4. A central screw with a threaded sleeve taking on each end (one end having a left- and the other a right-handed thread) and with a standing eye fitted to each sleeve.

In types 1 and 4 the length is adjusted by turning the screw (usually with a tommy bar) and in the others by turning the sleeve; after adjustment, simple locking devices are used to prevent the screw or sleeve from moving further.

Rigging screws in the Royal Navy comprise all four of these types, and they are known generally as *screws and slips*, *screws without slips*, or sometimes *bottle-screws*; type 4 is called a *double-ender*, or *collapsing screw*. Those issued for general purposes are of the first type described. In each type the screw is locked to the sleeve by a sliding block, and to the swivel eye at its head by a bolt taking into a slotted plate, as illustrated in fig. 8–3. In addition, screws of other types are issued for special purposes such as the adjustment of guardrails and davit guys. The collapsing screw is much mure clumsy than the remainder, but can be designed with a longer travel. Bottle-screws are also used with the slips for securing an anchor in the hawse pipe.

Rigging slip. This is a quick-release link used for joining the end of a rope or a chain to a fitting when the end may have to be cast off frequently or rapidly.

BLOCKS

A block is a portable pulley, made of *metal*, *metal and synthetic-resin bonded fibre* (SRBF) or, in some cases, *wood and metal*. The most common in naval service are the SRBF range of blocks and metal blocks.

Parts of a block (fig. 8–4)

The main parts of a block are the *shell* or body; the *sheave* or wheel over which the rope runs; the *pin* on which the sheave turns; the *bush* or bearing between the sheave and the pin; and the eye, hook, strop or other fitting by which the block is secured in the required position.

The top of the block where the eye or hook is fitted is called the *crown*; the bottom of the block is the *arse* or *tail*; the sides of the shell are the *cheeks*, and the groove made in the cheeks of some blocks to take the strop is called the *score*; the opening between the sheave and shell through which the rope passes is the *swallow*; and the eye sometimes fitted at the tail is the *becket*.

Classification of blocks

Wooden blocks are classified by their size, which is their length from crown to tail measured in millimetres round the shell; and will take a rope one-tenth their size. (Rope measured by diameter in millimetres.) Metal blocks and SRBF blocks are classified by the *size of rope* for which each is designed, which is marked on a plate affixed to one cheek or, in the case of SRBF blocks, stamped on the *binding* of the block.

Blocks may have more than one sheave: a single block has one sheave, a double block has two, a triple block has three, and so on.

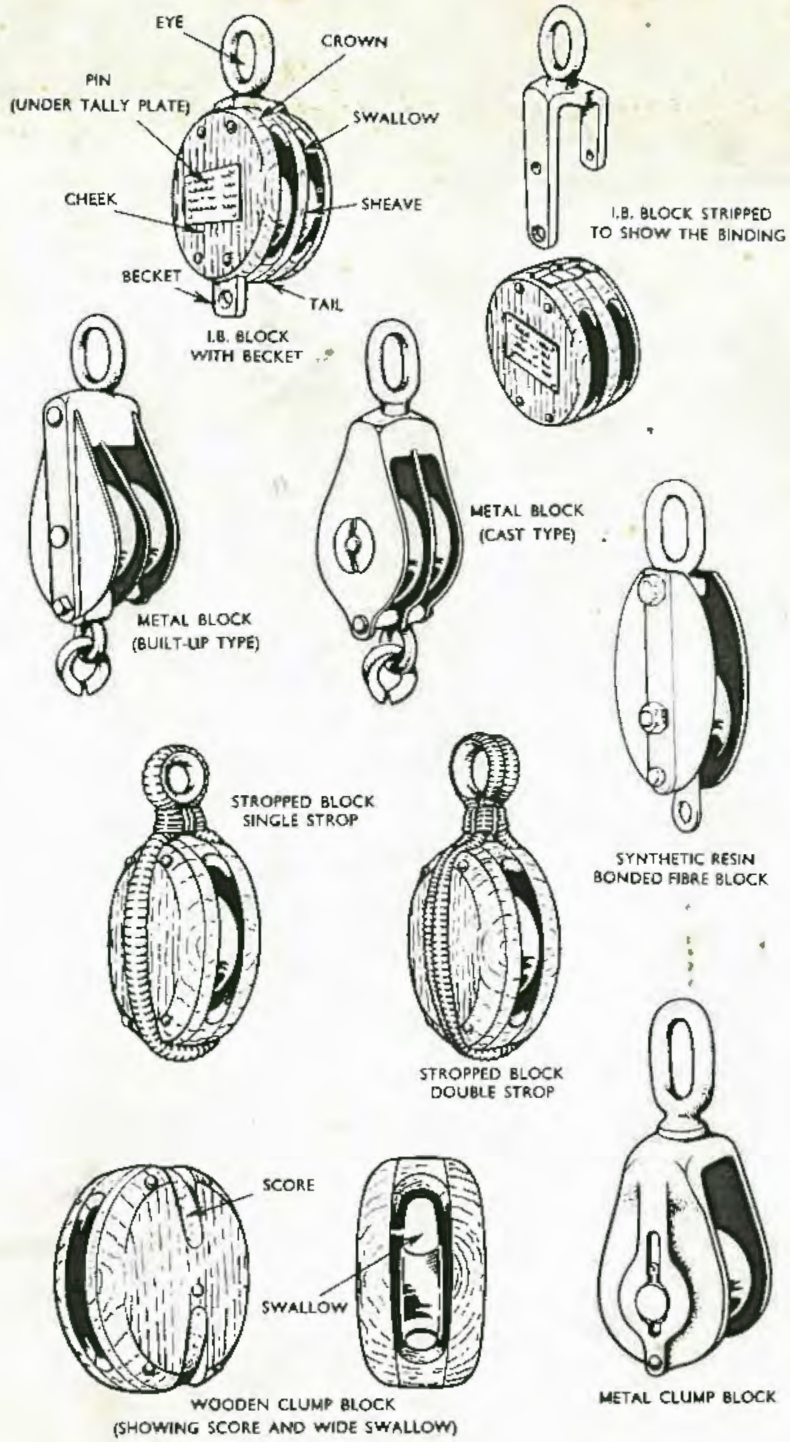

FIG. 8–4. Blocks

Types of block

Synthetic-resin bonded fibre (SRBF) block (fig. 8–4). This block is built up of steel bindings, and its means of attachment and sheave pins are of steel. The cheek plates and sheave are made of synthetic-resin bonded fibre. SRBF blocks are designed for use with man-made and natural fibre ropes and can be single, double or triple blocks or snatch blocks with *proof loads* of two, four or eight tonnes. These blocks should not be used for wire rope and should not be oiled or greased.

Metal blocks (fig. 8–4). These blocks are usually built up of steel plates and fittings, their shells have a binding which supplies the strength, but the cheeks, etc., are of light plating. The simplest pattern is the *gin block*, which consists of a binding, carrying one large sheave, and a skeleton rope guard instead of cheeks. Some types of metal blocks, however, have their shells cast in one piece.

Metal blocks vary considerably in quality and finish, the better ones being manufactured for special purposes such as the upper blocks of some boats' falls or the blocks of engineers' tackles. Some special-purpose blocks are made entirely of gunmetal or phosphor bronze, which do not corrode as easily as steel when exposed to the weather and are unlikely to cause sparks when working.

Internal-bound (IB) block (fig. 8–4). This block has a shell partly of wood and partly of metal, and is the modern type of wooden block. The metal portion consists of a fork-shaped steel fitting called the binding, which incorporates both the eye or hook and the becket when fitted; it also takes the pin of the sheave. The internal-bound block has been superseded by the SRBF block.

Snatch blocks (fig. 8–5). These are single blocks, metal or SRBF, in which part of the shell is hinged to form a 'gate' which allows a bight of rope to be inserted into the swallow from one side. They should not be used when a solid block is suitable for the job. They should *never* be used when the safety of life depends on them, because the gate may open if a sideways pull is exerted. Figure 8–5 shows a metal snatch block and an SRBF snatch block with the gate open and closed.

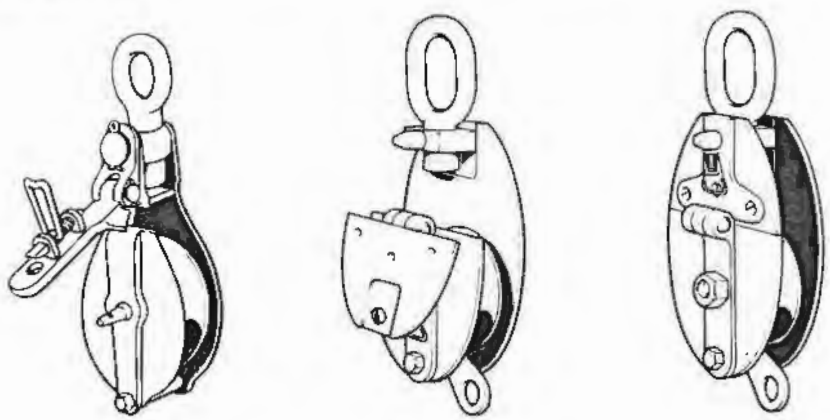

FIG. 8–5. Snatch blocks

(i) metal—open (ii) SRBF—open (iii) SRBF—closed

Common blocks. These blocks, which are rarely found in service, have shells made entirely of elm. They are the old-fashioned type of wooden block, which is held in position by a strop passed round its shell and seized into a thimble eye at the crown; the strop thus strengthens the shell and the block.

Clump block (fig. 8–4). This block can be of wood or metal and it has an exceptionally large swallow. It will take a rope one-sixth its size, where the block is measured from crown to tail in millimetres and the rope is measured by diameter in millimetres. For example, a 230-mm block will take a 36-mm rope. Wooden clump blocks are used on lower booms to support the bights of the boatrope(s), and metal clump blocks are designed to take chain.

Fiddle block. This is a double block in which the sheaves are carried one above the other instead of side by side. It is used where a double block is required but where there is either insufficient lateral room for the normal type or where it is desired to separate the parts of the fall with which the block is rove. Although this type is not generally used in the Royal Navy, the mainsheets of a 'Bosun' dinghy incorporate a fiddle block made of SRBF.

Sheaves and bearings

The sheaves of wooden clump blocks are of phosphor bronze, those of metal blocks are of either phosphor bronze or mild steel, and those of SRBF blocks are of synthetic fibre. Phosphor bronze sheaves are more expensive but are desirable where the blocks are exposed to corrosion, as in boats' falls and engineers' tackles, or when sparking may be dangerous, as in ammunition hoists. The pins of all blocks are of steel.

The bearing between the sheaves and the pin may be of the plain, roller, synthetic, or self-lubricating type. In accordance with common engineering practice, a plain bearing is provided in a steel sheave by pressing a small brass bush into its centre, because steel bearing on steel is liable to seize. Roller bearings are fitted in a number of special blocks, including most of those used for boats' falls. Self-lubricating bearings are similar to plain bearings but the bush is manufactured of porous bronze which is impregnated with lubricant. They are used in the Royal Navy for some derricks and in boat-hoisting machinery.

Means of attaching

Every block, except a stropped block, has a fitting at its crown by which to secure it where required. A list of such fittings is given below:

1. A standing eye in line with the sheave.
2. A standing eye at right-angles to the sheave (reversed).
3. A standing eye at right-angles to the sheave, with a free hook.
4. A swivel eye.
5. A swivel hook.
6. A swivel eye and a free hook.
7. A jaw in line with the sheave.
8. A jaw at right-angles to the sheave.

Notes

(i) A *jaw* is a fork-shaped fitting by which a block can be suspended and at the same time prevented from turning.

(ii) All blocks fitted with a swivel at the crown are called *swivel blocks*.

(iii) As a general rule types 1, 2 and 4 IB blocks have an oval eye for which a shackle is required, whereas similar metal and SRBF blocks have a shackle permanently fixed in the eye.

Description

A block is fully described as follows:

1. Size (wooden blocks only).
2. Number of sheaves.
3. Type (SRBF, steel, etc.), with details of sheaves sometimes included.
4. Size and type of rope.
5. Means of attachment (standing eye, swivel eye, swivel hook, etc.).
6. Catalogue number including management code.
7. The proof load.
8. Date and initials of manufacturer.

Strength of blocks

The safe working loads of blocks are covered in more detail in Volume II but, in general, it can be said that metal and SRBF blocks are stronger than the rope for which they are designed. The maintenance, survey and testing of blocks is covered in Volume II.

PURCHASES AND TACKLES

A purchase is a mechanical device by means of which an applied pull or force is increased; it may be a system of levers, a system of revolving drums or wheels geared to one another, or a combination of blocks or pulleys rove with rope or chain.

A tackle (pronounced 'taycle') is a purchase consisting of a rope rove through two or more blocks in such a way that the force of any pull applied to its hauling part is increased by an amount depending upon the number of sheaves in the blocks and the manner in which the rope is rove through them.

Parts of a tackle (fig. 8–6)

The blocks of a tackle are termed the *standing block* and *moving block*; the rope rove through them is called the *fall*, which has its *standing*, *running* and *hauling* parts. The size of a tackle is described by the size of its fall; a 24-mm luff, for example, would be rove with a 24-mm fall.

Mechanical advantage

The amount by which the pull on the hauling part is multiplied by the tackle is called its mechanical advantage (MA) and, if friction is disregarded, this is equal to the number of parts of the fall at the *moving* block. In fig. 8–7, for example, there are two parts at the moving block, therefore the mechanical advantage is two; in other words, a pull on the hauling part of 50 kg would, if friction were disregarded, hold a weight of 100 kg.

Friction, which occurs in the bearings of the sheaves and in the fall as it bends round the sheaves, reduces the mechanical advantage considerably; this loss through friction is explained on page 246.

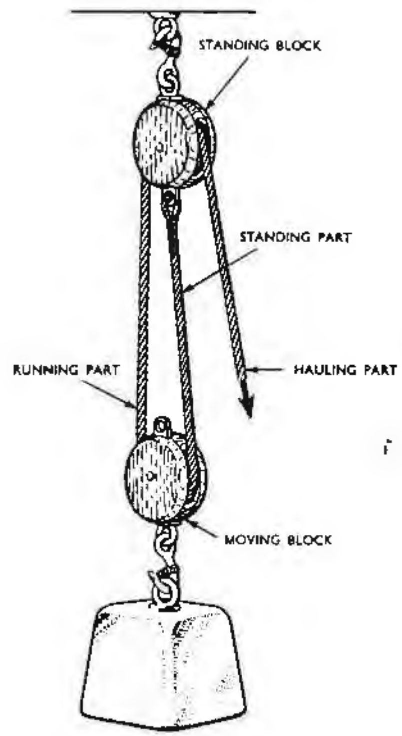

FIG. 8–6. Parts of a tackle

Velocity ratio

Mechanical advantage is gained only at the expense of the speed of working. In fig. 8–7, for example, the weight will be raised only half a metre for every metre of movement of the hauling part. The ratio between the distance moved by the hauling part and that moved by the moving block is known as the velocity ratio (VR) and is always equal to the number of parts of the fall at the *moving* block.

Reeving a tackle to advantage and to disadvantage

The number of parts at the moving block, and therefore the mechanical advantage, is always greater when the hauling part comes away from the moving block, and such a tackle is said to be *rove to advantage*. Conversely, a tackle in which the hauling part comes away from the standing block is said to be *rove to disadvantage* (see fig. 8–8). Where practicable, therefore, *rig a tackle so that the hauling part leads from the moving block and make the block with the greater number of sheaves the moving block.*

Load on the standing block (fig. 8–9)

The load on the standing block, and therefore on the fitting to which it is attached, is dependent upon the mechanical advantage of the tackle used. This load is calculated by adding the pull required on the hauling part to the weight which is being moved; and so, for a given weight, the greater the mechanical advantage the less will be the load on the standing block.

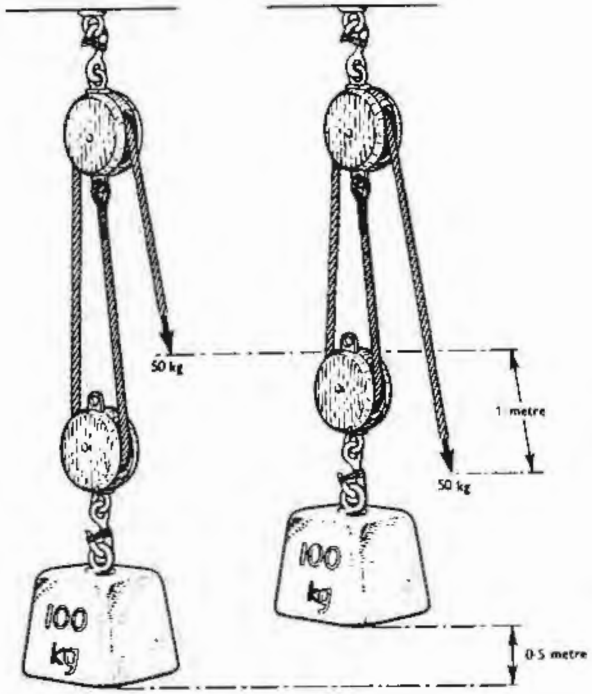

FIG. 8–7. Mechanical advantage and velocity ratio of a tackle

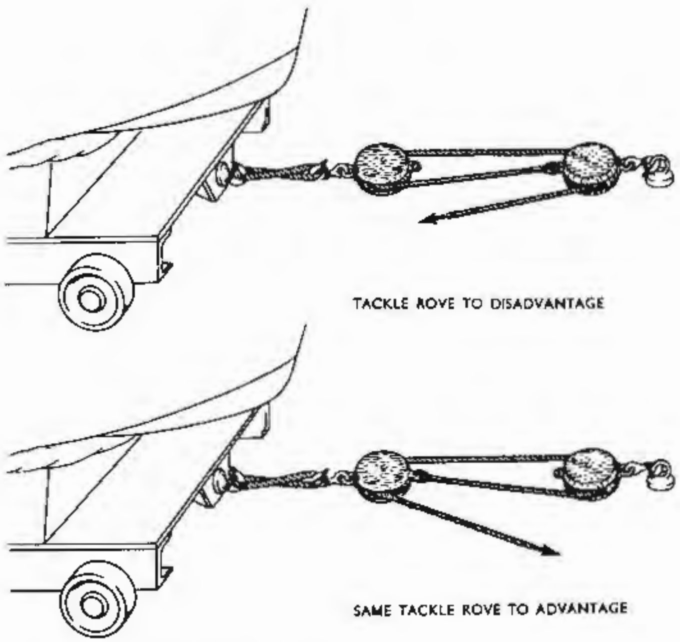

FIG. 8–8. Reeving a tackle to advantage and to disadvantage

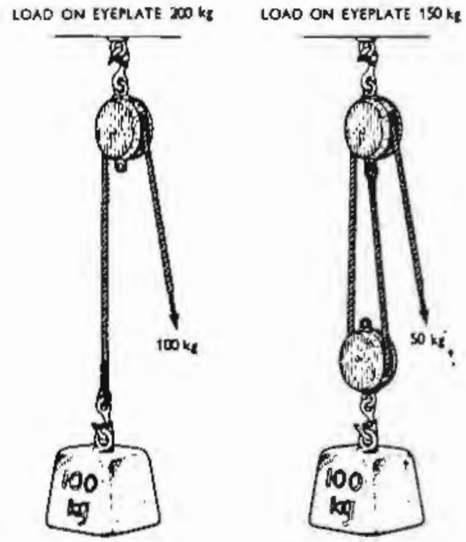

FIG. 8–9. Load on the standing block

EXAMPLES OF TACKLES AND PURCHASES

Examples of whips, tackles and purchases used at sea, together with their velocity ratios and mechanical advantages, are given below; in each the approximate loss of mechanical advantage due to friction has been taken into account.

Single whip (fig. 8–10)

This consists of a fall rove through a single standing block; no mechanical advantage is gained. It is used for hoisting light loads, and where speed of hoisting is an important factor.

Runner (fig. 8–11)

This consists of a rope through a single moving block. As there are two parts of the fall in the moving block, the VR is 2 and the MA is 1.82.

Double whip (fig. 8–12)

This is a purchase used for hoisting and consists of two single blocks with the standing part of the fall made fast near, or to, the upper block, and it cannot be rove to advantage. The VR is 2 and the MA is 1.67.

Gun tackle (fig. 8–13)

This is the term usually applied to a purchase consisting of two single blocks, but which is not used for hoisting; it cannot then be called a double whip, as this term is applied only when it is used for hoisting. In the gun tackle the standing part of the fall is always made fast to one of the blocks. The name

FIG. 8–10. Single whip

FIG. 8–11. Runner

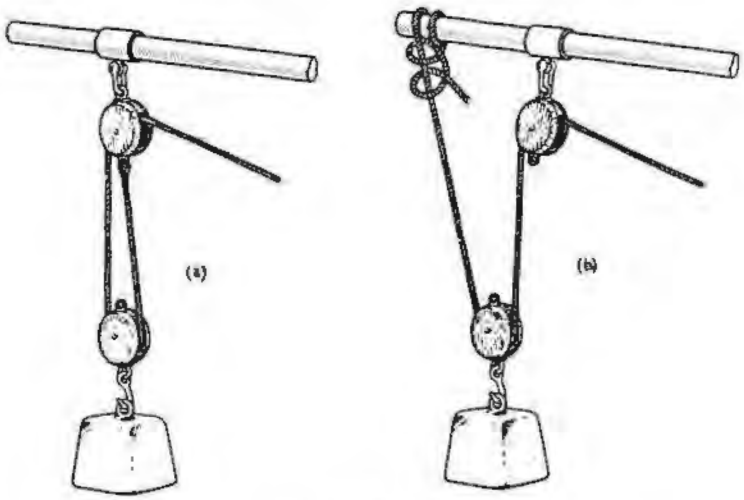

FIG. 8–12. Double whip

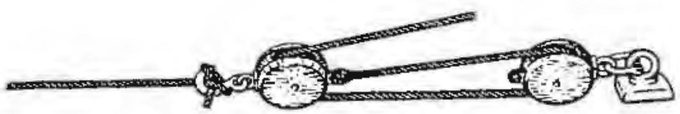

FIG. 8–13. Gun tackle

originates from the small tackle which was used to run out the old muzzle-loading gun carriages after they had recoiled. The VR is 3 if rove to advantage, or 2 if rove to disadvantage, and the MA is respectively 2.5 or 1.67.

Luff (fig. 8–14)

This is a purchase of size 24 mm or greater. It consists of a double and a single block, with the standing part of the fall made fast to the single block. The VR is 4 if rove to advantage, or 3 if rove to disadvantage, and the MA is respectively 3.08 or 2.3.

FIG. 8–14. Luff

FIG. 8–15. Two-fold purchase

Jigger

This is similar to a luff, but is from 16 mm to 20 mm in size.

Handy billy

This is a small tackle of less than 16 mm in size; it is usually rove as a jigger but can be rove as a small gun tackle.

Two-fold purchase (fig. 8–15)

This consists of two double blocks and is a useful general-purpose tackle. The VR is 5 if rove to advantage, or 4 if rove to disadvantage, and the MA is respectively 3.57 or 2.86.

Three-fold purchase (fig. 8–16)

This consists of two treble blocks; the VR is 7 if rove to advantage, or 6 if rove to disadvantage, and the MA is respectively 4.37 or 3.75.

Tackles having more than three sheaves to a block, such as the four-fold, five-fold and six-fold purchases, are not provided as deck tackles because they are too cumbersome to handle efficiently and because the friction in their sheaves considerably reduces their gain in mechanical advantage. If additional mechanical advantage is required it is better to combine two simple tackles.

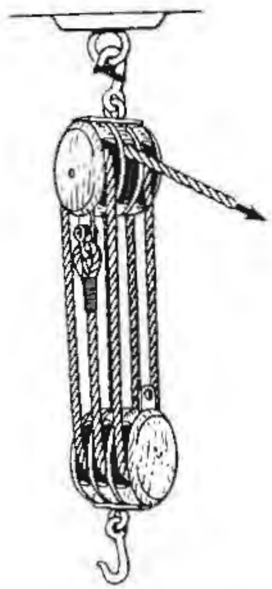

FIG. 8–16. Three-fold purchase

Luff upon luff (fig. 8–17)

This is a general term used to describe the combined use of two tackles in which the moving block on one is *clapped on* (secured) to the hauling part of the other; its mechanical advantage is the product of the mechanical advantage of each tackle. Figure 8–17 shows two luffs rove to advantage and as a luff upon luff whose VR=4×4=16; its MA is 9.49.

FIG. 8–17. Luff upon luff

Runner and tackle (fig. 8–18)

This is a tackle with its moving block made fast to the hauling part of a runner. The velocity ratio of the runner and tackle illustrated is 2×4=8, and the mechanical advantage is 1.82×3.08=5.61.

Five-part or three-and-two tackle

This consists of one triple and one double block, the standing part being made fast to the double block. This tackle is found in HM ships and is sometimes used in boats' falls.

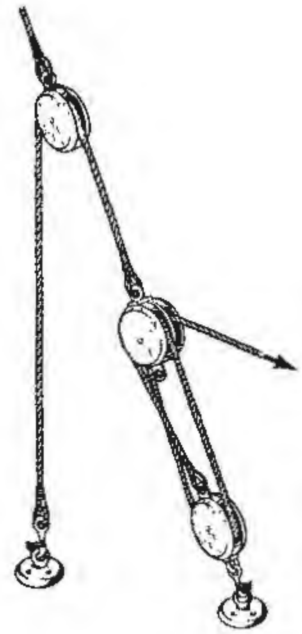

FIG. 8–18. Runner and tackle

Dutchman's purchase (fig. 8–19)

This is a tackle used in reverse to take advantage of the velocity ratio of the tackle; an example of its use is to drive a light whip at a fast speed from a slow

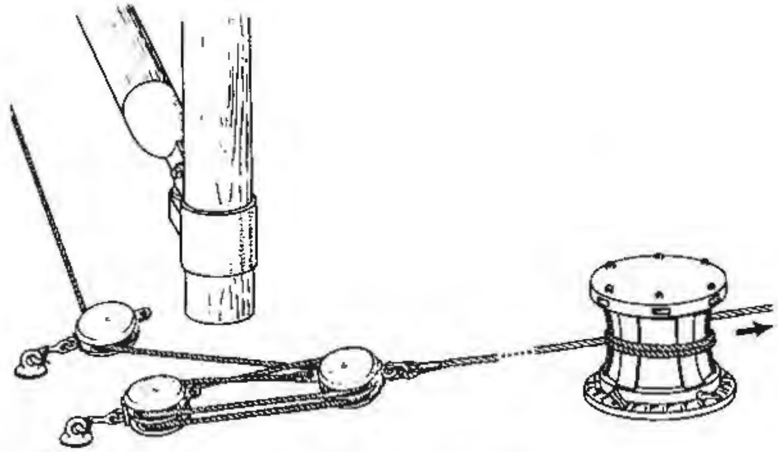

FIG. 8–19. Dutchman's purchase

but powerful capstan. In the example illustrated in fig. 8–19 the whip would move a distance of 5 metres for every metre travelled by the moving block. When using a tackle in this manner the pull exerted by the capstan must be equal to the product of the weight to be hoisted and the velocity ratio of the tackle, plus the friction in the tackle and its leading blocks; in this case a pull of at least 5.6 times the weight to be hoisted. Make sure that the tackle and its pendant are strong enough for the job.

Friction in a tackle

When a tackle is being worked considerable friction is set up, both in the bearings of the blocks and within the fall as it bends round the sheaves. This friction accounts for the difference between the velocity ratio of the tackle and its mechanical advantage, as shown in the examples of tackles already described. The general approximate rule for estimating the amount of friction is to allow from one-tenth to one-eighth of the weight to be hoisted for each sheave of the tackle according to whether the tackle is well made and in good condition or of poor quality and badly maintained.

To estimate the pull required on the hauling part of any tackle to hoist a given weight, divide the weight by the mechanical advantage of the tackle. Conversely, the weight which can be hoisted by a given pull on the hauling part of a tackle can be found by multiplying the pull by the mechanical advantage of the tackle.

When holding or lowering a load with a tackle, the friction will take part of the weight, and the force required on the hauling part is less than that required to hoist the load.

Notes

(i) The above statements are approximate and no block is to be used for lifting loads greater than the safe working load shown on it unless special approval has been obtained.

(ii) The effects of friction in tackles and purchases are more fully described in Volume II.

MASTS AND SPARS

In merchant ships, supports are needed for the derricks, and masts have developed in size, shape, number and strength according to the weights to be lifted and the number of holds. Nowadays the conventional mast is very much less in evidence. Masting for merchant ships generally is more in the form of a series of pairs of king-posts (or samson posts, or derrick posts) designed to function in connection solely with the cargo-handling facilities. The additional masting required for carrying steaming lights, signalling apparatus, radio aerials, etc. is readily met by the provision of light topmasts at the head of ordinary derrick masts, or on the cross-bracing platform between the heads of king-posts. It is fairly common practice to erect a light polemast above the navigating bridge structure. The heavy masts and king-posts are of tubular steel construction with steel wire shrouds and stays as necessary, and provision is made for additional stays to be rigged when heavy lifts are undertaken. Steel vertical ladders are secured directly to the masts and derrick posts for access purposes. Bipod masts are fitted in many merchant ships.

THE CONVENTIONAL MAST

This mast (fig. 8–20) is described here because most of the terms, although based on the sailing ship mast, are used today in sailing craft and to a lesser extent in modern power-driven ships.

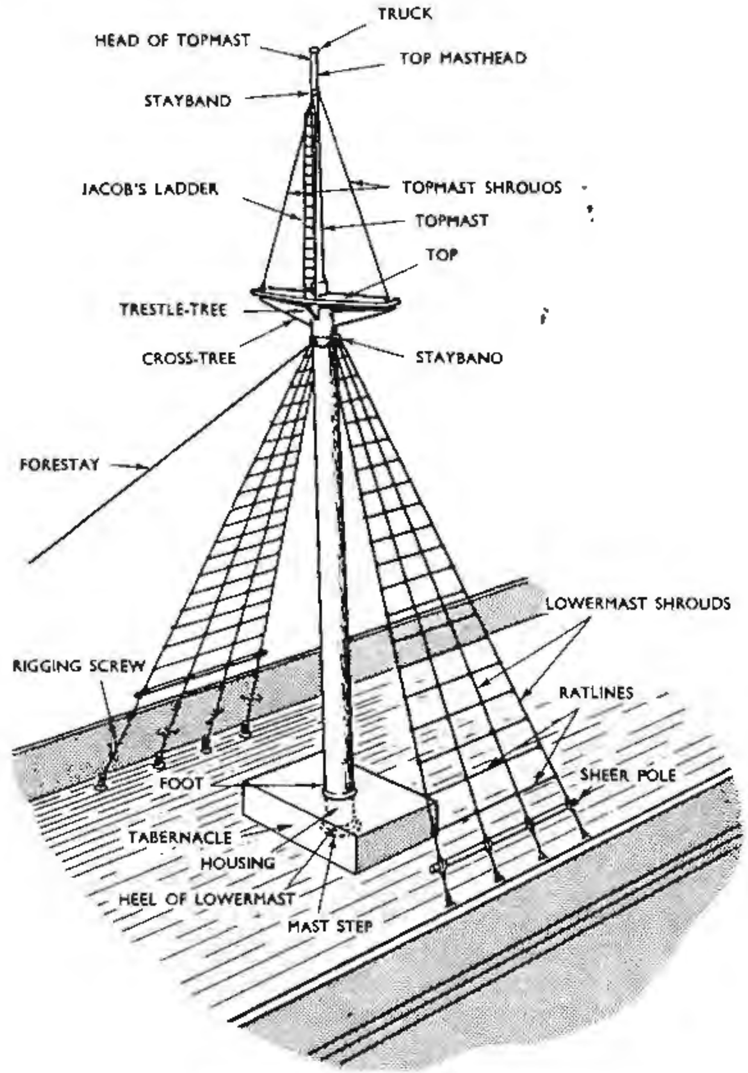

FIG. 8–20. The conventional mast

Parts of a mast and mast fittings

A mast is made in either one or two pieces; if made in two pieces the lower one is called the ***lowermast*** and the upper the ***topmast***; if made in one piece the mast is called a ***polemast***, and if particularly tall the upper part is called the topmast and the lower part the lowermast. The top of a mast is called the ***head*** and the bottom is called the ***heel***.

A mast is said to be *stepped*, i.e. supported, at the place where its heel rests. A polemast or a lowermast may be stepped on the ship's keelson, on one of her lower decks, or on her upper deck; a topmast is stepped at the head of its lowermast. Where a mast passes through a deck, the deck round the *mast-hole* is strengthened by girders and beams called *mast partners*, and the mast is secured in the hole by wedges. The mast-hole in the weather deck is made watertight by a polyvinyl chloride moulding called the *mast coat*, which fits snugly round the mast and its hole.

The heel of a mast stepped on the upper deck is fitted into a box-like structure called a *tabernacle*, which supports the lower part of the mast. The masts of river-going vessels which are stepped in tabernacles may be hinged so that they can be canted aft or laid on deck when the vessels have to pass under low bridges. For the same purpose a topmast is fitted so that it can be lowered and secured alongside its lowermast, in which position it is said to be *housed*; but if it is sent right down on deck it is said to be *struck*.

A mast, whether a polemast, a lowermast or a topmast, is divided into three parts known as the *housing*, the *hounding* and the *masthead*. The housing of a lowermast is that part which extends from its heel to the upper deck or the top of its tabernacle; the housing of a topmast is that part which extends from its heel to the head of its lowermast. The hounding is that part which extends from the top of the housing to a position some distance below the head where the standing rigging is secured. The masthead extends from the top of the hounding to the head of the mast, that of a lowermast being called the *lower masthead*, and that of a topmast being called the *top masthead*. The lower part of the hounding of a lowermast just above the upper deck is called the *foot*. In a polemast there is neither a lower masthead nor a topmast housing, the part above the position to which the topmast rigging is secured being called simply the masthead.

Where a topmast is fitted, the lower ends of its standing rigging may be secured to athwartship and fore-and-aft cross-pieces which are fitted to the lower masthead and called respectively *cross-trees* and *trestle-trees*; these are supported by brackets called *cheeks*, and over them is built a platform called a *top*.

On the head of a lowermast is fitted a band called the *mast cap*, to which is hinged a hoop called the *trunnion hoop* through which the foot of the topmast is stepped. At the upper end of the hounding of a mast is fitted a metal hoop called a *stayband*, which has a number of eyes to which the upper ends of the standing rigging are shackled. A wooden disc called a *truck* is fitted to the head of a topmast or a polemast; it is usually provided with one or two small sheaves to take signal halyards.

Wooden masts and yards are provided with lightning conductors consisting of copper strips running their entire length and connected to the steel hull of the ship; special contacts between mast and mast, and mast and yard, are provided where necessary.

Mast spars

A spar which is crossed horizontally athwart a mast is called a *yard*, and a spar projecting aft from a mainmast and cocked up at an angle of about 45 degrees with the mast is called a *gaff*; yards are used to carry signal halyards and radio aerials, and a gaff is used for wearing an ensign. The booms fitted at the foot of most merchant ships' masts and used for working cargo are called *derricks*.

Some masts may be fitted with *spurs*, which are steel arms of varying sizes projecting horizontally from the mast and used for carrying signal halyards or gantlines for hoisting oil- or battery-operated navigation lights and other gear into place. Brackets are provided on the foremast and the mainmast at the prescribed height above the upper deck for carrying, respectively, the fore and main masthead lights.

Standing rigging

A mast, except one of the plated, tripod and lattice types, is stayed, i.e. supported in position by its standing rigging; this consists of *forestays* and *backstays* which support it in a fore-and-aft direction, and *shrouds* which support it athwartships. The component parts of standing rigging are named after the mast they support, e.g. *fore-topmast backstay*. The upper ends of the standing rigging are shackled to their stayband and the lower ends are fitted with rigging screws so that the rigging can be set up taut. Lowermast standing rigging is secured to the gunwales or the weather decks; topmast rigging may be secured either to the cross-trees and trestle-trees of its lowermast or to the weather decks.

Insulators, where used, are fitted in wire-rope standing rigging to prevent electrical interference with radio and radar installations and to prevent Radhaz to personnel. The positions of these insulators must not be altered, as they have been determined by technical officers of the Ministry of Defence.

The introduction of Parafil cordage, with its electrical insulating properties, eliminates the interference associated with wire-rope standing rigging.

The shrouds of a lowermast are led each side to the gunwales; and, being led slightly abaft the mast as well as abreast it, they serve to some extent as backstays. The forestay of a fore-lowermast is usually led to the eyes of the ship (the foremost part just abaft the stem), and its backstays (if fitted) are led abaft the shrouds each side to the gunwales. The forestay of a main-lowermast is usually led to a position on the upper deck well before the mast and on the midship line, and the backstay is led to the stern.

The topmast is a comparatively light spar and is therefore not so heavily stayed as the lowermast. The shrouds of a topmast usually serve the double purpose of shrouds and backstays, and are led to the ends of the cross-trees. If backstays are fitted they can be led either to the deck in the same way as those of the lowermast, or to the after end of the trestle-trees. If a forestay is fitted it can be led to the deck in the same way as that of the lowermast, or to the fore end of the trestle-trees.

After the shrouds and stays have been set up taut their rigging screws are locked, packed with grease, parcelled with canvas strips and fitted with laced canvas covers called *gaiters*.

When the ship rolls, or when a heavy weight is slung outboard from a mast derrick, the shrouds on one side may slacken owing to the mast working slightly. To support the upper ends of the rigging screws and keep them in their correct relative positions when this occurs a horizontal steel rod called a *sheerpole* is usually fitted; it is seized to each shroud just above its rigging screw, and this serves also to keep turns out of the shrouds when the rigging screws are being set up.

Above the sheerpole, at intervals of about 35 centimetres, the shrouds may be joined by a number of light horizontal lines called *ratlines*; the shrouds then form a ladder, of which the ratlines are the rungs, for use when going aloft. The operation of fitting ratlines is known as *rattling down*, because originally it was begun at the masthead and continued downwards but the modern practice is to rattle upwards from the sheerpole. In many ships no ratlines are fitted and the mast is then climbed by a Jacob's ladder leading up the mast, or by means of steel rungs fitted to the side of the mast and projecting slightly from it.

Running rigging

In the days of sail the running rigging of a full-rigged ship was very complex and included, for example, *halyards* for hoisting and lowering the yards and sails, *sheets* for trimming the sails, *braces* for slewing the yards and *lifts* for squaring them, together with the various tackles for working them. Nowadays the running rigging on a mast is comparatively simple and consists chiefly of *signal halyards* and *dressing lines*, which are described below, and the rigging required to work a mast derrick, which is described later.

Signal halyards. These are made of plaited polyester and rove through sheaves in the truck or the masthead, or through gunmetal blocks on a yard, spur or gaff. Their ends are fitted with *Inglefield clips* which are specially designed to enable flags to be quickly bent on to the halyard. A signal halyard is named from the position at which it is rove, e.g. masthead halyard, starboard yard-arm halyard.

Gantlines. These are made of cordage, of small-size wire rope or of chain, and are rove through blocks on the masts or funnels. They are used for hoisting gear aloft and can be kept permanently rigged, and as they often have to bear the weight of a man they must be inspected frequently. Examples of gantlines are *clothes lines*, which are used for hoisting washed clothes to dry, and the *mast rope* for hoisting a man or material to the masthead.

Dressing lines. These are used on ceremonial occasions for 'dressing ship', i.e. for hoisting flags bent at close intervals on lines which, in a two-masted ship, run from the stem to the fore-masthead, thence to the main-masthead and thence to the stern. They consist of wire rope lines to which the dressing flags are permanently bent, and are tailed with cordage whips for hoisting them into position. The foremost line is called the *fore-down*, the amidships line is called the *fore-to-main*, and the after one the *main-down*. Ships with a single mast are fitted with a fore-down and a main-down only.

SPARS

Yards

Most modern yards are firmly secured to the mast and do not need standing and running rigging to keep them squared off. But there are a few *slung* yards in service and one will be described briefly, because some of the terms are common to all yards.

A slung yard (fig. 8–21) is supported at its centre or *bunt* by a shackle called the *sling*, which joins the eye of an iron band round the yard, called the *parrel band*, to the eye of an iron band round the mast, called the *mast band*. The yard is kept horizontal by *lifts* and is kept from slewing by *braces*. The ends of the

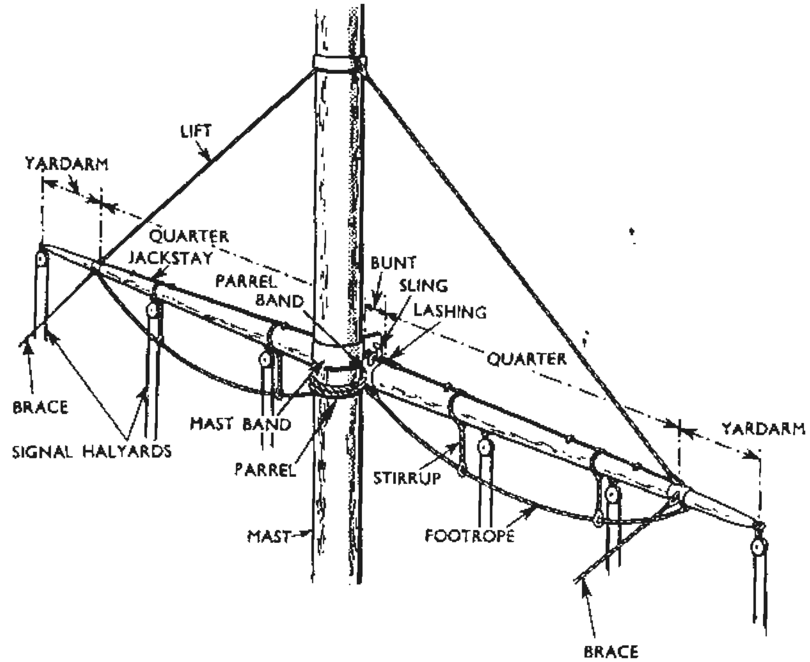

FIG. 8–21. A slung yard

yard outside the braces and lifts are called the *yard-arms*, and the parts of the yard between the bunt and the yard-arms are called the *quarters*. The bunt of some slung yards may be kept close against the mast by a strop called a *parrel*, which is passed round the mast and secured to eyes welded to the parrel band.

A *jackstay* and *footropes* are rigged along the yard to provide, respectively, hand-hold and foot-hold for men working on it, but these are not fitted on smaller yards if the lifts are within reach from the mast. The footrope is supported at intervals by *stirrups*.

Gaffs

A gaff in a sailing vessel is a wooden spar used to support the head of a four-sided fore-and-aft sail; it is therefore rigged with halyards for raising and lowering it, and its lower end is fitted with jaws which fit round the mast and thus allow it to slew sideways or be topped up or down. A gaff in a modern ship, however, is used only for wearing the ensign conspicuously, and is therefore rigged as a standing gaff in the manner described below and illustrated in fig. 8–22.

The lower end or *throat* of the gaff is fitted with an eyed metal sleeve called a *gooseneck*, which is bolted to a fork-shaped fitting pivoted at the upper end of the main-lowermast hounding; the gaff is thus supported at its throat by a joint which is hinged both horizontally and vertically. The gaff is also supported by a *standing topping lift* consisting of a pendant shackled to a *spider band* fitted round the middle of the gaff, the other end being shackled to a fitting on the

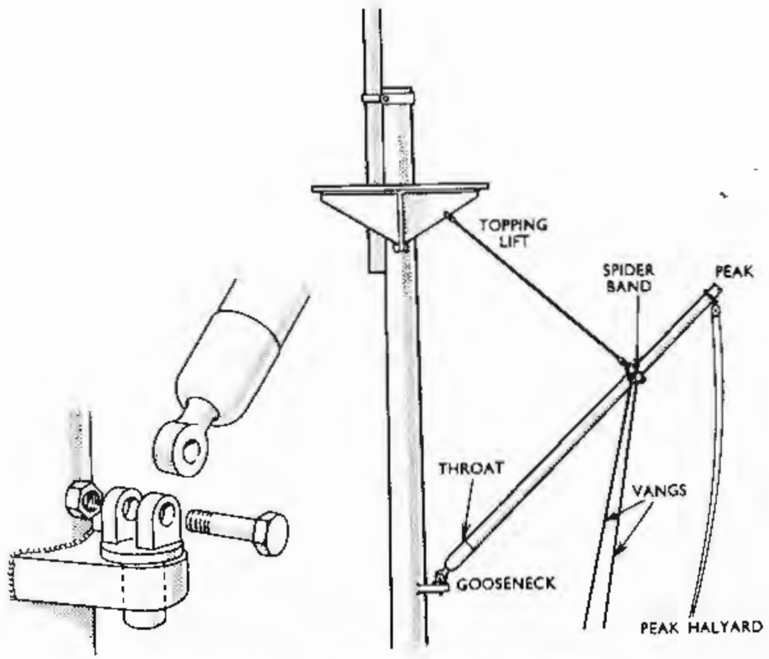

FIG. 8–22. A gaff and (inset) a gooseneck

after end of the main-lowermast trestle-trees; the length of the pendant is such that the gaff is held at an angle of about 45° with the mast. The gaff is stayed from slewing sideways by two *vangs*, which are shackled to the spider band and brought down to each side of the after superstructure. To the upper end or *peak* of the gaff is fitted a gunmetal block through which is rove the peak halyard. In some ships with lattice masts the vangs and topping lift are steel struts welded to the lattice.

WARSHIPS' MASTS

The conventional mast existed in warships, mainly for flag signalling purposes, until the First World War, when the need for increased arcs of gunfire and the need to house many gun-control personnel above the gun smoke caused the introduction of *tripod* masts. The foremast supported a structure called the 'fore top', while the mainmast supported the main derrick, which was used for hoisting the boom boats. Both masts had topmasts and yards for signal halyards and wireless aerials.

During the Second World War both masts were used to carry radar aerials and the number of yards decreased as daylight signalling lamps and radio replaced flag signalling for communication. When the number of radar aerials

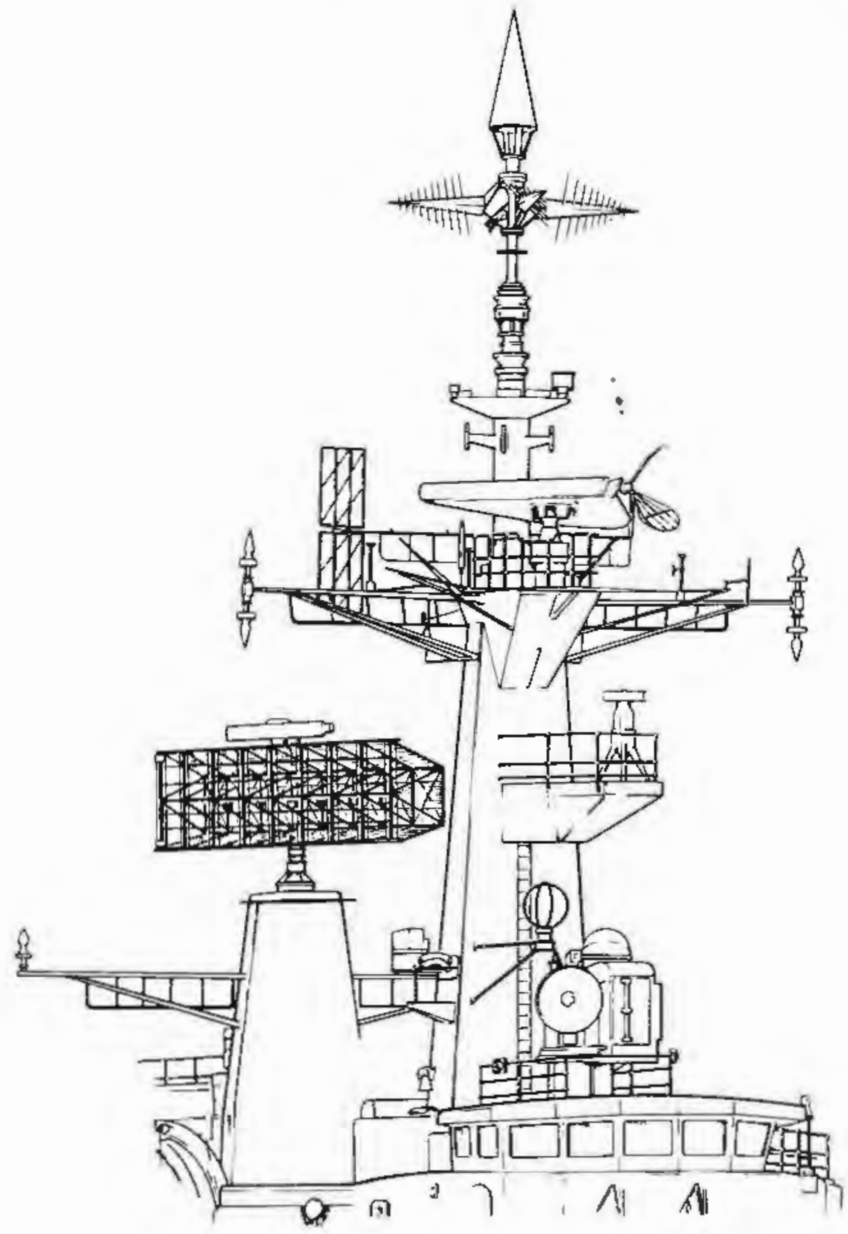

FIG. 8–23. A warship's mast

increased, particularly in small ships, a *lattice* mast of lighter and stronger construction was introduced and wooden yards were replaced by fixed steel yards.

The trend today is to construct warships' masts in an enclosed form using steel plate. This provides extra strength to carry heavier and more complex