at high speed in thick weather being thereby much in­creased. Through the want of masts and sails there is a probability of total loss by drifting helplessly on a lee shore during a gale, or by foundering “ in the trough of the sea.” In spite of her monstrous size (22,000 tons), the “Great Eastern,” in 1863 or 1864, with her six com­paratively small masts and weak sails was, after the loss of her rudder, very roughly used by the waves striking her full on the side. She was in the position which is expressed by the common sea-phrase “wallowing in the trough of the sea,” from which her crew had no power to extricate her. A smaller vessel deeply laden in such a position would most probably have foundered, leaving no one to tell the tale. Too much stress is laid upon the re­tardation caused by masts and rigging when steaming head to wind ; it is the pitching and plunging motion of the ship into a succession of waves that principally retards her speed. If the waves are approaching at the rate of 10 miles an hour and the ship is steaming against them at a similar rate, they will strike the bows with a force equal to 20 miles an hour. When a ship is steaming through comparatively smooth water (sheltered by land) against a gale of wind, her speed is but little reduced by the force of the wind alone, when other circumstances admit of her working full power. Storm-sails only require short masts, but these and the canvas they support should be strong, which is not the case in the merchant service generally.

Every seaman is expected to be thoroughly acquainted with the rigging of the vessel in which he serves, and when in charge he should frequently examine every part, to see that it is efficiently performing the duty assigned to it, being neither too taut nor too slack, nor suffering from chafing, wet, or other injury. He should be capable of repairing or replacing any part with his own hand if necessary and of teaching others how to do so. He need not necessarily be a navigator, though a good navigator must be a seaman ; nor is it necessary that a seaman should be a shipbuilder, a mast-maker, a rope-maker, or a sail-maker, but he should possess a general knowledge of each art, especially the last ; every able seaman should be able to sew a seam and assist the ship’s sail-maker in repairing sails. It is greatly to be regretted that various circumstances have brought about such a change in the system of rigging ships, in both the British navy and the mercantile marine, that those who sail in them seldom see it done. Young officers were in former times frequently entrusted with the charge of day watches, during which they would give the necessary orders for making, shorten­ing, or trimming sails, perhaps even tacking and wearing. That practice gave confidence and quickened the desire to learn more ; it was more frequently done in small than in large ships. The general adoption of the steam-engine in ships has not only diminished the value of sail-power but of seamanship also, and has produced such a change in the rig that instead of masts and yards we find only two or three poles. In the British navy so many new sciences have been introduced that seamanship takes but a low place among them at the examination of a midshipman, who has had but little boat duty and probably found the discussion of seamanship in his mess-place contrary to rule. The rapidity with which all sail and mast drill is executed, combined with the perfection of the “ station bill,” renders it worse than useless as a means of teaching, as it gives a false confidence which fails in the hour of necessity, when the accustomed routine is thrown out by a sail actually splitting to pieces or a spar snapping. The fact that the same men perpetually do the same thing must tend greatly to render each evolution quick so long as every one is in his accustomed place, but sickness or the absence of a party from duty will disorganize the ship for

some time, as the general usefulness of the men has been cramped. Sail drill in harbour is open to grave objec­tions : unless in a tide-way, the ship must be invariably head to wind ; for reefing and furling the yards are laid square, consequently flat aback ; both earings are hauled out at once, and as it is only for exercise they are only half secured. Even when reefing top-sails at sea either for exercise or of necessity in company with other ships, the yards are laid square to enable the men to get readily on the weather-side ; therefore, if on a wind, the sail must re­main aback or the ship must be kept away till the wind is on the beam in order to shake the sail.

The foundation of all teaching of seamanship must be a knowledge of the knots, bends, and splices, and their use in the various parts of the rigging and equipment of a ship. @@1 Some knots, bends, and hitches are intended to afford security as long as desired, and then to be easily disengaged. Other knots, splices, and seizings are of a more permanent character, generally continuing as long as the rope will last.

*Overhand Knot.—*Used at the end of ropes to prevent their unreeving and as the commencement of other knots. Fig. 1 represents an overhand knot hauled tight ; for an illustration of the same not hauled tight see Knot, vol. xiv. p. 128, fig. 7.

*Figure-Of-Eight Knot* (fig. 2).—Used only to prevent ropes from unreeving ; it forms a large knob.

*Reef Knot(see* Knot, *lοc. cit.,* figs. 8 and 9).—First form an overhand knot; then take the end *a* over the end b and through the bight. @@2 This knot is so named from being used in tying the reef points of a sail, since it will not jam. If the end *a* were taken under the end b, a *granny’s knot* would be formed.

*Bowline Knot.—*Lay the end of a rope *a over* the standing part b ; form with b a bight c over *a ;* take *a* round behind b and down through the bight *c*. This is a very useful knot, forming a loop which will not slip. *Running bow­lines* are formed by making a bowline round its own standing part above b. It is the most common and convenient temporary running noose. See Knot, *l.c.,* figs. 11 and 12.

*Bowline on a Bight* (figs. 3, 4).—The first part is made similar to the above with the double part of the rope ; then the bight *a* is pulled through sufficiently to allow it to be bent over past *d* and come up in the position shown in fig. 4. It makes a more comfortable sling for a man than a single bight.

*Half Hitch.—*Pass the end around the standing part b and through the bight.

@@@1 A person wishing to make sailor’s knots need not be deterred by the want of material, as nearly all that are here represented were made, for the purpose of sketching them, with the lashing of a packing case.

@@@2 For an explanation of this and other technical terms, see the glossary on p 603 below.