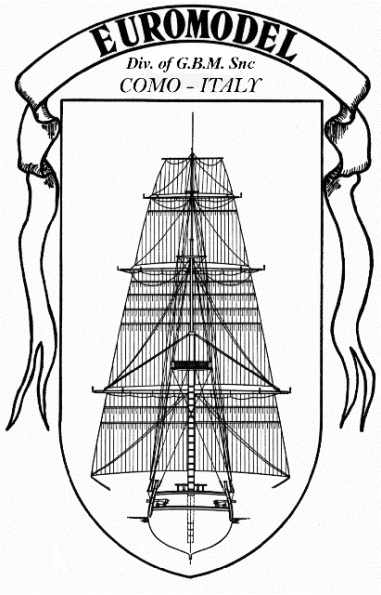


ADDITIONAL RESOURCES FOR SHIPBUILDING

(version 01)

The following pages are a collection of comments that explain in far greater detail some methods used in model construction as well as the operations involved in running a ship. **The majority of comments *do not apply to a basic kit build*** but are included either for general interest or for those who wish to refine their techniques.

Some of the comments and photos have been extracted from posts made by various members of the Model Ship World Forum and I am indebted to their giving permission to do so. They include (in no particular order) …
Brian C, Denis R, Dan Vadas, J.P., KeithW, Vince P, marktiedens, mtaylor, Janos, Tadeusz43, hornet, banyan, Amateur, JerseyCity Frankie. My apologies to any MSW contributors who I may have overlooked.

[To navigate through the contents – use 'control + click']

Contents

Illustrations

[The figures below are not hyperlinked]

Chapter 1: BASIC CONCEPTS EXPLAINED

Bulwark Height

Builders often comment on the need for the bulwarks to be higher above the deck than is shown in the drawings. Part of Plan Sheet 'A' is shown below that explains the problem and provides the correction necessary.

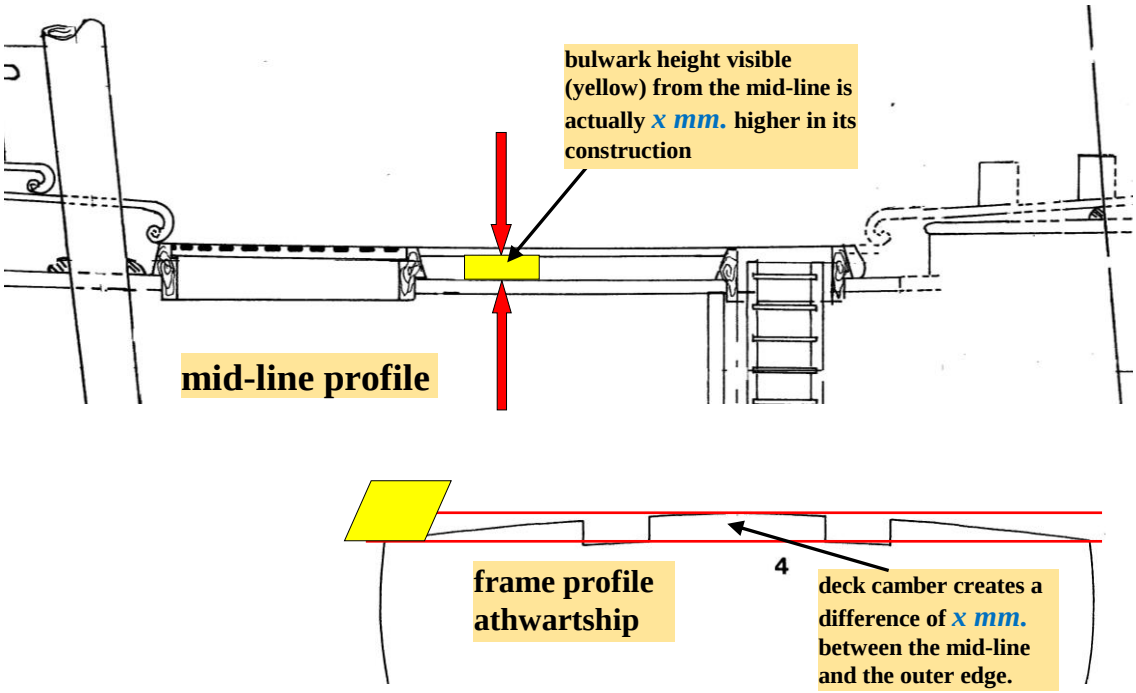


Figure 1: Bulwark Height Correction

Chapter 2: Further Ideas

What you read from here on is intended for enrichment about model ship building and in no way is meant to be prescriptive for any model being built. Many of the concepts and ideas might be useful for the enthusiast –

Indeed, to build any great model, most builders should peruse the pages and at least understand the concepts and techniques being discussed even if they do not use them.

Chapter 2: FURTHER IDEAS - HULL

Measuring

The following commentary is about taking things to an extreme ‘measure’ and only represents a whim that I decided to follow.

Maybe very few builders will ever go this extent ... but in order to interpret the plan drawings of the hull side view, it should be remembered that the drawings are a three-dimensional view shown in two dimensions. Allowances could be made for this ‘abberation’. The changes in dimension will be small and if this change is not followed, things will still fit into place. This particularly relates to ports and the wales.

Remember though, the position of the ports was established early in the construction of the hull so what follows, for most, will be superflous !

These techniques allows for a closer reproduction of that shown in the plan drawings.

Fig. 4 indicates how the bottom edge position of the port might be determined.

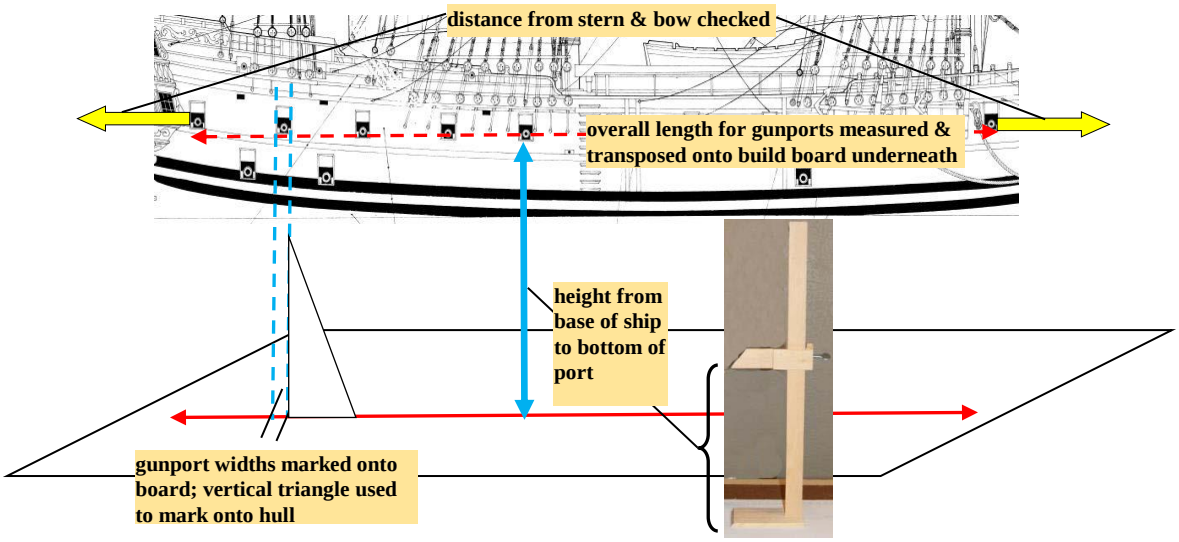


Figure 2: Establishing Gunport Positions

One aspect to double check on is the width of the ports as the bow curves – particularly the end port (chase port). On the drawings, these will appear to narrow due to their being a three-dimensional representation. In fact, all ports will have the same width.

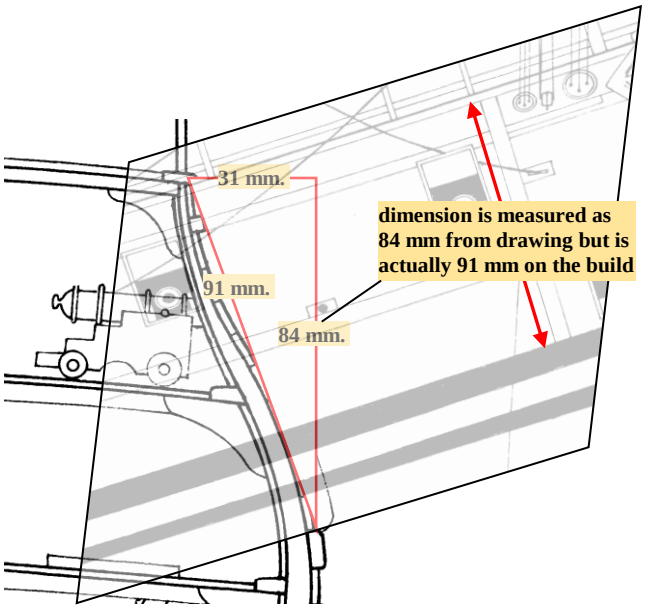


Figure 3: Making Adjustments for Three Dimensions

Fig. 5 illustrates a common problem faced by builders – the drawing illustrates what is *seen* but not what is *measured* … it is a three-dimensional view presented as a two-dimensional view.

The figures shown in Fig. 5 were taken straight off the computer screen but the *ratio of figures will remain the same*.

84 mm. from the drawing is actually 91 mm. on the model.

For gunport and wale readings, the figures obtained would be multiplied by 91/84.

(i.e. increasing measurements by a factor of **1.083**)

e.g. ***28 mm***. becomes 28 x 91/84 = ***30 mm.***

Plank Bending

I like this machine although I do not have one (as yet). From the Micro-Mark Catalogue comes the following description ...

‘ Professional Quality Bending Machine Forms Smooth Curves in Wood, Plastic and Metal’

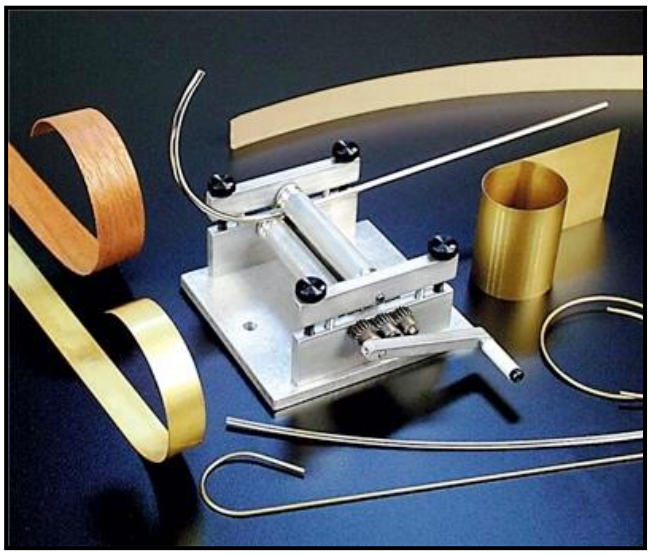


Figure 4: Micro-Mark Bending Machine

‘There's never been a better, easier-to-use tool for making perfect bends in ship model planking. ***Works on wood strips up to 2-1/4 inches (approx. 57 mm.) wide and 1/8 inch (approx. 3 mm.) thick***...even plywood! ... ... Simply set the rollers for the desired radius and turn the crank to feed and form the material. ... ... Precision machined of aluminum with steel gears. Rollers are 1/2 inch (12.7 mm.) diameter by 3 (76.2 mm.) inches long.’

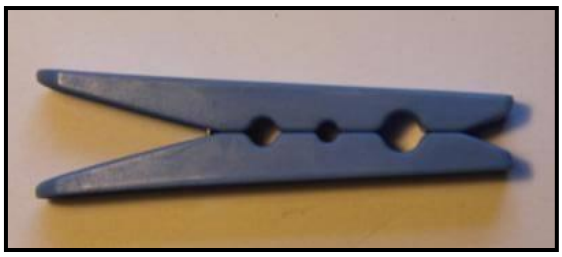
Fixing

Planking Screws

There are a myriad of planking screws/ clamps out there ... some are expensive and some are not such as this nylon clamp. It has a major draw-back in that after a limited useage, the metal screw loosens making this clamp difficult to use – although it has been suggested that heating the nylon to soften it allows the connection between that and the metal screw to reform. Those with a metal lathe have worked magic with brass rod to form new clamps but here follows a method of producing clamps from simple materials.

The Clothes Peg Model

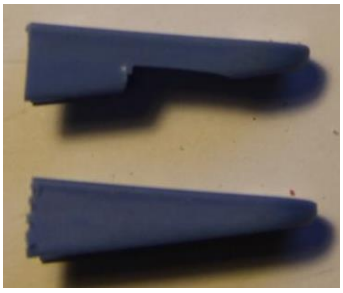
There is an alternative home-made clamp which has been described on the MSW Forum by *hornet* and who has given permission to use his idea.



- pegs were dis-assembled & the ends cut off.

- screw-in handle:
  8 mm. timber rod
  4G x 20 mm. wood screws

was the thinnest/longest screws I could find so I had to recess them into the dowel so they were long enough to go through the bottom. I had to grind the screw heads a little so they would fit through the dowel.



- using a knife, scroll saw, etc., notches were cut into the `wedge' each of the peg end sections.
- a hole was drilled as close as possible to the end of the notch – this would then give the greatest leverage when being used.

- the dowel `handle' was fitted to the peg `wedge' to create the planking screw.

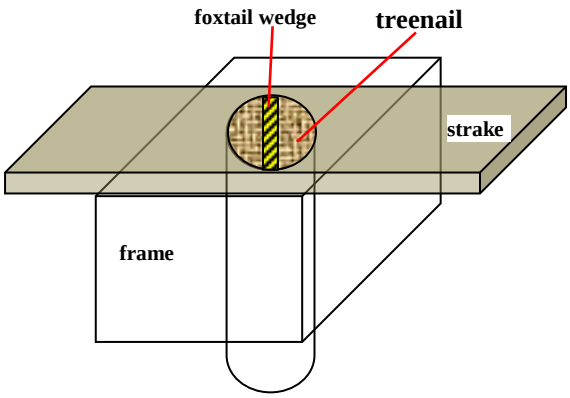


Figure 5: Diagrammatic View of Treenail

Treenail (also trenail, trennel or trunnel)

Instead of using metal fasteners to fix planks to the frames, it was common to do treenailing. This consisted of inserting wooden 'pegs' which were of a softer wood, into drilled holes and then expand their outer end with a wedge of much harder wood driven into them called a foxtail wedge. When the ship was immersed in water, the wooden pegs would swell and further tighten the pegs. This method worked extremely well to maintain the ship's physical integrity.

Nevertheless, this is an uncertain area in which some enthusiasts treenail expansively. The following two comments are worth reading …

An article by William Layman, (a Fleet Admiral at the time) *'Precursor to an Expose on Forest Trees' [January 1, 1813]* and archived by Google, made this following comment on p.19

'The use of tree nails in the ship-building not only consumes the very best oak in the making, - but very much diminishes the strength of the timbers transversely cutting the ligneous fibres in boring; and they are, after all, fastenings. On the same principle, any fastenings which require the timbers to be so perforated are objectionable.'

An interesting comment and one which cautions against the excessive use of treenails ?

Also, jbshan (MSW Forum wrote) … "Boudriot describes the outer appearance as being 'peppered' with trunnels and other fasteners. You have the plank fasteners, and far more of those than most modelers show, the knees, assorted through-bolts for eyebolts, ringbolts, belaying points, etc., and all of those somewhat smaller in diameter than most modelers depict. Most certainly there would not be lines of 3 or 4 inch diameter fasteners running up the hull at 8 or 12 foot intervals and nothing else, which is what you sometimes see."

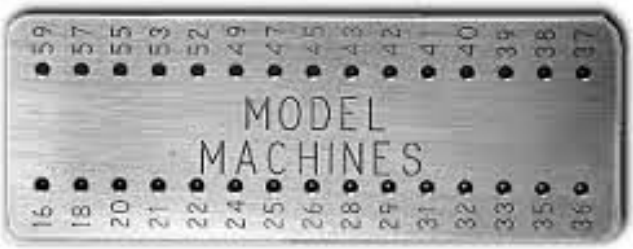


Figure 6: Byrne's Draw Plate

In ship modelling, it is common to manufacture these treenails from bamboo barbeque sticks by splitting them along their length and then passing them through a draw plate to create a specific diameter.

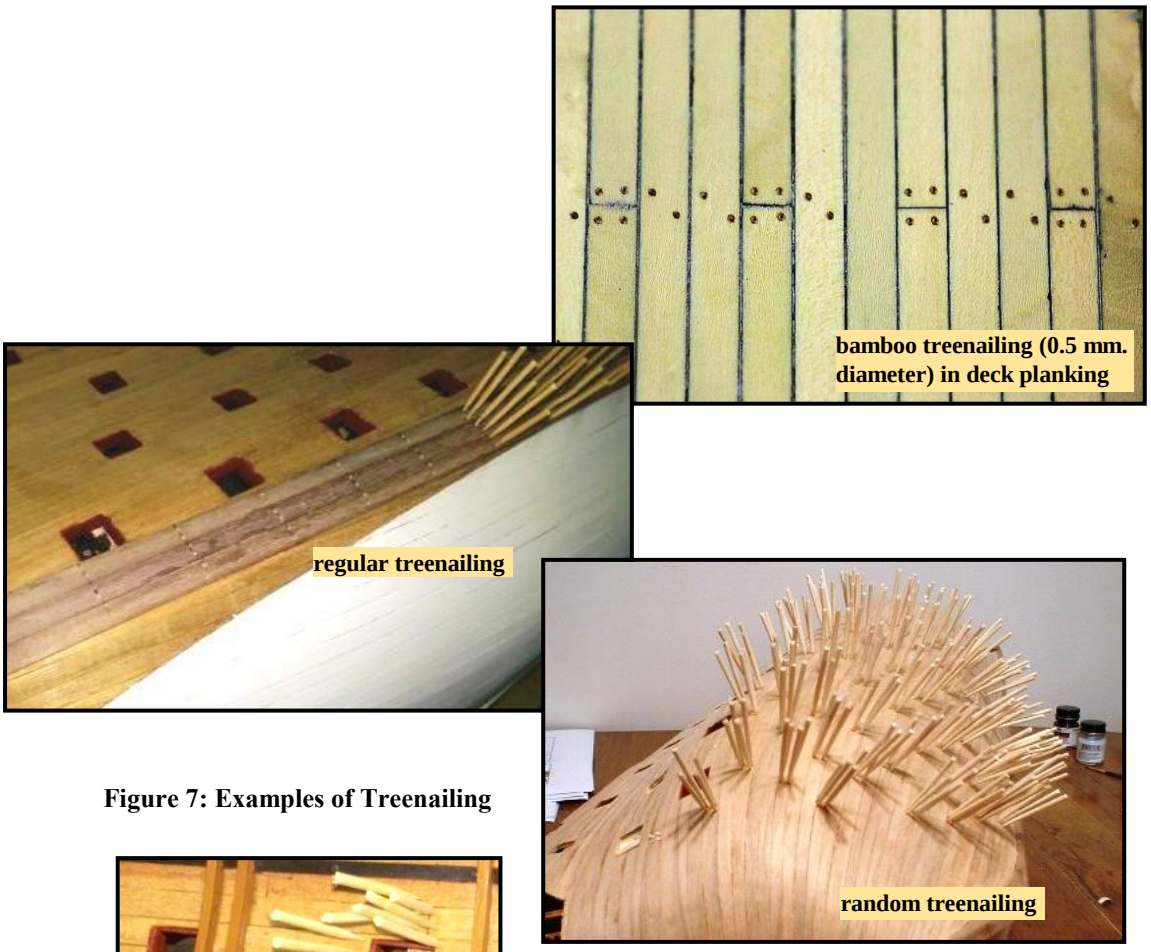


Figure 7: Examples of Treenailing

Ship Accessories

Stove

Figure 8: Brodie Stove - HMS Victory

Between 1650 and 1850, galley fire hearths underwent a significant change from brick hearths to self-contained iron stoves. Fire was an ever present danger in these wooden ships. In the early seventeenth century, these heavy brick hearths were well down in the ship for stability and consisted of enclosed pits over which cauldrons were suspended or set on iron grills. This position deep down afforded the galleys great protection from shot but also meant their close proximity to the ship's magazine. Another disadvantage was the difficulty in venting the heat and cooking odors. Towards the end of the seventeenth century, efforts were made to locate the galleys under the forecastle deck or at the fore end of the middle gun deck in three deck ships and although easily damaged during conflicts, these galleys were now distant to the magazines. They also were easily vented. Stability was not an issue due to major structural changes in the bow that broadened the ship.

Here are some useful/ interesting links (that are trustworthy to open)

Construction of a Ship's Stove: MSW Forum
http://modelshipworldforum.com/resources/furniture/BUILDING%20A%20SHIP%20stove.pdf

http://hmsfly.com/brodieGalleyStove.html

Creating Window Spaces

With the many metal components involving window panes available for model ships, the majority will be 'in-filled' with the metal as one solid piece. It is common for builders to paint the window panes a light blue colour to simulate reflection of the blue sky.

This section is included for those ardent enthusiasts who go to the trouble of milling/ filing out the panes and then infilling with some transparent material. The methods are numerous and varied but two are offered here out of general interest.

Figure 9: Spun Glass Panes

Up until the early 19 C only spun glass was available for glazing, limiting pane size (a large bubble of glass was attached to a glass spindle, spun at high speed, producing a flat disc of glass – a window pane was cut from that disc].

Most panes during this time period were only about ***15"*** high (approx. ***5 mm***. at 1:72). That would correlate well with the many ship models seen.

As mentioned above, the metal panes *could* be cut out with much care and patience ...

Figure 10: Steps in Milling Out the Panes

Filling Window Spaces

Method 1: Fixing small microscope glass cover slips

Method 2: Fixing in flexible transparent plastic sheeting

Methods 1 & 2 are simple to execute. Method 3 creates a PVA film ‘in situ’. In all three cases, the resultant pane is set back further than it should be but to the casual observer, that is of little consequence and so, unsurprisingly, all these methods are commonly used.

Method 3: Utilising PVA (based on a posting by ‘Janos’ on the MSW Forum; with permission)

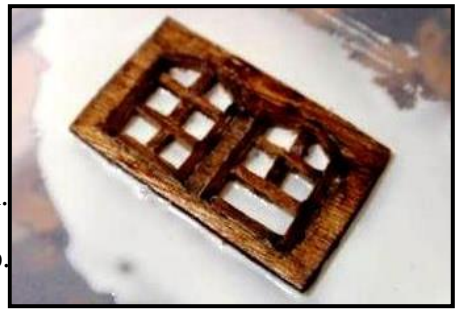
Requirements:

- PVA glue – a common woodworking glue,
- flat working surface such as glass or plastic sheeting,
- sharp blade

The 'glassing' can work on pre-fabricated windows (the one shown is old and damaged) or it can be used to just 'manufacture' glass panels which are then cut into the right size with sharp scissors or blade.

a. place a drop of the adhesive (can be also slightly diluted) on the flat surface,

b. smooth it out with a steel ruler or knife blade,



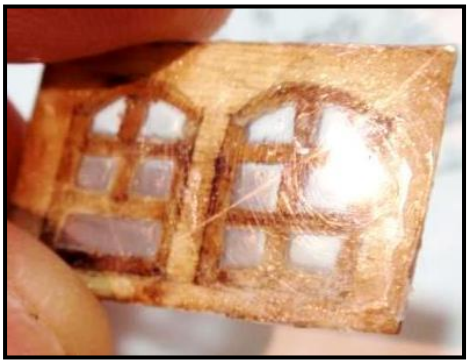
a.

b.

c. c. the 'panel' is ready now or if making glass applied directly to a window, then the back

d. of the window is gently pushed into the glue (don't oil the frame beforehand),

d. wait until it gets thoroughly dry (approx. 24 hours),



e. with a sharp blade, slice off the panels and cut to size or remove the window from the surface

f. for any surface apart from a flat one, the formed separate panels are flexible and can be glued on using a few drops of the same adhesive.

Figure 11: Two-Pack Expoxy

Method 4: Epoxy Application

Window panes can be produced 'in-situ' by pouring a liquid plasticised mixture into each window frame space. There are many similar craft products available - Craft Smart Liquid Gloss is one such example available at Spotlight in Australia.

Requirements:

- two-pack epoxy resin
- flat or contoured work surface
- mixing container & stirrer
- straw

The slow drying mixture allows time to fill/flow into the window panel spaces. When the two packs are mixed, the heat will generate some bubbles but these are easily removed by using a straw to blow across the surface after pouring. As with similar compounds, it contracts slightly on drying, often leaving a hollow in the middle. This then is similar to the window pane example shown above; or it can be filled with a second application.

Anchor Rope Haulage

To haul in the anchor cable, a 'messenger' rope system came into common use in the 1730's and 1740's when the main capstan became a double capstan enabling a greater power input from two sets of men rotating the capstan. The large anchor cable was temporarily attached to the messenger rope via a number of nipping ropes tying the two together. As a nipping tie approached the hatchway through which the cable was passed down onto the orlop deck, a team of ship's boys were engaged to untie the nipping and then run it back to the forward end where the cable was meeting the messenger rope. A new tie was made and that was followed along by each boy in turn. Working well, these boys were termed "good little nippers".

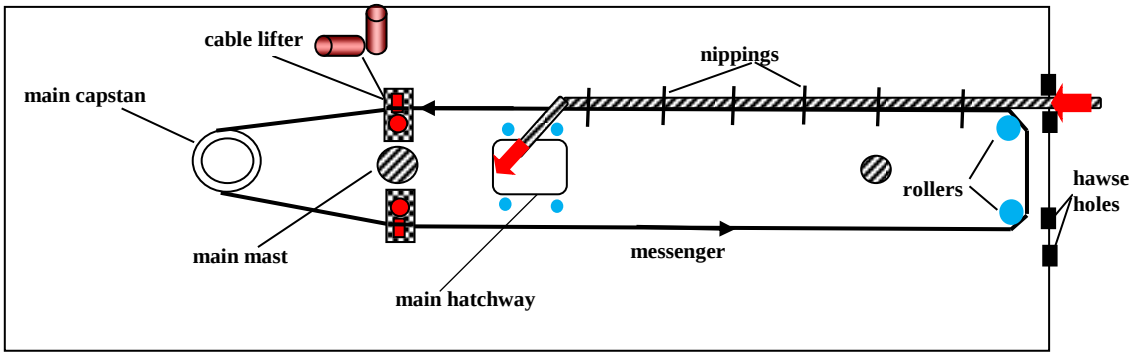


Figure 12: Messenger System

Fig. 12 is diagrammatic but portrays the essentials of the messenger cable system used to haul in the anchor cable.

- A few of the rollers that enabled the smooth flow of the cable through the hatchway are indicated by blue dots but there are more rollers included within the hatchway space as well as on the orlop deck itself.

- Approx. four turns of the messenger cable were passed around the capstan barrel and that was kept at the correct height by a pair of ***cable lifters*** fitted with both horizontal and vertical rollers (refer to Fig. 12 above).

- Essential to the smooth flow of the anchor cable itself were a pair of large, vertical ***rollers contained in the manger area*** immediately adjacent to the hawser holes (Figs. 12 & 13).

- Whilst the hauling part of the messenger cable would taut, the returning part would be slack.

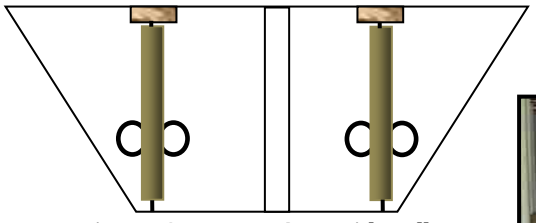


Figure 13: Manger Area with Rollers

Figure 14: Stowage of Anchor Cable

Modelling of HMS Victory's Capstan - http://nautarch.tamu.edu/model/report2/

The above discussion highlights the fact that a portion of the anchor cable + messenger cable could be incorporated along that portion of the Gun Deck visible through the Main Deck hatchway.

Capstans

Figure 15: Large Number of Crew Used on the Bars

At chest height, up to eight men could push on each bar – and with possibly twelve bars fitted – nearly one hundred men could be employed to rotate the capstan. Flat pieces of timber called whelps (Fig. 15) projected from the vertical barrel increasing the barrel circumference as well as the friction to hold the rope securely.

Whilst the main capstan was used to raise the anchors, the jeer capstan (between the fore- and main masts) was used for hoisting in stores, guns, boats, raising topmasts, yards and hoisting the lower yards on their 'jeer tackle' (rigging attached to large bitts on the deck adjacent to the masts)

Surrounding the capstan base were pivoting metal pawls (Fig. 16) that prevented the capstan from surging backwards when the pressure on the cable was uneven.

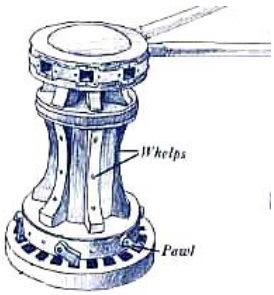


Figure 16: Whelps

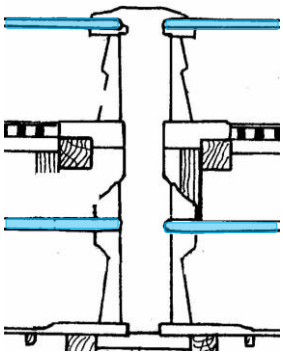


Figure 17: Double Capstan

The advantage of the double capstan was that there were two sets of bars (shaded blue) – at two different deck levels - that could be used on the one capstan barrel. This obviously increased the possible turning power.

It was common practice to use the bottom capstan to actually haul the anchor cable in (via the messenger cable) with the actual rotating force needed coming from the sailors operating the upper capstan. Thus the men would not need to step over the ropes.

Here are some useful/ interesting links (that are trustworthy to open)

Capstan Tutorial: MSW Forum
http://modelshipworldforum.com/resources/furniture/CapstanTutorial.pdf

Capstan Articles from MSW Forum
http://modelshipworldforum.com/resources/furniture/Capstans%20Articles.pdf

Steering

Tiller

The tiller was a horizontal lever that traversed left and right creating the turning motion for the rudder. Ash was the preferred timber as it would not crack under normal conditions. They were square in cross-section along their entire length – at the aft end where it entered the mortise in the rudder stock, it was one half of the athwartships width; at the fore end, it was considerably less. Iron tillers were introduced in the second decade of the 19 century.

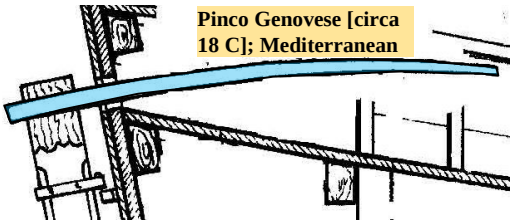


Figure 18: Tiller

Whipstaff

This system consisted of two levers – the whipstaff itself and the tiller arm. The tiller arm was set in a horizontal plane and again made from ash with its aft end fitted into a mortise in the rudder stock. The rudder blade movement produced a transverse movement in this beam … so up to this point, it behaved exactly the same as the tiller arm by itself (as described above.).

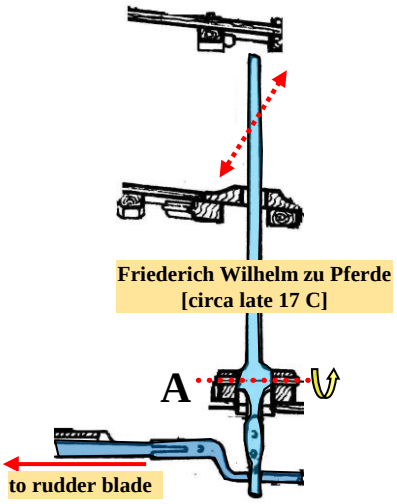


Figure 19: Whipstaff

The whipstaff (usually made from ash) was set in a vertical plane. This beam rotated around point A (Fig. 19) which was so positioned to create a large mechanical advantage. The lower end of the whipstaff engaged with the fore end of the tiller, creating a network of levers between the helmsman and the rudder. The maximum angle of rudder that could be achieved in either direction was 20º (although with block and tackle, it could be increased to 30º). The operation was simple in that the whipstaff was turned in the same direction as it was required to turn the ship. The whipstaff was circular in cross-section, tapering towards the top end.

Of interest is the supporting mechanism used for the fore end of the tiller beam – *quadrant* and *toad*. This is not discussed here but can be readily researched.

The whole system was far from being robust and so headsails were a necessary part of manoeuvring the ship – the rudder only being used for the finer aspects of steering.

Ship's Wheel

These were introduced on British ships during the first decade of the 18 C as a windlass with its axis sited athwartships. Detachable crank handles were used to turn the drum windlass and a single continuous rope extended down to the tiller fore end via a set of blocks and sheaves. With blocks and rope, a more precise control and a greater mechanical advantage control made this form of steerage easier than with the whipstaff. Being out on the Quarter Deck, response to orders was more rapid and perhaps the greatest advantage was the 60º rudder blade change in either direction. Disadvantages included not being able to view the change in direction when manning the crank handles, the drum diameter was small and therefore required many turns and causing injury through the sudden transmission of 'whipping' by the rudder blade in heavy seas.

Soon after the introduction of this windlass, it was decided to turn the whole assembly 90º, dispense with the crank handles and introducing a large spoked wheel followed by a second wheel a few years later. This system had many advantages …

- larger turning diameter of the wheel allowed more effective control,
- rudder whip unlikely to cause injury,
- helmsman could watch both the sails and the ship's heading,
- larger diameter drum meant fewer revolutions to turn the rudder,

Additional fittings were added including the quadrant, the gooseneck and the sliding foot assembly (refer to Fig. 20 for the latter fitting).

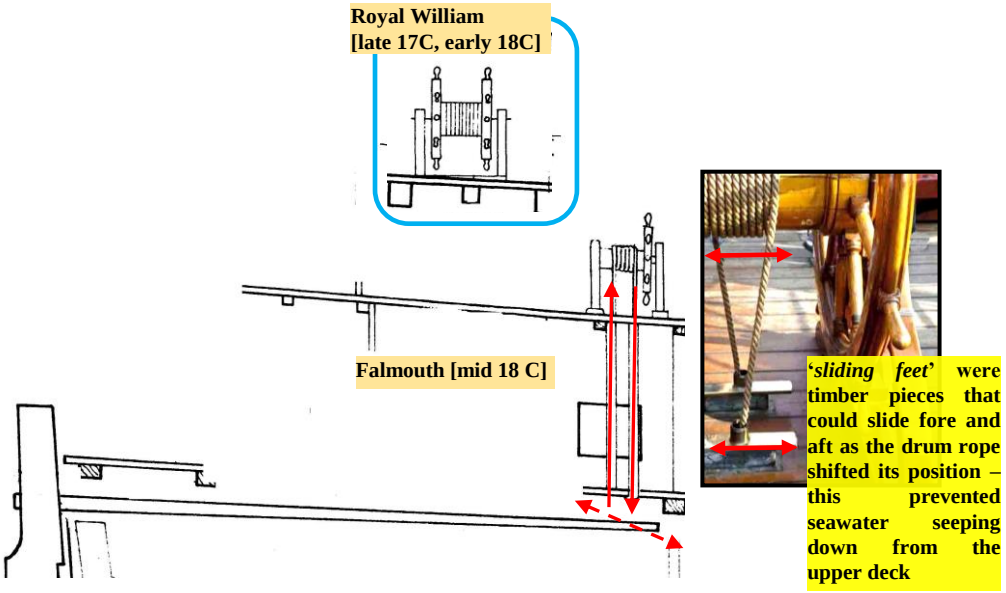


Figure 20: Ship's Wheel [*single & double* spoked wheels]

Chapter 3: FURTHER IDEAS - RIGGING

Rigging Tools

Needle Threader & Looper Threader

A gift came from Canada that contained this combination of a needle threader and a looper threader ... really fantastic to use. The threader is approx. 135 mm. in length which makes it a very handy length when getting amongst all the rigging.

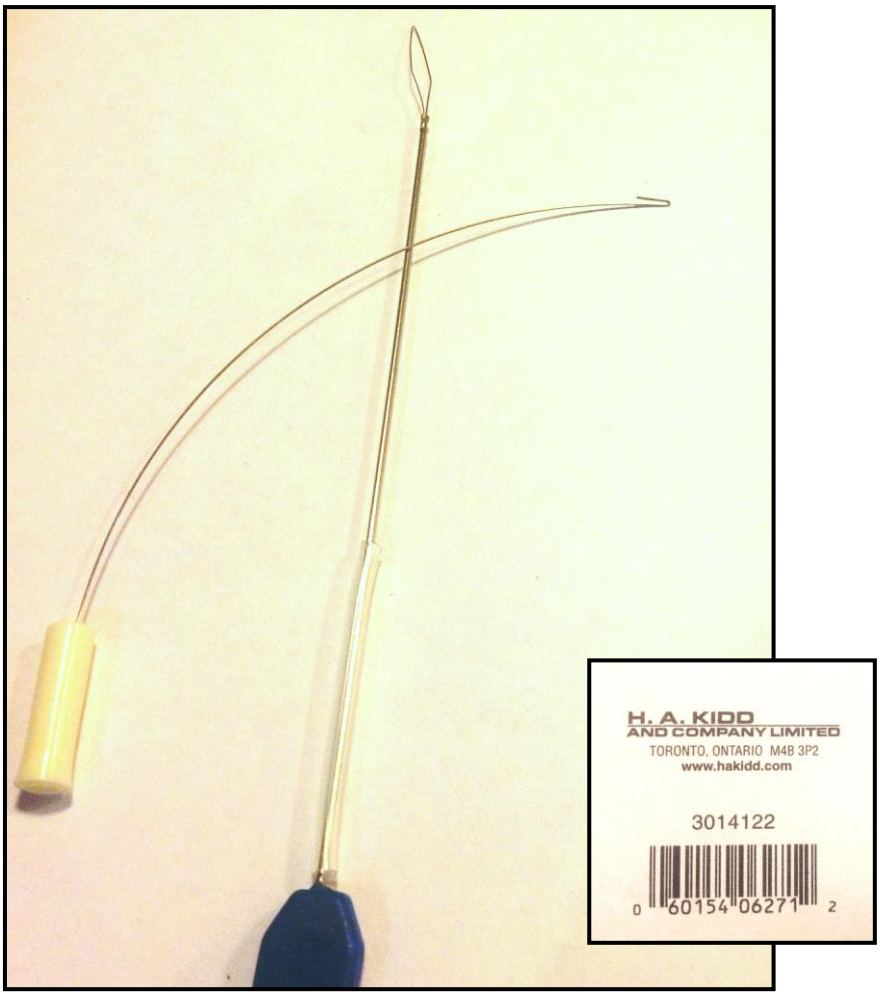
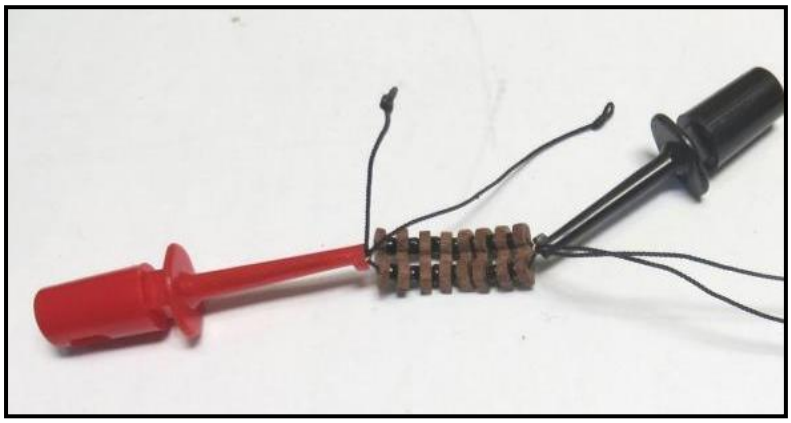


Figure 21: Two Rigging Tools

Rigging Clamps

Electronic ‘micro-clips’ ...



Sequence of Standing Rigging

Work proceeds from … ***bow to stern*** … and from … ***bottom to top***.

Success is dependant on … ***tension*** … and … ***counter-tension***. Consideration must be given to creating a tension in a rope and then taking into account the counter-tension being exerted by other connecting ropes.

Shrouds and backstays
… ***individual ropes fitted first starboard*** … and then … ***port***

1. Masts (especially bowsprit) fitted with any required blocks.

2. Bowsprit fixed in position & standing rigging added ...
    a. bowsprit gammoning
    b. bobstays
    c. bowsprit shrouds

3. Three lower masts fixed in position.

4.

5. Lower deadeyes and chain plates in position.

6. Main and fore shrouds attached and ratlines added.

7. Main stay and Fore stay lines fixed in position.

8. Mizzen shrouds attached and ratlines added.

9. Mizzen stay lines fixed in position.

10. Fore, main and mizzen backstays fixed in position.

11. Fore topmast shrouds attached and ratlines added.

12. Main topmast shrouds attached and ratlines added.

etc.

… leave ***all lines & tackles temporarily fixed*** … until … ***all standard rigging fitted***.

Rigging Concepts & Techniques

Bobstays

To withstand the upward force on the bowsprit exerted by the stays and masts in general, bobstay lines under tension were usually employed beneath the bowsprit mast.

Bobstays were introduced on large ships from 1685 (Lee, 1984). Around 1700 there were two bobstays but by 1740, this had increased to three.

Until the 1720's, bobstays were tensioned with *deadeyes*, but by the 1740's *blocks* were the norm.

Example of Rigging Variation – the Royal William …
Given the number of re-fits this ship had from 1670 to 1719, it is more than likely that on the bobstay rigging she started with deadeyes and finished with blocks. To confuse things, the build shown in Figs. 19 & 23 has deadeyes even though in the drawings, blocks are shown. Either case would be acceptable.

Figure 22: Bobstays

Figure 23: Royal William Bobstay Fixing

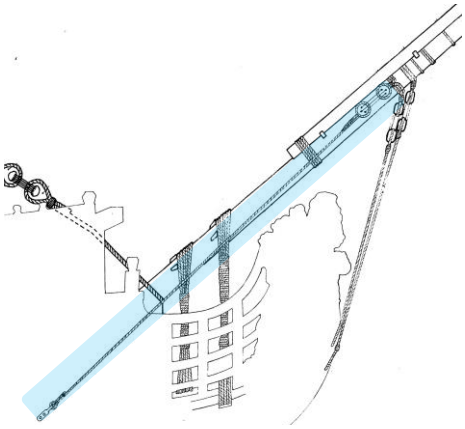


Figure 24: Bowsprit Shroud

Bowsprit Shrouds

From around 1720 (Mondfeld, 1989), one or two pairs of shrouds were added to give *lateral support* (Fig. 22).

Figure 25: Shroud Lateral Support

Using the above quoted date, this rigging could be expected on the Royal William which had its final re-fit in 1719 but not on the Friederich Wilhelm zu Pferde launched in 1685.

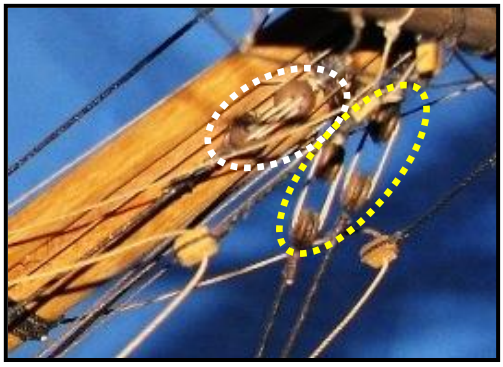


Figure 26: Deadeyes for Bobstays & Shrouds

Secured to the wales with eye bolts and hooks, they were initially set up with blocks but soon replaced by deadeyes (Fig. 23: broken white line for the shrouds, broken yellow line for the bobstays).

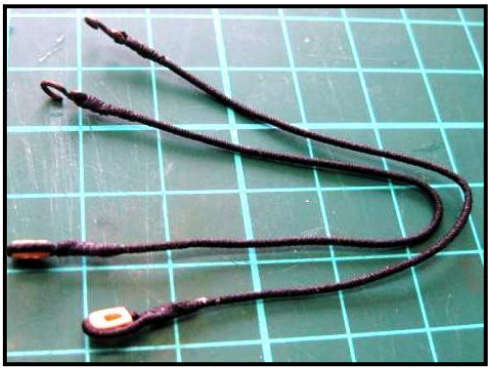


Figure 27: Bowsprit Shrouds

In Fig. 25 below, the inset image of a hook shows that the entire shroud line was served. The shrouds are *not* secured to the wales as mentioned above but this build conforms to the drawings. Whether the shroud is served and a hook used is up to the builder.

Figure 28: Bowsprit Shrouds (another build)

Catharpins

Catharpins are not shown in the Euromodel drawings and are a rigging feature best left to the very serious builder. They were a purchase of lines (Fig. 27) looped around the futtock stave and shroud and lashed together with seizings. Their function was to brace in the opposite shrouds on the fore and main masts to …

- counteract the outward tension of the futtock shrouds (Fig. 26)
- create extra room for the yards to be drawn in more obliquely when sails were being close-hauled.

"Ignorance of the crosscatharpins is not necessarily fatal. Explanation almost certainly would be."
Patrick O'Brian (author)

They made their appearance around the middle of the 17C but were no longer used after 1730 (Mondfeld).

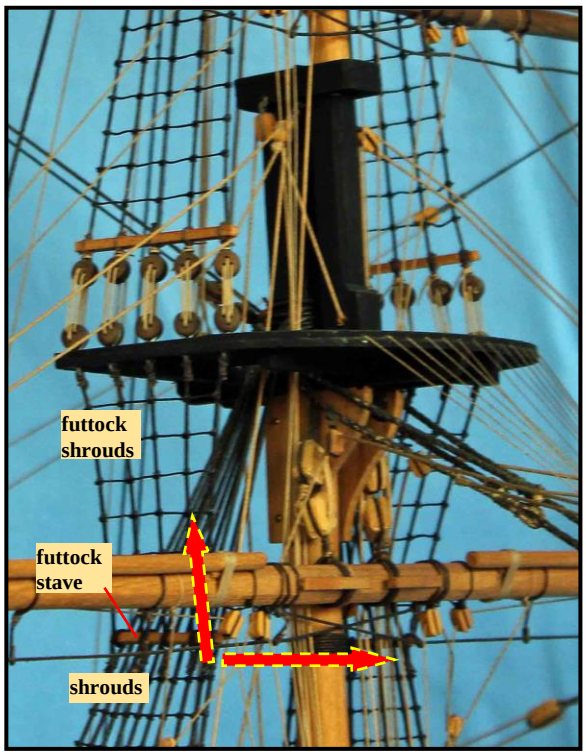


Figure 29: Catharpins Omitted

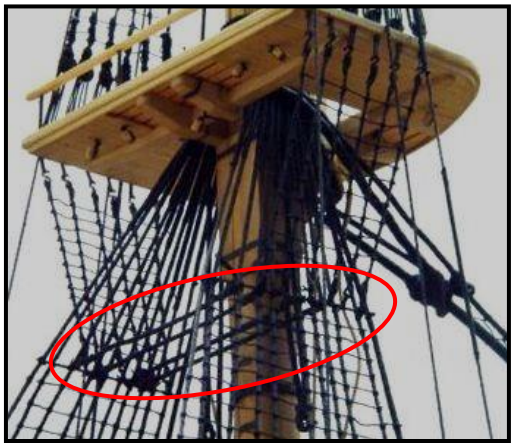


Figure 30: Catharpins (from Pinterest, modelshipbuilder.com, author unknown)

Very few references or images could be found relating to catharpins which strongly suggests that few builders engage in this area of rigging.

Fairlead

Fairleads (shaded blue in Fig. 28) were often found on the lower part of the bowsprit and their function was to guide various lines that moved in close proximity to each other but closely controlled any unwanted lateral movement. They allowed for a more effective effort to be made on a line more or less arranged horizontally by a large group of men (Fig. 28) rather than a line that passed more or less vertically to overhead rigging (Fig. 30) which could only be carried out by a smaller group of men.

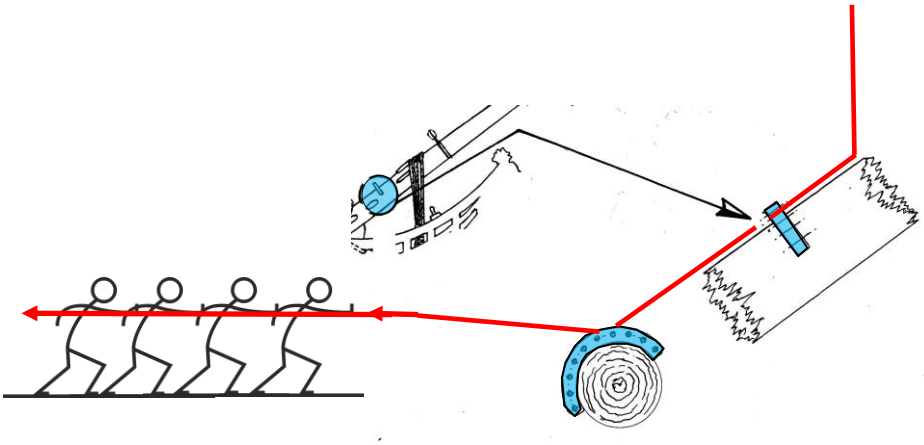


Figure 31: More Men & More Effective Effort

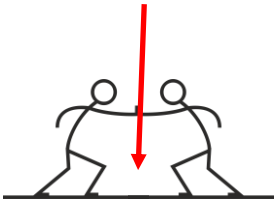


Figure 33: Fewer Men & Less Effective Effort

Figure 32: Fairlead on Friederich Wilhelm zu Pferde

Gammoning

Gammoning binds the lower part of the bowsprit mast to the ship's stem involving *seven, eight or up to ten turns*. This tension then enables the foremast stays in particular to be supported.

Figure 34: Multiple Gammons

- off the ship, a small eye is spliced into one end of the gammoning line
- the opposite end of the line is then reeved through the eye and tightened so that the eye splice lies immediately below the bowsprit mast.
- the line then passes through the gammoning hole in the stem and up around the bowsprit (Fig. 32).

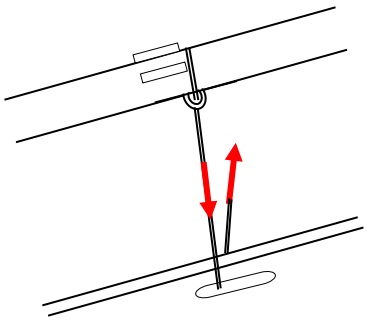


Figure 35: Beginning the Gammoning

- each successive turn lays forward on the bowsprit and aft in the stem (Fig. 32) and this is what gives the gammoning its unique twisting shape. The gammoning heaving should be taut (without being excessive) during this process.

- The line is then frapped (circled around) the mid-point of the gammoning (Fig. 34). Lees states that the *number of turns on the frapping is equal to the number of turns around the bowsprit.* The frapping is pulled tight to pinch the gammoning in the middle - this means that the gammoning itself must not be too tight around the bowsprit, otherwise pulling the frapping will not be possible and the gammoning won't look right.

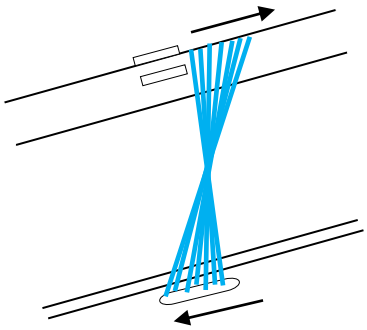


Figure 36: Successive Turns in Gammoning

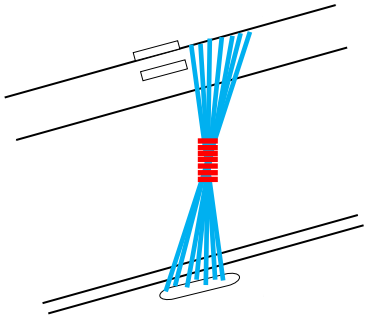


Figure 37: Frapping

Horses (foot ropes) & Stirrups

Discussion

The term 'horse' is interchangeable with the term 'foot ropes'; historically only the term 'horse' was used.

Horses (foot ropes) extended along *behind the yard* or *underneath the bowsprit jibboom* and about 760 mm. below it – they provided a foothold for crew whilst reefing the sails. The rope was aproximately 24 mm. in diameter with the far end having a spliced eye fitted over the yard arm and the inner end is wrapped twice around the yard and made fast behind the sling cleat on the other side of the yard. The ropes were held by short vertical ropes known as *stirrups* which were wrapped three times around the yard. The stirrups had an eye worked into the bottom end and the footropes would be strung through them**.** Small foot ropes known as *'Flemish horses'* were also attached to the yard extreme ends.

The horses on the actual ships were approx. 3 inches (76.2 mm.) in circumference giving a diameter of 24.2 mm.

Advanced Construction

The following comments all emphasise the historical accuracy of the rigging for the horses & stirrups. There are more ideas here in this section – shaded in Fig. 35 below - that you might wish to consider.

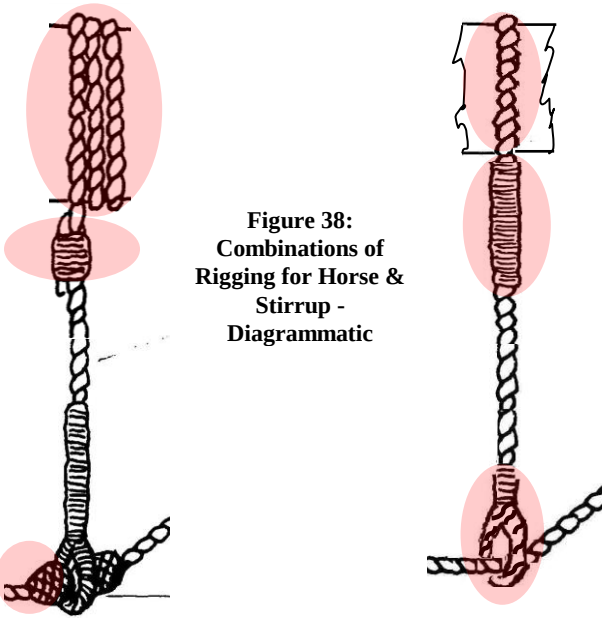


Figure 38: Combinations of Rigging for Horse & Stirrup - Diagrammatic

Figure 35 illustrates various combinations of rigging that *could* be used:

multiple or single lashing around the yard,
seizing under the yard,
seizing around the eye itself,
seizing above the eye.

Rigging at an advanced level involves a manipulation of one or more of the above points.

The following method of horse & stirrup construction is not intended as a complete, watertight 'how-to-do-it' operation but an examplar on which you can alter & improve what I have suggested. In particular, I have not addressed the seizing of either the eye itself or that above the eye.

lashing to the yard	wrapped *over* three times
seizing of lashing	thinner rope or false seizing
eye	stirrup wrapped around pin to form eye
eye seizing	thinner rope or false seizing

Step 1: Construction of HORSE JIG (Fig. 36)

- stirrup ropes (with excess length) are attached to the yard by seizing using either a thinner rope or applying the 'false seizing' method.
- The yard with attached stirrups is put to one side while a jig is made for joining the horse to the stirrups.
- Two lines are marked on the board to represent the distance between the yard (and all the other yards) and the horse.
- The yard is then put in place with four pins or nails with the stirrup ropes lying flat on the board and extending over the edge and downwards using 'alligator' clips as small weights. At this stage, ensure the stirrup ropes are perpendicular to the yard – you may wish to make some subtle changes before fixing to the horse.

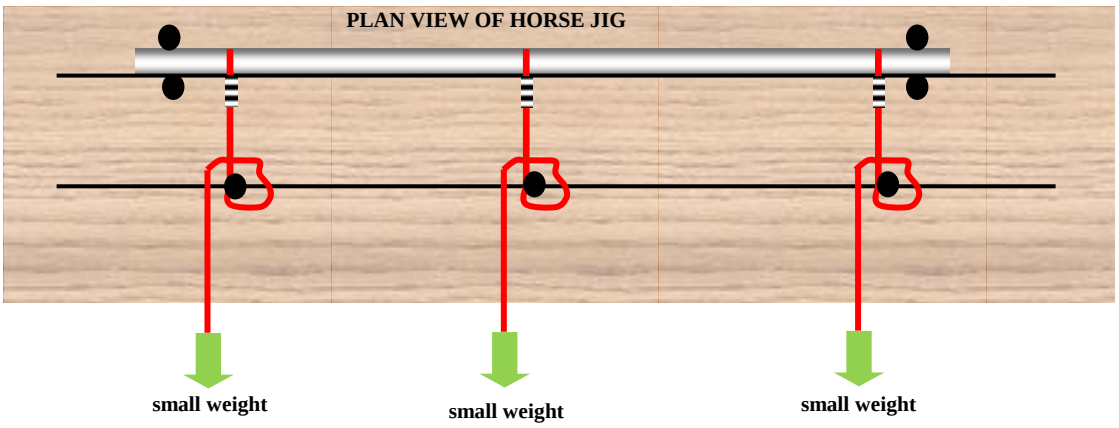


Figure 39: Horse Jig (advanced)

- A nail /pin is then added where each stirrup rope passes over the marked lower horse line.
- Each stirrup rope is lightly glued with PVA at this point and wrapped around the nail/ pin … … ***keeping a few millimeters above the board***. The weight helps keep a small tension on the loop forming the eye.

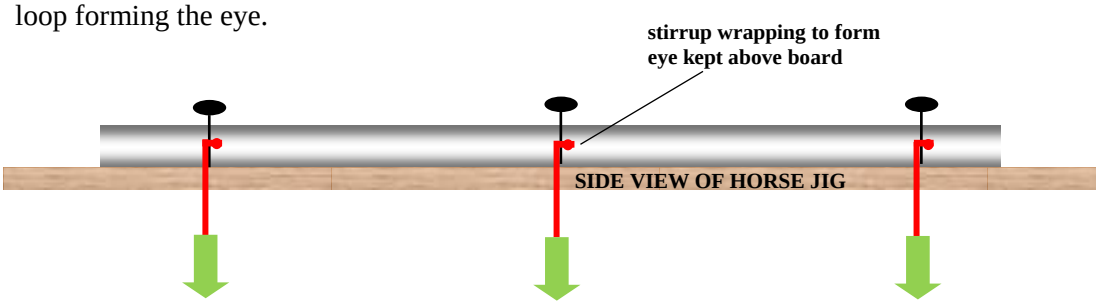


Figure 40: Forming the Stirrup Eye (advanced)

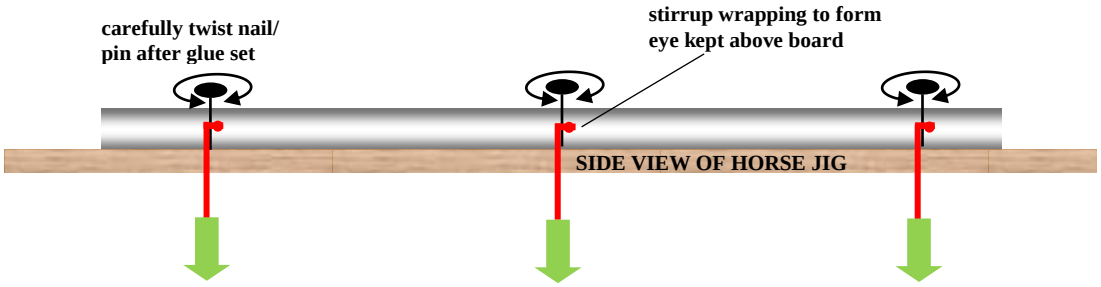


Figure 41: Removing Nail/ Pin from the Eye

- When the glue is fully set, the nail/ pin is carefully rotated backwards and forwards and then removed. The excess rope is not removed. The weights attached to these will still prove useful in the next step.

- The horse, fixed on one yard arm, is then passed through the stirrup eyes – I used a 'needle threader' to assist this operation. Again, small weights (in addition to those already attached to the stirrup ropes) are used this time to create a small degree of curvature as shown in Fig. 39 below. Glue is applied either side of the footrope.

- Any trimming is then carried out.

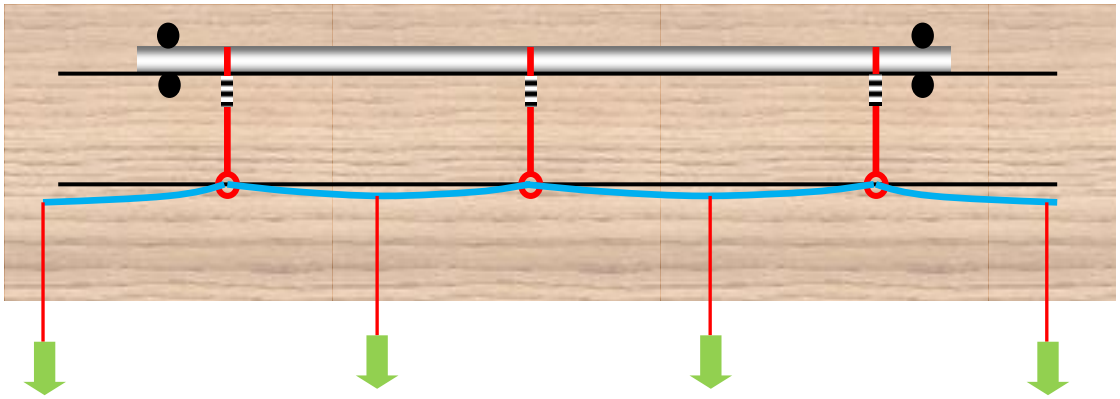


Figure 42: Creating Horse Curvature

Jeers

The term ***jeer*** relates to an assembly of tackles by which the lower yards of a ship were hoisted up the mast to their usual position or lowered as the occasion arose. The rope used in this system was generally referred to as 'tye' (red line, Fig. 40)

By the mid- seventeeth century in Britain, two *double* blocks were fixed to the middle of the main yards with two *triple* blocks fixed to the crosstrees; this system was held in position by two cleats (Fig. 40, shaded blue) nailed to the yard and whose long arms enclosed the ropes (This figure show pairs of *triple* blocks). In general, the Main Yard (lowest yard) would not require its position to be altered.

Two ropes (tyes) led down to typical halyard tackles at deck level (Fig. 43) either side of the mast.

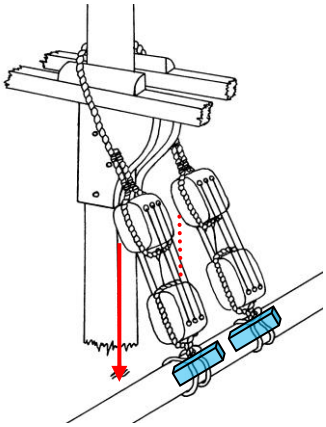


Figure 43: Jeer Tackle/ Sling for the Lower Yards

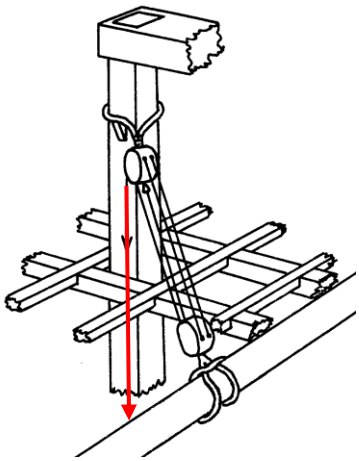


Figure 44:Jeer Tackle for Topmast Yards

The topmast tyes were rove through two blocks fixed to both the mast and yard by slings.

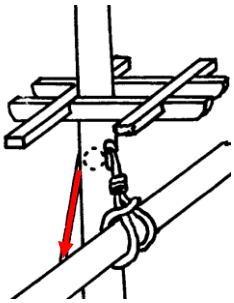


Figure 45: Sling for Topgallant Yards

The topgallant tyes were fixed to the yard with a strop and then passed through a sheave in the mast to the topmast crosstrees with the tye being belayed in the top.

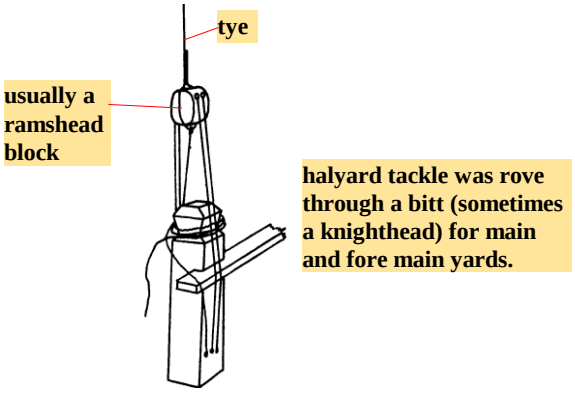


Figure 46: Typical Halyard Tackle

Lower Mast Tackles

Essentially, there was a need to employ lifting/ lowering mechanisms that were not part of the normal day-to-day operations. It was usual to have some sort of permanent linkage - a pendant - on each of the masts to which various tackle types (such as the 'burton' or 'garnet') could readily be attached.

Confusion reigns over the terminology used and mis-use has perpetuated those terms to become the norm. After doing some research, the overall 'mast tackles' encompass both the *permanent* pendant and the *temporary* tackle. It is not uncommon to read about both the 'burton pendant' and the 'burton tackle'.

Mast Pendant

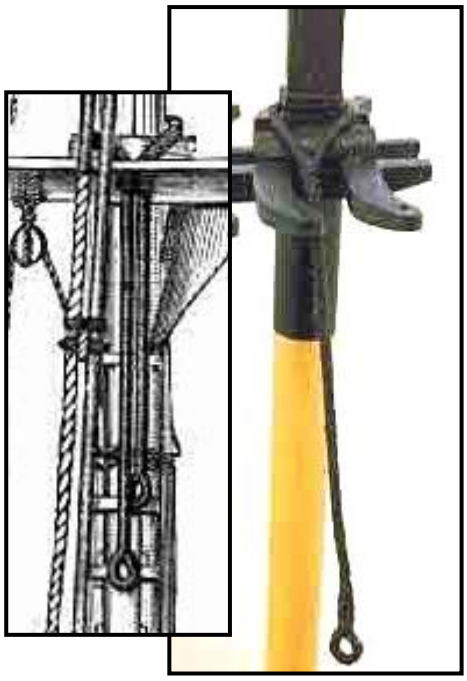


Figure 47: Mast Pendants

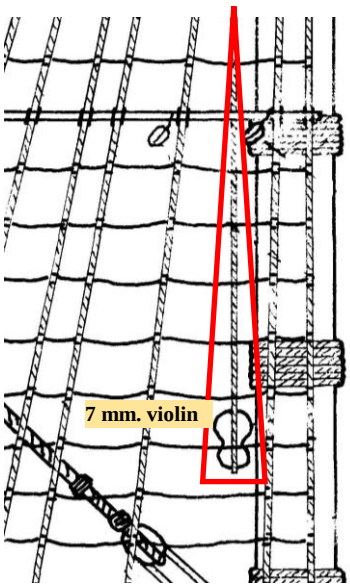


Figure 48: Main Mast Pendant: Royal William

Burton Tackle

Burton tackles consisted of a double and single block line system which by its design gives a very large load:effort advantage. When used with mast pendants, they can be employed in a variety of ways …

- tighten the shroud lanyards when initially fitted and later as needed.
- lift spars and ship's boats
- lift material on or off the ship
- shift items within the ship.

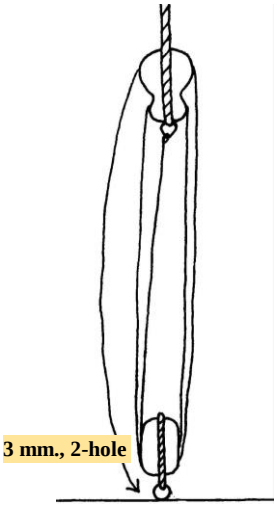


Figure 49: Burton Tackle – Royal William

Garnet Tackle

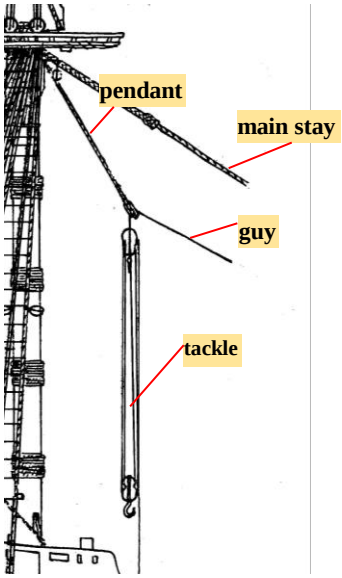


Figure 50: Garnet Tackle – Friederich Wilhelm zu Pferde

Used between the 16C – 19C, the garnet tackles on larger ships were usually double – both blocks having two sheaves. The pendant end (with a cut splice, lashed eye or horseshoe splice) was shipped over the shrouds on ships built to the British pattern. Thus this tackle would be the last fitting in the standing rigging.

A *fiddle block* was suspended between the *guy* (a line fixed to the foremast or to the fore top with a seized eye) and the *pendant* (Fig. 47). This drawing comes from the plans for the German ship, Friederich Wilhelm zu Pferde which whilst having a loading tackle in the form of a garnet tackle, did not have the mast tackles of later ships.

This tackle was usually arranged so that it operated directly over the main hatches.

Mouse

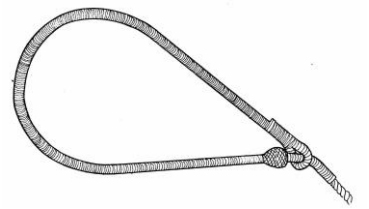


Figure 51: Stay Collar

The stay collar was wrapped around a mast but was prevented from pulling tight by the use of the ***stay mouse*** – a structure ***raised on the stay rope large enough not to pass through a small loop*** at the stay end.

Figure 52: Common Mouse Formation

The majority of builders avoid producing this piece of antiquity and Fig. 49 is a typical approach taken by the majority of builders – no actual mouse.

Figure 53: Replica Full-Sized Mouse

The mouse shown in Fig. 50 is one created for an actual replica ship.

However, the mouse can be produced with a high degree of accuracy or simulated to look realistic and there are many methods used by those willing to 'take the plunge'. In most cases, a wooden form is used to create the overall shape.

Method 1:

1. wooden form is produced (refer to Method 2)
2. loop of rope above and below the form,
3. continuous vertical loops over the form,
4. horizontal threading under and over the vertical loops.

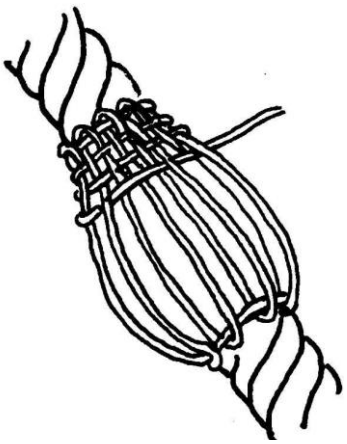


Figure 54: Mouse (method 1)

Method 2: (adapated from an article by *shopaholic*, MSW Forum – with permission)

The rope is then served just beyond where the mouse will be

Figure 55: Method 2, Step 1

Figure 56: Method 2, Step 2

The eye is formed by unpicking the ends of the rope, gluing them down to simulate a splice.

The splice is then served over.

Figure 57: Method 2, Step 3

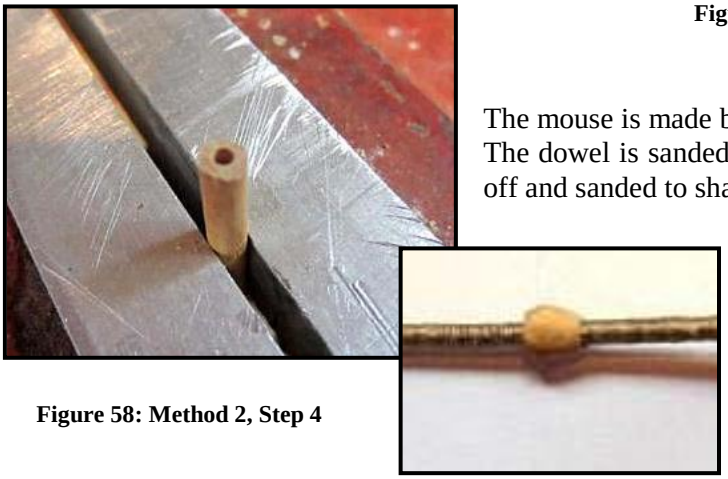
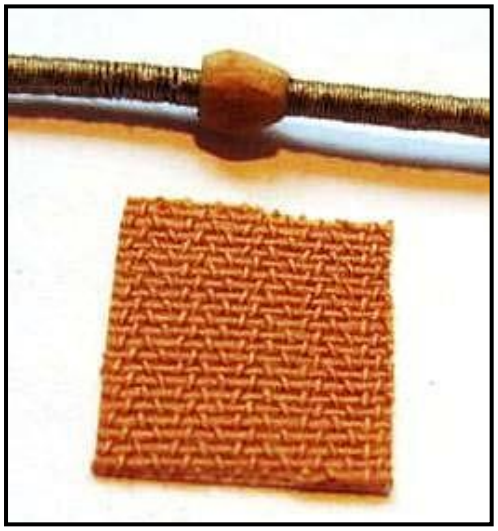


Figure 58: Method 2, Step 4

The mouse is made by drilling a hole in a piece of dowel. The dowel is sanded to a cone shape on the end then cut off and sanded to shape and slipped onto the rope.

To create the woven effect over the mouse, some flexible cloth wound dressing was used, being self-adhesive, it was easy to attach.



The lower part is served. A little bit of PVA glue on the join will stop the self-adhesive letting go in the future.

Figure 59: Method 2, Completion

Parrels (also known as 'Parrals)

These devices were designed to fasten yards and booms to the masts in such a way that they could easily be hoisted or lowered. There are different types of parrels described in the Euromodel builds ...

- a single rope
- a rope running through a collection of trucks & ribs,
- a rope passing through a series of trucks & no ribs,

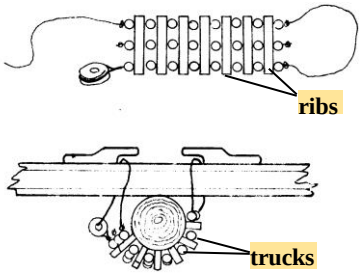


Figure 60: Rigging a Parrel

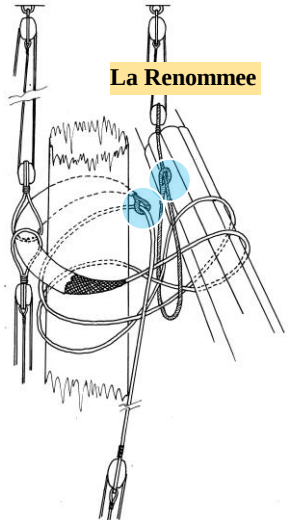


Figure 61: Fore, Main & Mizzen Mast Dolphin Parrel

The first of these was formed from a piece of rope, well-covered with leather or spun yarn (and commonly referred to as a *dolphin*) to reduce the amount of chafing against the mast. The two eyes (shaded blue), one at each end, were lashed together as shown in the diagram.

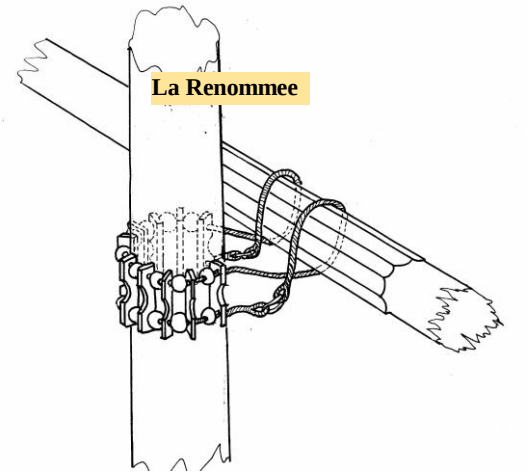


Figure 62: Fore & Main *Topmast* Parrel

The second form – commonly found on the upper masts - consisted of flat boards (ribs) and spherical forms (trucks) – Fig. 59 They generally had two ropes passing through them, each having an eye at one end. One rope passed over the yard and the other, under the yard with both eyes meeting on the same side of the yard and lashed together by *marling* – turns of a fine rope with every turn secured by a knot. This parrel was not phased out completely until late 18C/ early 19C.

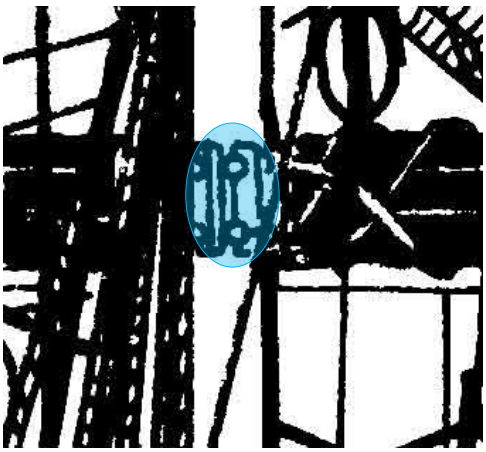


Figure 63: Topsail Yard Parrel, Royal William

Careful examination of the Royal William drawings show these typical parrels used on the topsail yards. Fig. 60 shows a Main Mast parrel but having looked at over fifteen builds of this ship, not one of them showed these parrels.

So ... something to consider depending on your enthusiasm.

Whilst the Fore- and Main lower yards were generally not lowered, there was a need to lower the Mizzen Mast yard such as the boom. To allow this to happen, it was connected through a halyard tackle to a bitt on the deck. Note the use of a deadeye for this purpose.

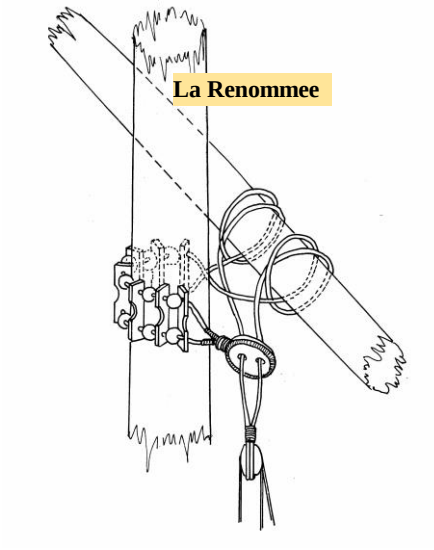


Figure 64: Mizzen Boom Parrel

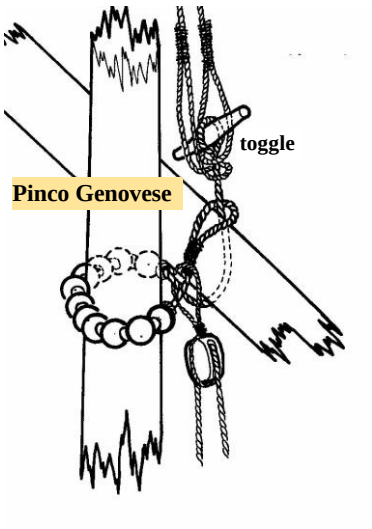


Figure 65: Main & Fore Lateen Parrel

More typical of Mediterranean-based ships were the simple parrels without any ribs. Ropes supporting all the lateens (diagonal yards) were passed through a sheave near the mast heads; when they needed to be lowered, a timber toggle near the parrel was removed allowing for a quick release.

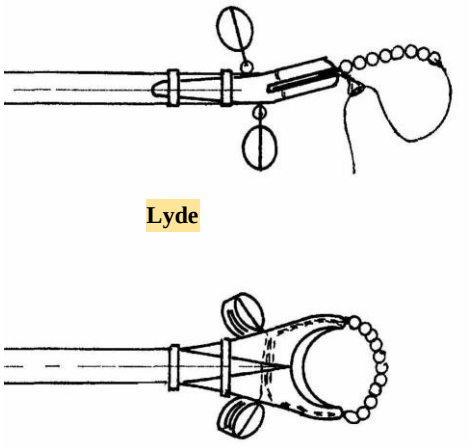


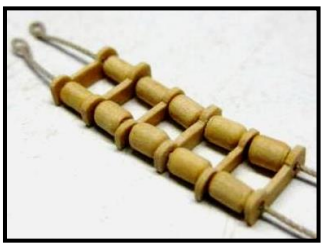
Figure 66: Mizzen Lateen Parrel

Parrel Trucks

- Glass seed beads of the required diameter can be purchased from craft/ sewing supply outlets and they work well as trucks but they should be opaque to prevent sunlight passing through and creating 'internal lights'

Figure 67: Lathe-turned Trucks

- Obviously a lathe can be used to turn out some excellent wooden forms.



More information on these trucks (and ribs) can be found in Dan Vadas' build of HMS Vulture on the MWS forum.

- One member, 'Amateur', needed to produce parrels of 1.5 mm. but could not locate any glass beads that small and so resorted to using bead making clay (soft but hardens after baking in an oven). Holes were drilled of the required diameter into a wooden strip and the clay pushed into the holes. A piece of thin copper wire was used to make a hole in the centre of each bead and then the whole collection in the timber was baked. After baking, the blunt end of the drill was used to push the parrels out of the strip. The corners were rounded off using a piece of sandpaper.

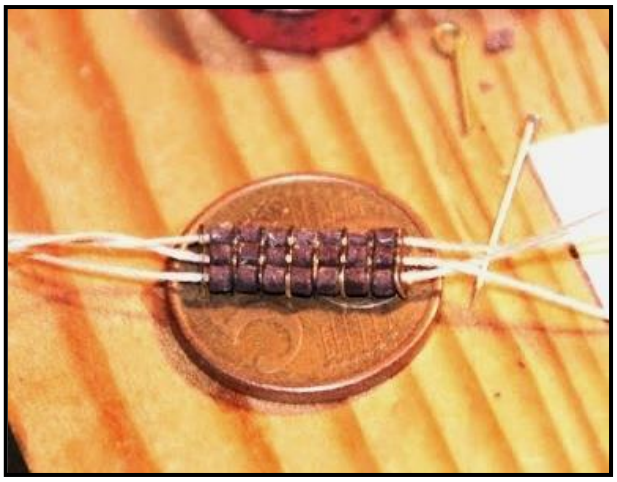


Figure 68: Clay Parrels

- Metal draw plates can be used to produced small diameter rods which can then be cut into suitable short lengths and the edges rounded.

Parrel Comments

The following comments (in sequence) were posted on a MSW Forum log. I have edited these invaluable words to make it, hopefully, a useful set of ideas in constructing and rigging the parrels. I have sought permission from the various authors but if I missed you, I apologise.

Initial preparatory comments

- "… cut the head off a small brass nail and drill a hole into the mast halfway the diameter and the same on the yard (to give some stability). CA glue the nail in the holes and attach the yard to the mast."

Working off the ship …

- "… set up the parrels and trucks off ship such that there ends up a single line coming off each end of the parrels much like a necklace. I then wrap and tie the parrels to the yard."

- "… found it best to seize one end of the parrel rope to the yard away from the ship and the other with the yard in it's lowered position along with the halyard tyres."
- "… I have rigged them on the bench and where necessary passed a double piece of thread through leaving a loop. Then once in place, pass the real thread through the loop and pull through. It takes an amount of planning which thread goes where beforehand but reduces the in-situ work considerably."

- "… assemble the parrels on the bench top using two lanyards/ropes with a very small eye on one end of each. I seize the eyes together and this forms one end of the parrel rope with each tail end reeved through the ribs (6) and trucks (2 rows of 5). I use micro clamps to pinch the rope at each end of the outer ribs to keep the assembly in place temporarily, leaving sufficient length of the seized ends of the ropes to form a loop that will easily slide over the pre-rigged yard.

Rigging the Parrel

- "… then tie/sieze one end of the parrel ropes (with the eyes) around the yard on one side of the mast, wrap the rope and parrel around the mast then loosely tie the other end of the ropes around the yard on the other side of the mast and haul these as taut as you can allowing some room for the parrel to slide up the mast."

- "… parrel tyes for the lower yards led down to tackles hooked into eyebolts in the deck abreast the mast. For the upper yards they most often led down to the tops.

- "… several eminent authors … state that the lower yard parrels, where still used, had been rigged as static (no fall with purchase or tye with tackle) by mid 18th century."
- "… then offer the yard to the mast about 3 inches (75mm) below the tops, pass the tail end of the ropes around the mast and then counter-wrap these around the yard, pulling through the excess of the loop on the other end and cinch them loosely. I then remove the clamps and tighten the ropes a little more, but being careful not to prevent the whole assembly being able to move up and down the mast. I then wrap the tail end of the parrel rope back around the mast within the hollow of the ribs, pass around the yards on the other side and return the tails back to the other side where I tie them off (around the yard)… then attach the tye sling strops (seize the two loops of each together) around the yard and hoist the yard back up to its required position carefully adjusting the parrel as it goes up.

Ratlines & Shrouds

The following YouTube video tutorials say far more than I could write on this topic.

- Deadeye construction: https://www.youtube.com/watch?v=UpaGK6v7dlc
- Deadeye fitting on channels: https://www.youtube.com/watch?v=pQ_gM2Pb3oE
- Deadeye rigging the easy way: https://www.youtube.com/watch?v=oU-h8i4LtPM
- Lanyard rigging: https://www.youtube.com/watch?v=PrImPdbLRAw
- Ratline making: https://www.youtube.com/watch?v=yMmGFWJhi8E
- Shroud pair rigging, Part 1: https://www.youtube.com/watch?v=qb-FA3P6PBk
- Shroud pair rigging, Part 2: https://www.youtube.com/watch?v=FV4WA2vCqD8
- Shroud pair rigging, Part 3: https://www.youtube.com/watch?v=g7V_uJjoJEo
- Shroud installation: https://www.youtube.com/watch?v=rGu2cIu8lSE

Sails

Knots and Trimming

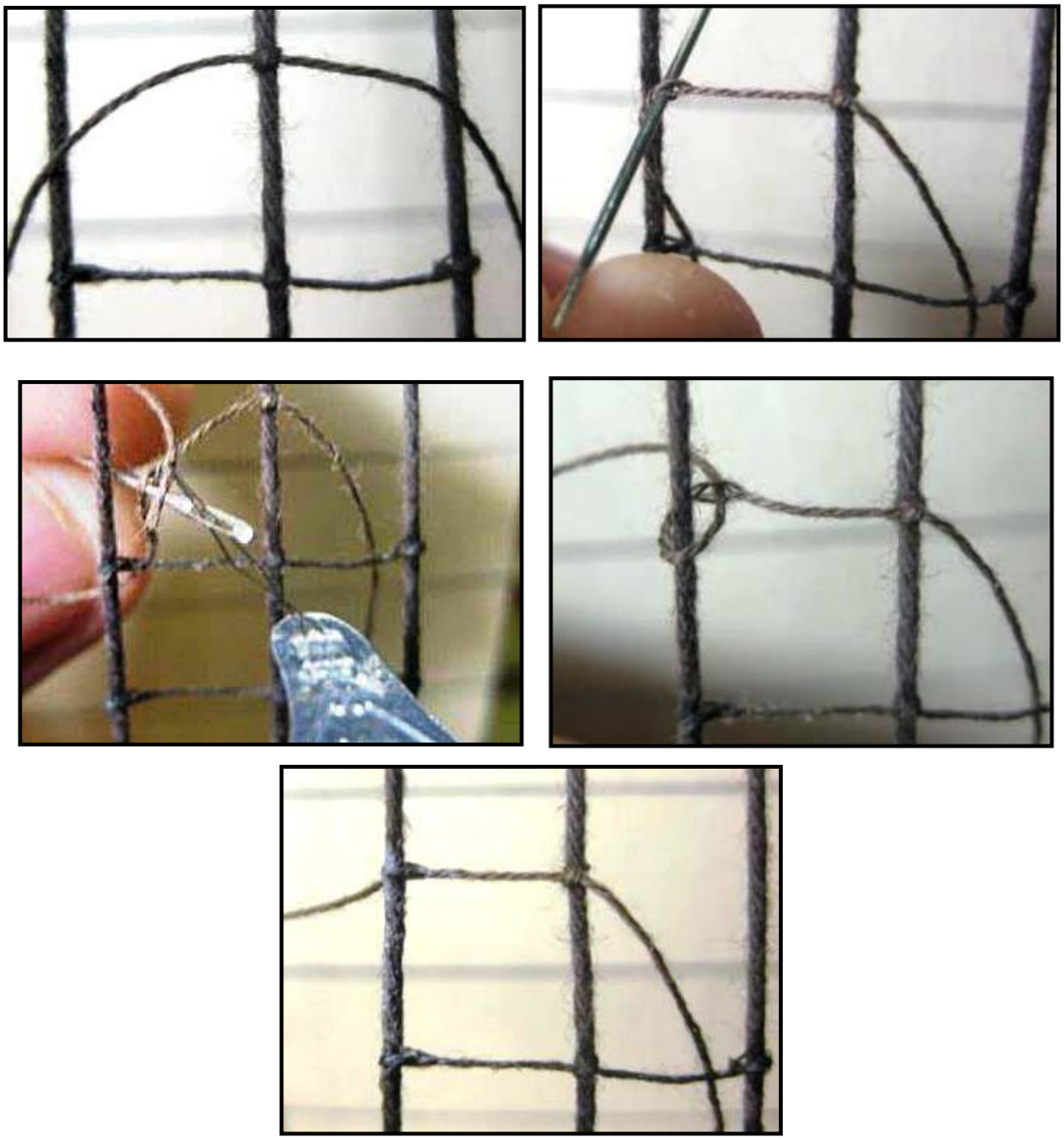
These following comments were found on the MSW Forum …and includes …

- clove hitch
- eye-splicing
- cow hitch

"… a ***clove hitch*** and trim the ends with nail clippers where the curve allows you to get close, then a dab of 'flat' varnish to hold the hitch."

"… a clove hitch was used where the ratlines crossed the inner shrouds but an ***eye-splice*** was formed in each end and this was seized to the outermost shrouds."

"… cyanoacrylate may be an option, but I prefer diluted white glue or flat clear lacquer because these have enough strength to do the job and will not leave a shiny spot or a white residue, nor run through my lines making them stiff, brittle and prone to break."



Dan Vadas (MSW Administrator) wrote … the ‘cow hitch’ (I can't remember if that's the correct name for this knot) is an alternative that looks much neater than a clove hitch for the two outer ones, as Janos mentioned. Here's how to tie them …

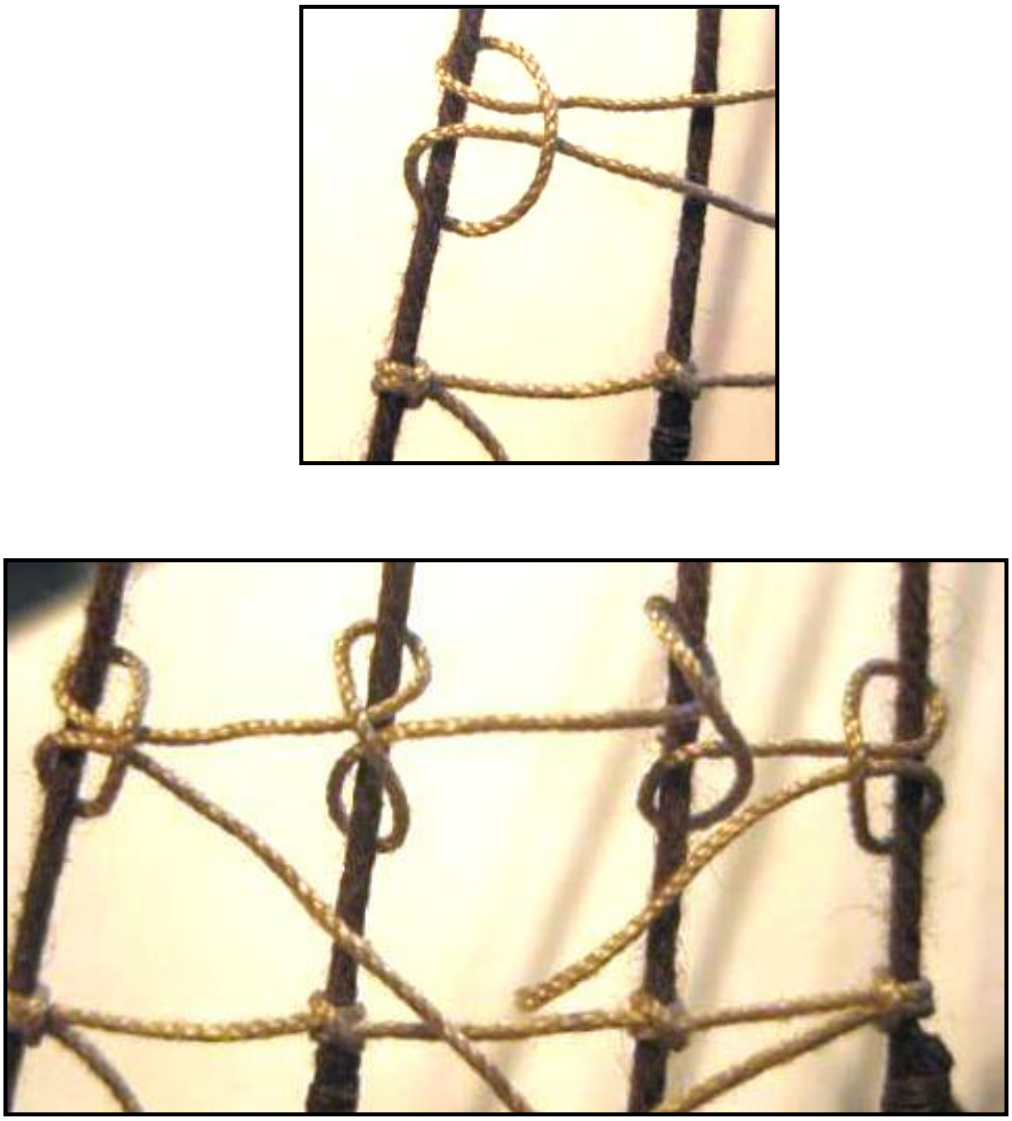


Figure 70: Producing the Outer 'Cow Hitch'

“… the tails of the cow hitches are both on the lower part of each knot, meaning that the two knots are mirrors of each other.”

Ropes and Lines

Q: When is a rope not a rope?

A: When it is taken onboard a vessel.

Whatever their function onboard ship, most ‘ropes’ were then termed ‘lines’.

Ropes

However, the term ‘rope’ was still applied to the following seven functions …

1. *Horse* (or ‘foot’) rope: underneath yards or bowsprit, also the bottom edge of a sail.
2. *Bolt* rope: sewn around a sail, or lowering a top-mast or a topgallant and royal mast
3. *Man* rope: hanging over the side of a ship as sea ladders.
4. *Mast* rope: is used in hoisting, or lowering a top mast, or a topgallant and royal mast.
5. *Buoy* rope: attached to a buoy.
6. *Yard* rope: used in lifting or lowering yards.
7. *Wheel* ropes: leading from the drum of a hand wheel to the tiller purchase.

Lines

- *Standing rigging* were lines of a fixed nature such as shrouds, stays, foot ropes and all hauling ropes.
  Shrouds ran athwartships and were tightened using dead eye blocks.
  Stays usually ran fore and aft collectively holding the masts in position.

- *Running rigging* were the lines that moved the sails, directly or indirectly.
  Braces moved the spars connected to the sails.
  Sheet lines were used to haul the sails to the spars.
  There could be more than 60 different running rigging lines, all anchored at different locations about the vessel.

Snaking (of Main Stay & Preventer)

These following comments were found on the MSW Forum …

"I am told the snaking was only used when action was imminent. Its effect is to keep a cut stay nearly in position for ease of repair and to keep it from coming down on deck and injuring crew members. This is, remember, the largest and heaviest line on the ship."

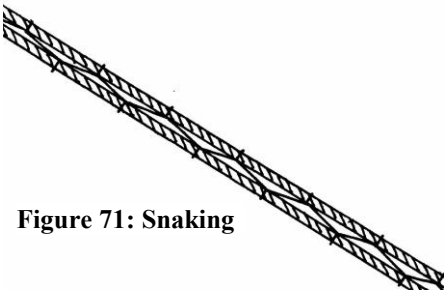


Figure 71: Snaking

"I use a needle to *thread the thin line through the stay and preventer*. You can adjust the tension of each segment to keep it relatively straight and avoid pulling the two stays together."

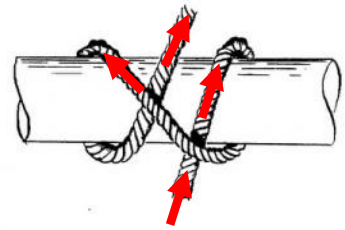


Figure 72: Clove Hitch Knot

"I remember attempting the *tying of clove hitch knots* in the outer part of the stay, but what ended working well, was tying the knots in the inner part of the stays."

Chapter 5: VIDEOS FROM YOU TUBE

Belaying pin rigging: https://www.youtube.com/watch?v=fUSKKMEW7yY

Bending planks: https://www.youtube.com/watch?v=JyzWH7yVlg8

Bending wood with steam in a microwave: https://www.youtube.com/watch?v=nwTFw8Ol2o4

Block rigging to a mast, gaff or boom: https://www.youtube.com/watch?v=WUrRb66VSSE

Deadeye construction: https://www.youtube.com/watch?v=UpaGK6v7dlc

Deadeye fitting on channels: https://www.youtube.com/watch?v=pQ_gM2Pb3oE

Deadeye rigging the easy way: https://www.youtube.com/watch?v=oU-h8i4LtPM

Gun carriage construction: https://www.youtube.com/watch?v=Fbb5C3jEycY

Lanyard rigging: https://www.youtube.com/watch?v=PrImPdbLRAw

Ratline making: https://www.youtube.com/watch?v=yMmGFWJhi8E

Rope coils: https://www.youtube.com/watch?v=SddByswjBUs

Seizing a rope or line: https://www.youtube.com/watch?v=nzDl5MYOgmQ

Shroud pair rigging, Part 1: https://www.youtube.com/watch?v=qb-FA3P6PBk

Shroud pair rigging, Part 2: https://www.youtube.com/watch?v=FV4WA2vCqD8

Shroud pair rigging, Part 3: https://www.youtube.com/watch?v=g7V_uJjoJEo

Shroud installation: https://www.youtube.com/watch?v=rGu2cIu8lSE

Strops and metal hooks: https://www.youtube.com/watch?v=0IXIElThY1E