CHAPTER 4

DECK SEAMANSHIP

In general, rigging is a large part of deck seamanship. The ship's standing rigging consists of lines, wires, turnbuckles, and other gear supporting and attached to the stacks, the masts, and the topside structure. Running rigging includes the rigging used in hoisting and lowering heavy weights or in positioning and operating movable deck gear.

GROUND TACKLE

LEARNING OBJECTIVES: Define ground tackle. Identify and describe equipment associated with ground tackle.

Ground tackle is all equipment used in anchoring and mooring with anchors and buoy mooring with chain and appendages. The following are defined as ground tackle:

- Anchors
- Anchor chain, wire rope, synthetic line, or combinations of these materials, when used with anchors
- Appendages consisting of connecting shackles or links, detachable links, pear-shaped links, end links, bending shackles, mooring shackles, mooring swivels, detachable-link tool sets, clear hawse pendants, dip ropes, chain stoppers, wrenches for chain stoppers, outboard swivel shots, chain cable jacks, mooring hooks, chain hooks, anchor bars, and anchor buoys

Ground tackle is one of the most vital parts of a ship's equipment. The vessel's safety frequently depends upon the proper use of this gear; suitable ground tackle has saved many ships and lives.

The anchor windlass, equipped with capstan head or gypsy heads, is a vital part of the ship's ability to handle its ground tackle and use the capstan or gypsy heads in mooring and warping operations.

SHIPS' ANCHORS

All anchors are designed to take hold as quickly as possible after they hit bottom. They take hold in one of two ways: either by hooking into the ground with one or both of their sharp flukes or by burying themselves completely. When an anchor is let go in fairly deep water, it strikes the bottom *crown first.* From this position, any drag on the chain causes the flukes, if properly set, to dig into the bottom. As the drag continues, the fluke is forced further into the bottom. If the proper scope of chain is used, the heavier the drag, the deeper the fluke will dig in, developing the full holding power of the anchor.

CHAIN AND WIRE ROPE CABLES

Chain, wire rope cables, or cable composed of both chain and wire rope for use with ships' anchors is a part of the ship's ground tackle. *Ground tackle* is the collective term applied to all equipment used in anchoring. It includes the anchors, their chain or cables, connecting fittings, and all associated equipment used in anchoring, mooring with anchors, buoy mooring, being towed, or securing or letting go anchors in or from their hawsepipes.

ANCHORS

LEARNING OBJECTIVE: Identify and describe the anchoring equipment used aboard ships.

Anchors used in the Navy today are grouped according to type. The most common types used are stockless anchors, lightweight (LWT) or stock-in-crown anchors, and two-fluke balanced-fluke anchors. Stock anchors (old-fashioned) and mushroom anchors are no longer specified as a part of Navy ship ground tackle.

STOCKLESS ANCHORS

Though there are a number of different designs of modern stockless anchors, all share the same distinguishing feature-they are stockless.

Three designs of stockless anchors are in use on naval ships: commercial, standard Navy, and the Mark 2 (Mk 2). These are shown in views A, B, and C of

figure 4-1. Of the three, the Mk 2, with its long flukes, has the greatest holding power. It is made only in the 60,000-pound size for use aboard aircraft carriers. The short, commercial-type flukes have the least holding power.

The stockless feature of these anchors provides many advantages, not only in easing handling and stowing, but also in allowing the anchor to be hoisted directly into the hawsepipe and secured, ready for letting go.

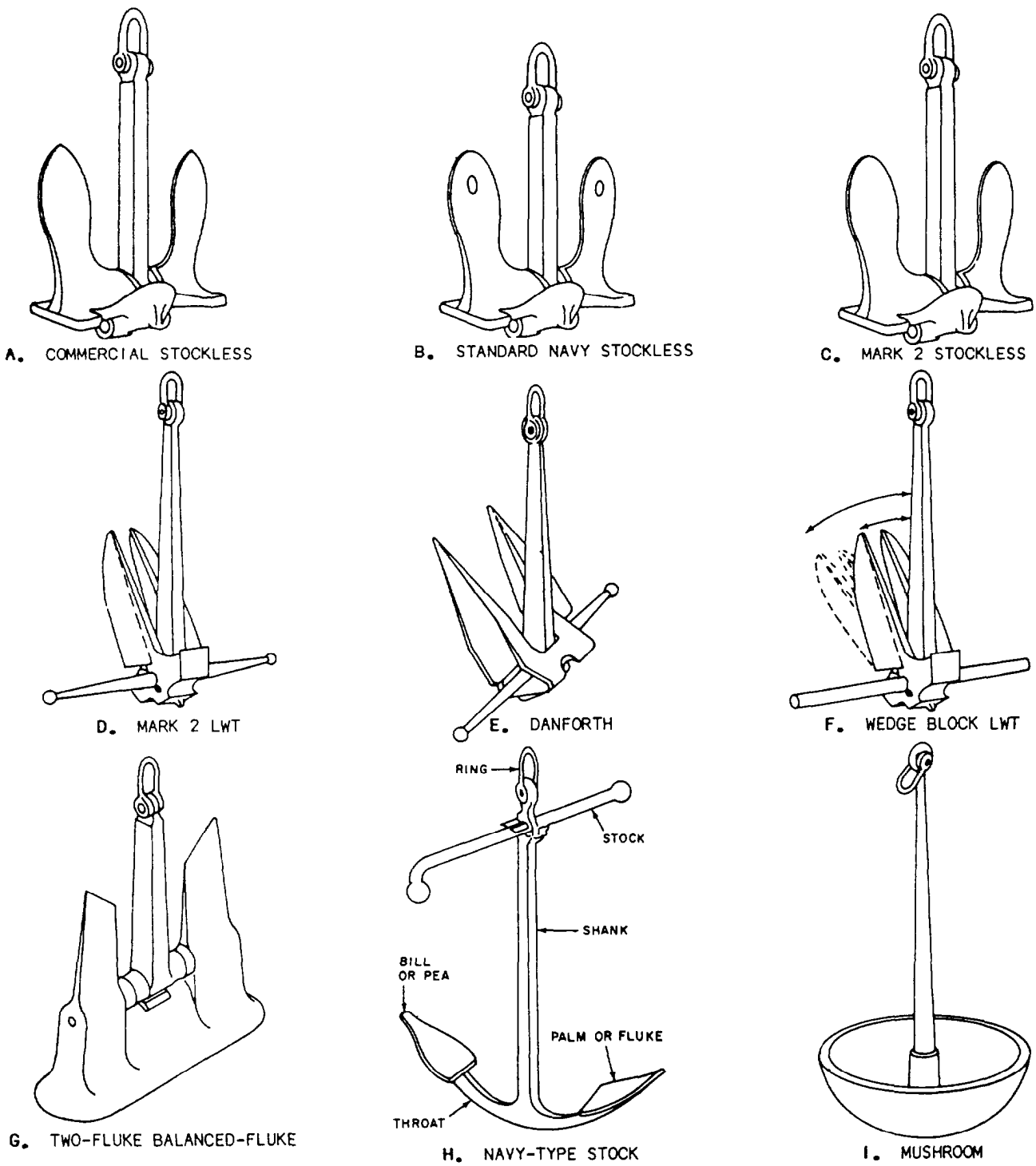


Figure 4-1.–Types of anchors.

The stockless anchor consists of a heavy head in which the crown, tripping palms, and flukes are forged in one piece. This unit is pivoted on the shank so that it can swing from 45° to either side of the shank. The flukes are large and long, and projecting shoulders or tripping palms are cast at the base of the flukes to make them bite. As the force of the drag exerts itself, the shoulders catch on the bottom and force the anchor to take hold by pushing the flukes downward into the bottom. Because an upward pull on the shank of a stockless anchor has a tendency to break out the flukes, a long scope of chain must be used to make sure the shank remains on the bottom when the anchor is set. With too short a scope, or even under a steady pull with a long scope, a stockless anchor may still disengage its flukes as a result of gradually turning over and rolling out. Under this condition, the anchor can offer no resistance to dragging except by its weight.

LIGHTWEIGHT ANCHORS

Two types of lightweight anchors are used on Navy ships: the Mk 2 LWT and the wedge block LWT anchor. These are shown in views D and F of figure 4-1.

Lightweight anchors are constructed of comparatively light metal, but are very strong in tension. They gain their holding power by digging deep into the bottom rather than lying as a deadweight.

Both the Mk 2 LWT anchor and the wedge block LWT anchor have high holding power for their weights. The 30° fluke angle on the wedge block LWT anchor is most effective in sand bottoms; and the 50° fluke angle, in mud bottoms. For example, both 10,000-pound LWT anchors are designed to have a holding power in a sand bottom slightly higher than the 22,500-pound standard Navy stockless anchor. They are used as bower and stern anchors and may also be used as stream or kedge anchors. Anchors less then 150 pounds are normally used as small boat anchors.

The main characteristic of the LWT anchor is the placement of large flukes at such an angle that they drive deep into the bottom to ensure good holding power. The crown is designed to lift the rear of the flukes and force their points downward into the bottom. Good stability is also obtained by placing the flukes close to the shank.

These anchors are extremely useful in any situation where *lightweight but good holding power* is essential. They have even been cast up to 3,000 pounds for use as stern anchors on LSTs. For Navy use, LWT anchors are made in approximate weights from 8 pounds to 13,000 pounds, for the Mk 2 LWT 6,000 pounds and 30,000 pounds for the wedge block LWT. The commercial Danforth anchor, shown in view E of figure 4-1, is used on some Navy craft and small boats.

TWO-FLUKE BALANCED-FLUKE ANCHORS

The two-fluke balanced-fluke anchor (view G of figure 4-1) is used for anchoring some surface ships and the newer submarines and is normally housed in the bottom of the ship. This anchor is used on certain combatant-type surface ships in place of a bower anchor, which could interfere with the ship's sonar dome.

STOCK ANCHORS

Old-fashioned, or stock, anchors (view H of figure 4-1) have been abandoned by large merchant and Navy ships because they are extremely cumbersome and difficult to stow. Because of their superior holding power, stock anchors are still used on some boats, and yachtsmen use them for small craft.

MUSHROOM ANCHORS

Mushroom anchors are shaped like a mushroom with a long narrow stem serving as the shank. Because of their excellent holding ability, they are used for permanent moorings and as anchors for channel buoys and other navigational aids. The mushroom anchor (view I of figure 4-1) is used to anchor buoys and torpedo testing barges. The rounded part, or crown, strikes the bottom first, and the upper surface of the mushroom is cupped to provide a biting surface. As the anchor shifts back and forth under strain, it digs itself deeper into the bottom, thereby increasing its holding power. Consequently, it takes a firm hold and remains fixed under the most adverse conditions. Because the mushroom anchor has no projecting stock or flukes to foul, the moored object can swing freely around a mushroom anchor. However, since a mushroom anchor will break out if the direction of pull is reversed, it is normally used only in groups of three or more, surrounding the central mooring point. Certain older class submarines use this type of anchor.

CHAIN AND APPENDAGES

Present day Navy anchor chain of the flash butt welded type is the Navy standard for new ship constructions and replaces die-lock chain as required

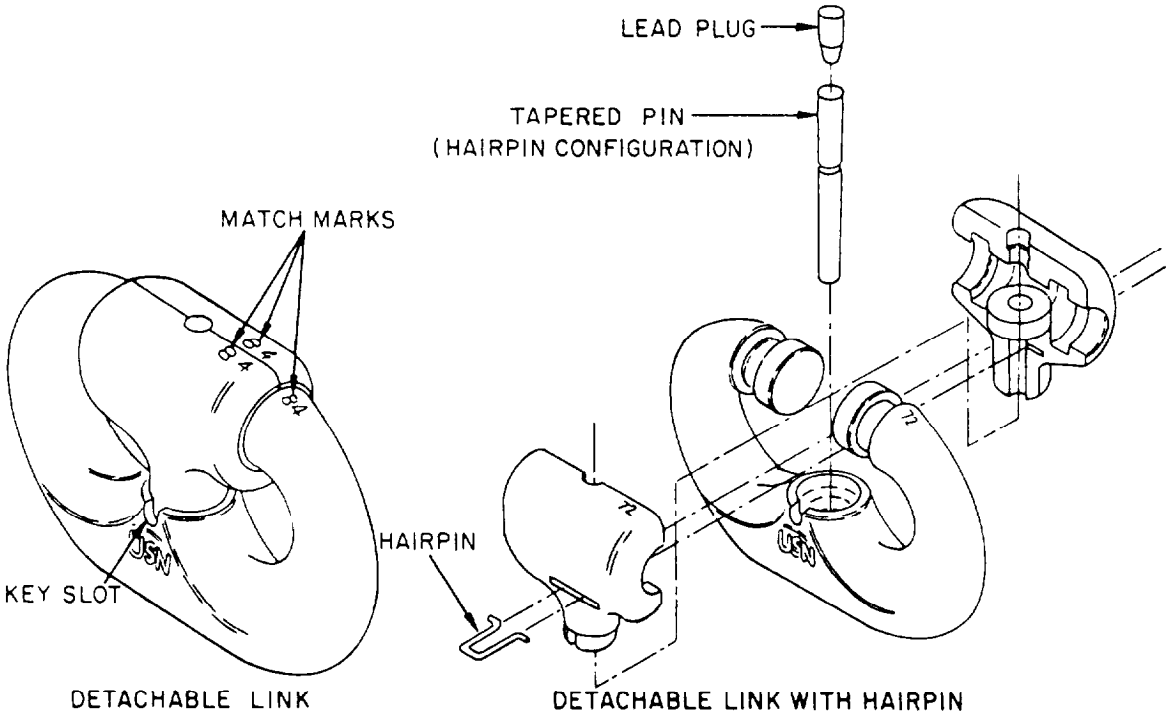


Figure 4-2.–Detachable link.

for back fit. All links are studded; that is, a piece of steel is placed in the center of the links. Studs prevent the chain from kinking and the links from pounding on adjacent links. The *Naval Ships' Technical Manual* lists standard sizes from 3/4 inch to 4 3/4 inches, and details the method of fabrication. The size of the link is designated by its nominal diameter, which is called wire diameter. Wire diameter is measured at the end of the link a little above the center line. The length of a standard link is 6 times its wire diameter, and its width is 3.6 times its wire diameter.

An anchor chain is made up of many parts besides common links and requires a variety of equipment and fittings to use and maintain the chain. The following descriptions will acquaint you with the details of anchor chain and some of the equipment associated with using and maintaining the chain.

Standard Shot

The lengths of chain that are connected to make up the ship's anchor chain are called shots and are made up with an odd number of links. A standard shot is 15 fathoms (90 feet) long. At the time of its manufacture, each shot of the chain usually bears a serial number stamped, cut, or cast on the inner side of the end links of each shot. If an end link is lost or removed from a shot, this identification should be cut or stamped on the inside of the new end link of the altered shot. Chapter 581, *Naval Ships' Technical Manual,* defines in considerable detail chain make-up, fittings, replacement, maintenance and rejection criteria.

Detachable Links

Shots of anchor chain are joined by a detachable link, shown in figure 4-2. The Navy-type detachable link consists of a C-shaped link with two coupling plates that form one side and stud of the link A taper pin holds the parts together and is locked in place at the large end by a lead plug. Detachable link parts are not interchangeable, so matching numbers are stamped on the C-link and on each coupling plate to ensure its identification and proper assembly. You will save time and trouble trying to match these parts if you disassemble only one link at a time and clean, slush, and reassemble it before disassembling another. The present day slush, a preservative and lubricant, is a mixture of 40 percent white lead and 60 percent tallow by volume. Other slush mixtures are being investigated to replace the white lead. When you re-assemble a detachable link, make sure the taper pin is seated securely. This is done by driving it in with a punch and a hammer before inserting the lead plug over the large end of the pin. Detachable link toolbox sets contain tools, including spare taper pins and lead plugs, for assembling and disassembling links and detachable end links.

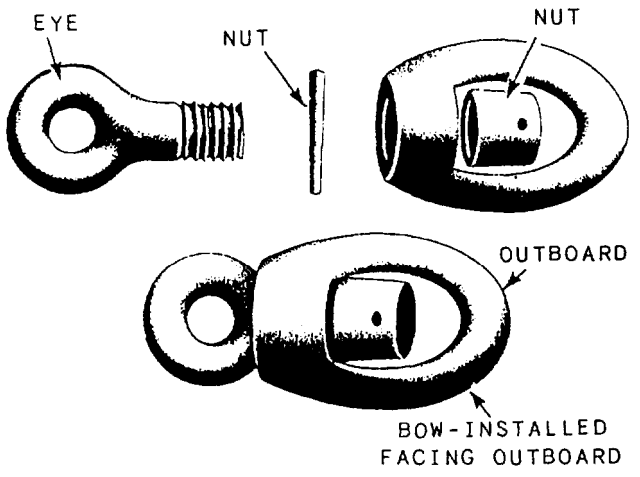


Figure 4-3.–Chain swivel.

Chain Swivels

Chain swivels (fig. 4-3) are furnished as part of the outboard swivel shot. They reduce kinking or twisting of the anchor chain.

Bending Shackles

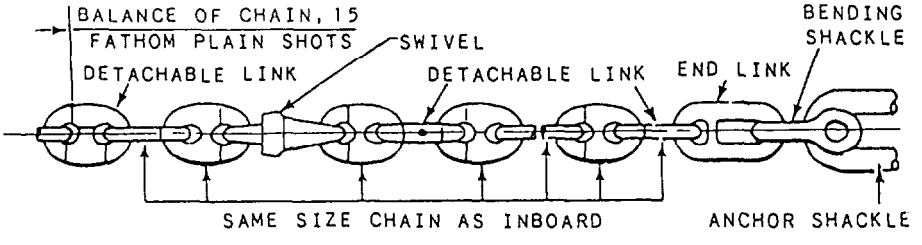
Bending shackles (fig. 4-4) are used to attach the anchor to the chain.

Outboard Swivel Shots

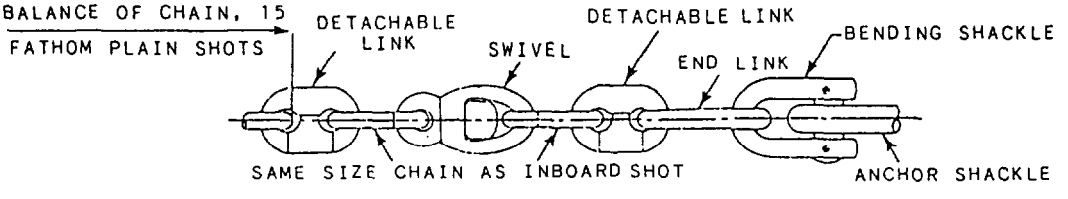
Standard and alternate outboard swivel shots also called "bending shots," consist of common links and fittings as shown in figure 5-4. They are fitted to attach the 15 fathom shots of anchor chain to the anchor. They also make it possible to stop off the anchor outboard of the swivel and break the chain at the detachable link inboard of the swivel. This allows the anchor chain to be used as part of the towing gear. Outboard swivel shots vary in length, but they usually do not exceed 5 fathoms. The taper pins in the detachable links in the outboard swivel shot are additionally secured with a U-shaped, stainless steel wire-locking clip (sometimes called a hairpin). This hairpin, inserted in holes drilled through the coupling plates, engages a keyway or groove on the taper pin and is mandatory. (See figures 4-2 and 4-4.)

Riding, Housing, and Towing Chain Stoppers

Riding and housing chain stoppers consist of a turnbuckle inserted in a couple of links of chain. A pelican hook is attached to one end of the chain; a shackle is attached at the other end. The housing stopper is nearest the hawsepipe and must be installed outboard of the swivel; the riding stopper is farther inboard. These stoppers are secured by the shackles to permanent pad eyes on the ship's deck Chain stoppers



STANDARD OUTBOARD SWIVEL SHOT & METHOD OF ASSEMBLING*



ALTERNATE ARRANGEMENT OF OUTBOARD SWIVEL & METHOD OF ASSEMBLING*

* NOTE
STANDARD AND ALTERNATE OUTBOARD SWIVEL SHOTS SHOWN REFLECT LATEST DESIGN ON LATER SHIP CLASSES USING FLASH BUTT WELDED CHAIN. VARIOUS ARRANGEMENTS WILL EXIST ON OTHER SHIPS USING DIE-LOCK CHAIN WITH COMMON LINES ON EACH SIDE OF THE SWIVEL.

Figure 4-4.–Outboard swivel shot arrangement.

are used to hold the anchor taut in the hawsepipes, to ride to an anchor, or to hold the anchor when the anchor chain is disconnected for any reason.

When in use, a stopper is attached to the anchor chain by passing the tongue over a link of the chain and securing it by engaging the bail of the Pelican hook and passing a toggle pin. When riding to anchor with more than one stopper on the chain, the strain must be equalized in the stoppers by adjusting the settings of the turnbuckles. Large chain stopper wrenches are used for this purpose. Special housing chain stoppers, such as devil's claw or pawl-type stoppers, normally are used with horizontal windlasses and where space limitations do not permit use of Navy standard stoppers. Although stoppers alone are more than adequate for holding the anchor, they should be backed up with the wildcat brake. Upon anchoring, first the wildcat brake band should be set up tight, then the stoppers should be passed. The wildcat should be left disconnected from the windlass. A Navy standard chain stopper is shown in figure 4-5.

Towing chain stoppers are similar to riding chain stoppers and housing chain stoppers except towing chain stoppers have locking plates added. These locking plates prevent the towing chain stoppers from unscrewing when they are subjected to the shock and vibration loading of the towing hawser. Chapter 581 of the *Naval Ships' Technical Manual* has detailed information on towing chain stoppers.

Mooring Shackles

Forged steel mooring shackles (fig. 4-6) are used to attach the anchor chain to mooring buoys. All mooring shackles, regardless of size, have a standard opening of 7 inches. Mooring shackles are not to be used for any other purpose.

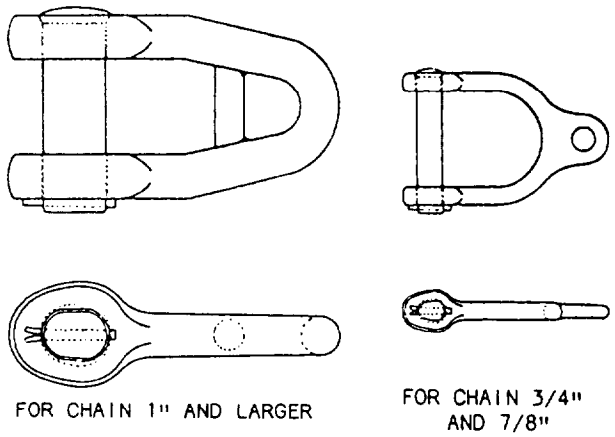


Figure 4-6.–Mooring shackles.

Mooring Swivels

Forged steel swivels, with two links attached at each end, are used to moor with anchors. They are inserted in the chain outboard of the hawse and serve to keep the chain from twisting as the ship swings. Mooring swivels are attached in the chain with the eye end outboard, or down, to prevent them from hooking on the outer lip of the hawse when they are heaved back aboard. However, ships today have large rounded lips on the hawsepipes, making it unlikely that a reversed swivel will catch. A mooring swivel is shown in figure 4-7.

Chain Cable Jacks

A cable jack (fig. 4-8), consisting of a lever mounted on an axle and two wheels, is used to handle anchor chain of 2 3/4 inches, or larger, in size. It is used to pick the chain up to pass a chain stopper. A pinch-point crowbar type of anchor bar is issued for smaller sizes of chain.

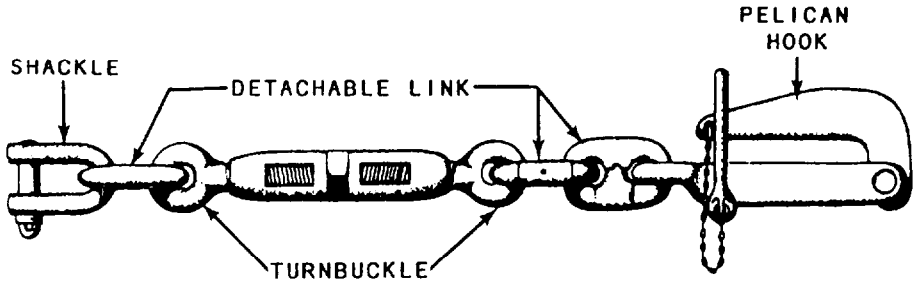


Figure 4-5.–Navy standard chain stopper.

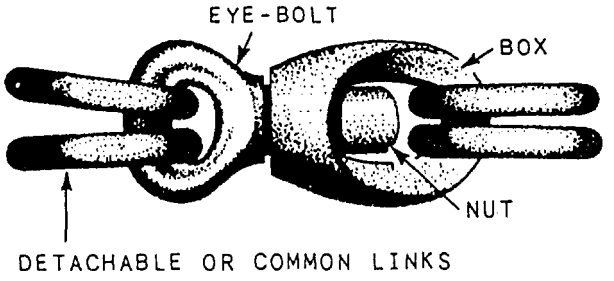


Figure 4-7.–Mooring swivel.

Clear Hawse Pendants

A clear hawse pendant is a wire rope pendant, 5 to 15 fathoms long, with a thimble at one end and a pelican hook attached to a length of open-link chain fitted in a thimble at the other end. This pendant is used to clear a hawse fouled by the anchor chain. See figure 4-9.

Dip Ropes

A dip rope is a fiber or synthetic rope pendant, 14 to 36 fathoms long, fitted at one end with a thimble and a dip shackle large enough to engage a link of the anchor chain. A dip rope is used when mooring or clearing a hawse.

Chafing Chain or Pendant

A short length of chain and/or a wire rope pendant is inserted between the anchor and the anchor buoy line. This prevents the anchor buoy line from chafing on the anchor and parting.

Anchor Chain Markings

The detachable links of anchor chains are painted red, white, or blue as follows: red for 15 fathoms, white for 30 fathoms, blue for 45 fathoms, red for 60 fathoms, white for 75 fathoms, and so on.

At the 15-fathom mark, one link on each side of the detachable link is painted white, and one turn of wire is wrapped securely around each stud. At the 30-fathom mark, two links on each side of the detachable link are painted white, and two turns of wire are wrapped around each of the last white studs. At 45 fathoms, three links on each side of the detachable link are painted white, and three turns of wire are wrapped around each

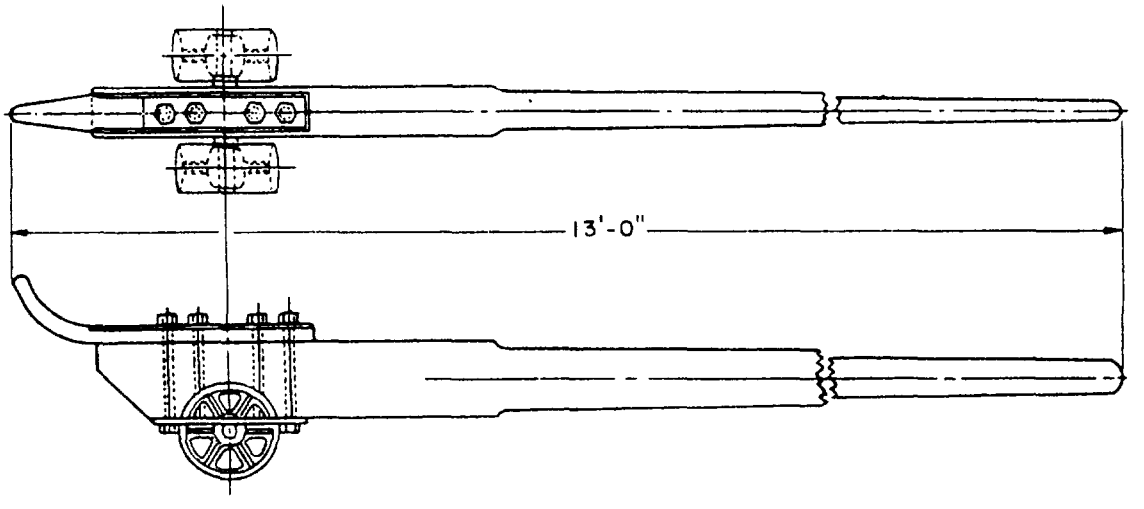


Figure 4-8.–Cable jack.

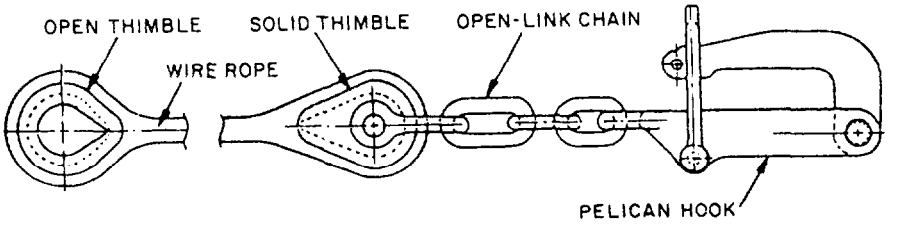


Figure 4-9.–Clear hawse pendant.

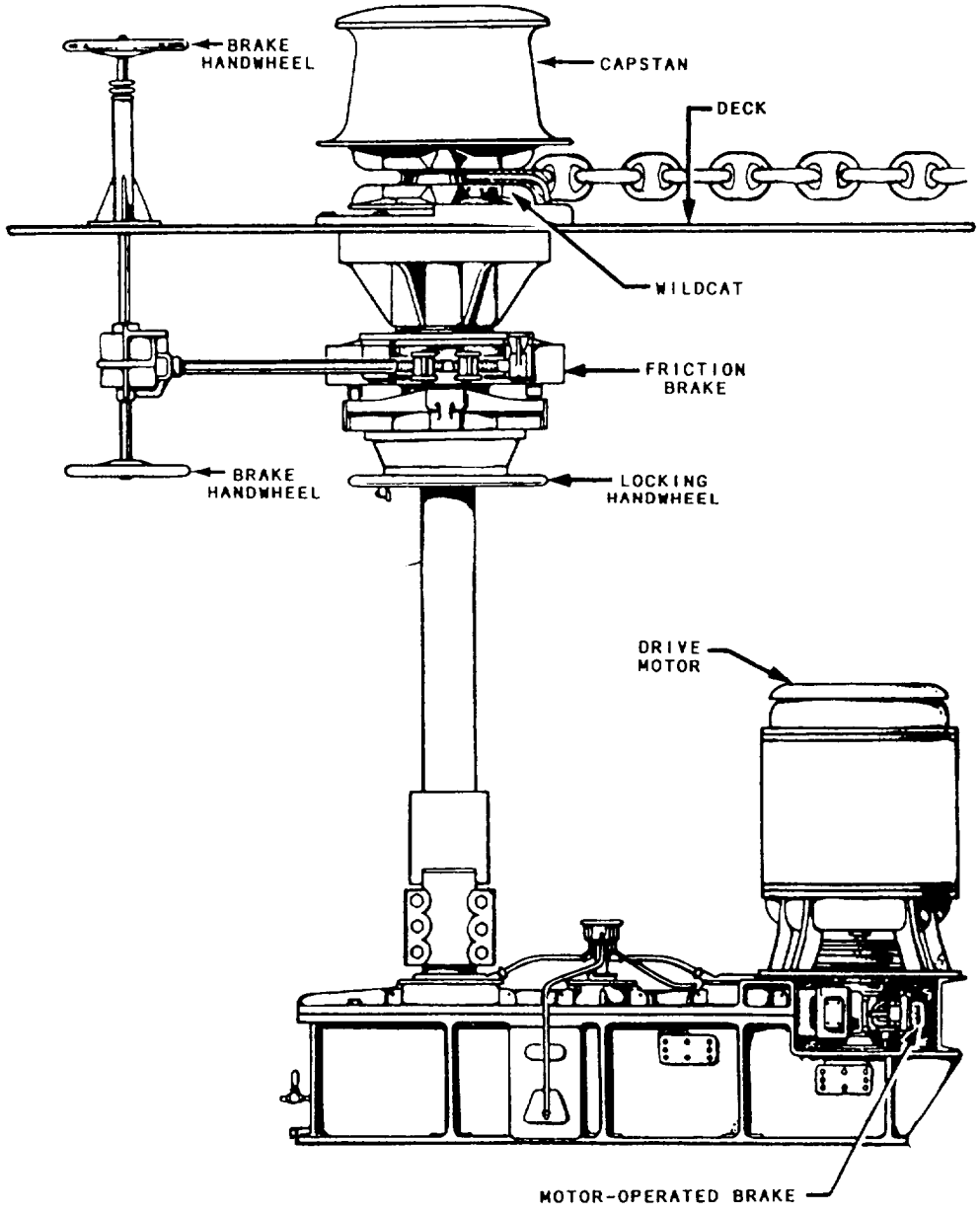


Figure 4-10.–Vertical shaft anchor windlass.

of the last white studs. At 60 fathoms, four links on each side of the detachable link are painted white, and four turns of wire are wrapped around each of the last white studs; and so on for each shot.

Each link of the entire next-to-last shot is painted yellow. The last shot is entirely red. These last two shots give warning and danger signals of the approach of the bitter end of the anchor chain.

CARE OF GROUND TACKLE

Anchors, chains, and appendages must be kept in good condition by the ship's force. The chain is overhauled by the ship's force whenever necessary, and precautions are taken to see that the various shots are properly marked and in good order. Two competent petty officers are detailed to examine the chain as the chain comes in, when getting underway, from an anchorage. Each link is examined for cracks and other defects.

Once each quarter, and more often if subjected to normal use, all anchor chains in sizes up to and including 1 1/2 inches are laid on deck and their entire lengths examined. The deck pad eyes and chain stoppers are inspected for cracks, deformation, and

excessive wear at this time. If necessary, they are scaled and cleaned of rust and other foreign matters, checked for excessive wear or corrosion and, where conditions warrant, replaced with new ones.

Disassembly of detachable links in the outboard swivel shot with hairpins requires removal, and probable destruction, of the lockwire. The availability of replacement wire of the same type should be established before removal for inspection of the detachable link. Replacement hairpins can be fabricated on board ship from corrosion-resistant steel.

Anchor chain and appendages are carefully examined for cracks, excessive wear, distortion, or other defects. Parts that require coating are painted with anchor chain gloss black paint. Shackles, bolts, locking pins, and swivels are examined carefully and put in order. The turnbuckles in chain stoppers require frequent attention to keep them clean, free from rust, and well lubricated with a graphite grease.

Chain of sizes by more than 1 1/2-inch wire diameter is overhauled, wire brushed, and placed in a good state of preservation as often as required. At least once every 18 months all anchor chain, regardless of size, (including all fittings) is examined, overhauled, and placed in a good state of preservation (5 years for carriers). To distribute the wear uniformly throughout the length of the chain, the shots are shifted to a new position as necessary during this inspection. If, during overhaul of the chain, significant defects are discovered, they are brought to the attention of the Naval Sea Systems Command. If it is not practical to make immediate replacement, the defective shots are shifted to the bitter end of the chain. Chapter C6, Volume 2 of OPNAVINST 5100.19 (series) *(NAVOSH Program Manual for Forces Afloat)* contains safety precautions on ground tackle.

ANCHOR WINDLASS

Windlasses are installed on board ships primarily for handling and securing the anchor and chain used for anchoring the ship and for handling anchor chain used for towing the ship. Most windlasses have capstans or gypsy heads for handling line in mooring and warping operations.

Windlasses can be located on the stern of the ship for stern anchoring, but are usually located in the bow of the ship for handling bower anchors. Windlasses also handle bottom-mounted braided fluke anchors (keel anchors) used on submarines (stern) and some surface ships (bow).

Landing ships capable of beaching have a separate anchor winch to handle the stern anchor used for retracting from the beach.

Two general types of windlasses are installed on naval ships. They are the vertical shaft and the horizontal shaft types. See figures 4-10 and 4-11. These two types are subdivided into classes, depending on the power source. These classes are electrohydraulic drive and electric drive. The essential parts of a typical windlass, regardless of its type and class, are the drive motor, wildcat, locking head, hand brake, capstan or gypsy head, and control.

Horizontal shaft windlasses are usually made as a self-contained unit with the windlass and drive motor mounted on the same bedplate. Vertical shaft windlasses have their power source located below deck with only the wildcats and capstans mounted above deck.

The windlass wildcat is a special type of drum or sprocket constructed to handle the anchor chain links. The outer surface has flats (or pockets) which engage chain links. At each end of the pockets, lugs (known as whelps) are provided, which contact the end of the flat link. A central groove in the outer surface accommodates the vertical links which are not in contact with the wildcat at any point.

Windlass wildcats have a locking head for disengaging the wildcat from its power source. The locking head permits free rotation of the wildcat when you are “paying out” the chain. Locking heads usually consist of two sliding block keys that may be shifted to key together a drive spider and the wildcat. The drive spider is keyed to the windlass's shaft, while the wildcat

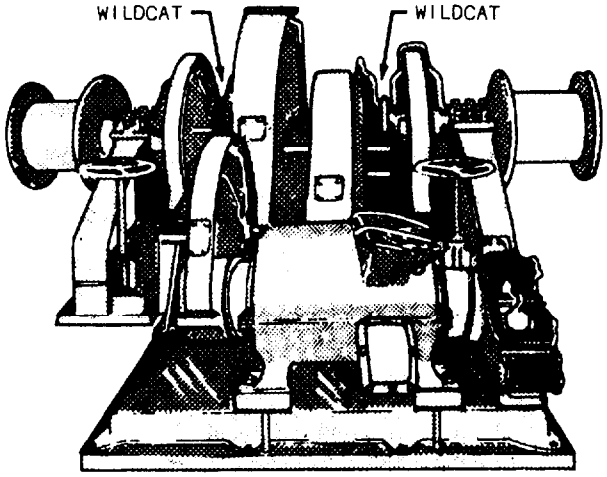


Figure 4-11.–Horizontal shaft anchor windlass.

is carried on bearings and is free to rotate, except when the locking head keys are engaged or when the wildcat's brake is set.

Each wildcat has an externally contracting flat hand brake operated by a handwheel. This brake may be used to hold the anchor and chain and to control the speed of descent when the anchor and chain are payed out.

Capstan and gypsy heads fitted on windlasses are keyed to the drive shaft and rotate when the windlass power source is turning. When using the heads, apply the wildcat hand brake, then disengage the wildcat locking head. The heads will now operate independently of the wildcats. When the wildcats are used, however, the capstan heads will always rotate.

Letting Go

When anchoring and weighing anchor, the ship's first lieutenant is in charge on the forecastle. Aboard most ships, the first lieutenant's assistant is the ship's Boatswain or Chief Boatswain's Mate.

The Boatswain's Mate in charge of the anchor detail musters the detail and makes sure all necessary gear is ready and available for use.

The exact procedure may vary for making the anchor ready for letting go, but the following tasks must be performed. The windlass is tested, the anchor in the hawse is freed, the anchor is walked out if anchoring is in deep water or if the bottom is rocky; the brake is set; and the wildcat is disengaged. All but one stopper is taken off and the anchor buoy line is shackled to the chafing chain or pendant.

The chain locker is checked for loose gear that may become wedged in the chain pipes or come flying out, endangering personnel on deck. An order then is given to stand clear of the chain. For obvious reasons, it is urgent that all hands obey this order!

At the command "STAND BY" the brake is released and two Seamen-one with a sledgehammer or maul-take stations at the stopper outboard side of the chain. When the command "LET GO" is given, one Seaman pulls the pin from the stopper tongue.

The Seaman with the maul knocks the bail off the tongue of the pelican hook and steps clear. As soon as the Seaman is clear, the brake is fully released. If for some reason the stopper does not fall clear, the chain can still be controlled by the brake.

The Seaman tending the anchor buoy tosses it over the side and the jack is two-blocked (hoisted all the way up). On the signal bridge, the anchor ball is hoisted.

The anchor buoy indicates the actual position of the anchor to which it is attached by floating above it. The buoys are painted a distinctive color; green for the starboard anchor, red for the port anchor, and white for the stern anchor.

If an anchor buoy floats on the surface, it is said to be "watching." An anchor buoy may fail to watch because its line is too short or the line is fouled in the chain. Before anchoring, the line attaching the buoy to the anchor should be adjusted to a length that is a couple of fathoms greater than the depth of the water at anchorage. This extra length allows for slight fouling, tide variations, or the sinking of the anchor in mud, which might cause the actual depth to be greater than that shown on the navigational chart being used. The anchor buoy and line must be laid up along, and outboard of, the lifelines. It should be put overboard, well clear of the ship the instant the anchor is let go.

On ships with power assist hand brakes, the power assist mechanism must be adjusted so when the brake is applied, the chain will not jump off the wildcat when it comes to a stop.

An anchor buoy is a valuable time-saver in locating an anchor lost in weighing or one that is slipped in an emergency. Slipping an anchor happens when unexpected circumstances do not permit time to weigh anchor.

As soon as the anchor hits bottom the brake is set so the chain will not pile on it. As the ship gains sternway, the brake is released to lay the chain out evenly on the bottom and to control any running movement of the chain.

As each chain marking passes the wildcat, the report "(Number) FATHOM ON DECK' is made to the conning officer on the bridge. The direction the chain is tending is indicated by pointing the arm and/or reporting "CHAIN TENDING (number) O'CLOCK."

If the chain tends around the stem, the situation is reported to the bridge. The chain must be allowed to run freely or the sharp bend around the stem may damage a link. Detachable links are particularly susceptible to damage in this regard.

If the anchor chain starts to get near the sonar dome, this situation is reported to the bridge, because anchor chain rubbing against the sonar dome can cause serious damage to it.

When the desired scope of chain is out, the conning officer gives the order "PASS THE STOPPERS." The brake is set and the stoppers are applied and evened up, the brake is taken off, and the chain is slacked between the windlass and stopper. The brake is set, and the wildcat is left disengaged. Before securing, all gear is picked up and stowed.

Weighing Anchor

When you are weighing anchor, the same gear must be available on the forecastle as for anchoring. In addition, there is a grapnel (a small four-armed anchor) used to retrieve the anchor buoy. A hose is rigged to wash mud from the anchor and the chain. The windlass is energized and tested, and then the wildcat is engaged. The brake is then released and the wildcat is tested. The brake is set, and all stoppers but one are cast off. When ready, the report "READY TO HEAVE IN" is made to the bridge.

On the command "HEAVE AROUND," the brake is taken off and the chain is heaved in enough to take the strain off the stopper. The stopper is then cast off and heaving is resumed. Reports are made to the bridge periodically on the direction the chain is tending, the amount of chain remaining out, and the degree of strain on the chain. If the command were "HEAVE AROUND TO SHORT STAY" the chain would be heaved in just short of breaking out the anchor (pulling the anchor loose from the bottom). When the chain is at short stay, it is reported to the bridge. On the command "HEAVE AROUND AND UP," start heaving. When the flukes have broken out, and the crown still rests on the bottom, the report "ANCHOR IS UP AND DOWN" is made. When the anchor is free of the bottom, it is said to be "AWEIGH" and is so reported. At this time the jack and anchor ball are hauled down and the ship is legally underway. When the anchor comes into view and its condition can be noted, the report "ANCHOR IN SIGHT, CLEAR (or FOUL) ANCHOR" is made. The anchor is reported as housed when the shank is in the hawsepipe and the flukes are against the ship's side. The anchor buoy is recovered as soon as possible, and a report is made to the bridge when the anchor buoy is on board. The anchor again is made ready for letting go and kept that way until the anchor detail is told to secure it after the ship is outside the harbor or channel.

To secure the anchor for sea, set the brake, then pass the stoppers and even them. Take the brake off, then slacken the chain between the wildcat and the stopper. The brake is set and the wildcat is disengaged. To prevent water from entering the chain locker, secure buckler plates over the chain pipes for those ships with open decks.

Stowing Chain

As the chain comes aboard, it passes along the deck, on metal flash plates, around the wildcat, and down into the chain locker. The chain goes into a locker as shown in figure 4-12. The bitter end is secured to a pad eye (ring) on the bulkhead of the chain locker.

All chain lockers on Navy ships are of the self-stowing type. However, when working small chain, at least two Seaman will be assigned to guard against any possible pileup in the chain locker. The chain can be kept from piling up by pushing any accumulation over with a length of 2 by 4 lumber.

Securing

A stockless type anchor is housed in the hawsepipe as shown in figure 4-12, and it is secured by passing the stoppers. The anchor must be drawn taut in the hawse-pipe by the outboard stopper to prevent the flukes from banging the sides. Stoppers are attached to the chain by straddling a link with the tongue and strong back of the pelican hook. The bail is then closed on the pelican hook. The toggle that keeps the pelican hook closed must then be inserted in the tongue of the pelican hook and the lanyard secured around the bail to prevent the toggle pin from coming out. The turn buckles must be adjusted so each stopper will take an equal strain.

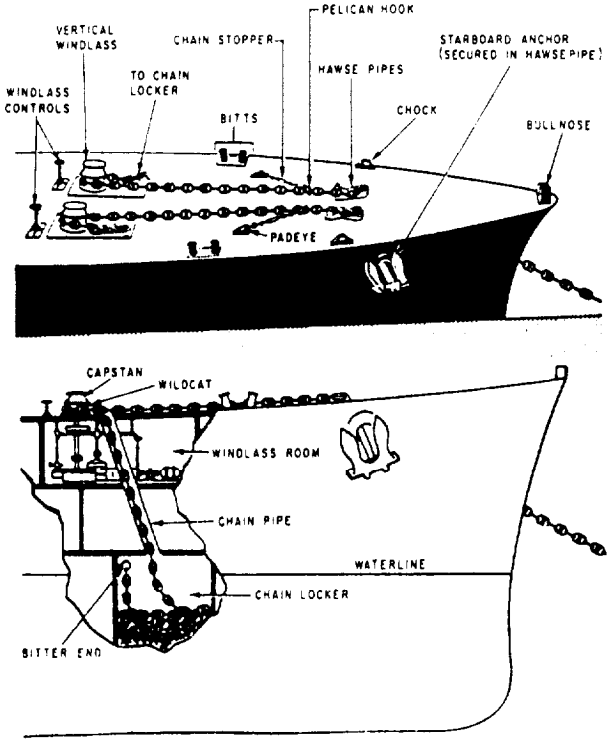


Figure 4-12.–Stowage of chain.

CAPSTANS

Capstans are mounted on deck to ease the handling of large, heavy mooring lines and wires. These capstans may be separate machinery units or part of the anchor windlass. The capstan's spool-shaped drum keeps the lines from slipping, especially when wet.

Most capstans are electrically driven. Depending on the class of ship and its size, capstans may be located any place on the deck, but they are usually found on the forecastle and fantail.

HEAVING LINE

A heaving line is a light line used to get a hawser ashore when mooring a ship to the dock or in passing a heavy line for any purpose. One end of the heaving line is fitted with a monkey fist to assist in getting distance when heaving. After making the heave, the other end of the heaving line is bent to the hawser with a bowline. The heaving line is coiled carefully with about two-thirds of the coil held in the right (casting) hand and the rest in the left hand.

In heaving, the right arm should be held straight, and the line in the left hand allowed to run out freely. Frequently the problem in not getting a long heave is that the coil in the left hand is not arranged clearly for running. Prewetting the line is done to improve distance and handling. To become proficient in heaving, you must practice frequently. Every Seaman should practice making casts. A poor cast is always a reflection on the ability of the Seaman.

BOAT DAVITS

LEARNING OBJECTIVE: List and explain the different types of boat davits and the safety devices.

A boat davit is a device that is designed specifically for handling a ship's boat or boats. The boat davit is designed to handle the ship's boats from the stowed position, through the lowering and hoisting evolutions, and returning the boat to stowage.

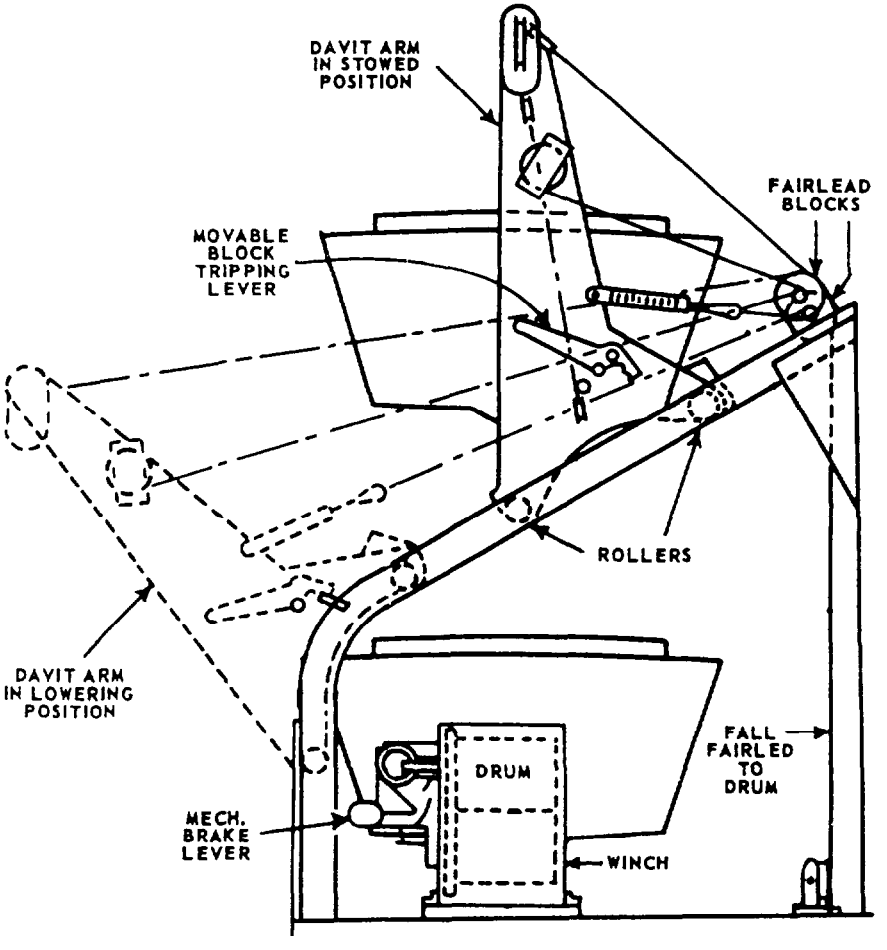


Figure 4-13.–Trackway gravity davit.

The typical boat davit system is made up of five major subsystem. These subsystems are the electrical system, the winch system, the boat davit arms and sheaves system, the boat falls system, and the stowage system. The primary function of the davit arm, (or arms, as applicable) is to swing out the boat from the inboard position to a point outboard of the ship's side from which the boat may be lowered. The reverse of this process occurs when the boat is hoisted. Hoisting operations are controlled by the winch and boat falls from which a hoisting hook (or hooks) is (are) suspended. The number of hoisting hooks is dependant on whether the boat davit is the single arm or double arm configuration. The falls lead from the boat davit winch (the source of power), through the boat davit arms and sheaves to the hoisting hooks. A drum type winch is used with all boat davits having a wire rope fall or falls. A gypsy type winch is used with some boat davits when the falls are synthetic fiber rope. Boat davits are either of gravity or mechanical type.

A gravity boat davit requires only the force of gravity to move a boat suspended from the hooks at the inboard position to the outboard position and down to the water. The lowering evolution from the inboard position to the water is controlled at the winch through the boat falls. The winch's manual brake controls the boat's descent speed and prevents the davit arms from slamming into the outboard stops. The manual brake is also used to stop the boat before it reaches the water to allow the coxswain to start the boat's engines. The power to hoist the boat from the water is provided by the winch. Handcranks can be attached to the winch for hoisting the boat by hand if a loss of electrical power should make it necessary. Gravity boat davits are either of the overhead suspended, trackway, pivoted, or pivoted link type, and may be of the single or double arm configurations. Figure 4-13 depicts the typical operation of a trackway gravity boat davit.

The mechanical boat davit requires the application of an external force to move the boat and davit arms from the inboard to the outboard position in preparation for lowering the boat to the water. Movement of the boat outboard with mechanical boat davits is not under control of the boat falls. Mechanical boat davits of the pivot sheath screw (occasionally called crescent) and radial designs are no longer being built for Navy ships. However, these older design mechanical boat davits are still used on some Navy and merchant vessels. The newest type of a mechanical boat davit being used by the Navy is the slewing arm boat davit. This boat davit is often called the SLAD and it handles the rescue boat called a rigid inflatable boat (RIB).

The double-link davit generally handles two boats. The double-link configuration can handle both the larger and heavier types of boats (officer/personnel, utility cargo) as well as the lighter weight rescue boat. A double-link pivoted gravity davit is shown in figure 4-14.

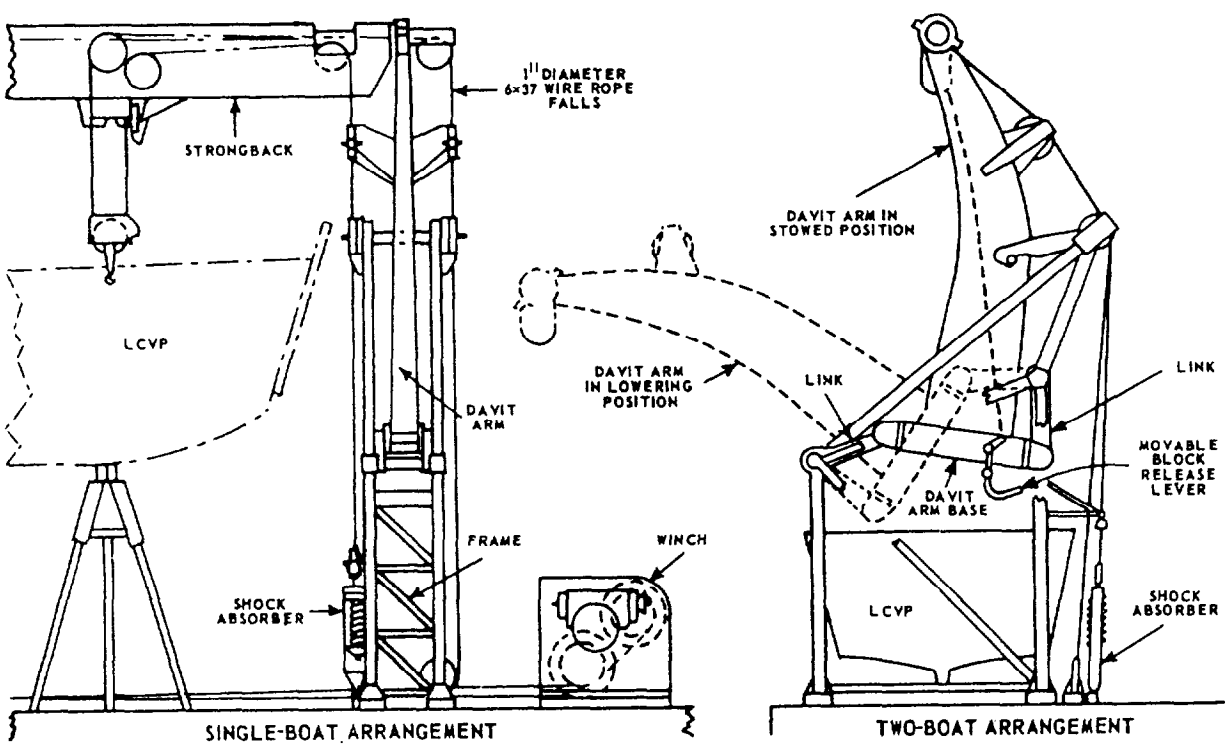


Figure 4-14.–Double-link pivoted gravity davit.

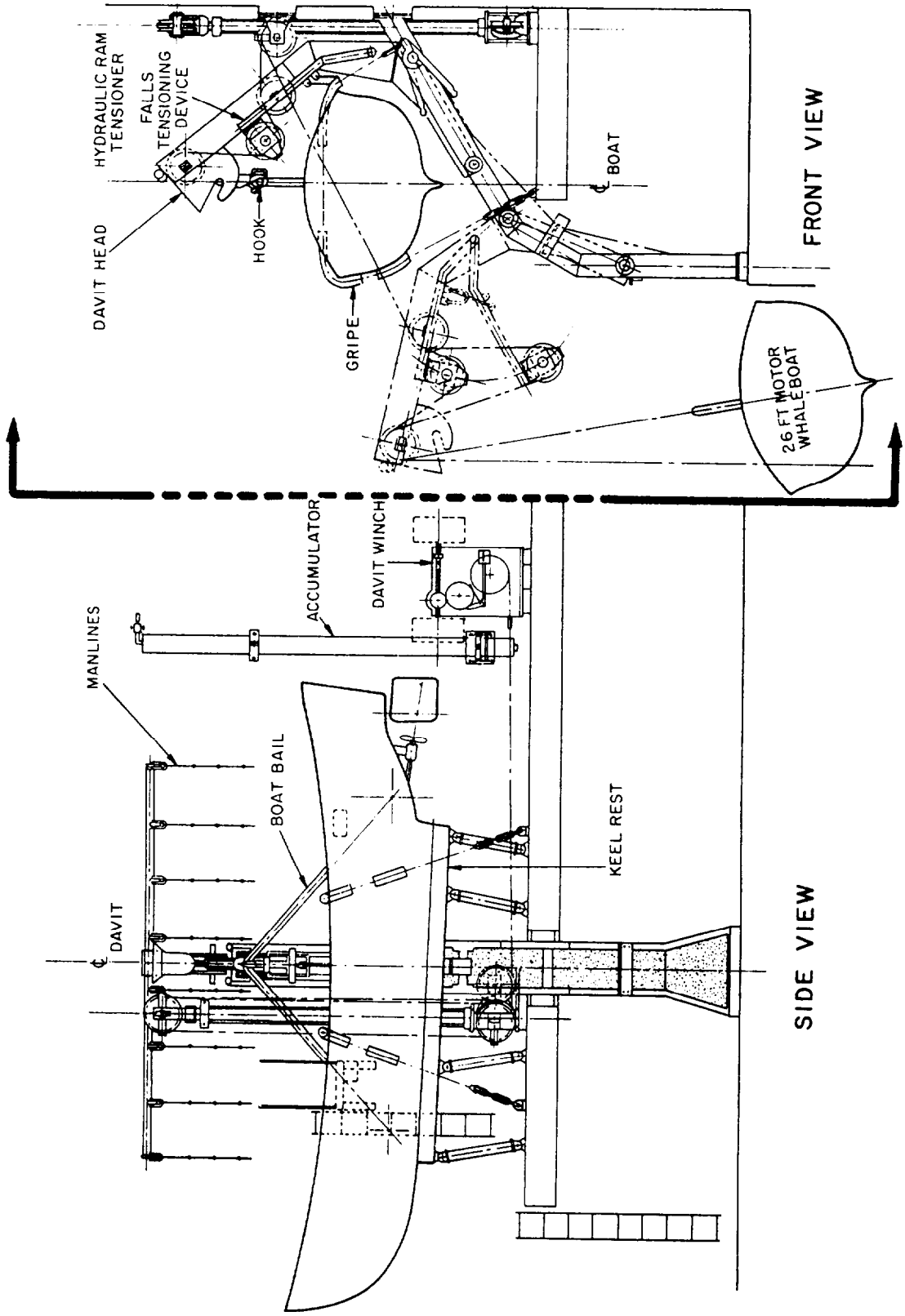


Figure 4-15.-Single-arm trackway gravity davit.

The single arm boat davit handles only one boat, normally the lightweight rescue boat. It uses a special boat bail or sling to enable lifting at a single point. Hence, the relatively dangerous and time-consuming process of threading two hooks through bow and stem hoisting rings is eliminated. A typical single arm trackway boat davit arrangement is shown in figure 4-15.

BOAT DAVIT TYPES AND CONFIGURATIONS

There are seven design types of boat davits currently in use for handling boats aboard Naval ships. Each of these design types comes in several different configurations. Table 4-1 shows a list of the design types and configurations.

Overhead Suspended Boat Davits

Overhead suspended boat davits consists of two sets of sheaves mounted beneath a sponson or other overhang. The boat falls are reeved through the sheaves and connected to a double drum boat winch for power hoisting. The boat is stowed suspended from hooks directly over the water. The boat is lowered using only the force of gravity and it is hoisted by the winch Overhead suspended boat davits are used mainly on aircraft carriers and amphibious helicopter landing ships.

Table 4-1.–Boat davit and configurations

DAVIT DESIGN TYPE	CONFIGURATION
OVERHEAD SUSPENDED	Double arm, fixed
PIVOTED	Single arm Double arm, span wire Double arm, strongback
PIVOTED LINK	Double arm, span wire Double arm, strongback
PIVOTED SHEATH SCREW	Double arm, span wire
RADIAL	Double arm
SLEWING	Single arm, standard Single arm, non-magnetic Single arm, overhead
TRACKWAY	Single arm Double arm, span wire Double arm, strongback

Pivoted Boat Davits

Pivot boat davits can be either the single-arm configuration or the double-arm configuration. The arm(s) pivot(s) around a single axis to move inboard or outboard. Pivot single-arm boat davits handle one boat. Pivot double-arm boat davits may handle one or more boats, depending on the application. Depending on the configuration, one boat may be stowed gripped in against the arms, or two boats may be stowed one over the other between the arms. Depending on the model, the boat davit arms are connected by either a strongback or a span wire. The single-arm configuration and the double-arm configuration are gravity boat davits.

Pivoted Link Boat Davits

The pivoted link boat davits are double-arm boat davits designed to lower, to hoist, and to store one or more boats. Two davit frames, one forward and one aft, are mounted to the ship's deck. Each frame supports a davit arm. The arms are connected to the frames by pivoting links. The arms then pivot around the multiple axes of the links to move the boat(s) inboard and outboard (fig 4-14). Depending on the configuration, one boat may be stowed gripped in against the arms, or two boats may be stowed one over the other between the arms. Depending on the model, the boat davit arms are connected together by either a strongback or a span wire. Pivoted link boat davits are gravity boat davits.

Slewing Boat Davits

Slewing boat davits have a single arm mounted on a pedestal, which in turn is mounted to the ship. The arm slew rotates about the vertical axis of the pedestal to move the boat inboard and outboard. This boat davit design, commonly called a slewing arm davit (SLAD), is used to handle rigid inflatable boats (RIB). The boat or boats are stowed on the deck of the ship next to the pedestal. The slewing boat davit is electrically powered and it is also a mechanical boat davit.

Trackway Boat Davits

A trackway boat davit can be either of single arm or double arm configuration. The trackway boat davits may handle one or more boats depending on its

application. Each arm is mounted on rollers which run on an inclined trackway that is mounted on the deck. The incline on the trackway(s) is sufficient for gravity to cause the boat and arm(s) to move down the trackway(s) from the inboard position to the outboard position so the boat may be lowered into the water. Depending on the model, the boat davit arms are connected by either a strongback or a span wire (fig. 4-13 and 4-15). Trackway boat davits are gravity boat davits.

BOAT DAVIT SAFETY DEVICES

Boat davit installations have various safety and protective devices. These safety devices are visual, electrical, and mechanical in nature. We will describe some of the safety devices in the following paragraphs.

Safe Hoisting Position Stripes

Safe hoisting position stripes are usually red in color and 2 inches wide, and they are used as a visual aid for the boat davit operator. They are painted on the davit frame and the davit arm(s) at a minimum distance of 8 inches from either the two-blocked position or the solidly compressed position of the buffer spring. They indicate when the electric motor must be de-energized during hoisting to avoid a two-blocked condition. A two-blocked condition is where the boat fall(s) are prevented from movement either by design or obstruction. Continued hoisting against a two-blocked condition could result in over stressing or failure of davit components.

Slewing Position Stripes

Slewing position stripes are used for a slewing boat davit (SLAD) as a visual aid to indicate when to de-energize the electric motor during slewing. There are three stripes, usually red in color and 2 inches wide. One stripe is painted on the arm and two stripes are painted on the pedestal. One of the two pedestal stripes indicates when the arm is slewed to the STOW position and the other indicates when the arm is slewed to the LOWERING position.

Emergency Disconnect Switch

The emergency disconnect switch is located at the boat davit operation station to allow the operator to interrupt power to the motor. It is used in an emergency situation to prevent a two-blocked condition if another control component fails to function properly.

Double Break Feature

Electrical contacts subjected to momentary jogging service are prone to sticking or welding. This can cause uncontrolled operation of the winch. The double break feature is the arrangement of two independent contactors in the supply leads to protect against this danger. When the motor power supply is interrupted by the master switch the supply leads are opened in two places by contactors which are not interlocked. In the

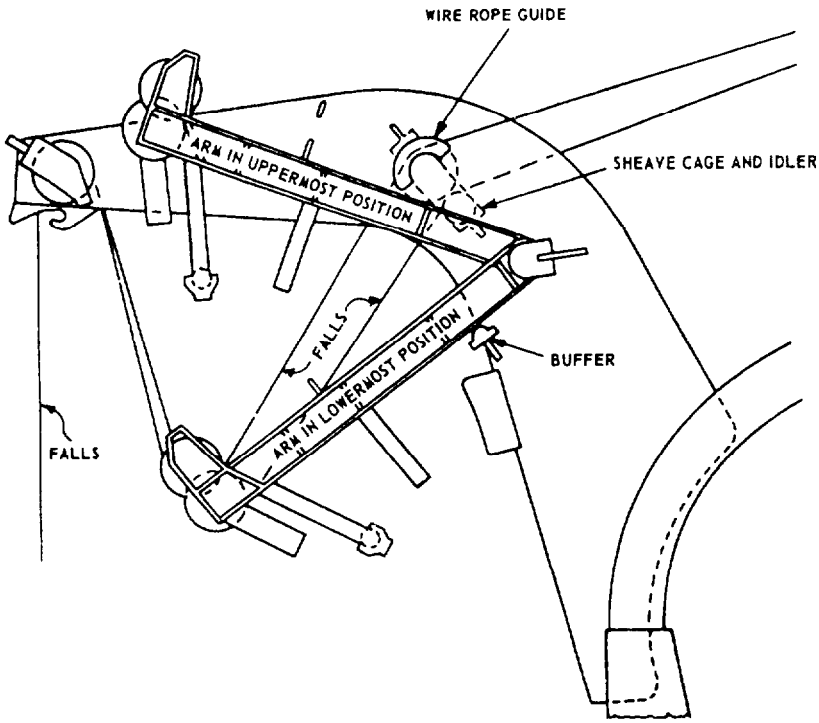


Figure 4-16.–Fall tensioning device.

event that the master switch is moved to OFF and one contactor sticks, the second contactor should interrupt the power.

Fall Tensioning Device

The fall tensioning device keeps the hook above the heads of the boat crew before boat hookup and after release. This reduces the danger to the boat and to the crew from a swinging hook assembly. When the hook is cast off during launching, the fall tensioning device counter-weighted sheave causes the hook to rise clear of the boat and crew. Figure 4-16 is an example of a fall tensioning device.

Fluid Brake

A fluid brake is attached to the output shaft of the electric clutch on the SLAD hoist drive motor. The purpose of this fluid brake is to regulate the speed of a descending boat thus preventing any damage to the equipment or personnel.

Safety Handcranks

Safety handcranks include an overriding mechanism. This mechanism functions in such a manner that, if a winch motor is energized while the winch is being manually cranked, no force is exerted on the crank handle from the winch side and thus prevents back drive. This device may be used in place of handcrank electrical interlock switches. For the SLAD, the formlock clutch prevents the back drive of slewing and hoist handcranks and thus both drives can be power driven with the handcranks being engaged.

DECK FITTINGS

LEARNING OBJECTIVE: Recognize common deck fittings found aboard ships and explain their purpose.

Deck fittings are the various devices attached to the hull that assist in handling the ship.

The most common fittings are found around the weather decks. A brief description of some common deck fittings (fig. 4-17) follows.

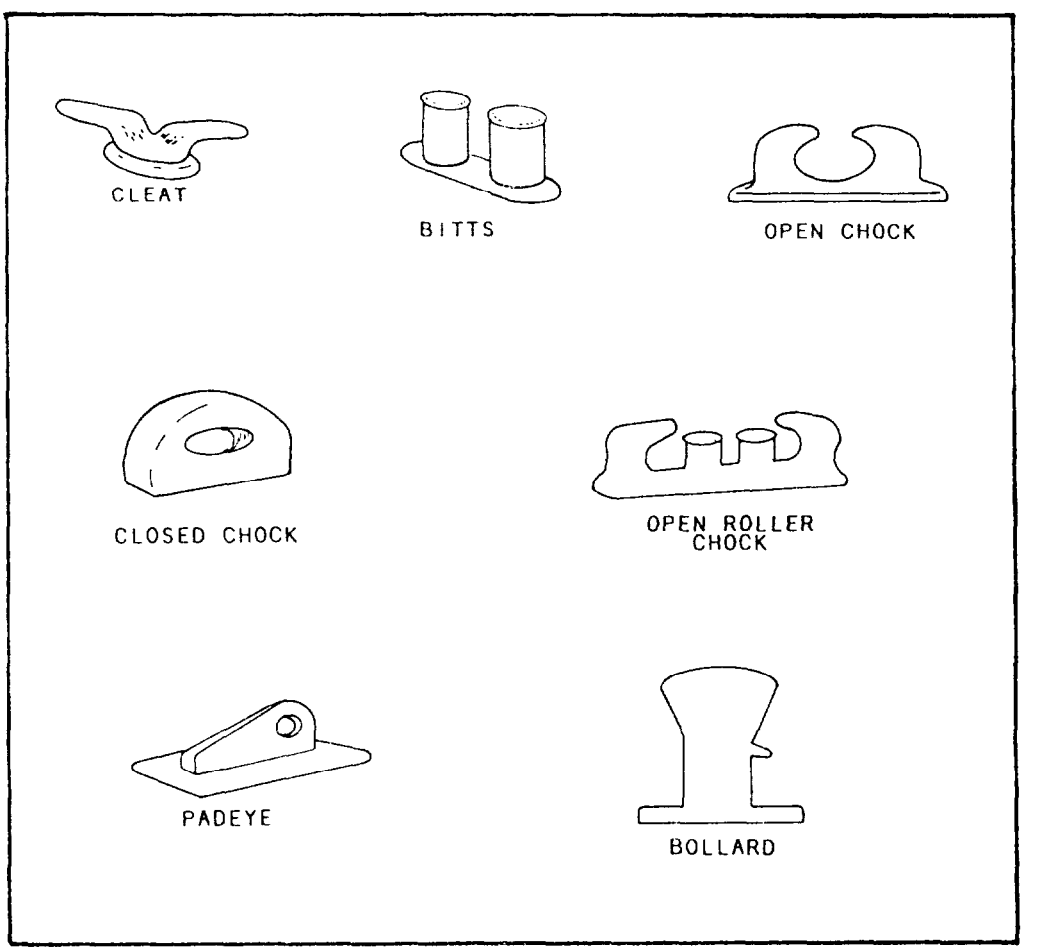


Figure 4-17.–Various deck fittings.

CLEATS

A *cleat* is a device consisting of a double-ended pair of projecting horns used for belaying a line or wire.

BITTS

Bitts are heavy vertical cylinders, usually arranged in pairs, used for *making fast* lines that have been led through chocks. The upper end of a bitt is either larger than the lower end or is fitted with a lip to keep lines from slipping off accidentally. As bitts are required to take very heavy loads, extra frames are worked into their foundations to distribute the strain. Usually there is a set of bitts forward and aft of each chock When constructed in pairs, each bitt is sometimes called a barrel.

CHOCKS

A *chock* is a heavy fitting with smooth surfaces through which mooring lines are led. Mooring lines are run from bitts on deck through chocks to bollards on a pier when the ship is moored. There are three types of chocks: An open chock is a mooring chock that is open at the top. A closed chock is a mooring chock, closed by an arch of metal across the top. A roller chock is a mooring chock that contains a roller for reducing friction.

PAD EYES

A *pad eye* is a plate with an eye attached, welded to the deck to distribute the strain over a large area and to which a block can be hooked or shackled. A pad eye is also used in towing operations.

BOLLARDS

A *bollard* is a strong cylindrical upright on a pier, over which the eye (or bight) of a ship's mooring line is placed.

ACCOMODATION LADDERS

LEARNING OBJECTIVES: Define accommodation ladder. Identify the construction and use of the accommodation ladder.

Ships are fitted with accommodation ladders that can be rigged and lowered over the side. These ladders provide a convenient means for boarding or leaving an anchored vessel. Some accommodation ladders can be modified for use on a pier or barge.

Large Navy ships have forward and after accommodation ladders, two on the starboard side and two on the port. If more than one ladder is rigged, the forward accommodation ladder is the quarterdeck and reserved for officers and ceremonies. The after ladder is used by work details and crew liberty parties. Some aircraft carriers are fitted with an accommodation ladder in their transom (on the stern of the ship).

The accommodation ladder, figure 4-18, has an upper and lower platform that is connected by the ladder and supported by either a chain or wire bridle and bail hanging by a pendant. Another method is the use of a metal bail shaped like an elongated upside down letter U which holds the ladder by a pendant rigged to the side of the ship or from a J-Bar davit.

The lower platform of the accommodation ladder has additional parts that must be rigged. An H-Frame equipped with fenders is rigged to the outboard side of the lower platform. This H-Frame is where boats can come alongside to pick up or discharge passengers. The inboard side of the lower platform is fitted with ports called shoes, that when rigged hold the ladder in the proper position off the side of the ship. The shoes have pads attached to their ends to help prevent damage to the ship or the ladder. The lower platform also has turnbuckles, and in some cases, pendants to restrict the fore and aft movement of the ladder.

The upper platform is supported by a brace known as a wishbone. A single-sheave block is attached to the underside of the forward outboard comer of the upper platform. A line is rigged through this block which acts as a sea painter to keep a boat alongside in position with the accommodation ladder. A toggle between the strands of the line prevents the line from running up into the block and becoming inaccessible to a boat.

There may be some accommodation ladders made of steel still in service, but for ease of handling, the Navy has changed to aluminum.

When an accommodation ladder is secured for sea, everything is rigged in, disassembled in most cases, and stowed in brackets either on the rail or along a section of the superstructure. All of the smaller portable parts are stowed in a gear locker close to where the ladder is rigged. Care must be taken so that this essential gear is not carried off for other purposes.

When an accommodation ladder is rigged, the first you must do is follow the ship's plans. You should make

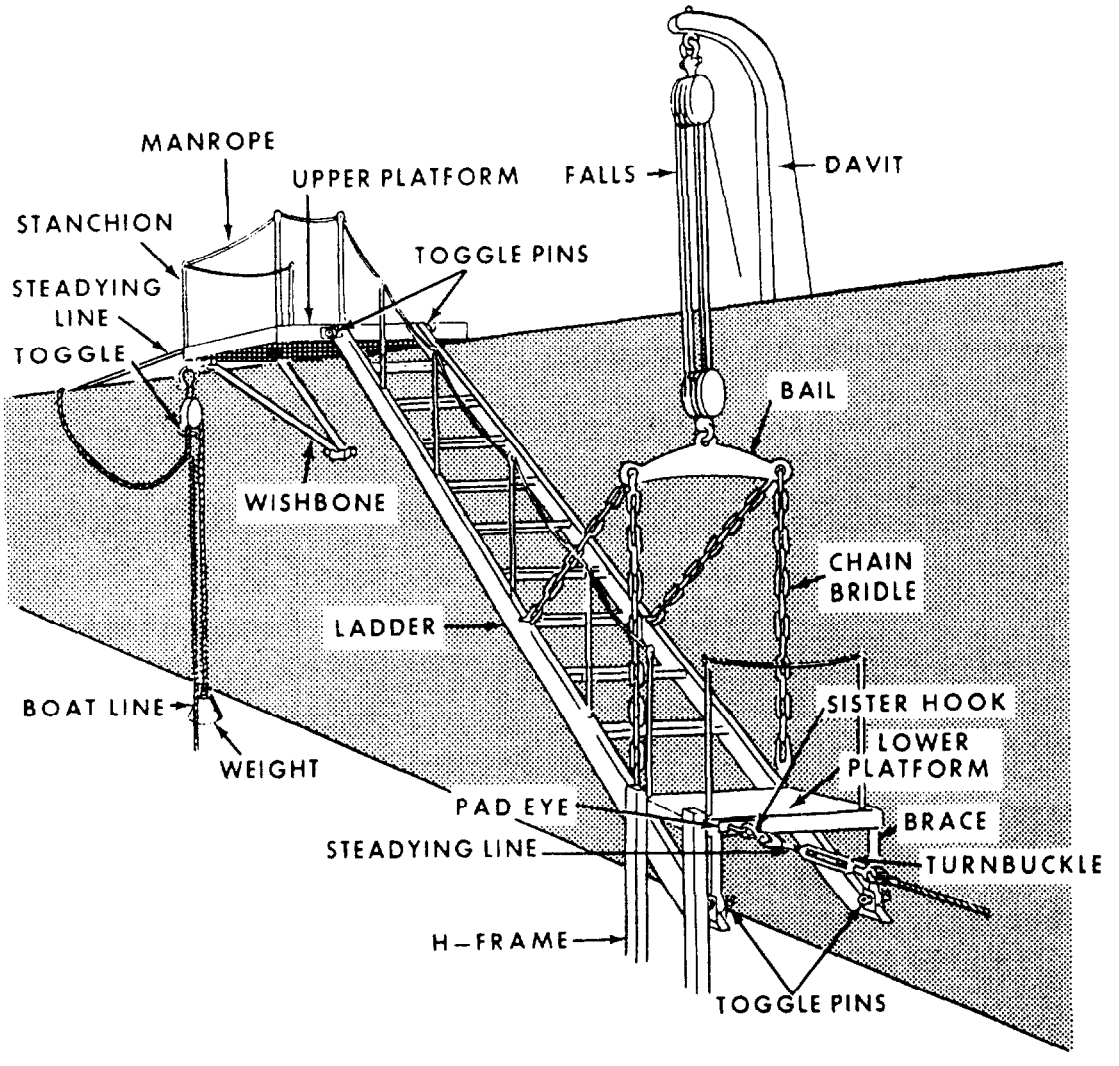


Figure 4-18.–Parts of accommodation ladder.

sure all parts are on hand and that the toggle pins and bolts are seized with short sections of wire and attached to the ladder to prevent them from being lost over the ship's side.

The next step is to rig the upper platform. Remember to be careful in lining up the brackets when you are engaging the bolts. Many a hand injury has occurred from careless or unsupervised rigging operations.

Once the upper platform is in place, the next step is to secure the ladder to it. This is an area where the ship's plans and design must be followed. Some ships have the ladder stowed against the rail. To attach this type ladder, you use a series of outriggers (arms swung out from the ship) to lay the ladder on and seat the ladder to the upper and lower platforms. On ships that do not have outriggers, the J-Bar davit can be used to support the ladder over the side to attach it to the upper platform. Another method is to use a ladder that engages pad eyes on the side of the ship and holds them in place by a two-fold rigged to the superstructure.

Depending on the type and class of the ship, rigging procedures will vary. Again, the ship's rigging plans must be used.

Now that the ladder is attached to the upper platform, the lower platform and the H-Frame must be rigged. It is easier if the H-Frame is rigged to the lower platform while it is still on deck. Once the H-Frame and the lower platform are rigged on deck they must be worked over the side to attach to the ladder. This can be done by using the falls from the J-Bar davit or from some other suitable attachment point.

The ladder is now taking shape and nearly ready to lower. Rig the bail and bridle to the ladder and attach the wire pendant between the bail and the J-Bar davit. On some ships, the pendant is rigged between the bail and a pad eye alongside the ship.

With this equipage rigged, we are ready to lower the ladder. Attach the falls to a sling on the lower platform. Make sure the hook is moused so the sling does not fall out of the hook.

If outriggers were used or if pad eyes and two-fold are holding the ladder, we must lay back on the falls to take the weight of the ladder off of them. Swing the outriggers in and or disengage the ladder from the pad eyes and remove the two-fold. The weight of the ladder is now on the falls attached to the lower platform and the attachment points of the upper platform.

The accommodation ladder should be lowered smoothly and it must always be controlled in its descent. As the ladder lowers into position, the pendant will extend itself between the attachment point and the bail. Keep an eye on the bridle and bail to make sure that they are not fouled as the ladder is lowered. The weight of the ladder will shift to the pendant, the bail, and the bridle when the ladder is in its down position. A crew member must now go down the ladder and rig the shoes. Shoes on an accommodation ladder are posts that slide out from the lower platform and act as fenders to keep the ladder in the proper position off the side of the ship. The shoes are secured by pins set in from the top of the lower platform into pre-drilled holes in the shoes. Turnbuckles are now rigged from the lower platform to the side of the ship. They prevent the fore and aft movement of the ladder.

While this is being done, another sailor rigs the boat line. The boat line is nothing more than a block rigged under the forward outboard corner of the upper platform. It acts as a sea painter to help boats making landing at the ladder.

The rails of the ladder are not set up and secured into position.

Remember that in some of these rigging procedures, personnel will be working outside of lifelines and over the side of the ship. It is absolutely necessary for these personnel to be in life jackets and safety harnesses with proper safety lines rigged. While underway, the Commanding Officer must give permission before anyone can work over the side.

Pneumatic fenders are now lowered over the side of the ship. They are positioned fore and aft of the accommodation ladder to protect the ladder and the ship from boats coming alongside.

When you complete the steps in rigging the accommodation ladder, you are ready to receive boats alongside. One of the marks of a smart efficient ship, when going to anchorage is not only the proper use of her ground tackle but the timely manner in which she has her accommodation ladders and boat boom rigged.

As previously mentioned, some accommodation ladders can be modified for use on a pier or barge. To do this, the lower platform and the H-Frame are left off, and a roller and a safety step are installed at the bottom of the ladder, as shown in figure 4-19. The safety step assembly eliminates the foot hazard caused by the ladder roller.

BOAT BOOMS

LEARNING OBJECTIVES: Define boat boom. Describe the purpose of the boat boom.

Ships that are at anchor, or are moored to a buoy, rig out their boat booms for the purpose of mooring their boats well clear of the side. This method of securing is known as “hauling out to the boom.” Forward booms are called lower booms, after booms are called quarter booms.

The boat boom (fig. 4-20) is a spar secured by a gooseneck to a pin on the side of the ship, which allows free motion fore and aft. The outboard end of the boom hangs from a wire and tackle combination called the topping lift. Nylon or wire rope forward and after guys control the fore-and-aft motion.

A strong line called a guess-warp leads from well forward on the ship, out through a block in the end of the boom, and ends in a metal thimble through which boats can reeve their bow lines. A toggle is seized between strands of the guess-warp above the thimble to keep it from running up (out of reach) when a boat lets go. One or more Jacob's ladders from the boom permit boat crews to come aboard.

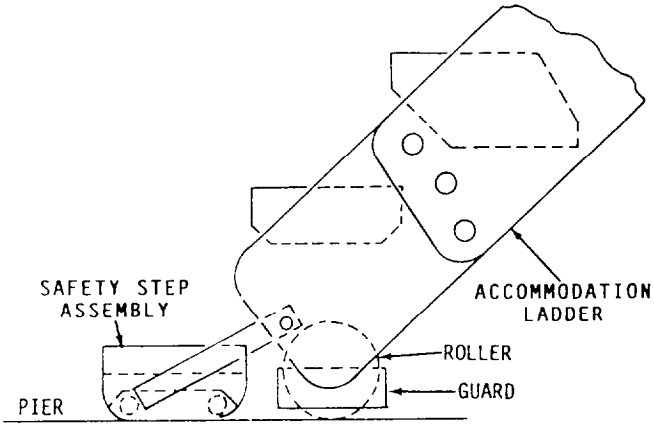


Figure 4-19.–Accommodation ladder rigged to pier.

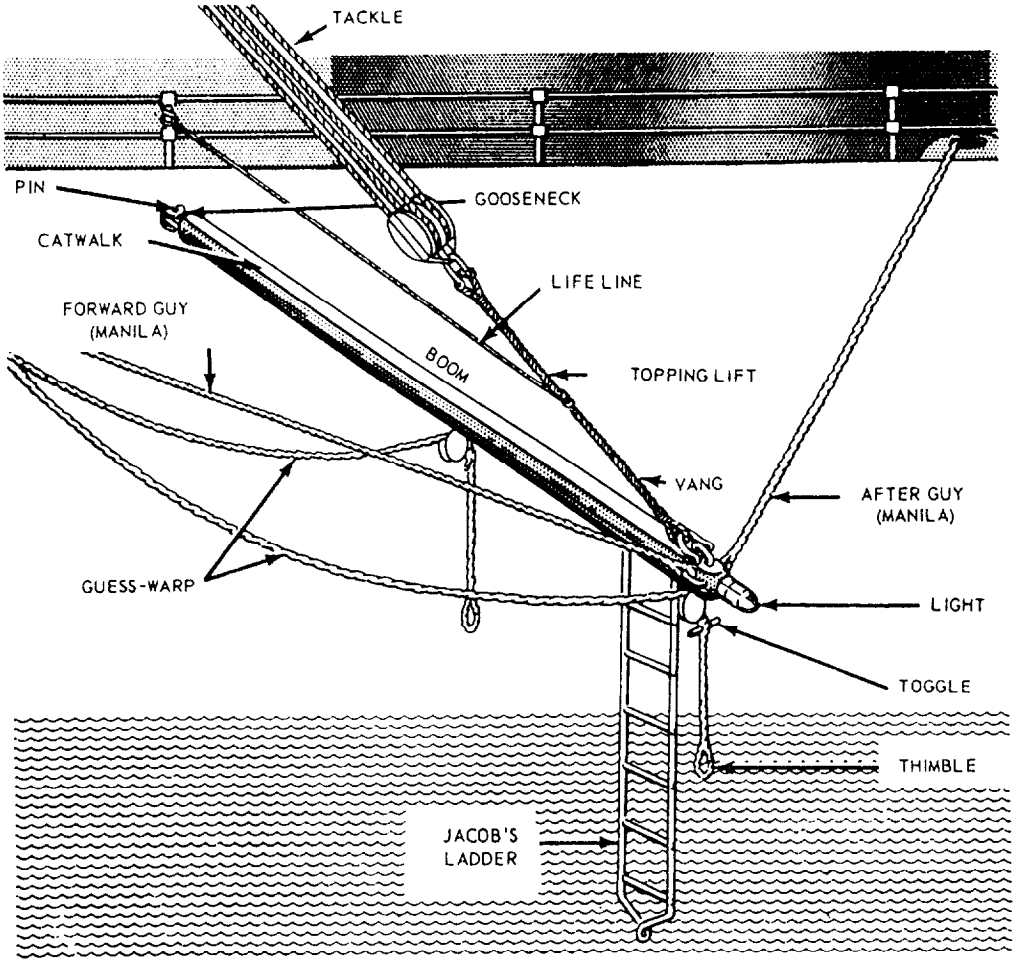


Figure 4-20.–Parts of a boat boom.

Rigging the boat boom is a simple matter. Ladder, guys, and guess-warp are attached, and the guys are led out fore and aft. The after guy usually is marked at the point where it secures, then it is made fast at this point first. Next, the boom is started out by a shove with a boat hook, or anything else suitable, and the forward guy is heaved around on until the after guy is taut and then secured.

You will find it easier to climb the Jacob's ladder hand over hand from one side, as you would climb a rope, instead of facing it as you would a rigid ladder. Be certain you have a good hold on the lifeline before you transfer from the ladder to the boom, and keep hold of it as you come in to the side. If you fall off, you are as likely to injure yourself against the boat as you are by falling in the water. Always wear a properly secured life jacket when traveling over the boom. You may be a good swimmer, but you cannot swim if you are unconscious.

In making fast to the guess-warp by the boat painter, always reeve the painter through the thimble and secure its end back in the boat, so you will not have to get at the thimble to let go. Always have the boat ride to a long lead on the painter. The shorter the painter, the more up and down the strain, and the more the boat's weight will come on the boom as it dives down on a swell.

CARGO-HANDLING EQUIPMENT

LEARNING OBJECTIVE: Describe cargo-handling equipment, including winches and hand signals used in the cargo handling evolution.

The Navy is always studying and experimenting to make all phases of cargo handling faster, safer, easier, and more economical. There are many ships designed for specific tasks that have rigs peculiar to those types. The following discussion on cargo-handling equipment is brief. For more detailed information, consult *Boatswain's Mate, Volume 1*, NAVEDTRA 10101, or *Naval Ships' Technical Manual,* chapter 573. Figure 4-21 shows you the typical rig for the yard-and-stay

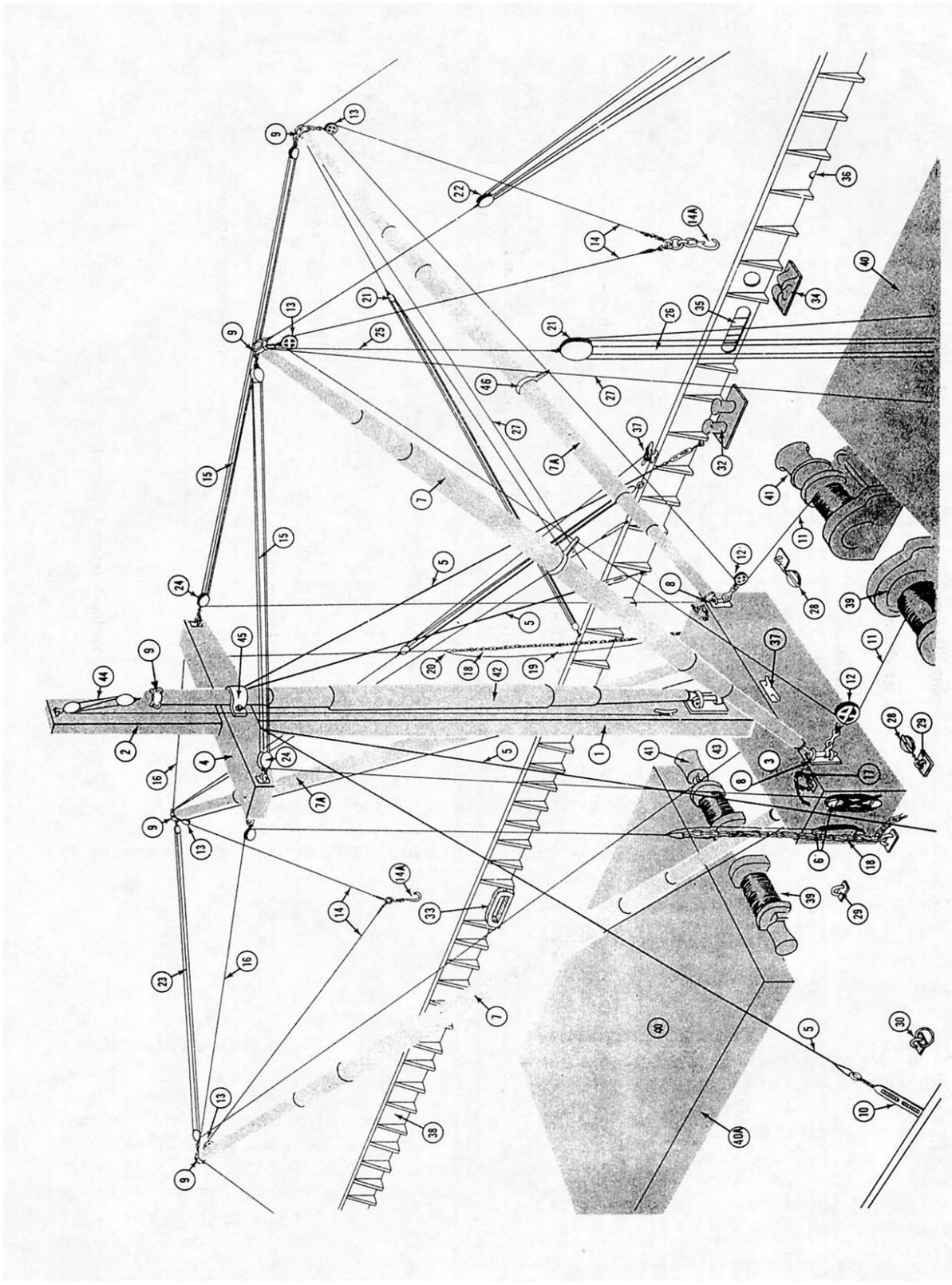


Figure 4-21.–Yard-and-stay rig.

1. Mast
2. Topmast
3. Mast table
4. Crosstree
5. Shroud
6. Topping lift cleat
7. Hatchboom
7A. Yard boom
8. Gooseneck
9. Linkband
10. Turnbuckle
11. Cargo whip
12. Heel block
13. Head block
14. Cargo whips
14A. Cargo hook
15. Topping lift (multiple)
16. Topping lift (single)
17. Stopper chain
18. Bull chain
19. Bull line
20. Flounder
21. Outboard guy
22. Inboard guy
23. Midship (schooner, lazy) guy
24. Topping lift block
25. Guy pendant
26. Guy tackle
27. Preventer
28. Snatch block
29. Pad eye
30. Pad eye and ringbolt
31. Shackle
32. Bitts
33. Closed chock
34. Open chock
35. Freeing port
36. Scupper
37. Cleat
38. Bulwark
39. Hatch winch
40. Cargo hatch
40A. Hatch coaming
41. Yard winch
42. Jumbo boom
43. Gooseneck and step of jumbo boom
44. Breasting-up tackle
45. Boom gate collar
46. Slack-wire fairlead

Figure 4-21.–Yard-and-stay rig-Continued.

method of cargo handling. Two booms are used. One boom plumbs the hatch, and it is called the hatch boom. The other boom is called the yard boom, and it is rigged over the side so that it plumbs the dock or pier. Booms are spotted in working position by hauling on the guys. The cargo whips coming from the hatch and the yard winches are run through heel and head blocks and are shackled to the same cargo hook. The outboard guys and preventers are balanced in proportion to the load and in the working position of the boom.

Cargo whips are shackled to the cargo hook, and a load is picked. The load is raised until the angle formed by the whips is about 120 degrees. The outboard guys and preventers are equalized by easing off the guy tackles. As outboard guys and preventers are being equalized, all slack is taken in on the inboard or midships guys. It is a good practice, when originally spotting the booms, to swing them slightly wider than desired. When guys and preventers are equalized, the booms will move inboard into position.

The winch controls for the yard and stay are usually located so that one person can operate both winches and have an unrestricted view of the hold. When you are moving a load from the hold to the pier, the yard whip is kept slack as the hatch whip hoists the load from the hold and clear of the hatch coaming. Then, when you heave around on the yard whip and pay out on the hatch whip, the load is moved across the deck and over the side. When the load is plumbed under the yard boom, the hatch whip is slacked off and the yard whip lowers the load to the pier.

Because topping and lowering booms are dangerous evolutions, safety is always emphasized. Personnel are cautioned to stay away from under the booms while handling operations are in progress. The deck should be kept as clear as possible of obstructions. A clean deck provides the safest working condition.

As a Seaman, you should always watch for discrepancies while a load is being moved, and keep every part of the rig under constant observation. No unnecessary personnel should be in the area. Those involved with the operation must stay alert.

CARGO WINCHES

Winches designed for handling cargo consist of a bedplate and side frames upon which are mounted a horizontal drum shaft, drum and/or gypsy head(s), reduction gearing, and usually the motor that drives the winch. Figure 4-22 illustrates the components of a typical winch. *Drum winches* are those with drums on which the rope is wound for raising, lowering, or pulling the loads. *Gypsy winches* have one or two horizontally mounted gypsy heads around which turns of line can be taken. *Combination winches* are drum winches with shafts extended to take gypsy heads on either side or on both sides. Preceding every winch operation, operators should review all general operating and safety instructions, among which are the following:

1. Always inspect the area around the winch, and make sure there is a dry, safe place for the winch operator to stand.

2. Inspect the rigging, making certain that the standing rigging is taut and that the running rigging is not fouled.

3. Inspect the equipment, making sure the clutch levers are locked in place.

Although the engineering department is responsible for maintaining winches, the winch operator and the petty officer in charge must make certain that the required maintenance is actually performed.

Coordination is essential for good winch operation. After sufficient practice, winch operators should be able to pick a draft from the hold and deposit it on the pier in one smooth, constant motion. However, during the early stage of training, the draft should be handled with three distinct movements: hoisting, moving, and lowering. In hoisting, one winch supports the entire load and the other maintains slack. When the draft is clear of the rail or coaming, it is carried across the deck by both winches. This is called moving. When a draft is in position to be lowered, the other winch supports the entire load and the first whip is slacked. It is vital that the right amount of slack be left in the nonworking whip during the hoisting and lowering phases of the load's cycle. If the whip is kept too tight, the draft will strike against the side of the ship or the coaming of the hatch. If the whip is allowed excess slack, loose turns will pile up on the drum of the winch, and these must be rewound before operations are resumed.

When cargo is being hoisted or lowered, swinging should be avoided if possible. A wildly swinging draft often results in damaged cargo and endangers the lives of personnel working in the hold, on deck, or on the pier. Swinging can usually be prevented in the hold or on the pier by dragging or touching the draft until it is directly under the head of the boom before hoisting. Occasionally, a draft will start to swing athwartships while being carried across the deck This swinging must be stopped before the load can be landed. It can be done easily with a little practice. When moving outboard, wait

until the draft is at the highest point of its arc swinging outboard, then slack the hatch whip quickly so the slings supporting the draft assume the usual perpendicular position. For safety reasons, you should practice stopping the swing of a draft with an empty pallet.

At least two steadying lines should be attached to heavy or unwieldy loads. These should be handled by personnel in the hold until the load is hoisted above the coaming, then passed simultaneously to personnel on deck.

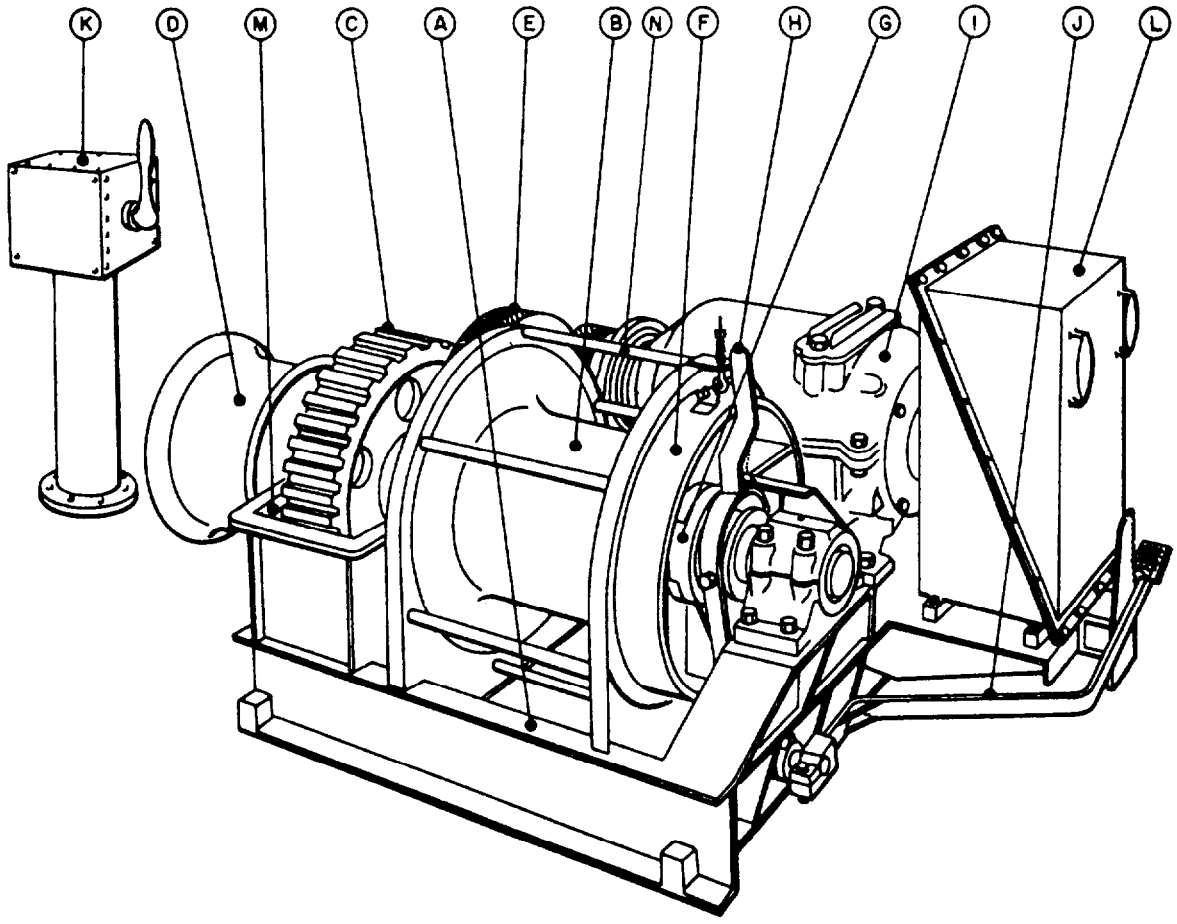
HAND SIGNALS

Hand signals to winch or crane operators by Signalmen provide continuous communications. The approved hand signals, shown in figure 4-23, are found in the *Naval Ships' Technical Manual* (NSTM). These hand signals are used when you are conducting crane operations afloat. Additional hand signals may be necessary for specific commands; however, no signal used should conflict with, or alter the meaning of, the hand signals contained in the *Naval Ships' Technical Manual.*

UNDERWAY REPLENISHMENT (UNREP)

LEARNING OBJECTIVES: Define underway replenishment (UNREP). Explain the various equipment used during an underway replenishment.

Underway replenishment (UNREP) is a broad term applied to all methods of transferring fuel, munitions,



A. Bedplate
B. Drum
C. Drum gear
D. Gypsy head
E. Reduction gearing
F. Drum brake
G. Drum clutch
H. Clutch lever
I. Drive motor
J. Drum brake lever
K. Speed control
L. Electric brake
M. Oil bath
N. Rope guard

Figure 4-22.–A typical winch.

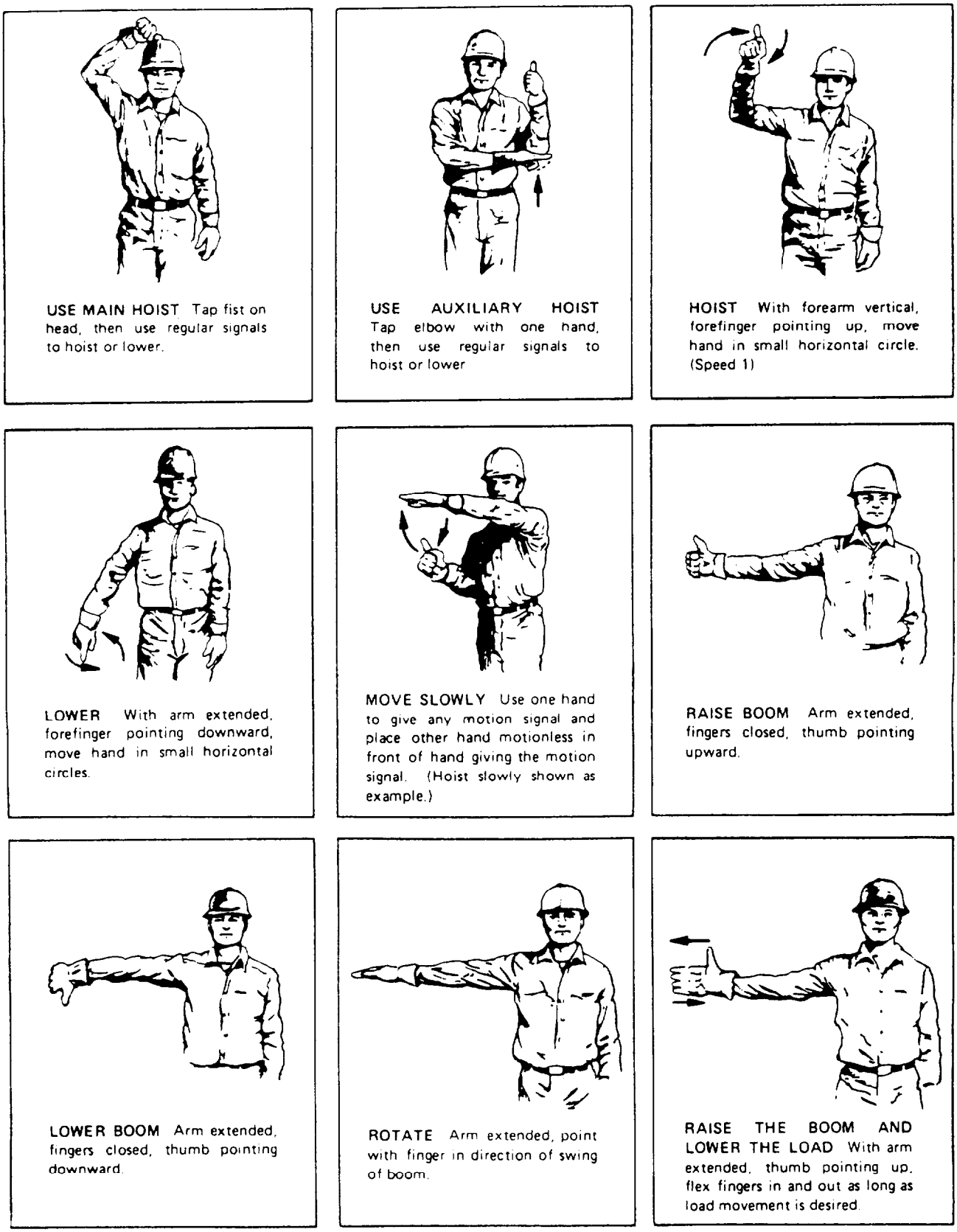
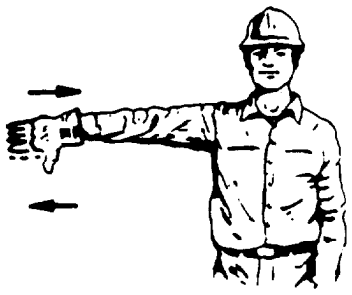
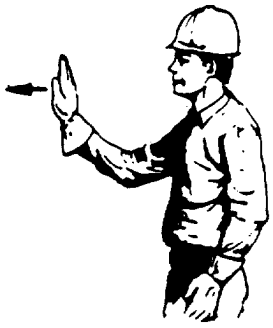


Figure 4-23.–Hand signals used in crane operations, sheet 1.

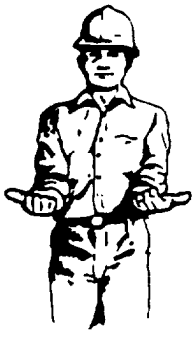


LOWER THE BOOM AND RAISE THE LOAD With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.



TRAVEL THE CRANE OR BRIDGE Arm extended forward, hand open slightly raised, make pushing motion in direction of travel.

TRAVEL THE TROLLEY Palms up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.



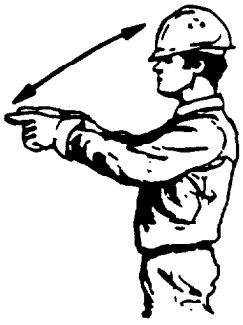
EXTEND BOOM (Telescoping Booms.) Both fists in front of body with thumbs pointing outward.

RETRACT BOOM (Telescoping Booms.) Both fists in front of body with thumbs pointing inward.

STOP Arms bent upward, fists clenched. When giving independent signals with each arm, a clenched fist on that shall be used to stop the respective crane motion.

EMLRGENCY STOP Arms bent upward, fists clenched. Pump arms up and down. This signal stops all crane motion in progress.

DOG EVERYTHING Clasp hands in front of body. (Set the brakes, place crane controls in neutral; load handling temporarily secured.)



SIGNALMAN TRANSFER Tap sides of helmet with both fists, then point to new signalman; repeat.

Figure 4-23.–Hand signals used in crane operations, sheet 2.

supplies, and personnel from one vessel to another while ships are underway. The term *replenishment at sea*, formerly used in this sense, applies to all methods except those for fueling at sea.

Before the techniques of UNREP were developed, a ship that ran low on fuel, supplies, or ammunition had to return to port, or the fleet had to lie to while the ship was partially replenished by small boats. If several or all the ships were in need, the whole fleet had to return to port. The disadvantages were obvious. The effectiveness of a fleet was reduced by every ship that had to leave, and a ship or small group of ships detached from a fleet were in greater danger of being sunk or captured. A fleet lying to in order to replenish was more vulnerable to attack, and a fleet heading back to port left the way open for an enemy fleet to accomplish its mission. With underway replenishment, a whole fleet can be resupplied, rearmed, and refueled in a matter of hours while proceeding on its mission.

The first significant replenishment operation ever performed at sea by the U.S. Navy was in 1899, when the U.S. Navy collier *Marcellus*, a coal carrier, while towing USS *Massuchusetts*, transferred coal to it. Since that time, many methods have been tried and abandoned. Those methods described in this section have been adopted as the most feasible and are currently used in the fleet.

The equipment and procedures used in replenishment operations are only briefly described in this section. They are discussed in more detail in *Boatswain's Mate, Volume 1*, NAVEDTRA 10101; and "Replenishment at Sea," NWP 14 (series).

Two general methods of UNREP are used: connected replenishment (CONREP) and vertical replenishment (VERTREP). They may be used singly or at the same time. In CONREP, two or more ships steam side by side, and the hoses and lines used to transfer the fuel, ammunition, supplies, and personnel connect the ships. VERTREP is carried out by helicopters. The ships may be in the proximity or miles apart, depending on the tactical situation and the amount of cargo to be transferred. CONREP concerns two processes: refueling and resupply. In fueling at sea (FAS), fuel is pumped from a delivering ship that may be a replenishment oiler (AOR), oiler (AO), fast combat support ship (AOE), or a large combat ship. Other replenishment ships, such as the combat store ship (AFS) and the ammunition ship (AE), can deliver lesser amounts of fuel, since their primary purpose is to deliver solid cargo (supplies and ammunition) by the methods now referred to as replenishment at sea (RAS).

The most common refueling rigs are the span-wire and the close-in rigs. Both rigs, and other variations, will be discussed in more detail later in this chapter. The span-wire rig has several variations: single hose, double hose, and probe. The span wire may be either tensioned or untensioned. Tensioning the span wire is accomplished by a ram tensioner. A tensioned span wire or highline, as it is called in RAS, is also used when the standard tensioned replenishment alongside method (STREAM) of transfer is used. STREAM transfer consists of an all-tensioned rig, highline, outhaul, and inhaul. The method of fairleading the outhaul is a traveling standard UNREP fixture (traveling SURF). The SURF is used with two STREAM rigs, the regular traveling SURF and the SURF traveling–actuated remotely (STAR) rig. STREAM with tension highline has an alternate method when the UNREP ship experiences difficulties with the outhaul winch. This rig is called a Burton outhaul and is sent to ships having Burton whip capabilities.

Other common methods of RAS include manila highline, Burton housefall, and modified housefall.

You must be familiar with the various equipments and procedures used during replenishment. Making rough sketches of the equipment and labeling the various parts might help you to remember the various rigs.

The illustrations in this section, and the procedures described, are representative only. For example, many items of rigging, such as guys and preventers, have been omitted from illustrations for clarity. Consult NWP 14 and the *Underway Replenishment Hardware and Equipment Manual* to determine the details of rigging and the personnel and tools required for each rigging situation. Ship's plans show rigging details, while the ship SORM fixes responsibility for the various functions to be performed.

The *Underway Replenishment Hardware and Equipment Manual* provides a catalog of the equipment used in the transfer of solid cargo and bulk fluids, and a description of the methods used in UNREP. The manual permits the user to identify the equipment and establishes the intended use. It also makes reference to additional detailed technical information related to the configuration, operation, maintenance, safety features, installation, and procurement of UNREP equipment.

Your worth as a Seaman will be judged largely on how you conduct yourself during evolutions, such as fueling at sea. Make sure that every piece of gear required is at your station. Do not forget such things as

buckets and drip pans, rags for wiping up spilled oil, buckets of sand to spread on slippery decks, spare stops, etc.

It is the responsibility of the officer in tactical command (OTC) to select a suitable course and speed, taking into consideration the mission of the group and the condition of the sea.

Generally, the delivering ship takes station, and the receiving ship maneuvers to come alongside and maintain position during the operation. When replenishing large CVs, however, replenishment ships may complete the final phase of the approach, because of obstructions to view from the bridge of aircraft carriers. During replenishment, individual flaghoists are displayed as shown in figure 4-24.

Because of the danger of hitting aircraft on deck, CVs, LPHs LHAs, and other ships with aircraft on deck fire the shot lines to the delivering ships.

Except for the gear actually rigged on the receiving ship, such as fairlead blocks and riding lines, and for the distance line and Burton whips, the delivering ship furnishes all the equipment. An exception to this practice is when carriers and cruisers are alongside replenishment ships and personnel are to be transferred.

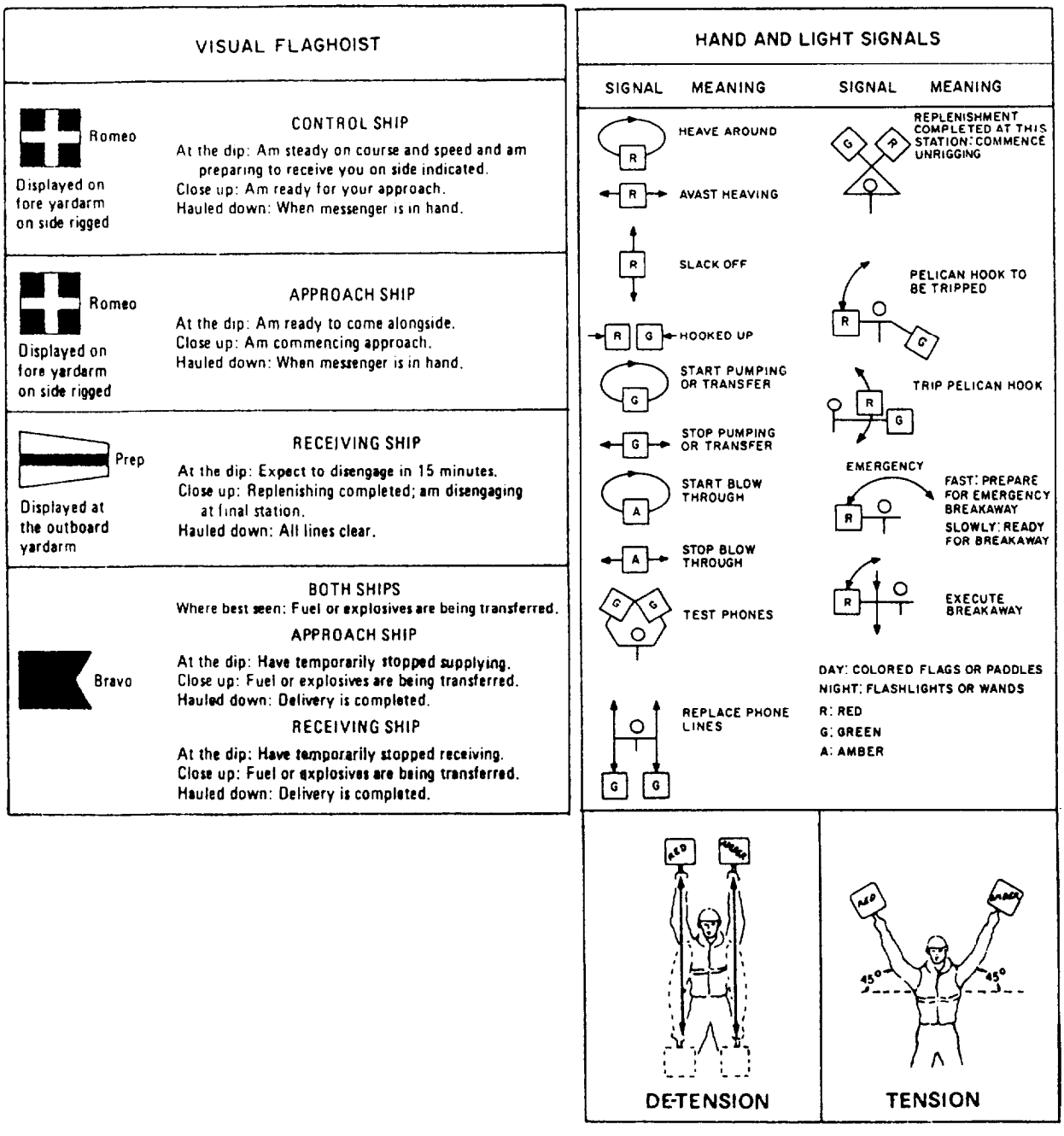


Figure 4-24.–Replenishment operations signals.

In this case, the combatants must furnish and tend the highline.

Each replenishment station has a telephone line to the corresponding station on the other ship. Necessary commands are transmitted by telephone, and a Signalman also gives them by the hand or by light signals as shown in figure 4-24. It is a good idea to post these hand signals at the replenishment stations or, better yet, to stencil them on the backs of the paddles.

PHONE/DISTANCE LINE

The zero end of the distance line (fig. 4-25) is secured at or near the rail of the delivering ship, and the other end is hand-tended on the receiving ship. Embedded in the polypropylene distance line are the conductors for the sound-powered (S/P) telephone line, which provides the communication link between the bridges of the two ships.

A bridge-to-bridge (B/B) combination phone/ distance line and station-to-station line are normally provided by the receiving ship. The line is fitted with a double jackbox at each end labeled B/B PHONE. Markers attached to the line indicate the distance between ships, enabling conning officers to know immediately when the ship is opening or closing distance. Daylight markers (marker flags) consist of 8-inch by 10-inch numbered colored cloth, nylon-coated fabric, or painted canvas squares spaced 20 feet apart. At night, a red flashlight or red chemical light is fastened at the leading edge of each daytime marker with the exception of the blue lights indicated in figure 4-25. The zero end of the line is secured to the rail of the delivery ship at a right angle to the ship's centering in view of the conning officer. During night replenishment, the line tender keeps the conning officer informed on the distance.

Electric megaphones are used during the approach until telephones are connected. After the telephones are connected, the megaphones are the main standby method of communicating.

SOUND-POWERED TELEPHONES

Sound-powered telephones are the principle means of passing information Although the receiving ship

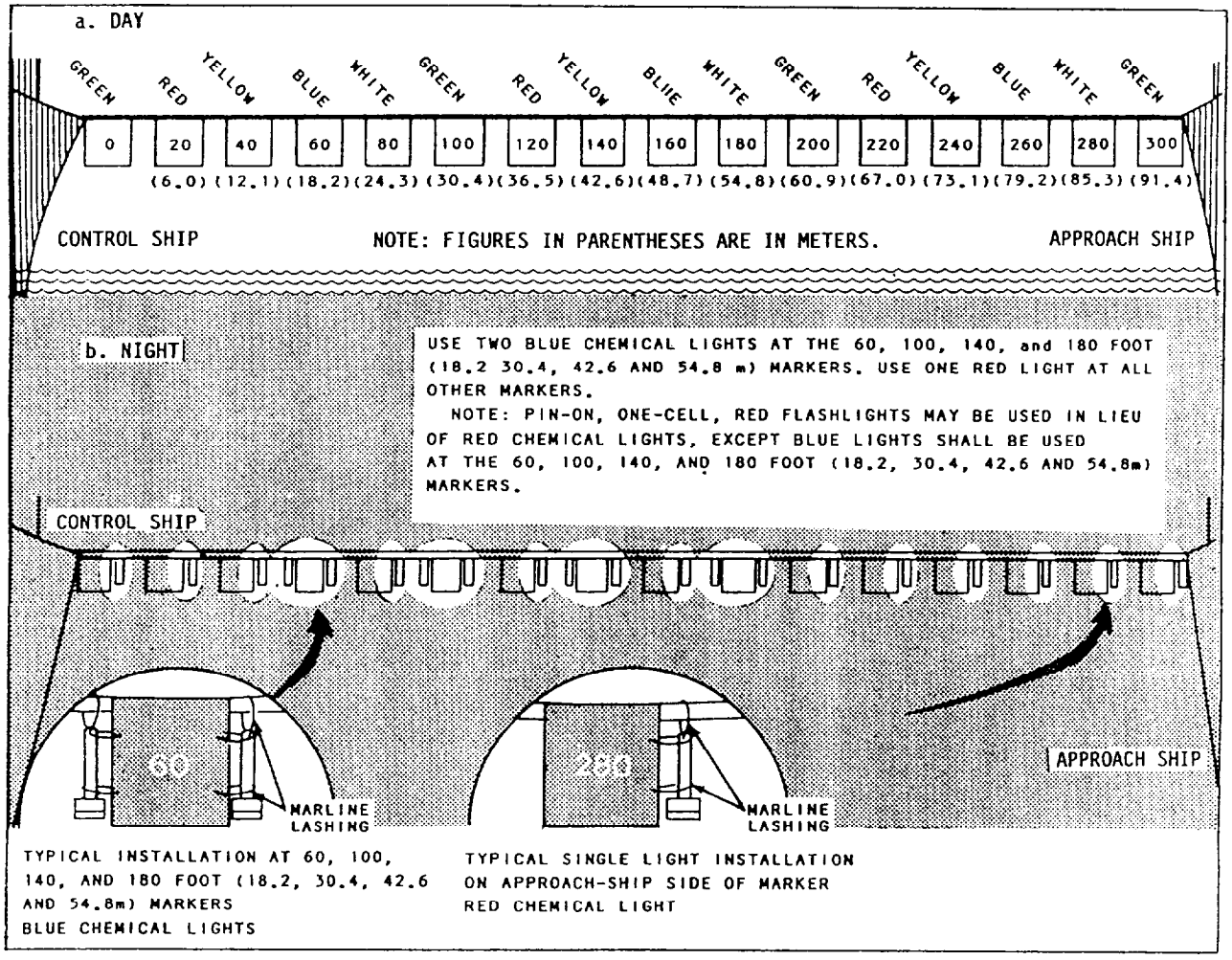


Figure 4-25.–Bridge-to-bridge phone/distance line markings.

normally provides individual telephone lines between conning stations, either ship may provide station-to-station phone lines for use between transfer stations. Talkers must ensure that telephone leads are ready to establish communications as soon as jackboxes are received aboard. To prevent injuries resulting from rapid surging of ships while they are alongside, talkers on the intership lines do not wear telephone neck straps; the telephone lines are hand-tended.

Careful attention should be given to the matter of jackbox covers. They must be secured tightly by wrapping the phone boxes in plastic bags when the telephone lines are being passed between ships. Experience shows that a replenishment-at-sea operation can be slowed by lack of attention to this small, but vital, detail. Hand paddle and light signals at replenishment stations parallel orders passed over the sound-powered telephones. During daylight, replenishment station Signalmen render hand signals with 12- by 12-inch paddles; at night, red, green, and amber flashlights or colored wands are used.

At each replenishment station both ships indicate the commodity being handled.

LINE-THROWING GEAR

Line-throwing guns or bolos are used to pass shot line between ships. Normally, this is done by the delivery ship except for carriers and other ships with aircraft on deck. The line-throwing gun fires an illuminated projectile. The bolo, which is preferred for passing the shot line in daylight, consists of about 10 ounces of lead with rounded corners. It is well padded, encased in rubber or leather, and attached to the end of a nylon shot line. A 2-inch toggle is secured to the line about 5 feet from the weight. To use the bolo, you must grasp the toggle and whirl the weight about your head several times to gain momentum before letting go. Utmost caution should be exercised when a line-throwing device is used because of the potential for possible injuries to personnel. A shot line is returned at the earliest possible time to facilitate preparation of the line for another relay, if needed.

Line-throwing gunners and bolo heavers must be well trained, and they must be outfitted in red helmets and red jerseys or red vests. Before firing or heaving the lines, the word is passed on both ships over the 1MC and/or by electric megaphone (bull horn) as follows:

FIRING SHIP: "ON THE (name of receiving ship), STAND BY FOR SHOT LINES. ALL HANDS TOPSIDE TAKE COVER."

RECEIVING SHIP: "ON THE (name of own ship), STAND BY FOR SHOT LINES AT (station(s) concerned). ALL HANDS TOPSIDE TAKE COVER."

Before firing the shot, each station on the delivering ship sounds one blast on a whistle. When ready to receive the shot line, each station on the receiving ship replies with two blasts. These two signals must be sounded each time the shot line is fired. The messenger is the main line used in hauling a rig between ships.

If the delivering ship has difficulty getting its shot lines across, the receiving ship uses its own line-throwing guns when requested to do so by the delivering ship. The shot or bolo lines are used to haul over the messengers and then passed back at the earliest convenience to the ship furnishing them.

Replenishment stations are marked according to the commodity delivered or received. These station markers are shown in figure 4-26.

	CODE		
COMMODITY TRANSFERRED	DAY 3 ft² (91.4 cm²) BUNTING OR PAINTED AREA		NIGHT LIGHT BOX
MISSILES	INTERNATIONAL ORANGE		
AMMUNITION	GREEN		
FUEL OIL	RED		
DIESEL OIL	BLUE		
DIESEL FUEL MARINE (DFM)	RED & BLUE TRIANGLES		
JET FUEL (JP-5)	YELLOW & BLUE TRIANGLES		
WATER	WHITE		
STORES	GREEN WITH WHITE VERTICAL STRIPES		
PERSONNEL AND/ OR LIGHT FREIGHT	GREEN WITH WHITE LETTER "P" CENTERED	P	
FUEL OIL AND JP-5	RED/YELLOW & BLUE TRIANGLES		
DFM AND JP5	RED/BLUE & YELLOW/ BLUE TRIANGLES		
BRIDGE-TO-BRIDGE PHONE/ DISTANCE	GREEN WITH WHITE LETTER "B" CENTERED	B	

Figure 4-26.–Station markers.

A complete set of working tools and repair equipment must be maintained in a location that can be readily accessed by transfer station personnel. Tools and equipment should be inventoried and checked for proper operation before each replenishment. Each transfer station should maintain, as a part of station equipment, a listing of all items (tools, spares, and so forth) that may be required to repair the station, together with the stowage location of such items.

REPLENISHMENT RIGS

LEARNING OBJECTIVE: Identify the common replenishment at sea and fueling at sea rigs.

Replenishment at sea is conducted by using a span wire to support the fuel hose rig between the two ships. The span-wire rig or close-in method may be used. The method used is determined by the type of ship delivering the fuel and the conditions under which the delivery must be made. The main difference between the rigs is in the method of extending the hose to the receiving ship. Of the two, the span wire is preferred.

Ships not equipped to transfer by span wire must do so by the close-in method.

SPAN-WIRE METHOD

In the span-wire method of fueling at sea, the hose is carried between ships on a span wire that may be tensioned or untensioned. The untensioned span wire, normally is referred to as the conventional span-wire rig. The tensioned span-wire method is referred to as STREAM. STREAM rigs are rigged with four saddles and a hose length of approximately 300 feet. The hose hangs from trolley blocks that ride along the span wire. Saddle whips position the hose while fueling, and serve to retrieve the hose after the fueling operation is completed.

The span-wire rig (see fig. 4-27) permits ships to open out from 140 to 180 feet. Such distance is reasonably safe and makes it fairly easy to maneuver

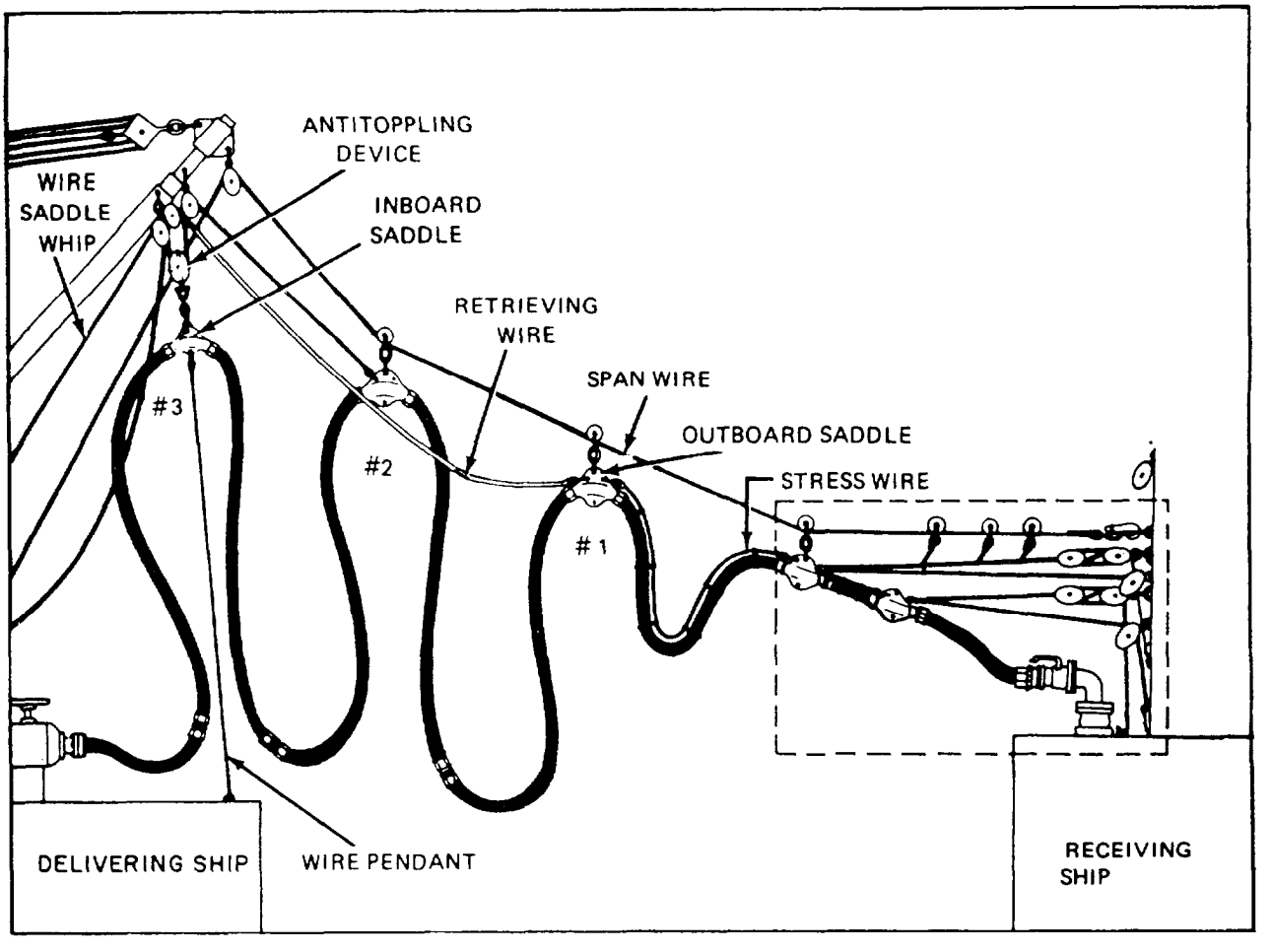


Figure 4-27.–Fuel stream, single hose with probe.

and keep station. These factors not only allow commanders a wider latitude in choosing a fueling course but also facilitate the use of antiaircraft batteries should the need arise. Additionally, the high suspension on the hose affords fair protection for it in rough weather.

Ordinarily, in the span-wire method, saddle whips and the retrieving line are of wire; but when the necessary winch drums are not available and winches with gypsy heads are available, 3 1/2-inch, double-braided nylon line may be substituted for one or more of the whips. A wire rope retrieving whip is mandatory in double-probe rigs.

CLOSE-IN METHOD

As stated before, the close-in method of fueling is used when the delivering ship is not equipped with the span-wire rig or the receiving ship does not have a pad eye strong enough to hold a span wire.

In the close-in rig, the hose is supported by whips leading from the hose saddles to booms, king posts, or other high projections on the delivering ship. When the rig is used to fuel ships larger than destroyers, the outboard bight of hose may also be supported by an outer bight line (fig. 4-28) leading from the outboard saddle to a high point on the receiving ship. The outer bight line is passed to the receiving ship by means of the hoseline messenger.

On the receiving ship, the same preparations are made as for receiving the span-wire rig except that an additional 12- or 14-inch snatch block must be shackled to a high, convenient, and adequately tested point above where the hose will come aboard. Such other blocks as are necessary to fairlead the bight line to a winch must also be rigged. A small pendant should be reeved through this set of blocks to quickly haul the outer bight line through the blocks and to the winch. The outer bight is used to help haul the hose to the receiving ship and, once the hose is secured, is tended in the same manner as are the saddle whips.

STREAM METHOD

There are several transfer rigs used to replenish provisions and stores. Some are suitable for heavy

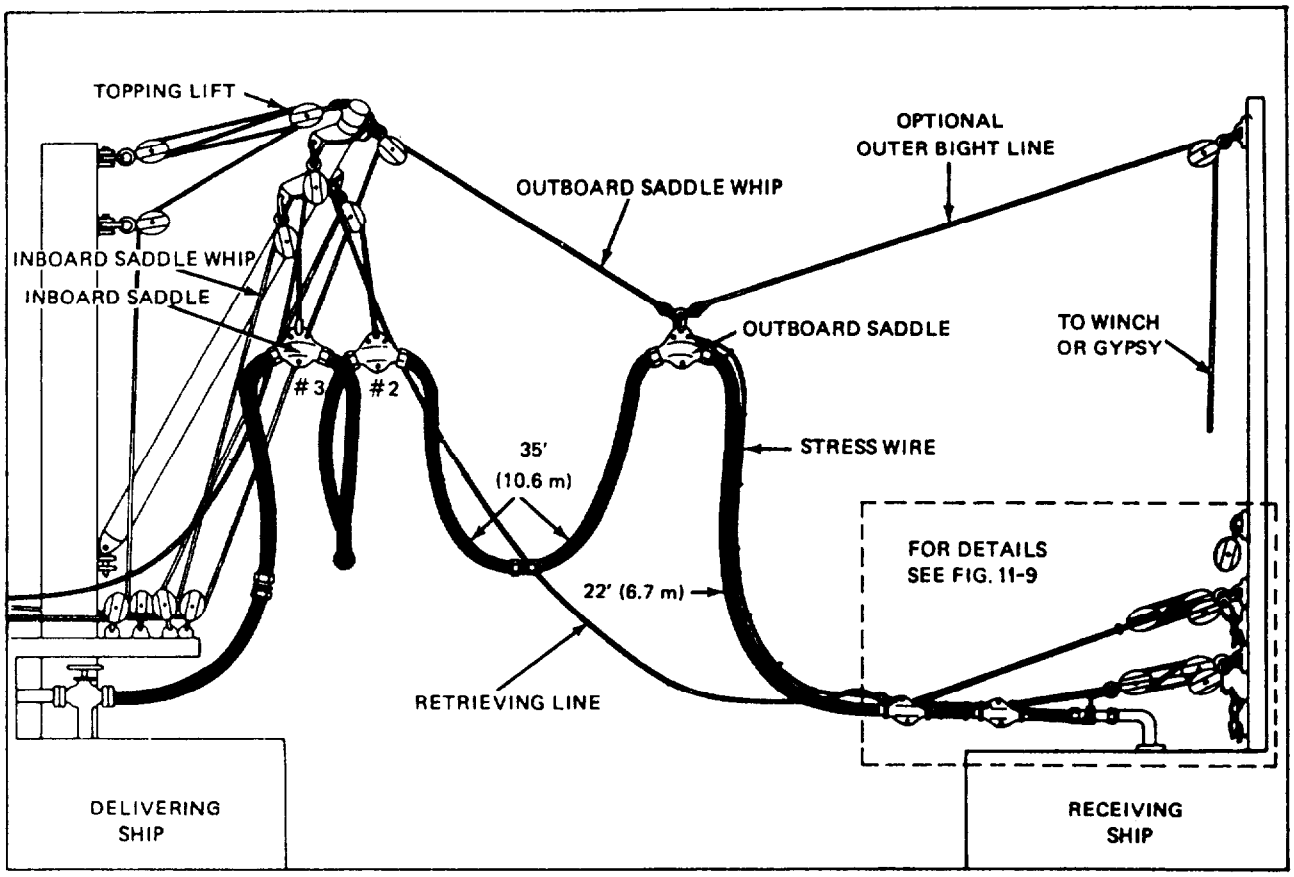


Figure 4-28.–Close-in rig.

loads, while others can be used only for light cargo or personnel transfer. Standard rigs, named here only for familiarization purposes, include the Burton, housefall, and highline.

The standard transfer replenishment alongside method (STREAM) is a high-speed, transfer method developed for transferring cargo and missiles between ships at sea. Passing a STREAM transfer rig is done in much the same manner as passing other rigs. During transfer, the missile is suspended from a combination strongback and trolley. The fundamental difference between STREAM and the conventional methods is the preset and controlled tension in the highline wire that allows STREAM to handle loads up to 9,000 pounds. A brief description of the major STREAM equipment follows.

Ram Tensioner

The ram-tensioned system employs an air-hydraulic ram unit to maintain constant tension on the span wire or highline, thus improving load control. An electronic control system assists the winch operator in maintaining desired tension on the ram-tensioned high-line. The ram tensioner consists of a large hydraulic cylinder (the piston acts as the ram), an air compressor, an accumulator, and air flasks. The highline is reeved through a movable block on the piston and a fixed block on the cylinder and then passed to the highline winch. Air from nearby flasks keeps pressure on a piston in the accumulator cylinder, from which the pressure is transmitted to the ram. As tension on the highline or span wire is relaxed, pressure in the system causes the ram (piston) to extend, taking up the slack.

Sliding Block

The sliding block travels vertically on a king post of the delivery ship. The sliding block lifts the transfer load above bulwark obstructions before transfer. The highline is reeved through the sliding block.

Sliding Pad Eye

The sliding pad eye travels vertically on a king post or bulkhead on the receiving ship. Its function is to pick up and lower loads to the deck of the receiving ship. Other devices are available with STREAM that can perform a similar function.

Various items of specialized equipment have been designed for the STREAM system. These are used to handle missiles and other large or delicate ordnance. STREAM equipment in this category includes missile strongbacks, dollies and adapters.

BURTON METHOD

Essential elements of the Burton rig are two winches and two whips, one each in each ship. The outer ends of the whips are shackled to a triple-swivel cargo hook, and the load is transferred by one ship paying out on its whip while the other ship heaves in on its whip. A single Burton can transfer loads up to 6,000 pounds.

There are various ways of rigging the delivering ship. Normally, the boom to the engaged side is used for the actual transfer and, with the boom on the opposite (or unengaged) side, for hoisting cargo from the hold. Another Burton method, may be used to transfer cargo when only one set of booms and winches is available at the active hatch.

Burton whips are of 6 x 37, high-grade plow-steel wire rope, 3/4 inch in diameter and 800 feet long. One is tended on the delivering ship and one on the receiving ship. Each ship furnishes its own whip.

SYNTHETIC HIGHLINES

Synthetic highlines are used to exchange personnel, light fleet freight, and mail during scheduled replenishments or as an independent operation.

WARNING

The maximum safe load for transfer by synthetic highline is 600 pounds.

EMERGENCY BREAKAWAY

During underway replenishment, an emergency situation may arise that requires an emergency breakaway. An emergency breakaway is an accelerated standard breakaway, using an orderly and prearranged procedure. The objective is to disengage quickly without damaging the rigs or endangering personnel.

Examples of conditions that warrant ordering an emergency breakaway are as follows:

- When either ship experiences an engineering casualty that affects its ability to maintain the replenishment course or speed
- When an enemy contact is reported that presents immediate danger

- When a carrier must break off for an emergency launch or recovery of aircraft

- When ships separate to the point where hoses appear in danger of parting; when separation distances cause wires to approach the last layer on the winch drums;, or when a casualty or equipment failure may result in a tightline condition

- When a rig parts and there is a possibility that the screw will become fouled

- When a person is lost overboard and a lifeguard ship or helicopter is not on station

The order for an emergency breakaway may be given by the commanding officer of either the receiving ship or the delivery ship. Once initiated, the delivery ship will assume control and initiate proper hand signals with appropriate parallel information on the sound-powered phones to the receiving ship. Most important in the execution of an emergency breakaway is to allow sufficient time for the ships to disconnect the rigs in an orderly manner.

Sound-powered phones and hand signals should be the primary means of communication for ordering an emergency breakaway, because of the minimal amount of noise generated. However, 1MC, bull horns, and voice radio circuits should be used, if necessary, to ensure rapid ship-to-ship communications.

The danger signal (at least five short blasts) will be sounded by the ship initiating the emergency breakaway to alert all ships in the vicinity. In sounding five short blasts on the whistle to alert ships near emergency breakaway, due regard should be taken of (1) the tactical situation, (2) the effect on increased noise levels on conning officer-to-helmsman communication, and (3) the disruption to intership and intraship sound-powered phone communications caused by whistle signals. Radio, or even visual means, may be preferred to whistle signals to notify ships in company. Authorization and/or coordination for nonuse of whistle signals should be affirmed between ships involved in the underway replenishment and the officer in tactical command (OTC) before commencement of the underway replenishment.

The OTC and other ships in the formation should be informed immediately of the emergency via voice radio if security permits. Amplifying details must be relayed as soon as possible thereafter. When a condition warranting an emergency breakaway is recognized, the following actions should be taken:

1. Notify the following intraship stations of conditions or situations that require execution of an emergency breakaway:

- Bridge (initiate the danger signal by radio or visual means, if prearranged, or by sounding five short blasts on the ship's whistle)

- Cargo control center

- Fuel control center

- Fueling stations

- Cargo stations

2. Pass the word between ships according to prescribed procedures for the following:

- Bridge to bridge for all ships alongside

- Station to station

- Bridge to OTC and other ships in formation (security permitting)

3. Stop all transfers.

4. Retrieve rigs in accordance with prescribed procedures.

5. When all lines have been released by the receiving ship, both ships maneuver as appropriate to get clear.

VERTICAL REPLENISHMENT (VERTREP)

LEARNING OBJECTIVE: Define vertical replenishment (VERTREP). Identify the time when vertical replenishment is used,

Since vertical replenishment (VERTREP) is discussed extensively in Boatswain's Mate, Volume I, NAVEDTRA 10101, it will be discussed only briefly here.

Vertical replenishment (VERTREP) uses a helicopter to transport cargo from the deck of an underway replenishment ship to the deck of the receiving ship. VERTREP augments or, in some cases, replaces connected replenishment. It can be conducted with the receiving ship alongside during connected replenishment, over the horizon in an ASW screen, firing gunfire support, or at anchor anywhere within range. Range depends upon the helicopter, flying conditions, and the load.

Cargo can be carried internally, but the preferred method is to sling it externally since this method is faster and provides more flexibility. Internal cargo is restricted to cargo that can be handled by an internal winch with a capacity of 600 pounds. Depending on the helicopter and flying conditions, up to 7,000 pounds can be carried externally.

The majority of VERTREP cargo-handling items are identical to, or are adaptations of, ordinary cargo-handling equipment. For example, the forklift and pallet trucks, wooden and metal pallets, and nylon cargo nets used for VERTREP are the same as those used in ordinary cargo-handling operations. Other items that may not be so familiar are cargotainers, cargo wraparounds, special hoisting slings, and various missile containers and dollies.

The same procedures used during the day are used during nighttime VERTREPs, except that increased caution and precision are required. The primary difference between a day and night VERTREP is a reduction in the speed of operations, due to decreased visibility. Ships must be certified and authorized to take part in night VERTREP, and only those with proper lighting will be certified.

GENERAL REPLENISHMENT SAFETY PRECAUTIONS

LEARNING OBJECTIVE: Describe the safety precautions to be observed during underway replenishment (UNREP).

Persons assigned to replenishment stations must be thoroughly schooled in safety precautions and should be so well trained that they observe them almost automatically. Unfortunately, people tend to be careless, particularly when doing familiar tasks. A primary consideration in every shipboard evolution is the safety precautions required, depending upon the equipment used. Additionally, safety precautions must be reviewed immediately before each replenishment and must be observed. Following is a list of general safety precautions according to NWP 14.

- Only essential personnel should be allowed at a transfer station during replenishment.
- Lifelines should not be lowered unless absolutely necessary. If lowered, temporary lifelines must be rigged. Temporary lifelines should be a minimum of 2 inches (50.8 mm) in circumference.
- When the shot line is passed with a line-throwing gun the procedures set forth in NWP 14 are to be followed.
- Personnel assigned to each transfer station, including line and cargo handlers, should remove rings, watches, and other jewelry that could inadvertently be caught in the rigs, blocks, lines, or cargo.
- Personnel must be instructed to keep clear of bights, to handle lines from the inboard side, and to keep at least 6 feet (1.8 m) from the blocks through which the lines pass. If practical, personnel should be forward of the span wire or highline.
- Line-throwing gunners should wear red jerseys or red vests, and Signalmen should wear green jerseys or green vests. Jerseys should be worn under life jackets and vests should be worn over life jackets if personnel are in the water.
- Personnel should be cautioned to keep clear of a suspended load and to stay clear of the rig's attachment points until the load has been landed on deck. Personnel must remain alert and never turn their backs to any load.
- Be careful to prevent the shifting of cargo that might endanger personnel or material.
- Span wires, whips, and wire highlines should be secured to winch drums by one wire rope clip, or specially designed clamp, to lessen the possibility of damage should an emergency breakaway be necessary.
- Deck spaces near transfer stations must be covered with nonskid to provide secure footing.
- Both the delivering and receiving ships must station a lifebuoy watch well aft on each engaged side. The watch must have S/P phone communications with the bridge and must be equipped with two smoke floats and a 24-inch (60.9-cm) ring buoy fitted with a float light.
- All hands must be instructed on the hazards of emergency breakaway.
- Phone talkers on intership phone lines must not fasten their neck straps.
- Cargo handlers should not step on or in a cargo net attached to a cargo hook.
- Personnel involved in VERTREP must wear protective clothing and safety devices as indicated in NWP 14 and NWP 42.

• Easing-out lines, when appropriate, must be rigged immediately upon rig hookup to prepare for a possible emergency breakaway.

• Personnel in the immediate area of the transfer station must wear construction-type safety helmets, equipped with quick-acting breakaway devices. Chin straps must be fastened and worn under the chin. Safety helmets will be color-coded as follows:

WHITE— Officers, CPOs, and supervisors

WHITE (with green cross)— Safety Officer

YELLOW— Rig captain

GREEN— Signalmen and phone talkers

BROWN— Winch operators

PURPLE— Repair personnel

RED— Line-throwing gunners (or bolo heavers)

WHITE (with red cross)— Corpsmen

BLUE— Deck riggers and line handlers

ORANGE— Checkers and supply personnel

GREY— All others

• Except forklift truck operators, topside personnel who are engaged in handling stores or lines or who are in the transfer area must wear properly secured, orange-colored, inherently buoyant, vest-type life jackets with collars. Forklift truck operators will wear inflatable life jackets fully ready for use: life jacket in front, opened, with the yoke over the head (except actual inflation).

• Personnel rigging aloft or working outboard of bulwarks or safety chains must wear a properly secured, orange-colored, inherently buoyant, vest-type life jacket with a buttonhole in the back cover to permit concurrent use of the safety harness and safety and working line. (See *Naval Ships' Technical Manual,* chapter 077, for details for use with a safety harness.)

• Personnel at a transfer station must wear a one-cell flashlight (or green chemical light), whistle, and sea marker (fluorescent) on the outside of their life jacket during night replenishment. Flashlights need not be lighted except at the discretion of the commanding officer. Chemical lights must be lighted, and are not to be discarded over the side during hours of darkness, during the replenishment, or until completely extinguished.

• Personnel involved in cargo-handling operations on both the delivering and receiving ships must wear safety shoes.

• Additional safety precautions to be observed during fueling can be found in NWP 14.

THE SEAMAN ALOFT

LEARNING OBJECTIVE: Describe the rigging used for going aloft.

As a Seaman in the deck division, you will be involved in painting or doing repairs while working either aloft or over the side. To do these tasks safely, you must be able to correctly rig and use both the boatswain's chair and the stage. You must also know the safety precautions involved in working aloft or over the side.

BOATSWAIN'S CHAIR

The boatswain's chair is a hardwood seat attached to a double bridle of stout line, as shown in figure 4-29. It is always bent to the gantline by a double becket. A length of slack end is left hanging, as shown, for use in securing to masts or stays aloft.

For a straight drop, as when painting down a mast, rig the chair for self-lowering. When you are coming down a mast, you will often find that the ladder takes you only to the crosstree. You must be hoisted from there to the truck by personnel on deck. When there is no way of getting to the truck by ladder, a dummy gantline usually is left reeved from the crosstree up through the sheave at the truck and back to the crosstree. The dummy gantline makes it unnecessary for anyone to climb the topmast to reeve a chair gantline through. You must never let the end get away from you and reeve out.

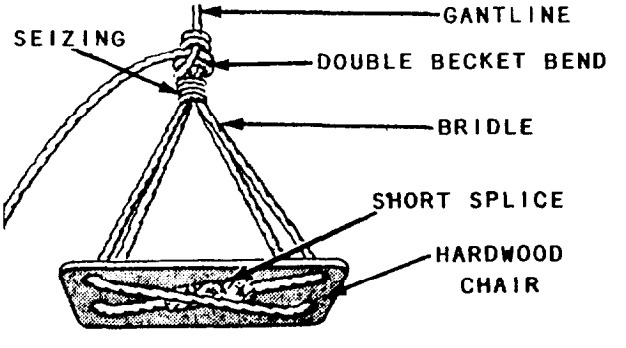


Figure 4-29.— The boatswain's chair.

A recommended method of securing gantlines is diagrammed in figure 4-30. The end of the chair gantline is secured to the end of the dummy gantline by butting the two ends together and seizing with turns of rope yarn back and forth between strands, so everything will pass through the sheave without fouling. The chair gantline is hauled up and through by the dummy gantline, the chair is heaved from the deck to the crosstree, and the hauling part is passed down to the party on deck.

Never attempt to hoist the chair aloft with the dummy gantline. All tools and equipment are attached to the chair so hands are free and to ensure the safety of anyone below from falling objects. When you are ready to go up, and the deck crew is ready to heave around, get in the chair and give a signal for them to pull you up. Help them by hauling down on the hauling part. Keep your hands clear of the part the chair is on or they may get jammed into the sheave when you are two-blocked to the truck. When the desired working height has been reached, signal the crew below and sing out "AVAST HEAVING". The deck crew will stop pulling and hold the chair in place. Reach above the double becket bend and firmly squeeze the two parts of the gantline together. When you have a good grasp, command the deck crew "UP BEHIND." This tells them to let go of the gantline. Warning: At this point, your grasp keeps the chair from falling. With your right hand, pull the gantline through the bridle and squeeze them together just above the double becket bend. Now the strain is on the bridle as in the first view of figure 4-31.

With your free left hand, pull up some slack from below so you have enough to pass over your head, clear around the chair, and under your feet, as in the second view of figure 4-31. The maneuver is a bit tricky, especially if you have a bucket or two hanging on the chair, but you will not have any trouble if you have enough slack pulled up. Keep hold of the gantline with your right hand until you have worked the hitch up to the apex of the bridle as shown in the third view of figure 4-31. Then hold the two parts of the gantline above your right hand with your left, and work the rest of the slack down.

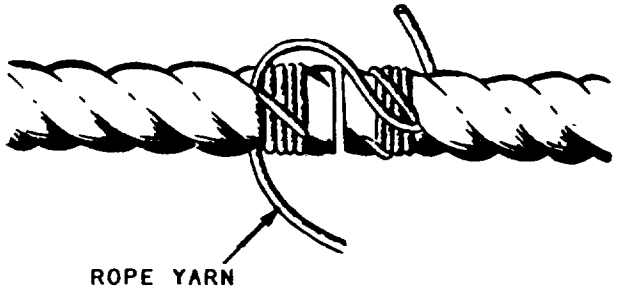


Figure 4-30.–Method of securing gantlines.

You are now in no danger of falling, and all you have to do to lower the boatswain's chair is pull up slack and pass it around. Before you go aloft for the first time, though, you should practice hanging off deck a few times.

RIDING DOWN STANDING RIGGING

Standing rigging usually leads too far out from the mast for you to lower yourself when slushing down. Someone must lower you from on deck.

In riding down standing rigging, bend the tail of your gantline (fig. 4-31) to a shackle placed around the wire. Never place the shackle pin on the wire. It may unscrew as it travels along, and if it opens and lets go, you will swing back against the mast hard enough to injure yourself. Always put the bow of the shackle around the wire.

Personnel must adhere to the following safety precautions when working aloft:

- Obtain permission from the officer of the deck before going aloft.
- Make sure radio and radar units are OFF and that antennas are guarded. A "man aloft chit" is processed to ensure that key personnel are aware of any work being done aloft. The chit is signed by the ship's electrical maintenance officer (EMO), communications officer (COMMO), and command duty officer (CDO).
- Tools and equipment will be tied to the boatswain's chair to prevent objects from falling on personnel below.
- Wear a safety harness and secure it to a fixed object above you once you are aloft.

WORKING OVER THE SIDE

LEARNING OBJECTIVE: Explain the procedures for working over the side and taking soundings.

Personnel preparing to work over the side should notify the officer of the deck (OOD). Upon securing, personnel should again notify the OOD.

All personnel working over the side of the ship on stages, boatswain's chairs, and on work floats or boats along the side of the ship are required to wear life

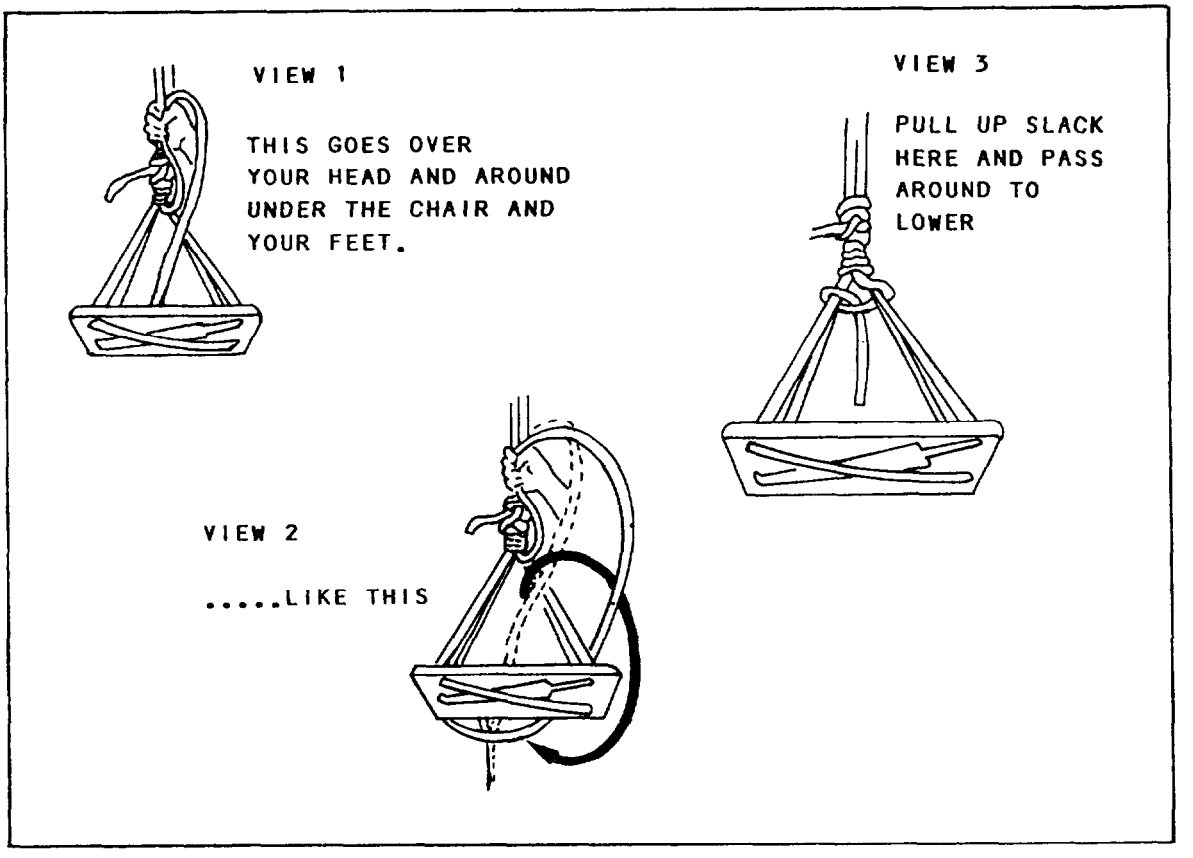


Figure 4-31.–Rigging for self-lowering.

jackets. Except for personnel in boats, personnel working over the side must be equipped with a parachute-type safety harness with safety lines tended from the deck above.

All personnel should be instructed in all applicable safety regulations before they are permitted to work over the side of the ship on scaffolding, stages, or in boatswain's chairs.

A competent petty officer must constantly supervise personnel working on scaffolding, stages, and in boatswain's chairs, and personnel must be assigned to tend the safety lines.

When personnel are doing hot-work such as welding or cutting while working over-the-side or aloft, fiber lines could burn and cause a serious mishap. To prevent this, replace all personnel safety lines and the fiber lines on the staging and boatswain chairs with wire rope. The Navy uses Corrosion Resistant Steel (CRES) wire rope. However, since the Navy supply system does not carry pre-assembled working or safety lines made of CRES, you must make them yourself.

When doing hot-work over the side, replace the nonadjustable, fiber-rope, working lanyard and the fiber-rope safety lanyard (DYNA-BRAKE, if needed) used with the safety harness with a 3/16-inch-diameter CRES wire rope. The wire rope should be 6-feet long (including the DYNA-BRAKE, if needed) with double-locking snap hooks at each end. Secure both hooks directly to the wire rope, using wire-rope thimbles and swaging.

All tools, buckets, paint pots, and brushes used by personnel working over the side of the ship should be secured by lanyards to prevent their loss overboard or injury to personnel below.

STAGE

The stage is a stout plank to the underside of which two short wooden horns are attached athwartships, either by nailing or bolting on, a foot or two from either end. When the stage is rigged properly, all the weight comes on the plank. The chief purpose of the horns is to hold the plank off the side.

The gantlines on your stage may be rigged in one of two ways. The first is by an eye splice in the end of the

gantline (fig. 4-32). Be sure to pass the part between the half hitches under the plank. If you pass it over, there will be nothing holding you up but the horns. The second method of rigging the stage is by the stage hitch shown in figure 4-33. This method is the better of the two because there are two parts of the gantline under the plank instead of one, and there is no need to eye splice the end.

REEVING GANTLINES

The best way to reeve your gantline for lowering is over a smooth surface. Never have your gantlines running over a sharp edge. Place chafing gear wherever the lines from your shackles cross anything sharp.

The following safety precautions should be observed while crew members are working over the side:

1. Lower one end of your partner's stage at a time while your partner keeps the other side secured.

2. Warn your partner before making moves that may jar the stage.

3. Always wear a safety harness and lifeline with dyna-brake when working on a stage.

4. Always wear a life jacket when working over water.

5. Keep clear of overboard discharges.

6. Do not secure safety lines or gantlines to the stations that hold up the lifelines; secure the line to a bitt or cleat.

7. Do not allow more than two persons on a stage at the same time.

8. Secure tools to the stage with small stuff to prevent them from dropping.

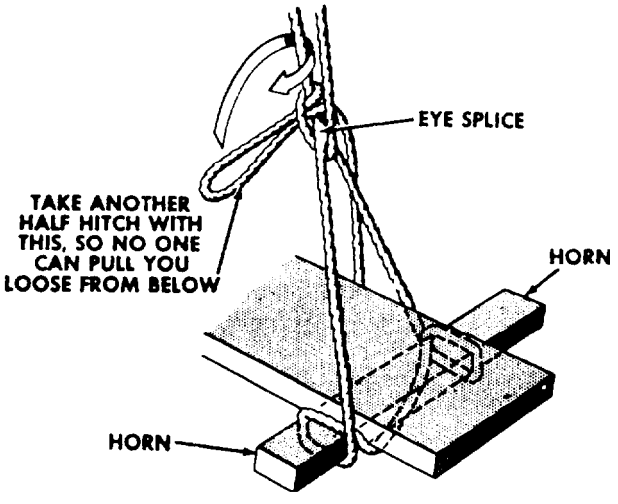


Figure 4-32.–Eye splice rig on a stage.

TAKING SOUNDINGS

Soundings (measuring the depth of water) are taken when the ship is going into or out of port or approaching an anchorage. The hand lead is the most accurate means for obtaining soundings. It is used in shallow water and when the speed of the ship is slow. Even though ships today have modem depth-sounding equipment, lead-lines are a mandatory piece of equipment and are routinely inspected during inspections and refresher training periods.

LEAD LINE

The leadline or hand lead consists of a narrow block of lead weighing from 7 to 14 pounds, which is attached to a marked line (fig. 4-34). With the ship making 12 knots, a good leadsman can get reliable soundings down to 7 fathoms. At slower speeds, of course, the lead has time to sink even deeper before the ship moves up to it. The leadline may also be used for determining the direction in which a ship, practically dead in the water, is moving. Direction of movement is found by placing the lead on the bottom, directly below the leadsman, and noting the direction of the motion of the ship as shown by the change of direction of the leadline from the up and down.

Before heaving, the leadsman takes station in the chains, which usually are platforms projecting over each side at the after end of the forecastle. The lead is then lowered over the side and is supported in the heaving hand by a wooden toggle, inserted in the lead line about 2 fathoms from the lead. The spare line is coiled in the other hand, free for running.

To make the heave, start by calling out "WATCH-ON-WATCH" then swing the lead in a fore-and-aft direction outboard of the chains to gain momentum. Then swing the lead in a complete circle. When the force is great enough, let go the lead as it swings for- ward at a point about level with the deck.

As the ship moves ahead, heave in the spare line rapidly. The marker should be read when the lead is on the bottom and the line hauled just taut, up and down. The ability to heave the lead can be acquired only by practice. It is necessary to practice with both hands because the right hand is used for heaving from the starboard chain; the left hand for heaving from the port chain.

A good heave has no value unless the depth can be read correctly and quickly. Learn the markings of the leadline identified in figure 4-34.

Leadlines often are marked at each half fathom over the range of depth used most and may even have foot markings around the more important depths. Some

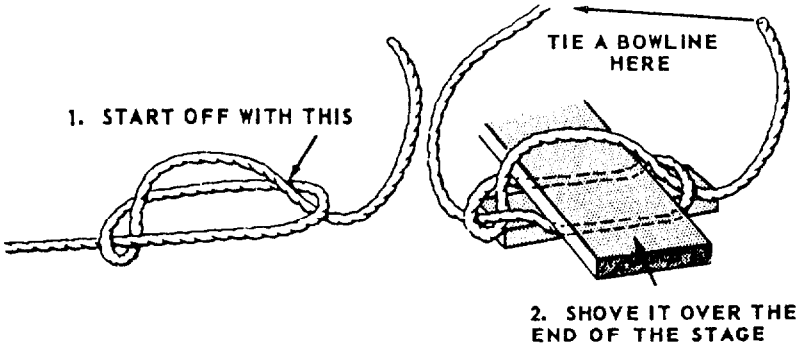


Figure 4-33.–Rigging with a stage hitch.

leadlines are so fixed that the depth may be read at the level of the chains instead of at the water's edge. This procedure makes it easier to take sounds at night. Learn any special markings of the leadline that may be used on your ship.

Report each sounding to the bridge in a sharp, clear voice. When the sounding agrees with one of the marks, report it by mark as 2, 3, 5.

When it falls on an even fathom between marks, report it as by the deep 4, 5, 8 or 9. If the reading does not give an even fathom, it is reported, for example, as "A QUARTER LESS THREE", "AND A QUARTER, FOUR", "AND A HALF, FOUR." Respectively, these reports mean that there are 1/4 fathom less than 3 fathoms of water, 1/4 fathom more than 4, and 1/2 fathom more than 4. If the bottom is not reached, report "NO BOTTOM AT (number of fathoms)."

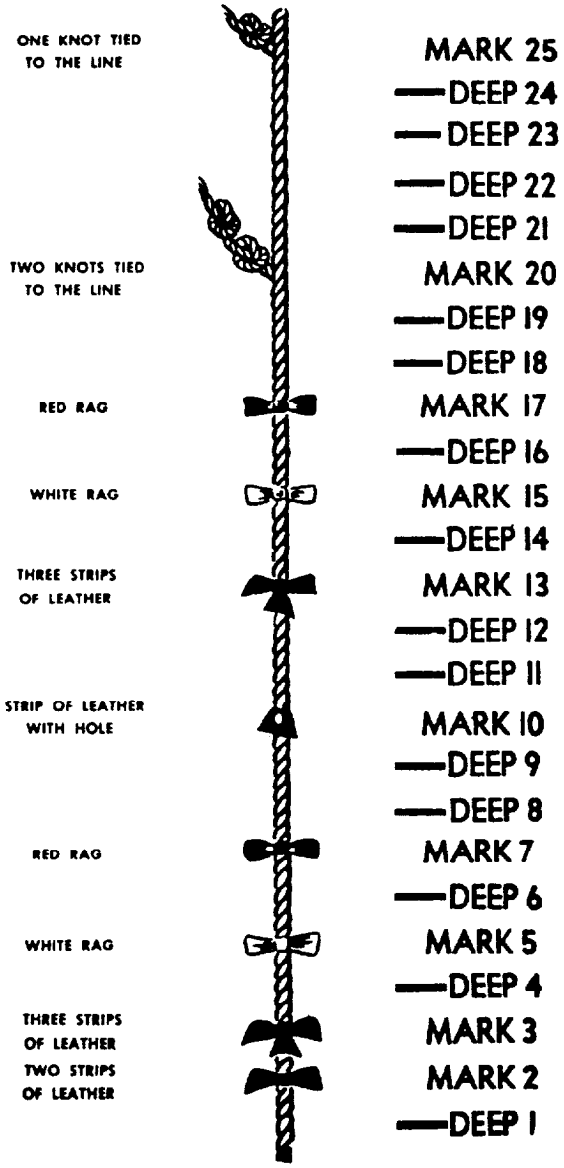


Figure 4-34.–Markings of lead line.

MOORING A SHIP WITH LINES

LEARNING OBJECTIVES: Describe the line-handling procedures to moor a ship. Recognize the difference between standing and running rigging.

The lines used to secure the ship to a wharf, pier, or another ship are called mooring lines. Five-inch synthetic rope is used for mooring lines in destroyers or smaller vessels. Larger ships may use 8-inch or even 10-inch lines. Nylon, polyester, and aramid fiber lines are now common for all types of ships. Aramid fiber rope is lighter and smaller (9 inch circumference nylon reduced to 5 7/8 circumference aramid) for equivalent breaking strength to other synthetic ropes. See figure 4-35. Each mooring line should be faked out on deck near the chock through which it will pass with each eye passed through the chock and looped back over the lifeline, for passing to the pier.

The mooring line that runs through the bullnose or chock near the stem of the ship is called the bow line. The line farthest aft at the stern line is called the stern line. These lines lead up and down the dock respectfully to reduce the fore-and-aft motion of the ship. Other

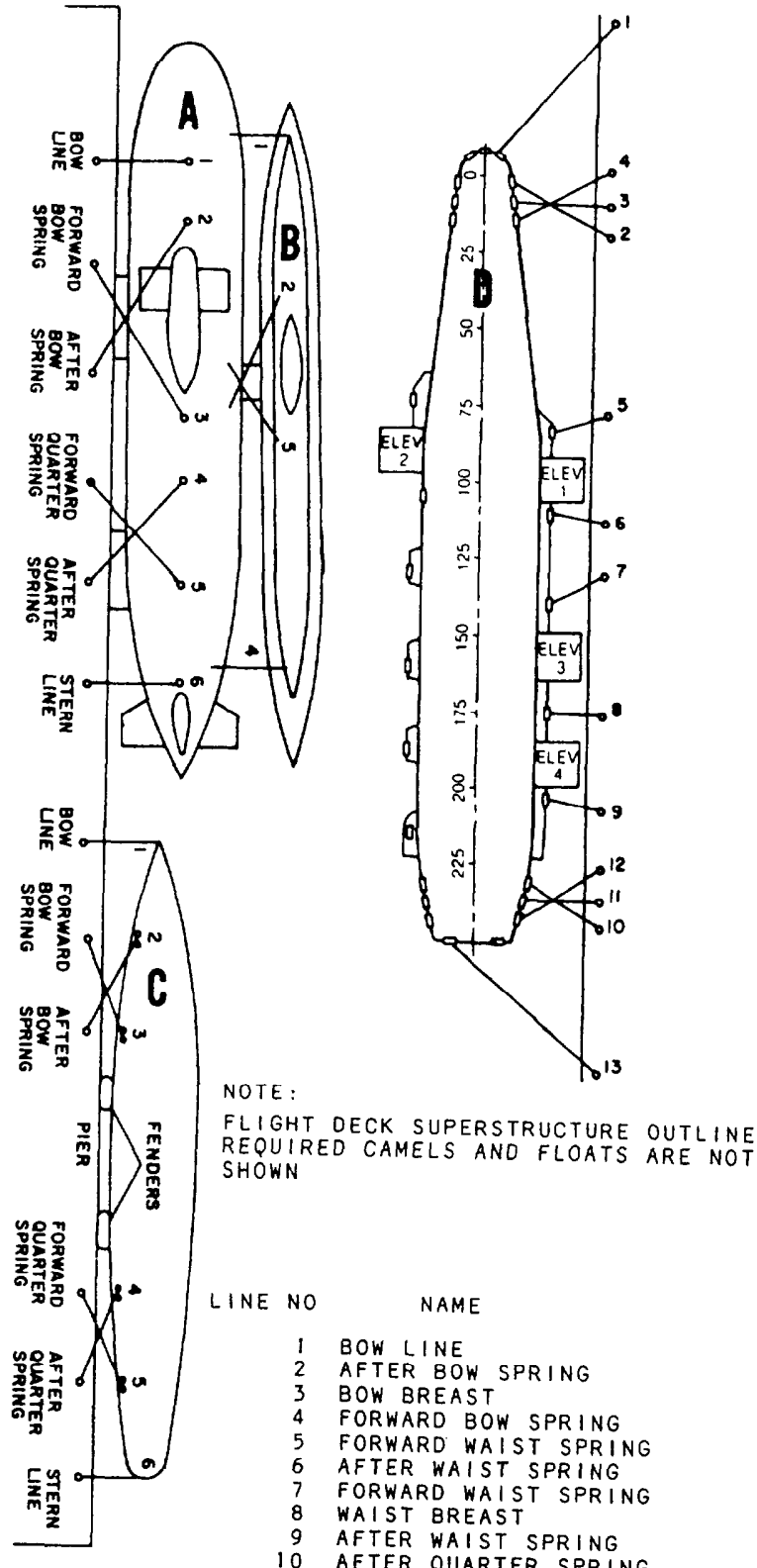


Figure 4-35.–Mooring lines.

Table 4-2.–Orders to Line Handlers

COMMAND	MEANING
PASS ONE (or NUMBER ONE)	Send line number one over to the pier. Place the eye over the bollard or cleat but do not take a strain,
SLACK (slack off) THE BOW LINE (NUMBER ONE)	Pay out the line specified, allowing it to form an easy bight
TAKE A STRAIN ON ONE (or NUMBER ONE)	Put number one line under tension
TAKE IN SLACK ON THREE (or NUMBER THREE)	Heave in on number three line but do not take a strain
EASE THREE	Pay out number three line enough to remove most of the tension
AVAST HEAVING	Stop heaving (taking in)
CHECK THREE	Hold number three line, and allow only enough of it to render around the bitts to prevent the line from parting
HOLD TWO	Take enough turns so that number two line will not slip
DOUBLE UP AND SECURE	In addition to single part of a mooring line at each bitt, a bight of line is passed to the pier or other ship which gives three parts of line holding the ship
SINGLE UP	Take in all lines but a single standing part to each station (preparatory to getting underway)
STAND BY YOUR LINES	Man the lines, get ready to cast off or moor
TAKE IN ONE (or NUMBER ONE)	Retrieve line number one after it has been cast off. When used by the conning officer it means to slack one, cast it off, and then pull it aboard. When used by the officer in charge on the forecastle, it is preceded by the command slack one, cast one and cast off one and means merely to retrieve line one and bring it back on deck
CAST OFF	A command to those tending the mooring lines on the pier or on another ship to disengage or throw off the lines from over the bollards or cleats

mooring lines are called either breast lines or spring lines. They are called bow, waist, or quarter breasts and springs, depending on the part of the ship from which they are run.

Breast lines are run at right angles to the keel and prevent a ship from moving away from the pier.

Spring lines leading forward away from the ship at an angle are forward (bow, waist, or quarter) springs. Those leading aft are after (bow, waist, quarter) springs.

To prevent confusion and to increase the efficiency of line handling, lines are numbered from fore to aft, according to the position where they are secured aboard ship.

In securing alongside a dock, wharf, or pier, special attention must be paid to the tide conditions. When securing at low tide, leave ample slack in the lines to ensure that, at high tide they will not part or cause the ship to list to a dangerous degree.

ORDERS TO PERSONNEL AT THE LINES

When you are handling mooring lines, it is important to observe all safety precautions and to make sure all personnel stay clear of bights of line. All lines are broken out and faked on deck in ample time before sea and anchor detail.

Depending on the class of ship, there is usually a first class petty officer or chief who is in charge of the fantail. The leading Boatswain's Mate and first lieutenant take charge of the forecastle.

Table 4-2 lists some of the orders to personnel assigned at the lines, with an explanation of each.

Be vigilant when you are handling lines by capstan. Warning of a dangerous strain is given by the creaking, stretch and reduction in circumference of the line when you are using nylon lines.

BLOCK AND TACKLE

A block consists of a wooden or metal frame (or shell) containing one or more rotating pulleys called sheaves. When a line or wire is reeved through a block or a pair of blocks, the whole arrangement becomes a tackle. Usually, the purpose of a tackle is to multiply the force applied on the hauling part of the fall. The number of times it is multiplied, disregarding friction, is the mechanical advantage of the tackle.

Every tackle contains a fixed block, attached to some solid support, and a movable block, attached to the load. The force applied at the hauling part is multiplied, excluding friction, as many times as there are parts of the fall at the movable block.

A block ordinarily is referred to by the number of sheaves it contains: for example, single sheave, double sheave, triple sheave. Its size is determined by the length of its frame (in inches). The frame is the main body of the block, and contains the metal strap supporting the pin on which rotates the sheave(s). Multiple-sheave blocks usually have both inner and outer straps. The closed upper end of the strap on a wooden block holds the hook or shackle; the other end accommodates the becket, for securing the end of the fall.

Wooden blocks are used exclusively with line; they are never used with wire. Blocks for wire normally are all-steel, heavy-duty, roller-bearing blocks, either self-lubricating or equipped with fittings for grease guns.

A snatch block is a single-sheave block, a part of which (strap) opens on a hinge so a line may be layed in the block. Fairleading, causing a line or wire to lead angularly around an obstruction and then straight to some desired point, is the usual purpose of a snatch block. See *Boatswain's Mate, Volume 1,* NAVEDTRA 10101, for further discussion on the blocks and tackle.

STANDING RIGGING

Standing rigging, usually of 6 by 19 galvanized high-grade plow-steel wire rope, is used to support the masts. The fore-and-aft supports are called stays, and the supports running athwartships are called shrouds. Stays and shrouds are set up at the lower end with turnbuckles, and those in the line of fire of the guns are also fitted with pelican hooks so they may be moved quickly. Vibration often causes turnbuckles to back off, To prevent this, keepers are installed on turnbuckles in standing rigging.

All standing rigging is grounded to the ship's structure with a bonding strap to eliminate the effects of charges in rigging induced by electromagnetic radiation. When you make any adjustments to the shrouds and stays, the bonding straps must be disconnected to prevent damage and/or breaking. Upon completion of adjustments they must be reconnected.

If shrouds and stays are allowed to become slack, their effectiveness is reduced. Standing rigging should, therefore, be inspected periodically and tightened if necessary. The following procedure should be observed when considerable adjustments are required:

1. Disconnect bonding straps. Loosen turnbuckles to slack all shrouds and stays so no unbalanced forces are applied to the mast.

2. Take up the slack as uniformly as possible until sag is eliminated from all stays and shrouds, and turnbuckles are hand-tight. Measure the distance between the ends of the turnbuckle bolts.

3. Tighten each turnbuckle so it is shortened by a distance equal to 1 inch for each 60 feet of stay length. Reconnect the bonding straps.

Insulators should present clean surfaces. They should not be painted, tarred, varnished, or coated in any way.

All electrical bond straps on standing rigging should be inspected for damage, broken or missing fittings, and excessive deterioration at points of contact between dissimilar metals as specified by the PMS periodicity and procedures. Deficiencies should be reported to the work center supervisor and/or division officer.

DECK SAFETY

LEARNING OBJECTIVE: Explain the importance of deck safety.

Lines must never be made fast to capstans or gypsy heads, but only to fittings such as cleats or bitts provided for that purpose. When hawsepipe covers are removed for any purpose, a safety guard must be installed forward of each hawsepipe to prevent personnel handling lines from stepping or falling into the opening. When heaving around or veering the anchor cable, only authorized personnel may remain on the

forecastle. In letting go the anchor, the brake operator must wear goggles while handling the brake.

Ring buoys with a line and light attached must be available for use when a sea ladder or a Jacob's ladder is being used.

LIFELINES

Personnel are not permitted to sit or lean on the lifelines at any time. Lifelines are safety barriers to prevent personnel from falling or being washed over the side. When lifelines are removed for any purpose, the officers and petty officers concerned are required to ensure that emergency lines are rigged and that everyone has been cautioned to keep clear. While working over the side in port or at sea, personnel must wear life jackets, safety harnesses with safety, and tending lines attached, and a safety helmet.

When the ship is underway and a crew member has to work outside the lifelines, permission must be obtained from the commanding officer.

At sea, weather decks of ships can be extremely hazardous, particularly aboard small ships. At any moment, the sea can submerge the main deck to a depth of several feet or a wave may come unexpectedly over the bow or fantail.

If your duties do not require you on the main deck, do not go there. Be aware of any locations on deck that present any tripping hazards. Line handlers should stand at least 6 feet away from the block through which the line passes. Always stand clear of the bights of a wire rope or a line.

During heavy weather, don't go on deck unless the officer of the deck gives you permission. Then, work in pairs and wear inherently buoyant (kapok) life preservers, safety harnesses, and safety lines.

CRANES, CAPSTANS, WINCHES, AND WINDLASSES

Only trained personnel and those who have been authorized specifically by the first lieutenant are permitted to operate cranes, capstans, winches, and windlasses. Except in an emergency, operation of the machinery must be supervised by a responsible officer or petty officer. The method of operation and all necessary special instructions must be posted at the place of operation.

Experienced personnel must always supervise the topping and lowering of booms. Before making any repairs or replacing any of the gear, personnel should always lower the booms on deck. Chapter C6, Volume 2 of OPNAVINST 5100.19 *(NAVOSH Program Manual for Forces Afloat)* contains safety precautions on cranes, capstans, winches, and windlasses.

LUBRICATING WEATHER DECK EQUIPMENT

LEARNING OBJECTIVE: List and explain the importance of lubricating weather deck equipment.

All weather deck equipment must be lubricated properly to ensure protection against wear and weather elements. This section deals with the lubrication of the boat davits, standing rigging, running rigging, and the like.

WARNING

All greases, lubricants, and cleaning compounds are hazardous materials. Avoid prolonged skin contact and always wear goggles when using these materials. Use in a well-ventilated area.

BOAT DAVITS

Inspect boat davits as required by the Planned Maintenance System (PMS) schedule. Follow the regular lubrication of the mechanical parts as outlined in the individual manufacturer's manual and PMS. Coat the davit wire rope falls, gripes, and latch-releasing devices with grease. Be sure to apply grease thoroughly to the areas where saltwater would form a pocket. Examples of these areas are next to shackles buttons or cramps, and around the thimble.

STANDING RIGGING

All exposed wire, whether galvanized or not, must be covered with some surface coating for protection against the weather. For wire in standing rigging not subject to wear, weather protection is the only important consideration. The Maintenance Requirement Card (MRC) lists the preservatives needed. You can get them by submitting a supply requisition to the supply department.

RUNNING RIGGING

Wire rope for running rigging, as on cargo winches, must be covered with a mixture that provides lubrication as well as protection against the weather. A preparation of graphite and grease makes an excellent covering for running wire if no prepared mixture is on hand.

SHACKLES AND TURNBUCKLES

Particular attention must be paid to protecting the threads of shackles and turnbuckles. They are the parts that will be eaten away first if not cared for properly. Turnbuckles should be opened out frequently; the threads should be brushed well; and the movable parts should be lubricated with graphite grease.

WINCHES, CRANES, AND ANCHOR WINDLASSES

The maintenance and lubrication of heavy deck equipment, such as winches, cranes, and anchor windlasses, is performed by personnel of the A division of the engineering department. You should bear in mind, however, that the deck divisions work with this equipment. For your own protection, therefore, you should assist a division as much as possible in the maintenance and lubrication of this equipment.

SUMMARY

In this chapter, we have discussed equipment and safety measures used on the deck of today's naval vessels.

More detailed discussion may be found in *Boatswain's Mate, Volume 1,* NAVEDTRA 10101, and other publications.

You must observe all safety precautions related to your work or duty assignments.