prevented from canting forward with the weight and drag of the sail ; accordingly the slings, either chain or rope, should be put on with the bight coming up the fore side (see fig. 18, where the arrow indicates the fore side and the direction the sail pulls) ; they are generally put on the wrong way. Merchant ships are invariably fitted with iron trusses, which are fixtures on the mast, holding the yard at the requisite distance and acting as a universal joint. They are of great advantage where there is not a large crew.

While the rigging is progressing the disposition of all heavy weights is worthy of serious attention ; for not only ought the vessel to be brought to the draught and trim designed by the builder, or that which has by experience been found the best, but there must not be too much strain at any one part, especially the extremities. In ships intended for sailing or steaming rapidly this is of vital importance ; the bows and sterns of cutter or schooner yachts should be empty. Placing the weights in the wings of the hold will steady the rolling motion and make the intervals longer ; but this may be carried too far for stability,— especially if the vessel has a low free-board. Weights low down close to the keel will increase stability at the expense of a quick uneasy jerking motion. A yacht which carries much ballast low down will be very stiff under canvas and may sail well in the Solent, but would be unfit to go outside the Isle of Wight. When heavy weights are carried in merchant ships as part cargo, they should never be placed as a solid mass ; railway bars, for instance, may be stowed gridiron fashion a foot apart, by which means they will occupy as much space and act upon the ship in the same way as an equal weight of provision casks.

Before bending sails all the ropes are rove ready for use. A yacht’s sails if new should be scrubbed, to take the stiffness out of them. In all cases they should be set when bent and the yards braced each way (unless it is blowing too hard), or there is a risk of some­thing going wrong when they are required for use. In setting them care should be taken that no part is stretched or girt unduly.

The inner end of a chain cable is usually secured by a tongue- slip and by a short piece of cable which passes round the mast or is shackled to the keelson; it still retains the name of “clinch.” The tongue should not have scope enough to reach the compressor, as it has been known to strip back the ring and slip the cable. It is a good thing to trice up the slip before the cable is stowed, so that it will be accessible at all times, either for slipping, shackling another cable, or bending a hawser. It may be thought that a chain cable would run into the locker and stow itself, but that is a mistake ; if care is not taken to spread it evenly, it will form a pyramid with turns round the base, upon which the upper part will fall as soon as the ship leans over ; it will then be necessary to haul up several small bights before the cable will run clear.

A ship should never lie long at single anchor in a tide-way or during variable winds, for fear of fouling her anchor and thereby destroying its holding power. Frequently space is wanted, as ship and cable range over a large circle, with liability to foul other ships or their anchors. A long scope of cable will only keep a ship clear of her anchor during very light winds, unless assisted by close attention and correct judgment on the part of the seaman. The direction of the two streams of tide should be considered in con­nexion with the wind in order to keep the ship to leeward of her anchor each time she passes it. A strong wind blowing across the direction of the tide and acting on the hull of the ship will secure that effect ; but, when the directions of wind and tide are the same or nearly so, precaution is necessary at each turn of the tide ; it is then that a buoy watching over the anchor is of great service. When the wind and tide are in the same direction the helm should be kept over to that side which will cause the ship’s head to point in the direction on which she has previously passed the anchor, as the bight of the cable will be dragging that way. The force of the tide alone will cause her to shoot over considerably ; but when she is assisted by the fore-top-mast stay-sail (or stay-fore-sail in a small vessel) the sheer will be much greater. The sheet in either case is better to windward and the fore-top-sail braced sharp abox if the wind is light ; but, when the tide commences to change, the sail should be allowed to fill, or it should be taken in and the helm

placed in midships. If sufficient effect has not been produced by elm and head-sails before the tide ends, the mizzen-top-sail should be set as soon as the ship falls head to wind, first braced abox to turn her stern in the desired direction and then flat aback so as to drag the cable straight. Cutters and schooners have not that ad­vantage ; they must depend on the helm and head-sails. At the end of a weather tide the helm and stay-sail will guide the vessel past the anchor. If a ship should break her sheer (pass the wrong way), or during calms and variable winds should approach her anchor, the cable should be hove in, and if there is reason to sus­pect the clearness of the anchor it should be sighted, since it will be of no use as an anchor if a turn of cable is round the fluke. When anchoring, the state of the tide must be considered in con­nexion with the depth of water ; a vessel was once left high-and- dry by the ebb-tide near Dungeness, and a large iron ship drove her own anchor through her bottom in the Solent, off Lymington.

The avoidance of the anchors in shallow water is another reason for mooring.

When a ship is in an exposed position, where it may become necessary to let go two or three anchors through stress of weather, in any part of the northern hemisphere, the bower on the port side should be used first, next the foremost one on the starboard side, and as a third the after one on the starboard side, since the ordinary wind veers with the sun, and at the end of the gale the cables will be clear of each other. In the southern hemisphere the reverse order holds good.

When a ship is likely to remain many days at an anchorage where there is a tide or variable winds it is better to moor at once on arrival, with a scope of cable each way six or eight times greater than the depth of water, and an open hawse towards the worst wind. The two cables combined should always be much in excess of the distance between the anchors, otherwise they will possess but little strength to resist a rectangular strain,—an error frequently com­mitted. The amount of support which cables will render under such circumstances will be in proportion to the sine of the angle contained between the anchor and the ship’s bow and a line from one anchor to the other. Suppose, for example, a ship moored with anchors east and west of each other, 100 fathoms apart and having 55 fathoms on each cable, in 10 fathoms of water. With chain cables the hawse pipes would not be more than 53 fathoms from each anchor, consequently with a south wind the support given to the ship by each cable will only be 33 per cent. of the strain on the cable,—that is, say, 66 tons combined when the cables are strained up to 100 tons each. The support increases rapidly as the cable is veered ; an addition of 5 fathoms each way will (under the above circumstances) give 101 tons, and a scope of 80 fathoms each way will give 153 tons. In practice the cables by dragging over the ground, especially soft mud, assume a direction more ahead, particu­larly when each cable has a long scope. The anchors should be placed sufficiently far apart to prevent fouling with the slack chain, but not farther, unless the water is too shallow to allow the ship to pass over her anchor at low tide. Such an anchorage is not suitable for very long ships unless special moorings are provided, for which purpose Parks’s mooring-blocks are very suitable and inexpensive ; they are commonly used in Portsmouth harbour. These blocks are recommended as moorings for the use of yachts and small craft, as being trustworthy and less likely to be stolen than anchors of any kind. Should a ship that is moored with a good scope on each cable have the misfortune to part one of them, her position will be preferable to what it would be if parted from a single anchor, as the bight of cable dragging over the ground will retard her progress, giving more time for another anchor to be let go. In all cases of veering cable either it should be done so freely that the ship will fall off broadside to the wind, when it may be secured while drifting, or it should be done very slowly, a few fathoms, or even a few feet at a time, the ship not being allowed to get any stern way. Veering during a squall should be avoided if possible ; it should be done in time, before the violence of the squall is felt ; but, if it is intended to pay out freely till broadside on, the head-yards should be braced abox to assist and another anchor should be ready. A cable should never be secured entirely by the bitts or windlass, but the compressor and deck stoppers should participate in the strain. When unmooring, the riding cable should be veered freely to allow the ship to get directly over the lee anchor ; if it is embedded, stopper the cable while vertical and heave on the other, which must break it out.

The laborious operation of clearing hawse was mitigated or avoided by the introduction of chain cables and the invention of the mooring swivel. As the cables unshackle at every 121/2 or 15 fathoms, the end to be dipped round the other cable need not be long. There are two general methods of holding the weight of the lee cable while the turns are taken out. The simplest is to have a light tongue slip to take the flat link, but only about one-tenth the strength of the cable ; in a large ship it should have a roller at the top, so that the end of a hawser may be rove and form a standing part. The slip being fixed on the lee cable close above the turns and the hawser taut, the nearest shackle inboard is taken out, and the short end thus formed is hauled out of the hawse-pipe by the fore-bowline, or else by a rope from the bees of the bowsprit, a hook-rope being also attached for hauling it inboard again. A boat should be in attendance from which to detach the hook-rope from the end of the cable, pass it round the riding-cable, and make it fast again to the end of the cable (hanging by the bowline) for hauling it back through the hawse-pipe ; thus an elbow is formed taut round the riding-cable in the reverse direction to the elbows and turns below the slip. That operation must be repeated till the same number of turns is formed above as below the slip,—observing that a cross cannot be removed, but the lee cable can be brought under the other. When the cable is taut in and shackled, the slip is knocked off, which allows the turns to drop clear. The cables will then be as they were when moored, with the addition of one or two fathoms on the lee cable. If the short end of the cable is lowered into a boat and lifted by the bowline only for each turn,