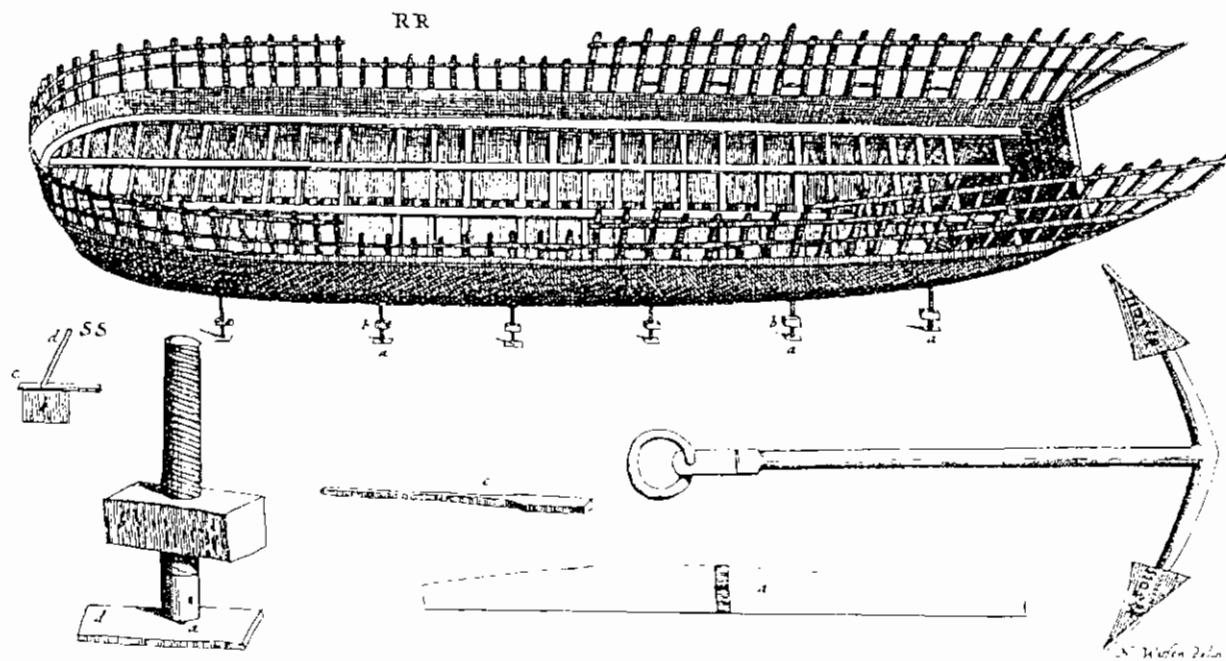


Fig. RR

About the erecting of the ship when it is laying on one side.

Take 4 or 5 jack-screws and place them in, bowl like prop as at **a** and take care that the “*jucken op de hoofden komen te leggen*” as at **b** in **SS**. **b** is the head of the jack-screw, **c** is the gangboard, **d** is the prop. Aft you set a *spons* fur/furring over the jack-screw because it will be to short and place it against the wale, secure it below at the other jack-screw with a *barkoen* [STANCHION KIND OF CROSSBEAM], to prevent turning; first you wind with two handspikes. When the ship

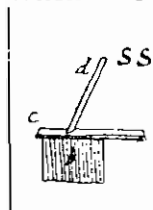


Fig. SS

[pp 156]

has been raised a little, you should place the bowls in which the jack-screws are placed a bit closer to the ship, otherwise you will get problems. A lot of people feel that it is not right to cant a ship ashore because of the damaging risk, and they choose to do the canting when the ship lays in the water and al parts are carried by the water. When you cant a ship, you should prop it well at the side which is carrying. Yet you can do everything without canting at all.

When you cant a ship in the water in order to keel-haul, to clean it, or to repair it, you must stow and prop the masts with heavy booms against the board, and then wind the ship at the mast over from a nearby ship. Use a strong rope on 'lower board' of the supporting vessel and keep standing and winding on board of is vessel to keep the ship in balance and to prevent it from capsizing.

Loaded ships in ebb and flow water in which the bottom of the sea is soft can be run ashore. In this case you must bring all the 'things' at one side of the ship and it will slowly cant in the mud. You should do your work now and clean the low side, and at another tide you can do the same at the other side of the ship.

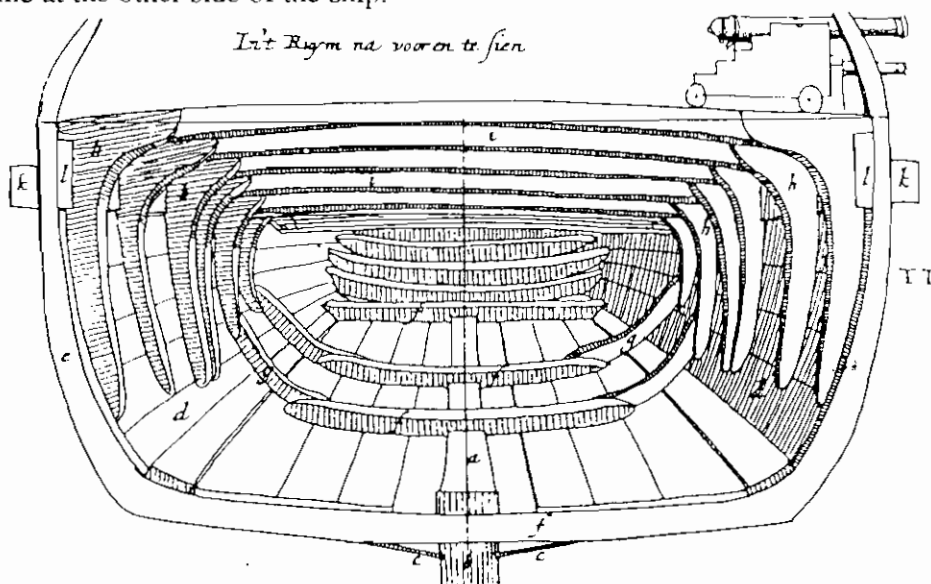


Fig. TT

Figure TT shows a view of the ship on the inside when standing on the bottom of the hold and viewing forwards: **a** is the keelson, **b** is the keel, **c** the garboard strake, **d** the *wagenen* [THICK STUFF] and **e** the futlocks, **f** is the floor timber, **g** are the *sitters* and **h** the hanging knees which

carry the deck or *overloop*, *i* are the first deck-beams or the deck beams of the lower gun-deck, *k* are the wales and *l* the *balkwagers*.

VV shows the inside of the ship when standing on the deck beams of the lower gun-deck and looking forwards: *a* is the floor, *b* are the binding strakes of the deck/carlings [the two strakes across the deck, *MvH*], *c* is the waterway, *d* are the 3th futtocks, *e* the knees and *f* are parts of the gun-ports, *g* the deck beams of the upper deck.

Figure **WW** shows the hold, looking aft the lower deck: *a* is the kelson, *b* is the crutch, *c* are the floor timbers, *d* are [there is no *d* in the picture] and the crutches]

The fourth figure **XX** shows the hold when facing backwards and the bulkhead/partition of the gun-room removed: *a* are gun-ports at the sides, *b* are two gun-ports at the rear, *c* are bands running down, *d* lodging knee, *e* are the hanging knees of the deck, *f* is the waterway on the deck.

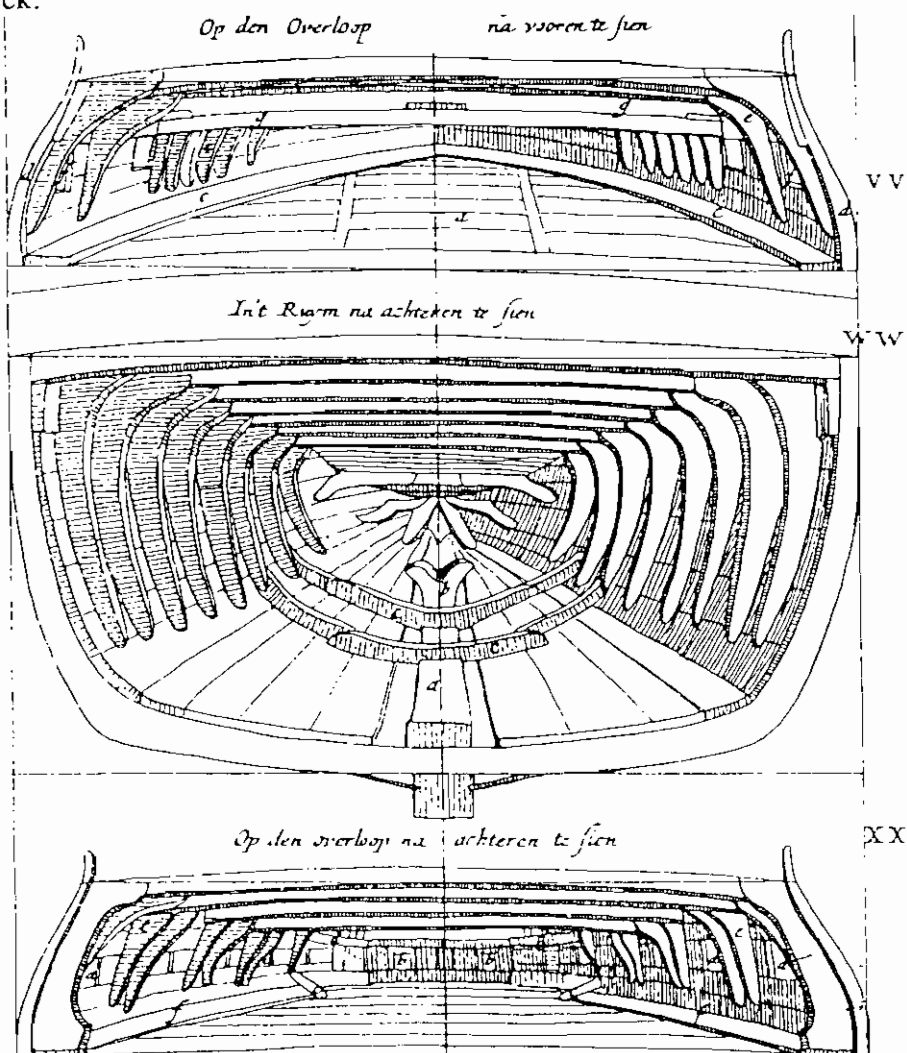


Fig. VV, WW and XX

This is my ship. I built it in my mind and completed it so far that it can be launched now. The remaining parts at the inside and the smaller outer parts that still have to be made, can be understand easily if the measurements and the names are known. Fore this reason I keep my mouth shut for now. I think it is unimportant which of these parts are made first.

After the ship has been launched you place the masts. This happens in smaller vessels using a crane (as is said before). The masts are hoisted. Large vessels, which don't fit under the cranes need another approach: you must place 'cranes' on the ships deck it self, against the sides, which should come together up in the middle and are secured there with ropes; here and there

you should place blocks, which are used to hoist and set the masts. This procedure can damage again the ship and therefore you better use a lighter and sheers. This are ships which are shown below [??]. These are laid next to the large ship. If the ship is very heavy and demands a very big mast, you take two lighters and attach them to the ships sides. A very thick mast or crane should be placed on the lighters and the masts are hoisted up using sheaves and they are set in the right places. You should fix clamps to the masts to be able to attach ropes when winding. Be careful that the lighters are not to light to prevent capsizing and further damage to the ship, a thing that happens sometimes.

This ship can be built in four months by 20 or 22 men. A ship of 180 or 185 *voet* length can be built in this land with 50 men in 5 month conveniently.

About the expenses and the money needed for a ship like this I can not say a word because I have no experience what so ever. This is something that changes and depends of the available working men, the cost of the timber at the moment and the other materials needed. It is hardly of my business anyway. For matters of convenience however I will give a short list of the expenses to build a ship as is mentioned.

Expense account of a vessel of 165 voet length, 43 voet breadth, 16 voet concave on which 8 voet and after this another 7 voet..

SHIP TERMS GLOSSERY NICOLAES WITSEN 1671

<i>achtersteven</i>	stem-post, stern
<i>bakboard</i>	port (-side)
<i>balkwager</i>	
<i>banden</i>	bands
<i>barckhout</i>	wale
<i>barkoen</i>	stanchion, yuffer
<i>beitel</i>	chisel
<i>beloop</i>	rake, slope, coarse
<i>bettingbalken</i>	cross-piece of the bitts
<i>binnenkiel</i>	kelson
<i>blok</i>	block
<i>boegspriet</i>	bowsprit
<i>boeien</i>	to fitt the planks
<i>boeitang</i>	
<i>borst</i>	shoulder
<i>bout</i>	bolt, pin
<i>breeuwen</i>	to caulk
<i>broekstuk</i>	lower transom
<i>buikhoofd</i>	coaming
<i>buikstuk</i>	floor timber
<i>centen</i>	ribbands
<i>dekbalk</i>	beam
<i>dofje</i>	broken spike to clinch
<i>dommekracht</i>	(screw) jack
<i>drumpels</i>	portsells
<i>duimen</i>	part of hinge
<i>evenmaat</i>	
<i>fokkemast</i>	fore-mast
<i>fokkespoor</i>	step of the fore mast
<i>galderij</i>	gallery
<i>geschutspoort</i>	port-hole
<i>gijnblok (jein)</i>	winding-tackle block with two or three sheaves
<i>halsmast</i>	wash board
<i>handspaak</i>	handspike
<i>hek</i>	stern (-frame)
<i>hekbalk</i>	wing-transom
<i>hekstut</i>	side counter timber
<i>hel</i>	wrain staff chain
<i>helling</i>	slanting
<i>hevel</i>	siphon
<i>hieling</i>	heel of the keel
<i>hol</i>	concave - <i>depth</i>
<i>holte</i>	cavity
<i>huidicht</i>	
<i>huidgang</i>	strake
<i>jock</i>	gangboard
<i>kaapstander</i>	capstan
<i>kajuit</i>	ship's cabin
<i>kapseizen</i>	to capsize
<i>karveelhouten</i>	ledges
<i>karvielhouten</i>	carvel work, small carlings put between the beams
<i>katteblok</i>	catblock

Glossery of 17th century Dutch Ship Terms

<i>keep, inkeping</i>	notch
<i>ketting</i>	chain
<i>kiel</i>	keel
<i>kielgang</i>	garboard strake
<i>kiellas</i>	joint in the keel
<i>kim</i>	bilge
<i>kim waterpas</i>	[BILGE-LEVEL-PROP]
<i>kimwaeger</i>	the thick-stuff and ceiling placed about the floor-heads
<i>kinnebak</i>	head or fore-foot of the keel
<i>klamp</i>	clamp, cleat, brace, chock, lock
<i>klos</i>	chock
<i>knechten</i>	knight heads
<i>knie</i>	knee
<i>koebrug(sdek)</i>	orlop
<i>kolsem</i>	kelson
<i>konstapels-kamer</i>	gun-room
<i>krabhout</i>	[RACING WOOD]
<i>kruishouten</i>	kevels
<i>las</i>	joint, scarf, seam
<i>met tap en gat</i>	tenon, mortis
<i>met zwaluwstaart</i>	dovetail
<i>lastdrager</i>	buttres
<i>legger</i>	floor timber
<i>lijfhout</i>	waterway
<i>lip: het overblijvende uiteinde van een stuk hout dat ingekcept is, van een uitstekende lip voorzien klamp om een lopend touw aan vast te maken</i>	remaining part of notched piece of timber
<i>lipklamp</i>	[LIPCLAMP]
<i>lopersblok</i>	runningblock
<i>luik</i>	hatch
<i>luikgat</i>	hatchway
<i>mal</i>	mould, shape, gauge
<i>middelkrab</i>	[hart of the keel]
<i>naad</i>	seam
<i>oorhout</i>	
<i>oplang</i>	2 nd futtock
<i>opslag</i>	
<i>overloop</i>	main deck, landing
<i>pan</i>	bowl
<i>passer</i>	pair of compasses
<i>passerbeen</i>	leg of a pair of
<i>plank</i>	plank, board
<i>poort/poorten</i>	gun-port
<i>poorthengsels</i>	port-hinges
<i>raa hout</i>	waist-rail
<i>rantsoen-hout</i>	fashion-piece
<i>regelingen</i>	rails
<i>rei</i>	batten, straightedge, measuring staff
<i>ribben</i>	carlings
<i>ronding</i>	camber

Glossary of 17th century Dutch Ship Terms

<i>ruim</i>	hold
<i>schaal</i>	bowl
<i>scheergang</i>	
<i>scheerlijn</i>	
<i>scheerstokken</i>	binding strakes of the deck, partners, carlings
<i>scheerstrook</i>	sheer strake
<i>scheg</i>	skeg
<i>scheinagel</i>	stopwater
<i>scheren: een touw</i>	
<i>in een blok scheren</i>	to reeve a rope
<i>schietlood</i>	plumbob, plummet
<i>schmeerhouten</i>	wooden chocks which are greased and used at the launching of a ship
<i>schoor</i>	prop
<i>schotbout</i>	eye-bolts with fore-locks or rings
<i>sitter</i>	sitter, first futtock
<i>slechten</i>	to level, to raze
<i>slotgat</i>	fid-hole
<i>slothout</i>	fid
<i>spanten</i>	timber, frame
<i>spiegel</i>	stem
<i>spijl</i>	fore locks
<i>spil</i>	capstan
<i>sponning</i>	rabbet
<i>stander</i>	prop
<i>stapel(blok)</i>	stocks
<i>steker</i>	sitter at the bottom
<i>stelling</i>	scaffolding
<i>steven-schoors</i>	prop at the stem
<i>streek</i>	stroke
<i>stut</i>	a)prop, supportingbeam, b)3th futtock
<i>stuurboord</i>	starboard
<i>tegenkiel</i>	kelson
<i>tingel bij de mast</i>	
<i>twillen</i>	crotches
<i>uitwatering</i>	free-board
<i>val van mast</i>	rake
<i>val, valling</i>	slope, gradient, rake
<i>vangbedden</i>	wooden chocks greased and used by the launching of a ship
<i>verdeck balk</i>	beam
<i>verloren lippen</i>	
<i>vertuiningen</i>	
<i>vijzel</i>	jack-screw
<i>vlak</i>	bottom
<i>vloed</i>	flow, flood
<i>voegen</i>	to flush, to point [?]
<i>voorsteven</i>	stem
<i>waeger/wager</i>	a general name for the planks and thick-stuff used in the ceiling of a ship
<i>wageren</i>	to place the thick-stuff of a ship's ceiling
<i>waterpas</i>	level
<i>worp, wurp</i>	transom

Glossery of 17th century Dutch Ship Terms

<i>yuffer</i>	kelson
<i>zaadhout</i>	garboard strake
<i>zandstrook</i>	sheer
<i>zeeg</i>	sitter, bilge futtock, first futtock
<i>zitter</i>	crotches
<i>zogstuk</i>	dovetail
<i>zwaluwstaart</i>	dovetail
<i>zwavel</i>	
<i>zwieping</i>	