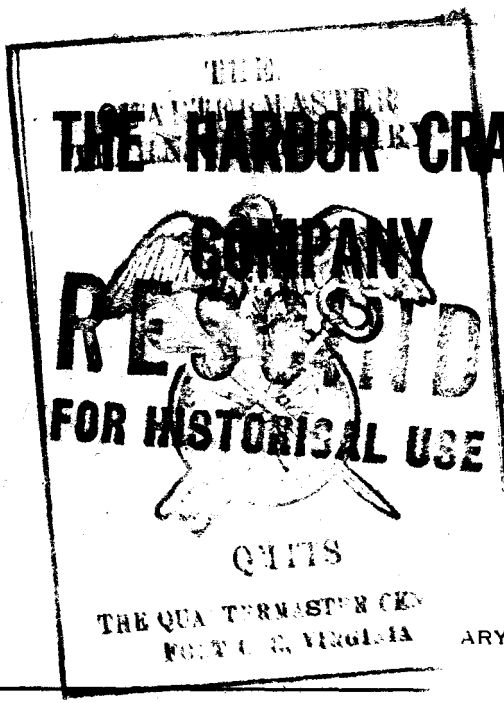
FM55-130

DEPARTMENT OF THE ARMY FIELD MANUAL



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FM 55–130 is published for the information and guidance of all concerned.

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FM 55-130

This manual supersedes FM 55-130, 31 January 1944

THE HARBOR CRAFT COMPANY

DEPARTMENT OF THE ARMY *MARCH 1951*

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CONTENTS

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. PURPOSE

This manual is published for the information and guidance of personnel concerned with the harbor craft company, a Transportation Corps organization. It contains instructions pertaining to standard harbor craft organization, functions, and procedures.

2. SCOPE

a. This manual includes a general explanation of such topics as mission, training, and organization of the harbor craft company; types and characteristics of its vessels; harbor craft crews and their duties; and preventive maintenance and repair.

b. It is not intended that this manual set forth a rigid set of operational functions and practices of a harbor craft company but rather that it furnish some rules, regulations, and procedures which are in use and are recognized as good harbor craft practice. Operating conditions vary under different circumstances, and information contained herein may require corresponding adjustment. Successful operation of the harbor craft company demands intelligent

adaptation of its personnel and equipment to prevailing circumstances.

Section II. MISSION AND ORGANIZATION

3. MISSION

The mission of the harbor craft company will vary with the circumstances under which it operates. A company may be assigned both or only one of the following missions: to operate and maintain barges, tugs, cranes, power boats, and liaison craft within a harbor and in the protected waters in the vicinity of that harbor, and/or to transport freight and passengers from that harbor or central port to smaller, outlying installations. The type, size, and number of craft assigned to the company for a particular operation will depend upon the amount and nature of the cargo and personnel to be transported, climatic conditions, urgency, and many other circumstances pertinent to the operation.

4. RELATIONSHIP TO BATTALION AND FORT

A harbor craft company operating overseas is organized to fulfill the specific mission assigned to it. Depending on the local situation, the company may be assigned to an oversea port or to a Transportation Corps composite battalion. The battalion in turn may be assigned to an oversea port, major or medium.

a. Each port presents its own organizational problems and the organization of the harbor craft company must be flexible enough to permit adaptation to local conditions of operation and organization.

b. The battalion headquarters to which a harbor craft company might be assigned normally would perform the administrative duties and would be responsible for all organizational equipment and its maintenance and repairs.

c. From three to six companies may be assigned to a battalion headquarters which may requisition such additional service units as medical type units.

d. Maintenance and repair teams would be assigned to the battalion on the basis of the total number of vessels assigned to the harbor craft companies in the battalion.

5. USE IN WORLD WAR II

a. The original need for the harbor craft company was felt in World War II in the Southwest Pacific where vast ocean areas separated the scene of combat from the source of supply. All available transocean shipping was needed to bring the supplies from the continental United States to the theater of operations and large cargo ships and tankers could not be spared to carry supplies to subports along coasts or to small, isolated islands. Many installations were so situated that it was impossible for transocean shipping to service them because of shallow channels, lack of berths and piers, scarcity of cargo-handling equipment, and undeveloped beaches and depot areas. Consequently, the larger vessels unloaded at central points and harbor craft distributed cargo to smaller ports and coastwise installations in the area.

b. The greatest utilization of the harbor craft company in the congested ports of Europe was in the

harbor itself, where its cranes unloaded cargo vessels unable to berth at damaged wharves, its tugs, lighters, and barges transported cargo, while the smaller craft were used for water taxi and messenger services.

c. At the end of World War II the Army had a total of 12,466 harbor craft type vessels, of which 7,563 were assigned to oversea theaters. These were operated by 57 harbor craft companies whose authorized strength was 1,785 officers and 13,792 enlisted men. Of the total, 4,597 vessels were nonpropelled barges, 2,676 were launches, 1,065 were motor towboats, 1,113 were marine tractors, 510 were freight supply vessels, 104 were class B tankers, and 746 were tugs of all classes.

6. ORGANIZATION

To perform the varied types of operations with which it is concerned, the harbor craft company must be flexible and adaptable in structure. Unlike the majority of Army units organized under tables of organization and equipment, the harbor craft company does not have a fixed, authorized strength. It is formed under the following cellular organizational system.

a. Company headquarters. Company headquarters, cell AC listed in T/O&E 55–500, provides personnel for administration and housekeeping purposes and conducts all administrative duties pertaining to the company. Its officers include the company commander and a supply officer. Its enlisted men, usually nine, include a first sergeant, motor sergeant,

supply sergeant, company clerk, armorer, supply clerk, bugler, and two truck drivers.

b. Vessel crews. The type, size, and employment of a vessel determine the size and organization of the crew assigned. Parts VIII and IX of T/O & E 55–500 prescribe the authorized crew for the several classes of vessels. The crew of each vessel comprises one cell. If 15 vessels are assigned to a company, the 15 appropriate cells comprise the operating strength of the company. Duties of crew personnel are described in chapter 3 of this manual.

c. Maintenance and repair teams. While crews are able to perform daily maintenance aboard their vessels, additional personnel may be required to perform further maintenance and light repairs for the harbor craft vessels. This personnel will be found in the maintenance and repair cells listed in T/O & E 55–500. Some cells provide personnel skilled in maintenance and repair, some in maintenance only, and some in repairs only. The number and type of vessels assigned to the harbor craft company will be factors in determining the number and type of maintenance and repair teams to be assigned to the company.

d. Mess teams. Crews of the larger vessels mess aboard their vessels, but crews of the smaller vessels usually mess with company headquarters. Mess teams listed in T/O & E 55–500 are attached to the company as required. The size of the mess team is determined by the number of personnel to be fed.

e. Auto mechanic teams. Auto mechanic teams are added to the company in accordance with the number of motor vehicles assigned.

Section III. TRAINING

7. TYPES OF TRAINING

Training of the harbor craft soldier is divided into three broad phases: basic military training, technical training, and unit training.

a. Basic military training. The first few weeks of training (usually 6, 8, or 13) are devoted to basic military subjects. This training gives the trainee an understanding of fundamental military principles and practices and establishes a uniformity of basic military knowledge among all soldiers. This training is accomplished in accordance with current Army training programs.

b. Technical training. A period of technical training follows the basic military training and is of approximately the same duration. Each man is given training in a particular skill. This enables him to become a member of a skilled team or unit. MTP 55–1 lists the technical courses to be given for Transportation Corps enlisted personnel.

(1) A soldier who successfully completes his basic technical training earns a military occupational specialty (MOS) which is represented by an MOS code number. A soldier may earn several MOS's during his Army career.

(2) Enlisted specialist skills required by harbor craft company personnel include marine engineer, boatswain, small boat operator, seaman, cook, electrician, marine oiler, crane operator, and radio operator, low speed.

c. Unit training. Upon completion of basic military and technical training, unit training is initiated. Each soldier, now a military specialist, learns to correlate his individual skill with those of others working together as an integrated organization. In order to provide practical experience for each specialist, the several teams in a company work on problems under simulated tactical conditions whenever possible. The training program for TC units is outlined in MTP 55–2.

CHAPTER 2

TYPES OF VESSELS

Section I. GENERAL

8. TRANSPORTATION CORPS MARINE FLEET

The marine activities of the Transportation Corps are limited to operations in harbors and inland waterways. The Military Sea Transportation Service (MSTS), under the direction and control of the Department of the Navy, has responsibility for transoceanic, intratheater, and coastwise movement of personnel and cargo. The principal types of vessels, together with their uses, which comprise the Transportation Corps Harbor Boat Service are given below.

a. Barges and lighters, self-propelled and nonpropelled—these are used within harbor limits and on other sheltered waters for the movement of Army dry, liquid, and refrigerated cargoes.

b. Tugs and towboats—these are used for docking and undocking of larger vessels and for the purpose of moving Army nonpropelled barges within harbor limits or on other restricted waterways.

c. Utility boats—these carry a limited amount of light Army cargo either on deck or below deck, are self-propelled, and are used for various other duties such as movement of small groups from ship to shore, etc.

d. Personnel boats—these are of several types and sizes and are used for command and inspection purposes as well as movement of personnel.

e. Floating cranes—these are used in the loading and unloading of heavy Army cargo when the ship's gear is unable to handle the lifts.

f. In addition to the above listed types, the Transportation Corps furnishes special types of vessels for use of Amphibious Special Brigade, harbor craft companies, continental armies, and oversea commands. Some of these are listed below.

(1) Patrol boats, wooden construction, Diesel-powered.
(2) Landing craft, normally of steel construction, Diesel-driven.
(3) Ferries, automobile and passenger, normally steel constructed, Diesel-driven.
(4) Pier barges, steel construction, nonpropelled.
(5) Floating machine shops, steel construction, nonpropelled.
(6) Floating drydocks, steel construction, nonpropelled.
(7) Training vessels, normally steel constructed, Diesel-driven.
(8) Shallow draft river vessels, normally steel constructed, Diesel-driven.

Section II. CLASSES OF VESSELS

9. GENERAL

Harbor craft company vessels of the self-propelled type are divided into four classifications: classes

A, B, C and D. Other vessels used by harbor craft companies, which are classed as E vessels, are nonpropelled barges and floating cranes. Outboard propulsion units are sometimes used in connection with these otherwise nonpropelled vessels. The manning crews for the various classes of vessels are made up from cells of T/O & E 55–500.

a. Class A vessels include—

(1) Dry, reefer, and liquid cargo vessels 125 feet and over in length.

(2) Harbor tugs 100 feet in length (fig. 1).

b. Class B vessels include—

(1) Cargo vessels under 125 feet in length.

(2) Harbor tugs 51 feet to 99 feet in length.

c. Class C vessels include launches over 50 feet in length (fig. 2).

d. Class D vessels include—

(1) Launches under 50 feet in length (figs. 3 and 4).

(2) Harbor tugs and towboats under 50 feet in length (fig. 5).

e. Class E vessels include—

(1) Floating cranes (figs. 6, 7, and 8).

(2) Cargo barges, dry and liquid (figs. 9 and 10).

(3) Other harbor craft.

(4) Outboard propulsion units.

10. CLASS A VESSELS

a. Cargo vessels over 125 feet in length.

(1) Dry, reefer, and liquid cargo vessels of the self-propelled type are used for supply of Army forces in small subports or other in-

stallations around the perimeter of a harbor, or along rivers and inland waterways. These vessels are of steel construction, are twin Diesel-powered, and have moderate draft and other characteristics which make them suitable for harbor and limited coastwise operation. They are approximately 150 feet in length and in loaded condition attain a speed of 11 to 12 knots.

(2) The dry-cargo vessel has a carrying capacity of approximately 300 tons below decks. Modifications of the basic design allow for movement of bulk liquid and reefer cargoes.

b. Large harbor tug.

(1) This tug (fig. 1) is 100 feet in length, has a beam of 26 feet, 5 inches, and a draft of approximately 9 feet, 9 inches. Power is supplied by one 6-cylinder 1200 hp Diesel engine.

(2) This tug is used for docking and undocking of large ships and for heavy towing within harbor areas and around the perimeter of a harbor. The vessel has been designed with exceptionally good freeboard, ample stability, and good cruising range. It is capable of proceeding under its own power to a theater of operations. Fire-fighting equipment is provided in all units of this design.

11. CLASS B VESSELS

a. Cargo vessels under 125 feet in length. One of the standard vessels of this class is of steel construc-

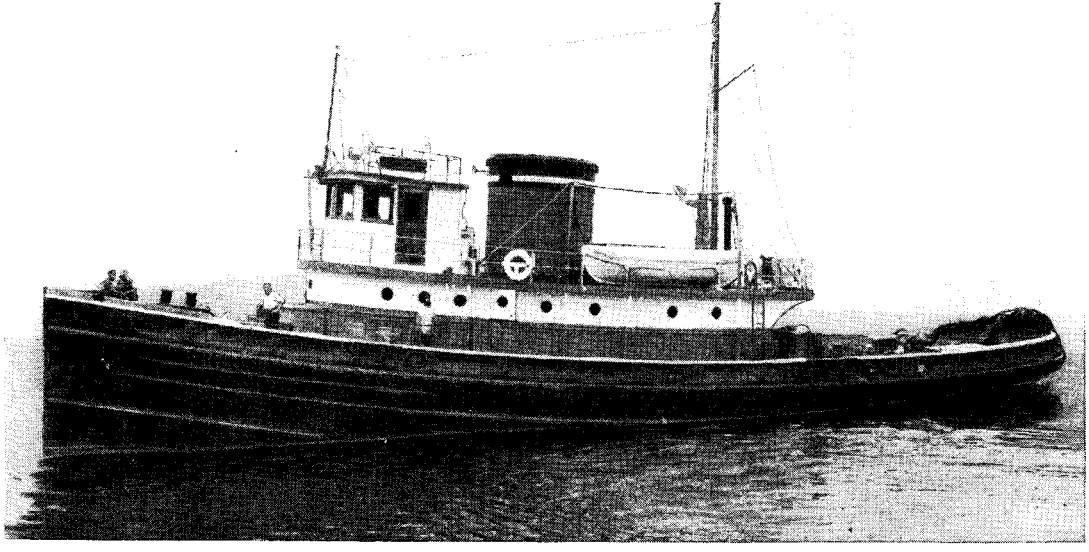


Figure 1. Class A large harbor tug.

tion and is used within harbor areas for movement of cargo and personnel.

(1) This vessel is 65 feet long with a beam of approximately 16 feet, 5 inches, and a draft of 5 feet, 2 inches.

(2) When loaded, it has a speed of 11 knots. Power is furnished by a 6-cylinder 300 hp Diesel engine.

(3) Its cargo capacity is 30 tons. In addition, 24 people can be accommodated in the deckhouse aft.

(4) The vessel is fitted with fire-fighting equipment and is capable of being shipped on deck of transports.

b. Harbor tugs 51 feet to 99 feet in length. Representative of this class is the all-steel 65-foot harbor tug, powered by one 500 hp Diesel engine. Dimensions of this vessel are such that better than average transverse stability and freeboard are attained. It is used principally for docking and undocking purposes and to move loaded barges from point to point in a harbor area.

12. CLASS C VESSELS

(Launches over 50 feet in length)

The principal example of this class vessel is the 63-foot patrol boat (fig. 2). This is a wooden vessel with a beam of 15 feet and draft of 3 feet, 10 inches. It is powered by twin Diesel engines and has a speed of 15 knots. The boat is used for transporting personnel within harbor areas, for command and inspection service, and for patrol work within harbor limits or around the perimeter of a harbor.

Figure 2. Class C patrol boat.

13. CLASS D VESSELS

a. Launches under 50 feet in length.

(1) A typical vessel of this category is the offshore patrol boat (fig. 3), with a length of

36 feet, 6 inches, a beam of 10 feet, 7 inches, and a speed of 15 knots. It is used to carry mail and light-packaged cargo, and to move personnel within harbor limits as well as to patrol restricted areas.

(2) Another boat in this class is the 26-foot utility boat (fig. 4) with a beam of 8 feet, 1 inch, and a draft of 3 feet. It has a speed of 10 knots; power is furnished by one 75 hp Diesel engine. This utility boat is used for many purposes including movement of light-packaged cargo and towing of small barges within harbor limits.

b. Harbor tugs and towboats under 50 feet in length. The 45-foot steel tug (fig. 5) is typical of this class. It is powered by one 200-hp Diesel engine and has a beam of 12 feet, 6 inches, and a draft of 5 feet, 6 inches. It is used extensively in the movement of light barges within harbor areas.

14. CLASS E VESSELS

a. Floating cranes. Floating cranes are of three sizes. The smallest one (fig. 6) has a lifting capacity of 30 tons; the intermediate size (fig. 7) is rated at 60 tons; while the largest (fig. 8) has a capacity of 100 tons. All three are revolving cranes of the Diesel-electric type mounted on welded steel barges. These cranes are used within harbor limits in the loading and unloading of heavy cargo which is beyond the capacity of the ship's cargo handling gear.

b. Cargo barges: dry, liquid, and reefer.

(1) These nonpropelled vessels are of different sizes, the smallest (fig. 9) being 45 feet in

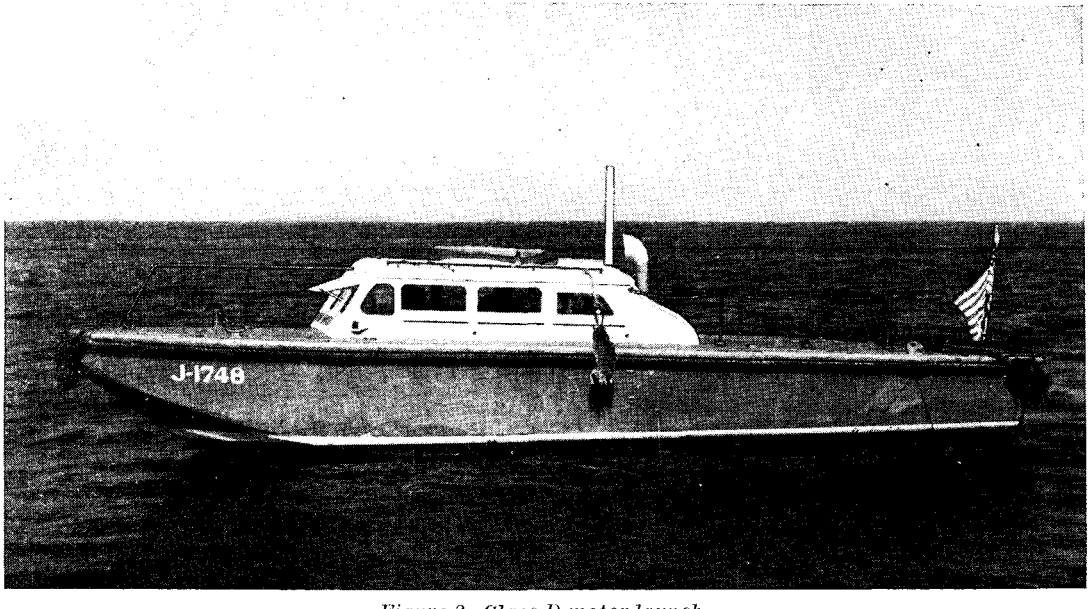


Figure 3. Class D motor launch.

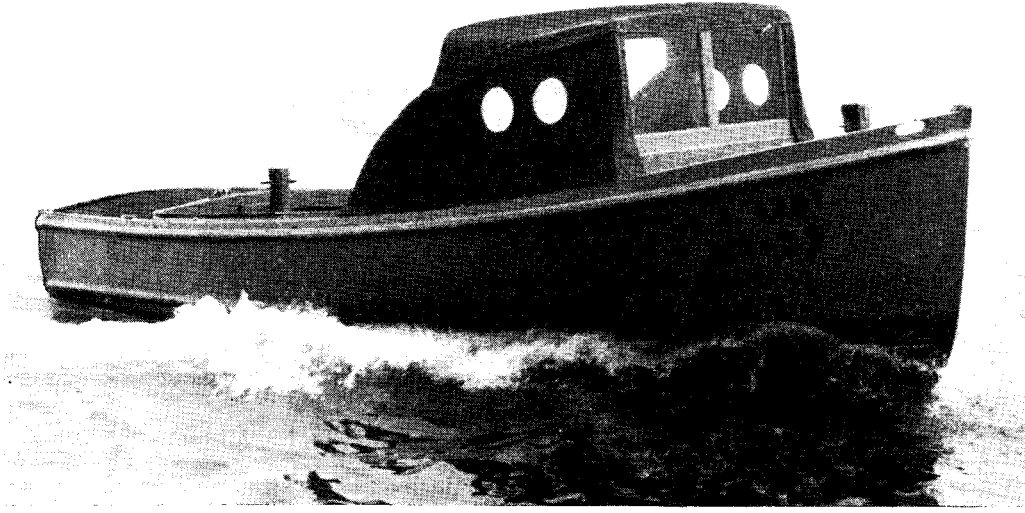


Figure 4. Class D utility boat.

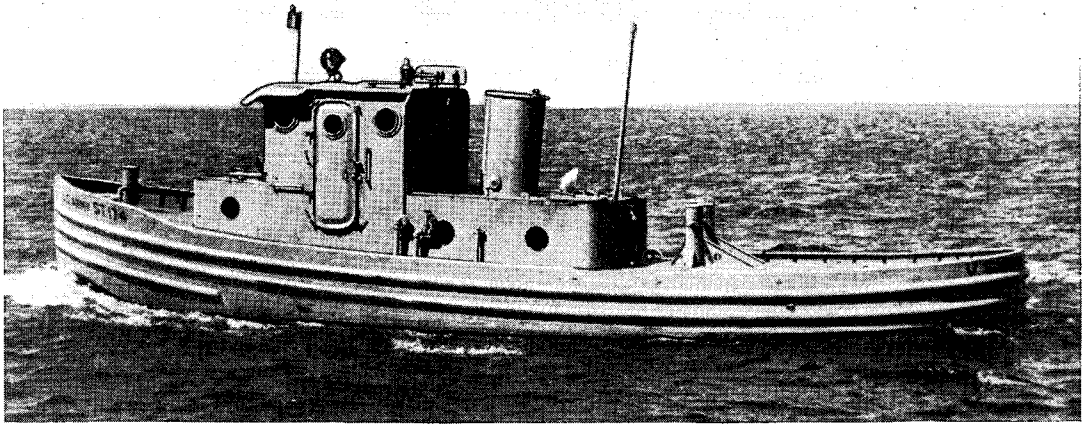


Figure 5. Class D 45′ motor tender, small tug.

length, the next larger size 81 feet, and the largest (fig. 10) 120 feet long. For the purpose of standardization, the basic design for the movement of dry cargo is used in the 81-foot and 120-foot sizes for the accommodation of reefer and liquid cargoes.

(2) All barges in the standard fleet are of welded steel construction. The 45-foot and 81-foot sizes are sectionalized for shipment on deck of transports. Because of their simplified designs they are easily assembled in theaters of operations. The various sizes and types of nonpropelled barges are as follows:

45′
81′ (dry cargo)
81′ (liquid cargo)
81′ (reefer cargo)
120′ (dry cargo)
120′ (liquid cargo)
120′ (reefer cargo)

c. Other harbor craft. Craft in this category include the 210-foot nonpropelled floating machine-shop barge. This vessel is a seagoing barge with large deckhouse. It is equipped with all necessary shop tools for maintenance and repair of machinery installed in harbor craft as well as for performance of hull repairs.

d. Outboard propulsion units. These units are of the Diesel type and are supplied in two sizes. The smaller size, 200 hp, when applied to units of the 81-foot barge designs give these vessels a speed of

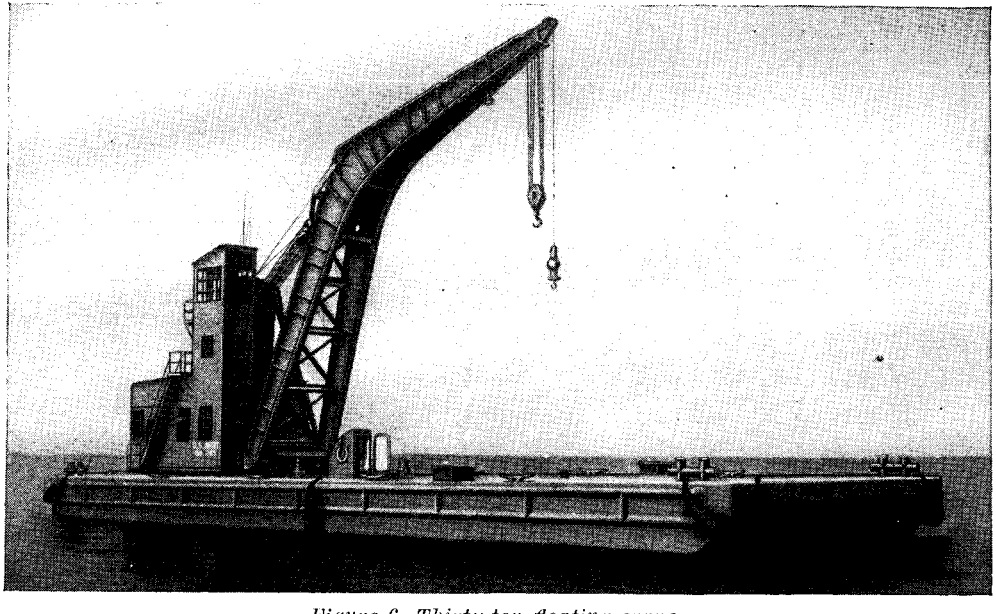


Figure 6. Thirty-ton floating crane.

approximately 6 knots in sheltered waters (fig. 11). The larger size develops 300 hp and is applied to 120-foot barges and to floating cranes. The units are of sturdy construction and are easily installed. Their use eliminates the necessity for many small tugs and towboats within harbor limits.

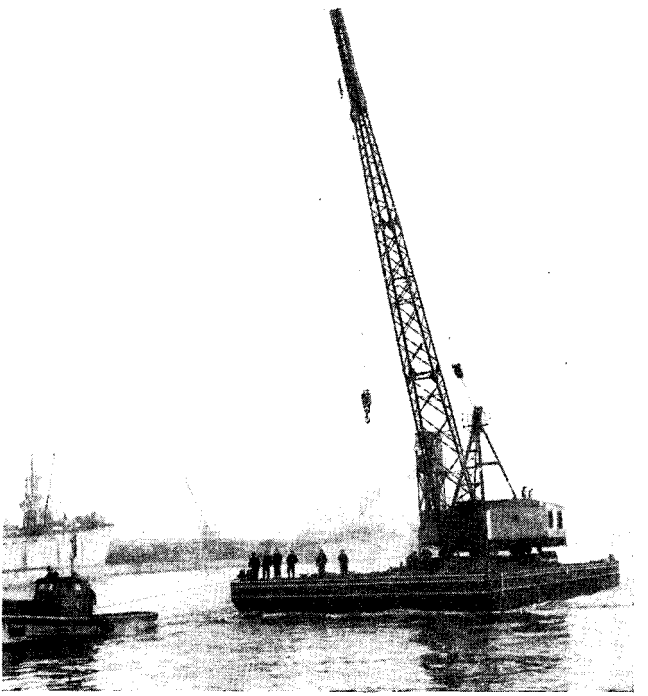


Figure 7. Sixty-ton floating crane.

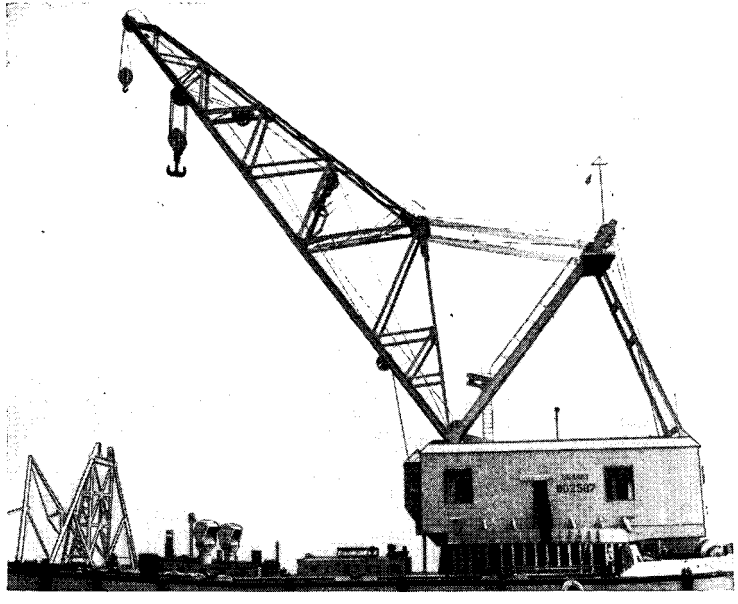


Figure 8. One hundred-ton floating crane.

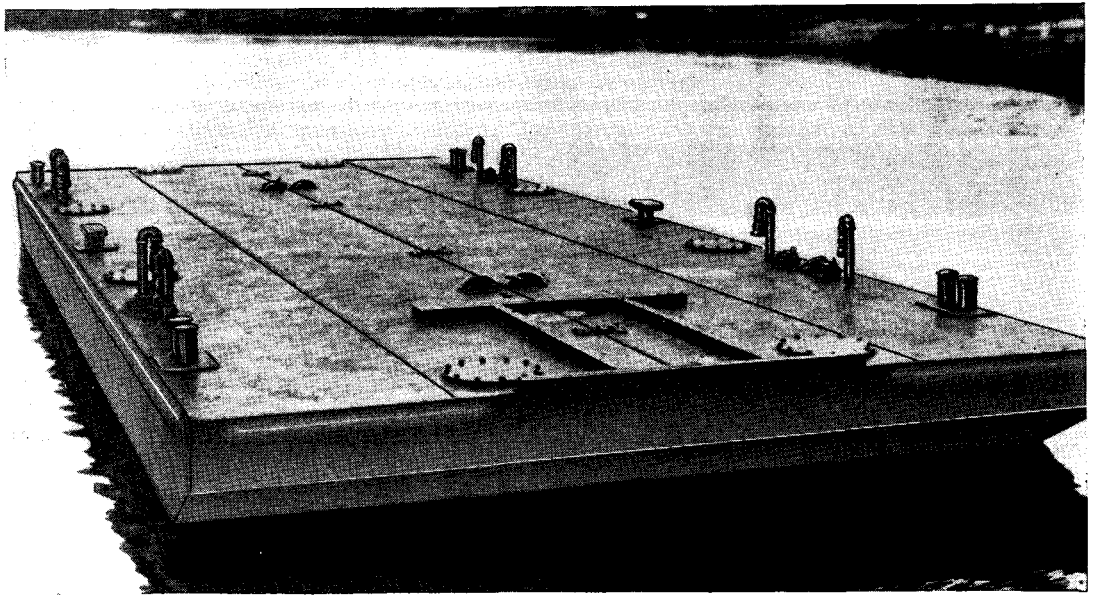


Figure 9. 45-foot steel cargo barge.

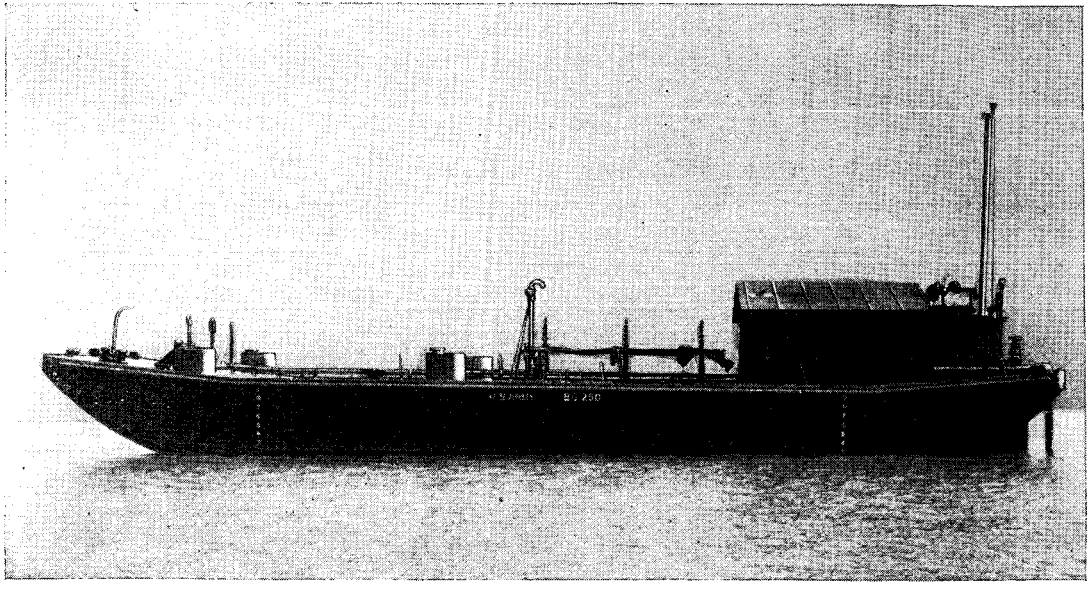


Figure 10. 120-foot liquid cargo barge.

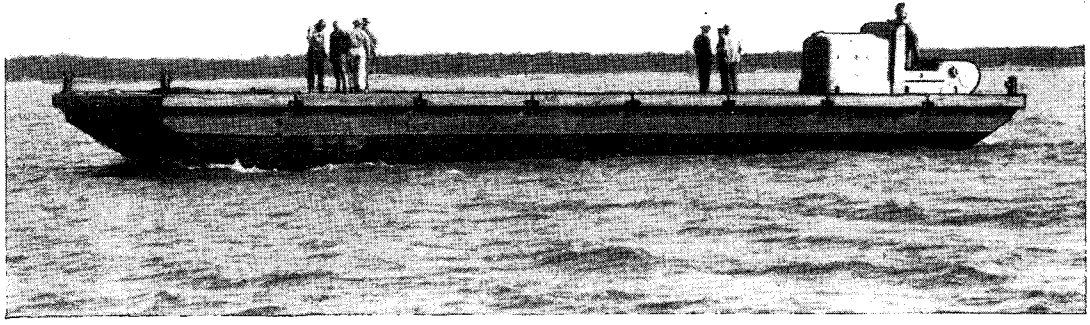


Figure 11. 81-foot nesting barge with 200 hp outboard propulsion unit.

CHAPTER 3
DUTIES OF PERSONNEL

Section I. DECK DEPARTMENT, CLASS A AND CLASS B VESSELS

15. GENERAL

Primary responsibilities of the deck department are the cleanliness, maintenance, supply, and safe conduct of the vessel. Although this department is separate from other departments such as engine room, communications, and steward, the necessary coordination of all departments is facilitated if each member of the deck department familiarizes himself with the duties of other departments.

16. MASTER

The master has supreme command of his vessel, notwithstanding the presence of a pilot, and is held responsible for proper navigation and the safety of the vessel and all those on board. He must have a thorough knowledge of navigation principles and be able to apply them. The duties of a master are many, covering technical, practical, and personnel problems. The duties of mess officer are the responsibility of the master, and he may delegate these duties to one of the deck officers, who should be familiar with TM 10–205 on mess management and training and TM 10–405 on the Army cook. Comprehen-

sive lists of the duties of the master may be found in AR 55–310, AR 55–510, and SR 55–510–1. It is the duty of the master to—

a. Be familiar with the mechanical operation of his vessel and its equipment.

b. See that maintenance of all equipment is performed and that all necessary repairs are made expeditiously.

c. Be certain that his vessel is fully supplied in all departments at all times.

d. Know cargo stowage and security.

e. Know fuel consumption of vessel, average rpm, and other engine data to compute speed and range.

f. Assure himself that all necessary inspections have been performed fully and that certificates are posted.

g. Have all station bills and licenses posted.

h. Conduct fire and boat drills as prescribed.

i. Be responsible for the safety, conduct, and training of his crew.

j. Be responsible for the safe and proper navigation of his vessel.

17. FIRST MATE

The first mate is executive officer of the ship and acts as assistant to the master in every way. Since the position of master is largely a supervisory one, it is the mate's duty to see that the master's instructions are fully and promptly obeyed. He observes all regulations prescribed for the master whenever he acts for the master during the latter's absence. A comprehensive list of the duties of the mate may be found in SR 55–510–1. The first mate—

a. Is in immediate charge of the deck department and is responsible for the good order and cleanliness of the ship, the discipline and efficiency of the crew, and the maintenance in a serviceable condition of all deck, lifesaving, firefighting, and navigation appliances, keeping a constant check on the entire vessel and its equipment.

b. Assist the master in the duties of navigation by relieving or assisting him on the bridge at any time the master requires his services and is responsible to see that the deck log is properly kept.

c. Has charge of the daily inspection of the ship.

d. Is in charge of checking the handling and stowage of cargo.

e. Keeps an inventory of all stores, allows no expenditure without his order, and before arrival in port submits requisitions for each trip to the master.

f. Stations deck officers and seamen by posting complete watch and station bills before sailing.

18. SECOND MATE

The second mate serves as assistant to the first mate and, indirectly, to the master. He is frequently called upon to assume the duties of the first mate. For this reason he should be familiar with the responsibilities of the first mate.

a. The second mate on a class A boat usually assumes the duties of the navigation officer. He checks and cares for all navigating instruments, confers with the master on courses to be followed, keeps charts, books, and all data up to date, checks the chronometers, and keeps all ship's clocks synchronized.

b. He usually acts as the ship's mess officer, and, as such, is responsible for the mess account, ordering stores in conjunction with the chief cook, and checking the quality and preparation of food.

c. The second mate may be called upon to assist the master with records and other paper work.

d. Although all ship's officers are qualified for first-aid work, the second mate is usually designated as the first-aidman and keeper of the medicine chest.

19. OFFICER OF THE WATCH

A long list of duties could be given, but they can be summed up in one statement: While on duty, the officer of the watch is in charge of the vessel under the master and is responsible to him for its safe and proper navigation. He has full authority for the duration of his watch, subject only to orders from the master. When in doubt of the course of action to be taken, he must never hesitate, but must call on the master immediately.

a. When coming on duty, the officer of the watch checks the log, barometer, lights or other identifiable objects expected on course, position, course, and all other pertinent information contained in the captain's orders.

b. It is the duty of the officer of the watch to keep the log and to notify the master immediately of any unusual situations which may develop.

20. BOATSWAIN

The duties of the boatswain are comparable to those of a foreman. In addition to being a compe-

tent able seaman, he must be a leader of men, conscientious in performance of duty, and alert. The mate and the boatswain work closely together. The mate plans the day's work and the boatswain sees that it is done. If he is efficient, no interference by the mate is necessary. The maintenance of discipline, efficiency, and harmony among the crew is the boatswain's prime responsibility.

a. The boatswain must understand the ship's rigging and be able to repair or replace any part of it. He must maintain and replace all ship's gear and should know the operation of all gear, especially the cargo winches, anchor windlass, capstans, and boat falls and davits.

b. The boatswain must know how to secure the ship for sea and how to check the cargo holds. He should know the fundamentals of mixing and applying paints, for much of this will be done under his supervision. Under the supervision of the mate, the boatswain must lead the men in all ship drills, including the launching and handling of lifeboats and ship's launches.

21. ABLE SEAMAN

Before qualifying for able seaman, the individual usually serves as ordinary seaman. He must be considerate, respectful to officers, and versatile, for his duties concern every phase of seamanship.

a. The able seaman must have a thorough knowledge of marlinspike seamanship and should have had enough experience to apply himself expertly. He must know how to inspect and care for rigging and

gear, including anchor windlasses, boat falls and davits, capstans, and lead lines.

b. He must be a competent lifeboatman, knowing all the phases of handling from launching to use in heavy weather, and be able to handle the ship's launch and know enough of the rules of the road to operate it correctly and safely.

c. He must conduct himself expertly in all ship's drills and observe all safety precautions. He must be a first-class helmsman, familiar with the peculiarities of his own ship.

d. It is necessary that the able seaman know semaphore. It is desirable that he know blinker signaling, but it is not a requirement. He must be able to identify the single-letter international code flags and know the meaning of each.

e. Each able seaman must be conscientious in the performance of his lookout duties, able to recognize not only danger, but to distinguish between aids to navigation, shore lights, lights of other ships, and distress signals.

22. LOOKOUT

The lookout is the man on watch with the special duty of searching for planes, other ships, land, rocks, discolored water, buoys, beacons, floating objects, and any other object and reporting them to the watch officer. Safety depends on the man assigned to a lookout post, since he is the eyes of the ship. Good day and night vision and perfect hearing, augmented by proper training, are the requisites for a lookout. He reports all objects sighted in relation to the fore and

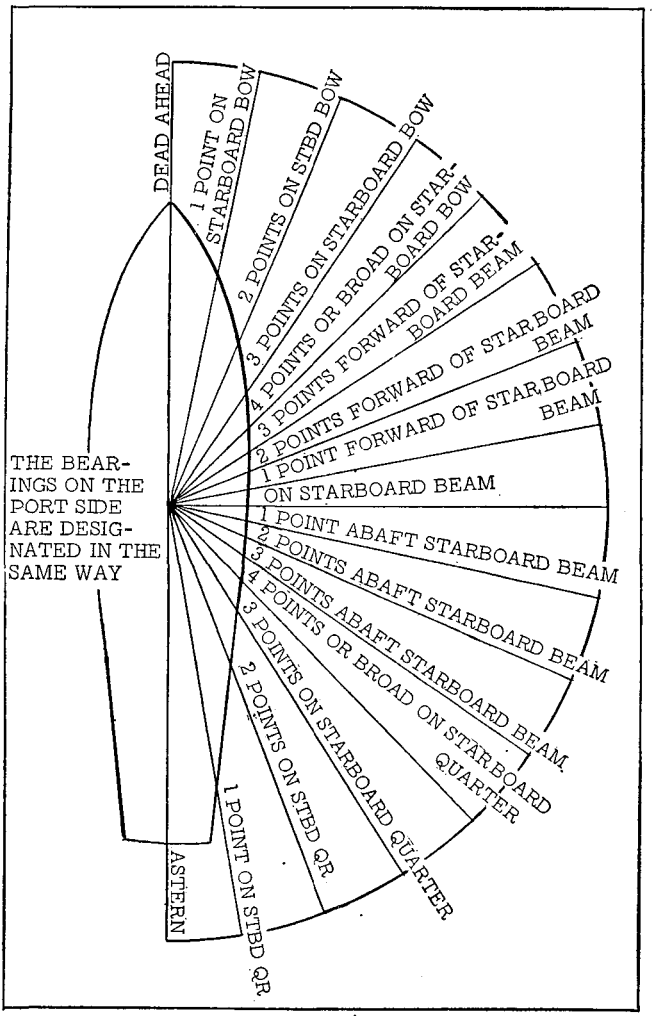


Figure 12. Relative bearings used in reporting objects sighted.

aft line of the ship, using the 32 points of the compass (fig. 12).

23. WATCHES

a. While the ship is under way, the safety of the ship and its crew is the direct responsibility of the men on watch. The watch may be divided into three parts: the officer of the deck, the wheel watch, and the lookouts. The watch officer or officer of the deck is stationed on the bridge where he maintains a constant alert, especially at night, and from which he supervises the wheel watch and the lookouts. A complete description of the duties of the watch officer is given in paragraph 19.

b. When the vessel is in port, the watch includes a watch officer or an officer of the deck and an anchor watch or fireguard. The fireguard may also be used as a gangway watch.

Section II. ENGINE ROOM DEPARTMENT, CLASS A AND CLASS B VESSELS

24. GENERAL

Close cooperation between the engine room department and the deck department is essential for the safe operation of the ship. The master should notify the chief engineer of docking and sailing time 24 hours in advance if possible. In return, the chief engineer or watch engineer should give the bridge as much advance warning as possible should it be necessary to slow down or stop the main engine.

25. CHIEF ENGINEER

The chief engineer should have an expert knowledge of technical subjects in connection with the operation of engines and other machinery. A comprehensive list of the duties of the chief engineer may be found in SR 55–510–1.

a. He is responsible under the master for the efficient and economical operation of the engine room machinery and the prompt and careful execution of all orders from the master. With the help of his assistant or assistants, the chief engineer supervises and directs all activities of the engine room crew to insure discipline and efficiency.

b. He is responsible for keeping the engine room log and all other records necessary for the efficient operation of his department.

c. He is responsible for all deck machinery and the ship's fuel and water supply.

26. ASSISTANT ENGINEER

The assistant engineer acts as assistant to the chief engineer in every way and sees that his instructions are fully and carefully executed. Whenever he acts in the absence of the chief engineer, he observes all regulations prescribed for his chief and performs any duties assigned to him.

27. OILER

The oiler's principal duty is the lubrication of main engines, auxiliaries, and electric motors. In addition, he assists the engineers in repair and maintenance work. He is responsible for keeping his

station clean at all times and for carrying out any orders given him by the engineers on duty.

Section III. COMMUNICATIONS DEPARTMENT, CLASS A AND CLASS B VESSELS

28. GENERAL

The communications department is one of the most important departments aboard ship. Its function is the maintenance of communication and signals, both visual and auditory, vital to the ship's operation. Visual signals include semaphore and flag hoists used during the day and blinker and pyrotechnic devices used at night. Auditory types of communication include radio voice and radio code. H. O. No. 87 and H. O. No. 88 have been compiled for flag signaling with the International alphabet flags, numeral pennants, substitutes, and answering pennants; for blinker signaling with the International Morse code; for sound signaling with the International Morse code; and for flag signaling with semaphore. This code is printed in seven languages, including English, French, Italian, German, Japanese, Spanish, and Norwegian. Further information may be found in the following manuals: FM 24–10 for combined radio-telegraph procedure and TM 11–454 for information pertaining to the radio operator.

29. SIGNAL OFFICER

The signal officer, who may also be the second mate, has charge of all signal equipment and its condition. His department sends and receives all messages under direct responsibility to the master

of the ship. This officer and the other communications personnel aboard comprise the signal team.

30. RADIO OPERATOR

Since actual operation of radio communication equipment is the duty of the radio operator, he must have an accurate knowledge of all types of communication, procedure, and code, as well as call letters, emergency signals, identification letters for flag hoists, and the various frequencies in his radio set.

31. METHODS OF SIGNALING

Both visual and auditory types have specific advantages and disadvantages with which communications personnel should be familiar.

a. Semaphore. This is a form of daytime visual signaling. Messages are transmitted by means of two flags, using the semaphore alphabet (fig. 13).

(1) When a communication is about to be made by semaphore, the international code flag "J" is hoisted either singly or inferior to a group of signal letters to denote that a communication is about to be made by semaphore. It is to be hoisted where most convenient and where best seen. See figure 17.

(2) As soon as the flag "J" is observed, the answering pennant is dipped by the ship addressed, then hoisted close up when ready to read.

(3) If there is any doubt as to which vessel is intended to answer the signal, the flag "J"

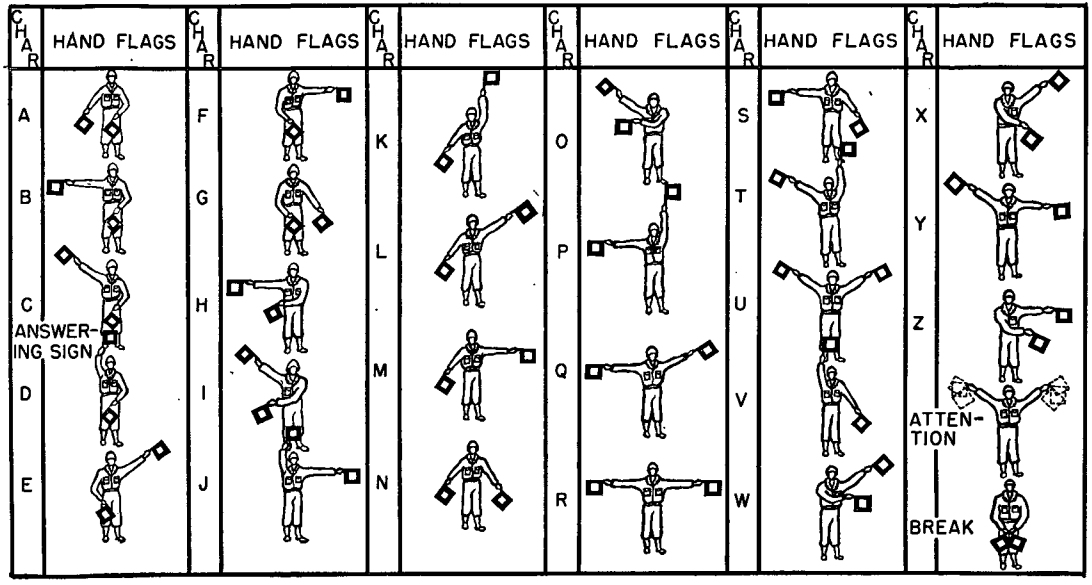


Figure 13. Semaphore alphabet.

is hoisted with a tackline inferior to the signal letters of the ship with which it is desired to communicate.

(4) If a man-of-war wishes to communicate by semaphore with a merchant vessel, she hoists the code pennant in a conspicuous position and the signal letters of the merchant vessel with a tackline superior to the "J" flag.

(5) The flag "J" is kept flying while the message is being made and is hauled down at the completion of the communication.

b. Blinkers. Transmitting messages by blinker is a form of visual communication useful for ship-to-ship communication and for ship-to-shore communication where no radio facilities are available. It has a high degree of flexibility and employs the Morse code (fig. 14) which is also used for radio communication.

(1) The portable blinker (fig. 15①) is a tube closed at one end with a light enclosed. This light is turned off and on by a trigger-operated switch. On shipboard a permanent unit (fig. 15②) may be installed either on the bridge wing or on the flying bridge. The unit consists of a light mounted on a staff with a swivel enabling it to be turned in any direction. Refer to TM 11–392 for types of portable blinker lights.

(2) The blinker has several advantages. It may be used when no radio is available or when signal security prevents the use of radio.

Brief messages may be sent with considerable speed. Since the equipment is lightweight and portable, it is useful on small craft when size and construction prevent the installation of elaborate radio equipment.

(3) There are certain disadvantages in the transmission of messages by blinker. It is comparatively slow and not well adapted to long messages. Its range is limited even under ideal conditions, and atmospheric and light conditions may prevent its use entirely. If it is used in theaters of operation, it is easy for a nearby enemy to locate the com-

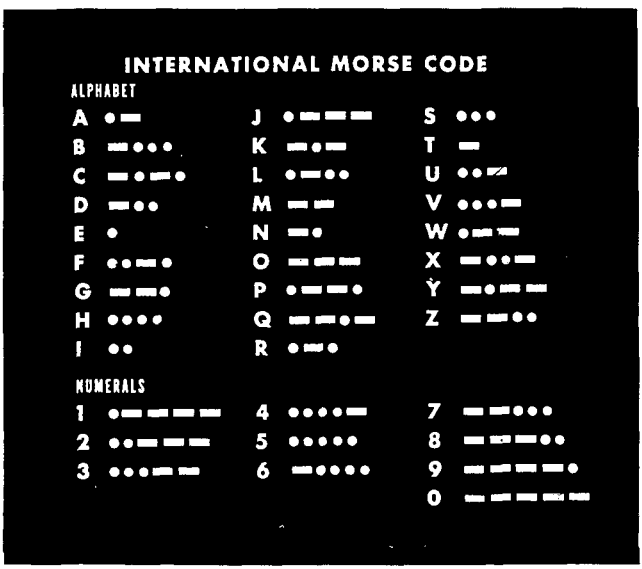
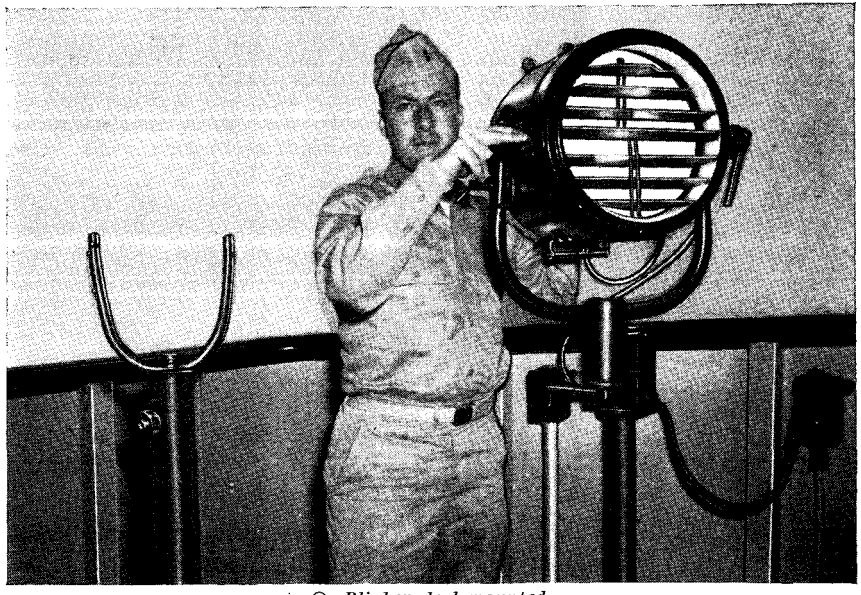


Figure 14. Morse code.

①. *Blinker, portable.*

Figure 15. Types of blinkers.



②. *Blinker, deck-mounted.*

Figure 15—Continued.

municating parties and subject them to attack.

c. Radio code.

(1) The Morse code (fig. 14) is used in radio signaling by ship, aircraft, and shore installations. With this code long messages may be sent in a minimum of time. The code has disadvantages in that both sender and receiver must be experienced men, and while they are using the code they are giving the enemy a chance to determine their position and to intercept and decode their message.

(2) FM 24–10, which was approved and published by the authority of the Combined Communications Board, is used for joint Army-Navy communication. A thorough understanding of this manual will provide an operator with the procedure needed to handle radio communications. Procedure must be precise if the message is to be understood.

d. Radio voice. The radio is standard equipment on all ships of any size. It ranges from small sets capable of transmitting up to 5 miles to sets which transmit several thousand miles. As a rule, the smaller sets are limited to one or two transmitting frequencies but as receivers, they have a much greater range in distance and in frequencies. Radio transmitters conform to specifications of the Signal Corps and are designed for transmitting on frequencies allocated to the type of service for which they are intended.

(1) All sets are registered and given a call letter which must be used for identification when sending. In wartime, call letters are changed at frequent intervals by the Navy port director's office to insure secrecy of ship movements.

(2) Just as in any other form of signaling, there is a definite procedure for use of a radio, and it should be known by anyone who might be called upon to use a radio at sea.

(3) Radio has the advantage of having a long range. It is the fastest method to send a message of any length, and it is much simpler to learn and operate than any other form of signaling at sea.

(4) Radio has certain disadvantages which cannot be overlooked. Weather, other stations, and mechanical contrivances are able to interfere with radio transmission and render it useless. In the event of power failure, the radio will be similarly useless, and repairs and spare parts are frequently hard to obtain. In theaters of operation, radio messages may be picked up by the enemy, and bearings may be taken on a radio set, leaving the position open to attack.

e. Pyrotechnics. Pyrotechnics include signals sent in the form of a flare, rocket, or smoke apparatus, or a spontaneous signal such as a fire or a gunshot. Pyrotechnics are most commonly used as distress signals, and many types are manufactured for that purpose. Special signals applying pyrotechnics of one kind or another may be worked out by a unit or

between two persons. One method of firing pyrotechnics is through the use of the Very pistol, which is a simple, single-loading type with a steel barrel about 9 inches long tapered at the muzzle (fig. 16).

(1) Pyrotechnics may be found in many forms, some in the form of cartridges to fit guns built particularly for that use and some in the form of hand flares, such as rockets, used especially in lifeboat equipment. Smoke apparatus is not common but serves many purposes. Before surfacing, a submarine may release a yellow smoke bomb to warn ships that may be in the vicinity.

(2) Flares, rockets, and other pyrotechnic devices have certain advantages, especially in lifeboats where radios are impractical. They are very effective for their size, may be seen at night at a great distance, and may be used to mark a definite position.

(3) Pyrotechnics have several disadvantages which restrict their use. They have a limited range of visibility during the daytime, and they may be seen by the enemy. When they are improperly handled they can be very dangerous, and because they must be ignited to be effective they are useless if wet.

f. Flag hoists. Flag hoists provide a method of communication which utilizes a set of flags of different patterns and colors. The set consists of 26 alphabetical flags, 10 numeral pennants, 3 repeaters, and 1 code pennant. The purpose of the repeaters

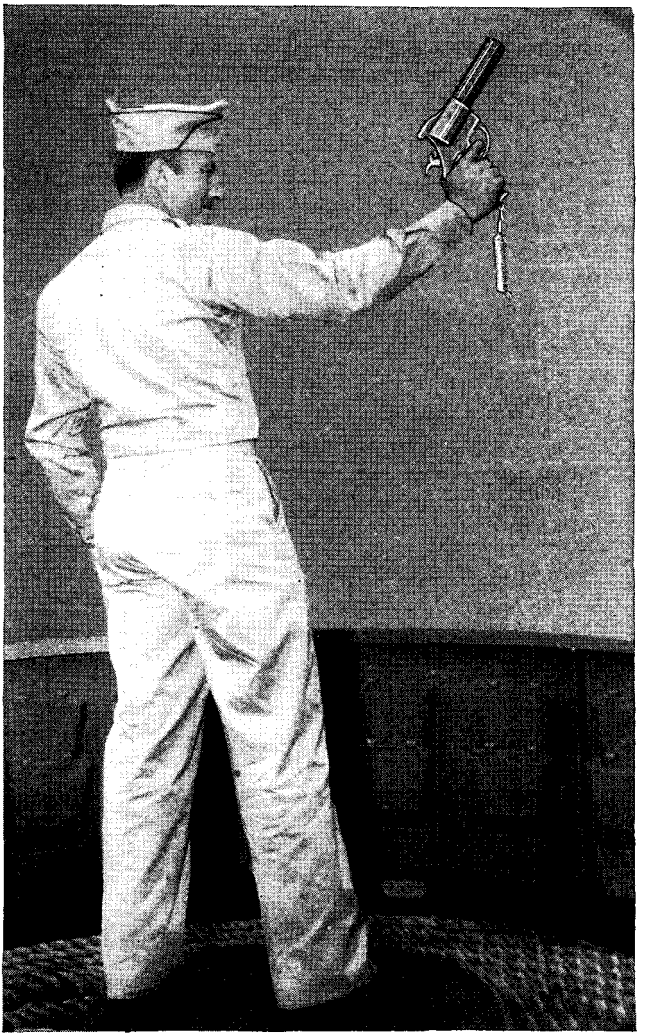


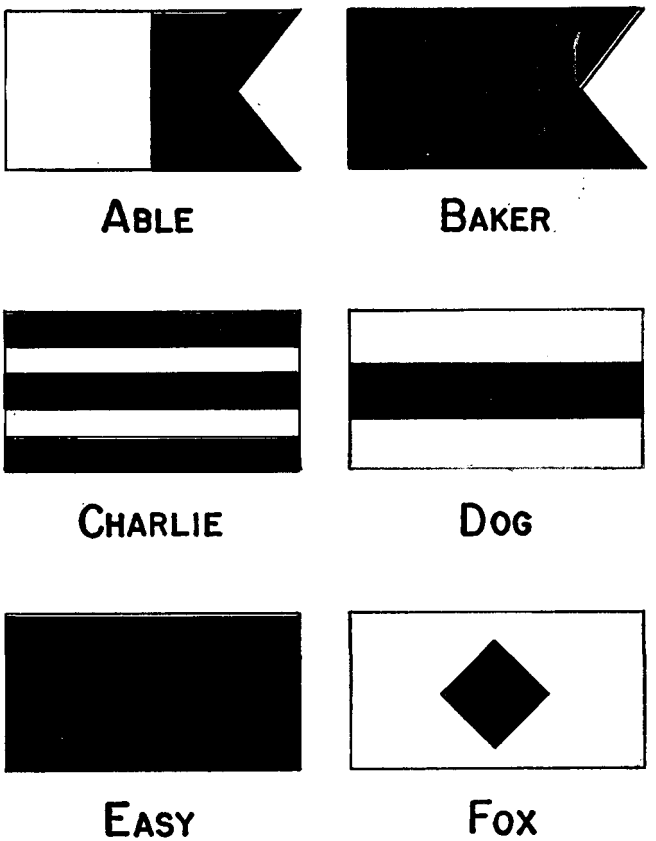
Figure 16. Very pistol.

is to enable the sender to use the same letter or number more than once in the same message. The code pennant is used preceding a group of flags to indicate that the message is in code. Each flag has a meaning in itself which should be known to everyone who may come in contact with this method of communication. These flags are referred to as the International code flags and are used by all principal maritime nations. See figure 17.

(1) There is a definite procedure to be used in flag hoist communication. The starboard outboard yardarm is the truck used first in the sending of a single flag message, and from there the hoists are worked to port. If more room is needed or more than one message is being sent, the triatic stay is put into use.

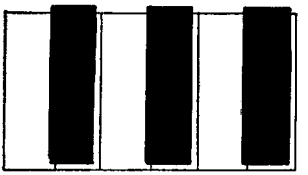
(2) Since flag hoist signals are published in many languages, this method has the advantage of allowing ships of different nationalities to communicate. Furthermore, it is possible to communicate with several ships at once when the flags are visible to all, or if secrecy is demanded, a code may be worked out between two or more ships to eliminate all others. Simple signals for towing and other activities may be worked out to facilitate routine movements.

(3) This method has the disadvantage of being slow and unsuitable for long messages. Flag hoists may be used only for short distances and may be obscured by heavy weather or darkness. A book of flag

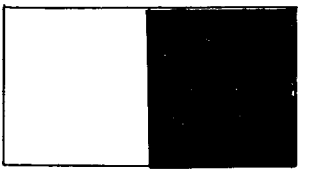


①

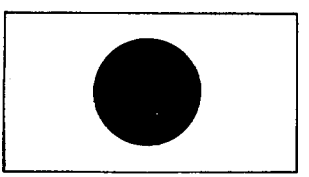
Figure 17. International code flags and pennants.



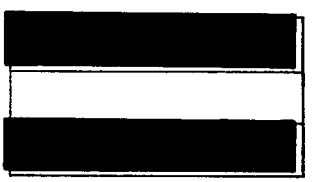
GEORGE



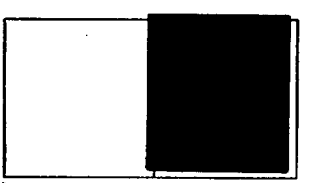
HOW



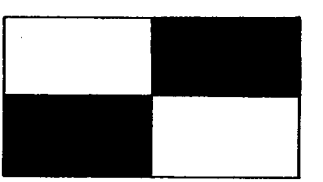
ITEM



JIG



KING



LOVE

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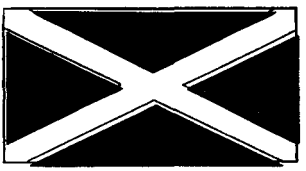
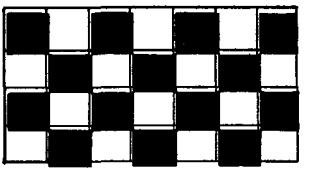
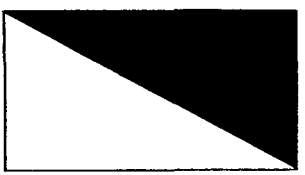
Figure 17—Continued.



MIKE



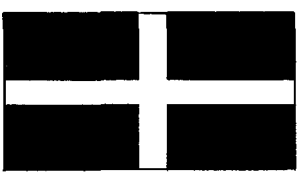
NAN



OBOE

PETER

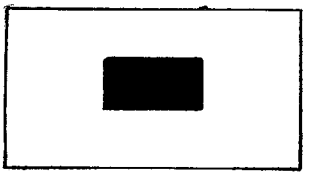
QUEEN



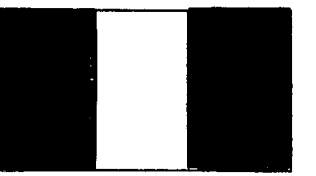
ROGER

③

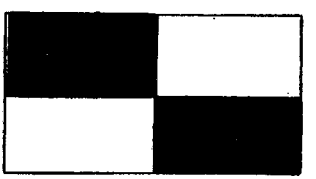
Figure 17—Continued.



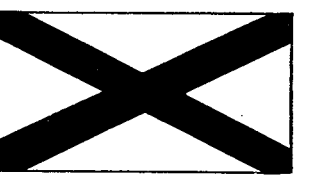
SUGAR



TARE

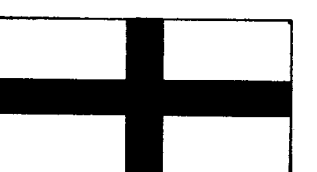


UNCLE



VICTOR

WILLIAM



XRAY

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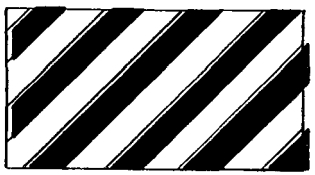
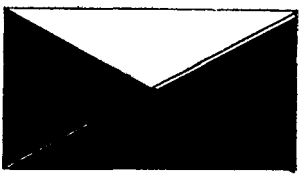
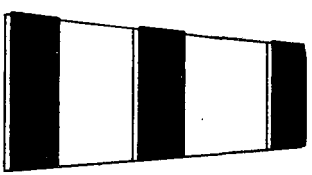
Figure 17—Continued.



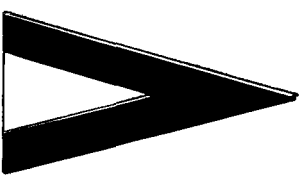
YOKE



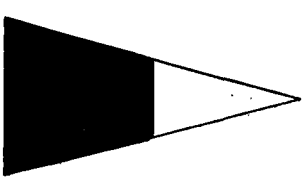
ZEBRA



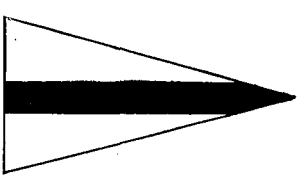
CODE



1st REPEAT



2nd REPEAT



3rd REPEAT

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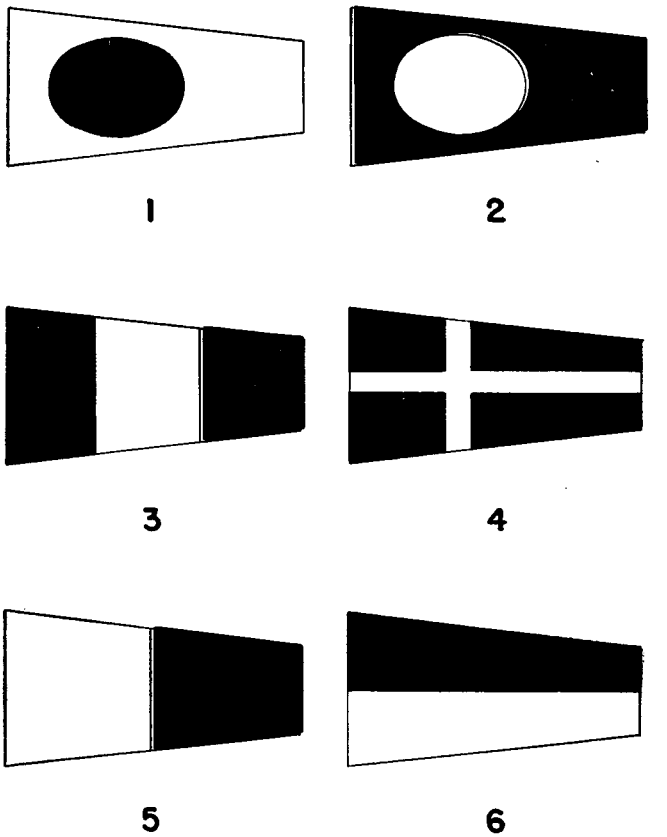
Figure 17—Continued.



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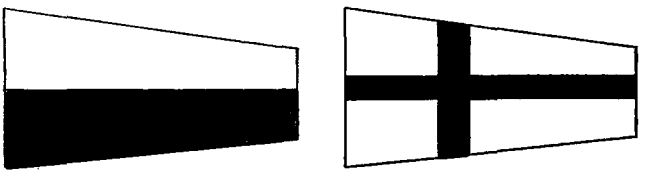

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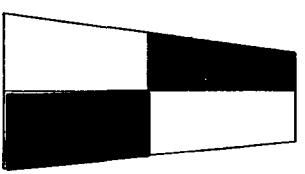

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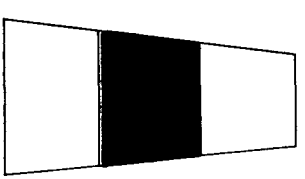

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⑦

Figure 17—Continued.

combinations, H. O. No. 87, is necessary to read messages of more than one flag.

(4) General instructions for the use of a flag hoist include the following:

(*a*) As a general rule, only one hoist should be shown at a time, but each hoist or hoists should be kept flying until answered.

(*b*) When several flags are displayed simultaneously, they are to be read in the following order: masthead, triatic stay, starboard yardarm, port yardarm.

(*c*) When more than one is shown on the same halyard, they must be separated by tacklines and must be read in numerical order of superiority.

(*d*) A signal is superior to another when hoisted before, either in regard to time or hoist.

(*e*) The transmitting ship should hoist signals where they can be seen best by the receiving ship.

Section IV. CLASS C AND CLASS D VESSELS

32. RESPONSIBILITIES OF SMALL BOAT OPERATOR

The small boat operator, although in command of a smaller boat and crew, is accountable for the operation, maintenance, and welfare of his boat and crew. Class C and class D boats are used for many types of work and are in demand during long periods of time. This means that the master must coordinate the activities of his crew so that the boat is

maintained in as near perfect condition as possible. All lines should be kept in proper shape and stowed correctly, the boat should be painted and kept clean, bilges and floorboards, as well as the hull, must be cleaned regularly, and the engine should be kept in proper working order with fuel and oil supplies at the maximum. All safety equipment must be in a serviceable condition and properly stowed. The operator, while supervising such work, must bear in mind that the small size of his crew makes him a part of it, and he must work side by side with his seamen and engineer. The small boat operator has the following duties and responsibilities:

a. Care of boat. The small boat operator is largely graded by the appearance and care he gives his boat. On small boats, care is as important as on a large freight supply vessel, and the smallest boats of class D should be painted regularly, carry adequate fenders, and be in good running order at all times.

b. Safety of passengers and crew. The small boat operator is responsible for the safety of his crew and passengers. He must see that they are safely placed aboard and discharged. While under way, they are in his charge, and he must provide proper safety equipment for them. The master should check with the engineer and the deck department before leaving the pier to make sure that the vessel is ready for use.

c. Skill in boat handling. A great proportion of the work of the small boat operator will be short trips, which means that he will have to make numerous landings and often operate in rough sea. It

is necessary that he be able to handle his craft with skill. He must plan maneuvers in advance and have in mind landing procedures before arrival at the landing site.

d. Knowledge of rules of the road. The small boat operator is bound by the rules of the road as is any craft. While working in congested harbors it is essential that he keep his craft out of danger and prevent it from becoming a source of danger to others.

e. Piloting and navigation. The small boat operator must know advanced seamanship, navigation principles, piloting, dead reckoning, and the use of charts, compass, and other navigational instruments. He should become familiar with the water which his boat will operate and with harbor regulations.

f. Keeping a log. All craft must keep a rough log. It should include running time, nature of duties, running conditions, and other pertinent data.

33. RESPONSIBILITIES OF ABLE SEAMEN

The able seaman on class C and class D boats has an opportunity for a more general knowledge of boat handling and maintenance than would be possible on a larger vessel. His duties are to handle lines while docking or towing and to assist in freight handling and stowage. Although generally responsible for the cleanliness of the boat, including painting, mopping, and washing down, he is usually assisted by the operator and the engineer. When necessary, he assists the engineer in maintenance and repair of the engine. The operator instructs the sea-

man and should give him an opportunity to operate the boat.

a. Care of craft and equipment. The able seaman is an important member of the crew. One of his main tasks is to keep the vessel painted and shipshape.

b. Knowledge of duties. The able seaman must know every phase of his job. He must have a complete knowledge of marlinspike seamanship, of preservation of surfaces, and of fundamentals of boat maintenance. The able seaman should report defects in the vessel's gear. He must know the fundamentals of safety aboard ship. Above all, he must remain mentally alert.

c. Knowledge of craft operation. The able seaman stands a wheel watch or, on a small vessel, assists the operator. It is necessary that he be able to steer a compass course. A knowledge of the controls of the vessel is helpful in an emergency. The rules of the road should be familiar to the able seaman and to all members of the deck crew.

34. RESPONSIBILITIES OF ENGINEER

The engineer of a small launch or towboat is responsible for complete maintenance of the power plant. If no maintenance and repair section is available, he must do all general repairing with the help of the crew. He is responsible for the proper operation of the engine, as a shortage of fuel, oil, or water, or a bad engine would immediately halt operations. On class C and class D craft the seamen assist the engineer and the engineer aids others in their duties, as necessary.

a. Work boats. Class C and class D boats are usually classified as work boats and may be in operation for long periods of time. They are assigned to work under a dispatcher who assigns them to various jobs. They may be sent to tend a floating crane by changing crews, carrying rations and mail, or securing small supplies, which is a 24-hour operation. Some of these craft are held by the dispatcher for short jobs or the hauling of passengers and the towing of barges.

b. Maintenance and repair. Harbor craft companies have a maintenance and repair section whose primary duty is that of repair or replacement of parts made necessary through wear or accident. These maintenance and repair teams are assisted by the engineer of the craft, but the repairs actually come under the chief of maintenance and repairs. When such service is not available, the engineer, assisted by all the crew members, does this work.

Section V. CRANES

35. TYPES OF CRANES

The floating cranes of the harbor craft companies are usually of two types, either the revolving (or whirley-type) floating crane or the type commonly called the stiff-leg crane. The revolving or rotary-type crane is mounted on a steel floating barge. Length, width, and tonnage of the barge depend on the capacity of the crane. Revolving cranes are efficient in handling tonnage because of their 360° turn. They are used for unloading all types of heavy lifts and may be useful also in salvage opera-

tions. The stiff-leg crane is also mounted on a floating barge which may differ in length, width, and tonnage according to the capacity of each crane. The difference between the revolving and the stiff-leg crane is found in the boom. The boom of the stiff-leg is anchored by means of a kingpin at the heel of the boom, and the entire boom can move in a 75° vertical arc; its horizontal movement is limited to 180° (fig. 6). The revolving crane has a boom anchored to the cab and moves horizontally 360° with the turn of the cab and vertically in a 75° arc (fig. 7). These cranes range in size from 15 to 100 tons and are powered by Diesel, electric, or steam engines.

36. DUTIES OF PERSONNEL

The crews of the various cranes are determined by size, capacity, type of engine, and other factors. A steam crane carries one or more firemen, while a Diesel crane has none. The deck crew consists of the master and his seamen. The engine crew consists of the engineer and his firemen or oilers. It is their responsibility to keep the main engine and all auxiliaries in an efficient state of operation.

a. Crane master. The master of the crane is responsible for the upkeep of his crane. He makes sure that all controls, engines, and sheave blocks are operating efficiently, and he supervises the periodic greasing and cable coating of all load lines to keep them in good condition and to prevent frequent replacements. The master of the crane has the additional responsibility of supervising the loading or unloading of heavy equipment. It is his job to see

that no load is lifted which has not been properly rigged for lifting or which is greater than the capacity of the crane.

b. Crane operator. The crane operator is responsible for the operation of the crane. He is in the control tower which contains all the necessary controls, and from there he lifts all loads that the master directs to be lifted. His job is a responsible one, for on him depends the safety of every man working the load at the time of lifting. He must watch his signalman constantly, especially when the control tower is below the level of the load, or the load is in a hatch beyond his view.

c. Engineer. He is directly responsible for the operation and maintenance of the engine room, its auxiliaries, and the electrical connections aboard the crane. It is his duty to instruct the men in proper care of the engine to insure its running efficiency. He is responsible for supervising the cleaning of all electrical circuits and contact points. On the new and modern Army cranes, there are numerous electrical units to be serviced, requiring the engineer to have a working knowledge of electricity.

d. Marine oiler. The duties of the marine oiler aboard a crane include keeping all moving parts of the engine lubricated. The working parts of a crane may be protected from friction by the use of two lubricants, oil and grease. It is necessary to oil and grease regularly other machinery aboard the crane, such as traversing gears, bull wheels, and sheave blocks. Negligence can cause damage to any part of the crane.

e. Seaman. The duties of the seaman include

painting, chipping, scraping, handling of lines, and general duties necessary to maintain the good appearance of the crane and the gear at a high level of efficiency. It is desirable that at least one of the seamen be trained in rigging.

CHAPTER 4

PREVENTIVE MAINTENANCE AND REPAIR, GENERAL

Section I. PROCEDURE FOR REPAIRS

37. WORK ORDER FOR GENERAL REPAIRS

When a vessel is due for drydocking and general repairs, a thorough check of all work to be done should be made by the master and chief engineer. All work should be listed, properly identified, and itemized in the work request. Each item should be broken down in detail as far as possible, so that a complete and final specification of repairs may be readily executed. The master should submit his work request through proper channels for further action.

38. INSPECTION DURING AND AFTER REPAIRS

It is important that constant inspection of all repair work be made during actual repairs. The shipyards should be notified of improper or deficient work before it is too far advanced. When the job is completed, it is too late to complain.

Section II. MAINTENANCE AND REPAIR TEAM

39. GENERAL

Ship maintenance and repair teams are authorized in three classes, and personnel and equipment vary

with number and class of boats to be serviced. Refer to T/O & E 55–500.

a. A maintenance and repair team, comprised of men with trades necessary to perform field maintenance of small boats and harbor craft, is normally included in the complement of a harbor craft company.

b. A maintenance team is added when it is anticipated that adequate maintenance requires more marine engine mechanics.

c. A repair team is added when it is anticipated that adequate maintenance requires more diversified skills.

40. PERSONNEL

a. Ship maintenance and repair officer. This officer plans and supervises the maintenance and repair of vessels, including mechanical and electrical equipment.

(1) He inspects vessels to determine the extent and nature of repairs to hull and superstructure and prepares working drawings and specifications.

(2) He inspects repair operations for quality of materials, workmanship, and conformity with specifications.

(3) He is responsible for coordinating shop and inspection procedures to insure the serviceable condition of a vessel and its equipment.

(4) He makes arrangements for docking a vessel for underwater repairs.

(5) He maintains records and files of opera-

tions performed by outside contractors of Army maintenance ships.

(6) He also requisitions supplies for repairs and may supervise the conversion of harbor craft.

b. All members of maintenance and repair teams should be qualified in their military occupational specialties. In addition, they should be trained as a unit to accomplish all necessary repairs in a satisfactory and expeditious manner.

Section III. BASIC PREVENTIVE MAINTENANCE REQUIREMENTS

41. CLEANLINESS

Keeping a vessel clean is the first and most important step in proper maintenance. It is essential to general welfare, efficient operation, and good health.

a. Decks. Decks must be scrubbed often with fresh water or salt water if fresh water is not obtainable. A fire pump and hose may be used for this purpose. Clean decks prevent the tracking of dirt throughout the vessel. If available, canvas or cocoa matting may be laid on the deck wherever people walk. Washing the deck is important not only for sanitation but in the case of wooden vessels to prevent the decks from drying out and to stop leakage to the spaces below. Drain holes will be kept clean to allow water to flow over freely. Pools of water on deck should be mopped up immediately.

b. Topsides. Topsides and superstructures should

be washed often, with fresh water if possible. If topsides and superstructures are very dirty, a small amount of washing soda added to the wash water will help in the cleaning, but too much soda will affect the paint. Parts washed with soda and water should be given a final wash with fresh water.

c. Interior. Quarters will be cleaned daily and close attention given to dark corners and spaces blocked by lockers, furniture, and other articles. Dust, dirt, and filth collecting in these spaces result in unsanitary conditions which may breed vermin or cause dry rot on wooden ships.

d. Cargo holds. Cargo holds should be cleaned when necessary and excess dunnage stowed and secured. Sources of any fumes or odors should be traced and the cause eliminated.

e. Galley. The galley will be kept clean at all times and cooking utensils, porcelainware, and silverware put away spotless. All cooking and eating implements should be steamed or washed with water hot enough to remove all traces of grease or food particles.

(1) The stove should be provided with a suction fan to draw all fumes and smoke from the galley.
(2) Food handlers will keep their bodies clean, wear clean clothes, and will have a certificate of health.
(3) Refrigerators and coolers will be kept clean at all times. Duckboards, hooks, and shelves should be scrubbed and the box defrosted at least every 2 weeks.
(4) Food should be checked daily for spoilage,

especially in the cooler and vegetable bins. Potable water will be tested periodically and the tanks flushed and cleaned every 6 months.

f. Paint lockers, boatswain's lockers, deck boxes, storerooms. These areas should be kept clean and neat. Dirty rags and other trash are fire hazards because of spontaneous combustion, especially in paint lockers or boxes where ventilation is poor. Spilled paint, fresh or old, should be removed.

42. ORDERLINESS

Deck and engine room gear carelessly left around a vessel may result in injury or loss of life. There is a place for everything aboard the vessel; all gear and equipment must be put in the proper place when not in use so that it will be on hand when needed. Crew quarters should not be cluttered with odds and ends; storerooms and lockers have shelves, hooks, and other fixtures where loose articles may be placed. Lines should be neatly coiled and, if possible, stowed on gratings so that the lines, as well as the deck underneath, may be kept dry. A vessel's constant motion will shake all objects loose, and even heavy gear must be properly stowed. Life rafts, lifeboat gear, and provisions have a definite place and will be properly stowed. Lifeboats or life rafts may be needed only once, but if needed, gear and equipment must be complete and in good condition.

43. VENTILATION

Proper ventilation aboard a vessel is important not only from a preventive maintenance standpoint but also from the standpoint of safety of the cargo and the health of the crew.

a. Wooden vessels are subject to dry rot which eats away the wooden fibers, weakening the wood. Proper ventilation will help prevent dry rot, which thrives in damp places. On clear days, hatches, escape scuttles, manholes, and doors should be opened so that fresh air may circulate, removing stagnant air. This is especially important in the bow and the stern of the vessel where circulation of air is usually poor. To be sanitary, living quarters should be aired and cleaned at least once a day.

b. When possible, all lines and ropes should be brought on deck, looped loosely, and laid in the sun to dry. Storerooms should be cleaned and aired frequently. Since sea air is moist, clothing, bedding, and other fabrics will mildew if not exposed to the sun as often as possible.

c. Improper ventilation of the cargo holds causes damage to cargo. Sometimes fumes accumulate causing a fire or explosion by spontaneous combustion. Some cargoes remove oxygen from the air; these include tobacco, oranges, resin, potatoes, wool, cotton, leather, coal, cereal grains, hemp, jute, and all petroleum products. Fuel products not only remove oxygen from the air, but they also produce hydrogen sulfide, a gas which is poisonous if there is a large quantity present in a confined space.

d. The two most common noxious conditions in

tanks are presence of carbon monoxide and oxygen deficiency.

(1) Carbon monoxide is usually found around running engines where exhaust gases are not properly carried off, their heavier-than-air property causing them to settle near the deck or in bilges.

(2) Oxygen deficiency is a lack of sufficient oxygen to permit normal breathing. Fresh, circulating air contains 21 percent oxygen, but 16 percent is considered safe. From 8 to 11 percent will cause loss of consciousness, and 6 percent can cause death within 6 to 8 minutes.

e. Certain precautions should be taken before entering a tank or hold for cleaning, painting, or inspection of cargo. When a tank or hold is known to have been gaseous, testing equipment should be used to determine purity of the air within since both carbon monoxide and oxygen are colorless, odorless, and tasteless. If no testing equipment is available, tanks or holds must be ventilated thoroughly and then entered cautiously. If approved gas masks are available, worker should be so equipped. If gas masks are not available, worker should be properly secured with a line before being lowered. He will not be left unattended and a constant check will be made of his condition.

CHAPTER 5

PREVENTIVE MAINTENANCE AND REPAIR OF HULL, GEAR, AND EQUIPMENT

Section 1. STEEL HULL

44. CLEANING

a. Rust chipping. It is highly important that all steel surfaces be properly cleaned of rust, grease, and dirt before painting.

(1) Equipment for descaling consists of electric and pneumatic chipping hammers, hand chipping hammers, chisels, scrapers, and wire brushes of different shapes. The pneumatic tool, or air gun, is highly effective as all-purpose descaling equipment; it may be used to clean large, open areas, as well as corners, narrow channels, and openings, performing efficiently in a minimum of time compared with other types of chipping hammers.

(2) When descaling steel surfaces, care should be taken to prevent the use of chisels which are too sharp. A smooth steel surface offers more resistance against rust than a rough surface; therefore, it is advisable to use a blunt type of chisel and avoid cutting into the steel and ruining the surface. Chisels of various shapes should always be at hand so that the hammer operator may select the

one most suitable for the area which is to be descaled.

(3) Certain areas, when covered with loose, heavy scale, may be descaled with a square blow from a rather heavy hammer. A firm rap will descale several square feet of the plate without doing any harm to the steel surface.

b. Scraping and cleaning. Not all types of rust can be removed by descaling. There will always be a certain amount which must be eliminated by the use of scrapers and wire brushes. Soft or loose rust is just as injurious as hard scale and must be removed before the steel is painted. Scrapers used for this work are of different types, depending on which part of the vessel is to be scraped. Deck scrapers are usually of the straight type, with a scraper blade of hard steel, varying in width from 2 to 5 inches, and a wooden handle long enough to let a man work with straight back. Scrapers used on the outside of the vessel have two scraping edges set at a 90° angle and a wooden handle 6 to 15 feet long. In addition, there are different types of hand scrapers of convenient size for use in narrow compartments, where long-handled scrapers cannot be used. It is excellent to use a sharp scraper before using a wire brush to clean the pores in the steel surface. A wire brush may be used also in places where it is impossible to use a scraper. Where possible, an electrically operated wire brush should be used to remove all rust remaining after the use of chipping hammer and scraper. The final cleaning of the horizontal sur-

faces may be done with a suitable broom to remove the remaining dust and dirt.

45. PAINTING

a. Paint should be applied in dry weather only, preferably on warm days. Temperatures below 45° are damaging to wet paint and should be avoided. A priming coat of red lead or zinc chromate is recommended; when the first coat is completed, check to see that no bare steel is exposed. The paint should be left to dry until it forms a tough, hard film; then apply a second coat of the same paint to form a firm, protective base for the finishing coat. If red lead is used for priming, care should be taken not to dilute it with oil below the safety limit. The paint should contain not less than 25 pounds of red lead to each gallon of oil (thirty-three pounds of red lead to 1 gallon of oil is considered the best mixture).

b. When the priming coat has hardened sufficiently, a coat of flat paint of the desired color should be applied before the final coat. All outside surfaces require a better grade of paint than more protected surfaces such as inside shell plates, bulkheads, and other parts of the vessel not directly exposed to the effects of sun, air, and salt water. All surfaces inside living quarters, mess hall, galley, and compartments which are subject to frequent cleaning with soap and water should have a final coat of enamel paint; this forms a hard and highly glossy finish which is easily cleaned and resistant to wear and chemical action.

c. Application of paint with a spray gun is chiefly a time-saving operation. If a long-handled nozzle is

used, large areas may be coated in a comparatively short time without the use of elaborate stagings and ladders, otherwise necessary when painting a surface such as the outside of a vessel. A spray gun also expedites a paint job in an engine room or storeroom where obstructions make brush application impracticable. However, a sprayed application is a relatively thin coat and is not considered so satisfactory as a brush application, which provides better and longer lasting protection to a surface. It is preferable to use the brushing method when painting the bottom and outside surfaces of a vessel. The brushing method involves more time and manpower, but the adhesive qualities of the paint are increased by brushing and working it into the pores and cracks of the surface. Also, the painter is able to observe whether the area is evenly coated with paint because of the short distance between himself and the painted surface.

d. It is important that the painter be well qualified for the job and that he use the proper type of paint and the correct kind of brush. Enamel paint requires a rather stiff brush, while flat oil paint may be applied more effectively with a softer brush.

e. Consult current directives and technical bulletins (TC series) regarding the quality and color of paint to be used for various purposes.

Section II. WOODEN HULL

46. PREPARATIONS BEFORE PAINTING

a. Paint removal. A heavy coat of old paint may be removed by using a blowtorch and a scraper.

Apply the flame of the torch close to the painted area which is to be cleaned until the paint begins to boil and blister; the paint may then be easily scraped down to the bare wood. Only a limited area should be heated at a time. Be careful not to use any excess heat, and keep the flame constantly circling the area being worked on. A scraper for woodwork, properly honed to a sharp edge, should be used immediately after the paint has been softened by the heat. Areas covered with a comparatively thin coat of paint may be cleaned by using a chemical paint remover and then scraping. This method is also excellent for removal of varnish and lacquer, particularly on surfaces where a blowtorch would have a damaging effect. When using paint remover, a heavy coat should be applied with a paint brush; it should be left on until the chemicals have had sufficient time to dissolve the paint, and then the paint may be removed with a sharp scraper. It is recommended that work be done on a limited area of 2 to 3 square feet at a time. Paint has a tendency to harden again if the paint remover is left to dry after the application. Removal of a heavy coat of old paint with only a scraper is unsatisfactory and, in most cases, ruins the surface of the wood.

b. Calking. After removing the old paint on the hull, all seams and butts should be examined for proper condition. Test the hardness of the calking by using a wooden mallet and a calking iron of the correct shape and thickness. A gentle stroke or rapping with the mallet on the calking iron will indicate whether the calking material (oakum or cotton thread) is tight in the seam. If it is soft, the seam

should be recalked where necessary and repaired with calking compound. A proper calking job requires a skilled calker. The pressure exerted on the calking material depends upon the type, thickness, and width of the planking. Oakum is used chiefly on the heavier planking, while cotton thread is more suitable for small craft. The seams should never be filled flush with calking material; sufficient space should be left for a good seal of marine type putty or calking compound, which will prevent the oakum or cotton thread from becoming water-soaked. After completing repairs to seams and butts, the finishing compound should be left for hardening. After it has hardened, all excess compound may be scraped off flush with the wood. When the hull has been scraped clean of paint and all repairs have been completed, such as replacement or renewal of planking or other outside work, the surfaces should be sanded down to a smooth finish and all dust brushed off, thus completing the preparations for the first coat of paint.

47. PAINTING

Current directives, technical bulletins (TC series), and specifications covering Government-approved paints for various purposes will be followed. Paint for the first coat on wooden surfaces should be "cut" only as specified. When the priming coat has dried sufficiently to form a hard film, all cracks and exposed fastenings and bolt heads should be checked and where necessary filled with putty or other suitable compound. Make sure the putty or compound is smoothed flush with the surface. A second coat of

paint of the desired color, thinned less than the first coat, should be applied. Be sure that a uniform, relatively thin coat is obtained. The third coat of paint will usually give the surface the desired protection and appearance. In painting the outside of the hull, all final strokes of the brush should be in the fore and aft direction; otherwise, the strokes should be in the direction permitting the longest strokes, or parallel with the longest beams. The underwater part of a wooden vessel is usually protected by two or more coats of copper paint. The instructions for applying copper paint should be read and followed carefully, particularly those regarding the last coat, which should be applied immediately before launching the vessel or refloating it after drydocking.

Section III. RIGGING

48. MASTS AND CARGO BOOMS

It is important that masts and cargo booms be given care and attention at all times. All permanently installed sheaves, cleats, and padeyes must be checked for good condition at regular intervals. Bolts and pins in sheaves and shackles should be kept free from rust and corrosion by regular greasing or lubrication with heavy oil. The gooseneck connection between the mast and cargo boom should be examined for proper condition at least once every year by lifting the boom out of the socket. After a thorough cleaning, check the parts for defects and reinstall all parts well lubricated. Keep the masts and booms coated with paint; prevent rusty spots on

the surfaces by patching the scratched and bare areas with paint.

49. SHROUDS AND STAYS

All standing wire rope rigging must be protected from deterioration with a coat of paint or tar at regular intervals of approximately every 6 months. The quickest way to paint the rigging is to soak a soft rag with paint and wash it on by squeezing the rag loosely around the shroud or stay. Place the paint container inside a bucket to prevent spilling paint on the deck. The rag may then be dipped in the container and excess paint squeezed off without getting paint on the decks and equipment below. Begin at the top of the rigging and work downward while sitting in a boatswain's chair.

50. TURNBUCKLES

Turnbuckles should be kept in good working condition so that they may be adjusted or released if necessary. The threaded parts must be free of paint and rust, protected by grease and a canvas cover or coated with a mixture of tallow and white lead. The latter, when melted and mixed, may be brushed on in a heavy coating; when cooled, it will form a good firm protection, watertight and easily removed. Shackles used in connection with turnbuckles should have the threaded ends, as well as bolts, protected in the same manner.

Section IV. CARGO-HANDLING GEAR

51. CARGO WINCHES

The electric motor should be given care and maintenance. All bearings for moving parts must be properly lubricated and protected from accumulation of water in the lubricating oil pockets under the bearings. Grease cups should always be in workable condition and never left empty. Fill the cups as soon as the last grease is pressed out. Use specified lubricant on all gears and transmissions and be sure that they are never operated in dry condition. Bearing surfaces for free-running or sliding gears and clutches should be protected from rust by keeping a heavy coat of grease on the shafts at all times. Maintain the brakes in good working condition. Check the brake linings and renew them if they are excessively worn; lubricate all moving parts regularly to prevent them from freezing. Gaskets on all watertight handholes and inspection doors must be kept in good condition, forming a tight seal against leakages. Keep lubricating points free from paint and dirt. Maintain lubricating pads and wicks in serviceable condition.

52. CARGO GEAR

Running wire ropes for handling cargo need lubrication which penetrates to the inner parts to prevent excessive friction. The strength of a runner or any wire used for hoisting purposes may be roughly determined by checking the outside wires. If worn down to half the original size or diameter, the run-

ner should be replaced with a new or better one. Wire rope having numerous broken wires or showing evidence of being subjected to excessive strain is unsafe for cargo handling and should be replaced. All blocks for topping lifts, as well as others used for working cargo or heavy lifts, should be taken apart for inspection once a year if used regularly. The check should be thorough, followed by a pull test to ascertain safe working condition. Proper lubrication of all moving parts, as well as painting of the frames, is routine maintenance work. Defective cargo hooks and shackles should be replaced with new ones of approved type and strength. Wire rope and chain used for operating and securing the topping lift on the cargo boom must be checked frequently. They are also subject to annual inspection and testing for safe operating condition.

Section V. ANCHOR GEAR

53. ANCHOR WINDLASS

When operating the anchor windlass, first observe whether all bearings and moving parts are properly lubricated. See that all oil cups have good wicks and are filled with lubricating oil. Check grease cups for sufficient grease, and squeeze the grease in until it appears at the ends of the bearings. Apply grease or oil on those parts of shafting supporting sliding gears and clutches. Lubricate all threaded ends and bushings on spindles for brake mechanism, bolts, and other moving parts. See that the wildcats are well lubricated when running free. Disengage the wildcats and try out the windlass before

working the anchors; then engage one side at a time and take the weight of the anchor. Release the devil's claw and other stoppers, if any, and veer out the anchor until it is free from the hawsepipe. Try out the brake carefully, making sure it works properly. Always maintain the locking rings for the wildcats so that they operate freely. After each operation of the windlass, check to make sure that all moving parts are protected against rust. A coat of watertight grease is excellent on the moving parts, threaded ends of brake mechanism, locker rings, and shaftings. Prevent water accumulation in the oil cups, and squeeze extra grease into the bearings. Open lubricating points should be plugged with grease or tallow. Operate the anchor windlass once a week to maintain good working condition.

54. ANCHORS

The maintenance work required on an anchor consists chiefly of a coat of paint and occasional lubrication of the connecting parts between the crown and the shank (if a patent anchor). If the anchor is seldom used, the belt in the crown shackle should be taken out and lubricated to prevent rusting of the sliding parts. All anchors are tested by a surveyor of the American Bureau of Shipping at the time of completion by the manufacturers. Stamps are placed on the fluke and shank of each anchor after it is tested. These stamps should never be coated so heavily with paint that they are illegible. If necessary to remove paint or rust from these parts, clean them with a wire brush (a chipping hammer would ruin the markings) and apply only a thin

coat of paint as protection from rust. It is advisable to frame the marking with red paint so that it may be easily located. The following information is usually stamped on an anchor:

a. Number of the certificate (furnished by the surveyor).

b. Initials of the surveyor who witnessed the test.

c. Month and year of test.

d. Proof of test applied in pounds.

e. Signification that the testing machine is recognized by the American Bureau of Shipping.

f. Weight of the anchor in pounds.

g. Weight of the stock (if a stock anchor) in pounds.

55. CHAINS

Ground tackle is very important to the safety of a vessel and must be given the best of care. A check of the condition of the links and shackles should be made at the time the anchors are weighed, and a thorough examination should be carried out at the time of drydocking or at least once a year. The chains should then be arranged for inspection and repairs if necessary. The chains are cleaned by hosing down with a heavy stream of water, removing all mud and dirt. Each link is tested with a hammer. Defective links will have a false ring or sound which indicates a loose stud or a crack in the material. All shackle bolts, locking pins, and swivels must be examined for good and safe condition. Defective parts will be repaired or renewed. Upon completion of repairs, the chains should be coated with tar, oil, or paint. When ready to heave the

chains aboard, the outboard end should be connected to the anchor and the inboard end fastened in the chain locker. By reversing them once a year, a more uniform wear of the chains will be obtained; this is considered an important factor in their maintenance and care. When reversing the chains, remember that all connecting shackles must be put in with the bowed end toward the anchor or they may foul the wildcats when the anchor is dropped. The American Bureau of Shipping specifies that chains, shackles, and other connecting devices be given a series of tests to determine their strength and perfection. After passing the test, each separate connecting unit and each shot of 15 fathoms of continuous chain must be stamped by the manufacturers with the following data:

a. Number of the certificate (furnished by the surveyor).

b. Initials of the surveyor.

c. Month and year of test.

d. The breaking test in pounds.

e. Proof of test applied in pounds.

f. Signification that the testing machine is recognized by the American Bureau of Shipping.

56. CHAIN LOCKERS

Keep mud and dirt from the chain lockers by hosing down the chains when the anchors are brought up. Overhaul the lockers when the chains are out for inspection or repairs. The lockers should then be thoroughly cleaned, descaled, and painted. Drainages should be opened and valves cleaned and put in good working condition. Rings, padeyes, or

other fastenings for the chains should be checked for safety and the chains properly secured afterward.

57. CAPSTAN

Aside from the usual routine work on the electric motor and controllers, a capstan needs little attention. The reduction gear, bearings, and stopper pawls must be lubricated regularly. The capstan should be operated at least once a week to maintain proper working condition and prevent freezing.

Section VI. LIFEBOATS AND EQUIPMENT

58. BOATS

a. Lifeboats and equipment will be kept up to U. S. Coast Guard standards for the maintenance and care of lifesaving and firefighting equipment. This is usually the responsibility of one officer; it is his duty to see that they are in good condition and ready for immediate use at all times. Once every year the boats should be stripped of all equipment and air tanks; all parts should be examined thoroughly to determine their perfection and safe service condition. Necessary repairs or replacements should be carried out immediately. Air tanks showing rusty or corroded spots should be subjected to a test of low air pressure; use soapy water to detect any leaks. Upon completion of tests and repairs, the tanks should be properly cleaned. Steel tanks should be coated with approved paint; copper tanks do not require painting. The boats should be painted inside and outside, and when the paint has hardened, the tanks should be reinstalled and secured in place, protected by wooden

strips on the inboard sides. The numbering and marking of lifeboats and equipment should be in accordance with current rules and regulations. During storage on board, lifeboats are protected by a canvas or wooden cover. It is important to remove these covers and air the interior of the boats at least once each month. Stagnant, moist air is damaging to the boats and equipment and is the chief destructive factor. Prevent accumulation of water in the bottoms of the boats by keeping the drain holes open and the plugs attached to brass chains, lying beside the holes. Inspect all lifelines or grabrails to see that they are in good condition, arranged with fastenings 3 feet apart, and properly secured. All releasing gear mechanism must be checked carefully for free and easy operating condition.

b. A motor-powered lifeboat should be operated under service conditions once each week to see if the engine is in good working order. One engineer should be responsible for the maintenance and care of the motor; he should see that fuel, lubricating oil, grease, tools, and replacement parts are in the boat at all times, stored in tanks and suitable containers, and properly protected and secured.

59. EQUIPMENT

All lifeboat equipment must be inspected frequently to see that it is in proper condition. It must be useful and of good quality. The boats must be fully equipped before the vessel departs from a port. Items not required should never be stowed in a lifeboat, nor should any of the required equipment be removed from the boat, except when checking.

Replacement of defective items is carried out under the supervision of the responsible officer. A routine inspection of all equipment is necessary to maintain satisfactory conditions. Food ration containers, water containers, distress signals, boat-handling equipment, etc., must be examined for defective condition and replaced with new items if necessary. It is most important that all tanks used for stowage be emptied and aired thoroughly; they must be completely dry before the equipment is replaced. All airtight gaskets on container lids must be checked and replaced if found defective. Different items, such as oars, buckets, boathooks, buoyancy tanks, and others, should be marked with the vessel's name and US Army (or port of registry) for identification. To prevent leakage, water breakers should never be left empty for any length of time; a constant replacement of drinking water is necessary because of the lack of fresh air circulation in the breakers.

60. DAVITS AND FALLS

a. Davits. All moving parts should be lubricated regularly. If Welin-type davits are used, the cogs on the quadrant should be free of paint and coated with grease to reduce the mechanical friction during operation. The crank spindle, with bearings, guides, and bushings, must also be coated with grease or heavy oil to operate freely and easily. Cranks should be kept in their respective holders on the davits ready for use. Radial davits need lubrication at the deck brackets and the lower ends of the heel sockets. Provisions should be made to protect

the friction points at the deck brackets with a canvas collar; the lower end sockets should have suitable drainage holes to prevent accumulation of water. All sheaves, fairleads, and swivels must be lubricated and kept in good working condition. The davits should be coated with paint to prevent rust and corrosion.

b. Falls. All fiber rope used for boat falls is subjected to rapid deterioration if not protected against the atmosphere by watertight covers. Thus, the parts between the blocks, which for practical reasons are unprotected, should be inspected every 6 months for safe working condition. It is recommended that the falls be changed end for end after being used for 6 months so that the free end of the fall is fastened to the blocks, and vice versa. This means that the bulky part of the fall coil which has been stored and protected in a canvas-covered receptacle is reversed and put into use where the load is heaviest. This arrangement gives a more uniform wear on the falls and increases the safety factor for handling the boats. The falls should be renewed after being used for 12 months. When reversing or renewing the falls, all blocks should be taken apart for overhauling and lubrication. Remove the sheaves from the frames, clean the rust and other impurities from bearings and pins, and reinstall the well-lubricated parts. Care should be taken not to use coarse emery paper when cleaning the bearing pins, as this will weaken them.

c. Miscellaneous. The maintenance and care of boat covers, cradles, lashings with slip hooks, davit guys, spans with lifelines, and debarkation ladders

(if such are used) are fully as important as the maintenance and care of items discussed in *a* and *b* above. Decks on which lifeboats and other lifesaving equipment are carried must be kept clear of freight, loose deck gear, or other obstructions that will interfere with the immediate launching of the lifeboats.

61. LIFE PRESERVERS

All life preservers should be properly checked for defects and laid out on deck to air at least every month. Fastenings on life preservers should be examined for safe strength and condition; attached flashlights and other equipment (if required) must be in serviceable working order. Make sure that equipment and storage places are completely dry before restowing; at the same time check to see that the required number and types of preservers are on board and properly distributed. All lifesaving equipment must be marked with the vessel's name for identification.

Section VII. CARGO HOLDS

62. HATCHES AND COVERS, TARPAULINS

Hatch coamings, covers, and strongbacks should be handled carefully to prevent undue damage. A wooden or steel hatch cover should slide easily into place without the use of another cover as a ramrod. If it is too tight to slide into place, have necessary alteration made so that easy handling is possible when opening or closing the hatches. Maintain the handholes and grips in good working condition for safe handling. Tarpaulins should be rolled up

neatly when not in use and stowed out of the way. They should be protected from cuts and the damage frequently caused by sharp corners, bolts, and nails when covering certain deck cargo. Battening-down beams and wedges should be properly cared for. Examine all gaskets, if they are used, and replace those that appear to be loose or lack sufficient flexibility. Protect all threaded ends and dogs for clamping-down bolts to assure smooth operation. Recut the threads and fair the bolts if damaged.

63. LADDERS

Broken or damaged hold ladders are dangerous. Proper repairs must be made immediately. Ladders must be securely fastened at both top and bottom ends, and sometimes in between, depending on the length of the ladder. Broken or bent rungs should be renewed and fastened so that there is no doubt about their safety. Keep the ladders clean and free of grease or other slippery substance which may cause accidents.

64. WATERTIGHT BULKHEADS AND DOORS

No holes or openings should be cut through the bulkheads other than those equipped with watertight doors and valves. Keep the bulkheads coated with paint to prevent rust and corrosion. Watertight doors must always be clean and well lubricated at sliding supports and mechanical moving parts for safe and easy operation. Under the supervision of a responsible officer, routine inspections of the doors should be made to see that they are in satisfactory

operating condition. No paint should be applied to any moving parts where it will interfere with the closing or opening of the doors. The operating devices at the doors and the remote control must be in such condition that either one may be used in case of emergency. Wrenches, ratchets, or other auxiliary equipment for operation of the doors must be in their respective brackets or racks at all times; if removed or lost, they should be replaced immediately.

65. SOUNDING PIPES

Make immediate repairs or replacements of damaged sounding pipes leading through cargo holds into double-bottomed tank compartments or other tanks located in these areas. These pipes are usually protected by wooden boxes, and damage may be prevented by careful handling of the cargo. Sounding pipes should never be used as supports for lashings of cargo or other heavy equipment, nor should they be used for anchoring of snatch blocks or fairleads when shifting cargo in the holds. Gastight caps must be provided on each sounding pipe extending up to the weather deck; both a counterbalanced, self-closing cock and a cap must be provided on each sounding pipe leading partly up in a cargo hold to point above the waterline. Keep the sounding pipes closed properly when not being used to take soundings.

66. TANK-TOP MANHOLE COVERS

It is important to the safety of the vessel, as well as to the cargo, that manhole covers be packed with

the proper type of gasket when the covers are replaced. An old or used gasket is usually unfit for re-use and should be replaced with a new one before closing a manhole cover. Any type of watertight and oiltight packing of sufficient flexibility may be used. Certain types of manhole covers are constructed for the use of a square type of tallow packing or rubber composition. Where a plain steel plate is used for a manhole cover, the gasket should be cut out of flange packing of the proper type and thickness. Use the cover as a template for correct size and location of holes. Clean the flanges properly, removing the old gasket and any paint or compound before the new gasket is installed. It is advisable to apply a coat of heavy red or white lead on both sides of the gasket to insure tightness of the cover when bolted down.

67. BILGES

Accumulation of dirt, rags, and trash should never be permitted in bilges and waterways in the cargo holds. Keep them clean and empty at all times and make a daily check of their condition. Proper ventilation should be maintained by opening the bilge hatches as often as conditions permit. Bilges in steel vessels may be coated with appropriate paint, sludging oil, or emulsified asphalt, while those in wooden vessels require a penetrating coat of paint or tar.

Section VIII. MISCELLANEOUS MAINTENANCE WORK

68. SKYLIGHTS

All moving parts for the operating devices and hinges must be lubricated regularly to maintain proper working condition. Overhaul battening-down bolts and dogs and replace broken glass, as well as defective rubber gaskets. All coated parts should be protected with paint to prevent rust. Keep the skylights clean at all times and make sure they close completely to prevent leaks.

69. VENTILATORS

To maintain good working condition of ventilators, it is necessary to remove the cowls from their bases so that the sliding parts may be thoroughly cleaned and lubricated. Remove all rust and scale from the guide rings, using chipping hammer and wire brush. When clean, apply a thick coat of grease on the surfaces to protect them from rust. Paint should never be used because it will increase the friction and make the turning operation difficult. Lubricate turning gears and cranking devices regularly. Ventilator screens must be kept in good shape and properly secured in the cowls.

70. VENT PIPES (TANKS)

Fire screens on vent pipes leading to fuel oil tanks should be examined for safe condition. Damaged screens must be replaced immediately as a safety precaution against fire.

71. PORTHOLES

Portholes must be prevented from leaking. Check each gasket; if defective, remove it and clean the groove properly. The new rubber gasket should be installed with suitable glue or rubber cement. Make sure that it is the correct size. Do not cut the gasket until the full length is in the groove so that it will not be too long or too short. Keep the dogs and hinges in easy operating condition; the threaded ends of the bolts should be free of paint to enable a proper closing of the porthole. Cracked glass may be renewed, but during this operation the ring nut which holds the glass in the frame must be handled carefully with a special wrench. After the old glass is removed, the frame should be properly cleaned and the new glass embedded in putty before the ring nut is screwed firmly into place.

72. OUTSIDE DOORS AND HATCHES

Action should be taken to prevent frozen hinges and defective locks caused by lack of proper lubrication. The condition of the doors should be checked regularly to see that they operate without difficulty and fit tightly to prevent leakage of water when closed. Defective gaskets must be renewed and the bolts and dogs kept free of rust if the steel doors are equipped with this closing mechanism. The doors should always be properly coated with paint to prevent deterioration. Do not paint hinges with paint that is too thick, as this will cause broken hinges. Check weather strips for satisfactory condition; they should permit easy operation of the doors and serve

the purpose for which intended. Steel watertight doors and hatches on weather decks require frequent attention regarding condition of knife edges and gaskets as well as lubrication of hinges and closing mechanisms. Knife edges should be kept clean and free of the rust and should be unpainted. Gaskets should be clean and unpainted.

73. WIRE REELS

Keep the wire reels painted and well lubricated. Bent or buckled parts may be faired in cold condition by hammering or bending. Check to see that the fastenings to the deck are secure, that the brake bands work properly, and that the cranks are conveniently located beside the reels.

74. MOORING LINES AND CABLES

When not in use, all mooring lines should be dried thoroughly, then coiled neatly and stowed in an appropriate space. Small ropes should be hung under deck or on suitable pegs on a bulkhead; the heavy ropes and hawsers should be stowed on wooden gratings raised from the deck to allow the air to circulate freely. Wire rope must be lubricated if put into storage after use. This is necessary to protect it against rust. For ease in handling, short lengths of cable, preventers, slings, and runners should be coiled and each coil secured individually by lashings. Heavy mooring cable should be stored in a well-lubricated condition on the wire reels. Fiber ropes and wire ropes in use should be checked for safe and serviceable condition.

CHAPTER 6

PREVENTIVE MAINTENANCE BEFORE AND DURING VESSEL OPERATION*

Section I. CHECK OF EQUIPMENT BEFORE VESSEL OPERATION

75. CYLINDER HEAD ASSEMBLIES

Before starting an engine it is essential that its condition be thoroughly checked. This precaution should be taken for the protection of the engine as well as for the safety of personnel.

a. Make sure that the propellers are clear before turning the engine over. Carelessness in this respect has caused many accidents.

b. Using a bar wrench, move the rocker arms to make sure the exhaust and intake valves are moving freely. Check the tappet clearances carefully. If the engine can be turned over with a bar, use a feeler gage to determine the clearance between the rollers and cams. For correct clearance, refer to the technical manual for the type of engine with which the vessel is equipped.

c. Look for any accumulation of water or fuel oil on the cylinder tops. This condition usually indicates leaks which should be repaired at once.

*The information in this chapter is presented only as a guide to the maintenance of machinery. Additional general information may be obtained from TM 55–320. Detailed information should be obtained from the appropriate instruction manual published by the manufacturer or from specific technical manuals listed in SR 310–20–4.

d. After making certain that all tools, rags, and other objects have been removed from the engine top, close the cylinder head inspection covers.

76. ENGINE CONTROL

a. Engine controls are usually intricate mechanisms, the degree of complexity depending upon the type and make of engine. Therefore, only qualified personnel should be entrusted with the disassembly, repair, and assembly of these parts. Careful inspection and proper maintenance during operation will normally keep the controls in good working order and major repairs will seldom be necessary. The connecting links and other visible parts should be checked frequently for proper operation and lubrication. The controls should be adequately protected and never subjected to abuse.

b. The engineeer should include in his inspection the following items and check for proper performance of the operations indicated: Controlair, actuator, pneudyne, camshifting interlock valve, throttle latch pilot valve, fuel cut-off valve, relay air valve, reducing valves, and direct drive reverse mechanism. Proper inspection of these items is explained in TM 55–320.

77. BEARINGS

a. Lubrication. Proper lubrication of every engine bearing is important for proper operation. When a bearing has become hot, it is too late to add oil, for by then heat has damaged the babbitt.

b. Crankpin bearings. Usually trouble will

develop first in the crankpin bearings. In order to detect trouble it is necessary to remove the doors opposite each bearing.

(1) To inspect for proper clearance, it is possible on most engines to insert a bar under the lower half of the crank bearing and, using the bar as a lever, move the rod and piston assembly up and down. During this operation excessive clearance can be determined by hand feeling.

(2) All bolts, nuts, cotter pins, and other locking devices should be checked for tightness and security.

(3) The crank pit should be inspected for sediment, loose pieces of bearing metal, and water. The pit should be cleaned when necessary.

(4) To check for proper lubrication of all bearings, put on the lubricating oil pressure by using either a hand pump installed for this purpose or an independently operated electric oil pump. Using a bar, turn the engine over. If the lubricating system is functioning properly, a small stream of oil will be visible in each bearing, showing that the oil lines are open and adequate lubrication is provided.

(5) All pipe-line connections inside the engine should be tested for tightness before the inspection doors are closed.

c. Thrust bearing. If this bearing is equipped with forced lubrication, make sure that the oil flows

freely through the inspection glass or overflow control while testing the internal bearings. If the bearing has a self-contained lubricating oil pit or sump, maintain a full-mark oil level and check regularly for sediment and water. Renew the oil when it becomes discolored.

d. Propeller shaft bearings. In most cases these bearings are supplied by individual oil sumps and either a ring or chain type oiling device. Check for proper oil level and make certain that the rings or chains are all in place and operate properly. Shaft bearings provided with grease cups, usually common on small craft, need special attention. See that grease cups are filled before the engine is started; press grease in until it appears on both sides between the shaft and bearing. If a grease cup lubricates the stern tube bearing, this same procedure is followed.

78. LUBRICATING OIL AND COOLING WATER PRESSURE

If the engine is equipped with hand-operated or electrically driven, independent lubricating oil and cooling water pumps, test these systems under pressure. Check the engine thoroughly for proper passage of oil and water. Observe the pressure gages and other indicators, such as warning signals, for critically low pressures. The oil and water systems should run under full operating pressure until all airlocks have disappeared. Airlocks are dangerous because they expose parts of the metal in the cooling spaces to a high temperature, or interfere with the proper lubrication of other parts, thus increasing

friction. The presence of airlocks is usually indicated by vibration of the hands of the pressure gages. It is reasonably safe to assume that no airlocks exist when the hands of the gages are steady at the pressure readings recommended by the appropriate technical manual.

79. FUEL OIL AND INJECTION SYSTEM

First check to see that the fuel oil in the day or engine tank is at a satisfactory level. Bleed the tank by opening the test or drainage valve on the bottom and drain out all water and sediment. Open the valves on the engine feed line and make sure that all strainers are clean and in good condition. It is also advisable to open the bleeder plugs on the injection pump to permit the escape of air from the housing. Prime the pump until resistance indicates that all fuel oil lines and valves are under pressure. Have a man on the engine look for leaks in the system from the pumps to the valves. If any leaks are discovered, repair them immediately. In order that all cylinders will have an equal workload and give their best performance, there must be no defects in the injection system.

80. CLUTCH AND REVERSING GEARS

a. Clutch drive. Before engaging or disengaging the clutch, test the clutch lever for satisfactory free travel (as specified in the appropriate technical manual). See that the lever releases the clutch completely before the lever has completed its stroke. Note any unusual noises in the clutch release bear-

ings. Check for defective clutch plates and pilot bearings. When engaging the clutch and when the clutch is fully engaged, look for any indication of slipping due to improper adjustment of the linkages.

b. Reversing gears. See that the lever operates freely and snaps into each position. On multiple-engine installations equipped with hydraulic or air controls, make certain that the controls shift properly and that the transmissions shift simultaneously.

81. WARMING UP ENGINES

Engine temperature should be increased gradually, as the greatest wear on an engine occurs during starting and running an engine while it is cold. A warm engine will also take a heavy load much better than a cold one. Preheating, by circulating hot water through the cooling spaces before engine operation, is recommended, and some vessels are equipped for this. When preheating is provided, start the hot water circulation soon enough to insure normal operating temperature by the time the vessel is scheduled to move. Engines that do not have preheating systems should be warmed up by starting them and allowing them to idle or run at slow speed, preferably with a little load on. This can be effected by engaging the propellers. Do not engage the propellers until a check has been made with the man in charge on deck to determine that the vessel is tied up so that the propellers can be engaged safely and are clear of all lines, other craft, or debris.

82. STARTING AIR SYSTEM

a. Air tanks and valves.

(1) Water will always accumulate in the bottom of the air tanks whenever air is being pumped. There is also a possibility that oil may enter the tanks from the air compressor. It is important for two reasons that these tanks be drained regularly. First, these accumulations will reduce the air volume, leaving less air for starting purposes. Secondly, if water rises high enough in the tanks, the water may be carried with the air into the cylinders of the engine. This may cause a cylinder head to crack. Therefore, whenever the compressor is being operated, drain the tanks by opening the valves at the bottom of the tanks.

(2) When starting the engine, make sure that all valves on the filling and discharge lines are open. Check the pressure gages with the engine pressure gage to insure proper air pressure for starting.

b. Compressors. Examine the air compressor for any defects. If it is driven by a separate engine, check the lubricating devices for proper amounts of oil and grease and then start the compressor engine. When the compressor is operating, inspect for proper function of the clutch or belt drive, seeing that no slipping is evident. Make certain that the unloader valve cuts out at maximum and in at minimum air pressure. For correct maximum and minimum pressures, see the proper technical manual for the compressor.

83. STEERING ENGINE

The steering engine should be inspected while the main engine is warming up.

a. Mechanical. Check the handwheel, cable connections, sheaves, and bearings. Fill all grease cups and press grease in until it appears clean at the ends of the bearings and bushings. Fill all oil cups and make sure that all wicks or pads are present and in good condition. Test the assembly by spinning the wheel from hard port to hard starboard, or vice versa, making sure that it operates freely. Test the tiller or quadrant for complete freedom of movement, making certain that nothing will obstruct its movement when the vessel begins to roll and pitch.

b. Electrical. On vessels equipped with electric or a combination of electric and mechanical steering engines, a man should be stationed at the wheel to operate it while the engineer makes his inspection. As the rudder moves from side to side while being operated from the bridge, check for sparks on all electric contact points on the controllers. Make sure that all mechanical parts are operating correctly. See that the rudder takes the time prescribed in the appropriate technical manual to travel through its arc of movement. Make certain that the brake stops the rudder at any desired position.

84. COMMUNICATION SYSTEMS

a. Telegraphs. A deck officer operates the telegraph control on the bridge, and the engineer answers from the engine room. When instructions are sent from the bridge, the engineer should make cer-

tain that the hand of the engine room telegraph points to the sector which correctly describes the speed or maneuver directed by the bridge. The officer on the bridge should make sure that the repeater hand on the bridge telegraph stops in the selected sector when the message is repeated from the engine room. This procedure should be repeated until all speed and maneuver selections on the telegraphs have been tested. Any inaccuracies should be corrected immediately. Improper indicator readings can usually be remedied by adjusting the slack in the cables connecting the two telegraphs. It should also be remembered that all telegraph controls, cable sheaves, and bearings will need occasional lubrication.

b. Telephones. Telephones should be tested for proper operation because they will be the next best means of communication between the bridge and engine room should the telegraph system fail. The noise of the engines will usually prevent the use of voice or speaking tubes.

c. Bell and jingle. Inspect the cable and cable connections for defects. Lubricate all moving parts and check for smoothness of operation.

85. STARTING ENGINES

a. Prestarting check.

(1) Before the engine is actually started, the engineer should take a minute or two to make a mental check of all items that should have been inspected. This review is vital since some parts may be hidden from view by protective coverings and thus

missed. It may be necessary, for example, to recheck the turning device on the main engine to make certain that it is disengaged.

(2) It is advisable to open the indicator valves until the engine has made a couple of revolutions. This precaution is taken in the event cooling water may have found its way into the cylinders through cracks in the liners or cylinder heads.

(3) Close the indicator valves and start the engine, keeping all personnel away from the top of the engine while it is being started.

(4) Do not race the engine; run it at a reasonably slow speed.

(5) Check all pressure gages for proper readings.

(6) Keep a close check on all temperatures.

(7) Make certain that all cylinders are firing.

(8) If necessary to have a little load on the engine, communicate with the man in charge of the deck and await his instructions.

b. Maneuvers. When the engine is performing satisfactorily and is warmed up enough, the engineer should notify the bridge or wheel house that the engine is ready and stand by for orders. He should execute all orders from the bridge promptly and accurately. He should make certain that the engine is reversed to go astern or ready to go ahead when so ordered by the bridge. Remember that successful operations and safety of the vessel depend to a large extent on an alert engineer who is faithful in the performance of his duties.

Section II. PROPER PERFORMANCE OF EQUIPMENT DURING VESSEL OPERATION

86. TEMPERATURES AND PRESSURES

a. Effect on material structures. Check temperatures and pressures constantly while the engines are under load. Since the engine absorbs the heat generated by combustion in the chambers and friction in bearings and guides, more cooling water will have to be added to reduce heat as the engine operates. If cooling water is exhausted, the high combustion temperature to which cylinder heads, liners, and other parts are subjected will cause them to melt. If water pressure drops below safe operating range, stop the engine immediately.

b. Effect of heat on salt water. When salt water is used for cooling, a scale is formed on the surfaces over which the water passes. This scale acts as an insulator, confining the heat to the combustion chambers. If sea water reaches a high temperature, the salt in the water will crystallize and a heavier scale will be formed. This scale may become so thick that the water will have little, if any, cooling effect. The engine will then be damaged by overheating. To prevent crystallization, the cooling water temperature should be kept below 140° F. Frequent checks of the temperature of the cooling water should be made at the discharge side of the cylinders. The cooling surfaces should be cleaned frequently and all scale removed to insure normal heat radiation from the metal.

87. LUBRICATION

a. Forced lubrication. Forced lubrication is considered the most dependable way to supply various moving engine parts with adequate lubricating oil. This reduces friction in such important places as between shafts and bearings and between cylinder liners and pistons. As the oil absorbs heat, its viscosity decreases and the oil offers less resistance. This is indicated by a decrease in oil pressure. Frequent checks must be made to see that proper oil pressure is maintained. In addition, all strainers and filters must be kept clean; all cartridges and other types of cleaners must be in good condition; and all inserts, such as perforated metal or mesh screen cages, must be repaired or replaced when found defective.

b. Manual lubrication. A great number of moving parts require hand lubrication by the use of different devices made for different types of lubricants. Because many hand-lubricated parts move slowly and, therefore, do not create enough heat to become warm or hot, there is danger that such parts may be neglected. Inadequate lubrication causes excess clearance of bearings, worn pins and shafts, and maladjustment of important engine parts.

88. EXTERNAL MOVING PARTS

All external moving parts, whether they move constantly or only occasionally, should be adequately lubricated at regular intervals. If possible, the camshaft, rocker arms, and valves in the cylinder head assembly should be inspected for proper func-

tion during operation. Chain drives and gears on some engines are usually provided with inspection covers so that these parts can be checked for proper lubrication. All bearings, moving linkages, and other types of power transmissions should be inspected hourly.

89. INTERNAL PARTS

a. Combustion and compression. Pistons, together with wrist pins, connecting rods, and bearings take the greatest workload when the engine is operating. It is essential, therefore, that the engineer give these parts ample attention. Complete combustion cannot take place without adequate compression in the cylinders. Compression is affected by the condition of the pistons, piston rings, cylinder liners, cylinder heads, and valves. Proper and complete combustion is indicated by a smokeless exhaust gas. If the exhaust gas is smoky, check each cylinder separately. Incomplete combustion may be caused by a leaky valve, improperly operating fuel injector valve, or too large an amount of fuel being injected. Replace all defective parts at the earliest opportunity. The engine should not be operated with improper combustion.

b. Mechanical trouble. Most trouble with the internal parts of the engine can be detected before serious damage occurs if the engineer is alert and recognizes danger signals. These danger signs may be seen, heard, felt, and even smelled. Regardless of the noise of a Diesel engine in operation, a good engineer can detect any unfamiliar sound, knock,

or rattle from any part of the engine. Excess bearing clearance will cause an unusual sound depending upon the type, material, and location of the bearing and extent of clearance. The condition of bearings may be indicated also by their temperatures. Crank bearing temperatures can be tested by feeling the doors outside of each bearing, and main bearings can be checked by feeling the discharge lubricating oil pipe lines from each main bearing.

90. CLUTCH REVERSING GEARS, AND PROPELLER SHAFT BEARINGS

Check these parts for adequate lubrication during engine operation. Check the gear case for leaks and the gears and other internal parts for unusual noises. Inspect the oil-seal ring at the end of the gear shaft. Inspect the clutch, levers, and linkages for proper condition. Feel the propeller shaft bearings every hour for normal temperature and check for adequate lubrication.

91. AUXILIARY MACHINERY

a. Generators. A Diesel generator engine should receive the same careful attention as that of the main engine. There is little difference in principle between a small Diesel engine and a large one; both are of equal importance in vessel operation. Try to minimize the generator load as much as possible. If there are two or more generators aboard, operate them so that their running times will be equalized. Maintain the idle generator in good operating condition.

b. Air compressors. Check the working condition of each stage by observing the pressure gages which indicate the relationship between pressures in the different compressor cylinders. The appropriate technical manual for the air compressor covers operating instructions and procedures for adjustment, repair, or reconditioning. For these reasons it should be read carefully. Insufficient lubrication and the use of improper lubricants are the two most prevalent causes of air compressor troubles. Another cause is inadequate cooling. The resulting high temperatures may cause combustion of lubricating oil or grease accumulations in the medium-pressure and high-pressure cylinders. Combustion in a compressor is very dangerous and has caused many fatal accidents.

c. Pumps. The kinds of pumps found on different vessels will vary, but all types require good care and maintenance.

(1) The piston and plunger types require the most maintenance. The chief item of preventive maintenance is the check for good condition of all strainers and mud boxes along the suction line. Inspect all valves, including bypass, snifting, and safety valves, for proper operation. Never operate these types of pumps dry for any length of time because no lubrication is provided other than the liquid being pumped. Compliance with this rule will prevent excessive wear on the pistons and cylinder liners.

(2) On centrifugal type pumps, check bearings

for lubrication, stuffing boxes for correct kind of packing, and strainers and mud boxes for good condition. Do not operate the pump with too tight a packing on the spindle or with a type of packing not specified in the appropriate technical manual.

92. ELECTRICAL INSTALLATIONS

a. Wiring. Defective wiring is one of the greatest fire hazards aboard ship. The engineer should, therefore, make it a standard watch routine to check the wiring for defective insulation and connections. If there are any indications of defects, such as are often found on portable electric-powered tools and hand lights, shut off the current supply, disconnect the wiring, and make temporary repairs. Permanent cables and wires may start to give trouble after a few years. Therefore, frequent checks should be made and necessary repairs and replacements requested.

b. Electric motors. Check the work load of each electric motor and make certain that each is operating within its safety limit (see appropriate technical manual). Check for sparks at the commutators and brushes. Make sure that the temperature is normal on the outside of the stator. See that no water can get into the assembly and that no excess oil from the bearings will get into the armature.

c. Power panels and switchboards. Only authorized operators should be allowed near panels and switchboards, and they should work only when standing on a dry wooden grating covered with rubber matting. All power panels and switchboards

should be kept dry and clean. Corrosion on switches and circuit breakers should be removed but only when proper precautions have been taken to assure that the current to the panel being worked on will not be turned on. All instruments must be handled with utmost care, and adjustments and repairs made only by specialists in electrical instrument work.

d. Starters.

(1) When an electric motor is started by automatic or press-button starter, the motor should reach its normal operating speed within a relatively short time. This indicates that the starter has functioned properly.

(2) The manual starter must be operated slowly and the motor allowed to gain speed gradually until all resistance in the starter has been used and the full flow of current has reached the motor. The starter handle must be in running position and not left between stop and start. Improper position of the handle will burn out the starter, and the motor will not receive sufficient current for proper operation.

93. FUEL OIL TANKS

a. Storage tanks. On large vessels fuel oil is usually stored in the ship's double-bottomed tanks, while on small vessels fuel oil storage tanks are placed in the most convenient spaces. The contents of these tanks are recorded once a day. When refueling from a dock, a static chain should be

installed before the fuel oil hose from the dock is connected to the fuel line of the vessel. Before the pumps are started, all valves and connections should be checked. All safety rules must be followed to prevent fire. The engineer on duty will arrange for transfer of sufficient fuel oil from the storage tanks to the day tank to maintain a proper oil level for feeding the engine injection pumps. The oil is pumped from the storage tanks to the day tank by the transfer pump. If this pump is automatic, the engineer must make certain that it functions properly.

b. Day tanks. The day tank as a rule is located in the engine room and high enough so that gravity will insure a steady flow of fuel to the engine injection pumps. It is vital that proper oil level be maintained in this tank. The engineer must keep a constant watch on this oil level, even if high and low levels alarms are provided. An empty day tank results in air in the injection pumps and a long stoppage of the engine. A vessel with a dead engine is hazardous to its own personnel as well as a menace to other craft, especially if it is in dangerous waters or amid harbor traffic. A test for water and sediment in the day tank must be made every 4 hours and immediately after each oil transfer from the storage tanks. The 4-hour inspection should be made by the engineer coming on watch. This test is made by examining a sample of the fuel oil taken from the drain in the bottom of the tank.

c. Transfer of oil and trim of vessel. To help maintain proper trim of the vessel, oil in storage tanks outside the centerline of the vessel should be

transferred according to a predetermined schedule. The master decides on the trim of the vessel and advises the chief engineer regarding the transfer of fuel oil. The chief engineer informs his assistant engineers from which tanks oil is to be pumped for transfer to the day tank. For stability of the ship, the master may order that empty storage tanks be filled with ballast water.

94. CONDITION OF ENGINE ROOM

Cleanliness is a vital part of preventive maintenance. Dirt causes unnecessary wear, especially in bearings and moving parts, and accumulations of grease and dirt obscure defects. Greasy lever handles, handrails, floors, and ladders are safety hazards. The appearance of the engine room reflects the efficiency of its crew.

a. Machinery. Men of each watch will wipe the engines and remove all dirt, grease, and oil from painted areas. They will dry off polished parts and maintain a clean engine. Rust and corrosion can be prevented by stopping leaks and by covering the skylights on wet days.

b. Floors. Floor area should be divided into as many sections as there are oilers or wipers available for cleaning work, and each man should be made responsible for the cleanliness of the floor and ladders in his section. The engineer should inspect to see that each section has been properly cleaned.

c. Bilges. Bilges are a fire hazard on vessels equipped with Diesel or gasoline engines. Water and fuel, mixed with lubricating oil, will collect in the bilges. In many vessels access to the bilges is

difficult which further increases fire hazards. The best way to minimize this hazard is to keep a constant check of the engines and pipe lines for fuel and lubricating oil leaks and have such leaks repaired immediately. Inspect the bilges daily and keep them clean and as dry as possible.

d. Storerooms and toolrooms. For maximum efficiency, these rooms must be kept clean and orderly. All personnel using storerooms and toolrooms should be informed regarding individual responsibility for maintenance and upkeep of parts, tools, and general engine stores. The chief engineer is responsible for all equipment used in the engine room and should, therefore, establish policies and rules governing the use, maintenance, and safekeeping of all parts and tools. These rules and policies will be executed by the first assistant engineer.

APPENDIX I

REFERENCES

1. FIELD MANUALS

FM 21–8 Military Training Aids.
FM 21–22 Survival at Sea.
FM 22–5 Leadership, Courtesy and Drill.
FM 24–10 Combined Radiotelegraph (W/T) Procedure.

2. TECHNICAL MANUALS

TM 10–205 Mess Management and Training.
TM 10–405 The Army Cook.
TM 11–392 Signal Lamp Equipment SE–11.
TM 11–454 The Radio Operator.
TM 20–205 Dictionary of United States Army Terms.
TM 55–310 Stevedoring.
TM 55–320 Small Boat and Harbor Craft Preventive Maintenance.

3. ARMY REGULATIONS

AR 55–310 Transportation Master.
AR 55–370 Flags, Honors, and Salutes on Army Transports.
AR 55–430 Conduct of Passengers on Transports.
AR 55–440 Boat and Fire Drill, Collision, or "Man Overboard" on Transports.
AR 55–510 Harbor Craft.
AR 260–10 Flags, Colors, Standards, Guidons, Streamers, Silver Bands, Tab-

ards and Automobile Plates; Description and Use.

AR 600–115 Leaves of Absence and Delays.

4. SPECIAL REGULATIONS

SR 56–20–1 Marine Casualties.

SR 55–510–1 Harbor Craft.

SR 110–1–1 Index of Army Motion Pictures and Film Strips.

SR 310–20–3 Index of Army Training Publications. (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).

SR 310–20–4 Military Publications. Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.

SR 310–20–5 Index of Administrative Publications (Army Regulations, Special Regulations, Read-

justment Regulations, Joint Army-Air Force Adjustment Regulations, General Orders, Bulletins, Circulars, Commercial Traffic Bulletins, Joint Procurement Circulars, Department of the Army Pamphlets, and ASF Manuals).

SR 310–20–6 Index of Blank Forms and Army Personnel Classification Tests.

SR 320–5–1 Dictionary of U. S. Army Terms.

SR 320–50–1 List of Authorized Abbreviations.

5. MOBILIZATION TRAINING PROGRAMS

MTP 55–1 Mobilization Training Program for Transportation Corps Enlisted Personnel of the Army Service Forces.

MTP 55–2 Mobilization Training Program for Transportation Corps Units of the Army Service Forces.

6. TABLE OF ORGANIZATION AND EQUIPMENT

T/O&E 55–500 Transportation Service Organization.

7. HYDROGRAPHIC OFFICE PUBLICATIONS

H. O. No. 87 International Code of Signals, Volume I, for Visual and Sound Signaling.

H. O. No. 88 International Code of Signals, Volume II, for Radio Signaling.

APPENDIX II

GLOSSARY

Aft. At, near, or toward the stern.

Anchor. A heavy metal implement attached to a vessel for holding it at rest in the water.

Anchor watch. The watch while at anchor.

Astern. Behind the vessel; in the direction of the stern.

Ballast tanks. Compartments which may be flooded when necessary to add weight to produce a change in trim or in stability of a ship.

Batten. A strip of wood or steel used in securing tarpaulins in place. To secure by means of battens, as to batten down a hatch.

Beam. Extreme width of a vessel. Also an athwartship or longitudinal member of the vessel's structure supporting the deck.

Bight. A loop or bend in a rope; strictly, any part between two ends of a rope.

Bilge. The rounded portion of a vessel's shell which connects the bottom with the side.

Block. The name given to a pully or sheave, or a system of pulleys or sheaves, mounted in a frame or shell and used for moving objects by means of ropes.

Boathook. A wooden staff with a metal hook at one end used for fending off or holding on.

Boatswain's chair. Ropes and board seat on which a man working aloft or overside is swung.

Boom. A term applied to a spar used in handling cargo.

Bow. The forward part of a vessel. The sides of the vessel at and for some distance abaft the stem, designated as the right-hand or starboard bow, and the left-hand or port bow.

Bridge. A high transverse platform, often forming the top of a bridge-house, usually used for navigating and control of the vessel, extending from side to side of the ship, from which a good view of the weather deck may be had.

Bulkhead. A term applied to any one of the partition walls which subdivide the interior of a ship into compartments or rooms. The various types of bulkheads are distinguished by the addition of a word or words explaining the location, use, kind of material, or method of fabrication, such as forepeak, longitudinal, transverse, watertight, wire mesh, pilaster, etc.

Buoyancy. Ability to float.

Butts. That end of a plank or plate where it comes squarely against another piece, or the joint thus formed.

Calking. The operation of jamming material into a contact area to make a joint watertight or oiltight.

Capstan. A vertical, revolving drum, spool-shaped, generally used for heaving in towing or mooring lines.

Cargo. Merchandise or goods accepted for transportation by ship.

Cargo boom. A heavy boom used in handling cargo (*see also* Boom).

Cargo hatch. A large opening in the deck to permit loading of cargo.

Cathead. A small auxiliary drum usually fitted on one or both ends of a winch or windlass.

Chain locker. Compartment in forward lower portion of ship in which anchor chain is stowed.

Chains. Usually refers to heavy chains attached to the anchor. Also applied to the lower parts of standing rigging which are attached to the chain plates.

Chocks. Oval-shaped castings, either open or closed on top and fitted with or without rollers, through which hawsers and lines are passed. Also, blocks of wood used as connecting or reinforcing pieces, filling pieces, and supports for lifeboats; also, brackets fitted to boiler paddles to prevent fore and aft motion and small brackets on the webs of frames, beams, and stiffeners to prevent tipping of the member.

Chronometer. Portable timepiece of high precision.

Cleats. Pieces of wood or metal of various shapes according to their use. May have two projecting arms or horns upon which to belay ropes. The term "cavil" is sometimes applied to a cleat of extra size and strength.

Coaming. Side wall of a hatch projecting above the deck around perimeter of the hatch.

Compartment. A subdivision of space, or room on a ship.

Compass. An instrument designed to indicate the magnetic or true north. The mariner's compass

consists essentially of a magnetized pointer, free to turn horizontally on a pivot in a liquid, and tending to point to the magnetic north. The gyroscopic compass is not magnetized but uses the principle of the gyroscope and points to true north.

Davit. A device used to lower and raise ship's boats or other equipment.

Deck. The floorlike planking or covering of any tier of beams above the inner bottom forming a floor, either in the hull or superstructure of a vessel. Designated by location as upper deck, main deck, etc., and forward lower deck, after superstructure deck, etc.

Dog. A hold-fast; a short metal rod or bar fashioned to form a clamp or clip used for clamping watertight doors, manholes, or pieces of wood in place.

Draft. The depth of the vessel below the waterline measured vertically to the lowest part of the hull, propellers, or other reference point. When measured to the lowest projecting portion at the bow of the vessel, it is called the "draft, forward"; and when measured at the stern, the "draft, aft." The average of the "draft, forward" and the "draft, aft" is the "draft, mean"; and the mean draft, when in full load condition, is the "draft, load."

Draft marks. Numbers placed on each side of a vessel near the bow and stern and often amidships, to indicate the distance from the number to the bottom of the keel or a fixed reference point. These numbers are 6 inches high, are spaced 12 inches

bottom to bottom vertically, and are located as close to the bow and stern as possible.

Engine room. Space where the main engines of a ship are located.

Fairlead. A term applied to fittings or devices used in changing the direction of line, chain, or wire so that it may be delivered fairly or on a straight lead to the sheave or drum. They may be drum guide sheaves, rollers, or merely smooth eyes or guides over which the line or chain can slide easily.

Fair-water cap. Cap which protects propeller nut.

Fake down. To lay a rope or chain down in long bights side by side or in coils in regular order so that it will run out clear or can be easily and rapidly paid out. Also one complete circle of a coil of rope.

Fall. By common usage, the entire length of rope used in a tackle; sometimes limited in application to that end to which the power is applied. The end secured to the block is the standing part; the opposite end, the hauling part.

Fender. A device fastened to or hung over the sides of a vessel to prevent rubbing or chafing against other vessels or piers.

Flash point. The temperature, lower than the burning point, at which a volatile liquid gives off vapor in sufficient quantity to ignite.

Flying bridge. Topmost location on a bridge-house.

Fore. Parts of a ship at or adjacent to the bow; also applied to parts of a ship lying between the midship section and stem, as forebody, forehold, and foremast.

Fore and aft. Lengthwise of a ship.

Forward. At, near, or in the direction of the bow.

Foul. Sea growth or foreign matter attached to the underwater portion of the outside of a vessel's shell. Also, obstructed or impeded by an interference, etc.

Galley. Ship's kitchen.

Gangway. The opening in the bulwarks of a vessel where persons come aboard or disembark.

Gear. The total of all implements, apparatus, machinery, etc., pertaining to and used in the performance of any given operation, as "cleaning gear," or "anchor gear."

Gravity flow. Flow of a liquid into a tank by its own weight without use of pumps.

Ground tackle. The anchor and chain.

Gudgeon. A metal eye or socket attached to the sternpost to receive the rudder pintle.

Halyards. Light lines used in hoisting signals, flags, etc. Also applied to the ropes used in hoisting gaffs, sails, or yards.

Hatch. Opening in the deck which gives access to a cargo hold.

Hatch cover. Cover for closing the hatchway, usually made of wood planks or steel.

Hawsepipe. Tubes leading the anchor chain from the deck on which the windlass is located, down and forward through the vessel's bow plating.

Hawser. Large rope for towing or heavy work.

Hold. Space between the lowermost deck and the bottom of a vessel, or top of the inner bottom if one is fitted; space below decks allotted for the stowage of cargo.

Hull. The framework of a vessel, including all decks and the inside and outside plating or planking, but exclusive of masts, yard, rigging, and all outfit or equipment.

Keel. A centerline strength member running fore and aft along the bottom of a vessel and often referred to as the backbone.

Lanyard. A rope used for making anything fast.

Lashing. Securing two pieces of rope together; securing cargo with rope.

Lazarette. Small space below decks, aft, for stowing provisions or spare parts.

Lead line. Small line attached to lead, used for measuring depth of water.

Leeward. Away from the wind.

Lifeline. Any line used in connection with lifesaving.

Lighter. A large open barge used in loading and unloading vessels or in carrying freight around a harbor.

Line. A length of rope, usually with a supplementary name indicating its use, such as mooring line, gantline, or heaving line.

Log. Book containing a complete official record of ship's position and activities. A log is kept in the engine room as well as on deck.

Manhole. A hole cut in decks, tanks, boilers, etc., to provide access.

Marlinspike. A pointed iron or steel tool used to separate the strands in splicing rope, and as a lever in putting on seizings.

Mast. A long, vertical pole of steel or wood originally used on sailing vessels for carrying sails;

now used as a support for rigging, cargo boat-handling equipment, and wireless.

Masthead. Top of the mast.

Mooring lines. The wire or manila lines used to tie up a vessel.

Outboard. Away from the center toward the outside; outside the hull.

Padeye. A fitting, attached to a deck or flooring, having an integral base plate and an eye to which lashings and guys may be secured.

Pintle. One of the metal braces or hooks upon which a rudder swings.

Poop. The structure or raised deck at the after end of a vessel.

Port. The left-hand side of a ship when looking from aft forward.

Quarter-deck. The part of the main or appropriate deck which is set aside for official or ceremonial functions.

Raft, life. A framework fitted with air chambers to support people in the water.

Rigging. A term used collectively for all the stays, shrouds, halyards, and lines to support the masts and booms of a vessel and to operate the movable parts.

Rudder. A device used in steering or maneuvering a vessel.

Runner. The wire or rope fall used in hoisting cargo in or out of the vessel (*see also* Fall).

Scuttle. A small opening generally fitted in decks to provide access, often termed "escape scuttle"; when fitted with means whereby the covers can

be removed quickly to permit exit, called "quick acting scuttle."

Sea chest. An arrangement for supplying sea water to condensers and pumps, and for discharging water from the vessel.

Sea cock. A valve secured to the plating of the vessel below the waterline for use in flooding tanks, magazines, etc.; may be used to supply water to the pumps.

Seaworthy. In condition to put to sea and meet usual sea conditions.

Shackle. Piece of iron or steel, U-shaped, with eyes in both ends. Fitted with a pin and split key or threaded for closing the two ends.

Sheave. The wheel inside a block.

Shell plates. Plates which form the hull of the ship.

Shipshape. Neat in appearance; in good order, ready for a sea voyage.

Ship's log. (*see also* Log).

Sling. A length of chain, rope, or wire employed in handling weights with a crane or davit; the rods, chains, or ropes attached near the bow and stern of a small boat into which the davit or crane tackle is hooked.

Sounding pipe. Pipe, leading to tanks, through which a sounding rod is lowered to measure the amount of liquid in the tank.

Starboard. The right-hand side of a vessel looking forward from aft.

Stays. Heavy lines, usually wire, that support the mast of a vessel in a fore and aft direction.

Stern. The after end of a vessel.

Stringer. Horizontal plate or plank made fast to a vessel's frames to support the beam ends.

Strongback. A heavy girder, usually as deep as the hatch coaming, extending fore and aft in the exact center of the hatch and fitted into slots or slides in the end coaming; often secured by bolts.

Superstructure. A structure built above the uppermost complete deck; a pilot-house, bridge, etc.

Tackle. Any combination of ropes and blocks that multiplies power. Also applied to a single whip which does not multiply power but simply changes direction.

Tackline. A length of halyard about 6 feet long used to separate each group of signal flags which, if not separated, would convey a different meaning from that intended.

Tailshaft. The aft section of the shaft which receives the propeller.

Template. A pattern or guide, as of wood or metal, adapted to the purpose of shaping something.

Thwarts. Boards extending across a small boat just below the gunwale to stiffen the boat and provide seats.

Tiller. An arm attached to the rudderhead for operating the rudder.

Topsides. The portion of the side of the hull which is above the designed waterline.

Triatic stay. A rope secured to the heads of the foremast and the mainmast.

Trim. The difference in draft at the bow and at the stern of a vessel.

Turnbuckle. A form of coupling composed of a loop or sleeve with a screw thread at one end and a

swivel at the other, or a right and left screw link, used for tightening a rod, stay, etc.

Valve. Device used for controlling or shutting off the passage of a fluid or gas into or out of a container or through a pipe.

Waterline. The line of intersection of the surface of the water with the hull of the vessel at any draft and any condition of trim.

Watertight compartment. A space or compartment constructed in such a manner as to prevent the leakage of water.

Wildcat. A drum or wheel on a windlass or capstan having in its circumference a deep groove with propections which engage the links of a chain as it passes, preventing the chain from slipping.

Winch. A hoisting or pulling machine used principally in the handling, hoisting, and lowering of cargo from a wharf or lighter to the hold of a vessel and vice versa.

Windlass. Apparatus used in handling heavy anchor chains, hawsers, etc.

Yard. Spar suspended horizontally from the mast.

Yardarm. Either end of a yard.