

# NAUTICAL GLOSSARY

Glossary was compiled and edited by Bruce Beveridge

This is a very large glossary with over 1,500 terms with many sub-terms and cross references. It's not the easiest to use unless you know exactly what your looking for. If you have any questions about these terms, we urge you to use the [message forum](#). One of the many regulars will help you out there. You may of course e-mail us if that doesn't help out, but we would prefer you use the board first. You may have the same question others have. Using the main board helps everyone out in the end.

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## A

**Aback.** The condition of a sailing ship when the pressure of the wind on the sails has a tendency to drive it astern.

**Abaft.** Towards the stern; aft, relative to.

**Abandon.** To leave, to forsake. Usually descriptive of the act of leaving a ship when it is no longer safe or seaworthy.

**Abeam.** At right angles to the vessel's longitudinal axis and in her plane of flotation.

**Aboard.** On or in a ship.

**About.** A ship is said to come about when in beating to windward it changes its course allowing the wind to bear on the opposite side of the sails. To change from the starboard to the port tack or the reverse.

**Aboveboard.** Above deck as distinguished from in the hold or below decks.

**Abreast.** Over against; opposite. See also Abeam.

**Access Hole.** A hole cut through a portion of a vessel's structure in order to permit ingress to or egress from a given space or compartment.

**Accommodation Ladder.** See Ladder, Accommodation.

**Accumulator, Hydraulic.** A tank designed to store water under pressure.

**Accumulator, Pneumatic.** A tank designed to store air under pressure.

**Acetylene.** A gas produced by the action of water upon calcium chloride. This gas combined with oxygen burns with a very hot flame.

**Acid Open Hearth Steel.** See Steel and Iron.

**Acidity, Boiler.** A term used when the feed water in a boiler is acid.

**Admiral Jug.** A kind of toby jug; specifically an earthenware ale jug made in the shape of a seated admiral. The originals were manufactured in commemoration of Lord Howe's naval victory on June 1, 1794, but other admiral subjects were subsequently chosen. Sometimes the subject is a sailor from the lower deck.

**Admiralty Coefficient.** See Coefficient, Admiralty.

**Admiralty Drafts.** Specifications, establishments, plans, outlines drawn up, given by the Admiralty to naval and civil dockyards for the construction of a vessel and/or its appurtenances. These even included the figureheads and "gingerbread" work in the days of sail, especially during the seventeen years between 1773 to 1790 when, to reduce costs, an Admiralty order required that drawings should be officially approved for all carved works on new ships.

**Admiralty Metal.** Described under Metals.

**Admiralty Pump.** See Pump, Admiralty.

**Adrift.** Afloat without effective means of propulsion or control.

**Adze.** A carpenter's tool having its blade set at right angles with a long curved handle and used for trimming

ship timbers. The act of trimming the timbers with this tool is called "dubbing."

**Aft.** In the direction of or toward the stern.

**After Collision Bulkhead.** See Bulkhead, After Peak.

**After Deck.** See Deck, After.

**After Peak.** A compartment immediately forward of the sternpost. Generally situated entirely below the load waterline.

**After Peak Bulkhead.** See Bulkhead, After Peak.

**After Perpendicular.** A line perpendicular to the base line, intersecting the after edge of the stern post at the designed waterline.

**Aground.** The situation of a ship in which its bottom touches or rests on the ground; stranded.

**Ahead.** Forward; in front of.

**Air Casing, Stack.** A ring-shaped plate coaming surrounding the stack and fitted at the upper deck, just below the umbrella. Its purpose is to protect the deck structure from heat and to help ventilate the fire room.

**Air Compressor.** An auxiliary designed to furnish air under pressure for pneumatic

tools, cleaning purposes etc. A form of compressor in common use is the single stage type.

**Air Courses.** A wood ship term applied to air spaces running fore and aft in the sides or bottom of a vessel to provide for a circulation of air to prevent decay in the timbers.

**Air Ejector.** A steam ejector connected to the condenser dry suction for the purpose of discharging the air and vapor into the atmosphere. A condensate pump handles the condensed steam.

**Air Hammer.** An air-driven tool arranged to deliver rapid longitudinal impulses against one end of a steel pin. It is contained in a cylindrical shaped casing about three inches in diameter and two feet long with a pistol grip at the opposite end from the pin. Various shaped tools can be fitted on the outer end of the pin to perform such operations as heading up rivets or caulking and chipping.

**Air Holding on Hammer.** A tool to hold against the head of a rivet while it is being driven. Its head is fitted on a piston which is cushioned in a cylinder filled with compressed air.

**Air Pipes.** Pipes leading from tanks to the open air as vents or to provide a supply or escape of air when pumping out or filling the tanks.

**Air Port.** See Port, Air.

**Air Propellers or Beeswing Fans.** A fan usually consisting of from two to four blades operated by an electric motor, the blades being so shaped that the air leaves the fan at right angles to its plane of rotation.

**Air Pump.** See Pump, Air.

**Air Pump, Dry Vacuum.** See Pump, Air, Dry Vacuum.

**Air Pump, Dual.** See Pump, Air, Dual.

**Air Resistance.** See Resistance, Air.

**Air Tight Door.** See Door, Air Tight.

**Air Trunk or Conduit.** The passage forming the main air supply to a fan or exhaust from a fan.

**Air Valve.** See Valve, Air.

**Air and Circulating Pump.** See Pump, Air and Circulating.

**Alarm Valve.** See Valve, Alarm.

**A-lee.** Away from the wind. A sailing ship which constantly requires the helm to be moved to the side of the vessel away from the direction from which the wind is coming in order to keep his course is said to carry a-lee helm.

**Alkalinity, Boiler.** A term used when the feed water in a boiler is alkaline and has the power of neutralizing acids.

**All Hands.** Every person on board a ship.

**Alligator Shear.** See Sheer, Alligator.

**Aloft.** In the tops or upper rigging; on the yards; above the decks.

**Alongside.** Parallel and in close proximity to. Used frequently relative to a ship lying parallel and close to another ship or a pier.

**Allow.** Low in or on; below.

**Alternating Current.** An electric current in which the instantaneous values of current at any point in the circuit vary from zero to a positive maximum value, back to zero; then to a negative maximum value and back to zero. When plotted it consists of half waves of equal area in successive opposite direction from the zero line.

**Aluminum Paint.** See Paint.

**Amidships.** In the vicinity of the middle portion of a vessel as distinguished from her ends. The term is used to convey the idea of general locality but not that of definite extent.

**Ammeter.** An instrument for measuring the electric current flowing in a circuit. The scale of the meter is calibrated to read in amperes.

**Ammonia.** A volatile alkali, a transparent, pungent gas that can be easily liquefied by pressure. It is used extensively as a refrigerating medium for cold storage systems aboard ship.

**Ammonia Joint.** On account of the penetrating nature of ammonia, great care should be taken with the joints in a refrigerating system where alkali is used. The joints should be made of wrought iron or steel, the connections should be soldered after they are screwed in place. Lead gaskets should be placed between flanges and lead or white metal packing used for the valve stems.

**Ampere.** The practical unit of electric current. It represents that value of current which will cause the electrolytic deposition of silver at the rate of 0.001118 gm. per second.

**Analysis of Flue Gas.** See Boiler, Analysis of Flue Gas.

**Anchor.** A heavy iron or cast steel implement attached to a vessel by a rope or chain cable. When the anchor is thrown overboard it lays hold of the ground and holds the vessel in its place. The earlier anchors were made of wood, with one arm and later with two. Stones were attached to give weight to sink and to increase holding power. An iron anchor, having a wood stock, followed the wood anchor. This in turn was replaced by an all-metal anchor. The *solid* or old-fashioned anchor consisted of the shank, the ring (shackle or Jew's harp), the arms, and the stock. The shank is the main body of the anchor, having the ring bolted to one end and the arms welded to the other, the crown being the heavy end of the shank from which the arms branch out, The stock is the beam attached to the shank opposite the arms. Various patent anchors exist, most of which are stockless and have their arms pivoted upon the shank and the palms in the plane of the arms.

**Anchors, Bowers.** The principal anchors carried by a vessel. They are so named because they are carried on the bows. In earlier times they were of different weights, the larger being known as the *best* bower and the smaller as the *small* bower. These anchors are now usually the same size.

**Anchor Deck.** See Deck, Anchor.

**Anchor Handling Gear.** The windlass and gear installed aboard ship, for letting go, taking in and handling the anchor.

**Anchor, Kedge.** A term applied to a light anchor used for warping or kedging.

**Anchor, Mooring.** A term applied to a second or extra anchor used for holding a ship at her mooring.

**Anchor, Sea.** A device constructed of spars and canvas in the form of a parachute, to which is bent a hawser or cable. It is put overboard in a heavy sea for the purpose of keeping a vessel head-on to the sea and to enable her to ride out the gale. Also termed a driving anchor or drag.

**Anchor, Stream.** An anchor used for anchoring in a narrow roadway or channel to prevent the stern swinging with the tide. The weight of this anchor is equal to about one-fourth that of the bower anchor.

**Anchorage.** A suitable place for a ship to lie at anchor. Harbor dues for anchoring in a port.

**Anemometer.** A gauge for measuring the speed and direction of the wind, with rotating vanes and recording dial graduating from 1 to 12 Beaufort scale, or in meters per second. Invented in 1727, early rotary examples were hand held and used with a 15 or 30-second Sand Glass. Later examples were fixed to the mast.

**Aneroid Barograph or Barometer.** An instrument to measure and record on paper the variations of atmospheric pressure during a period of time. First of the two main types is Vidi's barograph or barometer that consists of several metal vacuum chambers, with an interior spring to prevent their being damaged by crushing. They were compressed by atmospheric pressure changes, these being noted by a stylus on a drum. The sensitivity of the instrument depended on the number of vacuum chambers in it. The second type is the Bourdon aneroid barometer, which contains a vacuum tube, elliptical in section and bent to form a circle. Changes in pressure alter the tube's section and increase or reduce the circle's diameter, this being mechanically noted on a drum by a stylus or a dial by a needle.

**Angle.** An abbreviation for angle iron or angle bar.

**Angle Bar.** A rolled shape, generally of mild steel, having a cross section shaped like the legs of a right angle. In ship work it is used for frames, bulkhead stiffeners, attachment of one plate or shape to another, etc. The size is denoted by dimensions of cross section and weight per running foot.

**Angle Bar Frame.** See Frame, Angle Bar.

**Angle Bars, Frame.** See Frame, Angle Bars.

**Angle Clip.** A term applied to a short piece of angle bar used for attachment.

**Angle Iron.** See Angle Bar.

**Angle Valve.** See Valve, Angle.

**Angle Furnace.** See Furnace, Bar.

**Angle smiths.** Workmen who forge steel shapes such as angle or channel bar into the various parts of the ship's hull and fittings such as watertight staples and collars, door frames, etc.

**Anneal.** To soften metal by heating and slowly cooling. In annealing cast iron the carbon is burned out, near the surface, leaving the outer surface tough and strong while the interior is hard.

**Annunciator.** An electrical device for giving an audible and visible signal.

**Annunciator Wire.** See Electric Wire and Cable.

**Anti-Corrosive Paint.** See Paint.

**Anti-Fouling Paint.** See Paint.

**Anvil.** An iron or steel block used as a table on which metals are worked or forged. Where an iron block is used the working face is generally made of steel. It is usual to provide a hole about 1<sup>1</sup>/<sub>4</sub>in. square for holding working tools such as hardies, fuller blocks, etc. Anvils are used in a shipyard by blacksmiths, angle smiths and flange turners.

**Apeak.** In a vertical direction or nearly so. The anchor is "apeak" when the cable has been hauled

into a nearly vertical line and the vessel is then "hove apeak." A yard when raised by one end, until

nearly vertical is "apeak."

**Aperture.** The space provided between the propeller and stern post for the propeller.

**Appendages.** Such items as shafting, struts, bossing, docking and bilge keels, propellers, rudder and any other feature, extraneous to the hull and generally immersed.

**Apprentice.** A learner or student of a trade.

**Apron.** A reinforcing timber bolted to the after side of the stem.

**Apron Plate.** See Plate, Apron.

**Arc, Electric.** The luminous vapor of great brilliancy and high temperature between the tips of two electrodes.

**Arc, Lamp.** See Lamp, Arc.

**Arch Piece of Stern Frame.** The curved portion of the frame over the screw aperture, joining the propeller and stern posts.

**Arching.** Occasionally used as descriptive of the same phenomenon as the term "hogging."

**Architect, Naval.** See Naval Architect.

**Ardency.** That property of a ship by virtue of which she tends to throw her head up into the wind. Ships having this characteristic must be held on their course by keeping the helm a-weather. The reason for this tendency is found in the resultant lateral resistance of the vessel being before or ahead of her resultant wind pressure.

**Area of Sections.** The area of any cross section of the immersed part of a vessel, the cross section being taken at right angles to the centerline of the vessel.

**Armature.** The armature of a generator or motor is that part of the machine containing the winding in which the electromotive force is generated. For direct-current machines, it is usually revolving, while for alternating-current machinery it is usually stationary. The two essential parts of all generators and motors are the field magnet, which produces the necessary magnetic flux, and the armature on which the conductors are arranged.

**Armillary Sphere.** An item of navigational equipment, made of wood and brass. The name is derived from the Latin *armilla*, meaning a hoop or bracelet. Such spheres were first made by the ancient Greeks, having sights and being used for astronomical observations. They were widely used on ships in the 16th and 17th centuries to discover the solar system's important coordinates. The earth is shown as a small globe in the center of the sphere, which is itself formed by two rings at right angles to the line of the poles. Another broad ring, representing the equator, joins them at their midpoint. The globe representing the earth is, in some large examples, made of wood or glass, and shows the oceans and continents. The tropics of Cancer and Capricorn, and the arctic and antarctic circles, are represented by four narrower rings. A broad ring crossing the narrow tropic rings at an angle represents the ecliptic or path of the sun. The sphere is mounted in a meridian ring that is set itself in an equatorial ring. The polar axis angle of the armillary sphere could be adjusted to set the latitude. The sphere would be rotated on this axis to take the time factor into account. Portable armillary spheres for use at sea were generally contained in a two-halved, rounded case that supported the horizontal ring, and they were small and compact. The armillary sphere was superseded in the early 18th century by the Orrery.

**Artificial Horizon.** An instrument to take hydrographic sightings at a mooring during calm weather, or on land. It was also used during conditions of poor visibility, fog and heavy rain, when the true horizon was obscured. A pioneer attempt at such an instrument was John Elton's attachment of two spirit levels to a Hadley's Octant. This was not very successful, but two types of artificial horizon were developed later. One was the enclosed level mercury horizon of 1812. It had a separate trough and spare bottle of mercury to refill the horizon. The second was the mirror horizon, which had adjustable legs and was provided with a separate spirit level to check that the instrument was standing correctly. Both types were housed in a wooden box with hinged lid when not in use.

**Asbestos.** Principally a silicate of magnesia combined with water. It is used in varying forms where resistance to combustion is necessary. A fireproof composition used for insulation, packing, and lagging.

**Ash Chute.** A portable iron trough by means of which ashes are discharged overboard clear of the vessel's side.

**Ash Ejector.** An apparatus for utilizing the discharge water from a pump to convey ashes from the fire room up and out through the vessel's side above the waterline. It consists of a metal pipe or chute leading overboard above the waterline. At the lower end in the fire room a hopper is located, and into this the discharge from the pump is led. With the hopper closed and discharge valve opened the stream from the pump will pass with high velocity. The cover may then be removed and ashes dumped into the hopper from which they will be rapidly conveyed overboard by the water.

**Ash Expeller.** An apparatus for the discharge of ashes from the fire room below the water level. This type is of value in the case of war vessels when it is desirable to make an opening through the side armor. In this apparatus the ashes are placed in the hopper, from which they pass through a quick acting valve to an intermediate chamber. An air blast or hydraulic jet expels them from this chamber.

**Ash Hoist.** Gear for the removal of ashes from the fire room. It consists of a bucket, usually traveling in guides, a winch for hoisting same to weather deck, and sometimes a trolley track to ship's side.

**Ash Pit, Boiler.** See Boiler Ash Pit.

**Ashore.** Aground (when said of a ship); on shore or land as opposed to aboard of afloat.

**Asphalt Solution.** See Paint.

**Assemble.** To collect and place in the proper positions, the various members or fabricated parts entering into construction.

**Astern.** Signifying position, in the rear of or abaft the stern; as regards motion, the opposite of going ahead; backwards.

**Astracal.** A small molding placed on the front of one of a pair of doors near the inside edge to cover the joint where the two doors come together when closed.

**Asynchronous Generator.** See Generator, Asynchronous.

**Athwart, Athwartship.** In a transverse direction; from side to side at right angles to the fore and aft centerline of a vessel.

**Astrolabe.** An instrument dating back to ancient Greek, Persian and Arab times for ascertaining the positions of the heavenly bodies. It was primitively a kind of sextant, made obsolete by the eventual introduction of the quadrant and sextant.

**Atlantic Neptune Prints.** These prints were commissioned about 1780 by the British Admiralty for use during the American War of Independence, and showed American ports, harbors, landscapes and charts.

**Augmenter, Vacuum.** An apparatus consisting of a steam ejector and a small condenser with suitable connections and designed to diminish the condenser pressure and enhance the vacuum. A steam jet is installed in an air suction pipe leading from the top of the main air pump suction or from an independent connection to the condenser. The air and vapor entrained are delivered to a small

condenser in which the pressure is higher. Circulating water for the augments condenser is taken from a by-pass on the circulating pump discharge to the condenser, or from a connection to the front head of the main condenser. The ejector steam and the vapor drawn from the main condenser are densified in the augmentor and a water seal is interposed between the augmentor suction and the air pump to prevent the air and vapor from escaping back to the main condenser.

**Augsburg Dial.** A type of Sun dial specifically one of the Diptych dial types, made Of gilt and silvered brass and of ivory, comprising an hour-graduated ring, the plane of this being angled to coincide with the observer's latitude. A perpendicular axial gnomon at the ring's center is aligned to represent the polar axis. There is a hexagonal base plate. During use the ring of the instrument shows the shadow of the sun moving at a regular speed around it. Emanating from Augsburg in Germany at first.

**Auxiliary Circulating Pump.** See Pump, Auxiliary Circulating.

**Auxiliary Feed Pump.** See Pump, Auxiliary Feed.

**Auxiliary Foundations.** See Foundation, Auxiliary.

**Auxiliary Machinery.** As its name implies, it includes all machinery except the boilers and engines constituting the propelling machinery proper, and the deck machinery. Under this heading are included such items as Air Pumps, Ash Ejectors, Blowers, Bilge Pumps, Circulating Pumps, Condensers, Distillers, Evaporators, Fans, Feed Heaters, Feed Pumps, Filters, Injectors, Lubricating Oil Pumps, Oil Pumps, Sanitary Pumps, Transfer Pumps, Water Pumps, etc.

**Avast.** A command to cease pulling on a rope. Stop, cease.

**Avast-heaving.** A term used on shipboard as a command to stop pulling in the anchor chain.

**Awning.** A canvas canopy spread over a vessel's decks, bridges, etc., for protection against rain and sun.

**Awning Deck.** See Deck, Awning.

**Awning Deck Sheer strake.** The strake of outside plating adjacent to the awning deck.

**Awning Deck Stringer.** See Stringer, Awning Deck.

**Awning Deck Stringer Bar.** See Stringer, Bar.

**Axis, Neutral.** See Neutral Axis.

**Azimuth Circle.** A graded ring attached to a compass. it is used in taking the bearings of the sun, stars and terrestrial objects.

**Azimuth Compass and Vertical Compass.** A form of compass divided into degrees, with vertical sights used for taking the azimuth of a star. The azimuth of a star is the distance of that body in angular degrees from north or south point of the meridian: the angular distance measured along the horizon between the meridian of a place and the vertical circle passing through the center of a celestial object and the

zenith. Designed with an azimuth circle, and made in England by Ralph Walker, 1793, the instrument was part of the standard equipment, as a bearing compass, of Royal Navy ships between 1795 and 1819. With it, magnetic variation could be measured to about a tenth of a degree, and it supposedly solved problems of longitude, but the achievements of this very sensitive compass were never fully appreciated or utilized because of the lack of knowledge of the laws of magnetic deviation at that time.

## B

**Back-Board.** A portable back support nicely designed and fitted on the after side of the stern thwart in a small motor or row boat.

**Backbone.** A term applied to the keel of a ship and sometimes to the center vertical keelson.

**Backing.** Making speed or having motion astern.

**Back Hand Rope.** See Rope, Back Hand.

**Backstaff.** This was an instrument used for deducing altitude when at sea, so named because it was employed with the observer's back to the sun. It was also known as Davis's Quadrant, the English quadrant, or, in France, Quartier l'anglois or Quartier de Davis.

**Backstays.** Stays which extend from all mast levels, except the lower, to the ship's side some distance abaft the mast. They serve as additional supports to prevent the mast from going forward and at the same time contribute to the lateral support, thereby assisting the shrouds.

**Baffle Plate, Boiler.** See Boiler, Baffle Plate.

**Baffle Plate, Condenser.** See Condenser, Baffle Plate.

**Balanced Rudder.** See Rudder, Balanced.

**Bale Measure.** A term used where the capacity of a cargo hold is measured to the inside of the frames or cargo battens.

**Ballast.** Any weight carried solely for the purpose of making the vessel more seaworthy. Ballast may be either portable or fixed, depending upon the condition of the ship. Permanent ballast in the form of sand, concrete, scrap or pig iron is usually fitted to overcome an inherent defect in stability or trim due to faulty design or changed character of service. Portable ballast, usually in the form of water pumped into or out of bottom, peak or wing ballast tanks, is utilized to overcome a temporary defect in stability or trim due to faulty loading, damage, etc.

**Ballast Port.** See Port, Ballast.

**Ballast Pump.** See Pump, Ballast.

**Ballast Tank.** See Tank, Ballast.

**Ballast, Water.** Sea water confined to double bottom tanks, peak tanks or other

designated compartments for use in obtaining satisfactory draft, trim or stability. In the days of the sailing vessel the object was attained by the use of solid ballast such as sand, gravel, rock, etc.

**Ballasted Condition.** A condition in which it becomes necessary to fill all or part of the ballast tanks in order to secure proper immersion, stability, and steering qualities. This condition may be the result of the consumption of fuel, stores, and water; or the absence of part or all of the designed amount of cargo.

**Ball Joint.** See Flexible Joint.

**Balsa.** A name used in South America to designate rafts made of light wood.

**Baluster.** Small upright pillar or column supporting the hand rail around a staircase.

**Banjo Frame.** A device for handling the propeller in an auxiliary screw steamer,

**Bank.** An elevation in the sea's bottom which, if sufficient height, forms a shoal.

**Bar, Boring.** See Boring Bar.

**Bar Furnace.** See Furnace, Bar.

**Bar Iron.** Rolled bars having various forms of curvature.

**Bar Keel** See Keel, Bar.

**Bar Stringer.** See Stringer, Bar.

**Barbettes.** Cylindrical structures built up of armor plates extending from the protected deck of a war vessel to the lower side of the turret shelf plate. They form protective enclosures in which are located the turret stools, shell stowage flats and ammunition hoisting gear for the turrets.

**Bare Poles.** The condition of a sailing ship with no sails hoisted. "Not a rag set."

**Barge.** A craft of full body and heavy construction designed for the carriage of cargo but having no machinery for self propulsion.

**Bark.** A vessel having three masts, fore, main and mizzen. The two forward are square rigged and the after or mizzen is fore-and-aft rigged.

**Barkentine.** A vessel having three masts, fore, main and mizzen. The fore mast is square rigged and the main and mizzen fore-and-aft rigged.

**Barnacles.** A cirriped crustacean which adheres in clusters to the under water portion of vessels, piles, piers, etc.

**Barometer.** An instrument for measuring atmospheric pressure or weight to determine likely weather changes.

**Bars, Boiler Grate.** See Boiler Grate Bars.

**Basin.** A natural or artificial berthing place in which ships may safely float at any stage of the tide.

**Basin Dry Dock.** See Dry Dock, Graving.

**Bath Brick.** A calcareous or siliceous earth preparation compressed into bricks and used for cleaning bright-work; so named for having first been made near Bath.

**Bathometer.** An instrument, invented in 1875, to measure the sea's depth.

**Batten (noun).** A thin strip of wood, usually tapered, used in laying down lines. A strip of wood or steel used in securing tarpaulins in place. (Verb) To secure by means of battens, as to "batten down a hatch."

**Battening Down.** Making the hatches watertight by means of tarpaulins firmly secured to the hatch coamings with battens, wedges, etc.

**Battens, Cargo.** A term applied to the planks that are fitted to the inside of the frames in a hold to keep the cargo away from the shell plating.

**Battens, Hatch.** See Hatch Battens.

**Battens, Sheering.** Long strips of wood which are clamped to the frames of a ship to locate the edges of the strakes of the shell plating in relation to the sheer of the ship's deck.

**Battle Cruiser.** A naval vessel of the first class having great speed, carrying guns of the largest size and range and having good protection against gun fire and torpedo attack. She must be so designed as to be capable of keeping the sea in all weathers and have a maximum radius of action. Ships of this class are intended to sink an enemy and under some circumstances to lie in the main line of battle.

**Battle Glass.** Another name for a large sand glass that "ran" for 4 hours. Used on board ship during battles or in rough weather, when the violent movement of the vessel might adversely affect the mechanism of chronometers and other time-keeping and navigational equipment.

**Battleship.** A naval vessel of the first class carrying maximum armament and protection, both against gun fire and torpedo attack, and having good speed. She must be so designed as to be capable of keeping the sea in all weather and must have a large radius of action. Ships of this class are intended to lie in the regular line of battle and bear the brunt of the fighting.

**Bead.** A reinforcing ridge on a pipe or tube.

**Beam.** The extreme width of a ship. A transverse, horizontal member supporting a deck or flat.

**Beam Angle Bar.** An angle bar used in the construction of a deck beam or an angle bar composing a deck beam.

**Beam, Awning, Anchor, Main, Lower, Shade, Shelter, etc.** The deck beams are given the name of the deck that they support.

**Beam Bracket.** See Bracket, Beam.

**Beam, Cant.** A term applied to any of the beams supporting the deck plating or planking in the overhanging portion of the stern of a vessel. These beams radiate in fan shaped formation from the transom beam to the cant frames.

**Beam Carlines.** A term applied to beams either of timber or steel running fore and

aft or diagonally between deck beams.

**Beam Clamp.** A device for attaching to the lower flange of a deck beam for hooking on a purchase, lead block, etc. It is made of metal in two parts, one of which has a sharp bend and hooks over the flange, the other, a straight flat piece, fits against the back of the web of the beam, the two parts being securely bolted together. In the lower end is a worked eye extending through both parts into which a ring is usually fitted.

**Beam, Deck-Molding of.** Its vertical dimension.

**Beam, Deck-Siding of.** Its horizontal dimension.

**Beam, Hold.** A term applied to any one of a tier of athwartship beams spanning the hold from frame to frame, and upon which no deck is fitted.

**Beam, Intermediate.** A term applied to a beam that is fitted in between, and running parallel to, the regularly spaced deck beams.

**Beam Knees.** A block of wood having a natural angular shape or a block cut to a bracket shape and used for connecting the deck beams to the frames in a wooden vessel. Also applied to the ends of steel deck beams that are split, having one portion turned down and a piece of plate fitted between the split portion, forming a bracket end.

**Beam, Main.** A term applied to the deck beam fitted at the point of maximum breadth of the vessel.

**Beam Mold.** See Mold, Beam.

**Beam, Molded.** The width over the widest portion of the ship measured to the outside of the frame angle or channel but inside the plating. Extreme: the greatest width outside the plating, armor or any part of the hull proper. Sometimes, but not always, taken over guards or fenders.

**Beam, Panting.** A term applied to an athwartship beam fitted in the bow or stern of a vessel, to panting stringers or to the under side of decks, for the purpose of preventing in and out motion of the sides of the vessel.

**Beam, Transom.** A strong deck beam situated in the after end of a vessel directly over the stern post, and connected at each end to the transom frame. The cant beams which support the deck plating in the overhang of the stern radiate from it.

**Beams, Deck.** A term applied to any of the main beams upon which the plating or planking of a deck is supported. These beams usually run athwartship from side to side of a vessel and are fastened to the frames. In the way of hatch openings they run from the side to the opening and are bracketed or clipped to the casing or coaming as the case may be. In fore and aft framing the beams run longitudinally and are bracketed to the bulkheads and also supported by heavy transverse web or belt beams.

**Bear-a-hand.** A command to give assistance at whatever is being done. Same as "Lend-a-hand."

**Bearding.** A term applied to the line of intersection of the plating and stem or stern

post.

**Bearers.** A term applied to foundations and particularly to those having vertical web plates as their principal members. Also the vertical web plates of foundations are called bearers.

**Bearing.** The ship's bearing is the direction of her course as indicated by the compass. The bearing of an object from the ship is the direction of the object expressed in points of the compass from the ship's course, one point equaling 11° - 15°.

**Bearing Compass.** This is a compass for the taking of bearings from sea-marks, which are sights on shore whose position is known in relation to the magnetic north. Consequently the ship's position could be plotted on a chart. The bearing compass is also used at sea to measure the angle between a known star and the magnetic north, which enables a calculation to be made of the deviation of the steering compass. The first of these bearing compasses was no more than a square box containing an ordinary compass, with slits on opposite sides that had cross-hairs for sighting. In the 18th century two-armed sighting vanes with cross-hairs and a central pivot were added. The sun's azimuth was measured from the shadow that fell on the compass card, thanks to lowering or raising the arm with the cross-hairs.

**Bearing, Rudder.** See Rudder Bearing.

**Bearings, Roller.** See Roller Bearings.

**Beat to Windward.** To work up against the wind by means of a series of tacks.

**Becalmed.** (Applied only to sailing vessels.) That condition in which there is insufficient wind to give steerage way even though all sail is set.

**Becket.** A small grommet used for various purposes, as for reefing a sail with toggles; the extension of the cheek straps of a block together with the bolt and thimble or eye bolt to which is secured the standing part of the fall.

**Bed Plate.** A structure, consisting of a series of transverse girders connecting fore-and-aft members or girders. It is usually made of cast iron or steel, the girders having box or L-shaped sections. It may be either cast in one piece or built up of several castings bolted together. The bed plate is fitted for the support of the feet of the engine columns, as well as to provide for the support of the crank shaft bearings. Further, it assists in the distribution of the engine weight and stresses to the ship structure to which it is attached by holding down bolts.

**Bees.** Strips of wood or iron fastened to each side of the bowsprit.

**Beetle.** A heavy long-handled wood mallet with metal hoops, sometimes called a reaming beetle or hawing beetle, used by caulkers for striking a reaming or horsing iron.

**Before.** Toward the stem or in front of the vessel.

**Beken of Cowes.** This is the name of a firm of marine photographers of Cowes in the Isle of Wight, whose early photographs, and postcards made from them, have become collectors' items. An entire series records the modern history of yachting and shipping generally. Alfred Beken and his son Frank moved in 1888 from Canterbury

to Cowes, where the father bought a chemist's shop, and eventually received a Royal Warrant for supplying medicines and scents to Queen Victoria. Alfred was a keen photographer, and indulged his hobby by taking pictures of local scenes and happenings. Frank, also a keen photographer from an early age, developed the craft as a business. In due course he was commissioned by wealthy yacht-owners and even by royalty to take pictures of themselves and their vessels.

**Belay.** To secure a rope or line about a cleat or belaying pin by winding it back and forth in the manner of the figure eight.

**Belaying Pin.** A small iron or tough wood pin consisting of a head, shoulder and shank. The pin, being securely fitted in a rail, is used for belaying the hauling parts of light running gear, signal halyards, etc.

**Bell Crank.** A bent lever used to alter the direction of application of a force.

**Bell Mouth.** A term applied to an expanded, trumpet-shaped fitting, used on the ends of voice tubes, etc.

**Bell, Ship's.** A bell and clapper of the usual shape used aboard ship as a means of denoting the time at regular intervals by day and by night; viz., 12 o'clock, midday or midnight, 8 bells; 12.30, 1 bell; 1 o'clock, 2 bells; 1.30, 3 bells; 2 o'clock, 4 bells; 2.30, 5 bells; 3 o'clock, 6 bells; 3.30, 7 bells; 4 o'clock, 8 bells; 4.30, 1 bell; 5 o'clock, 2 bells; 5.30, 3 bells; 6 o'clock, 4 bells; 6.30, 5 bells; 7 o'clock, 6 bells; 7.30, 7 bells; 8 o'clock, 8 bells; 8.30, 1 bell; 9 o'clock, 2 bells; 9.30 3 bells; 10 o'clock, 4 bells; 10.30, 5 bells; 11 o'clock, 6 bells; 11.30, 7 bells. Ship's bells are also used as a signal when anchored in a fog and as an alarm in emergencies.

**Below.** Underneath the surface of the water. Underneath a deck or decks.

**Bend.** The act of securing one thing to another; as, an anchor to a cable; a sail to a yard, one line to another, or to a buoy, boat, etc.

**Bend.** A term applied to a pipe that is bent through an angle of from 45° to 180°.

**Bend, Return.** A U-shaped pipe fitting for the purpose of connecting the ends of two parallel pipes, thus providing for a return flow.

**Bending Moment.** Any beam, girder or structure subject to bending is acted upon by a "bending moment." The bending moment at any point in the structure is the sum of the products of the force acting to produce bending and the perpendicular distances from the lines of action of the forces to the point under consideration.

**Bending Shackle.** The heavy shackle which connects the chain cable to the ring or shackle attached to the shank of an anchor,

**Bending Slab or Block.** A cast iron slab usually about five feet square, perforated with holes 2" square arranged in a manner similar to a checker board. The slab is generally about 2" thick except around the edges where it is about 8" deep. The floor in front of the furnace in the plate and angle shop is made up of a number of these slabs raised to the level of the furnace door. Such work as furnacing plates and bending and beveling is done on these slabs, the holes being used for setting pins around which to bend frames and providing a means for dogging down the work and any forms used.

**Berth.** A term applied to a bed or a place to sleep. Berths, as a rule, are permanently built into the structure of the staterooms or compartments. They are constructed singly and also in tiers of two or three, one above the other. When single, drawers for stowing clothing are often built-in underneath. Tiers of berths constructed of pipe are commonly installed in the crew space. The term berth is also used to designate a stateroom or cabin, and also to specify a position; for example, he has the berth of captain. Still another use of the term is to designate the place where a ship is docked or tied up.

**Bessemer Steel.** See Steel and Iron.

**Between Decks.** The space between any two, not necessarily adjacent, decks. Frequently expressed as "Tween decks."

**Betwixt Wind and Water.** At or near the water line at which a ship is floating.

**Bevel Board.** See Board, Bevel.

**Bevel, Closed.** A term applied where one flange of a bar is bent into an acute angle with the other flange.

**Bevel Gear.** A gear designed to transmit power from one shaft to another with which it makes a definite angle. When the shafts are at right angles to each other, the gears are called miters.

**Bevel Lines.** See Lines, Bevel.

**Bevel, Open.** A term applied where one flange of a bar is bent out to an obtuse angle with the other flange. In the bow and stern the frames are given an open bevel so that the inner flange will connect to the transverse beams without making it difficult to rivet the outer flange to the shell.

**Bevel-Faced Hammer.** A hammer used in riveting having its face set at an angle.

**Bevel-Faced Holding on Hammer.** A large hammer with its face sloped. It is held against the head of a rivet while it is being driven.

**Beveling Machine.** A machine used for beveling steel angles and other shapes. A set of steel discs is operated by an electric motor and set to any desired angle by a mechanism attached to a threaded shaft operated at one end by a hand wheel. The bars are heated in a bar furnace and run through the beveling machine while hot.

**Bibb.** The bent outlet of a cock.

**Bight (of a rope).** A loop or bend in a rope, though, strictly considered, any part between the two ends may be termed the bight.

**Bilge.** (Noun) The rounded portion of a vessel's shell which connects the bottom with the sides. (Verb) To open a vessel's lower body to the sea.

**Bilge and Ballast System.** A system of piping generally located in the hold of a vessel and connected to pumps. This system is used for pumping overboard accumulations of water in holds and compartments, and also for filling ballast and peak tanks.

**Bilge Discharge Pipe.** A pipe on the discharge side of a bilge pump for discharging

water pumped from the bilges or bottom of the vessel overboard.

**Bilge Ejector.** An apparatus designed for the expulsion of the water accumulated in a vessel's bilges.

**Bilge Injection.** The suction from the bilges to the main circulating pumps which permits discharging bilge water overboard or through the condensers in case of a leak of sea water into the bilge.

**Bilge Injection Water.** The water pumped from the bilges by the main circulating pumps.

**Bilge Inlet.** The suction side of a bilge pump or circulating pump which can be used for pumping water from the bilges.

**Bilge Keel.** See Keel, Bilge.

**Bilge Keelson.** See Keelson, Bilge.

**Bilge Pump.** See Pump, Bilge.

**Bilge Strake.** See Strake, Bilge.

**Bilge Stringer.** See Stringer, Bilge.

**Bilge Suction Pipe.** See Pipe, Bilge Suction.

**Bilge Water.** Drainage water which accumulates either in the bottom or bilge.

**Bilge and Fire Pump.** See Pump, Fire and Bilge.

**Bilge ways.** The timbers or part of the launching ways directly under the bilge of a ship.

**Bill-board.** The inclined anchor bed fitted at the intersection of the forward weather deck and shell. On some ships a tripping device is fitted on the bill-board so that by turning a rod the anchor will slide off into the water.

**Bind.** To secure the end of a rope against unlaying by taking turns of twine or small-stuff around it. The term is synonymous with whip.

**Binnacle.** A stand or case for housing a compass so that it may be conveniently consulted. Binnacles differ in shape and size, according to where used and the size of compass to be accommodated. A binnacle for a ship's navigating compass consists essentially of a pedestal at whose upper end is a bowl shaped receptacle having a sliding hood-like cover. This receptacle accommodates the gimbals supporting the compass. Compensating binnacles are provided with brackets or arms on either side, starboard and port, for supporting and securing the iron cylinders or spheres used to counteract the quadrant error due to the earth's magnetization of the vessel. This type of binnacle is usually placed immediately in front of the steering wheel, having its vertical axis in the vertical plane of the fore-and-aft center-line of the vessel.

**Binnacle Clock.** A clock made for use aboard ship, to show the nautical watches, and to strike from one to eight.

**Binoculars, Marine.** A form of telescope designed for the use of both eyes at the

same time.

**Bitter-end.** The extreme inboard end of a chain cable which is secured in the chain locker.

**Bits.** A term applied to short metal or wood columns extending up from a base plate attached to a deck or bulwark rail, timbers produced through and a short distance above a deck, or columns fitted to a windlass for the purpose of securing and belaying ropes, hawsers, cables, etc. Also called bollards.

**Bits, Mooring.** A term applied to the bits to which the mooring lines are attached.

**Bits, Towing.** A term applied to the bits fitted on the deck of a vessel for the purpose of belaying or fastening the towing hawsers.

**Bitumastic.** A black tar-like composition largely of bitumen or asphalt and containing such other ingredients as rosin, Portland cement, slaked lime, petroleum etc. It is sold under various trade names in the form of a solution, an enamel, and a cement, the exact composition being kept more or less a secret by the manufacturers. All three forms adhere well to steel when properly applied and are practically impervious to water. The solution is applied cold with a brush and is used as a priming coat for either the enamel or cement. The enamel is applied hot, after the solution is nearly dry or set, by being poured, where practicable, or otherwise spread over the surface, forming a fairly elastic surface after hardening and cooling. The cement is also applied hot, but being more difficult to apply than the enamel is used generally only on horizontal surfaces. The solution and enamel or cement is used as a protective coating in ballast and trimming tanks, chain lockers, reserve feed and fresh water tanks, coal bunkers, engine and boiler foundations, shaft alleys and below floor plates in vessels and as a damp-proof coating on the walls of cold storage spaces.

**Bituminous Solution.** See Paint.

**Black Balls.** A vessel which from any accident is not under command shall carry by day in a vertical line, one over the other, not less than six feet apart, where they can best be seen two black balls or shapes, each two feet in diameter. A vessel employed in laying or picking up telegraph cable shall carry in the daytime, in a vertical line, one over the other, not less than six feet apart, where they can best be seen, three shapes, not less than two feet in diameter, of which the highest and lowest shall be globular in shape and red in color and the middle one diamond in shape and white in color. These balls are to be taken by other vessels as signals that the vessel showing them is not under command and cannot therefore get out of the way. They are not signals of distress. A steam vessel proceeding under sail only, but having her funnel up, shall carry, in daytime, forward, where it can be seen, one black ball or shape, two feet in diameter

**Blacksmiths.** Workmen engaged in heavy forging, pressing, stamping, case hardening, annealing, tempering, tool dressing, etc.

**Blade Friction.** See Turbine, Blade Friction.

**Blades, Turbine.** See Turbine Blades.

**Bleeder.** A term applied to a cock fitted to a pipe line for the purpose of drawing off condensation.

**Bleeders.** A term applied to plugs screwed into the bottom of a ship to provide for drainage of the compartments when the vessel is in dry dock.

**Blind Pulley.** A circular block of hard wood with rounded edges perforated by several holes having grooves running from them to one side of the block. One of these blocks is secured to an end of a part of the standing rigging, as a shroud, and another to some part of the ship, they are then connected to one another by a lashing passing through the holes. These wooden blocks are commonly called dead eyes.

**Blinker Signals.** An electrical appliance used for signaling by the Morse code, consisting of two lanterns and two controllers. The lanterns are secured at the ends of the signal yard, while one controller is located on either side of the bridge.

**Block.** A device used in applying power to move heavy weights by means of tension in a cable. It consists of a frame made of wood or metal containing one or more pulleys or sheaves, set side by side and turning on the same axis. If more than one sheave is fitted, the sheaves are separated by divisions of the same outline as the sides or cheeks of the block. In referring to blocks the words single, double or triple are prefixed to tell the number of sheaves they carry in their frames. The position a block occupies in the tackle of which it is a part determines what its fitting should be, that is, whether or not it should have affixed eyes, hooks or beckets. The block on the stationary end of the tackle has on its end a hook or an eye by which it is fastened. The Becket is a fitting on one end of a block to which is secured one end of the tackle rope or "fall," and may be either on the stationary or movable block. Blocks derive their names from the purposes for which they are used, the places which they occupy or from distinctive features of their form or construction

**Block and Block; Two Blocks; Chock-a-block.** The name given the condition of a tackle when the two blocks have been drawn together so that no more power can be derived from them.

**Block, Cheek.** A block made with one of the sides or cheeks formed so that it can be secured to a spar.

**Block, Clump.** A short, thick, single block with a large swallow.

**Block Coefficient.** See Coefficient, Block.

**Block, Fiddle.** A block with two sheaves of different diameters, placed one above the other.

**Block Fittings.** Swivel, loose, stiff, side or sister hooks, regular or upset shackles, swivel jaws or eyes, stiff eyes, links, etc., mounted on various blocks to adapt the block for purposes required.

**Block, Jewel.** The block fastened to a yard to take the studding sail halyards.

**Block, Snatch.** A single block with a hook having one end of the frame arranged so that it can be hinged up to allow the bight of a rope to be placed on the one end of the rope through the swallow. Snatch blocks are used to lead ropes around obstructions which prevent straight leads to a winch or capstan.

**Block Stopper.** A short piece of rope attached to a stationary block and used to temporarily secure the running part of a fall.

**Block, Swivel.** A block having a swivel attachment to its supporting hook or shackle, thus allowing it to revolve.

**Blocks, Bilge.** Short heavy pieces of timber similar to the keel blocks. They are placed at intervals on both sides of the keel as supports for the bottom of a ship both when building and in dry dock.

**Blocks, Gin.** Sometimes called Gins. Single blocks with a metal frame having a sheave of large diameter for ease in overhauling and used where the operation of hoisting by a single part is to be performed many times in succession as in hoisting cargo.

**Blocks, Keel.** Short heavy timbers about twelve inches square in section, placed one above the other, up to a height of about five or six feet, and used to support the keel of a vessel when building and when in dry dock. They are placed under the keel from bow to stern and re-spaced a sufficient distance apart to allow access to the work.

**Blocks, Secret.** Single blocks with the sheave completely enclosed by the frame. Two holes are left on one end for the rope to pass in, around the sheave and out again. They are used to prevent the fouling of any rigging with which they come in contact.

**Blocks, Sister.** Two single blocks joined together at their ends by a swivel.

**Blow, Bottom.** See Boiler Blow, Bottom.

**Blow, Surface.** See Boiler Blow, Surface.

**Blower.** Common name for a speaking tube for communicating with various essential parts of the ship. Each speaking tube had its own nameplate, indicating to whom it communicated. The ends were formed into mouth-pieces, in which whistles were fitted. Actually "voice pipes", as they called them originally, were used in the Royal Navy long before engines and engine-rooms.

**Blowers.** Mechanical devices used for artificial air supply to machinery or other enclosed spaces and forced draft. The centrifugal type is in almost universal use at the present time. It consists of a series of vanes mounted on radial arms supported on a central revolving shaft. Air is taken in at the center and is charged by centrifugal force from the blade tips. Blowers are driven by reciprocating or turbine steam engines or electric motors. In the location of the Blower and the design of supply leads, great care must be taken as to economical use of space and the securing of a satisfactory point of intake.

**Blow-off Valve, Blow-through Valve.** See Valve, Blow-off.

**Blue Peter.** A blue flag having a white square in its center hoisted as a signal that the ship is ready to begin her voyage.

**Board, Bevel.** A wooden board upon which is drawn the bevels applying to some part of the ship's structure such as the frames, and given to the workmen in the yard for ready reference where a paper plan or sketch would not stand rough usage.

**Boarding.** The act of going on board a ship.

**Boat Deck.** See Deck, Boat.

**Boat Deck Stringer.** See Stringer, Boat Deck.

**Boat Deck Stringer Bar.** See Stringer Bar.

**Boat Hook.** A metal fitting in the form of one or more hooks and a prong, attached to the end of a pole. They are used for catching, holding and steadying small boats.

**Boat Stowage.** The provisions made aboard a ship for stowing and launching life boats.

**Boat Tanks.** Air tight compartments in ship's small boats to provide buoyancy when a boat is filled with water.

**Boatswain (Bo's'n).** One of the lower officers on shipboard who has immediate charge of the deck force, deck gear, boats, rigging, cordage, etc.

**Boatswain's Call.** A small silver whistle or pipe used by a boatswain or his mates to summon men to their stations and direct them in their duties.

**Boatswain's Chair.** A piece of plank forming a seat hung in two straps on which a man may be hoisted aloft or lowered over the ship's side.

**Bobstay Piece.** A term applied to the forward projecting edge timber of the stem directly below the bowsprit.

**Bobstays.** The chains or ropes attached underneath the outer end of a bowsprit and led to the stem to prevent the bowsprit from jumping. Frequently two or three bobstays are fitted; when three, they are designated as inner, middle, and cap bobstays; when two, as inner and cap bobstays.

**Body, After.** That portion of a ship's body aft of the midship section.

**Body Plan.** A plan consisting of a pair of half transverse elevations or end views of a ship, both having a common vertical middle line, so that the right hand side represents the ship as seen from ahead, and the left hand side as seen from astern. On the body plan appear the forms of the various cross sections, the curvature of the rail and deck lines at the side, and the projections as straight lines of the waterlines, bow and buttock lines, and the diagonal lines.

**Body-post.** See Propeller Post, Stern Post.

**Boiler.** Any vessel, container or receptacle that is capable of generating steam by the internal or external application of heat. There are two general classes of boilers, i. e., fire tube and water tube.

**Boiler Acidity.** A term used when the feed water is acid.

**Boiler, Air Required.** The amount of air that should be supplied to a furnace may be calculated from a flue gas analysis and the weight of carbon remaining in the ashes.

**Boiler Alkalinity.** A term used when the feed water is alkaline and has the power of neutralizing acids.

**Boiler, Analysis of Flue Gas.** A determination of the quality of the gases passing up the stack for the purpose of ascertaining how complete the combustion of the fuel

is.

**Boiler Ash Pit.** The space underneath the grate bars in a furnace which has the double function of receiving ashes and providing air space for combustion of the fuel.

**Boiler Baffle Plate.** A plate perforated with small holes and used in the top drums of water tube boilers to separate the steam from the water. Plates in fire tube boilers to induce the circulation of water in the proper direction are also called baffle plates.

**Boiler Bearers.** See Boiler Foundation.

**Boiler Blow, Bottom.** A valve located near the bottom of the boiler for the purpose of blowing off the mud, sediment or dense water. Also sometimes used for emptying a boiler when examination and cleaning are required. The better practice for emptying, however, is to let the boiler cool down and either draw or pump the water out.

**Boiler Blow, Surface.** A valve with pipe connections to the interior of the boiler and overboard, used for the purpose of blowing off the scum and grease that collect on the surface of the water.

**Boiler Bracing.** The stay rods, stay bolts and stay tubes used in supporting the flat surfaces in a boiler. A cylindrical surface requires no bracing for internal pressure, but ring stiffeners, ribs or corrugations are necessary for external pressure,

**Boiler Bracket.** A bracket connected to both the boiler and ship structure.

**Boiler Capacity.** The highest number of boiler horsepower that can be generated in a boiler. The rated horsepower is commonly based on 10 square feet of heating surface per horsepower.

**Boiler Chocks.** Brackets to prevent fore and aft motion of the boiler.

**Boiler Circulation.** The continuous circulation of water established in a boiler, with a view to increasing its efficiency, durability and safety. Proper circulation adds to the ability of the water to take up heat, reduces the tendency toward violent boiling which causes excessive priming, and prevents in a large measure the formation of deposits on the heating surfaces. It also adds to the durability and safety of the boiler by keeping all parts at a nearly uniform temperature, thereby reducing the liability of unequal strains due to expansion and contraction.

**Boiler Combustion Chamber.** A chamber or space adjacent to the furnace in a boiler designed for the purpose of completing the combustion of the gases from the fuel.

**Boiler Compounds.** Substances, generally having a soda or tannic content, that are injected into the boiler with the feed water or through a soda cock. These compounds should be used to prevent scaling, rather than to break it up after it has already occurred. Care should be taken to suit the compound to the water used rather than to use the compound as a cure all.

**Boiler Corrosion.** Destruction of the steel parts due to the oxidizing properties of the feed water. It may result from galvanic action, the presence of air or acidity of the water.

**Boiler Crown Sheet.** The plate over the furnace in a Locomotive type, or the plate over the combustibility chamber in a Scotch type of boiler.

**Boiler, Donkey.** A small boiler placed aboard ship for operating auxiliary and deck machinery, heating plant, etc., when the fires are drawn from the main boilers.

**Boiler Door, Ash Pit.** A single plate door fitted over the ash pit and serving as a damper.

**Boiler Door Frame.** See Boiler Furnace Front.

**Boiler Door, Furnace.** A door consisting of a steel plate with a cast iron inner plate perforated with small holes and so fitted that there is an air space between the two plates. In addition to the hinges and opening bar the door usually has a peephole which is large enough to allow a bar to be used for stirring up the fire.

**Boiler Drum.** A rectangular or cylindrical container into which headers are connected or nests of pipes expanded. They provide space for steam, and in most cases for sufficient water to prevent foaming when steam is separating from the water.

**Boiler Drum Head.** A circular plate flanged for connection to the sides of the drum and pressed to a convex shape. It is used to close the end of the drum.

**Boiler Dry Pipe.** A pipe running along the top of the steam space in which slots are cut in the top or sides for the purpose of admitting only dry steam to the line. One end of the pipe has a blank ending and the other end is connected to the steam outlet. Drainage holes are drilled along the bottom of the pipe.

**Boiler Economizers.** See Boiler Feed Water Heater.

**Boiler Efficiency.** This depends principally on having sufficient area and proper arrangement of the grate and heating surfaces combined with sufficient combustion space to insure complete combustion of the gases before they enter the stack. Good draft and circulation of water, and clean heating surfaces are also important items that are necessary to obtain the greatest efficiency.

**Boiler Electrolysis.** See Boiler, Galvanic Action.

**Boiler Evaporation.** A measure of the amount of water evaporated per pound of coal or per square foot of heating surface per hour.

**Boiler Feed Check Valve.** See Valve, Check, Boiler Feed.

**Boiler Feed Pipe, Internal.** A pipe with a blank end and perforated with numerous small holes through which feed water is delivered to the boiler.

**Boiler Feed Water.** The feed water should be as free from the carbonates and sulphates of lime and magnesia as possible. Hard or salt water should never be used except in an emergency. Due to the fact that water loses its solubility at high temperatures these substances are deposited in the form of scale upon the heating surfaces.

**Boiler Feed Water Heater.** A container used for heating the feed water before it is injected or pumped into the boiler. The feed water may be heated by passing it

through tubes around which the exhaust steam, or in some cases live steam, circulates, or by allowing the water to circulate around tubes through which exhaust or live steam passes. Other types which are frequently called economizers utilize the heat from the waste flue gases. The advantages of a feed water heater are as follows, viz.: They utilize heat that would otherwise be wasted. They increase the steam capacity by shortening the time necessary to bring the water up to steaming temperature. They also prevent strains in the boiler due to the introduction of cold water, and they retain a large portion of the scale that would otherwise be deposited in the boiler.

**Boiler, Fire Tube.** If the hot gases from the furnace or combustion chamber are led to the uptake through tubes around which water circulates the boiler is of the fire tube type. Fire tube boilers have the advantage over the water tube boilers in the following points, viz.: Less damage is done when it becomes necessary to use salt water. Not so much attention need be given to the regulation of the supply of feed water. Less trouble with the tubular elements. Better adapted for handling by firemen who are transient or below the average in intelligence. Not so sensitive.

**Boiler Firing.** No general rule for firing can be given. as the desirable thickness of the fire and methods used depend on the quality of the fuel, draft and numerous other conditions. With bituminous coal there are two common methods, called spreading and coking. In the spreading method the coal is thrown evenly in a thin layer over one furnace at a time. This method requires frequent firing. In the coking method the coal is thrown in the forward end of the furnace, allowed to coke and then spread out over the entire furnace. The ashes are sometimes removed by pulling the good coal from the back of the furnace, then dumping the ashes in the back end. The good coal in the forward end is then pushed back and the ashes in the forward end dumped. Steam jets may be used in the ash pit to soften the clinkers.

**Boiler Flue.** A large tube used to convey hot gases through a boiler.

**Boiler Flue Gas.** The gases passing up the stack.

**Boiler, Flue Type.** In this type the furnace is below one end of the boiler. The flames and hot gases pass along the sides and underneath the shell and return through flues inside the boiler to the uptake.

**Boiler, Flue and Return Tube Type.** This type has a rectangular shaped furnace located in the front. The flames and hot gases pass through a flue or flues to a combustion chamber in the back and return through small tubes to the uptake which is located at the front end.

**Boiler Foaming.** When there is a scum or suspension of particles on the surface of the water in a boiler, the steam has difficulty in freeing itself and foaming occurs. This condition may be due to the presence of organic matter or excess of boiler compounds used for treating the water.

**Boiler Forced Draft.** An artificial means for increasing the rate of combustion in a boiler by creating an excess of pressure under the fuel or a suction above it and at the same time provide for the proper supply of air to the grates as required by the rate of combustion desired. Blowers and fans are used to accomplish these results.

**Boiler Foundation.** The structure upon which the boiler is secured. It generally consists of girders built up from plates and shapes and securely fastened to the

boiler and riveted to the ship structure. With a cylindrical boiler the athwartship girders are often called saddles.

**Boiler Front.** The front head of a fire tube boiler. Water tube boilers generally have an ornamental front which is fitted to the forward supporting frame. Large doors for access to the front headers and the frames for fire and ashpit doors are fitted to it.

**Boiler Fuel.** The most commonly used fuels are anthracite and bituminous coal, although peat, lignite, wood and many kinds of refuse are used. The liquid fuels are generally crude oil or petroleum.

**Boiler Fuel Consumption.** The rate of fuel burned expressed in ounces per square foot of grate surface, heating surface, or I.H. P. per hour.

**Boiler Funnel.** See Smoke Stack.

**Boiler Furnace Front.** A steel plate attached to the front of the furnace which serves as a door frame and as a support for a cast iron protection plate on the fire side. The cast iron plate is perforated with a large number of small holes to prevent it from burning, and has an air space between it and the front plate.

**Boiler Gage, Steam.** An instrument which indicates the difference between the steam pressure in a boiler and the pressure of the atmosphere.

**Boiler Gage, Water.** A gage containing a glass tube, about 12" to 15" long, in which the water level in the boiler is indicated. Metal fittings, containing stop valves, ball non-return valves, or a combination of both, are attached to the ends of the glass tube, and these in turn are attached to small metal pipes, the upper one of which should be connected to the steam space of the boiler near the top and the lower one to the water space near the bottom. A drain cock is also provided at the bottom for blowing out the glass. On large boilers the gage glass is attached to a large pipe which is direct connected to the steam and water spaces. This prevents fluctuations in the water level in the glass. The glass tubes used in water gages are usually about 5/8 to 3/4 inches in diameter and about 1/8 inch thick. They are frequently broken, and, therefore, as an added precaution, tell-tale or gage cocks are provided. Where the glass is connected to the water and steam spaces direct, these cocks are attached to the boiler, but in large boilers where the glass is attached to a pipe column, the tell-tale cocks are attached to this pipe covering the range of the glass reading.

**Boiler Galvanic Action.** To prevent galvanic action in a boiler, zinc plates are installed. They should have as good metallic connection with the steel as possible. In addition to preventing electrolysis, they take up oxygen more readily than steel, thus preventing corrosion.

**Boiler Girder.** A plate girder usually consisting of two plates about 5/8" to 3/4" thick, connected together by rivets passing through thimbles or short pieces of pipe and used to support the top of the combustion chamber in a fire tube boiler. The stay bolts forming the connection between the girder and the crown sheet pass between the plates making up the girder and are fitted with nuts and retaining washers at the top.

**Boiler Grate Surface.** The area of the grate.

**Boiler, Gunboat Type.** This boiler is somewhat similar to the Scotch boiler, having

a furnace and combustion chamber, but instead of the hot gases returning to the front end they continue through tubes to the rear end of the boiler where the uptake is situated. This gives a smaller diameter but longer boiler and is suitable where low head room is desired.

**Boiler, Hand-Hole.** A small elliptical hole in a boiler fitted with a cover on the inside which is held in place by a clamp or strong back on the outside. The purpose of hand holes is to provide access for cleaning.

**Boiler Hatch.** See Hatch, Boiler.

**Boiler Heads.** Plates used to close the ends of the boiler shell in fire tube boilers. They are usually flanged around the edge for connection to the shell.

**Boiler Heating Surface.** The area of the surfaces of the boiler that is subject to the heating action of the flames and hot gases. In fire tube boilers there should be from 2 to 5 square feet of heating surface for each I. H. P. required.

**Boiler, High Pressure.** A boiler designed for working pressures greater than 150 lbs.

**Boiler Horsepower.** One boiler horsepower is conventionally taken as being equal to an evaporation of 345 lbs. of water per hour from and at 212° Fahrenheit. As the efficiency of a boiler depends on many things, it follows that the accuracy of its capacity can only be determined by a boiler test.

**Boiler Incrustation.** See Scale.

**Boiler Lagging.** See Insulation.

**Boiler, Leg Type.** See Boiler Flue and Return Tube.

**Boiler, Locomotive Type.** In this type there is a rectangular furnace in the front with fire tubes leading to the back end and uptake. In way of the firebox the sides are flat and the top flat or rounded. The remainder of the boiler is cylindrical.

**Boiler, Low-Pressure.** A boiler designed for working pressures of 50 lbs. or less.

**Boilermakers.** Workmen engaged in the construction and erection of the component parts of boilers, condensers, and uptakes.

**Boiler Manhole.** A hole in a boiler or drum large enough to allow a man to enter for the purpose of examining and cleaning out the interior. Specially designed covers are made for manholes with bolt and dog fastenings.

**Boiler Manhole Ring.** A reinforced ring of metal fitted around the manhole to provide local stiffness.

**Boiler, Medium-Pressure.** A boiler designed for working pressures from 50 to 150 lbs.

**Boiler Mud Drum.** Either a cylindrical or rectangular container, located at the bottom of the boiler as remote as possible from the fire, for the purpose of catching impurities deposited from the water. It is provided with access holes for cleaning out.

**Boiler Pitting.** Corrosion of isolated spots in a boiler.

**Boiler Priming.** The amount of moisture suspended in the steam generated.

**Boiler Room.** Used to designate a compartment in a ship or building in which one or more boilers are installed.

**Boiler Room Bulkhead.** See Bulkhead, Boiler Room.

**Boiler Room Casing.** See Casing, Boiler Room.

**Boiler Saddle.** See Boiler Foundation.

**Boiler, Safety Valve.** See Valve, Safety.

**Boiler, Scotch.** This type consists of a cylindrical shell with internal circular furnaces which are generally corrugated to enable them to withstand external pressure. Grate bars subdivide the furnaces into two parts, the upper part for the fire and gases and the lower part for the ash pit. The hot gases pass to a combustion chamber in the back of the boiler and from there return through tubes to the front end and uptake. The water should be kept to a level above the top of the tubes and combustion chamber and occupies all the space not taken up by the furnaces, combustion chamber, tubes, stay rods, stay bolts and steam space. Large Scotch boilers have as many as four furnaces.

**Boiler Seating.** See Boiler Foundation.

**Boiler Shell.** The outside plating of the boiler with the exception of the end plates.

**Boiler Space.** A term applied to the compartment or compartments in which the boilers are installed.

**Boiler Stack.** See Smoke Stack.

**Boiler Stays.** Steel rods or tubes used to brace flat plate surfaces in fire tube boilers.

**Boiler Stop Valve.** See Valve, Stop, Boiler.

**Boiler, Sub-Division.** A term applied to the manner in which the interior of a boiler is subdivided by partitions for the purpose of separating the fire and hot gases from the water. The circulation of the water and the heating efficiency depend largely on the manner in which this is done.

**Boiler Throat Sheet.** A plate connecting the cylindrical and flat sided porthole in the locomotive type of boiler.

**Boiler Tube Cleaners.** Contrivances used for removing the scale and soot from boiler tubes. In fire tube boilers the scale on the outside of the tubes is generally removed by scaling tools or chisels and scrapers. The scale on the inside of the tubes in water tube boilers is removed by wire brushes or by revolving scrapers or cutter heads attached to a small air or water driven turbine.

**Boiler Tubes.** Their use is described under water tube and fire tube boilers. Seamless drawn steel is the best material.

**Boiler Tube Expander.** A tool used to expand the tubes into the tube sheets, and also to bead over the ends.

**Boiler Tube Sheets.** The plates in a fire tube boiler into which the ends of the fire tubes or flues are expanded. The front tube sheet is usually that part of the boiler head which supports the forward end of the tubes and the back tube sheet is usually the plate forming the front end of the combustion chamber.

**Boiler Wagon Top.** A form of flat sides and rounded top in the way of a fire box or front end of some types of boilers.

**Boiler Water Bottom.** The space underneath the furnace occupied by water in an internally fired boiler.

**Boiler Water Column.** See Boiler Gage, Water.

**Boiler Water Leg.** The space occupied by water around the sides of a furnace in a boiler of the locomotive type and around the sides and back of a combustion chamber in a Scotch boiler.

**Boiler, Water Tube.** If the flames and hot gasses act on the outside of tubes through which water circulates the boiler is of the water tube type. In connection with the tubes horizontal drums are installed at the top and bottom. The feed water generally enters the top drum or drums and flows down through tubes to the lower drum or drums. It then returns through tubes about which the hot gages pass to the upper drum, where steam separates. The water level may be below the upper drum or at about half its depth. When the water level is below the top drum the tubes are called dry and when the water level is above the entrance of the tubes into the drum they are called wet. The tubes may be straight, curved, or bent, but in any case the fire grate is situated below so that the flames and hot gases may pass through them in rising. Surrounding the furnace, thus and part or the whole of the drums, a casing is fitted to prevent radiation. The water tubes have the advantage over the fire tubes in the following points, viz.: The weight of the boiler and the contained water is less. Steam may be generated more quickly. The danger from bad explosions is less. Less trouble from the ship's structure in installation and in renewing worn or defective portions. High pressures are more easily provided for.

**Bollards.** A term applied to short metal columns extending up from a base plate which is attached to a wharf or dock and used for securing the lines from a ship. Also, applied to timber posts extending above the level of a wharf for the same purpose. The bitts on a ship are frequently called bollards.

**Bolster.** A term applied to a piece of timber used as a support. A temporary foundation.

**Bolt.** A rod, usually of iron or steel, used as a fastening. With a few exceptions, such as drift bolts, a head or shoulder is made on one end and a screw thread is cut on the other.

**Bolt, Carriage.** Bolt with round head and square neck used on miscellaneous work.

**Bolt, Clinched.** A term applied to a bolt having one or both ends hammered over, after it is in place.

**Bolt Cutter.** A machine used to cut threads on bolts or rods. The work is held in a vise mounted on a carriage which travels along the bed of the machine while the die-head holding the cutting die revolves around the work. Bolt cutters are made with single or multiple head.

**Bolt, Deck.** A flat head bolt with square neck (plain or slotted head), used principally for securing deck planking through deck beams and plating.

**Bolt, Eye.** A rod of metal with one end having the shape of a torus or doughnut, and the other end having a screw thread cut on it or left smooth for riveting over. They are made with and without shoulders at the eye end.

**Bolt Forcer.** A machine designed to force in or start "driving fit" bolts such as those used in shaft couplings, etc. Common types of bolt forcer consist of a hydraulic cylinder and ram to which are attached side plates shaped in the form of a hook.

**Bolt Hanger.** A bolt cut with machine thread at one end and with lag screw thread at the other end, used on miscellaneous work.

**Bolt Heading Machine.** A machine used for upsetting bar stock to form bolt heads. Upsetting and heading machines are divided into two general classes, stop-motion and continuous-motion headers. The stop-motion headers have the greatest range and are primarily used for heading bolts, but are also used for all kinds of upset forgings. The continuous-motion headers are used only for heading rivets, carriage bolts, and short lengths of hexagon and square-head machine bolts; they produce these parts at a much faster rate than is possible with a stop-motion header, but their range of work is limited.

**Bolt, Holding Down.** Also called tie rod. A rod of metal with a head on one end and a machine thread on the other, or a thread on both ends. They are usually used in the sides of deck houses, where they extend through the sill, up the sides between the ceiling and outside planking and through the top plates. Their purpose is to hold the deck house to the ship's structure and prevent it from being carried away. Also applied to bolts used in securing machinery to their foundations.

**Bolt, Lock.** See Lock Bolts.

**Bolt Pointer.** A machine used for rounding or pointing the ends of bolts preparatory to cutting the thread. Its operation is similar to that of a bolt cutter.

**Bolt, Rail.** A bolt threaded at both ends. Used principally in fastening the ends of wood rails or planks together.

**Bolt, Ring.** An eyebolt having a ring worked through the eye. Ring bolts are made with lag screw ends for attachment to wood, with plain ends for riveting, and with ends fitted with a screw thread for nuts. They are also made with and without shoulders at the eye end.

**Bolt Rope.** See Rope, Bolt.

**Bolt, Stay.** See Stay Bolts.

**Bolt, Stemson.** A term applied to a bolt used to fasten a stemson to a stem or stern post.

**Bolts, Stove.** A small bolt with either a flat or round countersunk head and used for miscellaneous light work.

**Bolt, Stud.** A bolt threaded on both ends, one end of which is screwed into a hole drilled and tapped in the work for it. It is generally used where there is not sufficient

access to use through bolts and where it is not practicable or possible to drill through the work.

**Bolt, Through.** A metal rod used as a fastening, with heads upset at both ends, after it is fitted in place. Also applied to bolt passing through the work as a distinction from stud bolts.

**Bolt and Nut.** A metallic pin threaded over a portion or all of its length and having one end upset or forged to form a head. The nut is a piece of metal drilled and threaded to fit and travel along the helical threads on the bolt by turning or revolving.

**Bolt and Nut Machines.** Machines designed to forge and thread bolts and nuts are known as bolt cutter, bolt forging or bolt header, bolt pointer, nut taper, etc.

**Bolter Up.** A workman who fastens the steel work in place with bolts, preparatory to and in order to facilitate its permanent fastening or riveting up.

**Bolting Up.** Securing parts of a structure in proper position by means of bolts and nuts preparatory to riveting.

**Bone in Her Mouth.** An expression used in speaking of a ship making considerable speed. It refers particularly to the foam on the bow wave.

**Bonjean Curves.** Curves of areas of transverse sections and curves of moments of the same above the base line.

**Bonnet.** A term applied to a valve cover. In most valves the bonnet is designed to enclose and guide the valve stem.

**Booby Hatch.** See Hatch, Booby.

**Boom.** A term applied to a spar used in handling cargo, or as the lower piece of a fore-and-aft sail.

**Boom Chock.** See Cock, Boom.

**Boom Crutch.** A term applied to a structure built up from a deck to support a boom when it is not in use.

**Boom Mountings.** All metal bands, collars and other gear secured to a boom to connect it to a mast or for attaching ropes to the boom.

**Boom Stowage.** Provision for stowing the booms when not in use and consisting essentially of boom crutches or chocks.

**Boom Table.** An outrigger attached to the mast or a structure built up around a mast from the deck to support the heel bearings for booms. Boom tables are necessary to provide proper working clearances when a number of booms are installed on one mast.

**Booster Pump.** See Pump, Transfer.

**Boot-Topping Paint.** See Paint.

**Boring Bar.** A portable, heavy duty tool used for boring and facing where true

alignment is of prime importance. These tools usually consist of a heavy shaft which is passed through the part to be bored and supported by bearings which are adjusted to the proper alignment. A cutter head which holds the cutting tools is fitted to slide along the shaft on a feather and the travel or feed of the cutter head is regulated by a feed-screw recessed into the shaft. The shaft is rotated by mechanical means and the feed is regulated by hand or automatically depending on the type of tool. Boring bars are used in a shipyard for boring, re-boring, facing or grooving rudder post gudgeons, stern tube bearings, cylinders, turbine engine casings, etc.

**Boring Machine.** Boring machines may be divided into two general classes, vertical and horizontal. The standard designs of these machines are not intended exclusively for boring, as the name indicates, and very often boring constitutes a small part of the work. For instance, vertical boring machines are very generally used for turning cylindrical, flat and tapering surfaces, whereas many machines of the horizontal type may be used for drilling, milling and flange facing. Because of this fact, the names vertical, boring and turning machines, and horizontal boring, drilling and milling machines, are frequently applied to these two classes of machine tools.

**Bosom Piece.** A short piece of angle bar used as a butt strap or connecting piece. Unlike the heel piece, its flange projects in the same direction as the bars it connects and it is fitted in the bosom or between the flanges of the bars it joins.

**Boss Barrel.** A term applied to the plating around the boss and stern tubes.

**Boss Frame.** See Frame, Boss.

**Boss Plate.** See Plate, Boss.

**Boss, Propeller.** See Propeller, Boss.

**Boss, Propeller-Post.** That portion of the propeller post that is swelled out to receive the stern tube.

**Bottom.** That portion of a vessel's shell between the keel and the lower turn of the bilge. In Bottom used with reference to the ship as a whole.

**Bottom, Outer.** A term applied to the bottom shell plating in a double bottom ship.

**Bottom Strake.** See Strake, Bottom.

**Bottomry.** The business of leasing or mortgaging ships.

**Bound. Confined, Destined.**

Outward Bound. Bound for the sea.

Homeward Bound. Bound for the vessel's home port.

Tide Bound. Unable to progress because of adverse tide.

Wind Bound. Unable to make progress because of adverse winds.

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

**Bow Chock.** See Chock, Bow.

**Bow Chock Plate.** A plate fitted for the purpose of taking a bow chock. This plate is fitted near the stem and above the forecastle deck.

**Bow, Clipper.** A long, curved overhanging bow, such as was characteristic of the fast wooden sailing ships built in the United States during the middle of the nineteenth century.

**Bow Grace.** A term applied to the fenders suspended over the bow of a ship as protection against ice.

**Bow Ornament.** A figurehead or ornament fitted on the bow or bobstay piece.

**Bow Plate.** See Plate, Bow.

**Bow Plating.** A term applied to the shell plating in the bow of a vessel.

**Bow Port.** See Port, Bow.

**Bow Rope.** A rope leading from a vessel's bow to another vessel or to a wharf for the purpose of hauling her ahead or securing her. Also known as "bow-line" or "bow-fast."

**Bow Wave.** The wave thrown up at the bow of a vessel as she plows through the water.

**Bower Anchors.** See Anchor, Bowers.

**Bowlines.** Ropes connected by bridles to the leeches of square sails and leading forward for use in hauling the weather leech well forward in order to hold the wind when sailing close-hauled. When sailing in this manner a vessel is said to be on a bowline, that is, close to the wind.

**Bowsprit.** A spar projecting forward over the bow for the purpose of holding the lower ends of the head sails.

**Bowsprit Cap.** An iron band fitted on the forward end of the bowsprit.

**Box Keelson.** See Keelson, Box.

**Boxing the Compass.** The enumeration, in regular sequence, of the points and fractional points of the mariners' compass.

**Box, Starting.** See Starting Box.

**Brace.** A rope attached to the yard arm. By means of this rope the position of the yard arm may be altered in a horizontal plane. This operation is known as trimming sail.

**Bracing, Boiler.** See Boiler Bracing.

**Bracket, Boiler.** See Boiler Bracket.

**Bracket, Frame.** A bracket connecting the side frame to the margin plate of a double bottom.

**Bracket, Plate.** A plate, usually of triangular shape, provided for the purpose of

rigidly connecting structural members.

**Brackets, Beam.** A term applied to small steel plates, usually of triangular shape, used to fasten the deck beams to the frames at the side of a vessel. Also used to fasten deck half beams to fore and aft bulkheads, casings or coamings.

**Brails.** Ropes rove through blocks fastened to a spar and attached to the leech of the sail. The overhauling of these ropes gathers the sail up against the spar.

**Breadth (extreme).** The maximum breadth measure over plating or planking, including beading or fenders.

**Breadth, Molded.** The greatest breadth of a vessel, measured from the heel of frame on one side to the heel of frame on the other side.

**Breadth, Register.** The breadth of the broadest part on the outside of the vessel shall be accounted the vessel's breadth of beam, and should be taken either by plumb lines let full so as to touch the sides of the vessel or by other practical means.

**Breaker.** A wave breaking violently over or against a reef, rock, etc., lying at or below the surface of the water

**Break in.** To produce a deformation in the plating at a seam by driving the calking edge down too hard.

**Break of Poop or Forecastle.** The point at which the partial decks known as the poop and forecastle are discontinued.

**Breakwater.** A term applied to plates or timbers fitted on a forward weather deck to form a V-shaped shield against water that is shipped over the bow.

**Breast.** Rounded bows are sometimes called the breast of a vessel. To breast the sea is to meet the waves bows on.

**Breast Hook.** See Hook, Breast.

**Breeches Buoy.** A life saving contrivance for rescuing persons from a wreck. It consists of a ring buoy fitted with a canvas trunk similar to the upper part of a pair of breeches.

**Bridge.** A high transverse platform, often forming the top of a bridge house, extending from side to side of the ship, and from which a good view of the weather deck may be had. An enclosed space called the pilot house is erected on the bridge in which are installed the navigating instruments, such as the compass and binnacle, the control for the steering apparatus and the signals to the engine room. While the pilot house is generally extended to include a chartroom and sometimes staterooms, a clear passageway should be left around it. As the operation of the ship is directed from the bridge or flying bridge above it, there should also be clear open passage from one side of the vessel to the other.

**Bridge, Connecting.** A narrow walkway fitted between the poop and bridge decks or between the bridge and forecastle decks. This walkway is common on oil tankers on account of the slippery condition of the upper deck and is particularly desirable where bulwarks are not fitted.

**Bridge Deck.** See Deck, Bridge.

**Bridge Deck Stringer.** See Stringer, Bridge Deck.

**Bridge Deck Stringer Bar.** See Stringer, Bar.

**Bridge Gunwale.** See Gunwale, Bridge.

**Bridge House.** A term applied to an erection or superstructure fitted about amidship on the upper deck of a ship. The officers' quarters, staterooms and accommodations are usually located in the bridge house.

**Bridge House, Closed in.** A bridge house having bulkheads at both the forward and after ends.

**Bridge House Frame.** See Frame, Bridge House.

**Bridge House, Open.** A bridge house having the forward and after ends open.

**Bridge, Long.** See Bridge, Connecting. A fore and aft walkway between deck houses.

**Bridge, Navigating or Flying.** The uppermost platform erected at the level of the top of pilot house. It generally consists of a narrow walkway supported by stanchions, running from one side of the ship to the other and the space over the top of the pilot house. A duplicate set of navigating instruments and controls for the steering gear and engine room signals are installed on the flying bridge so that the ship may be navigated in good weather from this platform. Awnings erected on stanchions and weather clothes fitted to the railing give protection against sun and wind.

**Bridge Piece.** See Arch Piece.

**Bridge, Pilot.** See Bridge, Navigating or Flying.

**Bridge Sheer strake.** The strake of outside plating adjacent to the bridge deck.

**Bridge Warping.** A platform erected at the after end of a vessel for the use of the navigating officers when docking.

**Brig.** A vessel having two masts, fore and main. Both of these are square rigged but the main mast has in addition a gaff main sail.

**Brigantine.** A vessel having two masts, fore and main. The foremast is square and the main mast fore-and- aft rigged.

**Broach.** To suddenly veer into the wind laying the sails aback, thus exposing the vessel to danger of capsizing; said usually of a vessel running with the wind quartering.

**Broken Backed.** Said of a vessel when, owing to insufficient longitudinal strength, grounding, or other accident, her sheer is reduced or lost, thereby producing a drooping effect at both ends. (See Hogged).

**Brow.** A small curved angle or flanged plate fitted on the outside of the shell of a ship over an air port to prevent water running down the ship's side from entering the

open port.

**Bucket, Pump.** See Pump, Bucket.

**Bucket Valve, Pump.** See Pump, Bucket Valve.

**Bucklers.** Generally, though not exclusively, applied to devices designed to close chain pipes, hawse pipes, and turret gun port openings.

**Built-in Furniture.** See Furniture, Built-in.

**Built-up Frame.** Described under Frame.

**Bulb Angle Bar.** An angle bar having a bulb or swell worked along the edge of one flange. In ship work it is used for frame bars, light bulkhead stiffeners and deck beams. The size is denoted by dimensions of cross section and weight per running foot.

**Bulb Angle Frame.** See Frame, Bulb Angle.

**Bulb Plate.** A narrow plate, generally of mild steel, rolled with a bulb or swell along one of its edges. In ship work it is used for bilge keels, hatch coamings, built-up beams, etc.

**Bulb, Tee.** A rolled shape, generally of mild steel, having a cross section shaped like the letter T, with a bulb formed along the outer edge of the web. In ship work it is used for bulkhead stiffeners, deck beams, etc. The size is denoted by dimensions of cross section and weight per running foot.

**Bulk Cargo.** Cargo made up of commodities such as oil, coal, water, grains, etc.

**Bulkhead.** A term applied to any of the partition walls used for subdividing the interior of a ship into the various compartments. The main partition walls also serve as strength members of the ship's structure and as a protection against water passing from one compartment to another.

**Bulkhead, After Peak.** A term applied to the first transverse bulkhead forward of the stern post. This bulkhead forms the forward boundary of the after peak tank and should be made watertight.

**Bulkhead Bounding Bar.** A bar used for the purpose of connecting the edges of a bulkhead to the tank top, shell, decks, or to another bulkhead. Angle bars are generally used for this purpose as both flanges are easily caulked.

**Bulkhead, Boiler Room.** A term applied to a bulkhead bounding the boiler space.

**Bulkhead, Cargo Hold.** A term applied to a bulkhead bounding a cargo hold.

**Bulkhead, Center Line.** A fore and aft or longitudinal bulkhead erected on the center line or in the same plane as the keel. Also a reference line scribed on a transverse bulkhead to indicate the center of the ship.

**Bulkhead, Coal Bunker.** A term applied to a coal bunker partition wall. These bulkheads, when they serve no other purpose than enclosing coal bunkers, need not be made watertight.

**Bulkhead Coaming.** See Coaming, Bulkhead.

**Bulkhead, Collision.** The foremost transverse watertight partition in a ship that extends from the bottom of the hold to the freeboard deck. The principal object of this bulkhead is to keep the water out of the forward hold in case of a collision or damage to the bow.

**Bulkhead, Corrugated.** A bulkhead made from plates of corrugated metal or by flat plates alternately attached to the opposite flanges of the bulkhead stiffeners. Corrugated metal bulkheads are used around staterooms and quarters. Corrugated cargo hull bulkheads are generally constructed of flat plates alternately attached to opposite flanges of the stiffeners, but they are weak in compression.

**Bulkhead, Deck.** The uppermost continuous deck to which all transverse watertight bulkheads are carried. The term is used in connection with the method of subdividing merchant ships described in the Report of the Committee appointed by the president of the British Board of Trade.

**Bulkhead, Engine Room.** A term applied to a bulkhead bounding the machinery space.

**Bulkhead, Fore Peak.** The bulkhead nearest the stem, which forms the after boundary of the fore peak tank. When this bulkhead is extended from the bottom of the ship to the weather deck it is also called the collision bulkhead.

**Bulkhead Frame.** See Bulkhead Bounding Bar.

**Bulkhead Liners.** See Liners, Bulkhead.

**Bulkhead, Longitudinal.** A partition wall of planking or plating running in a fore and aft direction. Fore and aft bulkheads are very common on warships.

**Bulkhead, Partial.** A term applied to a bulkhead that only extends to a portion of the way across a compartment. They are generally erected as strength members of the structure.

**Bulkhead Plate.** This term may be applied to any plate in any strake of bulkhead plating.

**Bulkhead, Poop.** The wall erected at the forward end of the poop running between the upper and poop decks.

**Bulkhead, Recess.** A bulkhead bounding a compartment that is recessed off from a main compartment. This is frequently done at the after end of the machinery space to accommodate the thrust block.

**Bulkhead, Screen.** A term applied to a light non-watertight bulkhead fitted between the engine and boiler rooms. This bulkhead is fitted to keep the dust and heat out of the engine room, and is often constructed around the after ends of the boilers.

**Bulkhead Stiffeners.** A term applied to the beams or girders attached to a bulkhead for the purpose of supporting it under pressure and holding it in shape. These steering beams are usually spaced from about two to four feet apart and are attached to the shell, tank top and decks by brackets or lugs. Vertical stiffeners are most common on bulkheads, but horizontal stiffeners or a combination of both may

be used.

**Bulkhead Stringer.** A term sometimes applied to horizontal bulkhead stiffeners. A horizontal girder running across and riveted to a bulkhead for stiffening purposes. The stringer is connected at the ends by a gusset bracket to the side stringers or shell.

**Bulkhead, Structural.** A partition wall that is designed to perform the work of a strength member of the ship's structure. Most all of the main water tight bulkheads are strength members.

**Bulkhead Stuffing Box.** See Stuffing Box, Bulkhead.

**Bulkhead, Temporary.** Any partition wall erected to temporarily divide a compartment or for the purpose of keeping out water until a permanent bulkhead is repaired or installed.

**Bulkhead, Transverse.** A partition wall of planking or plating running in an athwartship direction across a portion or the whole breadth of a ship. The principal function of transverse bulkheads is to divide the ship into a series of watertight compartments so that any rupture of the shell will not cause the loss of the vessel. The best practice is to fit transverse bulkheads near enough together so that the admission of the sea to any two adjacent compartments will still leave the ship enough reserve buoyancy to float. Transverse bulkheads also serve as efficient strength members and are important in preserving the transverse shape of a vessel. These bulkheads also serve the purpose of subdividing the cargo space and quarters into compartments of desirable length.

**Bulkhead, Trunk.** A term applied to the casings or partition that forms an enclosure running from deck to deck and surrounding hatch openings.

**Bulkhead, Wash.** A non-watertight divisional bulkhead usually erected on the center line of deep tanks and peak tanks. The peak tanks are generally really narrow at the bottom and the wash bulkheads installed in them need not be constructed but a few feet down from the tank top. They should be strongly built to withstand the flow of liquid caused by the motion of the ship.

**Bulkhead, Watertight.** A partition of planking or plating reinforced where necessary with stiffening bars and capable of preventing the flow of water under pressure from one compartment to another. To do this all seams, butts or connections of the plating or planking must be efficiently calked and the strength of the structure must be sufficient to stand up under pressure.

**Bulkhead, Wire Mesh.** A partition built up of wire mesh panels.

**Bull Ring.** See Follower Plate, Junk Ring, etc.

**Bull's Eye.** An annular piece of hard wood with a large hole for a bowline or other rope to pass through and a score or groove around it for slicing into a strap. It is frequently termed a lizard; the name of a lantern, particularly its lens; the center of a target. A round window.

**Bulwark.** A term applied to the strake of shell plating or the side planking above a weather deck. It helps to keep the deck dry and also serves as a guard against losing deck cargo or men overboard. Where bulwarks are fitted it is customary to provide

openings in them which are called freeing ports, to allow the water that breaks over to clear itself. Bulwarks interfere with the rapid handling of cargo as care must always be taken to hoist everything clear of its top.

**Bulwark Frames.** See Frames, Bulwark.

**Bulwark Plate.** Any plate used in a bulwark strake of plating.

**Bulwark Port.** See Port, Bulwark, Clearing or freeing.

**Bulwark Stanchions.** See Stanchions, Bulwark.

**Bumboat.** A boat employed in carrying supplies for sale to vessels, the term being a corruption from bombard, the vessel in which beer was formerly carried to soldiers on duty.

**Bumped.** A term applied to a convex head on the end of a water tank or boiler.

**Bung Starter.** A heavy bat or stave used for strike- in casks or barrels on either side of the bung in order to start or loosen the bung.

**Bunk.** A built-in berth or bed. The term is usually applied to a berth in the sailor's or steerage quarters.

**Bunker Frame.** See Bulkhead Bounding Bar.

**Bunker, Hold.** See Hold, Bunker.

**Bunker, Side.** See Side Bunker.

**Bunker, Athwartship.** See Athwartship Bunker.

**Bunkers.** Stowage spaces for either oil or coal fuel.

**Bunkers, Coal.** The spaces or compartments of a ship in which is stowed the coal used as fuel for the boilers.

**Buntlines.** Ropes toggled to the foot of square sails some distance from the center for use in hauling the foot of the sail up to the yard for convenience in furling. They reeve through blocks at the masthead and thence down to the deck forward of the sail.

**Bunting.** A thin, coarse woolen material used for small pennants and for flags.

**Buoy.** A term applied to a floating object that is moored or anchored so that it remains at one place. Buoys are used for marking the place on the water where a ship is sunk, where reefs are below, where the edges of the channel are, or to provide means for mooring a ship at a desired position.

**Buoy, Life.** See Life Buoy.

**Buoy, Life Ring.** See Life Ring Buoy.

**Buoy Rope.** See Rope, Buoy.

**Buoy Mooring.** A term applied to a floating object that is anchored in a harbor or roadstead for the purpose of providing a mooring for a vessel. These buoys are

commonly made in the shape of rectangular steel tanks having a heavy ring fitted on the top.

**Buoyancy.** The supporting effort exerted by a liquid (usually water) upon the surface of a body, wholly or partially immersed in it.

**Buoyancy Reserve.** The floating or buoyancy power of that part of a vessel's hull which is above the load waterline.

**Buoyancy, Working.** The buoyancy acting at any given time to support a vessel in her floating condition. The term is used in contrast to reserve buoyancy, a portion of which becomes working buoyancy in the event of increased load or of damage resulting in the admission of water to the hull below the waterline.

**Burden.** A vessel's carrying capacity expressed in long tons.

**Burgee.** A triangular or swallow-tailed flag used as a distinguishing pennant by yachts and merchant vessels. In some cases it bears the name of the vessel, in others the initials or some device of the company or firm owning or operating the vessel.

**Burners.** Men who operate gas torches which sever or trim material by burning it away or which heat the edges of a joint so they flow together and unite to form one piece.

**Burners, Boiler Oil.** See Oil Burners.

**Burring Machine.** A machine designed to remove burrs from hot pressed nuts.

**Burton.** A tackle used for various purposes, as for hoisting a topsail aloft, supporting a yard, etc. A top-Burton is hooked to a topmast pendant and used for setting up rigging, for securing lower yards when rigged for handling weights, and for any other purpose requiring a tackle placed aloft. It is usually rove as a luff, with a fall of sufficient length to be led out on deck when the lower block is at the deck. The fall of the main top-Burton is the longest piece of running rigging on a vessel.

**Bus Bar.** An electrical conductor. A metal bar of low electrical resistance commonly used on the rear of power switchboards for carrying current between electrical apparatus.

**Bushing, Stern Tube.** See Stern Tube Bushing.

**Bussa.** A metal contraption, rather like a coiled spring, used in the West Country of England during the 19th century for cooking pilchards.

**Bussa Pot.** Also called a pilchard pot (and not to be confused with a Great Crock). It is a deep, round pan, with vertical sides and internal glaze, used in Devon and Cornwall for salting pilchards.

**Butt Joint.** See Joint, Butt.

**Butt Plate.** See Plate, Butt.

**Butted Frames.** See Frames, Butted.

**Butterfly Valve.** See Valve, Butterfly.

**Buttocks.** The traces formed by the intersections of longitudinal vertical planes parallel to the central longitudinal vertical plane of the ship, with the forward and after surface of the ship's hull. These traces when occurring in the forebody are called bow lines, and when in the after body, buttock lines. However, the term buttocks is often used to denote both bow and buttock lines.

**Butts, Shift of.** A term applied to the arrangement of the butt joints in plating. These joints in shell plating should be so shifted that the adjacent strakes of plating have their butts at least two frame spaces apart. Also the butts in any frame space for the complete number of strakes should be made as few as possible, say every six or seven strakes.

**Butt Straps.** A term applied to a strip of plate serving as a connecting strap between the butted ends of plating. The strap connections at the sides are called seam straps.

**Butted Frames.** See Frames, Butted.

**Buttock.** The rounded portion of the lower stern. This term is also applied to fore and aft sections on the line plan.

**By-Pass Valve.** See Valve, By-Pass.

**By the Board.** Overboard, over the side, off the decks and into the water.

## C

**Cabin.** The interior of a deck house, usually the space set aside for the use of officers and passengers.

**Cabinet, Metallic or Wood.** A piece of furniture used for holding clothing and other objects. When made of metal it is generally finished off to resemble wood.

**Cable.** See Rope, Definitions.

**Cable-Laid Rope.** See Rope, Cable-Laid.

**Cable Length.** A rough measure of distance equal to about six hundred feet.

**Cable Molding.** A molding often used in decorating a vessel's stern. It is carved to simulate the appearance of a rope.

**Cables, Electric.** See Electric Wires and Cables.

**Caisson.** A watertight structure used for raising sunken vessels by means of compressed air.

**Caliber.** A term applied to the inside diameter of a cylinder, tube or pipe.

**Calipers.** A gauge having two arms of equal length operating on a hinged joint, and used to measure and transfer dimensions, without the use of figures, on machine or wood work.

**Calked Deck.** See Deck, Calked.

**Canal Horn.** A horn, usually of brass and similar to those used on stage coaches, which was blown by men on narrow boats to warn lock-keepers and others of their approach, before the steam whistle was invented.

**Caulkers.** (Steel) Workmen who secure the water- and oil-tightness of joints in steel ships by swaging the metal into the openings between plates or other parts. This work is generally done with suitable tools driven by compressed air.

(Wood.) Workmen who open the seams between the planks and drive in oakum or cotton to make them watertight.

**Calking.** To make watertight by swaging the sight edges or shapes or plates riveted in place. In wood work to make watertight by filling the seams with oakum.

**Calking Box.** A caulker's kit box.

**Calking Iron.** A tool used for driving oakum into seams.

**Calking Hammer, Pneumatic.** A light machine operated by compressed air, in which a calking tool with its shank having a sliding fit in the bore of the machine is given very rapid, short and powerful strokes.

**Calking Mallet.** A wooden mallet used for striking the calking tool when calking a wooden vessel.

**Calking Pitch.** See Glue, Marine.

**Calorimeter.** An instrument used to determine the moisture content of steam.

**Cam.** A surface made up of a series or combination of inclined planes to which rotary motion is imparted by means of the shaft on which carried. The cam action may take place either in a plane perpendicular to the shaft axis or in a plane parallel thereto. Cams are generally constructed of hard steel to insure good wearing qualities.

**Cam Shaft.** A shaft designed to carry and actuate cams.

**Camber.** Round of Beam. The weather decks of ships are rounded up or arched in an athwartship direction for the purpose of draining any water that may fall on them to the sides of the ship where it can be led overboard through scuppers. This arching or rounding up is called the camber or round of beam and is expressed in inches in connection with the greatest molded breadth of the ship in feet.

**Camel.** A float used for helping vessels over sand bars and the like. The process of usage is as follows: the camel is flooded and sunk alongside the vessel to be raised. In its sunken position it is secured to the vessel, after which the water is pumped from the camel, the supplying additional buoyancy which raises the vessel.

**Candle-power.** The practical unit of the luminous intensity of sources of light

**Cant.** A term in general use by shipwrights signifying an inclination of an object from a perpendicular; to turn anything so that it does not stand perpendicular or square to a given object.

**Cant Beam.** See Beam, Cant.

**Cant Body.** That portion of a vessel's body either forward or aft in which the planes

of the frames are not at right angles to the center line of the ship.

**Cant Frames.** See Frames, Cant.

**Cant Hook.** A lever fitted with a hook, used for turning or slewing heavy articles, especially timbers. The lower end of the lever is sometimes shod with pointed metal.

**Canvas Covered Deck.** See Deck, Canvas Covered.

**Canvas Preservatives.** See Paint.

**Capacity.** The measure of power to receive or contain or the measure of ability to exert power. Illustrations: A hold of five hundred tons "capacity." A crane of ten tons "capacity."

**Capacity, Boiler.** See Boiler, Capacity.

**Capping or Nosing.** A term applied to a molding used in covering over the joints in joiner work.

**Capstan.** A device made of iron and wood for hauling up anchors and cables, taking down the foresail tack, aboard ship, or for drawing light boats above high watermark. The cable is wound round an upright cylinder revolving upon a pivot. At intervals in the upper part of the cylinder there are one or two rows of square holes, in which poles or bars are inserted to act as levers for the turning. The cable coils beneath these bars. The center-line capstan on the *Victory* had fourteen sockets around its upper part for the capstan bars. If ten men stood to a bar then 140 would be required to hoist a heavy item. The main capstan, used for weighing the anchors, would require 280 men. The decorated top of the center-line capstan was detachable, so that the ship's fiddler or other musician could stand in its place and perform while the men heaved the bars.

**Capstan Bar.** A hard wood or steel bar used in turning a capstan by hand.

**Capstan, Electric.** A power driven capstan in which the electric motor replaces the seam engine. The motor may be connected directly or by means of reduction gearing to the capstan shaft.

**Capstan Foundation.** A term applied to a seating prepared for a capstan. This seating is usually constructed by reinforcing the deck with a thicker or extra plate with bars worked between the deck beams beneath.

**Capstan, Steam.** A vertical drum or barrel operated by a steam engine and used for handling heavy anchor chains, heavy hawsers, etc. The engine is usually non-reversing and transmits its power to the capstan shaft through a worm and worm wheel. The drum is fitted with pawls to prevent overhauling under the strain of the hawser or chain where the power is shut off. The engine may be disconnected and the capstan operated by hand through the medium of capstan bars.

**Carbon Black.** See Paint

**Careen.** To incline from the upright either by the elements or mechanically for the purpose of making repairs.

**Cargo.** Merchandise or goods accepted for transportation by ship.

**Cargo, Deck.** See Deck, Cargo.

**Cargo Hatch.** See Hatch, Cargo.

**Cargo Hoist.** See winch.

**Cargo Hold Bulkhead.** See Bulkhead, Cargo Hold..

**Cargo Mat.** A mat, usually square in form, used to protect the deck covering, locally, when taking stores, ammunition, etc., on board. In its construction, manila rope is generally used. The strands being unlade are hung over a jackstay on either side, carried around, tied, and tucked to conform to the contour of the mat. The surface then is thrummed to produce a cushioning effect.

**Cargo Net.** A square net made in various sizes of manila rope or chain and used in conjunction with the vessel's hoisting appliances such as davits, boat cranes, etc., together with the necessary tackles, in hoisting stores, ammunition, etc., aboard ship. The outer edges of rope nets are formed by a continuous jackstay around the net with a bight or sling formed at each corner by seizing the two parts together. The meshes are made by crossing two sets of ropes at right angles to each other and to the jackstay, the ends stuck through the jackstay, a round turn taken and spliced into its own part. At the crossings one rope is pulled through the other under one strand and alternately hitched to right and left.

**Cargo Port.** See Port, Cargo.

**Cargo Reflector.** See Reflector, Cargo.

**Carlins.** A term applied to short fore and aft beams running under the deck beams or intercostal between them.

**Carlins, Beam.** See Beam Carlins.

**Carlins, Hatch.** See Hatch Carlins.

**Carpenter (Ship).** A woodworker who does the heavier and rougher wood work. In steel shipbuilding he sets the keel blocks and ribbands, builds stages, places the launching ways and packing.

**Carrier, Rudder.** See Rudder Carrier.

**Carrying Dog.** A tool with its end so shaped that it can be slipped over the edge of a plate or shape to facilitate its handling.

**Casemate Armor.** An armored bulkhead or belt fitted on a naval vessel. It may be pierced by gun ports. Ordinarily this armor is of less thickness than the main side belt and is fitted above the latter.

**Casing, Boiler Room.** The partition or walls enclosing the space above the boiler room in the way of the boiler hatch. This casing should form a trunk of sufficient size to allow the installation and removal of the boilers, and also, when the boilers are in position, to accommodate the smoke stack and ventilator cowls that leach to the boiler room. Doors are fitted in the casing at the deck levels thick give access to gratings and ladders leading into the boiler room. The top of the casing should project well above the weather deck where there is no superstructure and should be

carried up through the superstructure where one is erected.

**Casing, Deck Piping.** Covering plates built over exposed deck piping for protection.

**Casing, Engine Room.** The partitions or walls enclosing the space above the engine room in the way of the engine room skylight and hatchway. The casing forms a trunk suitable for access, light and ventilation. At the top of the casing a skylight with hinged covers is fitted through which the heat from the engine room escapes. Doors are fitted in the casing at the deck levels which give access to gratings and ladders leading down into the engine room. Care should be taken that the engine room casing encloses a space sufficiently large to provide for installing the engines and for lifting the cylinder covers where reciprocating engines are used. Portable strong beams are fitted in the casing trunk to compensate for the opening and for convenience in lifting covers, etc. The top of the casing should project well above the weather deck where there is no superstructure and should be carried up through the superstructure where one is erected.

**Casing, Turbine.** See Turbine, Cylinder or Casing.

**Cast Iron.** Described under Steel and Iron.

**Cast Steel Wire Rope.** See Rope, Cast Steel Wire.

**Casting Bow.** See Stem.

**Casting, Stern.** See Stern Frame.

**Castings.** Metal frames, gears, housings, etc., made by pouring molten metal into forms and allowing to cool. Stems, stern frames, struts, stern tubes, bits, chocks, turbine casings, cylinders, gear wheels, etc., are some of the castings common in ship work.

**Castors, Plate.** A plate castor is essentially a wheel mounted in such a manner on a post, about two feet high, that it is free to turn on its own axis or around the axis of the post. On a series or bed of such plate castors, ship plates in the course of construction can be easily rolled and handled by a small number of men during the shearing, punching and forming operations. Plates may be handled with these castors without the use of overhead cranes, thus materially reducing the labor required. The use of plate castors as a means of handling steel plates has been customary in large steel mills for the past twenty-five years, but they have only been recently applied to shipyard use. They are economical and if properly constructed are a material aid in reducing the labor necessary for manipulation of ship plates of all sizes.

**Cat Davit.** See Davit, Cat.

**Cat Head.** A term applied to a short beam or support projecting over the sides of a vessel at the bow for the purpose of taking the cat tackle

**Cat Hook.** A term applied to a hook used in picking up an anchor after it is brought to the surface.

**Cat Tackle.** A tackle used in raising an anchor from the surface of the water or from under the hawse pipe.

**Cavil.** A large piece of timber fastened to the forward or after bitts about midway between the base and top forming a cleat.

**Cavitation.** The breaking down of the continuous stream lines flowing through a propeller. Cavitation takes place at high speed due to the inability of the water to flow into the wheel as rapidly as it is forced astern.

**Ceilers or Planers.** Wood workers, carpenters who fit the planking on the inside and outside of the frames of a wooden vessel.

**Ceiling.** A term applied to the planking with which the inside of a vessel is sheathed. Also applied to the sheet metal or wood sheathing in quarters and storerooms.

**Ceiling, Floor.** Planking fitted on top of the floors or double bottom in the cargo holds.

**Ceiling Hold.** A term applied to thick strakes of planking fastened to the inside flanges or edges of the framing in the cargo holds.

**Center Board.** A heavy slab of wood or metal fitted in a vertical slot on the centerline of a sailing boat. It can be raised or lowered and when lowered it projects below the keel keeping the boat from slipping to leeward.

**Center Line Bulkhead.** See Bulkhead, Center Line.

**Center of Buoyancy.** The geometric center of gravity of the immersed volume of the displacement or of the displaced water. It is determined solely by the shape of the underwater body of the ship and has nothing to do with the center of gravity of the ship.

**Center of Buoyancy, Longitudinal.** The location longitudinally of the center of buoyancy is usually stated as a distance either forward or aft of the middle perpendicular.

**Center of Buoyancy, Vertical.** The distance in a vertical direction of the center of buoyancy measured from a given reference line, frequently the bottom of the vessel's keel, though sometimes the plane of the designed waterline.

**Center of Effort.** Term generally used in connection with sails, meaning the center of the application of wind pressure against the sail area. Ordinarily no allowance is made for variation in wind pressure over the sail and the center of effort is assumed to be the center of gravity of the sail area.

**Center of Floatation.** That point about which a vessel rotates when slightly inclined in any direction from her free position of equilibrium by the action of an external force without change in her displacement. The center of floatation is coincident with the center of gravity of the water plane of the vessel in her initial condition.

**Center of Gravity.** The point at which the combined weight of all the individual items going to make up a vessel's total weight may be considered as concentrated.

**Center of Gravity, Longitudinal.** The location of the center of gravity as regards its longitudinal position, usually stated as a distance either forward or aft of the midship frame or the middle perpendicular.

**Center of Gravity, Vertical.** The location of the center of gravity as regards its vertical position, usually stated as a distance above the base line or bottom of keel.

**Center of Lateral Resistance.** That point through which a single force could act producing an effect equal to the total lateral resistance of the vessel. The center of lateral resistance is ordinarily assumed to be coincident with the center of gravity of the central immersed longitudinal plane.

**Center of Pressure.** That point in a sail or an immersed plane surface at which the resultant of the combined pressure forces act. The center of pressure on a sail is the point at which the resultant of the wind pressure acts and the center of pressure on a rudder is a point at which the resultant of the water pressure acts.

**Centrifugal Pump.** See Pump, Centrifugal.

**Chafe.** To destroy or wear away by rubbing or abrasive action.

**Chafing Plate.** A plate worked around the lower edges of hatch beams or carlines to prevent wear of the hoisting ropes. Also applied to plates fitted on the forecastle deck under the anchor chains.

**Chain.** See Equipment.

**Chain, Close Link.** Sometimes known as short link chain. Chain in which the links are so short relative to their width that studs cannot be fitted.

**Chain Compressor.** A forging fitted below the upper deck and pinned at one end to the deck casting at the head of the chain pipe or to the ship's structure near by. At the other end of the shank an eye is worked for the attachment of a tackle. The controller is so located that the application of force by tackle or other means at the eye controls or stops entirely the passage of the chain by forcing it against the chain pipe.

**Chain Controller.** A device located on deck between the windlass and the hawse pipe in line with the anchor chain. The compressor consists of a heavy cast or forged bed shaped to receive a link of the anchor chain and a lever so arranged as to force the chain into the bed at the will of the operator. This device is termed a chain compressor in the merchant service.

**Chain Hoist.** A differential block and chain fall operated by an endless chain. Chain hoists are used for raising heavy weights about a shop and weights like cylinder heads, auxiliaries, etc., aboard ship.

**Chain Lockers.** Spaces or compartments intended for stowage of the anchor chains. They are usually located in the fore hold directly underneath the windlass with chain pipes connecting them to the anchor deck under the wildcats.

**Chain Pipe.** A pipe generally of cast iron, though sometimes of wrought iron or mild steel, leading from the upper deck bolster to the chain locker for the purpose of handling the anchor chain. At its lower end it is fitted with a half round or so shaped as to prevent the chafe of the chain when running out. Chain pipes are usually set at an angle to the vertical in order to minimize the noise made by the chain swinging against the chain pipe with the vessel's roll.

**Chain, Stud Link.** Chain in which each link has a short distance piece (known as a

stud) worked at its mid-length at right angles with its major axis. This is done in order to maintain the link shape.

**Chain Stopper.** A device used to secure the chain cable when riding at anchor, thereby relieving the strain on the windlass and for securing an anchor in the housing position in the hawse pipe. Stoppers differ widely in construction. For the smaller cables they are of rope, usually hemp, with a stopper knot or an iron toggle in the outer end and a lanyard for lashing to the cable. For larger cables wire rope is used in lieu of hemp, while for the largest cables the stoppers are of heavy chain fitted with slip hooks and turnbuckles for adjusting and for equalizing the strain when more than one stopper is attached to a cable. According to its use a chain stopper is termed a "riding stopper" or a "housing stopper". The inner end of the stopper is attached to a deck pad by means of a shackle or lashing.

**Chain Tierers.** The men who stow the chain cables as they are paid down into the chain locker. The chains are arranged regularly in symmetrical long flakes in a fore and aft direction. The tierers use chain-hooks and hook-ropes and in some cases tackles in performing their work. Some cables are too heavy to be handled by tierers and are stowed in deep and narrow lockers, where the chain is allowed to assume any position as it is paid down.

**Chamfer.** To bevel.

**Channel Bar.** A rolled shape, generally of mild steel, having a cross section shaped like that of an I-beam from which both flanges on the same side of the web have been cut even with that face of the web. In ship work it is used for frames, deck beams, bulkhead stiffeners, etc. The size denoted by dimensions of cross-section and weight per running foot.

**Channel Bar, or Channel Frame.** See Frame, Channel Bar.

**Charlie Noble.** The hood of the galley smoke pipe, sometimes used to mean the entire smoke pipe including the hood.

**Chart.** In general, a map showing the contour of coasts, the location of shoals, rocks, soundings, etc. There are many charts which do not fall strictly within the above definition, such as Charts of the inclination, Great circle charts, Heliographic charts, Physical charts, Selenographic charts, Variation charts etc. The earliest surviving sea map charts date from about 1300, but certainly had predecessors long before that. Early examples were called a periplus or coast pilot, mainly a description of a sailing route with instructions. There are references to an example from 450 B.C., which concerns a voyage to Gibraltar and along the west coast of Africa. Many early charts are undated, and can be judged for age only by their style.

**Chart House.** A house on or near the bridge, provided with stowage for navigation charts and facilities for their use.

**Chasers.** A term sometimes applied to assistants to the yard or shop superintendent. Their functions are to see that the work is promptly started, that the proper sequence of the steps involved is taken, and that the work is not interrupted. Also called Runners.

**Check Line.** An auxiliary line used only for checking dimensions.

**Check Pin.** A pin designed for securing the crank pin against turning. It is usually of

steel and fitted into the crank web.

**Check Ring.** A protective ring. Usually fitted to prevent the working loose of another part.

**Check Valve.** See Valve, Check.

**Checks.** A term applied to cracks or openings in the grain of wood caused by shrinkage of the material in the process of drying. The checks are not continuous and vary in depth from about one sixteenth of an inch to the entire thickness of the wood.

**Cheek Block.** See Blocks, Cheek.

**Cheeks of a Block.** The outer sides of the frame.

**Chine.** The line formed by the intersection of side and bottom in ships having straight or slightly curved frames.

**Chining.** The inserting of oakum or cotton between plank edges of boats.

**Chipper.** A workman who cuts or trims away the edges of plates, shapes, castings or forgings, either by hand or by pneumatic tools. Chipping may be necessary in order to secure a good calking edge or for fitting or finishing purposes.

**Chipping Hammer, Pneumatic.** A light machine operated by compressed air, in which a chipping tool with its shank having a sliding fit in the bore of the machine is given very rapid, short and powerful strokes.

**Chock.** A term applied to oval shaped castings, either open or closed on top, and fitted with or without rollers, through which hawsers and lines are passed. Also applied to blocks of wood used as connecting or reinforcing pieces, to blocks of wood used as filling pieces, and to supports for life boats.

**Chock, Boiler.** See Boiler, Chock.

**Chock, Boom.** A block of wood shaped to receive a boom and used as a rest when the boom is stowed and not in us.

**Chock, Bow.** A wedge shaped piece of timber used as an abutment for the bowsprit.

**Chock, Closed.** A term applied to oval shaped castings, through which hawsers or lines are passed, having no opening in the top.

**Chock, Open.** A term applied to an oval shaped casting used for passing hawsers or lines through and having the top open.

**Chock, Roller.** A term applied to an oval shaped casting fitted with one or more rollers and used for the purpose of passing hawsers and lines through.

**Chock, Rolling.** See Keel, Bilge.

**Chocks, Filling.** Timber filling in the triangular space between the bobstay piece, the gammoning piece and the stem.

**Chronometer, Marine.** A timepiece mounted on gymbals in a glass-covered case to

keep it horizontal and to preserve it from vibration, dust, drafts, and fluxuations of temperature. The mechanism is of a superior construction, having adjustments and compensations for temperature. While generally designed to run 56 hours, it is wound daily at a stated hour and is not regulated. The instrument is set as accurately as possible and its accuracy observed in an observatory. A certificate of rating is issued, showing its rate of gain or loss and this cumulative error must be considered when observing the time.

**Circuit Breaker.** An electric switch equipped with a carbon break and a trip for opening.

**Circuit Breaker, Automatic.** A circuit breaker, designed for automatically opening an electric circuit when a predetermined abnormal condition exists in the circuit in which the circuit breaker is connected.

**Circuit Breaker, Automatic Resoling.** A circuit breaker which will automatically open the circuit in which it is connected when a predetermined abnormal condition exists in that circuit and which will close the circuit automatically when the condition ceases to exist.

**Circulating Pump, Auxiliary.** See Pump, Auxiliary.

**Circulating Pump, Distiller.** See Pump, Distiller Circulating.

**Circulating Pump, Main.** See Pump, Main Circulating.

**Circulating and Air Pump.** See Pump, Air and Circulating.

**Circulation, Boiler.** See Boiler Circulation.

**Circumferentor.** An instrument, probably invented by Gemma Frisius (1508-1555), an instrument-designer of Louvain, which was used on survey ships and by surveyors to measure vertical and horizontal angles, and to chart coastlines in the 17th and 18th centuries. It is essentially a surveyor's compass, and was introduced into England by John Norden (1548-1625), an English surveyor. Eventually it was superseded by the theodolite. It should not be confused with the earlier Holland Circle. It comprises a compass with magnetic needle, around which is a graduated, non-magnetic brass ring or circle, divided into 360 degrees, mounted on a horizontal brass bar, on which two sight rules or alidades are positioned vertically to the outer ring. There are two slots parallel and longitudinal to the strip's edge. Some had a fine wire through the center of the sights. The needle would be positioned at north, using the compass, and the sight rules would be fixed on two predetermined points, so that their azimuths could be noted and the survey related properly to cadastral maps, which are maps of territorial property. When mounted horizontally on a stand, the circumferentor was used to measure horizontal angles, and when shackle-suspended it could measure vertical angles.

**Clack.** A simple form of check consisting of a flap suspended vertically or nearly vertically from hinges at top. Purpose: to limit flow of liquids to one direction only.

**Clack Box.** The casing enclosing the clack, The whole forming a clack valve. Box usually a casting Similar to other valves.

**Clack Door.** Cover providing access to interior of clack box.

**Clamp.** A device for holding two or more pieces of material together. It is generally operated by hand.

**Clamp.** A metal fitting used to grip and hold wire ropes. Two or more may be used to connect two ropes in lieu of a short splice or in turning in an eye.

**Clamp, Deck Beam.** A wood ship term applied to the fore and aft timber fastened to the frames and reinforcing the shelves which support the deck beams.

**Clamp, Rudder.** A term applied to the timbers that are fitted on both sides of the rudder and after portion of the stern to keep the rudder in a fore and aft position during the launching.

**Clapper.** See Tumbler.

**Clasp Hook.** Two hooks or one hook in two parts each forming a mousing for the other, and suspended from the same link or eye; or a pair of hooks whose jaws overlap and are held in place by a sliding ring. Also known as clip hook, See Sister Hooks.

**Classification.** Certification by a classification society as to the character of construction and outfitting of the vessel classed.

**Classification Society.** An institution that supervises the construction of vessels throughout under established rules, tests all materials for hulls, machinery and boilers; proof tests all anchors and anchor chains and issues Certificates of Classification which are a builder's receipt, and owner's guarantee, an underwriter's authority and a shipper's business guide.

**Claw Off, Claw.** To work a vessel off a lee shore to windward; especially when the performance is attended with great difficulty.

**Clearance.** The distance between the face of the piston, at the end of the stroke, and the inner face of the cylinder head, also the volume between the face of the valve and the face of the piston, the latter being at the end of the stroke, plus the volume of the steam port to the valve seat. It is frequently expressed as the percentage which the above volume makes of the volume swept by the piston. Clearance is allowed in order to avoid the possibility of knocking the head off in case of the accumulation of water in the cylinder. The clearance volume must be filled with steam at each stroke before the piston can be moved. This steam is not effective for work before expansion begins. A great portion of the loss due to this cause may be made up by cushioning the piston which consists of compressing the exhaust steam before the end of the stroke is reached. Cushioning assists in gradually stopping the piston, in restoring the temperature of the sides of the cylinder, which tend to cool during exhaust, and in producing uniformity in the tangential effort on the crank pins especially in high speed engines.

**Clear Hawse.** A vessel is said to have a "clear hawse" if when moored her cables lead off to the anchors on their respective sides clear of each other, i. e., without a cross in the hawse.

**Clear Hawse Pendant.** A strong pendant used in clearing hawse, consisting, usually, of a wire rope tailed with about six fathoms of chain and fitted with a pelican hook for connecting to the chain cable.

**Clearing Port.** See Port, Bulwark, Clearing of Freeing.

**Cleat, or Cavil.** A wood or a metal fitting having two projecting arms or horns to which a sheet, halyard or other rope is belayed. The deck, side plating, a stanchion, or other convenient structure serves as a support for securing the cleat. The term cavil is sometimes applied to a cleat of extra size and strength.

**Clew.** Either lower corner of a square and the lower after corner of a fore and aft sail; the nettles of light line woven into a sword mat at each end of a hammock by which it is suspended; the ring, heart, spectacle, or other shaped iron worked into the corner of a sail; to haul, by means of the clew garnets and crew lines, a sail up to the yard for furling; also to force a yard down by hauling on the clew lines.

**Clinch.** The end of a rope half-hitched around the standing part and stopped; to spread or rivet the point of a pin or bolt upon a plate or ring to prevent it from pulling out.

**Clinch Ring.** An oval shaped, heavy ring similar to a washer used under the heads of bolt and spikes where they pass through wood.

**Clinching Plate.** A small piece of plate used in the mold loft for backing up the nails or tacks used to hold a wood template together. After nailing the pieces of a template together it is turned over and the connections placed over the plate, while clinching the points of the tacks.

**Clinker Built.** See Plating, Clinker System.

**Clipper Bow.** See Bow, Clipper.

**Clips.** Short lengths of bars, generally angles, used to attach and connect the various members of the ship structure.

**Club Foot.** A fore foot in which displacement or volume is placed near the keel and close to the forward perpendicular. Its use results in forward sections with a marked tumble home at and below the load water line. It results further in very full forward endings for the lower water lines and a relatively fine entrance for the load water lines. A club foot may be used with advantage in vessels designed for speed length ratios below 1.1 particularly where such vessels have good draft.

**Clump Block.** See Block, Clump.

**Clutch.** A device designed to permit connecting and disconnecting two adjacent lengths of shafting in as expeditious a manner as possible. Clutches may be of various types depending upon the method of operation employed. Some of the principal types are as follows: mechanical, frictional, pressure and magnetic.

**Coal Bunker.** See Bunker, Coal.

**Coal Bunker Bulkhead.** See Bulkhead, Coal Bunker.

**Coal Bunkers.** The spaces allotted for stowage of coal for ships' use.

**Coal Forge.** A forge in which coal is used as fuel.

**Coal Passer.** A member of a ship's boiler room force who removes the coal from the bunkers and supplies it to the firemen or stokers.

**Coaling Hatch.** See Hatch, Coaling.

**Coaling Port.** See Port, Coaling.

**Coaming, Bulkhead.** A term applied to a strake of plating running across the top and bottom of tween deck, poop, bridge and forecastle bulkheads. The coamings are usually made thicker than the remaining plating and serve the function of top and bottom supports.

**Coaming, Hatch.** A frame bounding a hatch for the purpose of steering the edges of the opening and forming the support for the covers. In a steel ship it generally consists of a strake of strong vertical plating completely bounding the edges of a deck opening. In wood ships this coaming consists of heavy timber forming a frame around a hatch.

**Coaming, House.** A term applied to the narrow vertical plates bounding the top and bottom of a deck house. These plates are made somewhat thicker than the side plating and form a frame for the base and top of the house. Also applied to the heavy timber forming the foundation of a wood deck house.

**Coaming, Man Hole.** A frame worked around a man hole for the purpose of stiffening the edges of the opening and providing a support for the cover.

**Coaming, Skylight.** See Skylight, Coaming.

**Cock.** A valve which is opened or closed by giving a disc or tapered plug a quarter turn. When a plug is used it is slotted to correspond with the ports in the valve.

**Cock, Air.** A cock for the control of air entry or escape from pump, condenser, etc.

**Cock, Ash.** Cocks for supplying water to the fire room for use in cooling hot ashes, etc.

**Cock, Drain.** A small cock fitted to cylinders, steam jackets and other chambers so that any water which may collect can be drained away.

**Cock, Feed.** A cock for the control of the feed water flow.

**Cock, Pet.** A small cock used to test the working of bilge, feed and other similar pumps, and to indicate, in lieu of a gage-glass, the height of water or other liquid in a tank or other container. Also used for draining cylinders.

**Cocked Hats.** A form of headgear worn by naval officers, sometimes with gilt, braids, feathers, and escutcheons. They were worn athwart until about 1795, when officers of captain's rank and below started to wear them fore and aft. In 1825 all officers were ordered to wear them fore and aft.

**Cockpit.** Originally this term applied to a compartment below the gun deck of men of war, devoted during battle to the surgeon and his assistants. Applied to small boats, it refers to a sunken place or pit for the accommodation of the crew.

**Cocks, Test.** Small cocks either attached to the boiler shell or to a separate mounting for the purpose of indicating the water level within the boiler. Test cocks are usually three or four in number. The lowest is usually located several inches above the highest heating surface in the boiler and the highest well into the upper

part of the steam space.

**Code Calling Systems.** Code calling systems are used in large shipbuilding plants for the purpose of keeping executives in touch with one another as well as for locating any important man quickly in whatever part of the plant he may be.

**Coefficient.** A ratio between certain characteristics of a vessel which serves as a means of comparing that vessel with others. See particular coefficient desired.

**Coefficient, Admiralty.** A coefficient used in power estimating. The Admiralty coefficient is the cube root of the square of the displacement in tons times the square of the speed in knots divided by the indicated or shaft horsepower. The value of the Admiralty coefficient is practically identical for similar ships at corresponding speeds.

**Coefficient, Block.** The ratio of the immersed volume of a ship to the product of the waterline length times the breadth at waterline times the draft to the top of keel.

**Coefficient, Cylindrical.** Same as prismatic coefficient. The ratio of the immersed volume of a vessel to the volume of a circumscribed cylinder. The cylinder may be circumscribed about the midship section with a length equal to the length of the vessel, in which case the longitudinal cylindrical coefficient results; or it may be circumscribed about the load waterline with a length equal to the draft of the vessel, in which case the Vertical Cylindrical Coefficient results. The former is sometimes called the longitudinal coefficient and the latter the vertical coefficient. In case merely the term cylindrical coefficient is used without qualification invariably the longitudinal coefficient is referred to.

**Coefficient, Displacement Length.** The ratio of a vessel's displacement, in tons, to 1/100 of its waterline length in feet cubed.

**Coefficient of Fineness.** The ratio of the area of a curve to the area of its circumscribed parallelogram. The coefficient of fineness is sometimes used in relation to a solid, in which case it is the ratio of the volume of the solid to the volume of a circumscribed rectilinear parallelepiped.

**Coefficient, Longitudinal.** The ratio of the immersed volume of a ship to the product of its waterline length and immersed area of midship section. Also called Prismatic Coefficient.

**Coefficient, Midship Section.** The ratio of the immersed area of the midship section to the area of a rectangle having sides equal respectively to the waterline breadth and draft at the midship section.

**Coefficient, Prismatic.** See Coefficient, Longitudinal.

**Coefficient, Propulsive.** The ratio between the effective horsepower and the Indicated horsepower or shaft horsepower at any given speed

**Coefficient, Waterplane.** The ratio which the area of a waterplane bears to its circumscribing rectangle.

**Coffee Urn.** A large receptacle used for boiling coffee.

**Cofferdams.** Void or empty spaces separating two or more compartments for the

purposes of insulation, or to prevent the liquid contents of one compartment from entering another in the event of the failure of the walls of one to retain their tightness.

**Coil.** A term applied to a nest of piping. It may be composed of several pipes connected at the ends by headers or return bands, or it may consist of a continuous pipe which has been given a number of turns.

**Coir Rope.** See Rope, Coir.

**Coke Forge.** A forge in which coke is used as fuel.

**Collar.** As applied to machinery and machinery parts. A section of increased diameter in the form of a ring. As applied to ship structure, a piece of plate or a shape fitted round an opening for the passage of a continuous member through a bulkhead or floor plate to secure tightness against dust, water, air, etc.

**Collar.** See Collar, Angle. Applied to pieces of light plating formed to make a close fit around any beam at the point where it pierces a deck or bulkhead. Plate collars are used to obtain semi-watertightness, weather tightness and for finish.

**Collar, Angle.** Also called a staple. A term applied to a piece of angle bar that is forged or bent to form a close fit around a structural member.

**Collier.** A vessel designed for the carriage of coal. It may or may not be fitted with especial appliances for coal handling.

**Collision Bulkhead.** See Bulkhead, Collision.

**Collision Mat.** A large mat used to close an aperture in a vessel's side resulting from collision. The mat is constructed of a double thickness of cotton canvas quilted together, body roped, and thrummed on one side with hemp thrums. Hogging and distance lines used in placing and securing the mat in position are fitted to cringles worked in each corner. The thrummed side of the mat is placed in contact with the skin of the ship.

**Columns.** See Pillars.

**Columns, Engine.** See Engine Columns.

**Combination Punch and Shear.** See Punch and Shear, Combination.

**Combination Vise.** See Vise, Combination.

**Combustion Chamber.** See Boiler Combustion Chamber.

**Commutator.** A copper cylinder composed of insulated segments mounted on the shaft of an electric motor or generator. The insulated segments are connected to the armature coils and are so arranged as to change the connections of the armature coils with the carbon brushes as the armature rotates.

**Companion or Companion Way.** A hatch or opening in a flat, deck or house top to provide access; principally for the personnel.

**Compass, Dry.** A compass without liquid in it, prior to the liquid compass as developed in the 19th century.

**Compass, Gyroscopic.** The gyroscopic compass is entirely different from the magnetic compass. The earth's magnetism has nothing to do with its indication of the meridian. The north-seeking properties of the gyro-compass are derived from the peculiar properties of rotating bodies which in the case of the gyroscopic compass are electrically driven gyroscopic wheels. Any rapidly rotating body tends to place its axis parallel with that of the earth, which is, of course, North and South. We must modify the above statement by adding that any rapidly rotating body to do this must be supported so that it will have a freedom of motion in different directions. Such a device is known as a gyroscope. The gyroscopic compass may have one or more gyroscopes. The type used of recent times has two gyroscopes of equal size so arranged that when the ship is rolling, they will neutralize each other's tendency for error. The directive force of a gyroscope, while 100 times more powerful than that of the magnetic needle, is still further amplified by an auxiliary electric motor, which is sufficiently powerful to operate the compass card in azimuth. Repeater compasses, installed wherever desired about the ship, are operated by the master compass containing the gyroscopes by a simple electric follow-up system. The master compass is usually located at almost the rolling axis of the ship in a protected place. The complete gyroscopic compass equipment consists of master compass, repeaters, control panel, and storage battery. The motor generator is used to transform the ship's electric current into that suitable for the operation of the compass and the repeaters. The storage battery is for emergency use only and will store sufficient energy to operate the master compass for several hours in case of the failure of the ship's supply. The gyroscopic compass is standard in all the navies of the world. It is fast being introduced in the merchant marine service, and has already been adapted by the Cunard Line on some ten of their vessels. It is also in use on the Royal Mail, the Lloyd Seaboard and the Canadian Pacific steamers.

**Compass, Magnetic.** The compass is the most important instrument of navigation in use on board ship, the path of a ship through the waters depending upon the efficient working and use of this instrument. There are two kinds of compasses, the Dry Card Compass and the Liquid Compass. The Dry Compass consists essentially of a number of magnetic needles suspended parallel to each other and fastened to the rim of a circular disc that has a paper cover upon which are marked the points of the compass and the degrees. This card rests upon a pivot centered in the compass bowl, which in its turn is suspended by gimbals in the binnacle or stand, the latter having means of lighting the card at night and for the adjustment of compass errors due to the magnetism of the ship. In the Liquid Compass, the bowl is filled with alcohol and water, or oil. The needles are sealed in parallel tubes and form a framework which connects the central boss with the outer rim, the whole resting upon a pivot in the compass bowl. Upon the rim are printed the points and degrees. As regards the relative uses of these compasses, it may be said that the dry compass is the standard in the world's Merchant Marine, while the liquid compass is the standard in Navies, because of its freedom of vibration from the shock of gunfire, etc. The compass has been used for purposes of navigation since the third or fourth century, and the points of the compass were a natural development of subdivision of the card and have been in use since the fourteenth century. Capt. Flinders, R.N., was the first to investigate the laws of the deviation of the compass, and was the first to introduce the method of swinging ships for obtaining the deviation, in 1814. The construction of iron vessels and the consequent errors of the compass caused investigation, and in 1838-39 Sir George B. Airy, then Astronomer Royal for Great Britain, at the instigation of the Admiralty, conducted a series of experiments for "the purpose of discovering a correction for the deviation of the compass produced by the iron in the ship." The result of this investigation was immediately given to the world,

and the principles then discovered form the basis of our compass knowledge of today. To the late Lord Kelvin, navigators the world over are indebted for his untiring work in the interests of practical navigation, and through his researches we have accurate knowledge of how a compass, its binnacle and accessories should be made, based upon scientific and mathematical formulae, and compasses so made are "Standard" for that instrument. Lord Kelvin laid down two fundamental principles:

1. In order that a compass may be capable of adjustment so as to be correct on all courses at any one part of the world, it is essential to use short needles.
2. In order that the compass so adjusted may be correct on all courses at all parts of the world, it is essential that the magnetic strength of the needle be small.

An efficient compass, therefore, embodies within itself the principles of construction as laid down by the late Lord Kelvin, and also means to carry out fully the principles of adjustment laid down by Sir George B. Airy, the whole being an instrument of rugged construction made to withstand the vibrations and shocks incidental to the movements of a ship, and, at the same time, so constructed as to keep from the delicate parts of the instrument the effects of these movements. As an accessory to the compass, means must be supplied for the taking of Azimuth or bearings of celestial and terrestrial objects. This is generally accomplished by means of a sight vane accurately centered on the compass and free to move in any direction. With this instrument, it should be possible to obtain an accurate bearing even though the vessel is yawing for several degrees each side of her course. The magnetic compass, when once installed and adjusted, is the only instrument used in the equipment of a vessel whose proper working does not depend upon human agencies and which will perform its proper functions for years without human aid.

**Compass Lantern.** A lantern used to illuminate the compass in the binnacle during darkness. Heat from the lantern was taken away by a funnel on top of the binnacle.

**Compensator.** See Auto-Transformer.

**Compounds, Boiler.** See Boiler Compounds.

**Compounding of Stresses.** The superimposing, one upon another, of the various stresses acting upon a member. In compounding stresses the directions in which the various components act must be considered.

**Condensate Pump.** See Pump, Condensate.

**Condenser.** A chamber of rectangular or cylindrical shape whose function is to convert the exhaust steam from the engine, turbines, and auxiliary machinery into water.

**Condenser Air Cock.** An air cock is usually installed on the front or back head to allow any accumulation of air to escape.

**Condenser, Augmenter.** A supplementary condenser installed between the main condenser and air pump. It is used in connection with a steam ejector to densify the air vapor and ejector steam and to increase the pressure in the air pump suction.

**Condenser, Auxiliary.** A condenser for the auxiliary machinery such as pumps, refrigerating machine, turbo generator engines, winches, steering engines, windlasses, etc.

**Condenser Auxiliary Feed Connection.** A short pipe line including a valve for the purpose of taking circulating water from the front head to the steam chamber. As the circulating water is usually salt, it should be used only in emergencies.

**Condenser Back Head.** A water chamber on the back end of the condenser. When the front head has one dividing wall there is none in the back head. Where there are two or more dividing walls in the front head there is always one less in the back head. Where there is an odd number of dividing walls for the front head the discharge chest for the circulating water is on that head. Where there is an even number of dividing walls in the front head the discharge chest must be in the back head. Bosses for inspection and hand holes should be fitted on the back head for such compartment therein.

**Condenser Baffle Plate.** Also called Diaphragm Plate. A thin plate fitted in the way of the exhaust steam inlet and perforated with numerous holes, the object being to fill the whole condenser with steam and to protect the tubes nearest the inlet.

**Condenser Boiling Out Connection.** A connection for the admission for live steam to the condensing chamber.

**Condenser Cover Plate.** A plate for covering the hand and inspection holes.

**Condenser Diaphragm Plate.** See Condenser Baffle Plate.

**Condenser Doors and Hand Holes.** Openings for inspection which are closed by cover plates.

**Condenser Dry Suction.** A pad or flange for connection to an air and vapor pump or to an air and vapor ejector. It is located on the side of a condenser and above the wet suction.

**Condenser End Plate.** A liner plate to which the tube sheets, front and back heads are attached.

**Condenser Exhaust Nozzle.** A casting, boss, or fitting attached to the shell of the condenser for the purpose of making a connection to the steam exhaust line from the engines or their auxiliaries.

**Condenser Ferrule.** See Condenser, Tube Ferrule.

**Condenser Foundation.** A term applied to the foundation supporting the condenser. There are usually two supports, one for the main and one for the auxiliary condenser.

**Condenser Front Head.** The chamber that receives the circulating water. It has one or more dividing walls causing the water to pass back and forth through the condenser tubes. Bosses for two or more hand and inspection holes should be fitted on this head. The front head is generally a casting.

**Condenser Hanger.** A hanging support for a condenser. Most commonly used to support the auxiliary condenser.

**Condenser, Jet.** A chamber usually of cone shape in which the steam and cold condensing water are mixed. The condensing water, upon entering the condenser, is forced to pass through a plate perforated with a large number of small holes. This

forces the water into small jets and causes a more intimate mixture with the steam. This type is practicable only on fresh water or where a fresh supply of feed water is easily obtained. A better vacuum is obtained with the surface condenser.

**Condenser, Keel.** Pipes near the keel on the outside of the hull used for condensing steam. It is necessary that these pipes should be of a material that will not set up electrolysis with the shell, struts, stern frame and propeller.

**Condenser, Main.** A condenser for the main engines.

**Condenser, Rotary.** A synchronous motor or converter with over excited fields. This type of condenser is used when large capacity effect is desired.

**Condenser Saddle Plate.** See Condenser Foundation.

**Condenser Shell.** The outside wall of the condenser chamber. When the condenser is part of the engine frame the shell is generally rectangular in shape and made of cast steel or cast iron. When independent of the engine the shell is generally cylindrical, oval, or heart shaped and made of sheet steel or sheet brass.

**Condenser Soda Cock.** A connection for admitting soda or potash dissolved in water into the condenser. The object is to remove grease and dirt from the outside of the tubes. This is accomplished by boiling out this mixture with live steam.

**Condenser, Static.** A pair of electric conductors slightly separated by a dielectric. Two types of Electric Condensers are the flat type and the Leyden Jar. The Flat Type Condenser consists of tinfoil conductors separated by thin flat dielectric sheets (usually of Mica). The Leyden Jar consists of a glass jar, coated within and without two-thirds of its height with tinfoil, and a metallic rod protruding through the stopper of the jar and connected to the inner coat of tinfoil by means of a small chain.

**Condenser Stay Rods.** Steel rods running parallel to the tubes in the condenser chamber and serving the purpose of staying the flat tube sheets.

**Condenser Suction Pads.** Pads to provide connection for pumping the air and condenser steam from the condenser.

**Condenser Supporting Plates.** See Condenser Tube Rest Plates.

**Condenser, Surface.** A chamber in which steam is condensed by contact with the outside surface of a large number of thin brass tubes through which cold water is circulated. This produces a condensate of exhaust steam without the addition of any circulating water which is usually salt.

**Condenser Tubes.** The numerous small tubes closely fitted in a surface condenser. Thin brass tubes from about 5/8" to 3/4" outside diameter which run through the condenser chamber between tube sheets. The circulating water passes through them and the exhaust steam condenses on their outside surfaces.

**Condenser Tube Ferrule.** A cylindrical brass fitting used to secure the tubes in the tube sheets, threaded on the outside to fit the counter bore in the tube sheet and bored on the inner end to make a sliding fit over the condenser tubes. The outer end of the ferrule is tapered down so that its inside diameter is about the same as the inside diameter of the tubes. A slot is cut in the outer end for the purpose of screwing the ferrule down on packing which is placed between the bottom of the

counter bore in tube sheet and the inside end of the ferrule. This method allows the tube or ferrule to be readily renewed.

**Condenser Tube Plate.** See Condenser Tubes Sheet.

**Condenser Tube Rest Plates.** Also called Supporting Plates. These plates serve the purpose of intermediate supports for the condenser tubes between the tube sheets.

**Condenser Tube Sheet.** A brass plate into which ends of condenser tubes are fastened. These sheets, one at each end of the condenser, serve as end boundaries for the steam space and supports for the tubes. They are made of brass and counterbored for a brass ferrule.

**Condenser Vacuum Gauge.** A tube graduated in inches of mercury for obtaining the absolute back pressure in the condenser.

**Condenser Vanes.** Thin sheet steel plates placed among the condenser tubes and running between tube sheets. The object is to secure as near a uniform distribution of the steam to the tubes as possible.

**Condenser Water Chest.** A casting fitted to the front head of the condenser to which the discharge line from the circulating pump is attached.

**Condenser Water Inlet.** The circulating water inlet on the front head.

**Condenser Water Outlet.** A boss, chest or fitting on the front or back head of the condenser, as the case may be, for connection to the overboard discharge line.

**Condenser Wet Suction.** A pad or flange for connection to a condensate pump or to a combined air and water pump. It is located in the lowest part of the condenser.

**Condenser Zincs.** Zinc plates fitted in the front and back head to offset galvanic action. They should have good metallic contact.

**Conduit.** Wrought iron pipe, fiber pipe, tile or other hollow products specially prepared to accommodate and protect electric wire and cable.

**Conduit Box.** A metal box so designed that one or more conduits may be connected to it and so arranged as to make the electric wire or cable in the conduit easily accessible. A conduit box for marine work is usually made water tight.

**Conduit Pipe.** A pipe enclosing and protecting electric wiring.

**Condulet.** A conduit fittings so arranged as to allow the wires or cables in the conduit to be connected, pulled through, or brought out of a conduit in accordance with the Underwriters' Rules.

**Connecting Bridge.** See Bridge, Connecting.

**Connecting Rod.** That part of the reciprocating engine by means of which the reciprocating straight line motion of the piston is transformed into the rotary motion of the crank. It consists essentially of a metal rod having a head forged at its upper end and a foot at its lower end for the purpose of taking the cross head and crank pins respectively. The openings in these end forgings are fitted with brasses and caps. Marine connecting rods generally increase in area of cross section from top to bottom, the section being sometimes circular and sometimes flattened in the plane

vertical to the shaft line.

**Conning Towers.** Protective structures built up of armor plates and having various shapes and sizes. They are designed for the protection of the commanding officers of war vessels during naval actions. They are so located and designed as to command the best possible unobstructed view, while at the same time affording satisfactory protection.

**Continuous Floors.** See Floors, Continuous.

**Contline (of a rope).** The sunken space or groove following the lay of the rope between the strands.

**Contracting Ship-fitter.** A slip-fitter who takes a contract to lay out the material for some structural feature of the ship, as a keel, a deck, or the shell plating, and to set it up on the ship ready for riveting.

**Controller, Motor.** Controllers for electric motors include such apparatus as starting rheostats, speed regulating or controlling rheostats and such devices as compensator or auto-transformer types of motion starting apparatus, which are used for alternating current motors. There are also special types of switches, such as float and tank switches, magnetically operated switches, star-delta switches used with squirrel-cage induction motors, and various other styles used for controlling the motor. Automatically operated motor starters, regulators and controllers are also included under this heading. A motor of very small power can be started without the need of a starting rheostat, but for most motors used aboard ship and in the shipyard, starting or regulating devices of some kind are required.

**Converter, Synchronous.** Synchronous Converter.

**Cooler Pump.** See Pump, Cooler.

**Coping Machine.** A machine designed to cut away the flanges and corners of beams.

**Copper Sheathing.** See Sheathed.

**Coppers.** Galley steam kettles. These always used to be made of copper, hence the name.

**Coppersmith.** A workman who fashions or fabricates the various fittings or parts, which are made from copper piping, tubing or sheets.

**Cordage.** A comprehensive term for all ropes of what ever size or kind on board a ship.

**Core Oven.** See Oven, Core.

**Cornice.** An interior or exterior projection fitted along the upper edge of a deck house to form an ornamental appearance.

**Corresponding Speeds.** Speeds which bear the same relation to each other as that of the square roots of the linear dimensions of the ships involved. The foregoing presupposes the existence of similarity between the ships so that the wave formations resulting are similar.

**Corrosion.** Described under Steel and Iron.

**Corrugated Bulkheads.** See Bulkheads, Corrugated.

**Corrugated Furnace.** See Furnace, Corrugated.

**Cosmolabe.** This resembled an Astrolabe and was employed for astronomical observations.

**Cotton Rope.** See Rope, Cotton.

**Coulomb.** The practical unit of quantity of electricity. It represents the quantity of electricity that passes through the cross section of a conductor per second when the current strength is 1 ampere. It is also equal to the quantity of electricity contained in a condenser with a capacity of one farad, when the same is subject to an electric motive force of one volt.

**Counter.** That part of a ship's after body extending aft from the after perpendicular (usually above the water line).

**Counter bore.** A tool used for enlarging a hole without changing its relative position; also a term applied where a hole is rebored to a larger diameter for part of its length.

**Counter Electromotive Force.** The induced electromotive force in the armature circuit of an electric motor which tends to cause the current to flow in to opposite direction to the current in the line.

**Countersink.** A term applied to the operation of cutting the sides of a drilled or punched hole into to shape of a frustum of a cone. This shape provides a shoulder for a rivet or a bolt and allows a flush surface to be maintained. Also applied to the tool doing the work.

**Counter sinkers.** Men who operate hand or power tools which taper or countersink holes in material.

**Countersinking Machine.** A drilling machine becomes a countersinking machine when a countersink is used instead of a drill.

**Countersinking Machine, Portable.** A portable pneumatic drilling machine becomes a countersinking machine when a countersink is used instead of a drill. A small truck built in the form of a box and weighted with pig or scrap metal. Small wheels are fitted to one end and a pneumatic machine with a countersink attached to the other end. Handles are fitted to the machine end. By raising the handles the truck may be rolled along plates laid on the floor. The machine is started and run continuously from beginning operation until a job is finished, the holes being countersunk by rolling the truck into position and lowering the handles until the desired depth of countersink is reached.

**Countersunk.** A term applied where the end of a hole is chamfered off, the usual slope being 45°.

**Counter Timbers.** See Timbers, Counter.

**Coupling.** A device intended for securing together adjoining ends of piping, shafting,

etc. A flange coupling, used for line shafting, consists of an enlargement of the shaft end in the form of a disc or flange, the two flanges which terminate the adjoining shaft sections being securely attached to each other by body bound bolts. A socket coupling, used in twin screw vessels for the section of line shaft just inboard of shaft tube stuffing box, consists of a tapered end on the forward end of the outward section inserted in a socket worked in the after end of the inboard section, both being secured to each other by a key and locking ring. A flexible coupling, used sometimes with reciprocating engines, is similar to the flange coupling except that the face of one flange is given the shape of a spherical segment, centered on the face of the other by a ball and socket joint, and secured to the other flange by bolts, the nuts of which bear on springs so as to take up lost motion. Piping is joined by flange couplings similar to those described above and by threaded sleeves.

**Coupling Bolts.** Bolts intended for use with couplings. Their form varies with the type of coupling from the body bound bolt secured with nut and pin in a rigid flange coupling to the tap bolt of the socket coupling or the bolt and nut of the flexible coupling.

**Coupling Bolt Forcer.** See Bolt Forcer.

**Coupling, Pipe.** A wrought iron sleeve, having an inside thread used to make a joint between two pipes. Where it is not desirable to disturb the position of the pipes in making the joint, unions should be used.

**Coupling, Rudder.** See Rudder, Coupling.

**Course.** The path over which a vessel proceeds. Some courses used habitually are known by name. This applies especially to measured mile courses, where trial trips are conducted and to racing courses. In the open sea the course is designated by the point of the compass toward which the vessel is headed.

**Cover, Boat.** A Piece of canvas used as a cover for a small boat when it is not in use.

**Cover, Hatch.** See Hatch Cover.

**Covering Board.** A term applied to the plank fitted horizontally on top of frames and waterway board at the weather decks of wood ships.

**Covering, Deck.** See Deck Covering, Decking.

**Cowl.** See Ventilators, Bell Mouthed or Cowl.

**Coxswain.** A petty officer or sailor, who steers or has charge of a small boat.

**Crab Winch.** See Winch, Crab.

**Cradle.** The structure of wood or wood and steel with its lashings that is built between the top of the sliding ways and the shell of a ship. The part adjacent to the shell is carefully fitted in order to distribute evenly the stresses due to launching.

**Cradle, Launching.** A timber frame work built up to support and partly incase a vessel when it is launched.

**Craft.** A vessel of any type.

**Crane.** A machine used for hoisting and moving pieces of material or portions of structures or machines that are too heavy to be handled by hand or that are heavy enough to make handling by hand uneconomical.

**Crane, Bridge.** An overhead type of crane usually installed in shop buildings. This type generally consists of one or more girders mounted on trucks with wheels which run along tracks supported by the columns of the building. A carriage containing or supporting the hoisting apparatus is designed to travel across the beam providing in this manner for lateral motion. Bridge cranes designed for small loads are often operated by hand while those designed for the heavier loads are generally operated by electric motors. Electrically operated cranes are generally operated from a cab attached to the girders.

**Crane, Bucket Handling.** A crane designed to operate a bucket for excavating or handling coal, mud, etc.

**Crane, Gantry.** An elevated structure designed to travel along rails on the ground level and provided with a hoisting gear.

**Crane, Jib.** A boom or arm fitted to swing in sockets attached to a wall or column. The boom in this type of crane is generally fixed in a vertical direction but free to move horizontally.

**Crane, Locomotive.** A self-propelling car with a crane mounted upon it.

**Crane, Traveling.** See Crane, Locomotive, and Crane, Bridge.

**Cranemen.** Men who operate overhead cranes handling material in the yard or shop.

**Crank Arm or Web.** That portion of the crank or crank shaft which connects the crank pin and crank axle. It forms the lever by means of which the force exerted on the crank pin by the connecting rod is transmitted to and utilized in turning the shaft in its bearings. In engines of more than one cylinder the angles which the several crank arms make with each other are matters of careful consideration in order to make possible the obtaining of the most uniform torque possible throughout the entire revolution of the shaft.

**Crank Axle.** The cylindrical portion or portion of the crank or crank shaft by means of which all the members of the rotating system of the engine are carried and held in place.

**Crank Pin.** The cylindrical member, forming part of the crank, to which the foot of the connecting rod attaches and which receives the direct exert of the connecting rod. Its design receives the most thorough consideration because of the character and severity of the strains to which it is subjected.

**Crank Shaft.** That portion of a reciprocating engine in which rotary as distinguished from rectilinear motion first appears. The term is applied to the portion of the shaft which (depending upon the number of cylinders) is composed of one or more cranks rigidly attached to one another and arranged to work about a common axis viz.: that of the propeller shaft. Crank shafting may be either built up or forged. Built up crank shafts are composed of a series of crank pins, crank axles, and crank webs formed separately and shrunk and keyed together. This type is common in merchant practice where might is not of first importance. It lends itself readily to fabrication

and repair. Forged crank shafting is cut and machined from a single forging. It effects a saving in weight over the built-up type and is becoming more popular. It is at the present time universally used in naval practice and in high grade work outside naval practice.

**Crank Shaper.** See Shaper, Crank.

**Crank or Tender.** That quality by which a vessel assumes large angles of heel as a result of the action of comparatively small forces. It is the result of a small metacentric height.

**Cribbing.** Foundations of heavy blocks and timbers for supporting a vessel during the period of construction.

**Cringles.** Iron thimbles or grommets worked into or attached to the edge, head, leech, or clew of a sail for making fast the bowline, bridles, earrings, sheets, etc.

**Critical Docking Draft.** That draft at which a vessel loses her initial stability when being docked. When the draft of a vessel in process of docking or undocking is less than the critical docking draft either bilge blocks or shores must be in place to prevent the development of a list.

**Critical Speed.** Same as Squatting Speed.

**Cross.** A pipe fitting composed of four braces, so constructed that one pair is on one axis and the other pair is on another axis, the axes being at right angles.

**Cross Beams, Hatch.** A term applied to the portable athwartship beams in a hatch that support the fore and after which in turn support the hatch covers. Also applied where these beams support the hatch covers directly without fore and afters, in which case the hatch covers must run fore and aft.

**Cross Curves of Stability.** A series of curves of righting arm plotted to a base of displacement, each curve being drawn for a given degree of heel. In preparing such a series of curves it is customary to assume all displacements an axis or point of reference at fixed distance above the vessel's base, and to compute the values of righting arm from this axis. The ordinary curve of static stability corresponding to any loading may be derived by correcting the righting arms as taken from the cross curves for the various angles of heel at the proper displacement by an amount equal in each case to the difference between the correct height of the center of gravity and the height of the axis or base assumed for the cross curve multiplied by the sine of the angle of the cross curve.

**Crosshead.** That part of a reciprocating engine which attaches directly to the outer end of the piston rod and acts at once as the connection between piston and connecting rod and as a guide to the former to keep it in line with the axis of the cylinder in spite of the transverse component set up by the connecting rod due to its angular position. The crosshead of the usual marine type consists essentially of a body into which the piston rod is screwed and secured by a nut. From this body extend pins to take the jaws of the connecting rod and at right angles to these pins (termed crosshead pins) extend arms to carry the slides for the maintenance of proper alignment.

**Crosshead Guide Bars.** Parallel, fixed members between which the crosshead works, it being held to a straight line reciprocating motion by means of the

crosshead guides or slippers bearing against the guide bars. These members are made of cast iron carefully finished.

**Crosshead Nut.** A nut intended to secure the piston rod against turning in or out of the cross head.

**Crossing the Line Certificate.** A mock certificate issued aboard ship to a passenger who had crossed the equator for the first time and had undergone the somewhat harrowing but humorous "crossing the line" ceremony. A crew member arrayed as Father Neptune would perform the ceremony with the glad help of other veterans. Much ducking and mock shaving was involved.

**Crossjack.** The lowest yard carried on the mizzen mast of a vessel. Sometimes used with reference to the sail carried by this yard.

**Cross-Over.** A pipe fitting or a pipe, having a double offset which is used to allow one pipe to pass over another.

**Cross-staff.** This simple instrument was also known as the fore-staff, baculus, balestilla, and arballista, being thus called because of its resemblance to a cross-bow and its use for taking a sun-sight (hence the expression "shooting the sun"). Originally an astronomer's aid, it was adopted by mariners for measuring the angle of the altitude of the sun above the horizon at sea. One more name for it was Jacob's Staff, thanks to its physical resemblance to the constellation Orion, formerly Jacob on medieval star maps.

**Cross-Trees.** A term applied to athwartship pieces fitted over the trees on a mast. They serve as a foundation for a platform at the top of a mast or as a support for outriggers.

**Crown.** Term sometimes used denoting the round up or camber of a deck. The crown of an anchor is located where the arms are welded to the shank.

**Crown Sheet, Boiler.** See Boiler Crown Sheet.

**Crows Nest.** A lookout station attached to or near the head of a mast.

**Cruiser.** A vessel designed to keep at sea for extended periods. Such scantlings are fixed and type of machinery selected as will insure exceptional seaworthiness. A war vessel in which the protection against gun fire is more or less sacrificed for speed or lower radius of movement.

**Cruising Turbine.** See Turbine, Cruising.

**Crutch.** A term applied to a support or boom. Also applied to the jaw of a boom or gaff.

**Cuddy.** A galley structure on deck; a small cabin.

**Curve of Areas of Midship Section.** A curve indicating the area of midship section below any waterline under consideration.

**Curve of Areas of Water Plane.** A curve indicating the area of water plane corresponding to any draft.

**Curve of Center of Gravity of Water Plane.** A curve indicating the longitudinal

position of the center of gravity of the ship's water plane for any and all drafts.

**Curve of Displacement, Fresh.** Same as Curve of Displacement, Salt Water; excepting that the ship is considered as floating in fresh water of thirty-six cubic feet per ton.

**Curve of Displacement, Salt.** A curve which indicates for any draft the corresponding displacement of the vessel, the ship being considered as floating at designed trim in salt water of thirty-five cubic feet per ton.

**Curve of Longitudinal Center of Buoyancy.** A curve so plotted as to show the variation in value of the distance of the vessel's center of buoyancy from a given reference line (generally the half length) measured in a fore-and-aft direction and corresponding to variations in draft and displacement.

**Curve of Longitudinal Metacenter.** A curve so plotted as to show the variation in value of the longitudinal metacentric radius or of the height of the longitudinal metacenter above base corresponding to variations in draft and displacement.

**Curve of Moment to Alter Trim.** A curve which indicates the approximate moment in foot tons which at any draft is required to alter the trim of the vessel by one inch.

**Curve of Sectional Areas.** A curve, plotted from a straight base line, representing the length of the ship, the ordinates of which represent to scale the areas of the vessel's immersed cross sections at corresponding points. The area under this curve represents to scale the volume of the displacement. The center of gravity of this area represents the longitudinal center of buoyancy of the displacement.

**Curve of Tons per Inch of Immersion.** A curve indicating for any draft the number of tons of additional load which would be required to immerse the vessel one additional inch.

**Curve of Transverse Metacenter.** A curve so plotted as to show the variation in value of the transverse metacentric radius or of the height of the transverse metacenter above base corresponding to variations in draft and displacement.

**Curve of Vertical Center of Buoyancy.** A curve so plotted as to show the variation in value of the distance of the vessel's center of buoyancy measured vertically above or below a horizontal reference line (generally the molded base or the plane of flotation) and corresponding to variations in draft and displacement.

**Cutter.** A boat carried by war vessels.

**Cutters or Burners.** Workmen who operate gas cutting tools to sever, trim or cut away surplus metal.

**Cutwater.** A timber bolted to the forward side of the stem in wood ships. The forward edge of the stem in steel vessels is also called the cut-water.

**Cylinder.** That portion of the reciprocating engine in which the steam acts to force the piston from one end to the other and vice-versa. The name is derived from its internal shape inasmuch as its exterior is complicated by various attachments and additions. The cylinder is made of the highest grade of cast iron, the interior being carefully bored to a smooth cylindrical shape for the passage of the piston. With the barrel of the cylinder are usually cast the lower head, valve casings, chests, ports,

passages, etc., also the lugs for the attachment of the columns, braces, etc. The upper head or cover is cast separately and attached to the barrel by means of studs and nuts. The lower cover is fitted with a stuffing box and gland to permit the free passage of the piston rod but to prevent the escape of steam. The interior faces of the piston covers are so shaped as to conform closely to the contour of the piston faces in order to cut down the volume of clearance as much as practicable. Frequently the inner surface of the cylinder barrel is formed by a liner cast of fine grained extra hard iron. It is then possible to replace the liner in case of excessive wear. Such a liner also forms one side of the jacket space in case the cylinder is to be steam jacketed. In case steam jacketing is contemplated all joints must be carefully made in order to avoid steam leaks. In the ordinary triple expansion engine with three cylinders, the cylinders are known as high pressure, intermediate and low pressure respectively.

**Cylindrical Coefficient.** See Coefficient, Cylindrical.

## D

**Davit.** A crane used to lower and raise lifeboats and sometimes anchors. The rotary, or most common type, consists of a vertical pillar, round in section, with the upper portion bent in a fair curve and having sufficient out-reach to clear the side of the ship plus clearance. Each lifeboat has two davits, one near its bow and one near its stern; and they both rotate, lifting the boat from its stowage position on the deck, and swinging it clear of the side. This type of davit is usually stepped in a socket attached to the side of the vessel or on the first deck below the boat deck near the side. At the boat deck level it is held in place by a keeper or bearing.

**Davit Bearing.** See Davit Keeper.

**Davit, Cat.** A davit used in raising an anchor from the surface of the water or from under the hawse pipe.

**Davit Cleat.** This cleat is used for fastening the end of the boat falls. It is generally seized or lashed to the davit.

**Davit Fairleader.** An eye fitting seized or lashed to the davit and used to lead the end of the boat falls from the fixed block to the cleat.

**Davit, Fish.** A davit used in pulling an anchor on board from under the cathead.

**Davit Head.** This term applies to the swelled part of the top of the davit to which the boat falls are attached. This attachment is usually done with an eye bolt but sometimes with a yoke and bolt.

**Davit Keeper.** A ring-shaped fitting whose function is to hold the davit in position and also to serve as a side bearing.

**Davit, Mechanical.** Mechanical davits are those that are forced outboard by a mechanism.

**Davit Pivot Disc.** A circular piece of hardened steel with one side flat and the other side having a convex conical surface. It is set in the bore of the davit socket to form a pivot bearing for the foot of the davit.

**Davit Socket.** The fitting into which the foot of the davit is set. When used with a keeper or bearing it is a small casting a few inches in height. It is not uncommon to combine both keeper and socket in one piece which requires a much higher casting with a broader base.

**Davit Spreader.** A spectacle-shaped fitting, fastened, to the davit head for the purpose of attaching the end of the guy rope leading to the deck and the end of the span rope between davits.

**Dead Center, Dead Point.** Those points during the stroke of a reciprocating engine at which the line of action of the connecting rod and the axis of the crank shaft lie in the same plane.

**Dead Eye.** A solid oblate or flat circular piece of hard wood having three holes for reeving a lanyard in setting up the standing rigging. Where this method of setting up is employed, the lower dead eye is attached to the chain plate, the upper one to the shroud or stay, the lanyard is then rove through the two dead eyes forming a three-fold purchase.

**Dead Flat.** The midship portion of a vessel throughout the length of which a constant shape of cross section is maintained.

**Dead Light.** A term applied to a port lid or cover. A metal shutter fitted to protect the glass in a fixed or port light,

**Dead Load, Nautical.** A term used meaning the weight of cargo and stores carried by a vessel. A load steadily applied, as the weight of merchandise stored in a warehouse. In computing stresses in any structure the weight of the structure itself, if not moving, is a dead load.

**Dead Plate.** A flange at the lower edge of the furnace front or a plate which supports the forward end of the grate in a boiler.

**Dead rise.** The angle which the straight portion of the bottom floor of the midship section makes with the base line. It is expressed by the number of inches rise above the base line in the half beam of the vessel.

**Deadweight.** The total weight of cargo, fuel, stores and water which a ship can carry when at her designed draft. The term is frequently used as descriptive of the vessel's size. It must not be confused with the volume or cubic capacity of stowage space. See also "Useful Load." Deadweight is usually expressed in long tons.

**Deadweight, Cargo Factor.** A constant which if multiplied by the registered tonnage will give as a result the approximate deadweight cargo which the vessel can carry.

**Deadweight Efficiency.** The ratio of the deadweight to the designed displacement.

**Deadwood, After.** Timbers built up between the keel and keelson in the vicinity of the stern post.

**Deadwood, Fore or Stem.** Reinforcing timbers placed back of the joint of the stem and keel.

**Dead-works.** All parts of a vessel extending above the load water line.

**Deck.** A deck in a ship corresponds to the floor in a building. It is the plating, planking, or reinforced concrete covering or any tier of beams above the inner bottom, forming a floor, either in the hull or superstructure of a ship.

**Deck, After.** A term applied to a deck aft of the midship portion of a vessel.

**Deck, Anchor.** A term applied to the top of a small forecastle that is principally used for storage of anchors or for supporting anchor handling devices.

**Deck, Awning.** A term applied to a deck fitted from bow to stern on a light superstructure. The space below it is completely closed in and may be used for passengers or for the stowage of small or light cargo.

**Deck Beam.** See Beam, Deck.

**Deck Beam Clamp.** See Clamp, Deck Beam.

**Deck, Boat.** A superstructure deck provided for the stowage of the life boats and also generally used for staterooms or quarters.

**Deck Bolts.** The bolts that are used in fastening planking to the deck beams.

**Deck, Bridge.** A term applied to the deck forming the top of a bridge house, or partial superstructure.

**Deck, Bulkhead.** The uppermost continuous deck to which all the main transverse watertight bulkheads are carried. This deck should be watertight in order to prevent any compartment that is open to the sea from flooding the one adjacent to it.

**Deck, Calked.** A term applied to a steel deck having the edges of such plating and bars as are necessary to secure watertightness calked. It is applied to a wood deck when the seams between the planking are filled with cotton or oakum and payed with marine glue. Where planking is laid over a steel deck it is advisable to calk the planking only because any leaks in the wood covering would be held by the steel deck causing the wood to rot.

**Deck, Canvas Covered.** To secure water tightness wood decks that are not calked and also wood decks within the quarters are often covered with canvas. After the canvas is laid it is given a coat of paint.

**Deck Cargo.** A term applied to a cargo carried on deck.

**Deck Chair.** An item of furniture still found on beaches and in parks, but originally designed for the use of passengers and for easy stowing on liners. Developed from the hammock, and consisting of canvas stretched on a collapsible wooden frame. Luxury liners eventually had cane-seated, mahogany chairs, which, however, could similarly be collapsed.

**Deck Covering, Decking.** Various compositions and materials have been used for covering decks. The light upper weather decks are commonly covered with canvas and then given a coat of paint. The heavy steel weather decks, when not planked over, are often covered with a composition which serves as a protection to the steel and makes a better surface for working. The decks in the living quarters are usually covered with linoleum or some composition with the object of protecting the steel and of providing a surface that is easily kept clean and sanitary. In addition to the

above some of the compositions are insulating and fireproof as well as elastic and neat appearing.

**Deck Dowels or Plugs.** Cylindrical plugs used to cover the heads of the bolts fastening the deck planking.

**Deck Drain.** A fitting attached to the deck in washrooms, shower spaces, etc., to which the drain pipes are connected.

**Deck Erection.** A term applied to a forecastle, bridge poop or deck house erected on the upper deck.

**Deck Fitting.** A fitting attached to a deck where a pipe line penetrates and the water tightness of the deck is to be maintained..

**Deck, Flush.** A term applied to a deck having no poop, bridge or forecastle erection that extends from side to side of the vessel.

**Deck, Forecastle.** A term applied to a deck worked from the stem aft over a forecastle erection.

**Deck, Freeboard.** The deck to which the classification societies require the vessel's freeboard to be measured. Usually the upper strength deck.

**Deck Girder.** See Girder, Deck.

**Deck, Harbor.** A term applied to the side deck lying close to the water line in a turret deck vessel. It is formed by the reverse curve of the plating lying between the trunk and sides of the vessel.

**Deck Heights.** The vertical distance between the molded lines of two adjacent decks.

**Deck Hook.** See Hook, Deck.

**Deck House.** A term applied to a partial superstructure that does not extend from side to side of a vessel like a bridge, poop or forecastle.

**Deck, Hurricane or Promenade.** A term applied to an upper superstructure deck on passenger ships.

**Deck Line.** A line drawn through the intersection of the molded line of the deck beams and the molded line of the frames. Approximately the intersection of the lower surface of the deck stringer plate with the inner surface of the shell plating.

**Deck, Lower.** A term applied to lowest deck in two and three deck vessels, and in the next to lowest in vessels having four or more decks.

**Deck Machinery.** A term applied to capstans, windlasses, winches and miscellaneous machinery located on the decks of a ship.

**Deck, Main.** A term applied to the principal deck. It is usually the one next below a complete top or upper deck.

**Deck, Orlop.** A term applied to the lowest deck in a ship having four or more decks.

**Deck Paint.** See Paint.

**Deck Pillar.** See Pillar, Decks.

**Deck Planks or Planking.** A term applied to the wood sheathing or covering on a deck. Oregon, yellow pine or teak are used for this purpose. The seams between the planking should be thoroughly caulked.

**Deck Plates.** Watertight hand or manhole plates usually let in flush with the deck for access to coal bunkers, operating rods, etc.

**Deck Plate, Sounding Tube.** A fitting attached to a deck and forming the terminal for a sounding tube. A screw plug is provided and is removed when sounding the inner bottom tanks.

**Deck, Platform.** A term applied to a partial deck fitted in the hold of a ship.

**Deck Plating.** A term applied to the steel plating covering a deck.

**Deck Plug.** A wood plug set in over the head of a deck bolt and cut flush with the surface of the planking.

**Deck, Poop.** A term applied to a deck worked from the stern forward over a poop erection.

**Deck, Promenade.** An upper superstructure deck on a passenger ship designed as a promenade for the passengers.

**Deck, Quarter.** A term applied to the after portion of a weather deck. In a warship that portion allotted to the use of the officers.

**Deck, Raised Quarter.** Term applied to the after portion of a weather or upper deck that is raised a few feet above the forward portion.

**Deck Scuppers, Upper.** Scuppers for draining water from the upper deck, gutters or waterways.

**Deck, Shade.** A very light deck fitted from bow to stern to provide protection against the weather. The sides below this deck are fitted with openings.

**Deck, Shelter.** A deck similar to an awning deck, but built on a very light superstructure.

**Deck, Spar.** A term applied to a deck fitted from bow to stern on a superstructure having heavier scantlings than those under an awning deck.

**Deck, Steel.** A deck constructed of steel plating on steel deck beams.

**Deck Stringer.** See Stringer, Deck.

**Deck Stringer Bar.** See Stringer, Bar.

**Deck, Tongue and Groove.** A deck covered with thin machined planks and generally used on the upper light decks of vessels. Tongue and groove decks are usually covered with canvas after which a coat of paint is applied.

**Deck, Tonnage.** The tonnage deck in vessels having three or more decks to the hull is the second deck from the keel, and in all other cases it is the upper deck of the hull. If the second deck from the keel consists of several partial decks extending with breaks from stem to stern, the line of that course of decks must be taken as the tonnage deck; and if the partial decks are at different heights, the line of the lowest will be taken as the tonnage deck and the head room above such line under the higher will be measured.

**Deck, Trunk.** A term applied to the top of a fore and aft trunk erected on the upper deck.

**Deck, Turret.** A term applied to the top of a trunk formed by curving in the sides of a vessel to form a side deck close to the water line and then curving the side deck up to form the sides of the trunk. In this way the plating makes a reverse curve from the sides of the ship to the top of the trunk.

**Deck, Turtle.** A term applied to a weather deck that is rounded over so that it has a shape similar to the back of a turtle. It is used on ships of the whaleback type and on the forecastle decks of torpedo boats.

**Deck, 'Tween.** A term applicable to any deck below the upper deck. Also the space between decks.

**Deck, Upper.** Generally applied to the uppermost continuous weather deck. Where this is an awning, shade or shelter deck, these terms should apply and the deck next below may be called the main or upper deck.

**Deck, Weather.** A term applied to the upper, awning, shade or shelter deck or to the uppermost continuous deck exclusive of forecastle bridge and poop that is exposed to the weather.

**Deck, Wood.** A term applied where a deck is constructed of wood planking. Also applied to the wood sheathing of a steel deck. Teak, Oregon or yellow pine are most commonly used for wood decks.

**Deep Floor.** See Floor, Deep.

**Deep Frame.** See Frame, Deep.

**Deep Tank.** A tank extending from the bottom of a vessel or from the top of the inner bottom up to or higher than the lower deck. Deep tanks are commonly fitted either forward or abaft the machinery space in cargo vessels. They are fitted with hatches, so that they may be used for cargo when loaded as well as for ballast water when light.

**Deep Water Line.** The water line at which a vessel floats even carrying the maximum allowable load.

**Delivery Valve.** See Valve, Delivery.

**Depth by Lloyd's Rules.** The depth at the middle of length from the top of keel to the top of beam at side of uppermost continuous deck, except in awning or shelter deck vessels, where it may be taken to the deck next below the awning or shelter deck, provided the height of 'tween decks does not exceed 8 feet. When the height of 'tween decks exceeds 8 feet the depth is to be taken from the top of keel to a

point 8 feet below the awning or shelter deck.

**Depth Molded.** The vertical distance from top of beam of uppermost strength deck at side of vessel amidship to top of keel.

**Depth Recorder.** A device invented by Sir Wm. Thompson, consisting of a composition cylinder containing a piston upon which the water acts against a spring. The distance the spring is compressed is recorded by a marker on the piston stem. As the recorder is brought to the surface, the piston returns to its original position but the marker remains at the point to which it was pushed, thereby indicating the depth to which the recorder was lowered.

**Depth, Register.** The register depth should be taken from the underside of the tonnage deck plank, midship, to the ceiling in the hold, average thickness, at the side of the keelson, in a direction perpendicular to the keel, which may be done by a square placed upon the upper side of the keelson. If the vessel has a third deck, then the height from the top of the tonnage deck plank to the under side of the upper deck plank shall be accounted as the height under the spar deck.

**Depth Thermometer.** A thermometer housed in a strong brass cage with a sturdy base and uprights, used by deep-sea fishermen to discover the water temperature at various depths. It was believed that if the temperature of the water was right then the fish could more easily be caught. Also used on hydrographic ships in ocean surveys.

**Derrick.** An apparatus designed to hoist heavy weights. The general design of a derrick is similar to that of a post crane except that the boom is hinged at the heel which allows it to be set at any angle with the post. The post of a derrick usually rotates with the boom.

**Derrick, on a Ship.** A spar or a boom, one end of which is stepped in a pivot bearing on the lower portion of a vertical post erected on the deck of a ship or on a pedestal fitted to the deck at the foot of the vertical post. A hinged connection fitted to the pivot bearing allows the boom to be inclined at any angle with the post while the pivot permits it to be revolved. The derrick is fitted with ropes, guys and tackles and is used for transferring cargo from and into the hulls. Unlike most derricks on land the derrick post itself does not revolve.

**Destroyer.** A naval vessel of small displacement and maximum speed having a battery of light rapid-fire guns and heavy deck torpedo tubes. These vessels have a moderate steaming radius and are intended for the protection of capital ships and for convoy and scouting duty.

**Destroyer Leader.** A war vessel of the destroyer type but larger. Her greater size makes it possible to provide more comfort for the personnel, a slightly heavier battery, slightly more speed, and a considerably greater cruising radius than is possible in a destroyer.

**Devils Claw.** See Chain Stopper.

**Diagonal Plate.** A term applied to plates fitted diagonally across the deck beams to tie them together. Wood planking is fitted above them.

**Diaper Plate.** See Horseshoe Plate.

**Diaphragm, Turbine.** See Turbine Diaphragm.

**Die.** A tool, having several cutting edges, used for cutting threads. In drop forging work a template tool used to stamp out a piece of work in one operation.

**Die Sinkers.** Workmen who make the tools by means of which the drop forging machines stamp the articles from the heated material.

**Dipping.** The vertical oscillation of a ship resulting from rolling or pitching. A very low position of the vessel's center of gravity or marked changes of the vessel's form in the vicinity of the waterline or a combination of both tend to accentuate dipping.

**Diptych Dial.** A form of portable sun dial, hinged in two parts connected by a cord. The part acting as a lid was at right-angles to the base so that the cord, tightened, acted as the upright gnomon or style to cast the shadow. Chiefly produced at Augsburg, Germany, in the form of the Augsburg Dial and Nuremberg Diptych.

**Direct Acting Pump.** See Pump, Direct Acting.

**Direct Current.** An electric current which flows in one direction.

**Direct Acting Pump.** See Pump, Direct Acting. .

**Disc Cutter.** A large thin metal circular saw without teeth which revolves at extremely high speed and is used to cut pieces of metal.

**Dish Heaters.** A warming closet or oven heated by a steam coil for use in heating dishes to prevent the food being rapidly cooled by coming in contact with the dish.

**Dished.** A term applied to the end of a cylinder or drum when it is concave.

**Dismantle.** To remove the sails, ropes, blocks and other gear that would become damaged by exposure if left without care.

**Displacement.** The amount or quantity of water displaced by a floating vessel. It exactly equals the weight of the vessel itself with whatever is on board at the time at which the displacement is recorded. Displacement may be expressed either in cubic feet or tons; a cubic foot of sea water weighs 64 pounds and one of fresh water 62.5 pounds, consequently one ton is equal to 35 cubic feet of sea water or 35.9 cubic feet of fresh water. The designed displacement of a vessel is her displacement when floating at her designed draft. In merchant vessels this is generally taken with full cargo, fuel, stores and water on board. In the case of naval vessels it corresponds to the vessel complete with full supply of ammunition, and two-thirds full supply of fuel, stores and water.

**Displacement Length Coefficient.** See Coefficient, Displacement Length.

**Displacement, Volume of.** The volume of water displaced by a vessel. In the English system of units the volume of displacement is given in cubic feet and equals thirty-five times the displacement in salt water or thirty-six times the displacement in fresh water.

**Distance Finder.** A navigational instrument used for finding the distance of an object, and particularly the distance of another ship to keep vessels in station. It consisted of a small sighting telescope, with movable prism plate and a diagram base

plate. The last was graduated in cables, and engraved with dividing lines that radiated outwards from a central point like sun's rays.

**Distiller.** A chamber in which steam vapor from an evaporator is condensed, forming fresh water for drinking and other purposes. It consists essentially of a chamber into which the steam vapor enters and is condensed by a pipe coil through which cold sea water circulates.

**Distiller Foundation.** A term applied to the seating supporting a distiller.

**Distiller Pump.** See Pump, Distiller.

**Distortion.** Deformation from the natural or original shape of an object.

**Ditty Box.** A small box fitted with a hinged lid and lock, used by the crew on war vessels to hold thread, needles, combs, brushes, etc. Possibly from the Saxon "dite", meaning neat or tidy. Its forerunner, however, may have been a bag made of "dittis", which was a form of Manchester cotton fabric. Ditty bags are mentioned in naval records of at least two centuries ago.

**Dividers.** A two-pronged hinged instrument or "pair of compasses", for measuring on scales or marking off distances on a chart, introduced about 1703, made of brass usually in early versions, but later of other metals with steel points.

**Dock.** A basin for the reception of vessels. Wet docks are utilized for the loading and unloading of ships. Dry docks are utilized for the construction or repair of ships.

**Docking Draft, Critical.** See Critical Docking Draft.

**Docking Keel.** See Keel, Docking.

**Docking Plug.** See Bleeders.

**Dockyard.** A yard or plant where ships are constructed or repaired.

**Dog.** A short metal rod or bar fashioned to form a clamp or clip and used for holding watertight doors, manholes, or pieces of work in place. On watertight doors, it is usually a U shaped fitting composed of two main pieces, one of which is bent to form a right angle, having a handle on one end, the other end being passed through a gland in the door and having a screw thread cut on the end to which the second piece in the shape of a handle is attached. The complete dog provides a handle on each side of the door which when turned works over a wedge on the door frame and compresses a rubber gasket fitted to the door against the toe of the flange of the door frame. On manhole and hatch covers giving access to compartments in the ship's structure, the dogs usually consist of drop forged fittings riveted to the cover. U shaped openings in the dogs project over the edge of the cover a sufficient distance to allow drop bolts hinged to the manhole or hatch frame to be swung up into the openings and tightened by nuts. On manholes in boilers and tanks the dog consists of a strong bar fashioned to the shape of an arc of a circle and spanning the manhole. A stay bolt passing through the manhole door and through a boss in the center of the dog allows the door to be tightened. On the floor where the ship's framing is curved to shape, the dog consists of a piece of steel rod bent to somewhat less than a right angle. One leg of the dog is put through a hole in the bending floor and the other end on the frame or piece of work to be bent. A few blows of the hammer near the apex of the angle of the dog is sufficient to clamp the work to the

floor. For holding blocking together, the dog consists of a rod or bar of iron having its ends bent at right angles and pointed. In use the pointed ends are driven into the blocks to be held.

**Dog, Shore or Dagger.** A brace placed in such a position that it holds the sliding ways from slipping until all the necessary shores and keel blocks are removed, when it is itself removed allowing the ship to slide down the ways.

**Dolly Bar.** A steel bar used to hold the heads of rivet while the points are being clinched. A dolly bar is used where the space is not sufficient to use a holding on hammer conveniently.

**Dolphin.** A term applied to several piles that are bound together, situated either at the corner of a pier or out in the stream and used for docking and warping vessels. Also applied to single piles and bollards on piers that are used for docking and warping.

**Donkey Boiler.** See Boiler, Donkey.

**Donkey Pump.** See Pump Donkey.

**Door.** A swinging, sliding or removable part providing entrance or access to staterooms or compartments.

**Door, Boiler Ash Pit.** See Boiler Door, Ash Pit.

**Door, Boiler Furnace.** See Boiler Door, Furnace.

**Door, Cargo.** A door, usually composed of two or more parts, fitted in the side or an upper bulkhead of a vessel for the purpose of providing access through which cargo may be trucked.

**Door, Dutch.** A term applied to a door built in two independent sections, one above the other, so that the upper half may be open while the lower half is closed. These doors are commonly used for access to galleys.

**Door Frame.** A frame enclosing a doorway. It is generally composed of a horizontal piece at the top called a header, a horizontal piece at the bottom called a sill, the vertical sides called stiles and a piece which extends around the inside of the frame for the door to close against called the stop bead.

**Door Gangway.** A door fitted in the side of a vessel to provide access for a gangway.

**Door, Horizontal or Vertical, Sliding.** A door so constructed and operated that it can be slid, horizontally into position in the case of horizontal doors and vertically into position in the case of vertical doors. Such doors are usually watertight and so fitted with shafting and bevel gears or other means that they can be closed from the weather or upper deck.

**Door, Joiner.** A light door fitted for access to staterooms and quarters where watertightness is not required. These doors are made of wood, light metal plating and also of light metal plating on wood frames.

**Door, Metallic.** A term applied to a hollow metal joiner door. They are fitted in the

living quarters aboard ship.

**Door, Non-Watertight.** A term applied to a door that is not constructed to prevent water under pressure from passing through.

**Door, Screen.** A wooden door frame over which single or double wire mesh is stretched.

**Door, Slat or Blind.** A door composed of a frame fitted with slats or blinds. They are fitted in conjunction with joiner doors to state rooms and also independently to some compartments.

**Door, Watertight.** A door so constructed that when closed it will prevent water under pressure from passing through. A common type consists of a steel plate, around the edges of which a frame of angle bar is fitted, having a strip of rubber attached to the flange that is parallel to the door plate. The strip of rubber is compressed against the toe of the flange of an angle iron door frame by dogs or clamps.

**Door, Weather tight.** A term applied to outside doors on the upper decks which are designed to keep out the rain and spray.

**Double Acting Pump.** See Pump, Double Acting.

**Double Bottom.** A term applied to the space between the inner and outer skins of a vessel. Also applied to indicate that a ship has a complete inner or extra envelope of watertight plating. A double bottom is usually fitted in large ships extending from bilge to bilge and nearly the whole length fore and aft.

**Double Bottom Cellular.** A term applied where the double bottom is divided into numerous rectangular compartments by the floors and longitudinals.

**Double Bottom Plating.** See Plating, Double Bottom.

**Double Ported Slide Valve.** A type of slide valve in which the ports are so arranged that for a given movement of valve twice the area of steam port is uncovered as would be the case in a simple slide valve of ordinary type.

**Double Riveting.** See Riveting, Double.

**Double Whip.** A rope rove through two single blocks, having the standing part made fast to a fixed object near the upper block or to the block itself.

**Doubling Plate.** See Plate, Doubling.

**Doubling Shell.** See Shell, Doubling.

**Doubling Strake.** See Strake, Doubling.

**Douse.** To cover suddenly with a liquid; to lower quickly as a sail; to extinguish suddenly.

**Dowel, Butt.** A cylindrical pin used in making end joints in timbers. A hole of the same diameter as the dowel is bored in the end of each timber and the pin is inserted in one timber and then the joint made by forcing it into the other.

**Dowels, Joint.** Rectangular blocks inserted in grooves cut in the sides of a pair of frames or timbers for the purpose of making them work together.

**Downtown Pump.** See Pump, Downtown.

**Draft, Draught (of a vessel).** The depth of a vessel below the waterline measured vertically to the lowest part of the hull, propellers or other reference points.

**Draft Marks.** The numbers which are placed at the bow and stern of a vessel to indicate how much water she draws. These numbers should be as near the stem and stern as possible and should be six inches high and spaced twelve inches apart vertically.

**Draft, Mean.** The mean of the drafts measured at the bow and the stern, or in the case of vessels with straight keels the draft measured at the middle of the waterline length.

**Draftsmen.** Men engaged in the preparation of the general and detail plans from which are built the ship's hull, machinery, fitting, etc.

**Drag.** See Anchor, Sea.

**Drag.** The designed excess in draft aft over that forward.

**Drain Hole Plug.** See Bleeder.

**Drainage System.** Piping located in the hold of a vessel and connected to drainage pumps for pumping overboard accumulations of water in the various compartments, hold, inner bottoms, etc.

**Drawing Room Equipment.** The equipment necessary to a drafting room to permit the engineers and draftsmen to carry on work such as making calculations, pencil drawings, tracings, blueprints, etc., for designs undertaken. It consists of drawing tables and benches, slide rules, calculating machines, plan filing cabinets, drawing instruments, scales, triangles, curves, splines, blueprinting and Photostat machines and miscellaneous supplies such as drawing paper, tracing cloth, blueprint paper, pencil ink, erasers, etc.

**Dredge or Dredger.** A vessel usually having a scow-shaped hull and equipped with especial machinery for use in deepening the channels of rivers, harbors, etc.

**Dredging Pump.** See Pump Dredging.

**Dresser, Galley.** See Galley, Dresser.

**Drift.** In erecting the structure of a ship it is often found that the rivet holes in the pieces to be connected are not concentric and the distance that they are out of line is called the drift. Where the drift is slight it can be corrected by reaming, but in many cases it is necessary to drive tapered pins far enough through the holes to bring them in line.

**Drift Angle.** The angle formed by the tangent to the vessel's path in turning and the fore-and-aft centerline of the vessel. Inasmuch as a ship's bow in turning tends to swing in toward the center of her turning circle, the propelling force delivered is along a line oblique to that of the vessel's motion. This is one of the reasons for a

ship's loss of speed during the act of turning.

**Drift Pin.** A conical shaped pin gradually tapered from blunt point to a diameter a little larger than the rivet holes in which it is to be used. The point is inserted in rivet holes that are not fair, and the other end is hammered until the holes are forced into line.

**Drill.** A cylindrical shaped tool with cutting facets on one end.

**Drill Drift.** A wrench for releasing a drill from its socket.

**Drill Frame Hoist.** A machine designed for operating the drill frames used in submarine drilling.

**Drill Press.** See Drilling Machine.

**Drill, Sensitive.** A machine for drilling small holes, When small drills are used in a machine any undue pressure in feeding the drill will cause it to break. For this reason the pressure necessary for feeding must be plainly perceptible at the hand lever or other feeding device and sensitiveness in this respect is attained by making the parts light and easy to move or operate.

**Drilling Machine.** A machine designed for the purpose of drilling holes in metal, wood, fiber, etc.

**Drilling Machine, Electric.** A portable drilling machine driven by an electric motor and used for the same purpose as a pneumatic drilling machine.

**Drilling Machine, Heavy Duty.** A drilling machine especially adapted to rapid drilling. This type of machine was developed to drive high speed drills to the limit of their capacity.

**Drilling Machine, Multiple Spindle.** A drilling machine which is built in both vertical and horizontal designs, with which a number of holes may be drilled simultaneously. Some drilling machines equipped with multiple spindles are known as gang drills.

**Drilling Machine, Pneumatic.** Pneumatic drilling machines, or air drills, or pneumatic drills, as commonly called, are usually portable drilling machines driven by an air motor of the reciprocating piston type, which is contained within the casing of the machine. They are not only used for drilling, but for reaming, tapping, grinding, wood boring and countersinking.

**Drilling Machine, Radial.** A drilling machine with a vertical spindle which is carried by an arm that may be swiveled about a vertical column. The distinguishing feature of this machine is the radial adjust of the arm about the column, which adjustment, in conjunction with the traversing motion of the drill spindle head along the arm, makes it possible readily to locate the drill in any position within the range of the machine.

**Drilling Machine, Upright.** The most common form of drilling machine. The general design of the machine is vertical and the drill spindle is in a vertical position.

**Drive, Electric.** See Electric Drive.

**Drop Forgers.** Workmen who operate Iron forging machines.

**Drop Forging Machine.** See Forging Machine, Drop.

**Drop Strake.** See Strake, Drop.

**Drum, Wildcat.** See Wildcat.

**Dry Compass.** See Compass, Dry.

**Dry Compass Card.** The card showing the compass positions, and used in the dry compass as above. Early examples were drawn by hand. By the late 17th century they were engraved and printed, the north often being indicated by a nautical or state symbol. These cards, from the 13th to the 16th century, were mounted in lidded wooden bowls, but from the 16th century they were placed in brass bowls on gimbals, the last-named to stop the ship's movement from affecting the instrument. The area of the needle or lozenge was enlarged to increase the sensitivity of the card, but this added weight and caused wear of the pin; it could be blunted and thus affect the card's rotation. So pins with hardened, ruby tips and caps of agate were introduced. In the 18th century the card was fixed with glue to a disc of mica to avoid distortion, but Thomson's card was much better and lighter in the 19th century when it was printed on Japan paper. Strong silk threads formed a framework, from a stone cap and brass ring, to hold aluminum wires on which the silk paper card was glued, with the bar magnets below it.

**Dry Dock, Floating.** A hollow floating structure of L or U shaped cross section, so designed that it may be submerged, that a vessel may be floated into it, and that it may then raise the vessel and itself so that the deck of the dock and consequently the bottom of the vessel is above the level of the water. The bottom of a floating dry dock consists of one or more pontoons or rectangular shaped vessels with high wing structures erected on one or both sides according to whether the section is to be L or U shaped. The deck of the pontoon is fitted with stationary keel blocks and movable bilge blocks which can be pulled under a vessel from the top of the wing structure. Pumps are fitted in the wings by which the dock can be quickly submerged or raised. Floating dry docks are used for repairing and painting the under water portions of vessels and for docking a damaged vessel. They are usually made up of several pontoons connected by more or less flexible joints and by the continuous wing structure. A pontoon may be detached at any time and docked on the remaining pontoons, thus making the dock self-repairing. On account of the unequal distribution of weight, fore and aft, in a ship, the pontoons in way of the middle portion of the ship should be given more buoyancy or lifting power than the end pontoons by regulating the amount of water pumped out of each pontoon. If this is not done the stresses set up in the longitudinal members of the ship's structure are much larger than in an excavated dock. Floating dry docks recently designed, having truss girders in the wing structures should also reduce the stress in the docked ship to an amount well within the stresses allowed for in the vessel's design. Floating dry docks are much cheaper to construct than excavated docks, and they possess a further advantage in that they may be moved or towed to a desirable location.

**Dry Dock, Graving.** A basin excavated at a waterway and connected thereto by gates or a caisson which may be opened to let a vessel in or out and then closed and the water pumped out. The dock is fitted with stationary keel blocks and movable bilge blocks, which usually are fitted on rack tracks, allowing them to be pulled under a vessel before the water is pumped out. Graving docks are more common in Navy

Yards, as they are more expensive to construct than floating docks. On the other hand, when once made, they are practically permanent and they supply a more rigid foundation for supporting a ship than the floating dock. The gate of a graving dock is usually a caisson or a complete vessel in itself, the cross section of which is generally elliptical in shape and having a strong rectangular shaped keel and end posts which bear against the bottom sill and side ledges at the entrance of the dry dock. The caisson is designed so that it may be submerged at the entrance of the dock until it rests against the sill, and it is also equipped with power and pumps so that it may raise itself. When a ship is to be docked, sluice valves in the caisson are opened until the water in the dock reaches the same level as the water outside. The valves are then closed and the caisson pumped out and swung to one side, allowing a vessel to enter the dock. The caisson is then swung back to close the entrance and submerged, completely separating the basin from the waterway. After the vessel is lined up over the keel blocks the water is pumped out of the dry dock. Graving docks are constructed by making a large excavation, driving pile or building concrete foundations in the bottom and by constructing wood, concrete or stone retaining walls around the sides. The sides are usually built in the form of steps.

**Dry Dock, Railway.** A railway dock consists of tracks built on an incline on a strong foundation and extending from a sufficient distance in shore, to allow a vessel of the maximum size that it is built for to be docked, to a sufficient distance under water to allow the same vessel to enter the cradle. The cradle running on the tracks may be of wood or steel fitted with keel and bilge blocks and sufficiently weighted to keep it on the track when in the water. A hoisting engine with a winding drum or wild cat is fitted at the in shore end of the railway which operates the cradle by a cable or chain. These docks are less expensive than either the floating or graving docks, and are extensively used for docking ships of moderate size. The older types of marine railways had their cradles designed so that a vessel, in entering the dock, grounded on the forefoot and pivoted as the cradle came out of the water to a position in which the vessel's keel was approximately parallel to the tracks. A later and better design has been developed in which the cradle is designed so that the whole vessel grounds at the same time, and which allows a ship to be pulled up on the shore on an even or approximately horizontal keel. Railway docks are usually designed for hauling a vessel up the tracks bow first, but side-haul docks have also been built.

**Drying Oven.** See Oven, Drying.

**Dub.** To smooth down; as to dub a spar or timber with an adze.

**Ductility.** That property of a material which permits of its being drawn out into a thread or wire.

**Dug-out.** A term applied to a boat fashioned out of a log.

**Dump Scow.** A flat bottom craft used for transporting rubbish, etc. No machinery is installed for its propulsion.

**Dumping Boards.** A term applied to the planks fitted on the top of the inner bottom underneath the hatch openings. These planks take the wear of the cargo when loading and protect the inner bottom plating.

**Dunnage.** Loose wood or waste material placed in the hold of a vessel for the protection of the cargo from dampness. Also used as descriptive of a sailor's kit or personal belongings.

**Duplex Pump.** See Pump, Duplex.

**Dutch Door.** See Door, Dutch.

**Dutchman.** A piece of wood or steel fitted into an opening to cover up poor joints or the crevices caused by poor workmanship.

**Dutchman's Log.** A variation of the use of a log to ascertain the speed of a ship, being a piece of wood thrown overboard at the bow, whose time was measured between two marks on the gunwale or between two seamen similarly positioned.

**Dynamo.** See Generator, Electric.

## E

**Earring.** Metal of wood or ivory worn as decoration by a seafarer long after landlubbers had abandoned them to the ladies. Associated specially with bloody-minded mariners of the piratical type. They often had the anchor device, symbol of the sailor's patron saint, St. Nicholas of Myra (later to be transformed into Santa Claus). It was believed that if a man fell overboard then his earrings with anchor device would save him from drowning; St. Nicholas would put a hook through one of the rings and pluck him out of the sea to safety.

**Eccentric.** A form of crank in which a circular disc set eccentrically upon a shaft forms at once the crank web and crank pin. Eccentrics are usually made of cast steel or iron and if large are lightened to save weight. They are made in two parts connected by tap bolts and keyed to the crank shaft. Eccentrics are utilized to convert circular to rectilinear motion. The rectilinear travel is usually short relative to the diameter of the crank shaft so the ordinary form of crank is impracticable.

**Eccentric Rod.** A rod attached to the eccentric strap and designed to drive valves where the travel is less than half that of the piston.

**Eccentric Strap.** A metal ring fitted round the eccentric disc. It is made in halves and bolted together, provision being made to attach the eccentric rod unless same is cast as part of the strap. The eccentric strap is generally made of cast steel or brass.

**Economizers, Boiler.** See Boiler Feed Water Heater.

**Eddy-making Resistance.** See Resistance, Eddy-making.

**Edge, Sight.** That edge of a strake of shell plating which laps outside another strake and is, therefore, in plain sight.

**Effective Horsepower.** See Horsepower, Effective.

**Effective Length.** This term ordinarily indicates the mean length of that portion of the hull below the waterline. The length of a vessel has an important influence upon her resistance. In general, frictional resistance increases with increase in length and residuary or wave-making resistance decreases with increase in length. Certain formulae involving the vessel's length are used for determination of the frictional resistance. These formulae generally produce more accurate results if the mean length of vessel below the waterline is used, and for that reason the foregoing definition in general holds true. In dealing, however, with residuary resistance, a

vessel may be so formed as to produce a system of waves similar to the wave system of a vessel of greater length but of ordinary shape, and running at the same speed as the vessel under consideration. In such a case the vessel might be considered to have an augmented length effective for wave making. This augmented length is termed the effective length in speaking of the residuary resistance, but owing to the practical difficulties in the way of estimating any exact or even reasonably approximate value of such an equivalent length, no effort is made toward the formulation of any rule.

**Efficiency, Propeller.** See Propeller Efficiency.

**Efficiency, Turbine.** See Turbine Efficiency.

**Ejector, Ash.** See Ash Ejector.

**Ejector, Bilge.** See Bilge Ejector.

**Electric Arc.** See Arc, Electric.

**Electric Fan.** A small cast iron pedestal supporting an electric motor which operates a small fan. Electric fans are used in staterooms and quarters to circulate the air and keep them from becoming stuffy.

**Electric Furnace.** See Furnace, Electric.

**Electric Gag Control.** A mechanism attached to a punching machine for locating the plates as desired and for placing the punch over a center punch mark of the plate.

**Electric Generator.** See Generator, Electric.

**Electric Hoist.** See Hoist, Electric.

**Electric Light Fixtures, Watertight.** Electric light fixtures so arranged that the electrical connections of the circuit are protected by watertight casings.

**Electric Motor.** See Motor, Electric.

**Electric Range.** A galley cook stove in which the heat is generated by electricity.

**Electric Rivet Heater.** A machine in which rivets are heated by an electric current. These machines consist of a specially designed transformer with one or more openings in the secondary winding. The rivet or rivets to be heated are inserted in these openings. Placing the rivets in the openings complete the secondary circuit and the rivets are heated by the current passing through them.

**Electric Telemotor.** See Telemotor, Electric.

**Electric Watertight Plug.** See Plug, Watertight Electric.

**Electric, Whistle Control.** See Whistle Control, Electric.

**Electric Wire and Cable.** Wire used for conducting electric currents is made from copper, copper alloys, aluminum, iron and steel. Annealed or soft-drawn copper wire has a conductivity higher than any other wire used commercially and is used almost exclusively for all low voltage power requirements. A number of strands of wire twisted or woven together constitute what is known as a cable.

**Electricians.** Workmen who set up the electric plant and its auxiliaries with their fittings, such as wiring, switchboards, control panels, etc.

**Electrolysis, Boiler.** See Boiler, Galvanic Action.

**Electrolyte.** A solution or composition of fused salt in which electrical energy is generated by means of chemical action or in which chemical reaction occurs due to the passing of an electric current through it. The solutions in wet primary batteries and storage batteries, and the fused salts in dry batteries are called electrolytes.

**Electromagnet.** A magnet in which the magnetic field is produced by an electric current passing through a coil of wire wound upon a soft iron core.

**End-For-End.** To have the wrong end foremost. To place the opposite end where the other end was originally.

**End Plate, Stern Tube.** See Stern Tube End Plate.

**Engine Foundation.** A term applied to the girders and brackets supporting an engine. They should be built rigid enough to assimilate the vibration of the engine and to efficiently distribute its weight to the structure of the ship.

**Engine Hatch.** See Hatch, Engine.

**Engine, Inclined.** A reciprocating engine in which the cylinders are located at an angle and below the crank shaft. This type is successfully used on lake and river steamers.

**Engine, Main.** The engine or engines forming the propelling installation as distinguished from auxiliary engines.

**Engine, Marine.** An engine designed for the propulsion of ships.

**Engine, Non-Condensing.** An engine from the cylinder of which the exhaust steam passes directly into the atmosphere.

**Engine, Oscillating.** A reciprocating engine in which the cylinders are located directly below the crank shaft and are swung on trunnions. In this type the piston rod is connected directly to the crank pin so that the connecting rod and cross head are eliminated. This type is successfully used for side wheel paddle steamers.

**Engine, Reciprocating.** An engine designed to convert the pressure of live steam into work. This is accomplished by means of the backward and forward motion of a piston from end to end of a cylinder as the result of steam being alternately admitted to each end of the cylinder and the expanded steam exhausted from the other end. The straight line motion of the piston is communicated to the piston rod to which it is directly attached and is then transformed into rotary or circular motion by means of suitable mechanism.

**Engine Room Bulkhead.** See Bulkhead, engine Room.

**Engine Room Casing.** See Casing, Engine Room.

**Engine Room Control Valve,** See Valve, Engine Room Control.

**Engine, Turning.** A small steam engine or an electric motor arranged to turn the

main engines over very slowly for purposes of repair, adjustment, etc.

**Engineers, Designing.** Those engineers, civil, mechanical or naval, who are responsible for the basic features of a design and the general methods by which its details are developed.

**Engineers, Operating.** Engineers in charge of plant or machinery and responsible for its condition and operation.

**Engraving Machine.** A machine designed to cut or carve, in sunken patterns, the letters and figures on name plates, label plates, etc. The incision is often filled with black scaling wax to make the engraving clear and distinct.

**Ensign.** A flag indicative of a vessel's nationality. It is hoisted at the stern.

**Ensign Staff.** A term applied to a flag pole erected at the stern of a vessel.

**Entrance.** The forward under water portion of a vessel at or near the bow.

**Entrance, Angle of.** The angle formed by the center line of a ship and the tangent to the designed waterline at the forward perpendicular.

**Ephemerides, Ephemeris.** A table giving the computed positions of the celestial body for a given period, such as successive days; also an astronomical calendar or almanac.

**Equilibrium, Neutral.** The state of equilibrium in which a vessel inclined from its original position of rest by an external force tends to maintain the inclined position assumed after that force has ceased to act.

**Equilibrium, Stable.** The state of equilibrium in which a vessel inclined from its original position of rest by an external force tends to return to its original position after that force has ceased to act.

**Equilibrium, Unstable.** The state of equilibrium in which a vessel inclined from its original position of rest by an external force tends to depart farther from the inclined position assumed.

**Equivalent Girder.** A diagrammatic representation of the disposition of that material in a cross section which contributes to the longitudinal strength of a vessel. Such a diagram visualizes, at once, the manner in which the material is disposed relative to the neutral axis. When any of the members have not the same strength in tension and compression or when regarded as contributing to one and not the other, or when allowance is made for rivet holes in tension but not in compression; then two separate girders must be considered, one for hogging and one for sagging.

**Erectors.** Workmen who put together and secure fabricated parts to form the structure or machine.

**Escape Valve.** See Valve, Escape.

**Euphroe.** A wood block or slat or metal fitting perforated to allow the awning halyards to pass.

**Evaporator.** An auxiliary for supplying fresh water to make up the loss in boiler feed water. Steam leaks in pipe joints and stuffing boxes may occur. The whistle may be

used or the exhaust opened or in some other manner losses of boiler feed water take place. These losses are appreciable and the evaporator must supply the "make up" feed in order to avoid the use of salt water. A typical evaporator consists of a chamber into which boiler steam is passed in coils or nests of tubing. Salt water is admitted into the chamber and is converted into steam which passes over to the condenser or low pressure receiver. The water found in the coils by the loss of heat is returned to the feed.

**Evaporator Feed Pump.** See Pump, Evaporator Feed.

**Evaporator Foundation.** A term applied to a foundation supporting an evaporator.

**Even Keel.** That condition in which a ship floats at her designed draft both forward and aft, or in which her keel line is parallel to its designed position.

**Exhaust Fan.** A type of fan outfit used to remove dust and smoke from shop buildings ashore. The usual method of construction for fans of this type consists of a metal ring with arms supporting an electric motor, the shaft of which is centered on the ring. The fan is mounted on the motor shaft and is made the full diameter of the ring less a small clearance at the tips of the blades.

**Expander, Boiler Tube.** See Boiler Tube Expander.

**Expansion Hatch.** See Hatch, Expansion,

**Expansion Joint.** A term applied to a joint which permits linear movement to take up the expansion and contraction due to changes in temperature.

**Expansion Tanks.** A term applied to the trunkways below the cargo hatches in an oil tanker that are provided for the purpose of allowing the cargo oil to expand.

**Expansion Trunk.** A trunk extending above a hold for the stowage of liquid cargo. The surface of the cargo liquid is kept well up in the trunk, thus allowing for expansion of the liquid without danger of excessive strain coming on the hull, and allowing for contraction without undue increase in free surface with its accompanying effect upon stability.

**Extreme Breadth.** See Breadth (Extreme).

**Eye.** A hole through the head of a needle, pin, bolt, etc., or a loop forming a hole or opening through which something is intended to pass, such as a hook, pin, shaft or rope. Familiar examples are an eye at the end of a tie bar in a bridge truss, an eye at the end of a rope as the parts of shrouds and stays that pass over a masthead. A "worked eye" is one having its edge rounded off like a ring, while a "shackle eye" is drilled straight through, permitting an inserted bolt or pin to bear along its entire length.

**Eye Bolt.** A bolt having either a head looped to form a worked eye or a solid head with a hole drilled through it forming a shackle eye. Its use is similar to that of a pad eye.

**Eyes.** The forward end of the space below the upper decks of a ship which lies next abaft the stem, where the sides approach very near to each other. The hawse pipes are usually run down through the eyes of a ship.

## F

**Fabricate.** To shape, assemble and secure in place the component parts in order to form a complete whole. To manufacture.

**Fabricated Ship.** A ship that is constructed by assembling plates and shapes that have been laid out and formed, without the aid of templates taken from the work during the process of construction. One advantage of this method of construction is that the material may be laid out at the steel mills and shipped to the yards ready for erection.

**Face Plate.** A plate fitted perpendicular to the web and fastened to the flanges at one edge of a frame, stiffener or girder to compensate for the continuous plating attached to the flanges at the other edge.

**Factor of Safety.** A design factor such that when multiplied by the allowed working stress for a given material it will give a product equivalent to the ultimate strength of that material. The foregoing defines "factor of safety" as ordinarily used. Strictly speaking and especially for elastic materials this definition applies only to the "nominal factor of safety." The real factor of safety for design work involving elastic materials is that factor which if multiplied by the allowed working stress will be equal to the stress required to strain the material to its elastic limit. If the nominal factor of safety is used in any case, the real factor of safety for the case in hand is smaller in proportion as the elastic limit of the material is lower than the ultimate strength. For design in such materials as wood, cast iron in compression, and the like, the distinction between nominal and real factor of safety is non-existent.

**Fair Curves.** Curves which do not in any portions of their entire lengths show changes of direction such as to mark those portions as out of harmony in any respect with the curves as a whole or with the other portions of the curve.

**Fairleads.** A term applied to fittings that are used to change or preserve the direction of a rope or chain so that it is delivered fairly to a sheave or drum. Large fairleads in the shape of a drum on a vertical shaft are used to deliver a hawser coming through a chock or mooring pipe to a gypsy or a winch or windlass. Fairleads are also used with the steering leads in which case they may be fittings with small sheaves or annular rings. With steering leads the fairleaders are generally more for preserving than changing the line of the ropes.

**Fair Line.** A term applied to a curved line when it is smooth and without bumps or abrupt breaks in direction. A sweet line.

**Fair or Fair Up.** To so draw the lines of a vessel that the defined surfaces will show no irregularities throughout their entire extent. To line up the frames to their proper position.

**Fair Ship.** To keep the ship properly placed on the berth during the building period.

**Fairwater.** A term applied to plating fitted in the shape of a frustum of a cone, around the ends of shaft tubes and struts to prevent an abrupt change in the stream lines. Also applied to any casting or plating fitted to the hull for the purpose of preserving a smooth flow of water.

**Fake.** 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, though a strict adherence to the term would limit its application to the end to which the power is applied. The end secured to the block is called the standing part, the opposite end, the hauling part.

**False Keel.** See Keel, False.

**False Sternpost.** See Sternpost, False or Inner.

**Fan Exhaust.** See Exhaust Fan.

**Fan, Induction.** See Blower.

**Fantail.** The stern overhang in vessels which have round or elliptical after endings to uppermost decks and which extend well abaft the after perpendicular.

**Farad.** The unit of electrostatic capacity. It represents the capacity of a conductor that requires 1 coulomb of electricity to charge it to the potential of 1 volt.

**Fascia.** A strip of wood used in covering over openings in joiner work.

**Fast.** A rope or chain used to moor a boat to the wharf. It is designated in accordance with the end of the boat with which it is used as bow-fast or stern-fast.

**Fasteners.** Men who drive the iron bolts that fasten the parts of a wooden vessel together.

**Fastenings.** A term applied to bolts, nails, rivets, tree-nails, etc.

**Fastenings, Through.** A term applied to a fastening that is driven completely through the pieces to be connected.

**Fathom.** A unit of length used in measuring cordage, depths, etc. The length varies in different countries, being six feet in Great Britain and the United States. This is roughly obtained by extending both arms.

**Faucet.** A term applied to a valve or cock used to control the flow of a liquid.

**Fay.** To unite closely two planks or plates so as to bring the surfaces into intimate contact.

**Feed Pipe, Boiler, Internal.** See Boiler Feed Pipe, Internal.

**Feed Pump, Auxiliary.** See Pump, Auxiliary Feed.

**Feed Pump, Evaporator.** See Pump, Evaporator Feed.

**Feed Pump, Main.** See Pump, Main Feed.

**Feed Water, Boiler.** See Boiler Feed Water.

**Feed Water Heater, Boiler.** See Boiler Feed Water Heater.

**Feed Water Heater Foundation.** A term applied to the seating supporting the feed

water heater.

**Felloes.** The pieces of wood composing the rim of a steering wheel.

**Fend Off.** To prevent a ship or boat from coming violently in contact with a pier, another ship, or structure.

**Fender.** This term is applied to various devices fastened to or hung over the sides of a vessel for the purpose of preventing rubbing or chafing.

**Ferrule, Condenser Tube.** See Condenser Tube Ferrule.

**Ferry.** A craft used regularly for the transport of cargo or passengers back and forth across a narrow body of water or river. Such a craft may vary in type from a small high speed yacht to a large, heavy scow used in the carriage of fully loaded freight cars.

**Fid.** A wood or metal bar used to support the weight of a topmast or top-gallant mast when in position, being passed through a hole or mortise at its heel and resting on the trestle trees or other support; a hardwood tapering pin or tool, used by riggers and sail makers to open the strands of a rope, eye, grommet, etc. A "hand fid" is rounder at the ends. A "standing or cringle fid" is larger than a hand fid and has a flat base.

**Fidded Topmast.** See Topmast, Fidded.

**Fiddle Block.** See Block, Fiddle.

**Fiddlehead.** Ornamental carved work on the bows of a sailing ship, culminating in an upward-turning scroll like the head of a violin.

**Fidley.** Also spelled "Fiddley" A term applied to the top of a boiler casing. Through it pass the smoke stack and boiler room ventilators. The top around the stack and cowls is fitted with gratings made of bar steel with metal covers that can be closed when the weather is very bad.

**Fidley Gratings.** A term applied to gratings made of bar steel and fitted over the top of the boiler hatch.

**Fife Rail; Pin Rail.** A term applied to a rail worked around a mast and fitted with holes for belaying pins for securing the running gear.

**Figure Head.** An ornament, usually the figure of a woman, placed on the foremost edge of the stem just below the bowsprit.

**Filler Piece.** See Liner.

**Fillets.** A term applied to the metal filling in the bosom or corners where abrupt changes in direction occur in the parts of a casting or forging.

**Filling Transoms.** See Transoms, Filling.

**Filter, Feed Water.** An apparatus designed for the removal of oil from boiler feed water. It consists of a suitable connection and a container in which is placed the filtering material. This material may be gravel, sand, or broken stone, etc., or it may be cloth, sponge or similar material. Water may be led through the apparatus by

gravity or forced through under pressure. In the latter case provision must be made for relief from excessive pressure should a stoppage in the filter occur.

**Fire and Bilge Pump.** See Pump, Fire and Bilge.

**Fire Boat.** A vessel of about the type and size of a large tug, but fitted with all available fire fighting apparatus.

**Firemen.** Members of a ship's boiler room force who are responsible for the care of the fires under the boilers.

**Fire Tube Boiler.** See Boiler, Fire tube.

**Fireproof Bulkhead.** See Bulkhead, Fireproof.

**Fireproof Flooring.** See Flooring, Fireproof, and also Gratings.

**Fish Boom.** See Davit, Fish.

**Fish Hook.** A large hold attached to a stout cable and used on some vessels to take the anchor on board. Also applied to a hook attached to a line and used for the purpose of catching fish.

**Fish Pendant.** A stout piece of rope or cable having a thimble on one end and a fish hook on the other.

**Fish Tackle.** A tackle used in pulling an anchor on board from under the cat head.

**Fish Tackle Pendant.** A rope one end of which is attached to the foremast and the other end to the fish tackle.

**Fittings, Pipe.** A term applied to the connections and outlets, with the exception of valves and couplings, that are attached to pipes.

**Fixed Light.** A thick glass, usually circular in shape, fitted in a frame fixed in an opening in a ship's side, deck house or bulkhead. The fixed light is not provided with hinges and serves only to provide access for light.

**Flags.** Emblems or symbols made of cloth, bunting or silk. They are used to denote the country or company to which a vessel belongs, and also for various signals.

**Flags, Signal.** Flags used in signaling. These flags symbolize the letters of the alphabet according to code. It is thus possible for one vessel to communicate with another or with a shore station.

**Flam.** A term often used to express the meaning as flare, but more properly used to denote the maximum curl or roll given to the flare at the upper part, just below the weather deck.

**Flange.** The turned edge of a shape or girder which acts to resist a bending movement. A casting or forging which may be attached to a pipe forming a flange or projecting rim suitable for bolting the pipe secure. Some pipe flanges are worked as an integral part of the pipe.

**Flange, Blank.** Applied to a flange fitting that is complete with the exception of the bolt holes. Also applied to a flat plate or flange that is used to close the end of a pipe.

**Flanged Plate.** See Plate, Flanged.

**Flanging Machine.** A machine designed for flanging plate work.

**Flanging Machine, Hydraulic.** A machine designed to bend or flange long or short plates. It often consists of a heavy cast iron or steel beam actuated in a vertical direction by a number of hydraulic rams. The hydraulic cylinders are supported over the work table by four heavy columns which also serve as guides for the beam.

**Flare.** The spreading out from the central vertical plane of the forebody of a ship with increasing rapidity as the section rises from the waterline to the rail.

**Flare-up Light.** See Light, Flare-up .

**Flashlight Signal, Electric.** The electric flashlight signal is used in conjunction with the electric whistle control. It consists of a cluster of electric lights made into any design and mounted on the masthead above the pilot house and electrically connected to the circuit that operates the whistle control. When the whistle switch is closed in the pilot house to blow the whistle, current is also supplied to the flashlight lamps on the masthead, lighting them in time with the signal given by the whistle. This gives to the eye the same signal that the whistle gives to the ear. Often in heavy winds the whistle signal can not be heard, but the escaping steam carries the message to the eye. The employment of the flash light spells this same message at night when the steam can not be seen.

**Flat.** A term applied to a partial deck built without any camber.

**Flat of Bottom.** That portion of a ship's bottom without rise or having a rise without curvature or nearly so.

**Flat Plate Keel.** See Keel, Flat Plate.

**Flat Rope.** See Rope, Flat.

**Flexible Joint.** A pipe joint so constructed that the pipes it connects can turn or bend without leaking. They are usually constructed on the ball and socket principle. Flexible joints in shafting are usually called universal joints.

**Floating Dry Dock.** See Dry Dock, Floating.

**Floating Power.** The sum of the utilized buoyancy and the reserve buoyancy of a vessel. Utilized buoyancy is the buoyancy required to counteract the vessel's weight. It is exerted by that portion of the vessel's hull which is below her waterline.

**Flood Light.** This term is given to a light so arranged as to give a diffused light over a large area. It is directly opposite in purpose to the spot light which is designed to give an intense light over a small area.

**Floodable Length.** The length of vessel which may be flooded without sinking her below her safety or margin line. The value of the floodable length for a given vessel varies from point to point throughout her length due to change in form. Similarly at a given point it varies from time to time, depending upon . the permeability of the cargo or condition of loading.

**Floor.** A plate placed vertically in the bottom of a ship usually on every frame and

running athwartship from bilge to bilge.

**Floor Clips.** Angle clips used to connect the longitudinals and brackets to the floor.

**Floor, Continuous.** A floor extending in one length from bilge to bilge and also applied to those extending in one length from centerline to bilge.

**Floor, Deep.** A term applied to any of the floors in the fore and after ends of vessels. Due to the converging sides of ships in the bow and stern, the floors become much deeper than in the main body.

**Floor Head.** A wooden ship term for the end of a floor timber.

**Floor Head Chock.** A piece shaped to form a scarf joint between the floor and futtock in a wooden ship.

**Floor, Intercostal.** A floor composed of a range of plates fitted between longitudinals and securely clipped to them.

**Floor, Long and Short Arm.** A wooden ship term applied where the floor arms are alternately long and short on both sides of the keel.

**Floor, Main.** The floor placed at the extreme beam.

**Floor, Midship.** The floor fitted at the midship section or at a point half-way between perpendiculars.

**Floor Plates.** See Floors, Also used to designate the plates used in the construction of floors.

**Floor, Transom.** The floor or vertical plate extending athwartship across the top of the stern post and attached thereto. On account of the overhanging nature of the stern this plate is made of extra thickness. Plates attached to the arch and propeller post of the stern frame are also called transoms.

**Flooring, Fireproof.** A flooring consisting of a fireproof compound laid on a deck.

**Flooring, Metallic.** This type of flooring consists of high metal plates either smooth, checkered, or having a ridged upper surface. They are principally used for working floors in the boiler and machinery spaces.

**Flooring, Stokehold.** A flooring of checkered plating or grating is usually fitted in the fire room a small distance above the inner bottom plating.

**Flooring, Ventilating.** See Gratings.

**Flow Meter.** An instrument for measuring the total flow of steam, water, oil, air or gas through pipes or closed conduits.

**Flush Deck.** See Deck, Flush.

**Flush-deck Vessel.** A vessel constructed with an upper deck extending throughout her entire length without a break or an erection, such as forecastle, poop, or similar structure.

**Flush System.** See Plating, Flush System.

**Flushing Pump.** See Pump, Sanitary.

**Fly.** The length of a flag; that portion of a flag farthest away from the supporting spar or halyard.

**Flying Bridge.** See Bridge, Flying.

**Flying Jib Boom.** See Jib Boom, Flying.

**Flying Jib Boom Stay.** A stay running from the forward end of the flying jib boom to the martingale.

**Foaming, Boiler.** See Boiler, Foaming.

**Forced Draft, Boiler.** See Boiler, Forced Draft.

**Force Pump.** See Pump, Force.

**Fore.** A term used in indicating portions or that part of a ship at or adjacent to the bow. Applied to that portion of the ship lying between the midship section and stem as fore body. Also to portions or parts of the ship lying between the midship section and stem as fore hold and foremast.

**Fore Deadwood.** See Deadwood, Fore.

**Fore Deck.** See Deck, Fore.

**Fore Peak.** The extreme forward end of the vessel below decks. The forward trimming tank.

**Fore Peak Bulkhead.** See Bulkhead, Fore Peak.

**Fore and Aft.** Parallel to the ship's centerline.

**Fore-and-aft Ribbands.** See Ribbands, Fore and aft.

**Fore and Afters.** A term applied to the portable beams running fore and aft in a hatch which support the covers and in turn are supported by athwartship cross beams. This term is also applied to sailing vessels having a schooner rig.

**Forebody.** That portion of the ship's body forward of the midship section.

**Forecastle.** A short structure at the onward end of a vessel formed by carrying up the ship's shell plating a deck height above the level of her uppermost complete deck and fitting a deck over the length of this structure. The after end of the forecastle may or may not be closed by a transverse bulkhead. The name given to the crew's quarters on a merchant ship when they are in the fore part of tube vessel.

**Forecastle Deck.** See Deck, Forecastle.

**Forecastle Deck Stringer.** See Stringer, Forecastle Deck.

**Forecastle Deck Stringer Bar.** See Stringer, Bar.

**Forecastle Frame.** See Frame, Forecastle.

**Forecastle Gunwale.** See Gunwale, Forecastle.

**Forecastle Sheerstrake.** The strake of outside plating adjacent to the forecastle deck.

**Forefoot.** A term designating the approximate intersection of the curved portion of the stem and the keel, That point in the forward end of the keel about which the boat pivots in an endwise launching.

**Forelock.** A wood or metal pin securing a shackle pin or bolt in place. Wood forelocks are usually coated with white lead before being driven home, while steel ones are tinned or galvanized. Fore locks are principally used in connecting shackles for chain cable.

**Foreman, General, on Ship.** A boss or overseer who has charge of all the workmen working either on the hull or installing the propelling and auxiliary machinery.

**Forestay.** A stay extending from the head of the fore mast, fore top mast, fore top-gallant mast, etc., to the deck, bowsprit, Jib-boom, or flying jib-boom. It prevents the foremast from falling backward under the tension of the shrouds, backstays, etc.

**Forge.** A basin or receptacle, holding burning fuel for heating small iron or steel bars and other metal parts. Forges are usually provided with a means of forced draft to intensify the heat. The term forge is used to designate the process of forging.

**Forge, Rivet.** See Furnace, Rivet.

**Forging.** A piece of metal, hammered, bent or pressed to shape while hot.

**Forging Ahead.** Moving forward at a rapid rate of speed.

**Forging Machine.** A machine for shaping metal by hammering or pressing it into dies while hot.

**Forging Machine, Drop.** A type of power hammer in which dies are fitted and the hot metal shaped by being forced into the dies with a succession of sharp, heavy blows from the hammer.

**Forging Press.** A type of power machine in which dies are fitted and the hot metal shaped by being forced into the dies by a steady pressure. Forging presses are generally of the hydraulic type.

**Forging Press, Steam Hydraulic.** See Forging Machine.

**Forming.** Rouging out, shaping timbers or structural shapes for fabrication.

**Forward.** In the direction of the stem.

**Forward Part.** The portion of the vessel in the vicinity of the stem, the bows.

**Forward Perpendicular.** A line perpendicular to the base line and intersecting the forward side of the stem at the designed waterline.

**Forward Perpendicular, Area at.** The area of the cross section at the forward perpendicular when the vessel has a projection below the designed waterline, such as a ram or bulbous section; the bulbous section being introduced to secure the advantage of increased length without increasing the waterline length. When a vessel is not fitted with an actual ram she may be given a vertical area at the forward

perpendicular by snubbing the lines of the forefoot sharply into the stem from slightly abaft thereof.

**Forward Quarter.** Those portions of the vessel's sides immediately abaft the stem.

**Foul.** A term applied to the underwater portion of the outside of a vessel's shell when it is more or less covered with barnacles, grass or foreign mater. It has been found that even an oily film over a vessel's bottom will reduce the speed and that barnacles or grass will reduce a vessel's propulsive efficiency to a large extent.

**Found.** "All found" – complete as to fittings, outfit and equipment. "Well found" – all fittings, outfit and equipment of good quality and in good condition.

**Foundations, Auxiliary.** A term applied to seatings constructed of wood, steel or a combination of both for the purpose of providing foundations for condenser, distillers, evaporators, pumps or any of the auxiliary machinery in the engine or boiler room. These foundations may be built up from the tank top, bracketed to the bulkheads or hung from beams.

**Founder.** To sink as the result of the entrance of water.

**Foundrymen.** Workmen engaged in the manufacture of metal fittings or parts by casting. They are responsible for the preparation of molds, usually in sand, from the patterns furnished; for the proper mixing and melting of the metals required and for the pouring and cleaning of the castings.

**Frame.** A term generally used to designate one of transverse ribs that make up the skeleton of a ship. Where the structure is built up of a relatively small number of strong transverse webs or belt frames and a relatively large number of smaller fore and aft bars, the fore and aft bars are called the frames. The frames act as stiffeners, holding the outside plating in shape and maintaining the transverse form of the ship.

**Frame, Angle Bar.** A frame composed of an angle bar.

**Frame Angle Bars.** The angle bars which compose or are a part of a frame.

**Frame Bender, Portable.** A machine designed for bending steel shapes to required curvatures. It often consists of a hydraulic ram mounted on wheels for moving over the bending slabs and a pin arrangement for preventing motion while in use.

**Frame Bracket.** See Bracket, Frame.

**Frame, Boss.** A frame that is bent to fit around the boss in the way of a stern tube or shaft.

**Frame, Bridge House.** A frame supporting the outside planking or plating of a bridge house.

**Frame, Built-up.** Described under Frame.

**Frame, Bulb Angle.** A solid frame composed of a bulb angle.

**Frame, Bulkhead.** See Bulkhead Bounding Bar.

**Frame, Bulwark.** A frame projecting above the upper deck for the purpose of

supporting the bulwark. See also Stanchion, Bulwark.

**Frame, Butted.** A term applied where the ends of the frames butt together as over the keel. In this case, which occurs with a bar or wood keel, a heel piece about 3 feet long with its flange reversed is required. The heel piece serves to make a continuous member out of a starboard and port frame and furnishes additional attachment to the shell plating.

**Frame, Cant.** A term applied to any of the frames in the overhanging portion of the stern of a ship. They abut on the transom frame to which they are connected by brackets and radiate out to form the skeleton of the overhanging stern. The spacing of these frames at the knuckle line should be about the same as the frame spacing amidships. Also a term applied to the frames in the bow and stern that are not set up at right angles to the keel

**Frame, Channel Bar.** A solid frame composed of a channel bar.

**Frame, Deep.** A web frame or a frame whose athwartship dimension is over the general amount.

**Frame, Forecastle.** A frame supporting the shell plating in the way of the forecastle.

**Frame, Intermediate.** A term applied to a frame in the double bottom, to which floor plates are not attached and where the floors are butted to alternate frames.

**Frame, Lapped.** Where a joint in a frame is made by lapping the ends. This is done by reversing the flange of one member.

**Frame Liner, Straight.** A strip of plate or bar steel, the width of the faying flange of the frame inserted between the frame and the outside strake of an in-an-out system of shell plating.

**Frame Liner, Tapered.** A strip of plate or bar steel the width of the faying flange of the frame and tapering from the thickness of the outside plating down to a line. This liner is inserted between the frame and the outside plating at every seam of a clinker system,

**Frame Liners.** See Liners, Frame.

**Frame, Longitudinal.** A term applied to any of the frames that run fore and aft.

**Frame, Main.** The frame installed at the point of extreme breadth.

**Frame, Midship.** The frame installed half way between perpendiculars or at the midship section.

**Frame, Poop or Poop House.** A frame supporting the shell plating in the way of the poop. A frame supporting the outside planking or plating of a poop house.

**Frame, Reverse.** A bar riveted to the upper edge of a floor plate or the web or inner flange of a frame. The fore and aft flanges of reverse bars when riveted to frames are toed in the opposite direction to the flange of the frame. One advantage of using frames and reverse frames over solid frames is that the reversed frame may be stopped at or a little above the bilge where the design will permit. A common design

is to run all reverse frames in the bow and stern to the upper, forecastle or poop deck as the case may be and to run the alternate reverse frames to the upper deck in the main body.

**Frame, Rudder.** See Rudder Frame.

**Frame, Side.** A term applied to a frame extending from the bilge to the upper deck.

**Frame, Solid.** Described under frame.

**Frame Spacing.** The distance between heel and heel of consecutive frames.

**Frame Squad.** A crew of workmen who assemble and erect the frames of a ship.

**Frame, Stern.** See Stern Frame.

**Frame, Transom.** A term applied to the frame or the frame and floor plate extending athwartship across the stern post and fastened thereto. This frame acts as a foundation or support for the structure of the overhanging stern in a vessel. Frames attached to the arch and propeller post of a stern frame are also called transoms.

**Frame, Transverse.** A term applied to a frame that runs athwartship.

**Frame, Tunnel.** A term applied to one of the frames supporting the plating of shaft and access tunnels. When the tunnel has a rounded top the frame may be made in one piece bent round at the top. The spacing of the frames should coincide with the main transverse frames of the ship.

**Frame, Web.** A built up member consisting of a web plate to the edges of which single or double bars are riveted. They are placed several frame spaces apart with smaller frames in between. They extend from the tank top to the deck and between decks where extra strength is required. Where a web frame system is installed the intermediate frames may be smaller than for the ordinary framed ship. The web frame on account of its great depth is very stiff and it backs up the intermediate frames through intercostal girders running fore-and-aft between web frames.

**Frame, Web, Angle Bars.** Angle bars riveted to the inner edge of the web plate of a web frame.

**Frame, Web, Angle Clips.** Clips used for attaching the web frames to tank top, decks, stringers, etc.

**Frame, Wing.** A term applied to one of side frames in a ship.

**Frame, Z Bar.** A solid frame composed of a Z bar.

**Framing, Paddle Box.** The framing upon which the semi-circular compartments for housing the paddle wheels is connected.

**Framing, Plan.** A diagrammatic plan showing the distribution and type of construction of the members making up the vessel's framing

**Freeboard.** The distance from the waterline to the top of the weather deck at side. Sometimes used with reference to the entire out of water portion of a vessel's side.

**Freeboard Deck.** See Deck, Freeboard.

**Freeing Port.** See Port, Bulwark, Clearing or Freeing.

**Freighter.** A vessel designed for the safe and economical transportation of merchandise from port to port.

**Frequency of an Electric Circuit.** The number of cycles the electromotive force, or current, passes through in one second. When an alternating electromotive force, or current, has passed through a complete set of positive and negative values, starting from any value and again returning to that value, in the same direction, it has completed what is called a cycle.

**Fresh Water Pump.** See Pump, Fresh Water.

**Friction Drum.** A drum used to control the speed of the windlass shaft when paying out. Direction drums are used on winches to throw the power on or off the hoisting drum shaft.

**Friction Saw.** A rapidly revolving soft steel disc, the edge of which is slightly nicked by a special chisel.

**Frictional Resistance.** See Resistance, Frictional.

**Fuel, Boiler.** See Boiler, Fuel.

**Fuel Oil Burning System.** The fuel oil burning system includes everything necessary to an oil burning installation including the fuel oil tanks, oil pump, air compressor heater, piping, hurlers, etc.

**Fuel Oil Heater.** An auxiliary used in connection with an oil burning installation to heat the fuel oil and make it volatile. It usually consists of a chamber in which a steam coil is lifted. The oil is admitted to the chamber and heated by live steam passing through the coil after which it is carried by a pipe line to the burners.

**Fuel Oil Heater Foundation.** A term applied to the seating supporting the fuel oil heater.

**Fuel Oil Service Pump.** See Pump, Fuel Oil Service.

**Full Ended.** When the extremities of the waterlines in the vicinity of the load line are strongly convex to the surrounding water and the ends of the sectional area curve are full indicating that the displacement is carried well forward and aft towards the ends of the vessel.

**Fuller.** A tool used in hand forging to smooth rough surfaces or to make offsets.

**Funnel, Boiler.** See Smoke Stack.

**Furnace.** A built up chamber in which fuel is burned to produce intense heat. Furnaces are used to heat plates, shapes, etc. to permit their being hammered or bent to a ship's form. A space or receptacle built in a boiler in which the combustion of fuel takes place.

**Furnace, Angle.** See Furnace Bar.

**Furnace, Bar.** A furnace used for heating shapes forming the frames, etc., in order to shape and bevel them to the required form. These furnaces are generally of small width and great length.

**Furnace, Corrugated.** A cylindrical type of furnace used on fire tube boilers, the shell of which is corrugated to resist external pressure.

**Furnace Door, Boiler.** See Boiler Door, Furnace.

**Furnace, Electric.** A furnace in which the heat is furnished by an electric arc, or by the current going through the furnace charge or a special resistor, as in the resistance furnace, or by the current flowing through the secondary of a special transformer as in the induction furnace.

**Furnace Front.** See Boiler Furnace Front.

**Furnace, Hardening or Tempering.** A furnace using solid fuel such as coal, coke, etc., and containing a cast iron or clay plate or receptacle in which the pieces to be hardened or tempered may be heated. The heat is reflected from the grate to the plate by an arch. Steel is also hardened by use of a liquid bath, consisting of lead, mercury, common salt and other compositions in a furnace similar to a Tempering Pot Furnace.

**Furnace Men.** Workmen who heat and bend plates and shapes to the required forms. They also bend and bevel frame bars and fashion boss plates.

**Furnace, Oil.** A furnace in which oil fuel is used for producing the required heat.

**Furnace, Plate.** A furnace used for heating plates which require working into special forms, such as boss plates. These furnaces generally are wide and only about half as long as an angle furnace.

**Furnace, Rivet.** A small basin or receptacle, holding burning fuel for heating rivets.

**Furnace, Tempering Pot.** A furnace containing a receptacle which holds a bath for drawing temper in steel. A commonly used bath consists of lead and tin in varying proportions, boiling linseed oil or lead heated to the melting point by coal, oil, gas or other fuel. The composition of the bath depends upon the temper required.

**Furnaced Plate.** See Plate, Furnaced.

**Furniture.** The furniture aboard a ship may be divided into two groups, built-in and portable. Built-in furniture consists of berths, seats, lockers, side boards, etc., that are an integral part of the joiner work of the ship. Portable furniture consists of arm chests, bedsteads, benches, boxes, bureaus, chests, chiffoniers, desks, file boxes, lockers, sofas, swinging berths, tables, toilet racks, wash basin stands, wardrobes, etc. Benches include seats for the crew and steerage passengers, work benches for carpenter, engineer or mechanics. Boxes include ice boxes, and lockers include provision lockers, chronometer lockers, etc.

**Furrings.** Strips of wood secured to the frames or studding for the purpose of securing an even surface to attach sheathing or ceiling.

**Fuse.** A short piece of metal, in the form of a wire, rod or strip, forming part of an electric circuit to protect electrical apparatus or electric wiring from excessive

current. For a given circuit, a fuse is used of such metal and conductivity that it will melt and thus open the circuit as soon as the limit of current carrying capacity of the circuit is reached. Fuses are generally placed in boxes, tubes or other receptacles, to prevent the vaporized metal flying out on surrounding objects.

**Fuse Box.** A fireproof receptacle, enclosing a fuse or fuses, with suitable contacts or clips for readily attaching them.

**Fusible Plug.** A plug of soft metal fitted near the dangerous low water level in water tube boilers, its purpose being to melt out when the water level drops to low and allow the escaping steam to extinguish the fires. Fusible plugs generally consist of a bronze casing with a hole filled with pure tin. In externally heated cylindrical boilers with flues, fusible plugs are located in the top of the upper flue and in the shell of the boiler immediately below the fire line. Scotch boilers and boilers having a combustion chamber are provided with plugs located in the crown sheet of the combustion chamber.

**Futtock Double.** A piece of timber forming two futtocks in one length.

**Futtocks.** The pieces of timber of which a frame in a wood ship is composed. Starting at the keel they are called the first futtocks, 2nd futtocks, 3rd futtocks, and so on.

## G

**Gadget.** A slang term applied to various fittings. It is generally used where a proper name for the fitting is hard to decide upon or not remembered.

**Gaff.** A spar to which the top of a main, mizzen or similar sail is attached. It usually has a jaw fitted at one end to clasp the mast.

**Gage.** An instrument used in determining the pressure in a boiler, that is, the pressure above the atmosphere. A glass or pipe column, the latter fitted with gage cocks, used to determine the amount of liquid in a boiler or tank. An instrument for measuring dimensions, number of threads, etc. A standard length, thickness or number of threads.

**Gage.** An instrument or standard of measure used on fine machine work, etc. Some of the most common gages are the micrometer, plug and ring gage, snap gage, thickness gage, limit gage, drill gage, thread gage, wire gage, etc.

**Gage Cock.** A small cock fitted to a boiler or tank for the purpose of determining whether the liquid within is up to the level that it is fitted at.

**Gage, Draft.** An installation comprising a glass tube, graduated to scale and a small pipe, in communication with the sea. It indicates, in approximate units, the draft of the vessel.

**Gage Glass.** A glass tube forming a part of a gage used to determine the amount of liquid in a boiler or tank.

**Gage, Jacket.** A gage mounted on the steam jacket of a cylinder for the purpose of determining the pressure therein.

**Gage Pipe.** A small pipe connecting the steam or water gage to a boiler.

**Galley.** The space on shipboard where the food is prepared; a ship's kitchen.

**Galley Dresser.** A cook's work table located in the galley. It is usually a built-in structure of metal or wood on which the cook prepares the food, having shelves and lockers fitted underneath for stowing miscellaneous cooking utensils.

**Galley Equipment.** Equipment necessary to a ship galley for cooking, baking, warming, etc. Included in this equipment are ranges, steam tables, cold and hot water urns, vegetable cookers, kettles, etc.

**Galley Force Pump.** A hand pump used in the galley for drawing fresh water from the tanks below.

**Galley Smoke Pipe or Funnel.** A smoke pipe fitted to the galley range. It is constructed of sheet iron and led up through the deck above or through the galley skylight to the open air.

**Galvanizing.** The process of coating one metal with another, ordinarily applied to the coating of a metal (usually iron or steel) with zinc. The chief purpose of galvanizing is to prevent corrosion.

**Gammoning Piece.** A timber on top of the filling chocks between the bobstay-piece and stem. An iron band, lashing used to assist in securing the bowsprit to the stem.

**Gang board, Gangplank.** A term applied to boards or a movable platform used in transferring passengers or cargo from vessel to wharf or dock or vice-versa.

**Gangway.** A term applied to a place of exit from a vessel. Gangways are fitted in the shape of ports, which may be closed, in the sides of a vessel and in the shape of movable portions of bulwarks or railings on the weather decks.

**Gangway Port.** See Port, Gangway.

**Gantline, Girtline.** A rope reeving through a single block aloft and used for hoisting or lowering rigging, etc.

**Gantry Crane.** See Crane, Gantry.

**Garboard Plate.** See Plate, Garboard.

**Garboard Strake.** See Strake, Garboard.

**Garland.** A strap lashed to a mast by which it is hoisted on board and placed in position.

**Gaskets.** Packing materials, by which air, water, oil or steam tightness is secured in such places as on doors, hatches, steam cylinders, manhole covers, or in valves, between the flanges of pipes, etc. Such materials as rubber, canvas, asbestos, paper, sheet lead and copper, etc., are extensively used. Ropes or plaited stuff used to confine furled sails to their yards or booms. Harbor Gaskets are usually of plaited stuff named according to their position as yard-arm, quarter and bunt gaskets. A Sea Gasket, also termed a Furling Line, is a long rope passed around both the yard and sail when a neat appearance is not so much desired as security.

**Gate Shear.** See Shear, Gate.

**Gate Valve.** See Valve, Gate.

**Gear.** A comprehensive term in general use on shipboard signifying the total of all implements, apparatus, mechanism, machinery, etc., appertaining to and employed in the performance of any given operation. For instance the brooms, brushes, buckets, dust pans, mops, etc., constitute the "cleaning gear"; the rudder, steering engine or motors, shafting, gears, drums, etc., the "steering gear"; etc.

**Gear Cutter, Automatic.** A machine designed to cut spur and bevel gears and worm-wheels. These machines are generally automatic, all the operations required in gear cutting being performed by the machine itself except the lacing of the wheels in position and setting the machine for the proper depth and length of cut.

**Geared Door.** See Door, Horizontal or Vertical, Sliding.

**Gearing.** A term applied to wheels provided with teeth that mesh, engage, or gear with similar teeth on other wheels in such a manner that motion given one wheel will be imparted to the other

**Gemma's Ring.** Also known as the ring dial, this was a development of the Augsburg Dial, a reasonably accurate sun clock.

**General Arrangement Plans.** The plans showing the various quarters, spaces and compartments into which a ship is usually divided.

**General Service, Pump.** See Pump, General Service.

**Generator, Asynchronous.** A commutator type of alternating current generator which does not operate asynchronous speed.

**Generator, Compound.** A direct current generator in which the field consists of both series and shunt field coils.

**Generator, Electric.** A machine which transforms mechanical energy into electrical energy.

**Generator, Engine Driven.** An electric generator driven by gas or steam engine of the reciprocating type.

**Generator, Series.** A direct current generator in which the field winding is connected in series with the armature winding thus allowing the full armature current to go through the field coil.

**Generator, Shunt.** A direct current generator in which the field coil is shunted across the armature, thus allowing only a small portion of the armature current to pass through the field coil. The voltage of a shunt generator is very nearly constant, with a slight decrease in voltage as the load increases.

**Generator, Synchronous.** An alternating current generator the speed of which bears a certain fixed relation to the frequency of the circuit.

**Generator, Turbine Driven.** See Turbo Generator.

**Gibe.** A metal fitting that holds a member in place or presses two members

together.

**Gig.** A pulling or row boat of fine model and good length used principally for the convenience of the shipmaster in the performance of his duties between the ship and the shore.

**Gilders.** Decorators in gilt or gold leaf.

**Giguy.** A designation for a makeshift contrivance on board ship; also a term applied by sailors to anything whose name is unknown to them.

**Gimbals.** A device by which a ship's compass, chronometer, etc., are suspended in a constant horizontal position irrespective of the rolling and pitching of the vessel. It consists of two concentric brass hoops or rings whose diameters are pivoted at right angles to each other on knife-edge bearings.

**Gin Blocks.** See Blocks, Gin.

**Girder.** On ships this term is generally applied to continuous beams running in a fore and aft direction under the decks. They are used in connection with stanchions for the purpose of supporting the decks and binding the deck beams together. This term is sometimes used to designate the longitudinal in the double bottom.

**Girder, Boiler.** See Boiler Girder.

**Girder, Deck.** A term applied to a continuous beam running in a fore and aft direction under, and attached to, the deck beams. Also applied to a continuous range of intercostal plates and bars running fore and aft between deck beams. In deciding the height between decks the depth of the girders should be considered so that sufficient head room will be provided for.

**Girder Equivalent.** See Equivalent, Girder.

**Girder, Intercostal.** A term applied to a range of short plates fitted between and attached to continuous structural members.

**Girder, Longitudinal.** See Longitudinal Girder.

**Girder, Ship's (Strength).** That portion of a ship's hull structure which is composed of continuous, longitudinal members, whose material, location and connection to other portions of the structure are such that they efficiently resist the forces which tend to produce hogging or sagging. The principal members falling within the above definition are longitudinal framing, shell plating, inner bottom plating, longitudinal bulkheads and decks.

**Girders, Side.** See Stringer, Side.

**Girder, Wing.** See Margin Plate.

**Girdle.** Extra planking fitted over the Wales in a wooden ship.

**Girtband.** Sometimes termed bellyband, A strip of canvas worked across the middle portion of a sail to provide additional strength.

**Girth.** The distance measured on any frame line from the intersection of the upper deck with the side around the body of the vessel to the corresponding point on the

opposite side.

**Gland, Stern Tube.** See Stern Tube Gland.

**Globe Valve.** See Valve, Globe.

**Glue, Marine.** A preparation of pine, coal tar or asphalt pitch used to fill the crevices between the planks of a wood deck to prevent water and dirt from leaking through.

**Gooseneck.** A fitting used to attach and support a cargo boom. A short piece of pipe, used as a ventilator, one end of which is given a 180° bend and the other end attached to a deck over an opening equal to the diameter of the pipe. Also applied to pipes and fittings in which a large bend or curve is worked.

**Gorget.** A crescent-shaped ornamental plate in gilt copper, worn round the neck by officers of the French Navy in full uniform.

**Gouge.** A tool with a half round cutting edge used to cut grooves.

**Governing.** The process of controlling automatically the speed of the engine under varying loads.

**Governor.** An apparatus or mechanism designed to eliminate great increases in engine speed due to propeller emergency. There are various types of governors for marine engines. None is entirely satisfactory because of tardy operation. Modern practice favors a form of governor which depends upon change of engine speed for its impulse.

**Governor, Pump.** A pressure controlling valve for governing pumps for fresh or salt water, oil, ammonia, air, etc.

**Grab Stand.** A piece of apparatus designed to hold a drilling machine when in operation.

**Grade Line.** An established reference line from which measurements are taken to any point.

**Grain.** A term applied to the texture or fibers of wood.

**Grain Measure.** A term used where the capacity of a cargo hold is measured to the shell of the vessel instead of to the inside of the frames or cargo battens.

**Grain, Straight.** A term applied where the grain runs parallel or nearly so to the face of the board.

**Grain, Vertical or Edge.** A term applied where the grain of the wood is near or at right angles to the face of the board.

**Granny Knot.** See Knot, Granny.

**Grapnel.** An implement having four prongs or hooks radiating from a common shank, fitted with a ring in the end of the latter and used as an anchor for small boats, for the purpose of recovering objects dropped overboard, for securing one vessel to another in boarding, or to make fast a towline to a burning vessel, hooking on to lines, etc. Also known as Grappling Iron.

**Grapnel Line.** A line bent to a grapnel, sometimes tailed with a length of chain next to the grapnel in order that it may not be burned away in towing a burning vessel or severed by the crew in boarding a hostile vessel.

**Graphometer.** A surveying instrument for measuring angles, derived from the Circumferentor, invented about 1696, although a plan for the first of the type, a circumferentor with graduated semi-circle, was published in France by Philippe Danfrie a hundred years before.

**Grappling Irons.** See Grapnel.

**Grate, Fire Grate.** A type of cast iron grating made up of heavy portable cast iron bars and bearers installed in the furnace. It is used to support the burning fuel.

**Grate Bars.** These bars support the fire in a boiler furnace and are usually made of cast iron. The bars are generally rectangular in cross section with the long side vertical and somewhat deeper in the center than at the ends. Lugs are cast on the sides to provide an air space between bars about equal to their thickness and they are commonly cast in pairs. A shallow groove running along the top of early bar will aid in keeping down the adhesion of clinkers, The grate bars are usually fitted in two lengths set to slope slightly toward the rear of the furnace and are supported in the front and rear by the furnace structure and in the center by a bearing bar.

**Grate Bearer.** A support for boiler grate bars, usually made of cast iron.

**Grate Surface, Boiler.** See Boiler Grate Surface.

**Grated Hatch.** See Hatch, Grated.

**Grating, Fantail.** A lattice work, made of wood, fitted at the after end of tug boats. It is built about eighteen inches above the deck and extends forward for a distance of about twelve feet. This grating forms a good drainage platform for stowing hawsers and towing gear when they are not in use.

**Grating, wood.** A lattice work constituting of two systems of wood bars running at right angles to each other. One system is usually mortised into the other to form a flush surface. Gratings are used as drainage platforms on the bridges, bath rooms, cold storage spaces, etc. They are generally made up in sections in sizes convenient for handling. Simple gratings are also often made by securing a number of small square strips of wood together with bolts or rivets, small blocks being inserted between the strips in way of the rivets to act as separators.

**Gratings, Flooring, Hatchway, Walkway, Ladder Steps.** A structure of metal bars so arranged as to give a support or footing over an opening, while still providing spaces between the members for the passage of light and the circulation of air. For large openings it is usually built up in panels of comparatively small size grouped on a supporting frame. For small openings it may be made in one section of the proper size. The most common applications for gratings in marine construction are for covering fair-weather and boiler hatches, floors for oil fired boiler rooms, walkways, and galleries in the engine and boiler rooms, ladder steps, etc. One of the oldest forms of grating consists of metal bars set on edge, punched or drilled at intervals, and strung on rods with short spacers of pipe placed intercostally between bars to maintain the opening. Another form of grating consists of a frame of flat bars set on edge with holes punched or drilled at short intervals in two opposite sides to receive the ends of square or round rods or flat bars set on edge. The ends of any of these

types of closely spaced cross bars are turned down to form a shoulder and to fit the holes in the frame bars. The holes in the frame bars are usually countersunk on the outer side, allowing the ends of the grating rods or bars to be riveted up to a flush surface. A light and strong type of grating consists of alternate straight and corrugated or reticuline bars set on edge and solidly riveted together. To construct this grating the corrugated or reticuline bars are pressed to shape, after which they and the straight bars are carefully punched to templates, then assembled in alignment, and a heavy rivet formed in each hole. This grating possesses excellent non-slipping qualities and is also suitable for trucking.

**Gratings, Fidley.** See Fidley Gratings.

**Gratings, Hatch.** Gratings usually constructed of wood, fitted over hatch openings. They are particularly desirable where hatch covers are removed or opened.

**Gratings, Skylight.** See Skylight Gratings.

**Graving Dock.** See Dry Dock, Graving.

**Graving Pieces.** Small pieces of wood fitted into the deck where the surface has been injured or decayed, and where it is not deemed feasible or practicable to renew the entire piece.

**Grease Cup.** A receptacle designed to hold grease and used where a positive feed is required for lubricating machinery.

**Grease, Launching.** See Launching Grease.

**Greaser.** A member of a ship's boiler room force who cleans out the bilges and boiler flues and performs other work of the lower grade.

**Gridiron.** Heavy sleepers or timbers fastened to the tops of piling at or near the bottom of a river or harbor where there is a tide. Boats or scows are placed on the gridiron at high tide so that they may be done on their sides or bottom at low tide. Scows are also placed on gridirons so that they will remain at the level while they are being loaded or unloaded.

**Grill Work.** An ornamental lattice work.

**Grinding Machine.** A machine employing an abrasive wheel for any kind of grinding, such as sharpening or forming tools, truing machine centers, finishing machine surfaces, etc. Grinding machines are generally electric motor or belt driven, but pneumatic machines are built in both the portable and bench types.

**Grinders.** Men who remove excess material by means of an emery wheel

**Grindstone.** An abrasive wheel generally used for sharpening wood working tools.

**Gripe.** A curved piece of timber joining the forward end of the keel and the lower end of the cutwater.

**Gripe, Release.** Fittings and chain assembled together for holding purposes which can be easily parted at a moment's notice.

**Gripes, Boat.** An arrangement for holding small boats securely in their stowage chocks. They are made up of lashings or chains fitted on one end with a turnbuckle

or pelican hook and a shackle for attachment to a pad eye on the deck and on the other end with a flat bar hook for attachment to the gunwale of the boat.

**Grommet.** A ring of fiber usually soaked in red lead or some other packing material and used under the heads of bolts and nuts to preserve tightness. Also applied to washers or eyelets of metal.

**Gross Tonnage.** See Tonnage, Gross.

**Ground Tackle.** A general term for all anchors, cables, buoys, ropes, purchases, etc., used in the operation of mooring and unmooring a ship.

**Gudgeons, Rudder.** Lugs cast or forged on the stern post for the purpose of hanging and hinging the rudder. They are bored to form a bearing for the rudder pintles and are usually bushed with a lignum vitae or white metal bearing surface.

**Guess Warp.** A hawser carried out in a small boat and bent to a distant fixed object in order to warp the vessel toward it. The name originated from the necessity of having to judge the distance by the eye.

**Gun Tackle.** A purchase consisting of two single blocks and a length of rope.

**Gunboat.** A war vessel designed principally for use on a foreign station. Its principal characteristics are moderate displacement, moderate speed, good cruising radius, moderate draft, light battery, comfort for the personnel, and robust construction.

**Gunter's Scale.** A wooden or brass ruler 1-2ft. long, engraved with the scales of chords, logarithms, trigonometry foundations and the like, used in navigation and for surveying. It was a predecessor of the slide rule.

**Gunwale.** A term applied to the line where an upper deck stringer intersects the shell.

**Gunwale Bar.** A term applied to the bar connecting a stringer plate on a weather deck to the sheer strake.

**Gunwale, Bridge.** The line where the bridge deck stringer intersects the shell.

**Gunwale, Forecastle.** The intersection of the forecastle deck stringer with the shell.

**Gunwale, Poop.** The line where the poop deck stringer intersects the shell.

**Gunwale, Quarter Deck.** The line where the quarter deck intersects the shell.

**Gunwale, Rounded.** A term applied where the shell and frames are rounded into a deck.

**Gunwale Stringer.** See Stringer, Gunwale.

**Gusset; Gusset Plate.** A term applied to a horizontal bracket. It is used as additional attachment for strong hold beams to stringers, the bottom of side frames, to the tank top, etc.

**Guys.** Wire or hemp ropes, or chains to support booms, davits, etc., laterally. They may consist of single lines or purchases, leading from the davit head or boom end to the deck. In the case of single lines they are either lashed to eyes or rings or else

fitted with turnbuckles and hooked or shackled to deck connections. Guys are employed in pairs. Where a span is fitted between two booms or davits one pair only is required for the two. Guys to booms that carry sails are sometimes known as backropes.

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

**Gyroscope.** Strictly, any rotating mass. Usually a wheel so constructed as to demonstrate or utilize gyroscopic action.

**Gyroscopic Compass.** See Compass, Gyroscopic.

**Gyroscopic Stabilizer.** See Stabilizer, Gyroscopic.

## H

**Hair Hygrometer.** An instrument often incorporated with a barometer, for discovering the degree of humidity of the air. It comprised a whisker or beard, actually the hair from a seed of wild oats, that formed a spiral when dry, and unwound when damp.

**Half Breadth Plan.** See Lines Plan.

**Half-hour Glass or Clock.** This is a sand glass that ran from one bulb to another in half an hour. It was used at sea from the Middle Ages till the mid-19<sup>th</sup> century. The helmsman would turn the glass as the officer of the watch called the passages of the sun through the meridian. He turned it again at the end of the first half-hour, striking the ship's bell once. After the second half-hour he struck the bell twice and so on.

**Half-minute Glass.** A sand glass for a half minute, used as log timers, and surviving on sailing ships until the 20<sup>th</sup> century. Their bulbs were made in one piece, unlike the two-bulbed glasses made to measure longer periods.

**Half Hitch.** A hitch formed in the end of a rope by passing the end around the standing part and then bringing it up through the bight.

**Halyards.** Light lines used in hoisting signals, flags, etc. Also applied to the ropes by which gaffs, sail or yards are hoisted.

**Hambroline.** A cord of three yarns, approximately the same size and yardage as round line. It is used for serving, worming, etc., but is of an opposite twist from round line.

**Hammer, Calking.** A hammer used in the hand calking of plates, shapes, etc.

**Hammer, Plying.** A type of hand riveting hammer.

**Hammer, Pneumatic.** The pneumatic hammer is a combination of a cylinder, a reciprocating piston or plunger, a valve for automatically controlling the movements of the plunger, air, and a throttle valve for regulating the flow of air to the hammer from the supply pipe.

**Hammer, Power Forging.** A machine which, by means of a crank or eccentric, by

steam or by compressed air against a piston in a cylinder, imparts a vertical motion to a hammer or ram die.

**Hammer, Set.** A hammer used in bringing a shape or frame bar to its final shape on the bending slab.

**Hammer, Riveting.** See Riveting Hammer.

**Hammer Runners.** Men who operate power hammers that make large forgings.

**Hammock.** A rectangular canvas article suspended from hooks attached to the vessel's deck beams or other structure. It is used for berthing seamen aboard ship. Of late years it has been superseded to some extent by fixed berths of various types.

**Hammock.** A term applied to a swinging canvas bed principally used on war ships. The hammocks are hung from hooks attached to deck beams and are taken down and stowed away during the day time.

**Hand Pump.** See Pump, Hand.

**Hand Spike.** A round bar or lever of hard wood which is placed horizontally in the head of a capstan to push against in order to revolve the capstan. A lever for moving heavy weights.

**Hand Wheels.** Wheels for operating machinery, valves, doors, etc., by hand.

**Hank.** A ring of rope, wood, or iron that slides on a stay and to which the luff of a staysail is seized.

**Harbor Deck.** See Deck, Harbor.

**Harness.** A term, now practically obsolete, for the furniture of a vessel.

**Harness Cask.** A large tub used to contain the salted provisions intended for immediate consumption.

**Harpoon.** A long shanked, barb-pointed spear or javelin used to strike whales or other large fish.

**Hatch or Hatchway.** An opening in a deck through which cargo may be handled, machinery or boilers installed or removed, and access obtained to the decks and holds below.

**Hatch, After.** A term applied to the deck openings aft of the midship portion of a vessel.

**Hatch Bar.** A term applied to flat bars used for securing and locking hatch covers.

**Hatch Battens.** A term applied to the flat bars used to fasten and make tight the edges of the tarpaulins that are placed over hatches. The batten and edge of the tarpaulin are wedged tightly in closely spaced cleats.

**Hatch Beams.** A term applied to the portable beams fitted to the coamings for the purpose of supporting the hatch covers. The ends of these beams receive hard usage in shipping and unshipping and should be reinforced at these points by doubling strips.

**Hatch, Boiler.** A hatch fitted over the boiler room through which the smoke stack passes. Iron grating is usually fitted around the stack for ventilation but steel covers that can be closed in heavy weather should also be fitted. This hatch should be made large enough to provide for the installation or removal of the boilers.

**Hatch, Booby.** An access hatch leading from a weather deck to the quarters. A small companion readily removable in one piece. A wooden hood-like covering, for a hatch, fitted with a sliding top.

**Hatch, Cargo.** A term applied to the deck openings leading to the cargo holds.

**Hatch Carlings.** Fore and aft girders running under the coamings at the sides of hatches to which the partial or half deck beams are attached.

**Hatch Carrier.** A term applied to the supports attached to the hatch coamings which take the ends of fore and afters and cross beams.

**Hatch, Ceiling.** An opening in the hold ceiling fitted with a cover that can be removed when the cargo is taken out. The object of these hatches is to provide access to the sides and bottom for cleaning and repairs.

**Hatch Cleats.** A term applied to the clips attached to the outside of the hatch coamings for the purpose of holding the hatch battens and edges of the tarpaulin covers.

**Hatch, Coaling.** An opening in the deck provided for the purpose of filling the coal bunkers. A trunk or casing is fitted from the upper opening to the top of the coal bunker.

**Hatch Coaming.** See Coaming, Hatch.

**Hatch Covers.** Covers for closing up the top of hatchways, usually made of wood planks and in sections that can be handled by the crew. When made of wood one or more tarpaulins are stretched over them to keep out the rain and sea. Watertight covers made of steel plates are also in use, but they are more or less in the way when the cargo is being handled.

**Hatch, Crank.** A term applied to the hatch over the engines in a paddle wheel steamer.

**Hatch End Beam.** A term applied to the deck beam at the fore or after end of a hatchway. Where the hatchway does not stop at a deck beam an end beam may be fitted under the coaming or the coaming may be produced down to form an end beam.

**Hatch, Engine.** A hatch fitted over the engine room. It is usually provided with a skylight having hinged covers that can be operated from below. The hatch should be made large enough to provide for the installation or removal of the engine.

**Hatch, Expansion.** A term applied to hatches with high coamings fitted on oil tankers for the purpose of allowing space for expansion of the oil.

**Hatch, Fore.** A term applied to the deck openings forward of the midship portion of a vessel.

**Hatch, Grated.** A term applied where the top of the hatch is fitted with a wood or steel grating.

**Hatch Gratings.** See Gratings, Hatch.

**Hatch, Main.** A term applied to one of the principal cargo hatches.

**Hatch Rests.** A term applied to the shelf fitted at the top of coamings for the purpose of supporting the edges of the hatch covers.

**Hatch Strong Back.** A portable beam fitted in a hatchway for the purpose of lifting heavy weights as a beam fitted over the engine in the engine hatch for lifting cylinder covers, etc. The portable hatch beams fitted to the coamings to provide supports for the hatch covers are sometimes called strongbacks.

**Hatch, Upper, Main, Lower, etc., Deck.** An opening for access or cargo handling in any deck is usually given the name of the deck on which it is situated as Upper Deck Hatch.

**Hatch, Watertight.** A term applied where the hatch is fitted with a steel watertight cover. The bearing edges of the cover are fitted with strips of rubber which are compressed down on to the coaming by dogs.

**Hatch, Wood.** A term applied where the side framing of the hatch is made of wood.

**Hatchway Gratings.** See Gratings.

**Hatchway Trunk.** A term applied where the space between a lower and the hatch or hatches above it are enclosed by a casing.

**Hawse Bag.** See Jackass.

**Hawse Pipes.** Tubes leading the anchor chain from the deck on which the windlass is located down and forward through the vessel's bow plating. Hawse pipes are generally of cast iron or cast steel. They are of heavy scantling and sometimes made in two or more parts to facilitate construction.

**Hawser.** A large rope, either fiber or wire, used for warping, towing, mooring, etc.

**Hawser, Port.** See Port, Hawser.

**Hawser Reel.** A heavy reel for the stowage of hawsers when not in use. In its simplest form it consists of a cylindrical body on which the hawser is wound. At each end a disc shaped guard is fitted to keep the hawser in place. Hawser reels are sometimes mounted on frames and fitted with friction brakes with which to control the paying out of the rope.

**Hawser Rope.** See Rope, Hawser.

**Head of the Bowsprit.** The forward end.

**Head of Keel.** See Forefoot.

**Head of a Ship.** The fore end formerly fitted up for the accommodation of the crew. A vessel is trimmed by the head when drawing more water forward and less aft than contemplated in her design.

**Head-Board.** A piece of timber connecting the end of the bobstay with the top of the stem.

**Head Sails.** The sails forward of the foremast. These are triangular fore and aft sails termed in general jibs and stay sails.

**Heads.** The upper portions of wood frames. Also used to designate seamen's toilets.

**Header.** A box or pipe, usually of rectangular cross section and having either a straight or sinuous form, into which the ends of the tubes in water tube boilers are expanded. A pipe or casting into which several smaller pipes are lead. Also the top piece of a door frame or window frame.

**Header, Window Frame.** The horizontal piece at the top.

**Headledge.** A term applied to the forward or after end coaming of a hatch. This term is more frequently used in connection with wood coamings.

**Heater, Boiler Feed Water.** See Boiler Feed Water Heater.

**Heater, Fuel Oil.** See Fuel Oil Heater.

**Heater, Rivet.** See Rivet Heater.

**Heating System.** A system of piping and radiators or pipe coils designed for heating the enclosed spaces and quarters of a vessel during cold weather. Steam is usually used to supply the warmth but hot water installations have been made in special cases.

**Heater or Heater Boy.** A boy who operates forges to heat rivets for the riveters.

**Heating Surface, Boiler.** See Boiler Heating Surface.

**Heating Tongs.** Long handled tongs used by rivet heaters to place rivets in the forge and withdraw them when heated for driving.

**Heave.** To haul; to cast or hurl; as, to heave the lead, to heave a line, The alternate rising and falling of a vessel in a seaway.

**Heave-handsomely.** A command to proceed slowly and carefully when pulling in the anchor chain.

**Heave-round.** A term used on shipboard as a command to start pulling in the anchor chain.

**Heaver.** A wood bar used as a lever; a sailmaker's tool consisting of a fluted tapered metal pin fitted with a handle at right angles to the pin similarly to an auger.

**Heave-To.** To bring a sailing ship into such a position that the wind produces no headway. To stop the engines of a ship and lie without headway.

**Heaving Line.** A small line bent to a hawser, the loose end thrown ashore and caught for the purpose of hauling one end of the hawser to the wharf for making fast.

**Heaving the Lead.** Taking soundings with a lead and line.

**Heel.** The inclination of a ship to one side, caused by wind or wave action.

**Heel Knee.** A bar bent to a right angle or V-shape for the purpose of securely connecting the bottom of the stern post to the keel.

**Heel of a Keel.** The extreme after end of the keel.

**Heel Piece.** A bar about three feet long serving as a connecting piece for the ends of frames, whose ends butt together. The flange of the heel bar is reversed from those of the frames it connects.

**Heeling.** Hauling a vessel over on her side for cleaning and painting; careening; causing a vessel to list to one side by shifting weights on board for the purpose of ascertaining her center of gravity.

**Helm.** A term applied to the tiller, wheel or steering gear, and also to the rudder. It indicates the control of the maneuvering or steering gear as in the term "Port the helm," and again the position of the rudder in the expression "Lee helm."

**Helm Port.** A term applied to the hole in the counter of a vessel through which the rudder stock passes.

**Hemp Rope.** See Rope, Hemp.

**Hinge.** A fitting used to join doors, covers or parts to partitions or other parts and so constructed that the door or movable part is free to swing or turn on the fitting. Also called butts.

**Hitch.** A term applied to a variety of methods of bending a line to a post, spar, or ring so that it may be readily detached.

**Hogged.** Permanently deformed by the action of hogging forces.

**Hogging.** A distortion of a vessel's form in which the bow and stern drop below their normal position relative to the midship portion of the vessel. Structural weakness, grounding, or improper loading may result in this condition.

**Hoist.** To raise or elevate by man power or by the employment of mechanical appliances such as cranes, derricks, shear legs, tackles, differential blocks, etc.; any device employed for lifting weights.

**Hoist, Electric.** Any type of device in which the power for raising weights is furnished by an electric motor.

**Hoist, Marine Railway.** A winch or windlass located at the head of the tracks for taking in or letting go the rope or chain used for raising or submerging the cradle.

**Hoist, Steam.** Any type of device in which the power for raising weights is furnished by a steam engine.

**Hoisting Crew.** Men who have the care of getting on board ship and securing in their proper places any heavy weights requiring the use of shear legs, cranes or other hoisting or moving gear.

**Hoisting Engine.** A term applied to a winch or any power machine used in hoisting cargo, sails, ashes, etc.

**Hold Beam.** See Beam, Hold.

**Hold Beam Stringer.** See Stringer, Hold Beam.

**Hold Bunker.** A bunker or that part of a bunker below the lower deck. That part of the hold space which may be at times used for stowage of coal for ship's use,

**Hold Pillar.** See Pillar, Hold.

**Hold Stringer.** See Stringer, Hold.

**Holders-On, or Backers-Up.** Workmen who place the rivets in the hole and press against the heads a heavy hammer or dolly-bar while the riveters are hammering up the points.

**Holding Ground.** An anchorage where an anchor will bite into the bottom so as to prevent it from dragging.

**Holds.** Spaces or compartments between the lower-most decks and the bottom of the ship, or top of the inner bottom if one is fitted. The spaces below decks allotted for the stowage of cargo.

**Holes, Drain.** Holes in bulkheads, floors or other obstructions to provide clear flow of liquid to the pump suction.

**Holidays.** Portions of a ship's surface which through inadvertence have been missed in the application of paint or other protective coating.

**Holland Circle.** An altitude-measuring instrument from Holland, produced prior to the Circumferentor.

**Hollow Ended.** When the extremities of the waterlines in the neighborhood of the designed load line are concave to the surrounding water, and when the sectional area curve at the ends is fine indicating relatively small displacement in these locations.

**Hollow Keel.** See Keel, Hollow.

**Hollows of Resistance.** See Resistance, Hollows of.

**Holystone.** A soft sandstone used in scrubbing wood decks. The origin of the name is probably due to the kneeling posture of the men while using the stone, or else to the fact that they were formerly most frequently used on Sunday; to clean a deck by the application of a holy-stone.

**Home.** Close up; snugly in place. The port from which a vessel hails.

**Hood.** A shelter over a companionway, scuttle, etc. It is generally built of canvas spread over an iron frame. It may also be constructed of light metal plating.

**Hood Stick.** An arrangement designed for holding a drilling machine to be used in light drilling.

**Hoods.** A term applied to those plates placed at the extreme forward or after end of a ship.

**Hook, Breast.** A triangular shaped plate fitted between decks or deck stringers in the bow for the purpose of rigidly fastening the stem and fore-hoods of outside plating and the ends of side stringers firmly together. In wood ships a piece of iron bent in a V shape and fitted horizontally in the bow between decks to hold the bow planking in place.

**Hook, Deck.** A triangular plate fitted at the extreme ends of decks or deck stringers to hold the ends of the decks, the fore-hood plating and stem rigidly together. In wood ships a steamed timber or knee piece fitted at the extreme ends of the decks for the purpose of binding the bow timbers together.

**Hook, Fore.** See Hook, Deck and Breast.

**Hook, Pelican.** See Pelican Hook.

**Hookers On.** Men who place the necessary slings on material to be transported by a crane and assist the crane operator as to the proper disposition of the material.

**Hooks.** Triangular pieces of plate fitted in the extreme ends of vessels for the purpose of tying the ends of stringers and keeping the outside plating in place.

**Horn, Timber.** See Timber, Horn.

**Horning.** Setting the frames of a vessel square to the keel after the proper inclination to the vertical due to the declivity of the keel has been given.

**Horsepower.** The unit of power is a "horse-power," which is taken as "33,000 ft. lbs. of work performed in one minute" or its equivalent.

**Horsepower, Boiler.** See Boiler Horsepower.

**Horsepower, Effective.** The actual power available for propulsion which is equivalent to the indicated or shaft horsepower less all losses due to friction of machinery, line shafting, stern bearings, etc.

**Horsepower, Indicated.** A term applied to the horsepower actually developed in the cylinder or cylinders of an engine.

**Horsepower, Shaft or Brake.** A term applied to the power of turbines where it is not possible to use an indicator. It is measured from the shaft by an instrument called a torsion meter, and corresponds to brake horsepower.

**Horseshoe Plate.** A small light plate fitted on the counter around the rudder stock for the purpose of preventing water from backing up into the ruddertrunk. When fitted in one piece it has the shape of a horseshoe, but it is frequently made in two pieces to completely surround the stock and at the same time permit its removal.

**Horsing.** A term applied to the operation of driving oakum into the seams between planks.

**Horsing Iron.** A wide chisel-shaped tool with a wedge-shaped edge fitted with a long handle. It is placed in a seam which has been caulked with oakum and struck with a heavy mallet to drive the oakum down so another thread can be driven or the seam payed with pitch or marine glue.

**Hose.** A term applied to more or less flexible tubing used to convey water, oil,

compressed air, etc.

**Hose Couplings.** Fittings made in various forms for connecting lengths of hose together.

**Hose Nozzles.** A tapered pipe having a screw thread cut on the large end for attachment to the end of a hose line.

**Hot Well.** A receptacle for the water condensed from steam.

**Hound Band.** A term applied to a band fitted around the upper portion of a mast to provide attachment for the shrouds.

**Hound, Mast.** See Mast Hound.

**Houseline.** A tarred hemp, three-stranded, left-handed, small rope, somewhat larger than marline. It is used for both seizing and service.

**Housing.** A term applied to an enclosure partially or wholly worked around fittings or equipment. Applied to masts it is that portion below the weather deck and to topmasts, that portion overlapping the mast below.

**Hulk.** The body of an old, wrecked, or dismantled vessel unfit for sea service, but sometimes used for other purposes, as a coal depot, prison, etc.

**Hull.** The framework of a vessel, together with all decks, deck houses, the inside and outside plating or planking, but exclusive of masts, yards, rigging and all outfit or equipment.

**Humps.** Portions of curves of resistance or power where, due to disadvantageous wave formation, the residuary resistance is increased relative to that of the adjacent portions of the curves.

**Hurricane or Promenade Deck.** See Deck, Hurricane.

**Hurricane Dial.** A curious meteorological instrument, usually made of brass, comprising a compass rose, with several scales and pointers. When these were arranged correctly they were supposed to give a safe route to steer around the path of an impending hurricane.

**Hydrant.** An outlet in a pipe line suitable for a hose

**Hydraulic Accumulator.** See Accumulator, Hydraulic.

**Hydraulic Jack.** See Jack, Hydraulic.

**Hydraulic Riveting.** See Riveting, Hydraulic.

**Hydrokineter.** A device installed near the bottom of a boiler to provide forced circulation of the water when raining steam.

**Hydrometer.** An instrument for determining the density of the water in a boiler. Also, a mechanical device for measuring a ship's speed termed an "English log", invented by William Foxon in 1772.

**Hydrostatic Pressure.** See Pressure, Hydrostatic.

## I

**I-Beam.** A rolled shape, generally of mild steel, having a cross section shaped like the letter I. In ship work it is used for bulkhead stiffeners, girders, etc. The size is denoted by dimensions of cross section and weight per running foot.

**Ice Lining.** A term applied to doubling plates fitted on the bow of vessels at the waterline for the purpose of protection against ice.

**Impedance.** The apparent resistance in ohms of an alternating current circuit, i. e., it is that quantity which, when multiplied with the total current in amperes, will give the impressed e. m. f. in volts. It is a term applied to alternating current circuits and is due to resistance and inductance, to capacity and resistance or to all three.

**Impulse Reaction, Turbine.** See Turbine, Impulse Reaction..

**Impulse Turbine.** See Turbine Multiple Stage, Impulse; Turbine Single Stage, Impulse.

**In and Out System.** See Plating, In and Out System.

**Inboard.** Towards the center; within the vessel's shell and below the weather decks.

**Inboard Profile.** A plan representing a longitudinal section through the center of the vessel, showing heights of decks, locations of transverse bulkheads, assignment of various spaces and all machinery, fittings, etc., located on the center or between the center and shell on the port side.

**Incandescent Lamp.** See Lamp, Incandescent.

**Inclining Weights.** Known weights placed on board a vessel for use in obtaining a slight list when performing an inclining experiment.

**Inclinometer.** A sensitive, accurate instrument, invented in 1842, with magnetic needle and graduated ring dial, for measuring the force of magnetic attraction exercised by the earth, also the direction of the attraction relative to the plane of the horizon.

**Increaser.** See Reducer.

**Independent Piece.** A timber bolted to the forward part of the stem above the water line.

**Indicated Horsepower.** See Horsepower, Indicated.

**Indicator.** An instrument designed to measure and record the variation in the cylinder pressure of steam engines, pumps, etc., throughout the entire length of stroke.

**Indicator Card.** A diagram showing the variation in pressure in steam cylinders or pumps throughout the entire stroke. This diagram is made upon cards or paper by the indicator pencil.

**Indicator Cock.** A cock located in the indicator pipe line for the purpose of

controlling the supply of steam to the indicator.

**Indicator, Direction and Revolution.** A device fitted on the bridge and designed to show immediately the actual engine movement, direction, and speed so as to minimize the serious results possible from a misunderstanding of orders.

**Indicator Pipe.** A small pipe connection with the ends of a steam cylinder fitted for the purpose of supplying steam to an indicator.

**Inductance.** The property of an electric circuit, which results in an electro-motive force being induced in it due to a change in the value of the current it is carrying, is called its self-inductance, and the process is called self-induction. When two conductors or circuits are so related that a change of current in one results in an electro-motive force being induced in the other, they are said to have a mutual inductance and the process is called mutual induction.

**Induction Coil.** An electrical device consisting of a primary and secondary coil on a soft iron core. The most common form of induction coil consists of a primary coil of a few turns of coarse wire wound on the core and connected to a voltaic cell through a vibrator and a secondary coil of a large number of turns of fine wire wound upon the primary coil and carefully insulated from it.

**Induction Fan.** See Blower.

**Inertia, Moment of.** See Moment of Inertia.

**Initial Condition.** The datum condition from which the variations characteristic of any other condition are measured, or with which they are compared.

**Initial Stability.** The stability of a vessel in the upright position or at small angles of inclination. It is usually expressed by the metacentric height.

**Injection Pump.** See Pump, Injection.

**Injector.** An apparatus or fitting designed to force feed water into a boiler against the ordinary boiler pressure. The injector does not take the place of the boiler feed pump but is additional thereto. In principle the injector is an instrument for the mixture of live steam at high velocity with a stream of cold water. This results in the condensation of the steam and the imparting of great velocity to the water. The pressure thus built up is sufficient to open the check valve and force water into the boiler by overcoming the boiler pressure. As constructed in practice, the injector has almost perfect efficiency as a boiler feeder. The only heat loss involved being due to radiation from the injector itself and its connections.

**Inner Bottom.** A term applied to the inner skin or tank top plating. The plating over the double bottom.

**Inner Bottom Plate.** A term applied to any of the plates in the tank top.

**Inner Bottom Plating.** See Tank Top Plating.

**Inner Keel.** See Keel, Inner.

**Inner Post.** A reinforcing timber bolted to the forward side of the stern post.

**Inner Skin.** See Skin, Inner.

**Inner Stern Post.** See Stern Post, False or Inner.

**Inside Strake.** See Strake, Inside.

**Inspectors.** Men who examine and test the structure or machinery in order to ascertain if it meets the contract requirements.

**Insulation, Electric.** A poor conductor of electricity, i. e., rubber, fiber, mica, marble, slate, etc.

**Insulation, Heat and Cold.** Several considerations enter into the proper insulation of pipes and boilers for sea service, which are not always considered of equal importance for installation ashore. The subject naturally divides itself into two heads: covering for the high pressure main and auxiliary steam pipes and boilers, and covering for plumbing, service pipes, etc. In selecting the former class of covering, we have not only to consider the relative heat saving science of the material, but also its weight per foot and its ability to resist hard usage, constant vibration, the pounding of heavy seas, steam and water leakage and even possible submersion. The effect of a properly efficient pipe and boiler insulation is first to save coal or other fuels. By doing so it not only saves the labor of the firing squad but also materially increases the cruising radius of the ship and permits the use of smaller bunkers. A second but equally important result is to secure an ample supply of hot, dry steam to the engine at all times. Every engineer knows the discomfort, loss of time, and the potential danger of a water logged steam supply, especially in the turbine engine room. In order to secure the greatest possible amount of energy per pound of fuel, the insulating material must have the highest efficiency. The most important characteristic of a good insulation is its capacity to resist the factors of heat.

**Insulator, Electric.** A support for electric wires or cables made of good insulating material.

**Intercommunicating Telephone.** A telephone set used as one station in an intercommunicating telephone system. See Intercommunicating Telephone System.

**Intercommunicating Telephone System.** Two or more telephone sets so arranged as to enable the calling party to signal the party desired and to complete the talking circuit between the calling party's phone and any phone in the intercommunicating system by pushing a "Push Button" and without the assistance of a switchboard operator or any mechanical or electrical switching mechanism.

**Intercostal.** Occurring between ribs, frames, etc. The term is broadly applied, where two members of a ship intersect, to the one that is cut. A girder composed of short members running between and attached to continuous members.

**Intercostal Floor.** See Floors, Intercostal.

**Intercostal Girders.** See Girders, Intercostal.

**Intercostal, Keelson.** See Keelson, Intercostal.

**Intercostal Plates.** See Plates, Intercostal.

**Intercostal Stringer.** See Stringer, Intercostal.

**Interior Communication.** Electrical, mechanical or voice tube systems installed aboard a vessel to provide means of communication between the important stations like the bridge, engine and boiler rooms, and also inter-communication between the officer's staterooms, etc.

**Intermediate Beam.** See Beam, Intermediate.

**Intermediate Frame.** See Frame, Intermediate.

**Iron.** Described under Steel and Iron.

**Iron Wire Rope.** See Rope, Iron Wire.

**Isherwood System.** A system of ship's framing patented by Isherwood. This system contemplates closely-spaced, light longitudinal frames supported on widespread, transverse members of comparatively great strength.

**Isochronous Oscillation.** Swinging or rolling back and fourth, each swing or oscillation occupying the same.

**Isogonic Lines.** These show magnetic variation as determined by the Inclinator. "Isogonic" means literally the indication of equal angles or magnetic variation.

## J

**Jack.** A machine for raising or moving heavy weights. It commonly consists of one or more screws, turned by a lever or ratchet and working in a case, which rests upon the floor or ground.

**Jack.** Small flag of a ship, especially the national flag which was flown at the bow on a jack-staff. The Union Jack, properly the Union Flag was always flown in this position. The earliest reference to the use of the word jack as a flag dates from 1633, when it meant a small flag on the bowsprit.

**Jack, Hydraulic.** A machine for raising or moving heavy weights in which the power is exerted by means of the pressure of some liquid acting against a piston or plunger.

**Jack Rod.** A term applied to a pipe or a rod to which the edges of awnings or weather cloths are secured.

**Jack, Sand.** A rectangular cast iron box filled with sand and having a side outlet near the bottom which can be closed with a plug. The box is filled with sand to about one inch from the top on which a block is placed as a support for keel blocks or cribbing. They are placed under the cribbing and keel blocks so that when a vessel is ready for launching it may be lowered on to the cradle by removing the side outlet plugs in the jacks allowing the sand to run out.

**Jack, Screw.** A device in which the screw is used to overcome great resistances, lift heavy weights, etc. It consists of a cast cylindrical body, internally threaded, with a broad base worked at one end. A large screw turned by a bar or lever and carrying on its outer end a flat palm works into the threaded body.

**Jackass.** A conical shaped canvas bag stored with oakum and fitted with a lanyard

at apex and base, used for closing the hawse pipes around the chains to prevent shipping water through the pipes; also called a hawse bag. P.S.

**Jack staff.** A term applied to a flag pole erected in the bow of a vessel.

**Jackstay.** A rope, rod or pipe rove through eyebolts fitted on a yard or mast for the purpose of attaching sails to the yard or mast. The term is also applied to the outer or boundary rope of a netting or awning.

**Jacob's Ladder.** A ladder having either wire or fiber rope sides with wood or metal rungs attached at regular intervals. One end is usually fitted with sister hooks or shackles for hooking on.

**Jaw, Boom or Gaff.** The semi-circular end fitted to a boom or gaff for the purpose of making a loose attachment to the mast.

**Jet Condenser.** See Condenser, Jet.

**Jetsam.** Goods or cargo thrown overboard from a vessel in order to lighten her when in danger of sinking.

**Jewel Block.** See Block, Jewel.

**Jew's-Harp.** The odd shaped shackle fitted directly to the shank of the old-fashioned anchor.

**Jib.** A triangular sail bent to a foremast stay.

**Jib-Boom.** A spar placed on top and projecting forward of the bowsprit for the purpose of holding the end of the outer jib.

**Jib-Boom, Flying.** A spar placed on top and projecting forward of the jib-boom for the purpose of holding the end of the flying jib.

**Jib-Boom Stay.** A stay running from the forward end of the jib-boom to the martingale.

**Jib Crane.** See Crane, Jib.

**Jigger.** A term usually applied to the after mast in a ship having four or more masts.

**Jiggers.** Light tackles generally rove as luffs used for miscellaneous work on deck. They are also termed watch tackles and in some cases Handy-Billy tackles.

**Joggled.** A term applied where a frame or plate is offset in the way of a lapped joint. The object of the joggle is to dispense with the necessity of fitting a liner.

**Joggled Frame.** A frame in which offsets are worked in the way of the laps of the shell plating. By joggling or offsetting the frames at a lap both plates fit snug against the frame.

**Joggling Machine.** A machine in which two short power driven rolls are used for joggling, or crimping, or offsetting plates. The rolls are offset in such a way that a plate is joggled, or crimped by passing through the machine. These machines are generally operated by an electric motor.

**Joiner Door.** See Door, Joiner.

**Joiner Plans.** Arrangement plans of quarters and living spaces showing the location and arrangement of a vessel's furniture, toilet articles, etc.

**Joiners.** Wood workers who make and set up all the wood work requiring considerable skill such as panels, doors, sashes, built in furniture, etc.

**joint, Butt.** A term applied where a connection between two pieces of material is made by bringing their ends or edges together and by fastening the same by a strip or strap that overlaps both pieces. Holes for bolts or rivets are drilled or punched in the straps and pieces to be connected.

**Joint, Lapped.** A term applied where a connection between two pieces of material is made by overlapping the end or edge of one over the end or edge of the other and by fastening the same by bolts or rivets.

**Joint, Strapped.** See Joint, Butt..

**Jointer.** A type of wood planing machine used for planing the edges of lumber. The table and cutters are usually similar to a planer and a vertical fence is provided for use as a guide while dressing the edge of a plank or other piece of work.

**Jolly Boat.** A pulling boat of small size.

**Journal.** That portion of a shaft or other revolving member which transmits weight directly to and is in immediate contact with the bearing in which it turns.

**Journeyman.** Originally a workman who had completed his service as an apprentice. It was early practice to bind out apprentices for a term of years. Upon completion of apprenticeship, the workman was given a certificate testifying to his qualifications in his craft, and he could then journey where he would and ply his trade. Hence the name journeyman, meaning a workman skilled in his craft or trade.

**Jump.** To make a flush joint between two planks or plates of iron or other metal. To join by a butt weld in smith work.

**Jury Mast.** See Mast, Jury.

**Jury Rudder.** A term applied to any temporary or makeshift appliance that is used to steer a boat when the regular rudder is out of commission.

## K

**Kayak.** A term applied to a canoe made out of seal skin. These crafts are used by the Eskimos.

**Keel.** A center line strength member running fore and aft along the bottom of a ship and often referred to as the back bone. In wood ships, it is composed of as long pieces of timber as can be obtained, which are scarped together at their ends. In steel vessels it is composed either of long bars scarped at their ends or by flat plates connected together by butt straps.

**Keel, Bar.** A keel projecting below the bottom of a vessel consisting of an iron or

steel bar. The garboard strakes of shell plating are flanged down and riveted to it. These bars are obtained in as long lengths as possible and their joints are scarped. The proper size may be obtained from the rules of the Classification Societies.

**Keel, Bilge.** A fin fitted on the bottom of a ship at the turn of the bilge to reduce rolling. It commonly consists of a plate running fore and aft and attached to the shell plating by angle bars. It materially helps in steadying a ship and does not add much to the resistance to propulsion.

**Keel Blocks.** See Blocks, Keel.

**Keel Condenser.** See Condenser, Keel.

**Keel, Docking.** In dry docking, the weight of a ship is carried almost entirely on the keel and bilge blocks. The keel and keelson provide the means of distributing the pressure on the centerline and docking keels composed of doubling strips of plate or built up girders are sometimes fitted on the bottom at a distance from the centerline corresponding to the best position for the bilge blocks. The docking keels are fitted in a fore and aft direction, generally parallel or nearly so to the keel. In vessels having a flat bottom doubling strips of plate are used, but where there is a dead rise this keel is composed of plates and shapes built down so that its bottom is on the same level as the bottom of the keel. The number and lengths of these keels varies with the shape and size of the vessel.

**Keel, False.** An additional piece bolted on to the main keel and serving the purpose of a renewable rubbing strip or fender.

**Keel, Flat Plate.** A plate of extra thickness riveted to the bottom angles of the keelson. The flat plate keel has been substituted for the bar keel in most steel ships because it saves draft and is sufficient for docking purposes. Grounding on a rocky or uneven bottom is a rare occurrence, and when this does happen a bar keel is usually not strong enough to prevent disaster. Where extra strength is required the flat plate keel consists of two plates riveted together and having their butts staggered.

**Keel, Hollow.** A hollow box-shaped keel made up of plates and shapes.

**Keel, Inner.** The inner plate of a double flat plate keel.

**Keel, Lower.** A piece of timber placed between the main and false keels on wood ships.

**Keel, Outer.** The outer plate of a double flat plate keel.

**Keel Piece.** That portion of the stern frame forward of the propeller post in single screw vessels and forward of the stern post in sailing and twin screw vessels. Its function is to make a rigid connection with the keel.

**Keel-Plate.** A plate used to connect the wood keel to the steel framing in a composite ship. Also applied to any single plate composing the keel.

**Keel Rabbet.** A groove on each side of the keel into which the edges of planking or plating are fitted.

**Keel Rivet.** See Rivet, Keel.

**Keel Rope.** A rope used to clear the limber holes and inaccessible spaces in the bottom of a ship of waste matter.

**Keel, Safety.** A term applied where extra plates of thick plating are fitted over the garboard strake adjacent to the keel.

**Keel, Side Bar.** Either a bar on each side of which vertical plates are riveted or several vertical plates riveted together, the combined thickness equaling the required bar keel. The garboard strakes are flanged down and riveted to it.

**Keelson.** A term applied to the fore and aft girders in the bottom of a steel ship whether on the centerlines, to one side or at the bilge. In wood ships keelson consists of a strong timber running along the top of the transverse frames parallel to and directly above the keel.

**Keelson Angle Bar.** This term applies to the continuous fore and aft bars at the top and bottom of the keelson. The angles connecting floor plates and brackets to the keelson are generally called clips.

**Keelson, Bilge.** A fore and aft girder placed at the lower turn of the bilge.

**Keelson, Box.** A keelson made up like a box girder with two vertical plates.

**Keelson Bracket.** A bracket usually a triangular-shaped plate connecting the keelson and shell plating between frames.

**Keelson Casing.** A wood ship term applied to the wood box fitted around the keelson to provide a means for keeping it salted.

**Keelson, Intercostal.** A keelson made up of a range of plates fitted intercostally between floors and attached to the floors, shell and tank top by angle bars or shapes.

**Keelson, Rider.** A piece of timber placed on top of the main keelson in wood ships. A term applied to the keelson when it runs along the top of the floors in steel ships.

**Keelson, Side.** A term applied to the fore and aft girders running along the bottom of the ship parallel, or nearly so, to the keel.

**Keelsons, Sister.** Pieces of timber placed alongside of the main keelson in wood ships.

**Keelson, Vertical Center.** The lower middle line girder, which in conjunction with a flat plate keel on the bottom and a rider plate on top, forms the principal fore and aft strength member in the bottom of a ship. In addition to its importance as a "back bone" or longitudinal strength member, it serves to distribute and equalize the pressure on the transverse frames and bottom of the ship when grounding or docking occurs. In steel ships this keelson usually consists of a vertical plate with two angles running along the top and two along the bottom. The girder, however, may be made up of various combinations of plates and shapes. This member should continue as far forward and aft as possible.

**Keeper, Davit.** See Davit, Keeper.

**Keeper, Rudder.** See Rudder, Keeper.

**Kentledge.** Pig iron used either as temporary weight for inclining a vessel or as permanent ballast.

**Kerf.** A term applied in joiner work to a slit or cut made by a saw. Kerfs are made at the junction of timbers where the joints require adjusting. Also applied to the channel burned out by a cutting torch.

**Keying Rings.** Lead washers used to secure shackle pin forelocks. The forelock has a recess near the end into which the ring is upset by a special tool. In unshackling the keying ring is sheared off when the forelock is backed out.

**Keyseater.** A machine designed especially for cutting keyseats in shafts, the hubs of pulleys, gears, etc.

**Keyway Cutter.** See Keyseater.

**Kid.** A small wood tub, as a mess lid, spit kid, etc.

**Kilowatt.** The practical unit of electrical power. It is 1,000 times greater than the watt.

**Kingston Valve.** See Valve, Kingston.

**King Post; Sampson Post.** A strong vertical post used to support a derrick boom.

**Kink.** An abrupt bend or short curl or loop in a rope or cable frequently occasioned by excessive lay or twist.

**Knee.** A block of wood having a natural angular shape or a block cut to a bracket shape and used for the purpose of fastening and strengthening corners of deck openings, intersections of timbers, and supporting deck beams.

**Knees, Beam.** See Beam Knees.

**Knight-Head.** The forward vertical timbers adjacent to the stem post.

**Knot.** A unit of speed equaling one nautical mile per hour; a division of the log line which serve to measure a vessel's rate of speed; a term applied to a connection made with a piece of cordage to another piece or to another object.

**Knot, Granny.** A knot in which the first crossing is reversed from that in a square knot. This knot is insecure, difficult to open when jammed, and is held in contempt by seamen.

**Knot, Mathew Walker.** A single and a double knot namely from the originator. It is made by hitching each of the three strands, in the direction of the lay in such a manner, that the rope can be laid up and continued beyond the knot. The knot is in the form of a transverse collar around the rope and is used on the end of dead eye lanyards.

**Knot, Square.** A knot in which the ends protrude on the same side of the loop with the standing parts. Sometimes called a "flat knot" and also known as a "reef knot" from its employment in tying reef points. This knot has the advantage of not slipping and is easily untied; however, it does not answer well for uniting ropes of very different sizes since the parts would slip unless stopped down.

**Knuckle.** An abrupt change in direction of the plating, frames, keel, deck or other structure of a vessel. The term is most frequently used with reference to the line at the apex of the angle dividing the upper from the lower part of the stern or counter of elliptical or round stern vessels.

## L

**Label Plates, Name Plates.** Small plates usually made of brass and embossed or engraved with the name, number, etc., of rooms, compartment, frames, valves and equipment on a vessel, and attached to or located near the article to which it refers.

**Lace Piece.** A piece of timber joining the bobstay piece and cutwater.

**Lacing.** A cord or rope used to lash the head of a sail to a gaff, the leech of a staysail to a stay, or a bonnet to a sail; to secure sections of awnings or sails to each other and to replace reef points in a gaff sail. Eyelet holes or grommets are placed near the edge of the awning or sail through which the lacing is rove.

**Ladder.** A framework consisting of two parallel sides connected by bars or steps which are spaced at intervals suitable for ascending or descending. On shipboard the term ladder is also applied to staircases and to other contrivances used in ascending or descending to or from a higher or lower level.

**Ladder, Accommodation.** A term applied to a staircase suspended over the side of a vessel from a gangway to a point near the water, to provide an easy means of access from a small boat to the deck of a vessel.

**Ladder, Bridge.** A ladder providing access to a bridge

**Ladder, Companion.** A staircase fitted as access from a deck to the quarters.

**Ladder, Jacob's.** See Jacob's Ladder.

**Ladder, Mast.** A ladder attached to a mast to provide means for going aloft.

**Ladder, Pillar.** A term applied to a ladder formed by fitting rungs extending out from a pillar or stanchion. They are commonly used as a means of securing access to cargo holds.

**Ladder, Poop.** A term applied to a ladder leading from the Upper Deck to the Poop Deck.

**Ladder, Sea.** A term applied to rungs riveted to the side of a vessel to form a ladder from the weather deck to the water.

**Lag Screw.** See Screw.

**Lagging.** A term applied to the insulating material that is fitted on the outside of boilers, piping, etc.

**Lamp, Arc.** An electric lamp in which the light is produced by an electric arc drawn between two electrodes. The arc lamp is arranged to separate the electrodes automatically when the current begins to flow and to feed them toward each other as they burn away at the tip.

**Lamp Black.** See Paint.

**Lamp, Incandescent.** An electric lamp in which the light is produced by the electric current heating to incandescence a filament which is enclosed in a glass chamber from which the air has been exhausted as completely as is practicable or which is filled with some inert gas such as nitrogen.

**Lamp, Pilot.** A lamp mounted out or near a switchboard for giving the operator a signal when a circuit breaker opens, a fuse blows, the voltage in a circuit becomes zero, or that conditions in some circuit have changed.

**Lamp, Smoking.** A small lamp kept lighted during smoking hours on board naval vessels to furnish lights for the smokers.

**Land Boards.** A term applied to planks near the hatches for purpose of receiving the cargo and protecting the deck.

**Lanyard.** A length of rope or cord used in numerous dissimilar ways, i. e., as a fall rove through the dead eyes in setting up the shrouds or other standing rigging; as a knife-lanyard to prevent a knife falling from aloft. In this case it consists of a small cord attached to the ring in the end of the knife, the other end being worn around the neck; a port lanyard is a light line used to haul a port into the closed position or to support it when open. The term is also applied to the rope handle of a bucket. The present tendency seems to limit the application of the term to any line having a loose end the other being attached to any object for the purpose of either near or remote control.

**Lanyards.** A short piece of rope rove through dead eyes, connecting shrouds to side of vessel.

**Lap.** A term applied to the distance that one piece is laid over another in making a lap joint.

**Lap.** The distance which the valve edge on the steam side extends over the port, the piston being at mid- position.

**Lapped Frame.** See Frame, Lapped.

**Lapped Joint.** See Joint, Lapped.

**Lapstreak.** A term applied to boats built on the clinker system in which the strakes overlap each other. The top strake always laps on the outside of the strake beneath.

**Lateral Resistance.** See Resistance, Lateral.

**Lathe.** A machine used for producing various machine and tool parts and which is adapted to a great many operations, such as turning circular work, boring holes, cutting screw threads and for many other classes of work, the extent and variety of which depend upon the type of lathe and its auxiliary equipment.

**Lathe, Double Spindle.** A type of lathe having two working spindles arranged so that one gives a larger swing. than the other.

**Lathe, Engine.** The most common type of lathe. The term "engine" as used in this connection, simply means a machine, and it serves to designate that particular class

of lathe which is used by machinists for general work, and which may be considered as the standard type. In ordinary shop usage the word "lathe" is commonly used to indicate a lathe of this class.

**Lathe, Gap.** A lathe designed with a gap or space in front of the head stock to allow a larger swing for face-plate work.

**Lathe, Speed.** A simple lathe having no carriage or attachments operated by mechanical means.

**Lathe, Turret.** A lathe equipped with a turret which is mounted upon a carriage and contains the tools which are successively brought into the working position by indexing or rotating the turret

**Launch.** A term applied to a small power or motor boat.

**Launching.** A term applied to the operation of sliding a vessel into the water. There are two methods by which this operation may be accomplished, one of which is called end launching and the other side launching.

**Launching Grease.** A lubricant applied to the sliding and ground ways in launching a vessel. In addition to the grease so designated, tallow, steerine, etc., are also used either mixed in various proportions or else applied unmixed in layers to the ways.

**Launching Tallow.** Tallow used as a lubricant for the sliding and ground ways when launching a vessel.

**Law of Comparison.** Otherwise known as Froude's Law. For similar ships running at speeds less in the ratio of the square roots of their linear dimensions, the resistances are in the ratio of the cubes of the linear dimensions. The speeds as above noted are called corresponding speeds.

**Lay (of a Rope).** A term used to designate both the amount of twist put into a rope and its direction. The amount of twist is usually expressed as sail makers lay, bolt rope, soft-laid, regular lay, hard-laid, or other special lays as required for a particular use. In general, the softer the lay the greater the strength, but the less the resistance to wear. Wearing quality is sacrificed to facility in handling in soft-laid rope and strength to utility in hard-laid rope. The direction of twist is designated as right-hand and left-hand, or as right-laid and left-laid.

**Lay, Rope.** See Rope, Lay.

**Layers Out.** Workmen who indicate on the material the operations necessary to fabricate it.

**Laying Off.** Work performed by shipfitters nearly identical with "laying out."

**Laying Out.** Placing the necessary instructions on plates and shapes for shearing planing, punching, bending, hanging, beveling, rolling, etc., from templates made in the mold loft or taken from the ship.

**Lazaret.** The space above the after peak between decks, used as a store-room for provisions in some merchant vessels.

**Lazy Guy.** A name given to a light rope or tackle by which a boom is prevented from

swinging around.

**Lead.** A term sometimes used synonymously with the term "trim."

**Lead.** An apparatus used for determining the depth of water under a vessel. It is generally made of lead of nearly prismatic shape tapering slightly to the upper end through which is made a hole for bending a strap to which a marked line is attached.

**Lead.** Described under Metals.

**Lead.** The width of the admission steam or exhaust port opening at the beginning of the stroke.

**Lead Line.** A fine line marked in fathoms or feet to which the lead is attached and from which the depth of water is read off.

**Leading Edge.** Referring to a propeller blade, the edge which cuts the water when the screw is revolving in the ahead direction. Referring to rudders or strut arms, the edges toward the stem.

**Leak.** Any orifice or other opening in a vessel's structure which permits water or other fluid to enter or to escape. The egress or ingress of water or other fluid from or into a container or compartment.

**Ledge.** A strip along the front of a shelf or table to prevent articles from rolling off.

**Ledge Bars.** See Hatch Rest.

**Leech.** A term applied to the side edges of a square sail or to the fore and aft edges of a fore and aft sail.

**Lee Side.** The opposite side to that which is exposed to the wind; the opposite of windward side.

**Leeway.** The amount of a vessel's deviation from her steered course due to action of wind and tide.

**Left-Laid Rope.** See Rope, Left-Laid.

**Left Rudder.** A term recently adopted in the Navy which is applied to the operation of moving the rudder to port and consequently turning the bow of the ship to the left.

**Length by Lloyd's Rules.** The length from the fore part of the stem to the after part of the stern post on the range of the upper deck beams, except in awning or shelter deck vessels, in which cases the length is to be measured on the range of the deck beams next below the awning or shelter deck.

**Length on Waterline.** The length from the fore side of the stem to the after side of the sternpost or stern counter measured at the designed waterline.

**Length Over All.** The total Length over all, i. e., the length measured from the foremost to the aftermost points of a vessel's hull.

**Length, Register.** The length from the fore part of the outer plating or planking on the side of the stem to the after part of the main sternpost of screw steamers, i. e.,

the one to which the rudder is attached, and to the after part of the rudderpost of all other vessels measured on top of the tonnage deck. The register length of scows and barges with a square bow and stern sloping up from the bottom to the deck and with neither stem, sternpost or rudder-post is to be taken on the deck from the extreme point of the hull at the bow to the extreme point of the hull at the stern, i. e., the overall length of the hull is to be considered the register length of such vessels.

**Lengthening (of a Ship).** The act of increasing a vessel's length by inserting a section amidships. The vessel is placed in a dry dock or on a marine railway, the longitudinal members are cut through in a staggered direction at about amidships, the two resulting parts separated the desired distance, and the intervening space fitted up with frames, stringers, plating, etc., so as to unite the forward and after portions in a new and longer hull.

**Letterers.** Painters who label compartments, tanks, etc.

**Levee.** An embankment constructed along a river to prevent overflow.

**Lever, Beveling.** A lever with a jaw at one end used to bend the flanges of angles or channels to a given inclination with the other flange or web. This tool is most commonly used at bending slabs.

**Life Buoy, Ring.** A ring made of solid cork or equivalent buoyant material having an outside diameter of not less than thirty inches and an inside diameter of not less than seventeen inches. The number of buoys a vessel should carry depends on her length. They should not be permanently fastened to a vessel, but should be so placed as to be readily accessible in case of emergency. One of the buoys on each side of the vessel should have a life line attached of at least fifteen fathoms in length. Life ring buoys are also placed on wharves and along water fronts, and as on a ship they are thrown to persons in the water for the purpose of sustaining them until they can be reached.

**Life Preserver, Life Jacket.** A wide belt of good cork blocks, or other suitable buoyant material, made to wrap around the body under the armpits, and having shoulder straps so fitted that the device may be put on like a vest. The object of a life preserver is to keep a person from sinking in case a vessel has to be abandoned.

**Life Raft.** A frame work enclosing two or more air cylinders, to provide sufficient buoyancy to support the number of people it is designed to carry.

**Lifeboat.** A small boat carried on davits or on one of the upper decks of a vessel where it can be easily lowered into the water in case of an emergency.

**Lifeboat Falls Controller.** A type of winch installed aboard ships for controlling the falls when lowering or hoisting lifeboats.

**Lifeboat, Metallic.** A lifeboat having its shell constructed of light metal plates. The keel, stem, stern-post and gunwales should be of oak or other suitable wood.

**Lifeboat, Motor.** A lifeboat with an internal combustion type of engine substantially and permanently installed inside the boat.

**Lifting Gear, Engine.** Gear designed for the purpose of lifting cylinder covers, crank shafts, and other heavy engine weights. It consists of tackles, screws, etc.

**Lifting Gear, Turbine.** See Turbine Lifting Gear.

**Lifts.** Ropes supporting the yards at the yard arms being led through blocks or fairleaders at the mast head and thence to the deck or the top.

**Light, Anchor.** A vessel under one hundred and fifty feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light, in a lantern so constructed as to show a clear, uniform and unbroken light visible all around the horizon at a distance of at least one mile. A vessel of one hundred and fifty feet or upwards in length, when at anchor, shall carry in the forward part of the vessel, at a height or not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light. The length of a vessel shall be deemed to be the length appearing in her certificate of registry. A vessel aground in or near a fairway shall carry the above light or lights, and in addition it shall carry at the same height as the mast head light, where they can best be seen, and if a steam vessel in lieu of that light, two red lights, in a vertical line one over the other, not less than six feet apart, and of such a character as to be visible all around the horizon at a distance of at least two miles.

**Light, Blue.** A light used for signaling purposes and which is obtained by igniting a mixture.

**Light Cruiser.** A naval vessel of moderate displacement carrying a battery of guns of medium size, light protection and having high speed. These vessels are intended for scouting, blockade, and convoy work.

**Light, Flare-Up.** Every vessel may, if necessary in order to attract attention, in addition to her regular lights, show a flare-up light as a distress signal. Pilot vessels when engaged on their station on pilotage duty shall not show the lights required for other vessels, but shall carry a white light at the mast head, visible all around the horizon, and shall also exhibit a flare-up light or lights at short intervals, which shall never exceed fifteen minutes. Sailing vessels engaged in trawling shall, on the approach of or to other vessels, show where it can best be seen a white flare-up light or torch in sufficient time to prevent collision. Fishing vessels and boats may at any time use a flare-up light, as well as the regular lights, and they may also use working lights. A vessel which is being overtaken by another shall show from her stern to such last mentioned vessel a white light or flare-up light.

**Light, Flood.** See Flood Light.

**Light, Masthead.** Masthead lights on seagoing vessels should be installed as follows: A light on or in front of the foremast of steam vessels, or if a vessel without a foremast, then in the fore part of the vessel, at a height above the hull of not less than twenty feet, and if the breadth of the vessel exceeds twenty feet, then at a height above the hull of not less than such a breadth, so, however, that the light need not be carried at a height greater than forty feet above the hull, a bright white light, so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely; from directly ahead to two points abaft the beam on either side and of such a character as to be visible at a distance of at least five miles.

**Lights, Range.** A seagoing steam vessel when under way may carry an additional

white light similar in construction to the masthead light. These two lights shall be placed in line with the keel that one shall be at least fifteen feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

**Lights, Side.** Side lights on seagoing vessels should be installed as follows: On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from directly ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles. On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from directly ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles. The said green and red lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

**Lights, Stern.** A seagoing steam vessel which is being overtaken by another shall show from her stern to such last mentioned vessel a white light of a flare-up light. Said light must be carried as near as practicable on the same level as the side lights.

**Lights, Visible.** A term applied to lights that can be seen on a dark night in a clear atmosphere.

**Light Waterline.** The line to which a vessel submerges when she is light, i.e., without cargo, or ballast in the case of merchant vessels, and without complement, stores, fuel, ammunition, feed water, etc., in the case of war vessels.

**Light and Air Space.** Space required for the admission of light and air to the engine room, machinery or other similar spaces so situated as to render the direct admission of light by other means difficult or impossible.

**Lightening.** The act of discharging cargo in order to lessen the draft.

**Lightening Hole.** A hole cut out of any structural member, as in the web, where very little loss of strength will occur. These holes reduce the weight and in many cases serve as access holes. This condition is particularly true in floor plates and longitudinals in a double bottom.

**Lighter.** A full bodied, heavily built craft, usually not self-propelled, used in bringing merchandise or cargo alongside or in transferring same from a vessel.

**Lightning Switch.** See Switch, Lighting.

**Lignum Vitae.** A wood of very hard and oily nature. It is used in strips or blocks as a bearing surface for the propeller shaft in stern tubes.

**Limber-Boards.** Removable boards serving as covers for water-courses.

**Limber Chain.** A chain used to work back and forth through the limber holes to keep the same from becoming choked up.

**Limber Hole.** A hole or slot in a frame or plate for the purpose of preventing water from collecting. Most frequently found in floor plates just above the frames and near

the center line of the ship.

**Limber Strake.** See Strake, Limber.

**Linchpin.** A metal pin passing through a shaft or axle to hold in position a pulley, wheel, etc. Linchpin and forelock are terms used synonymously by many, though a forelock is the more narrow application of the term.

**Line.** A general term for a rope of any size used for various purposes; small cords such as log line, lead line and small stuff as marline, ratline, houseline, etc.

**Line Throwing Gun.** A small gun used for shooting lines from wrecked vessels to the shore or another vessel or vice-versa.

**Liner.** A piece of metal used for the purpose of filling up a space between a bar and a plate, between two plates.

**Liner, Atlantic.** A merchant vessel engaged in regular Transatlantic service, usually having high speed, comfortable passenger accommodations, moderate freight capacity, and large size, The term probably originated with the first efforts to place in service ships which should maintain a regular schedule across the Atlantic Ocean.

**Liner, Bulkhead.** A short or diamond shaped plate fitted between the outer flanges of bulkhead bounding bars and the outer strakes of shell plating. On account of watertightness the rivet spacing in bounding bars is closer than in the frames and the bulkhead liner is a compensating plate to make up this deficiency.

**Liners, Frame.** Small strips of plate, of the same width as the frame flange, inserted between the frame and a shell plate to give contact between the two, where owing to the method of fitting the plate it would not otherwise bear against the frame.

**Liner, Frame, Straight.** See Frame Liner, Straight.

**Liner, Frame, Tapered.** See Frame Liner, Tapered.

**Liners, Tapered.** A term applied to pieces of plate that are hammered into a wedge shape and used as filler pieces between plating and framing in the way of lap joints.

**Lines, Bevel.** A representation by means of lines of the inclinations which one set of surfaces make with others or with a datum line.

**Lines (on a Drawing).** Among the principal lines on a drawing are the following:  
Base Line: A horizontal fore and aft reference line for vertical measurements. This line is perpendicular to the vertical center line. A horizontal transverse reference line for vertical measurements. This line is perpendicular to both the vertical center line and the fore and aft base line. Buttock Lines: Vertical lines parallel to the vertical center line on the body plan; horizontal lines parallel to the fore and aft center line on the half breadth plan; and curved lines on the sheer plan. Center Line: A horizontal fore and aft reference line for athwartship measurements dividing the ship into two symmetrical halves. This line lies in the vertical plane passing through the base line. A vertical reference line being the center of the body plan, midship section or other section. This line is perpendicular to the base line. The projection of a vertical fore and aft plane embracing this line appears on the half breadth plan as a fore and aft line dividing the vessel into halves. Diagonals: Diagonal lines extending

from the vertical center line to the frame lines on the body plan and curved lines on the half breadth and sheer plans. **Frame Lines:** Curved lines showing the contour of the frames on body plan; straight vertical lines on the half breadth plan; and straight vertical lines on the sheer plan. **Water Lines:** Horizontal lines parallel to the horizontal transverse base line on the body plan; curved lines on the half breadth plan; and horizontal lines parallel to the horizontal fore and aft base line on the sheer plan.

**Lines (on a ship).** Usually chalk lines whose position may be permanently fixed by center punching; also wires or cords for temporary use.

**Lines (Plan).** A drawing showing a vessel's form, projected on three planes perpendicular to each other. Conceiving the surface of the vessel cut by planes parallel to each of these three reference planes, the intersections of these with the vessel's form will be curved lines which may be projected on the three reference planes. The projection of any particular intersection will appear as straight lines on two of the reference planes and as a curved line on the third.

**Linesman.** A mold loftsmen who is an expert on laying down ship's lines and developing work therefrom.

**Lining Up.** The process of adjusting the various moving parts of an engine so as to insure their functioning in exactly the desired manner both from the standpoint of individual action and from that of the engine as a whole.

**Link.** A machine member designed to receive and transmit power from one part of an engine to another.

**Link Brasses.** Brasses fitted in the bearings at the ends of a link.

**Link Motion.** Synonymous with a portion of the reversing mechanism or gear and referring to that part of the apparatus which is composed of eccentrics, eccentric rods, links, and slide valve rod.

**Link, Stephenson.** See Stephenson Link.

**Linoleum Cement.** See Paint.

**Linseed Oil.** See Paint.

**List.** The deviation of a vessel from the upright position, due to bilging, shifting of cargo, or other cause.

**Live Load.** A load suddenly applied, a moving load. Examples of live load are wind pressure, a weight being lifted by a crane, a train moving over a bridge.

**Lizard.** A rope having a thimble, bull's eye, or block spliced into the end. It is used as a leader.

**Load Line.** The line on the "lines plan" of a ship representing the intersection of the ship's form with the plane of the water's surface when the vessel is floating with her designed load on board. Also applied to the actual intersection of the surface of the water with a vessel's side.

**Load Water plane.** The water plane at which the vessel floats when in fully loaded

condition.

**Local. Bolts.** Bolts or studs used to hold in place a ring, band, bearing, etc.

**Lock Chamber.** The space or compartment contained between the gates at each end of a lock.

**Locker.** An enclosed space or small closet used for stowing articles.

**Loftsmen.** Workmen who lay down the ship's lines full size on the mold loft floor and make templates or molds for the various parts or details of the vessel's structure.

**Log.** An apparatus either for ascertaining the momentary speed of a vessel in knots or the distance she has traveled in a given time.

**Log Line.** The line connecting a log-chip or harpoon log to the vessel or between the rotator and the registering mechanism of a taffrail log.

**Loggerheads.** Heavy iron bars, heated and then used to melt pitch for caulking a ship. They were favorite weapons in private fights, hence the term "to be at loggerheads".

**Loll.** The action of a ship having small metacentric height, by virtue of which she heels sufficiently to bring her vertical center of gravity over the center of buoyancy. This term is really descriptive of the action of many crank ships.

**Long Splice.** A splice made without an increase in the rope's diameter. It is required in a rope that must reeve through a block. The strands are first unlade for a considerable distance, the end of the ropes then brought together, the strands interlaced, the ends of each subdivided and a part of them tucked over and under the full strands, and the remaining unused partial strands trimmed off.

**Longboat, Launch.** A large pulling boat of full lines and square stern intended for general utility.

**Longitudinal.** A general term meaning fore and aft, as longitudinal bulkhead, longitudinal strength, etc. A fore and aft girder in the bottom of a ship or a side keelson.

**Longitudinal Bulkhead.** See Bulkhead, Longitudinal.

**Longitudinal Coefficient.** See Coefficient, Longitudinal.

**Longitudinal Framed Ship.** See Ship, Longitudinal Framed.

**Longitudinal Frames.** See Frames, longitudinal.

**Longitudinal Girder.** A term applied to the fore and aft girders in the bottom of a ship. These girders are usually made up from plates and shapes and are sometimes intercostal and sometimes continuous. Where the plates are cut at the floors, either or both, the top and bottom bars may be made continuous by notching out the floor plates in their way and cutting the floor bars.

**Longitudinal Number or Numeral.** A key number used by Classification Societies in their rules for determining the scantlings of the fore and aft members and the plating. These numbers with the corresponding scantlings are tabulated in the rules

and are the results of experience and comparison. The numbers are arrived at in different ways by the various Classification Societies but they are always identification numbers indicating the general size of the vessel as well as the proper scantlings of the structural members.

**Longitudinal Stresses.** Stresses which act lengthwise of a girder or beam. Similarly for a ship, stresses acting parallel to the center line.

**Longitudinal Subdivision.** The subdivision of a ship resulting from the fitting of longitudinal or fore and aft bulkheads.

**Lost Buoyancy.** In case of damage to a vessel caused in flooding of a compartment or compartments, the amount by which the reserve buoyancy of the vessel is decreased by such flooding is termed the lost buoyancy. In computing the lost buoyancy for any given case, cognizance is taken of the permeability of any cargo in the compartments flooded and only the net loss of buoyancy is taken, credit being given for the inherent buoyancy of the cargo.

**Loud Speaking Telephone.** See Telephone, Loudspeaking.

**Louver.** An opening partially closed with slats, which are fitted diagonally so that they overlap, shutting out the view but allowing the free passage of air. They are frequently constructed in the sides of skylights and fidleys.

**Lower Deck.** See Deck, Lower.

**Lower Deck Stringer.** See Stringer, Lower Deck.

**Lower Deck Stringer Bar.** See Stringer, Bar.

**Lower Keel.** See Keel, Lower.

**Lower Rigging.** The shrouds, stays, etc., supporting the lower masts including the running rigging for working their yards and sails.

**Lubber's Point.** A vertical mark on the inside rim of the card chamber of a compass which is held in coincidence with the point of the compass card indicating the desired course to be steered. The installation of the binnacle is such, that with proper adjustment of this mark, the center of the compass card, and the fore and aft center line of the vessel lie in a vertical plane.

**Lubrication.** Lubrication is effected in various ways; by means of such devices as grease cups, compressibility cups, wipers and oil cans; by means of manifolds or reservoirs and piping through which the oil flows by gravity to the desired spot; by means of a pump and piping through which the oil is forced to the part to be lubricated.

**Lubricating Oil Cooler.** See Oil Cooler, Lubricating.

**Lubricating Oil Pump.** See Pump, Lubricating Oil.

**Lucky Bag.** A locker on board a naval ship provided as a receptacle for such articles belonging to the crew as are found out of place. The owners of the articles can regain possession of them only by bidding them in at auctions.

**Luff Tackle.** A purchase consisting of a length of rope, a fixed double and a movable

single block.

**Lug Piece.** A short piece of angle bar used to attach keelsons, girders, stringers, etc., to other structural members.

**Lug-Rig.** The arrangement of sails peculiar to an English and French type of boats known as loggers which have one, two or three masts with quadrilateral or four cornered fore and aft sails bent to a hoisting yard.

**Lug-sail.** A sail used in small craft. It is triangular in shape.

**Logger.** A vessel having from one to three masts rigged with quadrilateral fore-and-aft sails bent to yards.

**Lumber, Green.** Lumber having about the same moisture content as when cut from live timber.

**Lumber, Kiln Dried.** Lumber which has been dried by artificial heat.

**Lumber, Seasoned.** Lumber is seasoned when it has reached a moisture content that is equal to the average condition of the atmosphere without being exposed to artificial heat.

**Lumper.** An unskilled laborer about a shipyard.

## M

**Machine Beveling.** The operation of bending the flanges of shapes to given inclinations by machinery.

**Machine Screw.** See Screw.

**Machinery Arrangement.** The term "machinery arrangement" applies to the layout of the main propelling unit and its auxiliaries.

**Machinery, Auxiliary.** See Auxiliary Machinery.

**Machinery, Deck.** See Deck Machinery.

**Machinists (Inside).** Mechanics who operate drills, lathes, boring mills, shapers, etc., in the shop. They prepare the parts of machinery for assembling.

**Machinists (Outside).** Mechanics who assemble on shipboard the propelling machinery and auxiliaries. On naval vessels they assemble the turret rotating machinery.

**Macomb Strainer.** See Strainer, Macomb.

**Magazine.** Spaces or compartments devoted to the stowing of ammunition.

**Magnetic Field.** The space surrounding a magnetized body through which the magnetic force acts.

**Magnetism.** The property possessed by certain bodies to attract and repel each other according to determinate laws.

**Main Body.** The hull exclusive of all deck erections, spars, stacks, etc.; the naked hull.

**Main Check Valve.** See Valve, Main Check.

**Main Circulating Pump.** See Pump, Main Circulating.

**Main Deck.** Deck, Main.

**Main Deck Sheer strake.** The strake or outside plating adjacent to the main deck.

**Main Deck Stringer.** See Stringer, Main deck.

**Main Deck Stringer Bar.** See Stringer, Bar.

**Main Drain.** The principle drainage main usually applied only to the pipes arranged for pumping out the machinery spaces.

**Main Feed Pump.** See Pump, Main feed.

**Main Floor.** See Floor, Main.

**Main Frame.** See Frame, Main.

**Main Hatch.** See Hatch, Main.

**Main Hold.** The largest cargo hold.

**Main Piece, Rudder.** See Rudder, Main Piece.

**Main Truck.** See Truck.

**Mainsail.** The principal sail carried by the main mast. In a square rigged vessel it is suspended from the main yard. In a fore-and-aft rigged vessel it is spread on the main gaff and boom.

**Male and Female.** A term applied to two engaging pieces, one of which is raised and the other recessed.

**Malleability.** That quality of a material by virtue of which it may be satisfactorily worked under the hammer or by means of rolls.

**Maneuvering Valve.** See Valve, Maneuvering.

**Manger Plate.** A term applied to a plate forming part of a breakwater. They are installed on forward weather decks for the purpose of throwing off the water that is shipped over the bow.

**Mangle Rolls.** See Rolls, Mangle.

**Man of War.** A vessel designed for fighting purposes. Generally applied to naval vessels of the first class.

**Manhole.** A round or oval hole cut in floors, tank tops, decks, tanks, boilers, etc., for the purpose of providing access.

**Manhole Coaming.** See Coaming, Manhole.

**Manhole Cover.** A cover or lid used to close a manhole opening. Manhole covers may be air, water, steam or oil tight. The simplest type consists of a plate and gasket fastened by bolts but for easy access and tightness a hinged cover on a raised frame is more desirable.

**Manhole Ring, Boiler.** See Boiler Manhole Ring.

**Manholes, Boiler.** See Boiler Manholes. .

**Manifold.** A casting or chest containing several valves. Suction or discharge pipes from or to the various compartments, tanks and pumps are lead to it, making it possible for several pumps to drain from or deliver to a given place through one pipe line.

**Manila.** The prepared fiber obtained from the stalk of the wild banana. The principal supply comes from the Philippine Archipelago. It is light and flexible, and does not readily deteriorate, so that when made into cordage it does not require tarring.

**Manila Rope.** See Rope, Manila.

**Margin Bracket.** See Fame Bracket.

**Margin Line.** A line drawn parallel to the bulkhead deck at side lines and 76 millimeters (equivalent to 3 inches) below the upper surface of that deck. The term is used in connection with the method of subdividing merchant ships described in the Report of the Committee appointed by the president of the British Board of Trade.

**Margin Plank.** A term applied to the plank forming the boundary of the deck planking.

**Margin Plate.** The plate forming the side of the inner bottom tank. This plate is usually fitted normal to the shell to which it is attached by a continuous angle bar and has its top edge flanged over to make a seam. The side frames are usually attached to this plate by large brackets.

**Marine Compass.** See Compass.

**Marine Engine.** See Engine, Marine

**Marine Glue.** See Glue, Marine.

**Marine Hardware.** A general term usually applied to spikes, nails, screws, clinch rings, boat hooks, row locks, pipe fittings, hinges, locks, door knobs, draw pulls, etc.

**Marine Railway.** See Dry Dock, Railway.

**Marine Railway Hoist.** See Hoist, Marine Railway.

**Marker.** A short piece of brass pipe which is dipped in white lead and pushed through a mold to mark the location of a rivet hole on the material.

**Marker, Double Arm.** A device consisting of two wooden arms or battens rigidly fastened together at one end in such a manner that they are parallel. Both arms are drilled with holes directly opposite each other. This device is used when it becomes necessary to transfer the location of a rivet hole from one side of a plate or shape to the other.

**Marline.** A double threaded, left handed tarred cord, made from a good grade of American hemp. In general use on shipboard for purposes similar to other small stuff.

**Marline.** A tarred hemp, two-stranded, left-handed, small stuff, about 1/8 inch in diameter, used for neat seizings and fine service. Untarred marline is used for making sennit.

**Marline Hitch.** A half hitch in which the hauling part comes out underneath the standing part. Used by riggers in marling down parceling before serving and for lashing hammocks.

**Marline Spike.** A tapering pointed metal implement used by riggers and sailmakers to open the strands of rope in splicing and as a lever in marling and seizing. In general, a marline spike is the same as a fid except that the former is metal while the latter is wood, although a marline spike may have a wood handle.

**Marling.** To hitch marline, spun-yarn, etc., around the parceling on a rope to keep it in place while the serving is being done.

**Marry.** To join two ropes end to end in such a manner that the joint will run through a block; also to place two ropes alongside of each other so that both may be hauled on simultaneously.

**Martingale or Martingale Boom.** A spar erected perpendicular to the forward end of the bowsprit as a strut for the jib-boom and flying jib-boom stays.

**Martingale Guys.** Stays running from the martingale to each side of the bow.

**Martingale Stay.** See Jib-Boom Stay.

**Mast.** A long pole of steel or wood, usually circular in section, one or more of which are erected vertically on the center line of a ship. The mast may be in one piece or it may be a series of pieces banded together to form one continuous pole. The masts were originally erected for the sails but they are now used more as supports for the rigging, cargo handling gear and wireless.

**Mast Cap.** A band worked around two sections of a mast at the level of the top of the lower section and serving as a support for the upper section. Also applied to the band around a topmast to which the stays are attached.

**Mast Cheeks.** A term applied to brackets of metal or wood fitted over on each side of a mast underneath the crosstrees or a mast platform.

**Mast-Coat.** A canvas covering fitted around and lashed or nailed to a wood mast just above the upper end of the mast wedge and also secured at the deck to prevent leakage around the mast.

**Mast Collar.** A piece of wood or a shape, usually an angle iron, that is formed into a ring and fitted around the mast hole in a deck.

**Mast Fittings.** Bands, caps, pads, etc., fitted to a mast of supporting topmasts, heels of booms, etc., and to which the shrouds, blocks, etc., are secured.

**Mast, Fore.** The mast that is farthest forward in all vessels having two or more

masts.

**Mast, Heel of.** A term applied to the lowest portion of a mast.

**Mast Holes.** A term applied to the holes in a deck through which the mast passes.

**Mast Hounds.** The upper portion of a mast at which the outrigger or trestle trees are fitted. Also applied in vessels without outriggers to that portion at which the hound band for attaching the shrouds is fitted.

**Mast, Jury.** A term applied to any mast temporarily erected to take the place of one that is carried away. Also applied to a temporary mast erected in a new vessel.

**Mast Ladder.** See Ladder, Mast.

**Mast, Lower.** A term applied to the lowest part of a mast made up of two or more poles.

**Mast, Main.** The principal mast in a vessel. It is generally the second mast from the bow.

**Mast, Mizzen.** A term applied to the third mast in a vessel.

**Mast Partner.** A term applied to wood planking or steel plating worked around the mast hole in a deck to form a side support for a mast.

**Mast Rope.** See Rope, Mast.

**Mast, Royal Topgallant.** The third section above the lower mast. Its use is confined to square riggers.

**Mast Step.** A term applied to the foundation on which a mast is erected.

**Mast Table.** A structure built up around a mast as a support for the cargo boom pivots.

**Mast, Top.** A term applied to the portion next above the lower mast in a mast made up of two or more poles. Where the mast consists of two poles it is the upper pole.

**Mast, Topgallant.** That topmost portion of a mast made up of three poles. The pole next above the topmast.

**Mast Trunk.** A term applied to a well constructed in a vessel into which a mast may be lowered.

**Mast Wedges.** A term applied to the wood wedges driven around a mast where it pierces the deck in order to hold it in place.

**Masthead.** The upper portion of a mast above the hounds.

**Mathematical Lines.** Lines of a ship the offsets of which have been developed by mathematical means, i. e., by the use of formulae, coefficients, etc., rather than by the eye at the dictation only of judgment and experience.

**Mathematical Wave.** A wave whose contour follows some definite mathematical law. The best known mathematical wave is the Trochoidal wave.

**Matthew Walker Knot.** See Knot, Matthew Walker.

**Mean Effective Pressure.** The total area of the indicator card divided by the length of stroke.

**Mean Sinkage.** The change in a vessel's mean draft which occurs as the result of an increase in her displacement.

**Measurement.** The ascertaining of the tonnage of a part or the whole of a vessel either from the plans or from measurements made on the ship according to certain definite rules.

**Measurement, New.** The measurement of tonnage according to the revised ruling which established 100 cubic feet as the space equivalent of one ton of cargo.

**Mechanical Davit.** See Davit, Mechanical.

**Mechanical Ventilation.** See Ventilation, Mechanical.

**Mechanical Work.** The product of a force by the distance through which it operates. In the English system of measurements the unit of mechanical work is the foot pound. It is equal to the work required to raise a mass of one pound a distance of one foot against the action of the force of gravity.

**Messenger Chain.** A term applied to a chain used in transmitting motion from one machine to another. A chain used in driving a windlass from a winch.

**Messenger Wheels.** A term applied to wheels that are fitted to two machines for the purpose of allowing one machine to drive the other by means of a messenger chain or rope. They are more commonly used in driving a windlass from a winch.

**Metacenter, Longitudinal.** The metacenter corresponding to longitudinal inclination.

**Metacenter, Transverse.** The point of intersection of the vertical through the center of buoyancy of a ship in the equilibrium with the vertical through the new center of buoyancy when the ship is slightly heeled. The displacement is the same in both the inclined and vertical positions referred to.

**Metacentric Diagram.** A curve indicating the height of metacenter (generally above base) for all drafts to which the vessel may be loaded.

**Metacentric Height.** The distance between the center of gravity and the metacenter. It is termed transverse or longitudinal as the transverse or longitudinal metacenter is used.

**Metacentric Involute.** The locus of the centers of curvature of that curve which is described by the center of buoyancy of a vessel as she is continuously inclined from the upright through all angles of heel.

**Metacentric Stability.** Initial stability, stability at small angles, which is correctly indicated by the metacentric height.

**Metals.** Common metals utilized in shipbuilding are as follows:

**Brass**

**Admiralty Metal** is a brass to which at least 1 per cent of tin has been added. It is light yellow in color. It cannot be worked hot except within narrow limits of temperature and for that reason is generally drawn cold from the casting form to the finished product. It resists the corrosive action of sea water. The main use of admiralty metal is in the manufacture of condenser tubes.

**Commercial Brass Castings** contain from 20 per cent to 40 per cent zinc. The straight alloy of copper and zinc with the zinc content below 35 per cent is soft and ductile and drags severely under the tool. The addition of a small percentage of tin hardens it and the addition of lead improves the machining qualities, causing the chips to break. It is used for the manufacture of oil cups, name and number plates and castings where strength is not required.

**Commercial Rolled Brass** is used for the manufacture of brass sheets for liners, trim, etc., brass pipe hand rails, distributing oil tubes and water pipes, It is also used in the manufacture of brass rod where strength and incorrodibility are not required.

**Muntz Metal** is used in making castings and is rolled into bars, shapes and plates. It is employed in the manufacture of bolts and nuts; it is rolled into plates and used for sheathing ship's bottoms and drawn into tubes for condensers, oil coolers, etc.

**Naval Brass Castings** are employed for making hatch-frames, hatch-cover frames, door frames, scuttle-frames, fittings for mess tables and benches, skylights and chest hinges and fittings; rail and ladder stanchions, brackets, clips, fittings for canopy frames, brass valves and fittings of ventilation systems (except working parts), belaying pins, tarpaulin hooks, brass-pipe flanges, valve hand-wheels, handrail fittings, ornamental and miscellaneous castings and valves in water chests of condensers, etc., aboard ship.

**Rolled Naval Brass** resists corrosion by salt water. It is employed in the manufacture of bolts, studs, nuts, turnbuckles, rolled rounds, pump rods, tube sheets, supporting plates, shafts for valves in water heads and especially for propeller-blade bolts, air pump and condenser bolts and parts requiring strength and incorrodibility. If properly heat treated, the material is suitable for use in automatic or screw machines. It is supplied in rods, shapes, plates and tubing.

### **Brazing Metal**

**Brazing Metal** is used in the manufacture of flanges for copper pipe and other fittings that are to be brazed. This is not to be confused with Brazing Spelter which has a chemical analysis of about 50 per cent zinc and 50 per cent copper, or a brass which is often employed for brazing brass, copper, iron or steel and has a composition of about 80 per cent copper and 20 per cent zinc.

### **Bronze**

The bronzes are alloys consisting mainly of copper and tin. It is to be regretted that manufacturers often employ the terms Bronze and Brass indiscriminately. The terms brass (which consists mainly of copper and zinc) and bronze (which consists mainly of copper and tin) should be used in accordance with their firmly established English language meanings.

**Aluminum Bronze** is employed in the manufacture of castings such as struts, rudder frames, propeller blades, worm wheels, gears, etc., in fact, in all casings that require strength and must resist corrosion. in the manufacture of aluminum bronze.

Rolled aluminum bronze may be used for valve stems, propeller-blade bolts, air pump and condenser bolts, etc., and for all purposes requiring great strength. It possesses good bearing qualities and resists corrosion

**Gun Metal** is a bronze that was used for the manufacture of ordnance before steel became available. It is now employed extensively in valve bodies, gear wheels, bronze sleeves for propeller shafts, large bearings, pump manifolds, bolts and nuts, and in fact all miscellaneous composition castings where strength is required. Gun metal cannot be worked hot except within such narrow limits of temperature as to render the process impractical.

**Journal Bronze** is often specified for use in moving parts subject to considerable wear. It is harder than Gun Metal and is generally used in the smaller bearings. It is also employed for bushings, slippers, guide gibs and in reciprocating engines in valve crosshead bottom brasses, link block gibs and suspension link brasses.

**Manganese Bronze (Cast)** is used primarily in the manufacture of propeller blades, and propeller hubs.

**Manganese Bronze (Rolled)** is used in the manufacture of rolled round rods requiring great strength, where subject to the corrosion of salt water, valve stems, propeller-blade bolts, air pump and condenser bolts, etc.

**Phosphor Bronze (Cast)** is used in the manufacture of fittings that are exposed to the action of salt water; gears, driving and main nuts of steering gears and parts where strength, good bearing qualities and incorrodibility are requisites.

**Valve Bronze** is used extensively in the manufacture of all sizes of low pressure valve bodies and high pressure valve bodies under 4 inches in diameter. It is easier to produce sound castings with this mixture than with Gun Metal. This is probably due to the higher zinc content. Mechanical properties of Valve Bronze are usually not specified when ordering inasmuch as Gun Metal is used where great strength is required. It is suitable for use in the manufacture of castings subjected to severe stresses and the corroding action of salt water.

### **Bismuth**

The metal has a light reddish color and is so brittle that it can readily be pulverized. It is used only in alloys, usually for the purpose of obtaining a low melting point although it has a hardening effect on lead. "Wood's Metal" 50 per cent bismuth, 25 per cent lead, 12.5 per cent tin, and 12.5 per cent cadmium, with a melting point of 149° F. is the best known of the Bismuth alloys. Other alloys can be produced to obtain any desired fusing point. Such alloys may be used in connection with electric wire alarms, opening a circuit when melting, or for allowing automatic fire sprinklers to open at the proper temperature.

### **Cadmium**

A lustrous bluish-white metal. Its melting point is 500° F., specific gravity 8.6 to 8.7 and boiling point 680° F. It is used in combination with lead, tin, and bismuth to form alloys when a low fusing point is desired.

### **Copper**

A metal readily distinguished by its peculiar reddish color. It is very ductile and

malleable and second to iron in tenacity and in commercial importance. On account of its high ductility, sheet copper can readily be worked while cold into complicated shapes by means of the hammer; hammering tends to harden the metal and finally cause it to crack but annealing at a low temperature restores the original ductility. Castings of pure copper are usually imperfect; 1 per cent of boron suboxide flux added to the molten copper gives a fair casting. Copper castings are rarely used except for purposes where high electrical conductivity is required. Copper resists the corrosive action of the elements although it is attacked by ammonia and to some extent by the more common acids.

### **Copper Alloys**

Copper is the principal constituent of the various grades of brass and bronze and enters to a greater or less extent in the various alloys used for bearings. It is alloyed in varying proportions with gold and silver to increase the hardness of the resultant alloys. Uses: In addition to the use of copper in the alloys noted above, wrought copper is extensively used for electrical purposes on account of its high electrical conductivity, for tubes in feed water heaters and similar purposes where high heat conductivity is desired, and for pipes and sheathing where considerable ductility or resistance to the corrosive action of the elements is desired. The Alloys (brass and bronze) possess greater strength than copper alone, and are more easily machined, which renders them superior to copper for many purposes.

### **Cupro Nickel or Benedict Nickel**

Cupro Nickel or Benedict Nickel is employed in the manufacture of tubes for condensers, distillers and feed-water heaters. The addition of a small percentage of manganese facilitates the proper working of the alloy in ingots and under rolls.

### **Lead**

A metal of bluish-gray color and dull metallic luster. Its color turns to dull gray on exposure to air. It resists the action of most acids and the ordinary corrosive effects of air and moisture, but is readily attacked by alkalies. Has a tendency, increasing with an increase in temperature, to flow under slight pressure continuously applied and therefore must be rigidly supported to retain its shape.

### **Lead Alloys**

Lead is alloyed with tin in various proportions to form common solder, "half and half" being a standard commercial brand suitable for general use. The alloying of lead with a small percentage of antimony, makes the hardness of the alloy considerably greater than that of the lead alone, without materially affecting the other properties. Lead is alloyed in various proportions with a number of other metals to form "bearing metals"; as it possesses valuable antifriction properties but is far too soft to be used alone. From 1 per cent to 10 per cent of lead is frequently added to brass or bronze, making the material easier to work with machine tools and less likely to leak under hydrostatic pressure; it has in all cases a tendency to weaken the alloy to which it is added although with less than 2 per cent of lead there is but slight weakening of the alloy and a material increase in ease of its machining. Uses: In alloys, as noted above; in the form of sheets and pipe, lead is extensively used for handling acids as protection against acid fumes. A lead sheathing is frequently used on insulated wires and cables as a protection against the action of moisture and acids. Lead pipe is convenient for use for ordinary plumbing purposes on account of ease in

manipulation but on account of its mechanical weakness, it is inferior to iron pipe.

### **Magnesium**

A silver white metal. It is malleable and ductile. It burns in air with intense white light. It is used in the form of ribbon or powder for flashlights and signals.

### **Mercury**

A silver-white metal. It is a liquid at ordinary temperature, but freezes at  $-39^{\circ}$  F., and boils at  $680^{\circ}$  F. It is not affected by the atmosphere at ordinary temperatures but oxidizes when near its boiling point. It is tarnished by sulfur fumes and by dust, but may be cleaned by straining through cloth or chamois skin. It readily amalgamates with gold, tin, lead, zinc, and to a less extent copper and most of the other metals except iron and platinum, causing it to tarnish and lose its perfect fluidity. Glass containing a considerable amount of lead will affect mercury if left in contact with it for a long period.

### **Nickel**

A metal with a white luster, strongly resembling silver in appearance and not tarnishing under ordinary atmospheric conditions. It is attracted by a magnet, but less strongly than iron and can retain magnetism. It can be used in castings or rolled into sheets or rods.

### **Nickel Alloys**

Nickel is a very important constituent of many alloys, in most cases having a tendency to impart ductility, strength and toughness to the alloy "Nickel Steel" and "Chrome-Nickel Steel" (See Steel) are of the greatest commercial importance. It is used in the manufacture of instruments of various kinds and as a "resistance metal" in electrical work. "Resistance Metals" include a number of alloys of nickel with copper, iron, chromium, or manganese. They are used for electrical purposes and are generally superior to German Silver for such use. "Nicrome" or "Nickel-Chromium Alloy" is used principally on the resistance element of electrical heating apparatus; it possesses high resistance and will stand long and repeated heating to a white heat without oxidation or other changes in its characteristics. Uses: In addition to its use in alloys, and for nickel plating, by the electrolytic process; pure nickel is used to a considerable extent where ability to stand high temperature and corrosion, combined with great strength is desired. Among these uses are valve stems, seats, and discs for use with high pressure superheated steam; and keys and bolts in locations where some other metals have failed.

### **Zinc**

A metal of bluish-white color that tarnishes and whitens slightly on exposure to the air. Zinc is but slightly attacked by the action of air and moisture but is attacked readily by acids or alkalies.

### **Zinc Alloys**

Zinc is used principally for the manufacture of brass, bronze, and bearing metals; for which purpose it is alloyed with copper, tin or other metals. On account of its volatility there is always a loss of weight during the hot galvanizing process and in melting brass or bronze. Uses: Aside from its use in alloys, zinc is used principally for

galvanizing iron or steel, as described under galvanizing. The practice of suspending slabs of zinc in steam boilers to prevent corrosion of the boiler through electrolytic action has been found to be of but little value.

**Metal Furniture.** Berths, cabinets, lockers, etc., made of light metal. They are often decorated and finished so that they resemble wood.

**Metal Polishers.** Men who put the required finish or polish on parts of machines, fittings, etc., by means of a power-operated wheel turned at high speed and known as a buffer.

**Metal Specialties.** Includes such items as the end strips for linoleum and matting, moldings, tubes, special shapes, etc.

**Metallic Cabinet.** See Cabinet.

**Metallic Flooring.** See Flooring, Metallic, and also Gratings.

**Metallic Paint.** See Paint.

**Meter, Electric.** A measuring instrument for determining the magnitude or relation of the quantities in an electric circuit

**Microfarad.** The practical unit of electrical capacity. It is the millionth part of the farad.

**Middle Body.** That portion of the ship adjacent to the midship section. When it has a uniform cross section throughout, its length its waterlines being parallel to the centerline, it is called the parallel middle body.

**Middle Line.** Sometimes used in lieu of centerline, particularly with reference to bulkheads, floors or other transverse members of the vessel.

**Midship Deep Tank.** A compartment located near the middle length of a vessel used for carrying liquid cargo, fuel or water ballast, and having bulkheads and flats for its sides and top, as distinguished from a double bottom tank having the inner bottom for its upper limit.

**Midship Floor.** See Floor, Midship.

**Midship Frame.** See Frame, Midship.

**Midship Section.** The vertical transverse section located at the mid-point between the forward and after perpendiculars. Usually this is the largest section of the ship in area.

**Midship Section Coefficient.** See Coefficient, Midship Section.

**Midships.** Same as Amidships.

**Mild Steel.** See Steel and Iron.

**Mile, Nautical.** See Nautical Mile.

**Mill Men.** Men who work in a saw mill operating wood working machines.

**Milling Cutter.** A tool usually of cylindrical form, but also shaped to meet requirements, having teeth or edges for cutting. Milling cutters are mounted on an arbor or have an integral shank for holding them in a machine.

**Milling Machine.** A machine in which the tool or cutter rotates and the work is fed automatically in the required direction. The cutter has a number of teeth or cutting edges which successively mill away the metal as the cutter rotates.

**Milling Machine, Key Seating.** A machine designed for milling keyways. Keyways located in shafts, etc., where the ends are not open, are generally milled.

**Milling Machine, Universal.** A milling machine, the work table and feeds of which are specially arranged for doing all classes of plane, circular, helical, index or other milling.

**Milling Machine, Vertical.** A milling machine designed with a vertical spindle for holding the cutter.

**Miter Gear.** A bevel gear wheel, the sides of which are beveled to an angle of 45°.

**Mitered.** The operation of making a joint between two timbers, that lie at right angles to each other, by cutting the ends of each to an angle of 45°.

**Mold.** To draw out to full size the lines of a vessel or part of its structure; a pattern or form built up to show the contour or shape of anything.

**Mold, Beam.** A pattern showing the curvature, commonly called camber, of the beams for a deck.

**Mold Loft.** A space used for laying down the lines of a vessel to actual size and making templates therefrom for the structural work entering into a hull. The second floor of a large building is usually used as a mold loft, the floor being cleared and planed true. A vessel's lines are drawn in and faired on the floor, the body lines being scribed in to insure their being preserved until the structural work is completed. Practically all the templates for shaping and laying out the structural work in a ship are made in the mold loft from the lines on the floor. Upon the completion of the mold loft work on a vessel the floor is planed clean before laying down the next ship. On account of the desirability of having the mold loft as level as possible and to prevent warping it generally consists of two layers of planking laid diagonally and opposite. This method prevents the floor from warping, provides a top facing that may be renewed after being planed thin and on account of the seams running diagonally there is less likelihood of the lines laid down following a seam in the floor.

**Mold, Skeleton.** A template or pattern, made up of open framework instead of solid, to show the outline of some part.

**Molded Breadth.** The ship's maximum breadth measured to the outside or heel of frame bar and occurring generally, though not always, at the midship section.

**Molded Depth.** The vertical distance from the base line to the molded line of main deck at side measured at the midship section.

**Molding.** Ornamental strip either of wood or metal used for finishing purposes.

**Molding, Knuckle.** A batten or strip of wood or steel usually cut to a half round cross-section and used to cover the knuckle line.

**Molding Machine.** A machine for making wood molding. The knives are usually attached to a cutter head carried on a horizontal spindle which is supported over the work table. Rolls and springs are provided for feeding the work to the machine and holding it in place during the operation.

**Molding Machine, Variety.** A wood working machine designed to cut moldings on the edges of the work. The cutting tools or knives for this type of machine are carried on a vertical spindle projecting through the work table and the work rests on the upper surface of the table and is fed to the cutters by hand.

**Molding of a Floor.** Its depth.

**Molding of a Frame.** The measurement of the athwartship flange or web of a frame.

**Molding of a Keel.** Its depth, or dimension perpendicular to the bottom line.

**Molding of a Keelson.** Its depth.

**Molding of a Stem.** Its depth or dimension fore and aft.

**Molding of a Sternpost.** Its depth or dimension fore and aft.

**Moment.** The moment of an elementary mass about a plane is the product of the mass times its algebraic distance from that plane. The algebraic distance is plus when on one side and minus when on the other side of the reference plane. The moment of a body about a plane is the algebraic sum of the moments of the elements of mass constituting that body. If the body is of infinitesimal thickness, the reference plane becomes a line, which line is termed the axis of moments. If now the mass of elementary thickness be assumed of uniform density throughout, the conditions for considering geometrical moments of plane areas are fulfilled. Geometrical moments of plane areas are measured in units of area times units of length, no account whatsoever being taken of mass. Likewise, the geometrical moment of a volume is measured in units of volume times linear units, the volume being considered of uniform density, but no definite value being assumed. The moment of any body or volume about a plane or of any area about an axis is numerically equal to the product of the mass of the body or of the volume or area times the algebraic distance of the reference plane (or line) from the center of gravity of the body (volume or area). The moment of a force about any point is the product of the force times the distance of its line of action from the point. The moment of a force is measured in units of weight times units of distance as foot tons or foot pounds.

**Moment of Inertia.** The moment of inertia of an elementary mass about a plane or an axis is the product of the elementary mass times the square of its distance from the reference plane or axis. The moment of inertia of a body about a plane or an axis is the sum of the moments of inertia of all its elements of mass about the reference plane or axis. The moment of inertia of a body about an axis is ordinarily termed its polar moment of inertia. If the body is of an indefinitely small and uniform thickness and is of uniform density, the conditions are fulfilled for considering the geometrical moment of inertia of a plane area. Under these conditions the reference plane becomes a line termed the axis, and in the case of the polar moment of inertia the

axis becomes a point. Geometrical moments of inertia of plane areas are measured in units of area times linear units squared. In a similar manner geometrical moments of inertia of volumes are measured in units of volume times linear units squared. The moment of inertia of any body (volume or area) about a plane (or axis) is equal to the mass of the body (or volume or area) times the square of the distance between the reference plane (or axis) and a parallel plane (or axis) through the center of gravity of the body (volume or area) plus the moment of inertia of the body (volume or area) about the parallel plane (or axis) through its center of gravity.

**Moment of Inertia of Section.** The sum of the products formed by the multiplication of the mass of every particle of a material system by the square of its distance from a straight line known as the axis.

**Moment to Alter Trim.** The moment, i. e., the weight times the distance which it is moved which is required to effect a change in the trim of a vessel of one inch.

**Monitors.** A type of war vessel intended principally for work against shore batteries and fortifications. Its principal characteristics are moderate displacement, low speed, very low freeboard, heavy main battery guns, and good cruising radius. The modern type of heavy gun emplacement known as the turret was first used on vessels of this type.

**Monkey Forecastle.** A small forecastle. The enclosed space is generally used for the accommodation of anchor handling appliances and the deck proper for the stowage of the anchors themselves.

**Monkey Tail.** A term applied to a curved bar fitted to the upper, after end of a rudder and used as an attachment for the rudder pendants.

**Monorail Hoist.** A type of hoisting gear, usually electric, designed to travel along a single overhead track.

**Mooring.** A term applied to the operation of anchoring a vessel in a harbor, securing her to a mooring buoy or to a wharf or dock by means of chains or ropes.

**Mooring.** To make a vessel fast to a buoy, quay or wharf or by anchoring. Technically, a vessel is moored when she has two anchors down at a suitable distance apart with such a length of chain on each that she is held with her bow approximately stationary on a line between them, although allowing the stern of the vessel to swing with the tide and wind.

**Mooring Anchor.** See Anchor, Mooring.

**Mooring Bitts or Bollards.** See Bitts, Mooring.

**Mooring Buoy.** See Buoy, Mooring.

**Mooring Machine.** A term applied to a machine that is similar in construction to a winch and which is used for the purpose of docking and warping vessels. Automatic control of the tension in the mooring lines to take care of the change in trim, draft, and the tides are obtained in some makes of these machines.

**Mooring Pipe.** A round or oval casting or frame inserted in the apron plate or bulwark plating of a ship through which the mooring chains, hawsers or warps are passed.

**Mooring Staple.** A single or double ring shaped fitting attached to the shell of a ship for the purpose of securing mooring lines.

**Mooring Swivel.** A device generally used by men-of-war in mooring to prevent a foul hawse. The cables are disconnected and shackled to the swivel just forward of the stem. When the ship swings the swivel turns and the cable is kept clear. The swivel is similar to the usual form, but larger and heavier, and is fitted at either end with two links and shackles for attaching to the cables.

**Moorings.** Heavy chains permanently anchored in a harbor to which vessels may ride. To these are attached buoys having chains of the proper length and strength to haul the fast on board through the hawse pipes.

**Mortising Machine.** A wood working machine in which an auger and a chisel are worked automatically in performing the operations necessary to produce the square or rectangular mortise usually employed in wood work.

**Motor Boat.** Any vessel propelled by an internal combustion engine.

**Motor, Compound.** A direct current motor which has both a shunt and series field coil.

**Motor, Electric.** A machine which transforms electrical energy into mechanical energy. Lloyd's Rules suggest that great care should be taken that generators, motors and electric leads on board ship are not located in such a place that they will influence the compasses.

**Motor Generator Set.** A combination consisting of an electric motor and generator on the same shaft.

**Motor, Main.** The large motor direct connected to the line shafting in a vessel fitted for electric drive.

**Motor, Series.** A direct current or alternating current motor in which the field coil is connected in series with the armature winding, thus allowing the armature current to flow through the series field. The high starting torque and the variable speed of the direct current motor make it specially suitable for cranes and traction purposes.

**Motor Ship.** A ship driven by some form of internal combustion motor. In its broad sense the term may be considered to include small vessels driven by gas or gasoline engines. It is generally applied, however, to slow cargo vessels having lengths up to five hundred feet and driven by oil engines. For this service oil engine installations have the following advantages over steam or electrical machinery: The elimination of boilers, stoke holds, and coal bunkers with a resultant increase in cargo space. Greatly decreased consumption of fuel. Decrease in the size of operating force with resultant saving in wages. Reduction in machinery space temperatures with resulting increase in comfort and efficiency of operating force. During recent years this type of ship has increased in popularity largely on account of the successful operation of ships already in service.

**Motor, Shunt.** A direct current motor in which the field coil is shunted across the armature winding. The speed of a shunt motor is practically constant from no load to full load.

**Motor, Synchronous.** An alternating current motor, the speed of which bears a

certain fixed relation to the frequency of the circuit independent of the load on the motor. Such a motor must be brought up to synchronous speed by external means or by a special winding before the field winding is energized.

**Mouillage.** A French term applied to a vessel's berth in a harbor.

**Mouse a Hook.** To pass several turns of wire or small stuff around the point and back of a hook to prevent its unhooking in lowering or canting.

**Mousing.** The small stuff or wire used to mouse a hook.

**Movable Propeller Blades.** Propeller blades cast separate from the boss and attached thereto by bolts. These bolts are sometimes worked in such a manner as to permit of a slight adjustment of the pitch of the blade.

**Muck Bar.** Described under Steel and Iron.

**Mud Drum, Boiler.** See Boiler, Mud Drum.

**Mudhole.** A handhole in the mud drum of boilers to provide access for cleaning purposes.

**Mullion.** A member running parallel with the stiles on a panel door used to receive the inner edges of the panels where two or more panels are used.

**Mult-au-matic.** An automatic machine designed for boring, facing, turning or threading operations either singly or in combination.

**Mushroom Anchor.** See Anchor, Mushroom.

**Mushroom Ventilator.** A ventilator shaped like a mushroom, and designed so that the air will be drawn up under the overhanging umbrella of the mushroom and thence into openings into the vertical pipe leading down into the vessel. The object of the mushroom is to permit access of air but prevent access of water.

## N

**Natural Ventilation.** See Ventilation, Natural.

**Nautical Mile.** A distance approximately equal to 6,080 feet, or exactly one-sixtieth of a degree on the equator.

**Naval Architect.** Primarily, one responsible for the design and alteration of ships or for the investigation and carrying out of important projects in connection therewith. Frequently he is charged with responsibility for the maintenance of vessels in service, for valuation proceedings, for the construction of new vessels, etc., though these duties do not fall strictly within his province. The Naval Architect is responsible for the strength, stability, speed, trim and weight of the vessel in hand. It is, therefore, necessary that he should have an adequate knowledge of the principal items entering into the vessel such as machinery, cargo, fittings, etc., although he is concerned with the details of hull, fittings, etc., only.

**Naval Constructor.** Primarily, one responsible for the building and maintenance of ships or for the investigation and carrying out of important projects in connection

therewith. He is sometimes charged with responsibility for the design of new vessels and for the alteration of those already in service. The Naval Constructor is responsible for the proper interpretation of plans and specifications, for the fabrication of the vessel's structure, installation of fittings, and testing of parts, systems and equipment in accordance with the specifications and the best practice both as to general intent and as to detail.

**Navigating Bridge.** See Bridge, Navigating.

**Navigating or Flying Bridge.** See Bridge, Navigating.

**Navigraph.** A type of Sextant.

**Navisphere.** A navigational celestial globe used in sailing schools in the late 19<sup>th</sup> and early 20<sup>th</sup> century, also sometimes employed on ships for quick identification of the stars.

**Needle Valve.** See Valve, Needle.

**Net Tonnage.** See Tonnage, Net.

**Netting.** Nets made of either fiber or wire rope and used as a covering for hawse pipes, chock openings, etc., as landings in cage masts, and under spars in lieu of foot-ropes.

**Neutral Axis.** Consider the cross section of a beam, girder, or ship which is stressed by bending. The extreme fibers on one side are in compression while the extreme fibers on the other side are in tension. At some axis between them exists neither tension nor compression. This is termed the neutral axis for the section. The neutral axis passes through the center of gravity of the section.

**Neutral Equilibrium.** See Equilibrium, Neutral.

**Newel Post.** An ornamental upright pillar about which winding stairs are formed.

**Nibbing Plank.** See Plank, Margin.

**Nipple.** A piece of pipe, having an outside thread at both ends, used for making pipe connections. Close nipples are those that are threaded throughout. Short nipples are those having a small amount of unthreaded surface between the threaded ends. Shoulder nipples are those having a shoulder between the two pipe threads. Sub-nipples are those having different threads on the ends. Long nipples are those having a length of from 4 to 12 inches. Reducing or swaged nipples are those having one end smaller in diameter than the other.

**Nocturnal.** A navigational instrument of metal or wood for observing certain stars relative to the pole star in Ursa Minor, and thus discovering the hour at night.

**Non-Condensing Engine.** See Engine, Non-Condensing.

**Non-return Valve.** See Valve, Non-Return.

**Nosing.** The molding or part of the tread of a staircase which projects over the riser.

**Nozzle, Boiler.** A fitting with a finished face and fitted with stud bolts for the attachment of a pipe line to a boiler.

**Nozzle, Turbine.** See Turbine Nozzle.

**Nut Facing Machine.** A machine designed to automatically face and machine finish nuts.

**Nut Machine, Hot Press.** A machine designed to automatically heat and forge nuts from bar stock.

**Nut of Propeller Shaft.** A nut attached to the after end of a propeller shaft to prevent the propeller from backing off.

**Nut Tapper.** A machine similar in design and operation to a drilling machine, provided with tools for tapping the thread in nuts. Such machines are made with single or multiple spindle.

## O

**Oakum.** A substance made from soft vegetable fiber such as hemp and jute impregnated with pine tar. It is principally used for caulking the planking on wood decks of steel vessels and for caulking all the planking on wood ships where watertightness is desired, It is also used for caulking around pipes.

**Oakum Spinners.** Men who take the bulk oakum from the bales and roll or spin it into a loose or soft rope, called a thread, of the proper size to allow it to be driven into the seams between the planks.

**Octant.** An instrument for measuring angles, with a graduated arc of 45°.

**Offing.** That distance out from shore which permits the proper maneuvering of a vessel without danger of her taking the ground or of encountering other obstacles to her freedom of movement.

**Offset.** A term used by draftsmen and loftsmen for ordinate to ship's curves. See Joggle, for its meaning in structural work.

**Ohm.** A practical unit of electrical resistance. It represents the resistance of a column of pure mercury 106.3 cm. long, of uniform cross section and weighing 14,4521 gm. at 0° C.

**Ohm's Law.** The current in a direct current circuit is proportional to the e. m. f. and inversely proportional to the electrical resistance (i.e., the current is equal to the voltage divided by the resistance).

**Oil Burner.** A device for vaporizing or atomizing oil so that it burns like a gas.

**Oil Cooler, Lubricating.** A device on the order of a condenser, except that the cylinder is installed with its axis vertical. Numerous brass tubes, through which cold water circulates, pass between the top and bottom tube sheets and the oil is cooled by coming in contact with their cold surfaces. Baffles are generally installed compelling the oil to pass back and forth among the cold tubes in traveling from the top to the bottom.

**Oil, Creosote.** An oil obtained by the redistillation of crude tar which, in turn, is derived as a distillate in the destructive distillation of wood.

**Oil Forge.** A forge in which oil is used as fuel.

**Oil, Fuel.** A heavy mineral oil used extensively in place of coal for firing boilers.

**Oil Furnace.** See Furnace, Oil.

**Oil, Hard Wood.** Oil obtained from the tar of a hardwood by redistillation.

**Oil, Pine.** An oil, lighter than water, obtained by distillation from the crude resins and turpentine gathered from the pine tree.

**Oil Piping.** See Piping, Oil.

**Oil, Pump.** See Pump, Oil.

**Oil, Resin.** An oil obtained from resin by redistillation at high temperatures.

**Oil Service Tank.** In a lubricating oil system the tank from which the oil feed pipes lead in supplying the various journals, etc. In a fuel oil system the tank or tanks from which oil is drawn direct to the burners.

**Oil Tight Bulkhead.** See Bulkhead, Oil Tight.

**Oil tight.** Having the property of resisting the passage of oil. In shipwork this is accomplished by packing or calking after careful riveting of the joints.

**Oilers.** Members of a ship's engine room force who attend to the lubrication of all parts of the engines.

**Old Man.** A piece of heavy bar iron bent to the form of a "Z." One leg of the "Z" is bolted to the material that is to be drilled, and the drill top placed under the other leg and adjusted so the "old man" holds the drill against the material.

**On Board.** Aboard; in or on a ship, but having a different significance from "on deck" in that "on board" applies to any location in or on the ship as any of its parts, while the term "on deck" is generally limited to a location on the weather deck.

**On Deck.** On the weather deck; frequently used to imply "on duty."

**Open Bridge House.** A bridge house open to the weather at each end.

**Open Hearth Steel.** See Steel and Iron.

**Operating Gear, Turbine.** See Turbine Operating Gear.

**Ore Carrier.** A vessel designed to carry ore in bulk and similar in construction to a collier.

**Orlop Beam Stringer.** See Stringer, Orlop Beam.

**Orlop Deck.** See Deck, Orlop.

**Orlop Deck Stringer.** See Stringer, Orlop Deck.

**Orlop Deck Stringer Bar.** See Stringer, Bar.

**Orlop Stringer.** See Stringer, Orlop.

**Orrery.** A clockwork model of the planetary system, named after Charles Boyle, fourth Earl of Orrery.

**Oscillating Engine.** See Engine, Oscillating.

**Oscillation.** The roll of a ship from the extreme angular position on one end to the corresponding position on the opposite side.

**Oscillation, Arc of.** The total angle swept through by a ship in one oscillation.

**Oscillation, Period of.** The time occupied by a ship in performing one complete oscillation.

**Outboard.** Away from the center toward the outside; without the hull.

**Outboard Delivery Pipe.** See Pipe, Outboard Delivery.

**Outboard Profile.** A plan representing the longitudinal exterior of a vessel showing the starboard side of the shell, all deck erections, masts, yards, rigging, rails, etc.

**Outer Bearing.** A term applied to the bearing on the sponson supporting the outer end of the paddle wheel-shaft.

**Outer Keel.** See Keel, Outer.

**Outer Skin.** See Skin, Outer.

**Outlet Cock.** A cock or valve with a circular channel through the valve stem arranged so that a clear opening is obtained by 90 degrees rotation, located so as to drain any receptacle.

**Outermost Fiber.** In calculating the strength of vessels, that part of the vessel's strength girder which is farthest away from the neutral axis of the strength section.

**Outrigger.** A term applied to a small racing boat having the oarlocks located on framework extending beyond the sides.

**Outriggers.** A term applied to bars bolted to the outer ends of the cross-trees on each side of a mast for the purpose of spreading the stays to the topmasts. Also applied to the upper mast tables which form a support for the topping lifts operating the cargo booms.

**Outside Plating.** See Shell Plating.

**Outside Strake.** See Strake, Outside.

**Oven, Bake.** A commissary appliance used on board ship for baking bread, pastries, etc. The oven proper consists of one or more chambers externally heated, electrically or by burning coal or fuel oil.

**Oven, Core.** An oven in which cores used in foundry work are baked to insure their holding their form while pouring the molten metal.

**Oven, Drying.** An enclosure or room in which green timber is seasoned by the application of dry heat for a given period of time.

**Overflow Pipe.** A pipe fitted on a tank or compartment to permit excess liquid to escape, thus preventing undue pressure on the tank.

**Overhang.** That portion of a vessel's bow or stern which projects beyond a perpendicular at the waterline.

**Overhaul.** To repair or to put in proper condition as to overhaul a tackle. Where two vessels are going in the same direction and where one vessel is ahead of the other, the vessel behind is said to be overhauling the vessel in the lead when it is closing up the distance between the two by going at a faster speed.

**Oxter Plate.** See Plate, Oxter.

**Oxygen Compressor.** See Compressor, Oxygen.

## P

**Pacific Iron.** A fitting consisting of a Y-shaped piece hinged to a bearing pin. The inner end of a cargo boom is secured between the prongs of the Y and the bearing pin is passed through a pad eye on the mast, an eye on a mast ring or inserted through a hole in a pedestal. The cargo boom can be raised or lowered by means of the hinge and rotated by means of the pin. Also called Gooseneck.

**Packers.** Men who fit lamp wicking, tarred felt or other material between parts of the structure to insure water or oil tightness.

**Packet Bunkers.** A ready service bunker of small dimensions.

**Packing, Gland.** Packing for use in a stuffing box and against which the gland is forced. Packing material varies in character according to its use.

**Packing, Metallic.** Metal rings fitted in cylinders, cylinder stuffing boxes, etc., also bronze or white metal segments assembled in the form of an internal and external cone, fitting into each other and held in place by springs, thus floating them on the rod, to eliminate friction.

**Pad Eye.** A fitting having an eye integral with a plate or base in order to distribute the strain over a greater area and to provide ample means of securing. The pad may have either a "worked" or a "shackle" eye or more than one of either or both. The principal uses of such a fitting is that it affords means for attaching rigging, stoppers, blocks, and other movable or portable objects. Pad eyes are also known as lug pads, the two terms being practically synonymous.

**Paddle Beams.** Athwartship supporting girder at each end of the paddle box.

**Paddle Box.** A semicircular structure, placed at the stern or one on each side of a vessel, for the purpose of housing the paddle wheel.

**Paddle Box Annex.** A continuation of the paddle box structure faired into the sides of the ship and generally used for staterooms, toilets, etc.

**Paddle Box Cabin.** Staterooms or other living quarters built into the prolongation of a paddle box.

**Paddle Box Stays.** Inclined struts running from the planking or plating of a vessel to the sponson and spur beams supporting a paddle box structure.

**Paddle Wheel.** A large wheel consisting of two or more sets of arms and rims with radial boards or floats attached to the outer ends of the arms and running between the rims. The floats may be fixed in position, or feathered so that they enter and leave the water at the most efficient angles.

**Paddle Wheel, Feathered.** A paddle wheel having floats that are controlled by a mechanism so that they enter and leave the water at the proper angle.

**Paint.** A viscous or plastic mixture of solids and liquid applied in thin coats for protection or decoration or both. Paint may be defined as a close union of solids or pigments and liquids or binder.

### **Aluminum Paint**

Consists of a mixture of finely divided aluminum powder and a special vehicle containing hard varnish resin, raw linseed oil and turpentine. This paint has very good heat resisting properties and when applied to iron and subjected to a dull red heat is only slightly affected.

### **Anti-Corrosive Ship's Bottom Paint**

This paint is generally made of metallic zinc, zinc oxide, shellac, alcohol, pine tar and turpentine and is designed to insulate the metal in the anti-fouling coat from the steel plating, preventing corrosion and pitting. Anti-corrosive and anti-fouling ship's bottom paints differ radically from oil paints in that the vehicle portion consists of shellac, alcohol, and pine tar solution. This produces a very rapid drying paint which can be submerged a few hours after application. Anti-corrosive ship's bottom paint is designed to prevent corrosion from electrolysis. This coat does not offer resistance to the flow of electric current but contains a metal which is electropositive to iron. Electrolysis decomposes this metal and deposits it on the steel hull. Insulation or protection from electrolysis is not obtained by paint which offers resistance to the flow of electric current since abrasion and movement of the plates will prevent the maintenance of a continuous film necessary to prevent the passage of current. A number of proprietary paints are on the market and are reported as giving satisfactory service. Anti-corrosive paint also provides a solid base for the anti-fouling paint.

### **Anti-Fouling Ship's Bottom Paint**

This paint is intended to prevent marine growth from adhering to the underwater surface of the hull. This is effected by the presence of a poisonous compound in the film, usually mercuric oxide, copper oxide, copper cyanide, etc. An efficient antifouling paint is so designed that it will exfoliate, thereby presenting new surfaces at regular intervals, In this class falls the so-called copper paint for wooden hulls. This paint usually contains a substantial percentage of copper oxide ground in a special vehicle.

### **Asphalt Solution**

Is a viscous asphaltic solution in mineral spirit or turpentine substitute and is applied to metal surfaces as a priming coat for the bituminous cement and enamels. The enamel is solid and is applied hot ranging in thickness from 1/16" to 1/4". Asphaltic

compounds are specially prepared to resist fairly high temperatures without running or sagging, and low temperatures without being unduly brittle. Asphalt enamels made of a properly balanced mixture of asphalts or tars having various melting points and other specific characteristics, admixed with rosin, Portland cement and mineral spirits produce compositions which have been found to give excellent service. Bituminous compositions are usually applied to places with difficult access upon completion of new construction

### **Boottopping Paint**

Boottopping paint is generally a mixture of zinc oxide, lamp black and a special varnish. This paint is applied at the waterline of steel vessels, and will last for several months, whereas an ordinary oil paint would be washed off or destroyed in a few days by the alternate action of the water and the air. The special varnish used in the preparation of boottopping paint requires careful consideration and should be tested for its suitability in the manufacture of this type of paint. Tung oil varnishes are very water resistant but have a tendency to thicken up or "liver" when mixed or ground in zinc oxide.

### **Canvas Preservatives**

White and tinted – is usually a mixture of crude paraffine, paraffine oil, turpentine substitute and kerosene; if a tinted preservative is desired a quantity of zinc oxide and sufficient tinting material to produce the desired color is added. This type of preservative can be applied by painting with a brush, spraying with an air gun or by dipping the fabric.

### **Cork Paint**

Known also as under cork, consists of varnish, a small quantity of linseed oil and drier and a good grade of whiting. This mixture is painted on the surface to be corked and allowed to become tacky. Ground cork of fairly large grain is blown or pressed on and the paint allowed to set hard. Cork paint is usually applied to interior surfaces in living quarters, store rooms, etc., which become chilled by the conduction through the metal, and sweating occurs due to the extremes in temperature; over the cork the usual interior finishing paint is applied.

### **Deck Paint**

This type of paint is usually prepared with spar varnish, turpentine drier and coloring pigment, which dries rapidly forming a hard water resisting coating.

### **Linoleum Cement**

Is usually a mixture of shellac, crude rubber, whiting, alcohol and gasoline and in some respects is similar to certain brands of marine glue on the market. This cement is used to bind the linoleum to the deck or other surfaces without the use of fastening appliances. It is of such a character that it allows the linoleum to spread without buckling or injury.

### **Metallic Oxide of Iron Paints**

Are dark in color, usually red or brown, and when properly prepared are extremely durable. Red lead or zinc chromate or both of these pigments when added to an iron oxide base produces an excellent metal preservative paint which will give service

equal to red lead. In connection with the application of paints intended for use as metal preservatives, it will readily be seen that an ordinary paint giving good protective service on wood will not be satisfactory to iron and steel, since the characters of the two surfaces are entirely different, steel presenting a relatively smooth, non-porous surface which makes it necessary for the excess oil or other vehicle to harden by oxidation or evaporation, whereas wood, having many pores, absorbs the excess oil which amalgamates with the fibers of the wood forming an inseparable bond. In this connection it is recommended that skilled labor be employed for the application of paint, and especially paint intended or designed for metal surfaces. Many failures of paint can be traced to careless handling or improper application.

### **Priming Paint**

Red lead, free from coarse vitrified particles mixed with pure linseed oil makes the best priming coat for iron and steel. Consumers are cautioned, however, not to purchase or use red lead paste which has been ground sufficiently long enough to over oxidize the oil. When pure dry red lead (containing a substantial amount of litharge as a natural constituent) is mixed with pure raw linseed oil within 18 hours before application it can be applied to iron and steel without the addition of a thinner or drier. This practice is not recommended, however, since the drying conditions usually encountered in marine painting are not very favorable and the addition of a thinner and drier will enable the operator to apply a thin uniform coat which will dry rapidly, forming a very tenacious, hard, elastic weather resisting film. Rust resisting or preservative coatings are usually dark in color, since the white pigments (basic carbonate, basic sulphate white lead and zinc oxide) have certain physical and chemical characteristics which make them unsatisfactory for priming paints for iron and steel.

### **Smoke Stack Paint**

Smoke Stack Paint is usually made of zinc oxide, white lead, litharge and Damar varnish thinned with kerosene and a substantial amount of dryer added. This paint is very resistant to high temperatures. Another type of smoke stack paint is made as follows: white lead, silica, litharge, boiled linseed oil and mineral spirits. This mixture is tinted to the desired shade and applied in the usual manner.

### **Spar Varnish**

It is pale in color, very rapid drying, water resistant, elastic and durable; it is used to coat the "bright work" of ships and due to its rapid drying qualities it is frequently used on repair work. This varnish can be brushed on a surface and spread out to a very thin film which accounts for its rapid drying properties. It is somewhat deficient in durability, however, owing to the thinness of the film.

### **Pigment**

The solid portion of paint usually white lead, red lead, oxide of zinc, oxide of iron, Van Dyke brown, Venetian red, Indian red, vermilion, Prussian and Chinese blue, ultramarine blue, blacks and lakes. In addition to the above mentioned pigments, the following Extenders are used: Barytes, silica, Asbestine, aluminum silicate, calcium carbonate, etc. Extenders have specific value and are used to reduce the spreading power and increase the thickness of the paint film.

## **Pigments – Color**

Color pigments are used for tinting the base pigment and are usually as follows:

- (a) Natural Earth Colors: Ochres, siennas, umbers, metallic brown, Indian red and mineral blacks.
- (b) Chemical colors: Prussian and Chinese blue, lead chromate, chrome green, ultramarine blue, vermilion, etc.
- (c) Carbon blacks made by carbonizing animal and vegetable substances.

### **Basic Carbonate – White Lead**

Corroded white lead was first commercially produced in the United States about 100 years ago. This pigment is manufactured by two principal processes, known as the Dutch process, or stack method, and the chamber process, or quick method. The Dutch process probably produces about 75 per cent. of the corroded white lead used in the United States. Briefly described, this method is as follows:

A series of clay pots surrounded with tan bark and containing dilute acetic acid (vinegar) are filled with discs of metallic lead. Carbonic acid from the fermenting tan bark acts on the lead, converting it into hydrated carbonate of lead. This process requires about 90 days. In the Chamber process the dilute acetic acid acts on the finely divided metallic lead in the presence of carbon dioxide gas, producing a white pigment similar in every respect to the Dutch process white lead.. This process requires from one to two weeks.

### **Basic Sulphate – White Lead**

Sublimed white lead or basic sulphate white lead is obtained from Galena, a lead sulphide ore. The mined ore is roasted and the fumes given off combine with the oxygen of the air and form a white powder. Basic sulphate white lead, a product of sublimation, exceeds the basic carbonate in fineness. It is considered by some to be superior to basic carbonate white lead in that it is relatively non-poisonous and resists the darkening action of sulphur gas to a great extent.

### **Zinc Oxide**

This pigment has been commercially used as a paint pigment for a short time. It has, however, assumed a very important position in the paint industry and is a pigment of exceptional merit. Paints containing zinc oxide in appreciable quantities dry with a hard enamel-like surface, which is highly impervious to water. It is therefore very desirable in the manufacture of marine paints. In the manufacture of zinc oxide, the mineral is first mixed with powdered coal and spread on a bed of glowing coal. Air is blown through the charge volatilizing the zinc in the ore. This vapor is carried into the upper part of the furnace and converted into oxide of zinc by contact with the atmosphere. This oxide is drawn through cooling pipes, being finally deposited as an extremely fine powder in fabric bags.

### **Red Lead**

This pigment is prepared by heating litharge to approximately 700 degrees Fahr. in contact with the air. It then takes up more oxygen and turns red. The composition of red lead varies from 65 per cent practically pure red lead, little or no litharge being

present. The latter type is more expensive to make and is therefore sold at a higher price. Red lead is used extensively for the protection of metal and is usually applied as a priming coat.

### **Venetian Red**

A brick colored pigment in which the ferric oxide content varies from 20 per cent to 40 per cent, the balance being calcium sulphate, also used in the manufacture of metal paints.

### **Indian Red**

An earth pigment analyzing from 75 per cent to 90 per cent, the remainder being silica. Indian red when mixed with pure raw linseed oil and drier produces an excellent paint and tinting pigment.

### **Vermilion**

A precipitated dye on a lithol barium or orange mineral base used for striping and tinting purposes, being one of the so-called permanent reds.

### **Sienna**

This is a natural earth pigment, which contains as high as 70 per cent ferric oxide, the remainder being silicate of aluminum, or clay. The best grades are obtained from Italy, and are used largely for tinting purposes and in the making of stains.

### **Umber**

This is a natural earth pigment very much darker than sienna. This pigment is obtainable in commercial quantities in the United States, but the best grade comes from the Isle of Cyprus. It is used for tinting and staining purposes.

### **Ultramarine Blue**

Ultramarine blue in its natural state (lapis-lazuli) is found in Tibet, Prussia, China and in the Andes of South America. It is usually found in the form of pebbles. This natural pigment is not used in the paint industry on account of its harsh granular texture. Artificial ultramarine blue is a chemical color and has great tinting power, is soft in texture and relatively opaque.

### **Prussian or Chinese Blue**

This is a dark blue pigment which is a ferro-cyanide of iron and is prepared by chemical precipitation. This blue cannot be used in the tinting of white lead paints successfully. When Prussian blue is used for tinting white lead paints, it is acted upon and a chemical change in its composition takes place.

### **Chrome Green**

This color is a mixture of Prussian blue and Chrome Yellow (lead chromate) and unless chemically pure is found mixed with an inert base such as barytes. Chrome green contains Prussian blue which under goes a chemical change when used for tinting white lead paints. Salt atmosphere attacks chrome green and bleaches it.

### **Chromium Oxide**

This is a permanent green but is seldom used in the manufacture of commercial paints. It is used in special marine and railway paints and is unaffected by salt atmosphere or the white lead pigments. It is used on vessels in repainting the receptacle on which the port light rests.

### **Lamp Black**

Lamp black is the condensed smoke of petroleum oils and is considered one of the most permanent blacks used.

### **Carbon Black**

Carbon black is similar to lamp black in that it is intensely black in color. Its staining power is very great and due to its extreme fineness fairly large amounts of pigment have a tendency to separate from the paint and rise to the top of the liquid thereby making it difficult to incorporate and produce a uniform tint.

### **Metallic Zinc**

Metallic zinc used in the paint industry is in finely divided form and is used in the manufacture of anti-corrosive ship's bottom paint.

### **Shellac**

Shellac is the exudation deposited by a lac bug; it is soluble in alcohol and when cut in this solvent in the proportion of 2½ lbs. of gum shellac to one gallon of alcohol a good working shellac varnish is produced. Shellac varnish is applied to furniture, and to cover decks where the application of paint or varnish is not practical on account of the length of time required in drying. The use of shellac on woodwork exposed to the water is not recommended since the heat of the sun's rays will soften shellac and form blisters.

### **Vehicle**

The spreading medium or liquid portion of a paint which combines or holds in close union the solids or pigment portion. Linseed Oil is usually used as a base to which is added turpentine mineral spirits (or turpentine substitute) and a liquid drier.

### **Linseed Oil**

Linseed Oil is obtained from the flaxseed, which grows in practically all parts of the world. It is of interest to know, however, that oil extracted from the flaxseed from the various sources varies greatly in quality. South American flaxseed produces a slow drying oil which forms a relatively soft film; North American flaxseed yields a higher percentage of oil, which dries more rapidly, forming a very tough, elastic, hard film. Oil obtained from India flaxseed varies in its drying properties, but is more desirable than South American oil and is generally preferred to North American oil for varnish making, since it resists discoloration on prolonged heating.

### **Turpentine**

Turpentine is obtained from the pine tree by direct or steam distillation of the sap collected from the growing tree. Wood turpentine is produced by steam distillation of finely cut or macerated pine wood. The lower grades of wood turpentine have an objectionable, sharp odor and are not desirable in the manufacture of interior paints.

Turpentine has a high oxidizing value which causes the rapid drying of paints and varnishes. Turpentine is used to reduce the consistency of the oil paint so as to allow it to be spread in thin fine coats.

### **Driers**

In most cases the drying effect of the pigment is not sufficient and liquid dryers are added to accelerate the drying. The most commonly used dryers are composed of lead, manganese and cobalt or a mixture of these metals combined with pure linseed oil and a hydrocarbon solvent.

**Painter.** A length of rope secured at the bow of a small boat for use in towing or for making it fast. It is sometimes termed a bow-fast.

**Painters.** Inside workmen who mix paint, also those who paint, varnish and polish joiner work in the shop. Outside, workmen who apply the paint aboard ship.

**Pall, Pawl.** A term applied to a short piece of metal hinged to engage in a revolving mechanism for the purpose of preventing recoil. Usually fitted to capstans, winches and windlasses.

**Palm.** The fluke, or more exactly, the flat inner face of the fluke, of an anchor; a sailmaker's protector for the hand used when sewing canvas. It consists of a strong canvas or leather strap to which is secured a flat metal disc thimble to drive the needle through the canvas; a flat surface at the extremity of a strut or stanchion for attachment to plating, beam or other structural member.

**Panel.** The part of a door or bulkhead, the edges of which are inserted in the stiles and rails.

**Panel, Flush.** A panel, the surface of which is flush with the surface of the stiles and rails.

**Panel, Molded.** A panel which is set in and the stiles and rails projecting beyond the surface.

**Panel, Raised.** A panel, the surface of which projects above the surface of the stiles and rails.

**Panel Raiser.** A wood working machine designed to dress down the edges of the work so as to leave a raised panel.

**Panting.** The in and out vibrations of the frames and plating. Most noticeable in the bow and stern.

**Panting Beams.** See Beams, Panting.

**Panting Stringer.** See Stringer, Panting.

**Parallel Middle Body.** That portion of a vessel's body throughout the extent of which the cross sections retain the same area and shape as the midship section.

**Parallel Ruler.** This was used for plotting a course on a sea chart with a compass card.

**Parbuckle.** An improvised purchase used in hoisting and lowering casks or other

cylindrical objects where a tackle or crane is not available. The middle of a rope is secured above the object to be hoisted or lowered, the two ends passed over and under it and then brought back again. Hauling on the two ends raises or lowers the object as desired. This method is extensively used in handling shells in the turrets of men-of-war. The shells being stowed upright, base downward, on the turret floor are easily parbuckled horizontally in the bight of a single rope.

**Parceling.** Narrow widths of canvas which when tarred are wound around ropes, following the lay and overlapping in order to shed water. The parceling is applied after worming preparatory to serving.

**Parent Form.** A ship's form from which a series of forms are derived by the systematic variation of certain characteristic features.

**Parrel.** A rope or metal collar attached to a band on either side of a yard near its middle and encircling the mast. By this means the yard is attached to the mast though allowed a vertical movement.

**Part Double Bottom.** Descriptive of a vessel which is fitted with a double bottom extending throughout a portion of her length only.

**Partial Bulkhead.** See Bulkhead, Partial.

**Parting Strip, Window Frame.** The narrow strip fastened to the inside of the stiles for the purpose of dividing the paths of the outer and inner sashes or blinds.

**Partner, Mast.** See Mast Partner.

**Partner Plate, Rudder.** A term applied to plates fitted around the rudder stock where it pierces a deck.

**Passers.** Usually boys who receive the heated rivets from the heaters and deliver them to the holders-on.

**Passing Tongs.** Long handled tongs used by rivet passers to handle the heated rivets.

**Pattern Makers.** Workmen who fashion the wood forms or patterns for the use of the foundrymen in setting up molds. Inside pattern makers prepare those patterns which can be made from plans such as machinery parts. Outside pattern makers prepare patterns for those castings which are to be fitted to the hull such as stems, stern posts, and hawse pipes.

**Paulin.** See Tarpaulin.

**Pawl.** A small part or member of a mechanism used to prevent overhauling. Pawls engaging ratchet wheels are fitted on windlasses, capstans, etc.

**Paying.** A term applied to the operation of filling the seams between planks, after the calking has been inserted, with pitch, marine glue, etc. Also applied to the operation of slackening away on rope or chain.

**Peak.** A term applied to the outer and upper end of a gaff.

**Peak, Fore or After.** The space at the extreme bow or stern below the decks.

**Peak, Purchase.** A tackle applied to the peak halyards to haul them taut and straighten the leech of the sail.

**Peak Tank.** A tank or tank space built into or formed in the extreme forward or after lower portion of a vessel's hull.

**Pelican Hook.** A type of quick releasing hook used at the lower ends of shrouds, boat gripes, etc.

**Pelorus.** A navigational instrument similar to a binnacle and mariner's compass but without a magnetic needle. The instrument is used for taking bearings, especially when the object to be sighted is not visible from the ship's compass. Also known as a Dumb Compass.

**Pendant.** A length of rope usually having a thimble or block spliced into the lower end for hooking on a tackle, and when suspended from a masthead, yard, or gaff, is known as a mast head pendant, brace pendant, etc.

**Pendants, Rudder.** See Rudder Pendants.

**Perfect Fluid.** A theoretical fluid without viscosity or surface tension and incapable of internal friction or of friction against any object.

**Period of Roll.** The time occupied in performing one double oscillation.

**Permeability.** The percentage of a given space which can be occupied by water. The value of this factor is of great importance in all considerations of the effect of damage upon floatability and stability.

**Permissible Length.** That length of a vessel which may be flooded without causing her to sink below the margin line.

**Perpendicular, After.** See After Perpendicular.

**Perpendicular, Forward.** See Forward Perpendicular.

**Pet Cock.** See Cock, Pet.

**Photostat.** A machine for making photographic reproductions of tracings, blueprints, etc. The reproduction may be to the same, a greater or a smaller scale. The term is also applied to the photographic reductions made on these machines.

**Picklers.** Men who put steel plates through an acid bath in order to remove the mill scale preparatory to laying out and working the material into the ship.

**Pier.** A structure of iron, wood, or concrete, resting on piles built out into the water for use as a landing place for vessels, pleasure resorts, etc.

**Pieces of Eight.** This Spanish silver coin (dollar) was romantically the currency of Caribbean pirates, but was more important as the bullion which financed Spanish expansionism in the Americas from the 15th century on. It was the currency of the Hispano-American colonies, and remained coin of the realm in places such as Peru and Chile, Guatemala and Mexico, Honduras and Colombia long after they had wrested independence from their decaying conquerors. Pieces of eight were even used in the early settlements of Australia from 1788 onwards and in the North American colonies, where they were current until as late as 1857. In 1792 the

Americans passed legislation to introduce their own currency, which was called the dollar after the old Spanish version, but there were so many Spanish silver dollars around that they had to be used for a long time after. Other countries would use pieces of eight that had been counter-stamped with their own design. They were even used in Britain during the silver shortage of 1797; the head of George III was over stamped on these. Firms in Birmingham and elsewhere in the 19th century would sometimes overstamp old pieces of eight with their name or device and circulate them as TRADE TOKENS. A hoard of pieces of eight recovered from the wreck of the Dutch ship *Hollandia* contained some splendid coins that had been newly minted at Mexico City for the Spaniards before the ship sunk after striking the Gunner rock in the Scilly Isles in 1743. They bear on one side the Imperial Crown of Spain surmounting the Spanish Royal Family's coat of arms, surrounded by the legend "Philip V of Spain and the Indies, by the Grace of God", and with a figure eight to indicate the coin's value of eight reales. The reverse has two globes representing the Old and New Worlds, above which is the Spanish Imperial crown. On each side of the globes are pillars representing the Pillars of Hercules at the entrance to the Mediterranean, and under the globes are lines to indicate the sea that divided the Old and New Worlds with, finally, the date 1741. On some pieces of eight the Pillars of Hercules indicated that these showed the limit of the Old World: such would have the motto "Nothing Beyond". Such coins found in submerged wrecks are often badly worn if loose, but can be in almost mint condition when cemented in a conglomerate of sand and gravel, which can be carefully dissolved.

**Pig Iron.** Iron cast in the form of a rough oblong or bar.

**Pigment.** See Paint.

**Pilaster.** An ornamental column or false stanchion on a light bulkhead. It usually extends out from the bulkhead for a distance of about one half its diameter.

**Pile.** A pole or post generally of wood, though sometimes of metal or concrete, driven into the earth along the bank or in the bed of a body of water for the support or protection of bridges, piers, etc.

**Pillar.** A post constructed of wood or steel and used as an intermediate support for girders and deck beams. Also used as reinforcement under decks in the way of guns and heavy foundations, thus helping to distribute the load to the lower structural members.

**Pillar, Built-up.** A term applied to a column that is constructed by riveting plates and shapes together.

**Pillar Crane.** See Crane, Pillar.

**Pillar, Deck.** A term applied to a pillar supporting a deck. It is usually given the name of the deck that it supports, as Upper or Main Deck Pillar.

**Pillar Head.** A term applied to the upper end of a pillar.

**Pillar Heel.** A term applied to the lower end of a pillar.

**Pillar, Hold.** A column fitted in the hold of a ship for the purpose of supporting the lowermost deck. They are generally much longer and of greater sectional area than the pillars fitted between decks.

**Pillar, Middle Line.** A term applied to a column erected on the center line of the ship.

**Pillar, Movable.** A term applied to a portable pillar that can be easily shifted.

**Pillar, Pipe.** A term applied to a column constructed of piping or tubing.

**Pillar, Portable.** A term applied where the pillars are removable. A disadvantage of this type of pillar in a hold is, that if it is taken out while the cargo is being stowed, that is difficult to get back in the proper position.

**Pillar, Quarter.** A term applied to a column fitted from about one third to about one half the distance from the center line to the side of a vessel and to columns in the way of the sides of hatches.

**Pillar Socket.** A receptacle, usually a casting, for taking the end of a pillar. A common type consists of a hollow cylindrical piece set up on and connected to a flat base piece by triangular shaped webs.

**Pillow.** A block of timber used as a rest piece for the lower end of a mast or the inner end of a bowsprit.

**Pilot Bridge.** See Bridge, Navigating or Flying.

**Pilot House.** A house designed for navigational purposes. It is usually located forward of the midship section and so constructed as to command an unobstructed view in all directions except directly aft along the center line of the vessel where the smoke stack usually interferes.

**Pilot Lamp.** See Lamp, Pilot.

**Pin, Marking.** A short piece of pipe of approximately the same diameter as the rivet holes in a template. The pin is dipped in whiting and then thrust through the holes in the template to mark their location on a plate or shape.

**Pintle, Heel.** A term applied to the lower pintle.

**Pintle, Locking.** A term applied to a pintle having a head turned on the bottom end to prevent the rudder from unshipping. It is well to place this pintle at the top so that the rudder may be unshipped without dry docking, by trimming the vessel by the bow.

**Pintles.** A term applied to the pins or bolts which hinge the rudder to the gudgeons on the stern post. These pins are cylindrical in shape in the way of the gudgeons up to the rudder lug. Through the rudder lug they are given a conical taper and above the lug a thread is cut for a nut. The taper provides a shoulder which, by tightening on the nut, firmly fixes the pintle to the rudder lug. It is to be noted that the weight of the rudder should be carried by the rudder stock to a bearing above, and that the pintles should serve as a hinge and as a bearing only for the side pressure of the water. The pintles are often fitted with a brass sleeve in the way of the gudgeon which is provided with a white metal bearing surface. The upper pintle sometimes has a head turned on the bottom for the purpose of preventing the rudder from moving upward and unshipping itself.

**Pipe, Auxiliary Steam.** A steam pipe leading from the steam down to auxiliary

engines.

**Pipe Berths.** See Berth.

**Pipe Bending Machine.** A machine designed for bending pipe or conduit. Pipe bending machines are similar to bending presses except that special dies are used to suit the size of pipe being bent.

**Pipe, Bilge Suction.** A pipe leading from the well, which collects bilge water, to the bilge pump.

**Pipe Coverers.** Workmen who fit the insulating material on pipes. They also fit insulating material wherever necessary, as on boilers and engines.

**Pipe Cutting Machine.** A machine designed for cutting pipe.

**Pipe Cutting and Threading Machine.** A combination machine designed for both cutting and threading pipe.

**Pipe Down.** The signal on board a naval ship for the crew to sling their hammocks preparatory to retiring for the night. Used as a slang phrase, meaning to stop some annoying act.

**Pipe, Jacket Steam.** A pipe by which steam is led from the main steam pipe to a steam jacket.

**Pipe, Main Exhaust.** The principal steam lead from the engine to the atmosphere or condenser.

**Pipe, Main Feed.** A pipe by which water supplied by the feed pump is led from the hot well to the boilers.

**Pipe, Oil Lubricating.** A small oil supply pipe leading from a lubricator to some working part.

**Pipe, Outboard Delivery.** A term applied to the pipe leading from the outboard delivery valve to the shell or sea chest.

**Pipe, Sea Injection.** A term applied to the pipe leading from the sea chest to the outboard valve controlling the intake of water.

**Pipe, Smoke.** See Smoke Stack.

**Pipe, Standard.** A term applied to a pipe having a thickness equal to the standard adopted by the Wrought Pipe makers.

**Pipe, Steam Escape or Waste.** A pipe attached to and leading nearly to the top of the smoke stack from the upper deck. The steam from the safety valve is led into this pipe and escapes through it into the atmosphere.

**Pipe, Suction.** A pipe connected to the suction side of a pump and led to the compartment to be pumped.

**Pipes, Scupper.** See Scupper Pipes.

**Piping, Oil.** Systems of piping for loading, discharging, supplying, transferring, etc.,

fuel, cargo and lubricating oil.

**Piping, Steam.** Piping designed to carry live steam from the boilers to the main engines and to the various steam driven auxiliaries.

**Piping System.** Any system of pipes such as bilge and ballast, steam and exhaust, water, sanitary, steam heating and cargo and fuel oil systems that is installed aboard a ship for conveying water, oil, steam, etc.

**Piping, Water.** Systems of piping installed aboard ship for supplying, draining and transferring fresh and salt water. The sanitary, bilge and ballast, fire, condenser circulating and feed water systems, etc., come under this head.

**Piragua.** A term applied to a large canoe-shaped boat used by the Indians. Made by hollowing out a log.

**Piston.** The movable part upon which the steam in the cylinder exerts its pressure to produce rectilinear motion in alternate directions. It consists in general of a central disc with a heavy circumferential portion for the reception of the piston rings and a central boss to take the shouldered end of the piston rod.

**Piston or Packing Rings.** Rings fitted into annular channels in the cylindrical surface of the piston and designed to secure steam tightness between piston and cylinder barrel.

**Piston Rod.** That member which, being at one end securely attached to the piston, transmits the motion of the piston to the other moving parts of the engine. The piston rod projects through the cylinder stuffing box and terminates at its lower end in the cross head.

**Piston Valve.** See Valve, Piston.

**Pitch.** A term applied to the distance a propeller will advance during one revolution, the distance between centers of the teeth of a gear wheel, the spacing of rivets, etc.

**Pitch Chain.** See Sprocket Chain.

**Pitch, Coal Tar.** The residue obtained from the redistillation of coal tar.

**Pitch, Hard Wood.** The residue obtained by the redistillation of a hard wood tar.

**Pitch, Pine.** The black or dark-colored viscous residue from the distillation of resin oil or the residue after distilling the oils from crude pine tar.

**Pitch Pockets.** A pitch pocket is an accumulation of pitch occurring between the annular growth at any place in the timber.

**Pitch, Propeller.** See Propeller, Pitch.

**Pitch of Rivets.** See Rivet Spacing.

**Pitching.** The alternate rising and falling motion of a vessel's bow in a nearly vertical plane as she meets the crests and troughs of the waves.

**Pitting.** The rapid corrosion of iron and steel in certain spots, thereby producing small indentations.

**Pitting, Boiler.** See Boiler Pitting.

**Pivoting Point.** That point during the progress of a vessel's launch at which the moment of buoyancy about the fore poppets becomes equal to the moment of the vessel's weight. At this point the stern begins to lift the vessel pivoting about the fore poppet.

**Plain-laid Rope.** See Rope, Plain-laid.

**Plan Lines.** See Lines, Plan.

**Plane of Flotation.** The water plane at which a vessel is floating.

**Planer, Wood.** A machine designed to dress or plane wood. The table of the machine is divided and a rotating shaft, carrying the knives or cutters, is carried between the two halves of the table.

**Planer, Wood Portable.** A wood planing machine power operated, used for the dressing down wood decks.

**Plank, Margin or Nibbing.** The extreme out plank of wood deck generally fitted just inboard of the waterways and sometimes notched out to revive the ends of the deck planks. Also placed around the outside of coaming of hatches, and around manhole frames where wood decks are fitted.

**Planking.** A term applied to wood decks and to the outside planking in wood or composite ships.

**Planking, Bottom.** A term applied to the outside planking between the garboard plank and the side planking.

**Planks, Parting.** The centerline planks of the deck near the bow.

**Planksheer.** A term applied to the plank fitted horizontally on top of the sheerstrake in wooden vessels. It generally has a rounded edge on the outboard side projecting a little beyond the planking and giving a finished appearance to the vessel.

**Plate.** Steel or other metal rolled or cast into form such that it has in general a consistent thickness which is small relative to its length and breadth. In ship work mild steel plates cut to proper form are used for the shell, decks and bulkheads. Plate is generally referred to by thickness only.

**Plate, Apron.** A plate fitted in continuation of the shell plating above the forecastle sheerstrake as the stem. These plates are sometimes fitted, one on each side of the stem, and serve as a foundation for the bow mooring pipes.

**Plate, Bolted, Portable or Detachable.** A plate fitted to a deck, tank top or bulkhead with the bolts permitting its removal. These plates are used for the purpose of preserving water-tightness and at the same time providing for occasional access.

**Plate, Boss.** A term applied to the plate fitted around the boss of a propeller post or around the curved frames in way of stern tubes. These plates usually require furnacing and are thicker than the adjoining plating.

**Plate, Bow.** Any shell plate fitted in the bow of a ship.

**Plate, Bracket.** See Bracket, Plate.

**Plate, Butt.** A plate used for end connections between the ends of planking on a composite ship.

**Plate, Doubling.** A term applied where an extra plate is fitted over the regular plating either for extra strength or to compensate for opening in the structure.

**Plate, Face.** See Face Plate.

**Plate Flanged.** A term applied where one or more edges of a plate are bent over to more or less of an angle. It also applies where an aperture is made in a plate with its edges stiffened by bending them at right angles to the plate.

**Plate Furnace.** See Furnace, Plate.

**Plate, Furnaced.** A plate that requires heating in order to mold it into shape. The most common types are the oxtter and boss plates.

**Plate, Garboard.** See Keel, Flat Plate.

**Plate, Keel.** See Keel, Flat Plate.

**Plate, Margin.** See Margin Plate.

**Plate, Oxtter.** The plate that is riveted to the stern from immediately below or on the transom. On account of the shape of the ship at this it usually requires furnacing and molding into shape. The oxtter plate is given extra thickness to compensate for the stretching and heating necessary in bringing it to shape.

**Plate, Rider.** See Rider, Plate.

**Plate Scarphing Machine.** A machine for scarphing or tapering the corner of a plate. Shell plates are often scarphed where a seam crosses a butt lap to reduce the thickness of metal that the rivets penetrate and make a better job for water-tightness.

**Plate, Sheerstrake.** A plate forming part of a sheer-strake.

**Plate, Stealer.** A term applied to a plate taking the end of a drop strake or a plate combining two strakes into one. Stealer plates occur at the bow and stern, where the narrowing girth compels a reduction in the number of strakes.

**Plate Straightener.** A workman who removes from sheet metal any kinks, bumps or bulges so they will present a smooth even surface.

**Plate, Stringer.** See Stringer Plate.

**Plate, Swash.** See Swash Plate.

**Plate, Tuck.** A flat plate riveted to the arch piece and stern post of a stern frame, and having its forward edge flanged out to take the stern plating. It is advantageous when the propeller aperture is low, making the sides of the ship above the arch piece approximately flat.

**Plate, Web.** A wide girder plate as in a web frame or hatch beam. Angle bars are

usually fitted on each edge.

**Plate, Wood.** The horizontal timbers which are fitted above the studding and which run parallel with the sill forming a part of the framing of a deck house.

**Platen.** A work bench or table the upper surface of which lies in a true plane,

**Plates, Intercostal.** The plates in an intercostal member. Where the plates are cut and attached to each continuous structural member that lies in their path. The continuous members are usually at or nearly at right angles to the intercostal members, and in order to pass each other one or the other of the girders must be composed of a range of short plates attached by angle bars or other means to the continuous members.

**Platform, Deck.** See Deck, Platform.

**Plating, Clinker System.** Where the edges of outside plating form lap joints so that one edge of a plate is inside while the other is outside. In this case tapered frame liners are used.

**Plating, Flush System.** Where the edges of the outside plating form butt joints so that a flush surface is formed. The connections between plates are made by seam straps and butt straps.

**Plating, In and Out System.** Where the edges of the outside plating form lap joints so that both edges of the plates are alternately inside and outside. In order to do this, the frames have to be joggled in the way of the outside strakes or frame liners of the thickness of the plating have to be fitted between the frames and outside strakes.

**Plating, Rounded Gunwale.** Plates bent to fit a rounded gunwale and connecting the side and deck plating.

**Plating, Shell.** The plating forming the outer skin of a vessel. In addition to keeping the water out of the hold, it contributes largely to the strength of the vessel.

**Plating, Side.** See Side Plating.

**Plating Stern.** The shell or outside plating covering the stern frames.

**Plating, Tank Top.** The plating forming the top of the double bottom. It is fitted to the tops of the floor plates, longitudinals and center keelson, and makes a complete inner skin extending over the bottom and sometimes up the sides of a vessel.

**Plimsoll Mark.** A mark stenciled in and painted on the side of a vessel designating the depth to which the ship may be loaded. Lord Plimsoll originated the idea of so marking vessels.

**Plug, Fusible.** See Fusible Plug.

**Plug, Watertight Electric.** An electric device for connecting an extension circuit with the main circuit and so arranged that the connection is watertight.

**Plugs, Drain Hole.** Plugs sometimes of wood but usually of special design with screwed ends for closing drains from tanks and other compartments.

**Plumber Block.** See Spring Bearings.

**Plumbers.** Workmen who install the water closets, urinals, baths, lavatories and other sanitary fixtures and their connections to the mains installed by the pipe fitters.

**Plummet, Plumet.** A sounding lead or weight attached to a plumb-line, also a weight attached to a fishing line to keep the float in position. Also used by fishermen to plumb the water's depth.

**Pneumatic Hoist.** A hoist actuated by compressed air. A direct hoist may consist of a cylinder in which a piston travels up and down lifting the weight by means of a piston rod. A compact and more powerful type consists of cylinders actuating the hoist through gears. Steam can be used as well as air.

**Pole Mast.** A term applied where the lower and top-mast is in one piece.

**Pontoon.** A scow-shaped boat used in connection with engineering and military operations for the transportation of men and equipment or for the construction of bridges, etc. The term is sometimes applied to cylindrical airtight floats and ordinary scows used in salvage operations.

**Poop Bulkhead.** See Bulkhead, Poop.

**Poop Deck.** See Deck, Poop.

**Poop Deck Stringer.** See Stringer, Poop Deck.

**Poop Deck Stringer Bar.** See Stringer, Bar.

**Poop Gunwale.** See Gunwale, Poop.

**Poop Sheerstrake.** The strake of outside plating adjacent to the poop deck.

**Poop or Poop House Frame.** See Frame, Poop or Poop House.

**Pooped.** A term descriptive of a vessel which has shipped a wave over the stern.

**Port.** An opening in the plating or planking of a vessel for the purpose of providing access for passengers, loading and discharging cargo, taking on coal, discharging ashes and water, etc.

**Port, Air.** An opening in the side or deck house of a vessel, usually round in shape, and fitted with a hinged frame in which a thick glass light is secured. The purpose of the air port is to provide light and ventilation to the interior.

**Port, Ballast.** An opening in the side of a vessel provided for the purpose of loading and unloading ballast. A watertight cover or door should be provided.

**Port, Bar.** A strongback fitted on the inside of a port to hold the cover or door in position.

**Port, Bow.** An opening cut in the bow plating or planking to provide means of loading long timbers, piles, rails, etc. This opening must have a watertight cover as it is constantly under the pressure of head seas.

**Port, Bulwark, Clearing or Freeing.** A rectangular or oval opening in the bulwark just above the deck. These ports are necessary when seas break over the deck so that the ship can clear itself quickly. As these openings are about the size of a manhole, rods or bars are generally fitted across them. Flap doors are sometimes fitted on the outside hinging outboard.

**Port, Cargo.** An opening in the side plating or planking provided with a watertight cover or door and used for loading and unloading cargo.

**Port, Coaling.** An opening in the side of a vessel provided with a watertight cover used for loading coal aboard a vessel.

**Port Flap or Lid.** A cover or door hinged over a part so that it can only open outboard.

**Port Frame.** A term applied to the bars fitted around the edges of a port to compensate for the aperture and to hold the opening in shape.

**Port, Gangway.** An opening in the side plating, planking or bulwark for the purposes of providing access through which people may board or leave the ship or through which cargo may be handled.

**Port, Hawser.** An opening in the bulwark through which a hawser may be passed.

**Port Lid.** A cover hinged on the inboard side of an air port. It can be closed when the glass in the air port is broken or in danger of being broken.

**Port, Raft.** See Port, Bow or Stern.

**Port Side.** That side of a vessel to the left hand when looking from the stern toward the bow.

**Port Sills.** The horizontal members of a port frame.

**Port, Stern.** An opening in the stern plating or planking to provide means of loading long timbers, piles, rails, etc. This opening must have a watertight cover.

**Port the Helm.** A term originally applied to the operation of putting the tiller over to the left or port side, causing the rudder and ship to turn to the right or starboard. The operation of turning a steering wheel to port may cause the vessel to turn to either the right or left according to whether the leads are open or crossed or otherwise mechanically arranged. Different localities and countries and also different branches of the marine in the same locality have their own rules as to whether the ship turns with or against the wheel. Thus an order to port the helm on a vessel plying the inland waters or harbors or on the ship of a foreign country might be interpreted in the opposite direction from the same orders issued on board some deep sea and naval vessels.

**Portable Pillars.** See Pillars, Portable.

**Portable Scarphing Machine.** A scarphing machine designed to permit its being moved around to suit the work instead of requiring the work to be brought to the machine.

**Post Crane.** See Crane, post.

**Post, Propeller.** See Propeller Post.

**Post, Stern.** See Stern Tube.

**Power Factor.** The ratio of the electric power in Watts to the apparent power in volt amperes in an alternating current circuit.

**Precession.** See Gyroscope.

**Press.** A machine designed to exert pressure on a given area for purposes such as drawing, embossing, trimming, punching, forging, etc.

**Press, Bending.** A vertical press with two supports located below and equi-distant each side of a pressing head. Used for bending or straightening bars, shafts, pipes, etc. Horizontal types of bending presses are also used.

**Press, Embossing.** A machine designed to produce raised figures or letters on name plates, label plates, etc.

**Press, Flanging.** A press for flanging plate metal. The flanging may be done hot or cold.

**Press, Inclined.** A press designed to be used in a vertical or inclined position.

**Pressure Gage Glass.** The glass forming a cover over the face of a pressure gage.

**Pressure, Hydrostatic.** Pressure induced by a liquid. Usually hydrostatic pressure is due to and in direct proportion to the difference in elevation between the free surface of the liquid and the point at which the pressure is indicated, the difference in atmospheric pressure at the two points being neglected. The difference in atmospheric pressure may, however, be appreciable, especially in cases of enclosed vessels in which the pressure may be increased by mechanical means. Hydrostatic pressure may be measured in pounds per square foot, but is also often measured in "feet" or "inches of water" or "inches- of mercury," in which cases a pressure is signified equal to the pressure induced by a column of water (or mercury) at the stated height. One foot head of water is equivalent to 62.4 pounds per square foot or .43 pounds per square inch.

**Preventer.** A supernumerary member, such as a stay, shroud, or any rope, chain, etc., whose only function is to assist or be substituted for another when under unusual stress or when damaged or lost.

**Preventer Bolts.** Bolts used to secure the preventer plates.

**Preventer Plates.** Metal plates secured to the lower ends of the chain plates in large sailing vessels to assist in taking the stress.

**Preventer Stay, or Preventer Backstay.** An additional stay so secured as to be easily slacked away to allow a beam to swing around. Usually attached to the deck on or near the center line.

**Pricker.** A cone shaped tool used to make holes in canvas or to spread eyelet holes for working.

**Prismatic Coefficient.** See Coefficient, Prismatic.

**Profile Plan.** See Lines Plan.

**Progressman.** A man assigned to follow up work in a shipyard and make reports concerning the progress of the same.

**Progressive Rupture.** A rupture or break which starts at the point of maximum unit stress and then spreads with the recurrence of the strain. Progressive rupture may occur in such members as plates which are stressed to rupture at one point only. When failure occurs at this point the total stress is then perforce concentrated over a smaller area of cross section which naturally increases the unit stress resulting.

**Progressive Speed Trials.** A series of speed trials over a measured course, successive trials being run at varying speeds.

**Promenade Deck.** See Deck, Promenade.

**Promenade Deck Stringer.** See Stringer, Promenade Deck.

**Promenade Deck Stringer Bar.** See Stringer Bar.

**Pro-Metacenter.** A term used by some authors to designate a point on the metacentric involute directly above the center of buoyancy for any inclined position of the vessel.

**Proof Strain.** The test load applied to anchors, chain or other parts, fittings or structure to demonstrate proper design and construction and satisfactory material.

**Proof Strength.** The proof strength of a material, part or structure is the strength which it has been proved by tests to possess. The term is often used in referring to chain cable, wire rope and the like.

**Propeller.** A propulsive device consisting of a boss or hub carrying radial blades, from two to four in number, the rear or driving faces of which form portions of an approximately helical surface, the axis of which is the center-line of the propeller shaft. The propeller is ordinarily located at the after end of the propeller shaft. The rotary motion imparted to this shaft by the engine turns the propeller, thereby exerting a rearward thrust upon the water which reacts to force the ship ahead. The selection of proper characteristics, such as diameter, revolutions, pitch, etc., the accurate determination of blade thickness, shape, etc., and the great care in construction and finish are essential to the securing of the best results from the propeller in service.

**Propeller Aperture.** See Aperture.

**Propeller Blade, Back of.** The forward side of the propeller blade.

**Propeller Blade, Developed Area of.** The actual area of the surface of the blade.

**Propeller Blade, Projected Area of.** The area enclosed by the trace on an athwartship plane of the perpendiculars drawn from the edge of the propeller blade.

**Propeller Blade, Rake.** The sloping aft from a position at right angles on the axis of propeller shaft of the propeller blades.

**Propeller Blade, Root of.** That portion of the blade closest to the hub or boss.

**Propeller Blade Tip.** The outermost portion of the propeller blade.

**Propeller Blade Tip Clearance.** Generally the shortest distance between the skin of a vessel and the circle swept by the propeller tips.

**Propeller Blades, Screw.** The radial arms, attached to the propeller hub, the faces of which form portions of an approximately helical surface the axis of which coincides with that of the propeller shaft. Blades are either cast in one piece with the hub or cast separately and designed to be attached to the hub with bolts. In this latter case provision is usually made for a slight adjustment in pitch by means of the shape of the bolt holes.

**Propeller Boss.** The central portion of the screw propeller which carries the blades and forms the medium of attachment to the propeller shaft. It is taper bored for the reception of the propeller shaft and slotted for the key. When properly placed upon the shaft it is forced home and secured in its final position by means of the propeller lock nut.

**Propeller Cavitation.** That condition of screw performance in which increase of torque fails to produce a corresponding or reasonable increase in thrust.

**Propeller Diameter.** The diameter of the circle tangent to the tips of the propeller blades.

**Propeller Disc Area.** The area of the circle swept by the blade tips of a propeller.

**Propeller Driving Face or Face.** The after face of the propeller blade; that face which acts directly upon the water when driving the vessel ahead.

**Propeller Efficiency.** The ratio of the thrust horsepower delivered by the propeller to the shaft horsepower as delivered by the engine to the propeller.

**Propeller Following Edge.** The after edge of a propeller blade.

**Propeller Frame.** See Stern Frame.

**Propeller Guard.** A frame work fitted somewhat below the deck line of narrow, high speed vessels with large screws and so designed as to overhang or house the projecting propeller tips.

**Propeller Leading Edge.** The forward edge of a propeller blade.

**Propeller Pitch, Nominal.** The distance (measured parallel to the axis of rotation) between similar positions of appointment of the driving face of a propeller blade in successive revolutions. When the driving face of a propeller blade lies entirely in a true helical surface the blade is said to have uniform pitch. When the pitch at the following edge is greater than that at the leading edge, the blade is said to have axially increasing pitch. When the pitch near the tip is greater than that near the hub the blade is said to have radially increasing pitch.

**Propeller Pitch, Virtual.** The pitch of a theoretically perfect blade of no thickness which would act as does the actual blade. The pitch of the back of a propeller blade varies greatly from that of the face of the blade. Inasmuch as the back exercises a material influence upon propeller performance, correct conclusions are impossible unless proper allowance is made therefore. The virtual pitch as above defined meets

this requirement.

**Propeller Post.** The forward post of a stern frame on vessels having a center line propeller. It provides a support for the stern tube and propeller shaft as well as a joining frame for the converging sides of the ship at the stern.

**Propeller Racing.** The sudden increase in the number of revolutions made by the engine when the propeller blades or paddle wheels are lifted clear of the water, or nearly so, due to the roll or pitch of the ship.

**Propeller Shaft.** That length of shafting in a screw steamship which carries the propeller. It is the after-most piece of shafting and at its outermost end is coned, slotted and threaded for the attachment and proper securing of the propeller itself. This piece of shafting is carried directly by the propeller strut or stern bearing and is made slightly larger than the line shafting as a precaution against corrosion and shock. It is generally encased in a brass sleeve to provide proper bearing surface and to protect the shaft from corrosion.

**Propeller Slip Angle.** The angle between plane of blade face and its direction of motion.

**Propeller Slip, Apparent.** The value of the fraction Propeller speed – speed of ship

**Propeller Slip or Slip Ratio; Apparent True Slip.** The ratio of speed of slip to speed of propeller.

**Propeller Speed Ratio.** The speed of advance divided by the speed of propeller.

**Propeller Sweeping Up.** The process of preparing molds for the casting of a screw propeller in the foundry. It ordinarily consists of the generation of a helical surface by the revolution of a horizontal straight edge, called a sweep, about a central vertical column to which the sweep is so attached as to permit of vertical motion. At its outer end the sweep follows the helical edge of a guide board erected at the proper radial distance from the central column. The foregoing applies to propellers having a vertical generatrix. For those having an inclined generatrix, the straight edge is set at an angle other than 90° to the central column.

**Propeller Thrust.** The effort delivered by a propeller in pushing a vessel ahead. The power resulting from the propeller effort is termed thrust horsepower. It is equal to the actual thrust in pounds multiplied by the distance in feet moved by the ship per minute divided by 33,000.

**Propeller Thrust, Deduction.** The actual thrust of the propeller minus the tow rope resistance of the ship or the net thrust of the propeller. In driving a ship ahead the screw exerts a suction upon the afterbody of the ship, thereby virtually increasing its resistance over what it would be without the screw. The wake created by the ship's hull in moving through the water affects the action of the screw favorably. These two factors work against and partially offset each other.

**Propeller Tip Speed.** The speed in feet per minute swept by the propeller tips generally used as that corresponding to the maximum designed revolutions of the machinery.

**Propulsive Coefficient.** See Coefficient, Propulsive.

**Propulsive Efficiency.** The ratio of effective to indicated (or shaft) horsepower.

**Protection Plate.** A term applied to the plate fitted in the way of the hawse pipe for protection against blows from the flukes of the anchor.

**Protractor.** An instrument with graduated scales, for measuring angles or setting them out, and for other measurements.

**Prussian Blue.** See Paint.

**Puddening, Pudding.** Pads constructed of old rope, canvas, oakum, etc., in any desired shape and used on rigging to prevent chafing or on the stem of a boat to lessen the force of a shock.

**Puddling.** Described under Steel and Iron.

**Pulley or Sheave.** See Sheave.

**Pulsometer.** An apparatus for pumping water consisting of chambers in pairs, wherein steam is condensed, making a vacuum in alternate chambers. The water drawn into a chamber is forced out by the admission of steam under pressure.

**Pump.** A machine actuated by hand or power for raising and transferring fluids or gases and for inducing a vacuum.

**Pump, Admiralty.** A direct acting simplex or duplex pump with the piston and plunger on a vertical rod. In this type of pump the valves for the admission and discharge of water are easily examined and removed.

**Pump, Air.** The main air pump is for the purpose of reducing the back pressure in the low pressure cylinders or turbines and also for removing the condensed steam and vapor from the condenser. These pumps are driven either by a connection with a cross-head (usually the low pressure) on the main engine or by an independent engine. They are also made single and double acting. The single acting, direct driven type is the most common. As the vacuum in the condenser with the above described pump is dependent on the temperature of the hot well and as water will absorb only about 1/20 of its volume of air, dry vacuum pumps, augmenters, rotary and air ejector systems are being installed where a high vacuum is desired.

**Pump, Air and Circulating, Auxiliary.** This pump is composed of three cylinders: a steam cylinder for power, a water cylinder for circulating water through the auxiliary condenser, and a water cylinder for extracting the condensed steam in the auxiliary condenser and delivering it to the feed tank. This pump is an extravagant user of steam.

**Pump, Air, Bucket Valves.** Non-return valves placed in the moving bucket of the air pump and providing communication for the air, water and vapor from the suction to the discharge end of the pump cylinder. purpose of delivering the condensate to the hot well and allowing the air and vapor to escape.

**Pump, Air, Discharge Valves.** See Pump, Air, Head Valves.

**Pump, Air, Dry Vacuum.** A pump for discharging the air and vapor from a condenser into the atmosphere. The suction from this pump is located as high as possible on the suction line to the condensate pump or to a dry suction pad on the

condenser. These pumps may be operated at a high speed, and they also keep a uniform head of water to the condensate pump.

**Pump, Air, Dual.** A combined wet and dry pump. A wet cylinder takes care of the condensate, and a dry air cylinder, which has an independent cooling system, densifies the air and vapor. This keeps the temperature of the hot well close to the temperature of the vacuum.

**Pump, Air Ejector.** A steam ejector connected to the condenser dry suction for the purpose of discharging the air and vapor into the atmosphere. A condensate pump handles the condensed steam.

**Pump, Air, Foot Valves.** Air foot valve. Non-return valves placed at the suction end of the cylinder.

**Pump, Air, Head Valves.** Non-return valve placed in the discharge end of the air pump cylinder for the purpose of delivering the condensate to the hot well and allowing the air and vapor escape.

**Pump, Air, Suction Valves.** See Pump, Air, Foot Valves.

**Pump, Auxiliary Circulating.** A pump to force water through the tubes of the auxiliary condenser. It is often combined with the auxiliary air pump. These pumps deliver to the main feed line only.

**Pump, Auxiliary Feed.** A pump with the following suctions: From the main feed tank, the reserve feed tank, the sea, the bilge, and from the bottom of the condenser. It can deliver to the boilers, the reserve feed tank or overboard. On account of the number of leads to and from this pump great care should be taken that fresh water is not pumped overboard, salt or bilge water pumped into the boilers, unless it is an emergency and so intended, or that the pump is used at all for boiler feed after pumping the bilge unless it has been thoroughly washed by a salt water circulation.

**Pump, Ballast.** A pump used for filling and emptying the ballast tanks. It has by-passes so that it can work the bilges and fire system either alone or in conjunction with the other pumps.

**Pump, Bilge.** A pump used aboard ship to remove accumulations of water in the vessel's bottom tanks, hold and other compartments and discharge it overboard.

**Pump, Bilge and Fire.** See Pump, Fire and Bilge.

**Pump Booster.** See Pump, Transfer.

**Pump Bucket.** This term is sometimes used synonymously with the plunger. More correctly it is the cylindrical piston in vertical single acting pumps where the water is lifted from the bottom to the top of the cylinder. The term bucket should be used only when both top and bottom sides of piston come into operation in the performance of the function of the pump. Where one side of the piston only comes into operation, the term plunger should be used.

**Pump Bucket Valve.** A non-return valve placed in the moving bucket of a pump.

**Pump, Centrifugal.** This pump consists of a shaft to which vanes are attached and

which rotates in a circular shape casing. Water enters the casing near the center or rotating shaft and moves outward along the vanes by centrifugal force. There is a discharge pipe at the circumference of the casing through which the water escapes. The pump may require priming to start it and is more efficient with low heads.

**Pump, Condensate.** The function of this pump is to deliver condensate to the hot well or feed tank.

**Pump, Crank.** A pump that, hand-cranked with a cast-iron wheel, was used for expelling water from the ship. It would be sited near the main mast. Rotation of the wheel drove long crank-shafts that descended into the pump-well at the bottom of the hold.

**Pump, Direct Acting.** A pump in which the piston and plunger are on the same rod but that does not require a fly wheel to carry it over the dead points.

**Pump, Direct Driven.** A pump whose plunger is actuated from the main engine.

**Pump Discharge Head.** The distance from the pump up to the point of delivery including frictional resistance.

**Pump, Distiller.** A pump used for transferring the distillate to the culinary and supply tanks.

**Pump, Distiller Circulating.** A pump for forcing circulating water through the distiller tubes to condense the vapor into water. It should have a by-pass to the flushing system.

**Pump, Donkey.** This pump has the same suction and discharge leads as the bilge pump has, and in addition is usually connected to the donkey boiler. Thus it can work when the main boilers are cold.

**Pump, Double Acting.** A pump that delivers on each stroke and from both ends of the cylinder.

**Pump, Downtown.** A hand pump that is also a force pump. It is worked by cranks on each side of the pump chamber or if placed on a lowerdeck the cranks may work through shafting gears. It is arranged to draw from all compartments and from the sea and discharges overboard and to the fire main.

**Pump, Dredging.** A heavily built pump of the centrifugal type used on dredges and sand suckers for removing sand, gravel, etc. from the bottom of rivers and harbors when building or deepening channels.

**Pump, Duplex.** A pair of pumps so placed that the piston rod of one pump actuates the valve of the other. Such a pump is of great value when a large quantity of water is admitted to the ship through the hatches or by accident.

**Pump, Evaporator Feed.** This pump supplies the evaporator with salt water for vaporization.

**Pump, Fire and Bilge.** A pump used for keeping the bilges free of water, washing decks and for putting out fires. It has a sea suction and an overboard delivery of its own. It is more or less constantly in operation, keeping the bilges free of water and

when used for washing decks should be cleaned by pumping salt water overboard. This pump has a suction to the bilge, drains, and inner bottom.

**Pump, Flushing.** See Pump, Sanitary.

**Pump, Force.** One that in addition to lifting the water also forces it out through piping to a point of delivery.

**Pump Foundation.** A term applied to a foundation supporting a pump and given the name of the pump as Ballast Pump foundation, Feed Pump foundation, etc.

**Pump, Fresh Water.** This pump delivers fresh water that moves back and forth or up and down in the from the culinary or supply tanks to a gravity tank, which is called the daily supply tank. The gravity tank feeds the fresh water supply lines to the quarters, galleys, pantries, lavatories, etc.

**Pump, Fuel Oil Service.** A pump for feeding the oil burner in a boiler.

**Pump, General Service.** A term applied to the main fire and bilge pump.

**Pump Governor.** See Governor, Pump.

**Pump, Hand.** A pump worked by hand. They are located in the upper decks and consequently have a high suction and are difficult to operate by hand. The amount of water that they will handle is so small that these pumps are not of much use in ships of any size.

**Pump, Handy Billy.** A portable hand pump.

**Pump, Hydraulic Pressure.** A pump designed to deliver against a heavy pressure. The pump and its parts must be extra heavy and strong.

**Pump, Independent.** A pump with its own engine. The piston and plunger are usually on the same rod, the valve gear being actuated from the crosshead.

**Pump, Lift.** A pump that lifts only and does not discharge against a head.

**Pump, Lubricating Oil.** The function of this pump is to force lubricating oil to the shaft and engine bearings and crossheads.

**Pump, Main Circulating.** The function of this pump is to take water in large quantities from the sea, force it through the main condenser tubes and then overboard. On account of the low head to be overcome and the large capacity required, it is usually of the centrifugal type. In addition to a suction line, sea injection valve, it has a by-pass to the bilge which may at any time be used in pumping water overboard either directly or through the condenser. As a centrifugal pump will handle ashes and such refuse as are liable to collect in the bottom of a ship, it becomes of great value when a large quantity of water is admitted to the ship through the hatches or by accident.

**Pump, Main Feed.** The function of this pump is to keep the water at the proper level in the boilers. It takes fresh water either from the main or reserve feed tanks. Some types are driven from a connection to the main engine and others have independent engines. The number and location of these pumps depends on the size of the ship and the design.

**Pump, Oil.** Oil pumps on shipboard are used for feeding the lubricating system, feeding oil burners on boilers, transferring fuel oil from one tank to another and to the settling tanks, and for handling cargo oil.

**Pump, Oil Service.** A pump for the circulation of lubricating oil.

**Pump, Plunger.** A solid or hollow cylindrical piston that moves back and fourth or up and down in the water cylinder of a pump. The plunger retains its full diameter when it passes through a stuffing box.

**Pump, Reciprocating.** A pump composed of one or more cylinders in which a piston or bucket moves back and fourth or up and down. The power is obtained from steam cylinders and depends on the area of the piston and steam pressure.

**Pump Rose Box.** See Pump, Strainer.

**Pump, Rotary.** This pump discharges through the action of a rotating cam or plunger and does not rely on centrifugal force.

**Pump, Rotary Air.** One form of rotary pump consists of a waterwheel which throws thin films of spray into a discharge pipe in which a steam ejector is installed. It removes air and vapor only while a condensate pump handles the condensed steam.

**Pump, Sanitary.** The function of this pump is to supply salt water to the flushing system and for baths. It may deliver directly but commonly discharges into a gravity tank, the overflow of which is carried to the water closets and troughs. It also supplies a tank in which a steam coil is installed for the purpose of providing for hot sea water baths.

**Pump, Single Acting.** A pump that delivers from one end of the cylinder only and on alternate strokes.

**Pump Strainer.** A galvanized iron box with the sides perforated by small holes, the combined area of which equals at least twice the area of the suction pipe. The object is to prevent refuse from clogging the pumps.

**Pump Strum.** See Pump Strainer.

**Pump Suctions.** In the midship and dead flat sections of a ship and where there is not a sharp rise in the floor or bottom three suction are required, one at the keel and one on each side to make sure of clearing the ship when she has taken a heavy list. In the ends of the ship and where there is a sharp deadrise only one suction need be installed near the keel.

**Pump, Transfer.** An oil pump used for transferring oil from one tank to another and from the oil tanks to the settling tanks.

**Pump, Water Service.** A pump for circulating cooling water through shaft bearings, crosshead, slides, etc. The delivery should also by-pass to the fire main and to the distiller.

**Pump Wells.** A tank formed either independently or by the structural members of the ship in which the pump strainer on the end of a suction line is installed. The hot well may be an independent tank and is used to collect the condensate water.

**Punch and Shear, Combination.** A double ended machine designed for punching at one end and shearing at the other. Each end is controlled independently and may be operated simultaneously on two pieces of work.

**Punch, Double End.** A double ended punching machine, designed for punching holes in metal plates or shapes at both ends. The punches at each end are controlled independently and may be operated simultaneously on two pieces of work.

**Punch, Horizontal.** A punching machine in which the punch moves in a horizontal direction. This type is generally used for punching holes in shapes such as angles, zee bars, etc.

**Punch, Multiple.** A punching machine designed for punching more than one hole in a single operation.

**Punch, Vertical.** A punching machine in which the punch moves in a vertical direction. This type of punch is generally used for punching holes in plates.

**Punching Machine.** A machine used for punching rivet and bolt holes in metal plates, angles, I-beams, channels, etc.

**Punt.** A heavily built boat of rectangular shape used by workmen employed in painting, cleaning or repairing a ship's topsides when in sheltered water's.

**Purchase.** Any mechanical advantage which increases the power applied.

**Purser.** A ship's officer who has charge of provision accounts, is head of the steward's department, handles mail, etc.

**Putty, Rust.** A putty made from the cast iron filings or borings and sal ammoniac, used as a luting between the flanges of iron pipe, etc.

**Pyrometer.** An instrument for measuring the temperatures of the hot gases and steam in a boiler.

## Q

**Quadrant.** A casting, forging or built up frame in the shape of a sector of a circle attached to the rudder stock and through which the steering gear leads turn the rudder. The hub of the quadrant is bored and keyed to fit the rudder stock. It may be in two pieces clamped together by bolts or in one piece, in which case it must be slipped down over the end of the stock. The rim of the quadrant is provided with two grooves to take the steering chains or ropes and it should be designed with sufficient length of arc so that the leads are tangential to the rim at all angles of the rudder.

**Quadrant.** A reflecting hand navigating instrument, constructed on the same principle as the sextant, but with a shorter limb, measuring angles up to 90 degrees only. If named on the same principle as the sextant, it would be called an octant, and this name has been given to the metal-framed instruments manufactured in recent years. Quadrants have, generally, a wooden frame with an inlaid ivory limb and were formerly very much larger than the present quadrants or octants. A part of the reversing gear on a reciprocating marine engine. A fourth part of a circle or its circumference.

**Quadruple Riveting.** See Riveting, Quadruple.

**Quarter.** The part of a yard just outside the slings; the upper part of a vessel's sides near the stern; portions of a vessel's sides about midway between the stem and the middle and between the middle and the stern.

**Quarters.** Living spaces for passengers or personnel. It includes state rooms, dining saloons, mess rooms, lounging places, passages connected with the fore-going, etc.; individual stations for personnel for fire or boat drill, etc.

**Quarter Deck.** See Deck, Quarter.

**Quarter Deck Sheerstrake.** The strake of outside plating adjacent to the quarter deck.

**Quarter Deck Stringer.** See Stringer, Quarter Deck.

**Quarter Deck Stringer Bar.** See Stringer Bar.

**Quarter Iron.** A metal ring or hoop fitted on the yard arm at the quarter through which a studding sail traverses and is held down at its inner end when rigged out.

**Quarter Master.** An under officer of a ship's crew who steers the ship and has charge of the navigating instruments.

**Quarter Pillar.** See Pillar, Quarter.

**Quarterman.** An under foreman. A term generally restricted to the navy yards.

**Quay.** An artificial wall or bank usually of stone, made toward the sea at the side of a harbor or river for convenience in loading and unloading vessels.

**Quicken.** To lessen the radius of a curve or make it sharper; to snub; e. g. to quicken a waterline is to make its curvature more pronounced.

**Quintant.** An instrument allied to the Quadrant, used for measuring angles, and normally made of brass with a platinum scale.

## R

**Rabbet.** A groove in the stem, keel or stern frame into which the edges of planking or plating are fitted.

**Racing.** See Propeller Racing.

**Racking.** Spun yarn or other small stuff used to wind two ropes together.

**Racking.** The tendency to deformation in built up structures or shapes which results from the action of racking stresses. In a ship the transverse racking tendencies are of more importance than the longitudinal. This is due both to the character of the structure and to the nature of the stresses to which the structure is usually exposed.

**Racking Stresses.** Stresses which tend to produce racking strains.

**Radiator.** A pipe coil or casting designed to radiate heat from a steam or hot water

pipe line.

**Radio.** Radio is the transmission of intelligence by means of electromagnetic waves. Briefly, the apparatus consists of a transmitter, receiver and antenna ("aerial" consisting of an elevated system of wires). The same antenna is usually used for both sending and receiving. The transmitter is a device for causing high frequency alternating currents (oscillations) to flow up and down the antenna. These oscillations cause a disturbance in the surrounding ether somewhat similar to those caused on the surface of a sheet of still water into which a stone is dropped. When these waves impinge on an antenna which is being used for reception, it is set into oscillation (as a cork would bob, floating on the surface of the sheet of water). The receiver translates these oscillations into an audible sound in a pair of head telephone receivers.

**Raft, Life.** See Life Raft.

**Raft Port.** See Port, Bow or Stern.

**Rail.** Channel bars, shapes or flat pieces of wood fitted at the top of bulwark plating or at the top of rail stanchions. Also applied to the tiers of guard rods running between the top rail and the deck.

**Rail, Brest.** The top rail running athwartship on a bridge, the after end of a forecandle deck or the fore end of the poop deck.

**Rail, Hand.** A term applied to a rail fitted along the side of a ladder or a companionway.

**Rail, Main.** The top rail running along the top of the bulwark or rail stanchions on the upper or weather deck.

**Rail, Poop.** A term applied to the rail around the top of the bulwark or rail stanchions on the poop deck.

**Rail Stanchions.** Steel or wood stanchions that serve as fence posts for the guard railing or ropes enclosing the deck, bridge, forecandle, etc., of a vessel. They are spaced at approximately equal distances and are fitted permanently or removable as the requirements demand.

**Rail, Topgallant or Monkey.** The rail running along the top of a topgallant or upper extension of the bulwark.

**Raised Quarter Deck.** See Deck, Raised Quarter.

**Raising Iron.** A tool used by caulkers to remove dirt from a seam preparatory to caulking.

**Rake.** A term applied to the inclination from the vertical of a mast, smoke stack, stem post, etc.

**Rally.** Men uniting in driving wedges when launching a vessel.

**Ram.** A forward, strongly constructed, underwater projection of the stem post. They were until recently fitted on most warships. On account of the severity of the stresses set up by the shocks of a collision and also on account of the fact that action

between warships is generally conducted at long range, the ram as a means of offence is becoming less used. The bulbous shape, although not projecting forward, is still retained at the bottom of the stern post on American warships. A name given to a vessel that is designed for the purpose of sinking vessels by head on collision or for icebreaking.

**Range, Galley.** The stove, situated in the galley, which is used to cook meals.

**Rate.** The class in which a vessel is placed. In the merchant service rating is based upon the character of material and the construction. In the naval service the displacement, number of guns, protection, speed, etc., are the determining factors. The process of determining the error of a ship's chronometer relative to true time.

**Ratline Stuff.** A right handed, three stranded small stuff of usually four to eight threads to the strand making "I2-thread," "I5-thread," etc., ratline stuff.

**Ratlines.** Short lengths of ratline stuff secured to the shrouds parallel to the waterline. These serve the purpose of latter rungs for the crew in ascending or descending.

**Rave Hook.** A thin hook shaped tool use by caulkers to remove old oakum -threads from seams.

**Reamer.** A term applied to a rotary cutter used in enlarging punched and drilled holes.

**Reamers.** Workmen who operate a tool, usually power driven, so shaped as to enlarge holes already punched or drilled. Where the holes are unfair they cut away the overlapping material so bolts or rivets may be inserted.

**Reaming.** A term applied to the operation of enlarging a punched or drilled hole by a rotary cutter called a reamer.

**Recess Bulkhead.** See Bulkhead, Recess.

**Recess, Tunnel.** See Tunnel, Recess.

**Reciprocating Engine.** See Engine, Reciprocating.

**Reciprocating Pump.** See Pump, Reciprocating.

**Rectifier, Mercury Vapor.** An electrical device for changing alternating current to direct current.

**Red Lead.** See Paint.

**Red Leaders.** Painters who paint faying surfaces with red lead paint before they are placed together. Also painters who apply the coats of red lead paint to the structure while it is being erected to protect it from the weather.

**Reducing Valve.** See Valve, Reducing.

**Reduction Gearing.** Generally applied to gearing designed for use with marine steam turbines. When so fitted its purpose is to step down from the turbine speed to a speed suitable for the ship's propellers.

**Reef.** To reduce sail spread or area by rolling or folding that portion adjacent to a yard or boom and making it fast thereto. In square sails this reduction is made in the head, while in fore-and aft sails it is done in the foot

**Reef Points.** Short lengths of cordage fitted at equal distances apart on the reef bands of sails for tying up the sail in reefing. Sometimes referred to as nettles.

**Reef Tackles.** Tackles used for hauling the leeches of square sails up to the yards and out in reefing. The upper blocks are secured under the ends of the yard-arms, the lower blocks to the reef tackle cringles on the leech ropes of the sails at the upper ends of the reef tackle patches. The falls are led to the deck and when hauled on, the upper part of the leeches are slacked for passing the earrings and rousing the cringles to the yards.

**Reel, Hawser.** See Hawser Reel.

**Reeled Riveting.** See Riveting, Staggered.

**Reem.** To open the seams of the planking by means of a reaming iron that the oakum may be more readily driven in.

**Reeming Iron.** A chisel shaped tool used by caulkers to open up seams so that threads of oakum may be driven into them.

**Reeving.** The act of passing a rope or chain through an aperture as a rope through a block, dead-eye, bull's eye, etc., or a lacing through an eyelet.

**Reflector, Cargo.** A reflector for electric lights suitable for illuminating cargo holds.

**Reflecting Circle.** An instrument to measure angles up to 180 degrees in the horizontal and vertical planes.

**Refrigerating Machine Foundation.** A term applied to a seating prepared for a refrigerating machine. This seating may be built up from the deck or the deck may be reinforced by thicker or extra plates and shapes.

**Refrigerator Coils.** A series of pipes surrounding the sides of a refrigerating box for maintaining a low temperature.

**Register Breadth.** See Breadth, Register.

**Register Depth.** See Depth, Register.

**Register Length.** See Length, Register.

**Regulator Valve.** See Valve, Regulator.

**Relay.** An electrical device which will perform a certain operation in one electric circuit when a certain predetermined condition exists in another.

**Releasing Gear.** This gear is composed of specially constructed hooks attached to the davit heads and rods, chains or fittings installed in lifeboats. By the use of this gear both ends of a lifeboat may be released or picked up quickly and simultaneously.

**Relief Valve.** See Valve, Relief.

**Relieving Tackles.** Tackles used for emergency steering in case of accident to the steering gear or to assist the gear in heavy weather. The tackles are secured to the head of the tiller or to the cross head, the opposite ends being made fast to any convenient structure as a bulkhead or deck.

**Render.** To pass through an aperture freely, as a rope through the swallow or mortise of a block.

**Reserve Buoyancy.** The difference between the amount a vessel would displace if she were watertight and totally submerged, and the amount she actually does displace at her designed draft.

**Resistance, Air.** That part of a ship's total resistance to motion which is due to the above water portion of the vessel moving through the air.

**Resistance, Bare Hull.** The sum of the frictional and residual resistances of a vessel's hull to which no appendages such as bilge or docking keels, struts, spectacle frames, rudders, etc., have been fitted.

**Resistance, Center of Lateral.** That point through which a signal force could act producing an effect equal to the total lateral resistance of the vessel. The center of lateral resistance is ordinarily assumed to be coincident with the center of gravity of the central immersed longitudinal plane.

**Resistance, Eddy-Making.** Resistance due to the formation of eddies at the stern, usually resulting from the abrupt termination of the after ends of waterlines, from the action of propellers and rudder, and from the addition to the hull of projections such as struts, docking keels, etc.

**Resistance, Electrical.** Property of materials which opposes the free flow of an electric current through them, but does in no way tend to cause a current in the opposite direction to that in which the electric current actually moves.

**Resistance, Frictional.** The resistance due to the friction of the water upon the surface of the ship.

**Resistance, Lateral.** The resistance which a vessel offers to a lateral motion of translation through the water. The lateral resistance of a vessel is of especial moment in sailing ships, and it is for the purpose of increasing the lateral resistance that keels and center-boards are sometimes fitted.

**Resistance, Residuary.** The total resistance less the resistance due to skin friction, is termed the residuary resistance.

**Resistance, Skin.** The frictional resistance existing between the shell or skin of a ship and the water through which she is progressing.

**Resistance, Tow Rope.** The total resistance overcome in towing a ship or model. It equals the sum of the frictional resistance, eddy making and wave making.

**Retaining Strip, Stern Tube.** See Stern Tube Retaining Strip.

**Reverse Frame.** See Frame, Reverse.

**Reversing.** The act of turning completely about. Used with reference to either

motion or position.

**Reversing Shaft.** A threaded shaft actuated by the reversing wheel and forming part of the reversing gear.

**Reversing Wheel.** A hand operated wheel by means of which the reverse gear is controlled. It is located in front of an engine and easily reached from the starting platform.

**Revolution Counter.** A device arranged to register automatically and sum up engine revolutions.

**Rheostat.** An electrical device consisting of several resistances of different values arranged so that they may be cut in or out of an electric circuit.

**Rhumboscope.** A variation of the Station Pointer which was used to locate positions on charts. The "rhumb" was any one of the thirty-two compass points. All meridians were cut by this instrument at the same angle.

**Rypsometer.** This was introduced about 1871, for measuring a ship's speed.

**Riband.** A painted stripe or molding around a vessel's side. Applied for decorative purposes.

**Ribbands, Fore-and-Aft.** Pieces of timber arranged longitudinally around the building site outlining the form of the ship at different levels and having the frame stations marked on them. When a frame is erected it bears against the ribbands which hold it in its correct athwartship position and by setting it to the ribband frame station marks it assumes its proper fore and aft position.

**Ribs.** A term applied to the transverse frames of a boat or the skeleton.

**Ride.** To float in a buoyant manner while being towed or lying at anchor.

**Rider.** A plate or girder fixed to the inner side of the framing at the center line for extra strength.

**Rider Keelson.** See Keelson, Rider.

**Rider Plate.** A continuous flat plate attached to the top of the vertical center keelson, to the top of the floors, or both.

**Ridge Rope.** See Rope, Ridge.

**Rig.** As applied to a vessel, the method according to which spars and sails are designed and fitted. Rigs of all kinds fall into two classes, viz: square or fore-and-aft.

**Rigger.** A workman who makes up the standing and running rigging from cordage and fittings and fits same on shipboard. During the construction of a ship riggers have charge of the hoisting in place of such heavy parts as the stem stern post, boilers, engines, masts and spars.

**Rigging.** A term used collectively for all the ropes and chains employed to support and work the masts, yards, booms and sails of a vessel.

**Rigging Screws.** See Screws, Rigging.

**Rigging, Steel Wire.** The standing rigging in practically its entirety as well as a large part of the running rigging on modern vessels. The use of hemp cordage for rigging purposes is now nearly obsolete,

**Right Rudder.** A term recently adopted in the Navy which is applied to the operation of moving the rudder to starboard and consequently turning the bow of the ship to the right.

**Righting Arm, Maximum.** The maximum length of the righting arm attained by any given vessel with a given loading when heeled from the upright throughout her entire range of stability.

**Righting Lever or Arm.** The perpendicular distance between two vertical lines, one through the center of gravity and one through the center of buoyancy, the ship being inclined from the vertical. If the relative positions of the center of gravity and center of buoyancy are such as to produce a righting couple, the lever is positive and is a true righting lever. If, however, the couple produced tends to overturn the vessel, this righting lever becomes negative and is then more properly termed an upsetting lever. The displacement of the vessel multiplied by the righting lever equals the righting moment. At small angles of inclination, the righting arm is equal to the metacentric height multiplied by the sine of the angle of inclination.

**Righting Moment.** The product of the displacement and length of the righting arm. The displacement being expressed in tons, and the righting arm in feet, the righting moment is therefore given in foot-tons.

**Right-laid Rope.** See Rope, Right-Laid.

**Rimer.** See Reamer.

**Riming.** See Reaming.

**Ring Dial.** Another name for the Gemma's Ring, a form of sun-dial used as a sun clock to determine the hour for any given latitude, and probably the most common and simplest form of altitude dial.

**Rise of Floor.** See Deadrise.

**Riser.** The upright board of a stair.

**River Steamer.** A steam driven vessel designed for service on inland waters. Vessels of this type usually carry both passengers and cargo. For use on deep rivers, sounds, etc., large vessels of moderate draft, good hull free board, lofty superstructures, and either paddle or screw propulsion are present practice.

**River Steamer, Shallow Draft.** For shallow rivers the shallow draft type with small hull freeboard, lofty superstructures, and either stern wheel or tunnel screw is used.

**Rivet.** A pin used for connecting two or more pieces of material by the means of passing it through a hole drilled or punched for the purpose and hammering down one or both ends. Rivets should be made from high grade iron or mild steel, except that in cases where high tensile steel parts are to be connected high tensile steel rivets are generally used. Copper rivets are used for various minor purposes. In the shell plating, decking, bulkheads and the framing of a ship, as well as in the boilers, the joints must be very firm and in most cases watertight; therefore, for this reason,

and because of the fact that rivets 3/8" diameter or over can be more efficiently worked while hot, it is the practice to heat rivets before passing them through the holes and to hammer the points down before the rivet cools. The contraction of the rivet due to cooling will aid very materially in producing the firm joint desired.

**Rivet Counter.** Men who count rivets in ship construction. A person so engrossed in a particular ocean liner or vessel, that he researches the structure of his subject down to the number of rivets. In some cases, Rivet Counter's are thought, by friends or mates, to have a compulsive disorder. Some rivet counter's are actual researchers and offer their information to the general public, and will provide documentational evidence to support said information, over and above hear-say.

**Rivet Cutter.** A tool similar to a pneumatic riveting hammer used for cutting and punching out rivets.

**Rivet Forge.** See Furnace, Rivet.

**Rivet, Furnace.** See Furnace, Rivet.

**Rivet Heading Machine.** See Bolt Heading Machine.

**Rivet Heater.** One who heats the rivets. This work is generally done by one or two boys with a portable forge. They should be careful to place the rivets in the fire shank down so that the heads will not become too plastic when thrown or passed to the holder on. Care should also be taken not to burn the rivets or to leave them in the fire too long.

**Rivet Holes.** A term applied to the holes that are punched or drilled in plates, shapes, forgings and castings for rivet connections.

**Rivet, Keel.** A term applied to a rivet used in attaching the keel to the garboard strake.

**Rivet Set.** A caulking tool for use around a rivet.

**Rivet Spacing.** A term applied to the distance between the centers in a row of rivets.

**Riveter, Hydraulic.** Usually a large C-shaped cast steel, frame with a hydraulic ram fitted at the open end which carries the rivet set.

**Riveters.** Workmen who drive rivets by hammering the points into the required shape either by means of hand or power tools. Riveters usually work in gangs, a gang including one or two riveters, a holder on, a heater, and perhaps one or more passers. Riveters should be responsible for the fairness of the surfaces riveted and should see that there are no lateral bends, bumps or irregularities in the plating, because when once riveted the structure is permanent. They should also see that the surfaces are rigidly and firmly united when they perform the operation of swaging down the points of the rivets.

**Riveting.** The art of fastening two pieces of material together by rivets.

**Riveting, Bull.** A term applied where rivets are driven by power machines, usually air or hydraulic.

**Riveting, Chain.** A term applied to two or more rows of rivets that have their centers opposite each other. A line drawn perpendicular to the edge of the plate through the center of a rivet in one row will also pass through the centers of the corresponding rivets in the other rows.

**Riveting, Double.** A term applied when a connection is made with two rows of rivets. In butt joints there are two rows in each piece connected.

**Riveting Hammer, Hand.** Either a long double headed hammer of medium diameter with flat faces or having a long head and a narrow peen.

**Riveting Hammer, Pneumatic.** A light machine operated by compressed air, in which a rivet set with its shank having a sliding fit in the bore is given very rapid, short and powerful strokes.

**Riveting, Hydraulic.** A term applied where the rivets are driven by a machine actuated by hydraulic pressure.

**Riveting Machine.** A machine designed for upsetting and forming rivet points.

**Riveting, Reeled.** See riveting, Staggered.

**Riveting, Single.** A term applied where a connection is made with one row of rivets. In butt joints there is one row in each piece connected.

**Riveting, Staggered.** A term applied to two or more rows of rivets where the centers of the rivets in one row are one-half the pitch or spacing ahead of the other row.

**Riveting, Three-ply.** A term applied where three thicknesses of material are connected by one rivet.

**Riveting, Treble.** A term applied when a connection is made with three rows of rivets. In treble riveted butt joints there are three rows in each piece connected.

**Riveting, Zig Zag.** See Riveting, staggered.

**Rivets, Row of.** A term applied to a continuous line of rivets whether vertical, diagonal or horizontal. The spacing of the rivets from center to center depends upon the nature of the connection.

**Roasting Ovens.** The heated chambers constituting the interior portion of a ship's range.

**Rock Shaft.** See Shaft, Weigh.

**Rojas Dial.** Also called a Geminus Dial, one more from of sun-dial, made vertically, and found sometimes on the backs of Quadrants, Nocturnals, and Astrolabes.

**Roller Bearings.** The inherent principle of the roller bearing is the substitution of a true rolling motion for the sliding friction of plain bearings. The low coefficient of friction for rolling contact as compared with sliding contact is utilized in such a practical way that the power consumed in overcoming friction is reduced by from 60 to 75 per cent. Flexible roller bearings are wound helically from flat strip steel into a hollow, cylindrical roller, which, because of its flexible construction, can adapt itself to slight irregularities in either the journal or the housing without causing excessive

pressure or permanent deformation. The hollow center of the roller serves as a reservoir for the lubricant which is distributed through the helical slots over all the bearing surfaces. Roller bearings are extensively used on all type of machinery and can be applied in practically every place where a wheel or shaft turns. They minimize friction, give a smoother and easier operating machine, eliminate sticking bearings, hot boxes and bearing replacements, insure positive and care free operation, greatly reduce maintenance costs, and are capable of years of satisfactory service with no appreciable wear. They are the logical bearing for cranes, hoists, plate castors, and all shipbuilding equipment where a durable, dependable, easy running bearing should be used.

**Rolling.** The oscillating motion of a vessel from side to side due to ground swell, heavy sea, or other causes.

**Rolling Chock.** A term applied to a bilge keel.

**Rolling Ruler.** This brass rule, 12in. or more long, and 3in. wide, was introduced at the beginning of the 19<sup>th</sup> century to serve as a Parallel Ruler.

**Rolls, Bending.** A machine in which power driven steel rolls are used to give curvature to plates. Three rolls are provided and two are adjustable allowing the arc to which a plate may be rolled to be varied within wide limits. A slot is usually cut in the forward roll to allow the rolls being used for flanging plate brackets, etc.

**Rolls, Hand Power.** A small machine designed to give curvature to light metal plates. This type is operated by hand, a large wheel with wood spokes being usually provided for this purpose.

**Rolls, Mangle.** A machine in which power driven steel rolls are used to straighten plates

**Roofing.** A term applied to waterproof materials used in covering roofs.

**Rope.** The product resulting from twisting a fibrous material, such as manila, hemp, flax, cotton, coir, etc., into yarns or threads, which in turn are twisted into strands and several of these laid up together. Fiber rope is designated as to size by its circumference. Wire rope is made of iron, steel, or bronze wires twisted together like yarns to form strands, which in turn are laid up to form a rope. Wire rope is designated as to size both by its diameter and its circumference.

**Rope, Back Hand.** A rope in which the fibers are twisted up left handed, the yarn right handed, and the strands left handed.

**Rope, Bolt.** A rope used around the boundaries of sails, awnings, canvas, tarpaulins, etc. It is made from selected yarns of the best quality of hemp cordage, which are rather loosely laid up and tarred.

**Rope, Buoy.** The rope by which a buoy is attached to its anchor. It should be of sufficient strength to lift the anchor should a vessel be obliged to slip her cable or the cable part.

**Rope, Cable-Laid.** A term that was formerly exclusively applied to a rope consisting of nine strands, being made by laying three plain ropes together left-handed; but now used to denote three, sometimes four, plain laid three-stranded ropes twisted together in the opposite direction to the twists in the several ropes. Also known as

hawser laid and water laid rope.

**Rope, Cast Steel Wire.** A rope made from cast steel wires. It is used for standing rigging and derrick guys and when so used should be galvanized.

**Rope, Check.** A term applied to a rope used in checking the way of vessel when docking or warping. A hawser having one end fastened to a dock and the other end turned around a bitt so that it may be slackened or held taut.

**Rope, Coir.** Rope made from the fibrous husks of the cocoanut having about one-fourth the strength of manila rope. It is sufficiently buoyant to float upon the surface of the water, but is disagreeable to handle.

**Rope, Cotton.** A rope of small diameter made from cotton fibers and used for sheets and halyards on yachts and sail boats.

**Rope, Flat.** A rope having its strands braided instead of twisted up.

**Rope, Hawser.** A term applied to warping and towing lines.

**Rope Heart.** When a fiber rope has a heart it consists of a small pliable rope whose diameter is about one-third that of the strands. In a wire rope the heart may consist of a tarred hemp rope where pliability is the chief consideration and a wire heart where strength is more important.

**Rope, Hemp.** A rope made from fibers of the hemp plant. As in manila rope the fibers are made into yarn, the yarn into strands, and three or more strands twisted up to form a rope. Hemp rope when exposed to the weather requires tarring as it otherwise decays rapidly. Hemp rope is used principally for bolt ropes and standing rigging.

**Rope, Hide.** A rope made from strips of uncured hide and principally used as wheel rope.

**Rope, Iron Wire.** A rope made of iron wires. It has less strength but is more pliable than steel rope of the same make up.

**Rope Knots.** See Knots.

**Rope Lay.** The direction in which it is twisted up.

**Rope, Left-Laid.** Rope in which the strands are twisted together in the same direction as that of the hands of a clock.

**Rope, Manila.** A rope made from fibers of manila which are obtained from the wild banana plant growing in the Philippines. The fibers are made into yarn, the yarn into strands and three or more strands twisted up to form a rope. Manila rope is usually made up of three strands up to 3" circumference and above that diameter four strands with a heart center. This rope is more desirable than hemp for hawsers and running gear because it is lighter and more pliable and does not require tarring for preservation. Manila rope is stronger than tarred hemp rope but a little weaker than white rope.

**Rope Marline.** See Rope Spun Yarn.

**Rope, Mast.** A heavy rope used in hoisting or striking down a topmast, topgallant

mast, etc.

**Rope, Parceling.** This operation consists of wrapping straps of canvas around the rope with the upper edges overlapping similar to shingles. For wire rope the strips should be coated with red lead and linseed oil and for fiber rope they should be tarred. The rope is usually wormed if parceled.

**Rope, Plain-Laid.** A term that was formerly exclusively applied to the three-stranded right-handed rope, but is now applied commercially to three, four or six stranded rope laid up in the contrary direction to the twist in the strands.

**Rope, Plow Steel.** A rope made from plow steel wires. It is very strong and durable, and is used for running gear.

**Rope, Ridge.** A rope running through the eyes at the heads of the awning stanchions to which the edge of an awning is hauled out and stopped. The term is sometimes applied to the center rope of an awning, but "backbone" seems to be a more satisfactory term for it.

**Rope, Right-Laid.** Rope in which the strands are twisted together in the opposite direction to the motion of the hands of a clock.

**Rope Seizing.** A method of making a joint between two ropes by binding with marline or spun yarn.

**Rope Serving.** Consists of wrapping a complete layer of marline or cord around a rope to protect it against chafing. The rope is usually wormed or wormed and parceled before serving.

**Rope, Shroud-laid.** A rope made by laying up four strands around a core or heart in a right handed direction.

**Rope, Sisal** (a substitute for manila). The fiber for Sisal rope is procured from a plant grown in Yucatan Mexico and Key West, Fla. Its tensile strength is not more than three-quarters that of Manila fiber. Unlike Manila, Sisal is stiff and harsh, and deteriorates rapidly when exposed to the elements.

**Rope Splicing.** A method of making a rope joint which is accomplished by braiding the strands. A splice in wire rope is from 10 to 15 per cent weaker than the rope.

**Rope, Spun Yarn.** Hemp fiber loosely twisted and tarred. Also called Marline and Hambroline.

**Rope, Stern.** A rope leading from the stern of a vessel to a wharf or buoy for mooring. Also known as "stern line" or "stern fast."

**Rope Strand.** This is composed of rope yarns twisted up and usually in a left handed direction.

**Rope, Tapered.** A rope having a relatively large diameter where strength is required and tapering down to a smaller diameter where more pliability is desirable.

**Rope, Tiller.** A term applied to the ropes actuating a tiller. A very desirable type is made up of small bronze wires which is quite pliable.

**Rope, Tow.** A hawser of either fiber or wire by which a vessel is towed or tows

another.

**Rope, Twice-Laid.** Rope made from old yarns laid up a second time.

**Rope Walk.** A place where rope is manufactured by the less modern machine methods. A long walking space is required for the workmen in their back and forth motion in the operation of spinning, hence the name.

**Rope, White.** A term applied to untarred hemp rope. It is used for log and lead lines. The white rope is stronger than manila.

**Rope, Wire.** A rope made up of wires twisted up into strands and strands twisted up into rope. The strands are usually twisted up around a heart of hemp or wire. Particular care should be taken with wire rope to prevent kinking. It should never be pulled out from a coil as fiber rope but should be unwound from an axis or the coil should be rolled along like a wheel.

**Rope Wire Fittings.** See the respective headings for clips, clamps, sockets, thimbles, etc.

**Rope, Wire, Marline Clad.** A wire rope in which each strand is served with tarred marline before being twisted about the core. flat steel wire before being twisted about the core.

**Rope, Wire, Steel Clad.** A wire rope in which each strand is served with flat steel wire before being twisted about the core.

**Rope Worming.** Filling in the valleys between the strands of a rope with marline. The marline should run with the lay of the rope.

**Rope Yarn.** This consists of fibers of manila or hemp which are usually twisted up in a right handed direction.

**Rose Box.** See Pump Strainer.

**Rose Box, Strum or Strainer.** See Strum Box.

**Rose Lashing.** A lashing made by alternately passing the parts over and under the object lashed, then finishing by turning the end around the crossing point. Also known as Rose Seizing.

**Rose Seizing.** See Rose Lashing.

**Roses.** Perforated metal plates, fitted over the outside of injection sea cocks in order to prevent the entrance of weeds or other foreign substances to the ship's piping system or pumps. A perforated nozzle for delivering water in a fine jet.

**Rosin, Wood.** A solid substance exuded from various trees, or left as a residue from the distillation of turpentine.

**Rot.** A term applied to wood that has become soft or discolored.

**Rotary Air Pump.** See Pump, Rotary.

**Rotary Converter.** A rotary electrical machine for transforming alternating current to direct current or vice versa. Also called Synchronous Converter.

**Rotary Pump.** See Pump, Rotary.

**Rotary Shear.** See Shear, Rotary.

**Rotor, Turbine.** See Turbine Rotor.

**Round In.** To haul in a rope rapidly.

**Round Stern.** The Stern of a ship whose decks terminate aft in semi-circular or elliptical shape.

**Rounded Gunwale.** See Gunwale, Rounded.

**Roundline.** A three-stranded, right-handed, tarred hemp, small stuff used for seizings, service, etc.

**Rouse.** To overhaul rapidly as a rope or cable. To "rouse out" the crew to get them on deck quickly.

**Row Locks.** U-shaped fittings with shank or socket attachments to the gunwale of a boat. They are used as a fulcrum for oars in rowing, sculling and steering.

**Royal.** A light square sail set next above a topgallant sail.

**Rubbing Strip.** A plate riveted to the bottom of a keel, to afford protection in docking and grounding. Also a strip fastened to the outside of a fender or to the shell plating where contact is likely to occur.

**Rudder.** A device used in steering or maneuvering a vessel. The most common type consists of a flat slab of metal or wood, hinged at the forward end to the stern or rudder post and rounded at the after end to make a fair ending to the lines of the vessel. When made of metal it may either be built up from plates, shapes and castings, with or without wood filling or it may be a casting. The rudder is attached to a vertical shaft called the rudder stock, by which it is actuated or turned.

**Rudder Area.** The area of the effective rudder blade. Usually referred to as a percentage of the area of the immersed middle line or lateral plane of the ship.

**Rudder Arms.** A term applied to the frames or arms projecting or radiating from the vertical main piece for the purpose of supporting and stiffening the rudder plating.

**Rudder, Auxiliary.** A term applied to bow rudders. They are fitted to ferry and sometimes paddle-wheel boats.

**Rudder, Balanced.** A rudder having the forward or leading edge of the whole or a portion of the rudder far enough forward of the center line of the rudder stock to bring the center of pressure of the water on the rudder at the maximum helm angle on or near the centerline of the rudder stock.

**Rudder, Bearing.** A fitting usually constructed in two parts which are bolted together around the rudder stock. The upper portion of the bearing is usually fitted with an annular groove and a flat ring floating in oil upon which the rudder carrier turns.

**Rudder, Bow Piece.** A term applied to the curved frame forming the after edge of a rudder.

**Rudder Brace.** See Gudgeons. .

**Rudder Bushings.** A term applied to brass or metal sleeves fitted around the pintles.

**Rudder Carrier.** A fitting usually constructed in two parts which are bolted together around the rudder stock and which forms a means of transferring the weight of the rudder to the rudder bearing. The upper portion of the carrier consists of a sleeve that forms a close fit around the stock which is usually turned to a larger diameter at the top and bottom of the carrier sleeve to form shoulders. The upper shoulder aids in transferring the weight of the rudder through the carrier to the bearing and the lower shoulder prevents the stock from slipping up through the carrier. Set screws or a key and keyway are usually fitted to insure that the carrier turns with the stock. The lower portion of the carrier consists of a flange having a flat bearing surface that works on an annular ring floating in oil in a groove on the top of the rudder bearing.

**Rudder, Cast Steel.** A term applied to a rudder having the plate and framework of cast steel. It may be made in one piece or in two or more pieces bolted together.

**Rudder Coupling.** A term applied to the flanges or palms fitted to the lower end of the rudder stock and to the top of the main piece to provide a means of efficient connection.

**Rudder, Double Plate.** A rudder constructed by two planes of plating tapering in section from the width of the main piece in the way of the rudder stock down to the width of a bar at the edges. The space between the two plates is usually filled with wood.

**Rudder, Flat Plate.** A term applied to a rudder constructed by one plane of steel plating. The plating is supported and stiffened by arms projecting from a vertical main piece. The rudder arms may all be on the same side of the plate or alternating on one side and then on the other.

**Rudder Frame.** A term applied to a vertical or main piece and the arms that project from it, forming the frame work of a rudder.

**Rudder Gudgeons.** See Gudgeons, Rudder.

**Rudder Head.** The upper end of the main piece to which the rudder stock is attached. The head consists of a flange or thick palm to which a flange or palm on the lower end of the rudder stock is bolted.

**Rudder Heel.** A term applied to the lowermost portion of the main piece of a rudder.

**Rudder, Jury.** See Jury Rudder.

**Rudder Keeper.** A term applied to wedge shaped pieces of metal that are fitted between and prevent the nuts on the coupling bolts from working loose.

**Rudder Lugs.** A term applied to the projection, cast or fitted to the forward edge of the rudder frame for the purpose of taking the pintles.

**Rudder, Main Piece.** The vertical or main frame of the rudder to which the rudder arms are attached.

**Rudder Pendants.** A term applied to a pair of chains or ropes attached by a shackle to a hole bored through the upper after end of a rudder frame or to a monkey tail for the purpose of providing a temporary steering gear. The upper ends of the pendants are usually attached to pads fitted to the shell.

**Rudder Pintles.** See Pintles, Rudder.

**Rudder Scores.** A term applied to the portions of the forward edge of a rudder that are cut out between pintles. This scoring allows the rudder to be unshipped readily.

**Rudder, Side Plate.** See Rudder, Double Plate.

**Rudder Stays.** See Rudder Arms.

**Rudder Stock.** A vertical shaft having a rudder attached to its lower end and having a yoke, quadrant or tiller fitted to its upper portion by which it may be turned. In addition to the function of turning, the stock should take the weight of the rudder through a carrier attached to the stock which works on a bearing fitted at the top of the rudder trunk or on a platform or deck.

**Rudder Stock Stuffing Box.** See Stuffing Box, Rudder.

**Rudder Stops.** A term applied to fittings attached to the structure of the ship or to shoulders on the stern post which have the function of limiting the swing of the rudder to an angle of about 35 degrees.

**Rudder, Telltale.** See Telltale Rudder.

**Rudder Trunk or Tube.** A term applied to a casing fitted around the rudder stock and extending from the counter to a platform or deck. Its purpose is to prevent water from entering the hull, and for this reason a stuffing box is fitted at its upper end.

**Rudder, Underhung.** A rudder that is not hinged or stepped on the stern post but supported entirely by the rudder stock. In this form of rudder the bending stress on the stock at maximum speed is generally quite large and becomes the most important factor in calculating the size of the stock.

**Rules of the Road.** Regulations for preventing collisions and for promoting safety to navigation

**Run.** The under water portion of a vessel aft of the midship section or dead flat.

**Runner.** A length of rope made fast at one end and rove through a single movable block, i. e. a single whip reversed.

**Running Rigging.** Ropes which are hauled upon at times in order to handle and adjust sails, yards, etc., such as sheets, clewlines, halyards, downhauls, out-hauls, reef-tackles. etc.

**Rutter.** A book containing information on tides, sailing directions, marine routes, entries into ports and harbors, signs and tokens of the sun, moon and stars at various times and the appearance and sound of the sea.

## S

**Saddle.** A block of wood, hollowed out to receive the inner end of a jib-boom.

**Safety Steps.** Special non-slipping arrangements for the steps of ladders or stairs. When in the form of a surface attachment to existing steps, they are called safety treads. The most modern practice, however, incorporates the non-slipping feature in the step itself. One form of safety step consists of grating, set on edge and solidly riveted together so that it is ready to be attached to the frame of the ladder or stair.

**Safety Treads.** See Treads, Safety.

**Safety Valve Box.** The protective casing sometimes used to cover the safety valve and to prevent its being injured.

**Safety Valves.** See Valves, Safety.

**Sag, Sagging.** The drooping or tendency to droop of the midship portion of a vessel relative to the ends.

**Sagged.** Permanently deformed by the action of sagging forces.

**Sail.** An article made of canvas and rope designed to be spread on spars in such a manner as to utilize the power of the wind in driving a vessel. Sails are of two general classes: square and fore-and-aft. Square sails are suspended from yards. Fore-and-aft sails are spread on booms and gaffs or bent to stays.

**Sail Needle.** A strong needle with a large eye used by sailmakers.

**Sail Plan.** A plan drawn to show the number, arrangement and dimensions of the sails for a sailing vessel.

**Sailing Vessel.** See Vessel, Sailing.

**Sailmakers.** Workmen who work the canvas, rope and fittings up into sails, awnings, tarpaulins, weather cloths, covers, etc.

**Sampson Post, King Post.** A strong vertical post used to support a derrick boom.

**Sand Glass.** This device for measuring intervals of time has two pear-shaped glass bulbs, one above the other, joined together at their pointed ends or necks by a narrow tube, through which fine sand or marble powder slowly runs down in a pre-determined space of time.

**Sand Jack.** See Jack, Sand.

**Sand Sucker.** A scow, or hull of other form, on which is installed a large, power operated pumping outfit of the centrifugal type, arranged to take water from the bottom of the channel or river bed by means of a long pipe or tube and to discharge either through a pipe line, generally carried on floats, to any convenient point in the vicinity or into holds provided in the vessel's own hull.

**Sander.** A machine designed to automatically sandpaper and finish the surface of woodwork.

**Sanitary Fixtures.** Plumbing installations such as toilets, bath tubs, showers, lavatories, toilet cases, waste jars, supply pitchers, carafe, water heaters, etc.

**Sanitary System.** A system of piping supplying and draining the plumbing fixtures aboard a ship such as lavatories, showers, toilets, sinks, etc.

**Sanitary Tank.** See Tank, Sanitary.

**Sash, Window.** A frame for holding the glass. It is generally composed of a horizontal piece at the top, called the top rail, a horizontal piece at the bottom, called the bottom rail or, where beveled in an upper sash, a check rail, the sides called stiles, and pieces dividing the sash into separate lights called mullions or bars.

**Saturated Steam.** See Steam, Saturated.

**Scale.** A more or less hard adherent crust which forms on boiler heating surfaces by the depositing of impurities from the feed water. The salts of lime and magnesia are usually responsible for such incrustation.

**Scaling Hammer.** A hammer used by cleaners to remove the rust scales from iron or steel plates and shapes.

**Scantlings.** A term applied to the dimensions of the frames, girders, plating, etc., that go into a ship's structure. The various classification societies publish rules from which these dimensions may be obtained and as these rules are the results of continued observation of ships' structures they give the most reliable information from a practical standpoint that can be obtained. The forces acting on a ship at sea cannot be accurately determined, hence calculations made to determine the size of a member of a ship's structure should be compared with similar calculations on existing practice where possible.

**Scarph.** A connection made between two pieces by tapering their ends so that they will mortise together in a joint of the same breadth and depth as the pieces connected. It is used on keels, stem and stern frames, etc. Also used to designate the tapering of the corner of a plate where a joint occurs.

**'Scending.** The oscillations of a ship in the fore and aft direction. Synonymous with the term "pitching."

**Sceptre Recorder.** An instrument for recording the water depth under a ship.

**Schooner.** A sailing vessel with two or more masts rigged fore and aft.

**Sconce.** A metal bracket, sometimes with a reflector behind it, attached to a beam or bulkhead to hold a candle or lamp.

**Scotch Boiler.** See Boiler, Scotch.

**Scotchman.** A piece of wood, hide or metal fitting seized to a shroud or other rigging to prevent chafing by the running gear, etc.

**Scout.** A war vessel of small size, displacing from three to five thousand tons, carrying a battery of from five to eight guns of moderate size and several torpedo tubes, having large cruising radius and the capabilities of traveling at high speeds.

**Scratch Awl or Scriber.** A small rod of cast steel with hardened sharp points used

for marking lines on the surface of metal.

**Screen Bulkhead.** See Bulkhead, Screen.

**Screen, Clear View.** A mechanical means of keeping lookout windows clear and transparent and prevent them from becoming fogged in heavy weather.

**Screw.** A cylinder surrounded by a spiral ridge or groove, every part of which forms an equal angle with the axis of the cylinder, so that if developed on a plane surface it would be an inclined plane. It is considered as one of the mechanical powers. When used alone the term commonly means a wood screw, having a slotted head and gimlet point, for driving in with a screwdriver. Machine screws are similar, except that they have no gimlet point and have a metal screw thread. They are used for uniting metallic parts. All ordinary forms of bolts have screw threads cut on them, but are not commonly called screws. A special form of wood screw is a lag screw, which is a large size screw with a head like a bolt, so that it may be inserted with a wrench instead of a screwdriver.

**Screw Jack.** See Jack, Screw.

**Screw, Packing.** A tool designed for the removal of worn packing.

**Screw Propeller.** See Propeller.

**Screw-Post.** See Propeller Post.

**Screw-Race.** See Aperture.

**Screw, Shaft.** See Propeller Shaft.

**Screws, Rigging.** Implements possessing the mechanical advantage of the screw used at the lower ends of shrouds and stays in lieu of dead eyes and lanyards.

**Scrive Board.** A portable platform made of soft, clear, planed lumber on which a full sized body plan of a ship is drawn, the lines being cut into the surface of the wood in small "U" shaped grooves by means of a scrying knife, to prevent them from being obliterated.

**Sculling.** The propelling of a boat by means of a single oar over the stern.

**Scupper Holes.** Drain holes cut through the gunwale of deck stringer angle bar and adjoining shell plate to allow water to drain directly from the gutter or waterway overboard. Where from strength considerations the holes cannot be cut in angle bar plating, the usual scupper pipe is fitted, leading down through decks and the ship's side.

**Scupper pipes.** The pipes leading from the scupper to the fitting in the ship's side, for carrying accumulations of water from the deck overboard.

**Scuppers.** Drains from decks to carry off accumulations of rain water or sea water. The scuppers are placed in the gutters or waterways on open decks and in corners of enclosed decks, and connect to pipes leading overboard. The flap valve at the bottom of the scupper pipe is also often called a scupper.

**Scuttle.** A small opening, usually circular in shape, and generally fitted in decks to provide access as a manhole or for stowing fuel, water and small stores. A cover or

lid is fitted so that the scuttle may be closed when not in use. Also applied to the operation of opening a sea valve or otherwise allowing the sea to enter a ship for the purpose of sinking her.

**Scuttle Butt.** The designation for a container of the daily supply drinking water for the use of the crew. The scuttle butt formerly consisted of a simple wood cask standing on end, having a hole in its upper head or bilge. The more modern one is constructed of metal, well insulated and fitted with a sanitary drinking fountain. On large vessels provided with a refrigerating plant the scuttle butt is usually fitted with cooling coils connected to the refrigerating system.

**Sea Anchor.** See Anchor, Sea.

**Sea Chest.** A term applied to a casting fitted to the shell of a vessel for the purpose of supplying water from the sea to the condenser and pumps, and also for discharging water from the ship to the sea..

**Sea Cock, Sea Connection.** A sea valve secured to the bottom of the vessel for use in flooding the ballast tanks, supplying water to the fire pumps and sanitary pumps and other purposes. While these sea valves are sometimes called sea cocks, the ordinary type of valve is always used.

**Sea Injection Pipe.** See Pipe, Sea Injection.

**Sea Painter.** A long line led from a point well forward on a vessel outboard of the rail and awning stanchions to a lifeboat and bent to the inboard side of the forward thwart in such a manner that it may be quickly cast off. Hauling on the painter or when a strain is otherwise brought on it sheers the bow of the lifeboat away from the vessel.

**Sea Room.** The distance separating a vessel from the nearest point at which she could take the ground or meet other obstruction to navigation.

**Sea Valve.** See Valve, Sea.

**Seam.** A term applied to an edge joint whether flush or lapped. Also applied to the slight crevice between the ends or edges of butt joints.

**Seam Straps.** A term applied to a narrow strip of plate serving as a connecting strap between the butted edge of plating. The strap connections at the ends are called butt straps.

**Searchlight.** A powerful electric lamp placed at the focus of a mirror, which projects the light in a beam of parallel rays. The apparatus consists essentially of a base and turntable fitted with arms carrying trunnion bearings, in which is mounted the barrel or drum containing the mirror and lamp with its operating mechanism. The drum may be elevated and depressed and turned in azimuth by means of handles at the back, or by either mechanical or electrical distant control gear.

**Searchlight, High Intensity.** A searchlight of great brilliance distinguished from the ordinary type in being provided with carbons and lamp mechanism of special design, the positive carbon being cored, said core material being comprised of metallic salts which volatilize, becoming highly luminous when subjected to the temperature of an electric arc. The incandescent gas produced is held within the arc crater by the impinging of a flame from the negative carbon.

**Seating, Boiler.** See Boiler Foundation. .

**Secret Blocks.** See Blocks, Secret.

**Section.** A drawing showing the internal arrangement of a ship as it would appear if cut by a plane, usually longitudinally or transversely,

**Section, Midship.** See Midship Section.

**Sectional Area, Curve of.** A curve, plotted from a straight base line, representing the length of the ship, the ordinates of which represent to scale the areas of the vessel's immersed cross sections at corresponding points. The area under this curve represents to scale the volume of the displacement. The center of gravity of this area represents the longitudinal center of buoyancy of the displacement.

**Sector.** Known in France as the compass de proportion, this mathematical measuring instrument has two limbs or arms, and is essentially a brass-jointed ruler, the arms of which are engraved with various sets of graduated lines of scales, or tables, sines, tangents, and the like.

**Seize.** To secure one rope to another, two or more parts of the same rope together, or a fitting of any kind to a rope or other object by binding with any small stuff.

**Seizing.** A binding made of seizing stuff securing two ropes or two parts of the same rope together. Seizings are named according to their location and use, as throat or eye seizings, round seizing, flat seizing, etc. Several different ways of passing the seizings and making the finish are in general use for each of the above kinds. Seizings are also used to secure Scotchmen to rigging, cleats, davits, etc.

**Seizing Stuff.** A tarred hemp, right-handed, three-stranded small stuff of two, three or four threads to the strand. It is heavier and stronger than house-line or roundline, being made by machinery and finished similar to the larger sized ropes. Seizing stuff is also made in galvanized annealed steel wire, six wires around a wire center, varying from 1/16 inch to 1/4 inch diameter.

**Self Opening Die Heads.** A die head used on automatic screw machines and twists.

**Sennit.** A braided cordage made from rope yarns, spun yarns, and untarred marline plaited by hand in a number of patterns. Common or flat sennit is a plain plaiting of five or seven strands; French sennit is more open than the flat sennit, but similarly made of a greater number of strands; round sennit and square sennit take their names from their form, both consisting of an even number of strands. The former is plaited around a center or heart, while the latter is without a heart.

**Sentinel Valve.** See Valve, Alarm.

**Separator.** A device for removing water from steam. There are many varieties. That based on the centrifugal action developed by whirling or repeatedly changing the direction of steam is typical of such devices when fitted outside the boiler. In certain types of water tube boilers, perforated plates are fitted in the upper drum. The steam on its way to the steam pipe is subjected to a straining action by these plates.

**Separator, Steam.** A mechanism designed to extract the moisture and impurities from saturated steam. It is fitted on the steam line between the boiler and the engine.

**Series Motor.** See Motor, Series.

**Serve (to serve a rope).** To wrap any small stuff tightly around a rope which has been previously wormed and parceled. Very small ropes are not wormed.

**Service.** The covering of small stuff applied to a rope as a protection against the weather.

**Serving Stuff.** The various materials used in serving ropes, such as spun yarn, rope yarn, marline, house line, and round line. Where great neatness is not essential spun yarn is generally used, while marline, house line, and round line are used for neater work, being laid up more smoothly and of a superior quality material.

**Set.** Metal mold or template for use on the bending slab.

**Set.** Sometimes designated as "permanent set." The permanent deformation resulting from the stressing of an elastic material beyond its elastic limit.

**Set Iron.** A flat bar of soft iron used in transferring the shape of the frame from the scribe board to the bending slab.

**Set Screws.** A machine screw with either a slotted or square head used for the purpose of holding a part in place.

**Set Up.** To tighten the nut on a bolt or stud; to bring the shrouds of a mast to a uniform or proper tension by adjusting the rigging screws or lanyards through the dead eyes.

**Settling Tanks.** Oil tanks used for separating entrained water from the oil. The oil is allowed to stand for a time or until the water has settled at the bottom, when the latter is drained or pumped off.

**Sextant.** A hand navigating instrument for measuring, by reflection, the angle subtended at the eye by two distant objects by a single observation. It is the most convenient and accurate instrument yet devised for use where the observer has a very unstable support, as on board ship, and is very generally used by navigators and surveyors for determining the attitude of celestial bodies and the angular distance between them as well as the horizontal angular distance between terrestrial objects. It consists of a rigid frame having a handle, a horizon glass, silvered on its lower half, but clear on its upper half, and a telescope pointing into this mirror, all rigidly attached to the frame. Another mirror, known as the "index glass," is rigidly attached to a movable arm, which carries vernier reading on a graduated limb. A ray of light coming from a distant object strikes the index glass and is reflected to the mirrored part of the horizon glass and thence through the telescope, while a ray coming through the upper half of the horizon glass passes directly into the telescope, each of which set of rays forms a perfect image. The observation consists in bringing the two images into exact coincidence by means of the movable arm when the angle subtended by the two objects is then read off the limb. The name is derived from the fact that the limb of the instrument includes but an arc of 60 degrees of a circle, but owing to double reflection, angles up to 120 degrees may be measured with it. The scale is graduated to 120 degrees in a length of 60 degrees. A different form of instrument, known as the prismatic sextant, measures angles up to 180 degrees.

**Shackle.** A U-shaped link whose end is closed by a removable pin or bolt, Shackles are used principally to connect the shots of chain cables, blocks to davit heads and

other places where severe stress is brought on the block, rigging to mast bands and deck connections, etc.

**Shackle Bolt.** A bolt that passes through both eyes of a shackle and completes the link. The bolt may be secured by a pin through each end, or a pin through one end and through the eye, or by having one end and one eye threaded, or one end headed and a pin through the other.

**Shackle Bolt Pin.** A metal, or rarely, a wood pin, used to secure a chalked bolt. The pin generally has a split end, the two parts being slightly separated to prevent its starting, and is frequently termed a split pin.

**Shade Deck.** See Deck, Shade.

**Shade Deck Stringer.** See Stringer, Shade Deck.

**Shade Deck Stringer Bar.** See Stringer Bar.

**Shade-Deck Vessel.** A vessel constructed with a continuous upper deck of light scantlings and fitted with openings in the sides between the main and upper decks.

**Shaft Angle.** The angle which a propeller shaft makes with the line of intersection between the designed water plane and the longitudinal center plane of the ship. In many cases the horizontal shaft angle is ignored and only the angle which the shaft makes with the designed water plane is considered. This may be slightly less than the true shaft angle.

**Shaft, Crank.** See Crank, Shaft. .

**Shaft Horsepower.** See Horsepower, Shaft.

**Shaft, Propeller or Tail.** See Propeller Shaft.

**Shaft Stools.** A term applied to the seatings to which the plumber blocks or line shaft bearings are attached. In addition to supporting the weight of the shafting they have to resist any side bending tendency due to the vibrations or thrust on the shaft. The overturning force is not nearly so serious as in the thrust block.

**Shaft Strut.** A term applied to a bracket supporting the after end of the propeller shaft and the propeller in twin or multiple screwed vessels having propeller shafts fitted off from the center line. It usually consists of a boss, fitted with a bushing to form a bearing for the shaft, connected to the side of the ship by two arms of pear-shaped section. The inboard ends of the arms are fitted with palms for attachment to the shell.

**Shaft, Thrust.** See Thrust Shaft.

**Shaft Tunnel.** See Tunnel, Shaft.

**Shaft Tunnel, Shaft Alley.** A watertight passage housing the propeller shafting from the engine room to the bulkhead at which the stern tube commences. It provides access to the shafting and its bearings and also prevents any damage to the same from the cargo in the spaces through which it passes.

**Shaft, Weigh.** A shaft running parallel to the crank shaft, used for the purpose of controlling the valve gears on a reciprocating engine. It is carried in bearings

attached to the upper portion of the columns of the engine, and is fitted with one arm for the bridle rods to each link and one arm for connection to the reversing gear. The arms connected to the link bridle rods are slotted with a block working on a hand screw gear which permits independent adjustment of each link.

**Shafting.** Cylindrical rod or tubing used, in general, for the transmission of rotary motion from the source of power, the engine, to the propelling device, the propeller, or paddle wheel.

**Shakes.** Splits or checks in timbers which usually cause a separation of the wood between annular rings.

**Shank Painter.** A rope or chain passed around the shank and flukes of an anchor confining it to the billboard.

**Shaper.** A machine for planing small parts in which the work table is stationary, the cutting tool being held by a tool post on a moving ram which travels over the work.

**Shaper, Crank.** In this type of shaper a crank motion is used to drive the ram.

**Shaper, Double Head.** A type of shaper designed with two rams or heads. These machines also have two tables and may be used for planing large pieces of work and for work involving planing two surfaces some distance apart.

**Shaper, Geared.** In this type of shaper a rack and pinion are used to drive the ram with a slow cutting stroke, a quick return being effected by shifting an open and crossed belt arrangement.

**Shapes.** Bars of rolled mild steel or of extruded non-ferrous metals, having certain forms of cross section throughout their entire length. The forms of cross section given are such as to lend to strength and rigidity in fabrication.

**Shear, Angle.** A machine specially designed for cutting off angle bars.

**Shear, Gate.** A machine for cutting and trimming long sheets or plates. These machines are often designed for making cuts of from two to ten feet in length in one operation, the thickness of plate varying from 1-16" to 1 7/8", depending upon the capacity of the machine.

**Shear Legs.** An apparatus rigged up for raising and moving heavy weights where a crane or derrick is not available.

**Shearing.** The removing of excess material from the edges of plates or shapes by means of shear .

**Shearing Machine.** A machine used for splitting or trimming steel plates and for cutting of bars or structural shapes. Shearing machines are made both in hand and power operated types, and in many cases these machines are also adapted for punching operations by replacing the shear blades with one or more punches and dies.

**Sheathed, Sheathing.** A term applied to the wood planking fitted over a steel deck, to the planking fitted over the underwater portion of a steel shell, and to the copper plating with which the bottom of a wood vessel or a steel vessel sheathed with wood is covered.

**Sheave.** A wood or metal disc having a groove around its cylindrical surface to allow a rope or chain to run over it without slipping off.

**Sheave Holes.** A term applied to apertures cut through a mast, boom, or spar in which sheaves are installed.

**Sheepshank.** A method of quickly but temporarily shortening a rope. It is made by laying two long bights side by side and half hitching each part over the end of the near bight.

**Sheer.** The longitudinal curve of a vessel's rails, deck, etc., the usual reference being to the ship's side; however, in the case of a deck having a camber, its centerline may also have a sheer. The amount by which the height of the weather deck at the after or forward perpendicular exceeds that at the mid perpendicular. Mean sheer is the average of the sheers forward and aft as just defined.

**Sheer.** The deformation of a solid body equivalent to a sliding of each of the parallel infinitely thin laminae that may be considered to form it upon that next below it, in the same direction and by the same infinitesimal amount.

**Sheer Line.** The longitudinal curve of the rail or decks, which shows the variation in height above water or freeboard, throughout the vessel's entire length.

**Sheer Mold.** A molding placed flush with the top and along the outside edge of a wood deck.

**Sheer Off.** To steer clear of or keep away from some danger or object.

**Sheer Pole, Sheer Batten.** A term applied to a steel or iron rod fitted, for and aft, along the lower portion of the shrouds to hold them in place.

**Sheerstrake.** The strake of shell plating that runs along the level of the main or upper decks. Plates running along the level of lower decks are not called sheerstrakes. Sheerstrakes, on account of their distance from the neutral axis of the ship, are important strength members, and when adjacent to a strength deck they are made thicker than the side plating. The sheerstrake in wood ships is the strake of outside or shell plating that runs along the sides of the main or upper decks.

**Sheerstrake Plate.** See Plate, Sheerstrake.

**Sheet.** A rope or chain used to haul the clew of a sail out toward the yard arm or downward toward the deck and aft. Sheets take their names from the sails they extend, as "fore sheet," "main-staysail sheet," "mizzen-topgallant staysail sheet," etc.

**Shelf.** A wood ship term applied to the fore and aft timber that is fastened to the frames to form a support for the enclosure of the deck beams.

**Shelf, Hold Beam, Main, Upper Deck, Etc.** A fore and aft timber running under and supporting the ends of the various tiers of beams.

**Shell Doublings.** A term applied to extra plates fitted over the portions of the shell plating requiring additional strength. Also fitted as compensating plates in the way of ports or apertures.

**Shell Landings.** A term applied to that portion of the edges of shell plating occupied by the laps.

**Shell Liners.** See Frame Liners.

**Shell Lugs.** Short pieces of angle bar fitted to the shell plating between frames for the purpose of attaching stringer plates on the shell plating.

**Shell Plating.** See Plating, Shell.

**Shell-Room.** Spaces or compartments devoted to the stowing of projectiles.

**Shelter Deck.** See Deck, Shelter.

**Shelter Deck Sheerstrake.** The strake of outside plating adjacent to the shelter deck.

**Shelter Deck Stringer.** See Stringer, Shelter Deck.

**Shelter Deck Stringer Bar.** See Bar, Stringer.

**Shifting Beam.** A term applied to a portable beam fitted in a hatchway for the purpose of supporting the hatch covers. The ends of the beams are fitted in slotted carriers attached to the inside of the hatchway coamings.

**Shifting Boards.** A portable bulkhead generally constructed of wood planking.

**Shifting Valve.** See Valves, Shifting.

**Shim.** A piece of metal or wood placed under the bedplate or base of a machine or fitting for the purpose of truing it up.

**Ship.** A vessel having three or more masts. In a three-masted ship the masts are fore, main and mizzen, and all are square rigged. In a four masted ship the aftermost mast is called the jigger. It may be either square or fore-and-aft rigged.

**Ship Chandler.** An individual or firm handling provisions, outfit, or other commodities for a ship's use.

**Ship, Longitudinal Framed.** A ship constructed of widely spaced, deep or belt frames which support which support a relatively large number of small fore and aft frames.

**Ship, Transverse Framed.** A ship consisting of a large number of relatively small, closely spaced, athwartship frames, reinforced in the bottom by vertical floor plates and working in conjunction with widely spaced, fore and aft, deep girders, such as the keel, longitudinals, and side stringers. This is the usual type of vessel.

**Shipfitter.** A mechanic who lays out the shape, location of rivet holes, or openings, and bevels upon hull plates and shapes by means of templates or dimensions from the ship or from data obtained from plans or mold loft, in order that such plates and shapes may be satisfactorily fitted into their proper places in the ship's structure.

**Shipshape.** A nautical term used to signify that a whole vessel or the portion under discussion is neat in appearance and in good order.

**Shipwright.** A nearly obsolete term applied in wood shipbuilding where but a small amount of mold loft work was necessary to the men who set the frames, kept the form fair, and performed such work as would not lie within the province of a carpenter.

**Shipyard Plate.** This is not a utensil, but a bronze or brass plate inscribed with the name of the shipyard where a vessel was built.

**Shoes.** See Keel, False. .

**Sholes.** Small pieces of timber or plank placed under the heels of shores, etc.

**Shore, Spur.** A brace placed with one end resting on the side of a ship to keep it at a desired distance from the side of dock or dry dock.

**Shores.** Pieces of timber placed in a vertical or inclined position to support some part of a ship, or the ship itself, during construction.

**Shores, Bilge.** Short heavy timbers used in addition to the bilge blocks as supports for a vessel at or near the turn of the bilge.

**Short Splice.** A splice made where the rope is not required to render through a block and where an increased diameter is not objectionable as in straps, clings, pendants, etc. Less length of rope is required than when a long splice is made, which is sometimes the paramount consideration. The strands are first unlaidd for a short distance, the ends of the ropes brought together, the strands interlaced and tucked through the lay of the other rope.

**Shoveling Boards.** Boards placed in the bottom of coal bunkers forming a level surface.

**Shroud.** A principal member of the standing rigging, consisting of hemp or wire ropes which extend from or near a mast head to a vessel's side or to the rim of a top to afford lateral support for the mast.

**Shroud-laid Rope.** See Rope, Shroud-laid.

**Shroud Ring, Turbine.** See Turbine Shroud Ring.

**Shunt Motor.** See Motor, Shunt.

**Sick Bay.** A name applied to the space on board ship where the members of the crew or passengers are given medical treatment. As generally used, the term covers all rooms or compartments assigned for treatment of the sick, such as the dispensary, operating room, contagious ward, etc.

**Side Bar Keel.** See Keel, Side Bar.

**Side Bunker.** A bunker located in a vessel's wings usually in way of the boiler rooms. Bunkers of this type are common on coal burning vessels largely because of the facilities thus afforded for feeding coal into the fire rooms.

**Side Frame.** See Frame, Side.

**Side Girders.** See Stringer, Side.

**Side Keelson.** See Keelson, Side.

**Side Lights.** See Lights, Side.

**Side Plating.** A term applied to the plating above the bilge in the main body of a vessel. Also to the sides of deck houses, erections, etc.

**Side Scuttle.** A term applied to an opening in the side of a ship provided for the discharge of garbage, etc.

**Side Stringer.** See Stringer, Side.

**Siding of a Frame.** The fore and aft dimension of a frame.

**Siding of a Keel.** Its width.

**Siding of a Stem.** Its athwartship dimension.

**Siding of a Sternpost.** Its athwartship dimension.

**Sill.** The foundation timber of a deck house, on which the framing is erected. Also called Coaming.

**Sill, Dry Dock.** The stone, concrete or timber ledge at the bottom of the entrance of a graving dock against which the gates or caisson abuts when closed.

**Sill, Window Frame.** The horizontal piece at the bottom.

**Single Acting Pump.** See Pump, Single Acting.

**Single Riveting.** See Riveting, Single.

**Single Whip.** A rope rove through a single fixed block.

**Siren, Steam.** A form of whistle in which the sound is produced by the action of steam in passing through corresponding openings in two concentric and oppositely revolving discs or cylinders. The pitch and intensity are raised and increased respectively with the speed of rotation. The steam is permitted to escape through a funnel shaped opening or trumpet so as to increase the volume of sound as much as is possible.

**Sister Blocks.** See Blocks, Sister.

**Sister Hooks.** Hooks made in halves and set on eyes facing each other in such a manner that they may be made to function as a link

**Sister Keelson.** See Keelson, Side.

**Skeg.** The after end of the keel. It forms a support for the sternpost and sometimes projects sufficiently to form a step for the rudder post.

**Skeleton Mold.** See Mold, Skeleton.

**Skeleton of a Vessel.** The transverse and longitudinal members comprising the framework of the shell and decks.

**Skew Inclination.** The inclination resulting from the simultaneous action of both

transverse and longitudinal forces.

**Skiff.** A lightly built pulling boat. The term is sometimes loosely used as applying to pulling boats in general.

**Skin.** This term is usually applied to the outside planking or plating forming the watertight envelope over the framework. It is also applied to the inner bottom plating where it is called the inner skin.

**Skin, Inner.** A term applied to the inner bottom plating. This usually extends only across the bottom, but sometimes is carried up the sides.

**Skin, Outer.** A term applied to the outside plating, shell or planking of a ship.

**Skin Resistance.** See Resistance, Skin.

**Skylight.** A built up frame of metal or wood having glass lights fitted in the top and installed over a deck opening for the purpose of furnishing light and, where the top covers are hinged; ventilation to the spaces below.

**Skylight Coaming.** The vertical sides of a skylight frame whether of steel or wood.

**Skylight Cover.** The top of a skylight, having glass lights fitted in it and often hinged and operated from below. Brass rods are generally fitted over the glass for protection.

**Skylight Gratings.** A term applied to the gratings protecting the glass lights in a skylight cover. They are usually constructed of brass rods.

**Skylight Lifting Gear.** A gear composed of rods, pinions, worms or gears, levers and hand wheel for opening and shutting a skylight cover from below. This gear should be designed to operate easily and to support the cover firmly when open.

**Slabs or Blocks, Bending.** Square or rectangular iron castings of adequate strength, fitted with numerous regularly spaced holes for the reception of dogs or other holding devices. A number of these units are fitted side by side, their upper surfaces uniting to form a continuous floor of sufficient area. Upon this floor heated shapes such as frame bars are bent to the required contour and then fastened by means of dogs placed in the holes until a permanent set has been assumed.

**Slack.** The opposite of taught, not fully extended as applied to rope; to slack off means to ease up, or lessen the degree of tautness; as applied to water, that state of the tide when it has ceased running and appears stationary just before it turns, either at high or low water.

**Slack Away, To.** To pay out a rope or cable by carefully releasing the tension while still retaining control.

**Slackness.** The contrary of ardency, being that property of a ship by virtue of which she tends to throw her head away from the wind. Ships possessing this characteristic must be held on their course by keeping the helm a-lee. The reason for this tendency is found in the resultant lateral resistance of the vessel being behind or abaft of her resultant wind pressure.

**Sleepers.** Timbers placed upon the ground or on top of piling for supporting the

cribbing, keel and bilge blocks.

**Sleeve.** A casing, usually of brass, fitted over line or other shafting for protection against wear or corrosion.

**Slew.** To yaw from side to side while at anchor or being towed.

**Sling.** A length of chain or rope employed in handling weights with a crane or davit. A cask or barrel sling usually consists of a length of rope having the two ends spliced together; the chains or ropes attached at the bow and stern of a small boat to which is hooked the tackle when it is hoisted or lowered; the chain or rope extending from a mast head to the center of a yard forming a support for same.

**Slip.** The difference between the pitch of a propeller or the mean circumference of a paddle wheel and the advance of same through the water corresponding to one revolution. An inclined launching berth.

**Slipways or Berths.** The space in a shipyard where a foundation for launching ways and keel blocks exists and which is occupied by a ship while under construction. The term berth also designates the space a ship occupies at a pier or at an anchorage,

**Sloop.** A vessel having one mast and fitted with fore- and-aft sails.

**Sloop-Rig.** A single masted fore and aft rigged vessel. Distinguished from a cutter principally by her broad, shoal hull with its accompanying center board.

**Slop Chute.** A chute hung over the ship's side or built into the ship with discharge through the ship's side, for discharging garbage overboard.

**Slotting Machine.** A machine which operates on the same general principles as a shaper, except that the ram which carries the planing tool moves in a vertical direction at right angles to the work table.

**Slotting Machine, Crank.** In this type of slotting machine, a crank motion is used to drive the ram.

**Sluice.** An opening in the lower part of a bulkhead fitted with a sliding watertight gate or door having an operating rod extending to the upper or upper decks.

**Sluice Cock.** Either a cock or valve attached directly to a bulkhead to permit flow of a liquid directly from one compartment to another. A cock differs from a valve in that the liquid flows through a channel bored through the tapered plug forming the cock and in no case is it necessary to turn the handle more than a quarter turn to open it fully.

**Sluice Valve.** Sec Valve, Sluice.

**Sluice Valve Rod, Sluice Valve Spindle.** The operating rod by which the sluice valve, usually located at the bottom of a compartment, can be opened or closed from a deck above.

**Slush.** Grease obtained from the meat boiled in the coppers and used as a lubricant and for slushing the spars after scraping.

**Smoke Box.** The casing attached to the end of a boiler to which the uptake is connected.

**Smoke Box Door.** A door attached to the smoke box to provide access for inspecting and cleaning the tubes.

**Smoke Sail.** A piece of canvas hoisted close to the galley smokepipe to carry the smoke from the deck during a head wind or hoisted at the foremast to prevent soiling the mast.

**Smoke Stack.** A metal chimney or passage through which the smoke and gases are led from the uptakes to the open air.

**Smoke Stack Cover.** A canvas cover used to close the top of the smoke stack when the fires are drawn for any length of time such as during a repair period.

**Smoke Stack Paint.** See Paint.

**Snap Switch.** An electrical device for opening and closing a circuit by turning an insulated button. A snap switch for marine work is usually arranged so that the electrical connections are protected by a watertight cover.

**Snatch Block.** See Block, Snatch.

**Snubbing.** The checking of a vessel's headway by means of an anchor and short cable. The checking of a line or cable from running out by taking a turn about a cleat, bitts, or similar fitting. Also drawing the waterlines or diagonals of a vessel in suddenly at their ends.

**Socket, Davit.** See Davit Socket.

**Soda Cock.** See Condenser, Soda Cock.

**Sole-Piece of Stern Frame.** The lower fore and aft piece of a stern frame connecting the propeller and stern posts.

**Sole Plate.** A term applied to the top plate of a foundation to which the base of a machine or piece of equipment is bolted.

**Solid Frame.** Described under frame.

**Soot Blower.** A cleaning gear designed to clean the fire surfaces of steam boilers and remove the soot. These results are accomplished by means of steam jets.

**Sounding.** Measuring the depth of water or other liquid.

**Sounding Line.** The fine piano wire or wire rope used with a sounding machine.

**Sounding Machine.** A machine which has almost wholly superseded the antiquated and clumsy deep-sea lead, being designed to ascertain, accurately and quickly, the depth of water at rather high speeds, say up to 16 or 17 knots, in depths not exceeding 100 fathoms.

**Sounding Pipes.** See Tubes, Sounding.

**Sounding Rod.** A light metal rod, graduated as desired, for lowering into a sounding tube to determine the depth of liquid in a compartment or tank.

**Sounding Tube Deck Plate.** See Deck Plate, Sounding Tube.

**Sounding Tubes.** See Tubes, Sounding.

**Spacing of Frames.** See Frames, Spacing.

**Span.** A rope whose ends are both made fast some distance apart, the bight having attached to it a topping-lift, tackle, etc. A line connecting two davit heads so that when one davit is turned the other follows.

**Spanish Windlass.** A makeshift purchase consisting of a rope, a post or roller and a lever. One end of the rope is attached to the object to be moved, a turn is taken around the post and the other end secured to a fixed object. The lever is then inserted in the bight of the rope at the post and by turning it around a considerable strain is produced.

**Spanker.** Sometimes termed the driver. The fore-and-aft sail carried on the mizzen mast of a three masted vessel.

**Spanner.** A form of open head wrench for use with special fittings whose character is such as to preclude the use of the ordinary type of wrench.

**Spar.** A term applied to a pole serving as a mast, boom, gaff, yard, bowsprit, etc. Spars are made of both steel and wood.

**Spar Deck.** See Deck, Spar.

**Spar Deck Sheerstrake.** The strake of outside plating adjacent to the spar deck.

**Spar Deck Stringer.** See Stringer, Spar Deck.

**Spar Deck Stringer Bar.** See Bare, Stringer.

**Spar-Decked Vessel.** A merchant vessel constructed with a complete deck above the main deck and having scantlings above the main deck heavier than those of an awning deck vessel but lighter than those in a full three decked vessel.

**Spare Bunker.** A bunker for reserve coal.

**Spectacle Frame.** A single casting containing the bearings for and supporting the ends of the propeller shafts in a twin screw vessel. The frame consists of arms of pear-shaped section extending outboard from each side of the center line of the ship to bosses taking the bearings of the propeller shafts. These arms are usually inclined downward from the center line at an angle of about 30 degrees from the horizontal. The shell plating is worked outboard to enclose the shafts and is attached at the after end to the bosses and arms of the spectacle frame. They are used on steam yachts and large merchant vessels in place of shaft struts or brackets.

**Speed Length Ratio.** The ratio of the speed in knots to the square root of the waterline length in feet. Similar ships at corresponding speeds have the same value for this expression.

**Speeds, Corresponding.** See Corresponding Speeds.

**Spent Condition.** The condition of a vessel when all consumable provisions, stores, fuel and fresh water are exhausted.

**Sphere.** A globe representing the earth or the apparent surface of the heavens.

**Spikes.** A stout metal pin headed on one end and pointed on the other. Spikes are used for securing heavy timbers together. Spikes are generally made of square bar with diamond, button or nail type of head and of round bar with countersunk head.

**Spirketting.** A wood ship term applied to the first strake of inside planking or ceiling above a waterway.

**Spirketting-Plate.** A vertical side stringer plate attached to the inside of the frames at a lower deck or tier of hold beams.

**Splice.** A method of uniting two ropes by first unlaying, then interweaving and tucking the strands. See Long Splice, Short Splice, etc.

**Sponson Beam.** The outer fore and aft girder supporting the paddle wheel box and holding the outer bearing of the paddle wheel shaft.

**Sponsons.** Fore and aft beams supporting the paddle box structure.

**Spot Face.** The finishing off of the structure around a hole.

**Spray hood.** A canvas hood which may be designed in several different shapes, used aboard a boat to prevent the spray from coming on deck or into an enclosure.

**Spread.** The distance measured transversely to a vessel's longitudinal axis.

**Spring.** The deviation from a straight line or the amount of curvature of a sheer line, deck line, or beam.

**Spring Bearing Foundation.** A structural steel foundation built up of lightened plates and angles and surmounted by a heavy base plate to which the holding down bolts of the lower bearing piece are attached.

**Spring Bearings.** Bearings designed to take the weight of the propeller shaft. If bearings and shaft are properly in line and adjusted, the shaft weight is the only load to which the bearings are subjected. Such bearings quite commonly consist of a lower bearing piece of brass, iron or steel, lined with white metal, and a cap for the protection of the bearing surface and the support of lubricating apparatus.

**Spring Line.** A hawser run out from any part of a vessel to a point on shore, as a dock, to prevent her going ahead or astern. In the first instance, the line extends from well forward to a point on shore abreast the stern; in the latter, the operation is reversed. Spring lines are also used to turn or spring a vessel around a wharf or dock.

**Spring Stay.** A horizontal stay between two lower mast heads, derrick posts, etc.

**Sprit.** A small spar designed to raise the peak of a sail having neither boom nor gaff. The upper end of the spar bears against a becket and its lower end is stepped against and near the foot of the mast.

**Sprit Sail.** A boat sail carried by a sprit. Originally it was spread under the bow sprit of seagoing vessels from the sprit sail yard.

**Sprocket Chain.** A chain designed to transmit motion from one sprocket to another. This type of transmission is used in connection with certain types of steering gear and in ammunition hoisting gear.

**Spun Yarn.** A rough two, three or four-yarn, left-handed, small stuff, made from long tow or old rope yarns loosely twisted together. It is extensively used on shipboard for the coarser seizings, service, etc.

**Spun Yarn Rope.** See Rope, Spun Yarn.

**Spur Beam.** A beam running diagonally or fairing into the sides of a ship from the end of a sponson beam, Used on paddle wheel boats.

**Square.** An instrument used similarly to Gunter's Scales for working on a sea chart.

**Square Knot.** See Knot, Square.

**Square Stern.** The stern of a ship whose decks terminate aft in rectangular form. Generally the stern contour is a straight line approximately perpendicular to the surface of the water.

**Squatting Speed.** That speed at which a vessel changes trim by the stern because of the large bow wave.

**Squeegee.** A wood block or hoe shaped implement fitted with a handle and a narrow rubber blade secured by screws projecting from the lower edge. The implement is used for removing water from the decks, glass and other smooth surfaces. Also a strap with toggles in the end used to confine a studding sail while being set.

**Stability.** The tendency which a vessel has to return to the upright when inclined away from that position.

**Stability, Dynamical.** The amount of mechanical work necessary to heel a ship to an angle from the upright position. It is usually expressed in foot-tons.

**Stability in Damaged Condition.** The stability which remains after the flooding of one or more compartments with consequent loss of displacement and possible change in character or area of water plane.

**Stability, Initial.** The resistance offered by a ship to inclination from the upright and measured by the metacentric height.

**Stability, Range of.** The number of degrees through which a vessel lists before her curve of righting arms becomes 0.

**Stability, Statical.** The effort which a ship makes when held steadily in an inclined position to return to her natural upright position of equilibrium.

**Stabilizer, Gyroscopic.** A device for utilizing the gyroscopic properties of a rotating wheel to prevent a vessel from rolling. The wave forces tending to cause roll are exactly counterbalanced by the gyroscopic forces. Rotation of the wheel is by electrical motor and the gyroscopic stabilizing forces are controlled in direction and amount by other electric devices. The stabilizer is usually installed in or near the engine room, but it may be located elsewhere on the ship.

**Stable Equilibrium.** See Equilibrium, Stable.

**Stack, Smoke.** See Smoke Stack.

**Stage.** A floor or platform of planks supporting workmen during the construction or

while cleaning and painting either the inside or the outside of a vessel.

**Stage Builder.** A carpenter who erects platforms or stages in and about a ship on which the workmen stand to perform conveniently the necessary operations incidental to the construction of the ship.

**Staggered Riveting.** See Riveting, Staggered.

**Staging.** Upright supports fastened together with horizontal and diagonal braces to which common boards are secured to form a platform. Staging is necessary to provide access to the work both in construction and repair.

**Stairs.** A built-in staircase aboard a ship.

**Stanchion Bulwark.** A post or stanchion supporting a bulwark. The stanchions or stays are often made of plating having the inboard edge flanged or of channel bar, the stay making a slight angle with the bulwark plating and being clipped to the top of the bulwark and the deck.

**Stanchion, Hold.** See Pillar, Hold.

**Stanchion, Middle Line.** See Pillar, Middle Line.

**Stanchion, Quarter.** See Pillar, Quarter.

**Stanchions.** Short columns or support for decks, handrails, etc. Stanchions are made of pipe, steel shapes or rods according to the location and purpose they serve.

**Stand By.** A preparatory command intended to convey to some one the meaning that he is to be ready to execute promptly a command soon to follow. For one ship to remain in the vicinity of another in order to render whatever assistance may be necessary.

**Standing Rigging.** Rigging that is permanently secured and is not hauled upon such as shrouds, stays, bob-stays, martingales, mast pendants, etc.

**Starboard Side.** That side of a vessel to the right hand when looking from the stern toward the bow.

**Starboard the Helm.** See Port the Helm. A term originally applied to the operation of putting the tiller over to right or starboard side causing the rudder and ship to turn to the left or port. Different countries and different branches of the marine have their own rules as to whether this order means to turn the ship to the right or left.

**Stateroom.** A private room or cabin for the accommodation of passengers or officers.

**Station Pointer.** A three-armed protractor, for determining a point on a chart, but mainly used in hydrographic surveys.

**Staunch.** A maritime term signifying that a vessel is strong, sound, seaworthy.

**Stay Bolt.** A bolt used for bracing flat surfaces in a fire tube boiler.

**Stay Rods, Condenser.** See Condenser, Stay Rods.

**Stays.** The ropes, whether hemp or wire, that support the lower masts, topmasts, top-gallant masts, etc., in a fore and aft direction. They extend from the heads of the masts they support to the next lower mast head of the adjacent forward mast except the lower mast stays which extend to the deck. Any rope used as a tension member, as an awning stanchion stay, a canopy frame stay, etc. A bar, pipe, or plate used as a support against racking, bending, etc.

**Stays, Boiler.** See Boiler Stays.

**Steady.** The quality by virtue of which a ship experiences little natural tendency to depart from the upright position when subjected to the action of the waves in a sea-way. It results from a moderate metacentric height.

**Stealer Plate.** See Plate, Stealer.

**Steam Engine Generator Set.** A combination consisting of a reciprocating engine and an electric generator on the same shaft. Such sets are used for power and lighting in shipyards as well as on board ships.

**Steam Gage.** See Boiler Gage, Steam.

**Steam Hoist.** See Hoist, Steam.

**Steam Jacket.** A chamber surrounding the cylinder barrel of a reciprocating engine. To this chamber fresh steam is admitted for the purpose of keeping the body of the cylinder as nearly as may be at a uniform temperature. Such an arrangement is effective in avoiding the injurious effects of the cooling action of the exhaust steam on the cylinder walls. In modern high class engines the heads or covers are jacketed as well as the barrel.

**Steam, Mixed.** The intermingling of saturated with superheated steam.

**Steam Ports.** The passages from the steam chest to the cylinder through which the steam enters and those from the cylinder to the outer air or condenser for the escape of exhaust steam. Such passages are made as short as possible so that the clearance volume is not unduly increased, but they must be of sufficiently great area so that the pressure of incoming steam is not unduly decreased or excessive back pressure developed in outgoing steam.

**Steam Reducing Valve.** See Valve, Reducing Steam.

**Steam, Saturated.** Steam containing as much water as it is possible for it to absorb. When steam separates from the water in which it is generated, it is saturated and has the same pressure and temperature as the water. If in addition to the saturation, it contains water in suspension, it is called wet steam.

**Steam, Superheated.** Dry steam having a higher temperature than saturated steam at the same pressure. Superheated steam is produced by adding heat to saturated steam that has been removed from contact with the water from which it was generated.

**Steam Trap.** An apparatus used to collect the water of condensation in steam cylinders and piping and to discharge it automatically either to the boiler, feed tank, condenser or hot well, without wasting steam.

**Steam Vessel.** See Vessel, Steam.

**Steel Deck.** See Deck, Steel.

**Steel and Iron.** Steel is primarily an alloy of iron and carbon, the carbon content ranging from a trace to nearly two per cent. It is capable of being cast into ingots or molds of various shapes. Sulphur and phosphorous are generally present as impurities while silicon and manganese are added for definite reasons. Classes – Steel may be classified with relation to the common method of manufacture employed such as crucible, open-hearth, Bessemer, Electric, etc. or by the use for which it is suitable such as machinery or tool steel.

### **Machinery Steel**

Machinery Steel is often classified as mild, medium or hard; also applied to alloy steel such as nickel, vanadium, chrome-nickel, and chrome-vanadium and zirconium steel.

### **Mild Steel**

Mild Steel is soft, having a carbon content of not over 0.02 per cent and it will not harden when suddenly cooled by quenching. Purpose: Mild Steel is used in the manufacture of chain; it is rolled into sheets and strips for flanging, cupping and drawing, galvanizing and corrugating; it is rolled into rods for rivets and bolts; it is used for crucible stock.

### **Medium Steel**

Medium Steel is harder and stronger than mild steel and will appreciably harden when suddenly cooled by quenching. Purpose: Medium steel is used in miscellaneous castings and forgings such as engine and machinery forgings, deck plates, floor plates, boiler plates, structural steel shapes, rods for rivets, bolts and nuts, etc. For castings such as stern frames, rudder frames, high pressure steam piping and fittings, engine bed plates, etc.

### **Hard Steel**

Hard steel is steel harder than medium steel and thus less ductile. It fatigues more quickly under repeated stresses. Purpose: Hard steel is used in forgings for machinery and engines; it is rolled into plates and rods and employed in the manufacture of steel castings.

### **Process Definitions**

**Crucible Steel** is manufactured by the crucible process, which consists of charging crucibles made of high refractory materials, with known ingredients and submitting them to a temperature sufficiently high to melt all of the charge. This temperature is then held until the charge becomes homogeneous, after which the several crucible charges are usually poured into a ladle and from that poured into ingot molds or molds of special patterns, producing steel castings. All grades of machinery steel may be made by the crucible process as well as all grades tool steel.

**Open Hearth Steel** is produced in a furnace known as an open hearth. The open hearth furnace is a reverberatory, regenerative furnace, and is usually heated by producer or natural gas. The gas and air pass through a series of heated checker

work which raises the temperature of the gas and air before they enter the combustion chamber in which the metal is charged. Open Hearth furnaces are of two types, depending upon the lining of the bottom. All grades of machinery steel are made by the Open Hearth Process and also the cheaper grade of tool steel.

**Acid Open Hearth Steel** is produced in an open hearth furnace, the bottom of which is lined with ganister or silica brick. The sulphur and phosphorus content of the charge is not appreciably changed by the acid open hearth process.

**Basic Open Hearth Steel** is produced in an open Hearth furnace, the bottom of which is lined with magnesite brick. Generally a layer or two of chrome brick is placed between the magnesite lining and the silica brick sides to prevent chemical action. Both the sulphur and phosphorus content of the charge may be appreciably reduced by this process, the amount of reduction being dependent upon the temperature and the length of time employed for the melt.

**Bessemer Steel** is produced by the Bessemer process, which consists of a large receptacle usually lined with ganister, the bottom of which is provided with holes through which air is forced. The charge consists of molten pig iron direct from the blast furnace and the effect of the current of air passing through the molten metal is to burn out the carbon until only the required content is remaining. Only certain grades of machinery steel are made by this process.

**Tropenas Steel** is produced in a furnace similar to the Bessemer except the blast of air enters through the side of the converter and thus passes over the charge instead of through the charge. Tropenas steel is employed extensively in the production of steel castings.

**Electric Steel** is produced in a modified open hearth furnace; it is not provided with checker work and is heated by means of an electric current. On account of the absence of gases which contain sulphur, which the steel absorbs at high temperature, and on account of the ease with which the temperature may be regulated in the better designs, a superior grade of steel may be produced by this process. All grades of machinery and tool steel are produced by the Electric Furnace Process.

## Iron

Iron rarely occurs in the free state. It is obtained by the reduction of its ores. Iron usually occurs as oxides called Magnetite, Hematite, Goethite, etc. The iron ore is reduced in the blast furnace and the product obtained is called pig iron.

**Cast Iron** is usually remelted pig iron and is divided into two classes namely, gray and white.

**Grey Cast Iron** contains about one per cent of combined carbon, the remainder being graphitic or combined, Grey Cast Iron is used in the manufacture of iron castings of all sizes and descriptions where no further heat treatment is employed, such as motor frames, engine frames, machine tool frames and beds, steam and gas engines, cylinders and valve chests, cylinder liners and piping, etc.

**White Cast Iron** is exceedingly hard, practically all the carbon content existing in the combined form. It is used where great hardness is desired and where a shock resisting material is not required. White cast iron is often heat treated in such a manner as to change its combined carbon to graphitic carbon. This process is called

malleabilizing.

**Malleable Iron Castings** are produced by submitting white cast iron castings properly packed to a high temperature for a long period of time. Often these castings are packed in a carbon absorbing material such as mill scale, producing white heart malleable castings. Purpose: Malleable iron is employed in the manufacture of pipe fittings and miscellaneous small castings subjected to shock but where great strength is not required.

**Wrought Iron** is nearly pure iron, containing less than .03 per cent carbon. It is produced by reducing the carbon content of pig iron by burning out, as in puddle iron, or by employing burning charcoal, as in the sinking process, the latter producing charcoal iron. The various processes of manufacture of wrought iron are often referred to as follows: (a) Puddling, (b) bushelling, (c) faggoting, (d) bushelled steel, (e) muck bar, (f) common iron, (g) merchant bar iron, (h) refined bar iron, (i) double refined iron, and (j) bushelled steel bars.

**Steep Tub.** A wood or galvanized iron receptacle for steeping salted provisions and vegetables in water previous to cooking.

**Steerage.** The least desirable portions of a vessel as to accommodations for passengers and occupied by those paying the very lowest fare.

**Steerage-Way.** A term applied when a vessel has sufficient motion to maneuver by the aid of her rudder.

**Steering Chain or Ropes.** A term applied to the chains or ropes transmitting motion from the steering wheel or engine to the rudder stock.

**Steering Column.** A pedestal, usually a casting, supporting the steering wheel; and, where shafting is used for steering control, the brass miter gears attached to the steering wheel and leads. An indicator is usually fitted on top of the column to show the angle of the rudder.

**Steering Engine.** A steam, electric or hydraulic power machine used for turning the rudder and having its valves or operating gear actuated by leads from the pilot house.

**Steering Engine, Chain Drum.** A term applied to a cylindrical drum on the steering engine having spiral grooves to take the steering chain.

**Steering Engine Foundation.** A term applied to a seating prepared for a steering engine.

**Steering Gear.** A term applied to the steering wheels, leads, steering engine and fittings by which the rudder is turned.

**Steering Leads.** A term applied to the shafting, ropes or chains transmitting motion from the steering wheel to the rudder stock.

**Steering Wheel.** A term applied to a wheel in which the spokes are continued through the rim for a distance sufficient to provide a good grasp for the hands and which is used for actuating the steering engine or the rudder through its leads. Where there are rope leads a drum is fitted to the hub of the wheel upon which the ends of the steering rope are wound and when the leads consist of shafting, gears

transmit the motion from the axis of the wheel. In vessels that are not provided with a steering engine, this wheel usually has a diameter of about five or six feet to provide leverage which is supplemented by gears or purchases in the steering leads. Large wheels, sometimes single, but usually two or more in tandem are also fitted as an auxiliary hand steering gear at or near the steering engine and sometimes on the deck above it

**Stem, Stem Post.** The bow frame forming the apex of the triangular intersection of the forward sides of a ship. It is rigidly connected at the lower end to the keel. In wood ships the main piece of the bow frame is called the stem.

**Stem Cap.** A small plate on top of a stempost.

**Stem Deadwood.** See Deadwood, Stem.

**Stem Piece.** A filling piece fitted between the stem and knight heads.

**Stem Plate.** A plate fitted inside the stem on composite ships for strength and fastening purposes.

**Stemson.** A knee shaped piece joining the forward end of the keelson to the apron.

**Stephenson Link. Also Drag Link.** A mechanism designed to assist in reversing a reciprocating engine by means of regulating the distribution of the steam in the cylinder. It consists essentially of a curved slotted link of radius equal to the length of the eccentric rods and to the ends of which these attach. In the link slot a carefully fitted block works. To this block, the end of the valve rod attaches. The manipulation of the link position by means of the reversing rod determines the relative influence of the two eccentrics upon the travel and position of the steam valve.

**Step, Mast.** See Mast, Step.

**Steps.** See Treads and Treads, Safety.

**Steps, Safety.** See Safety Steps.

**Stern.** The after end of a vessel; the farthest distant part from the bow.

**Stern Frame.** A heavy casting or forging for the purpose of supporting the rudder and the propeller shaft in single screw vessels. It also serves as a frame for rigidly connecting the converging sides of the ship at the stern.

**Stern Light.** See Light, Stern.

**Stern Molding.** A term applied to the half rounds, battens or ornamental work fitted around the stern of a vessel.

**Stern Pipe.** A round or oval casting or frame inserted in the bulwark plating at the stern of a vessel through which mooring hawsers or warps are passed.

**Stern Plating.** See Plating, Stern.

**Stern Port.** See Port, Stern.

**Stern Post.** The main vertical post in a stern frame upon which the rudder is hung.

**Stern Post, False or Inner.** A piece of reinforcing timber bolted to the stern post.

**Stern Post Plate.** A plate fitted on the inside of the stern post in composite ships for strength and fastening purposes.

**Stern Rope.** See Rope, Stern.

**Stern Sheets.** The seat in the after part of a boat between the thwart and the coxswain's box.

**Stern Timbers.** See Timbers, Stern.

**Stern Tube.** The bearing supporting the propeller shaft where it emerges from the ship. It consists of a hollow cast iron or steel cylinder fitted with brass bushings, which in turn are lined with a lignum vitae or white metal bearing surfaces upon which the propeller shaft enclosed in a brass sleeve rotates. In single screw vessels the stern post is bossed out and bored to take the stern tube which projects far enough aft of the post to take a large flat nut. The forward end of the stern tube is connected by a flange to the after peak bulkhead, which in conjunction with a stuffing box fitted around the shaft, makes a watertight joint at this point. Water can enter the stern tube from the after end through grooves in the lignum vitae or white metal bearings and has been found to be a suitable lubricant when it is not mixed with sand or mud. The stern tube in single screw vessels takes the heavy weight of the propeller and must also withstand the side thrust caused when blades are broken off or come out of water. In twin screw vessels there is generally a strut or bracket aft of the tube to support the screw. In twin screw vessels the stern tubes are supported by the side framing and a bulkhead worked at the forward end of the tube. On account of the angle they make with the shell plating the tubes are generally longer than in single screw vessels.

**Stern Tube Bearing.** A common bearing surface for stern tubes consists of lignum vitae blocks or strips. Water gains access to the stern tube through the grooves in the bearing and on account of the hard oily nature of lignum vitae it forms a satisfactory lubricant. Where the water is sandy or muddy a bearing surface of white metal will be found more satisfactory.

**Stern Tube Bushing.** A hollow brass cylinder with an outside diameter equal to the inside diameter of the stern tube. There are usually two bushings, one of which is inserted in the after end and the other in the forward end of the stern tube. A flange is cast on one end of the after bushing which shoulders up against the outboard end of the stern tube and is fastened to it by tap bolts. The forward bushing has no flange but is feather keyed to the stern tube to keep it from turning with the shaft. The inboard end of the forward bushing serves as a shoulder for the packing in the stuffing box.

**Stern Tube End Plate.** A flat ring having its inside diameter about an inch less than the inside diameter of the after bushing. It is tap bolted to the flange of the after bushing and serves the purpose of holding the lignum vitae bearing strips from slipping out.

**Stern Tube Gland.** A term applied to a short hollow cylindrical casting having a flange on one end and used for compressing the packing in the stuffing box. The compression is obtained by stud bolts inserted in the forward end of the stern tube and passing through holes bored in the flange of the gland. The gland on a stern

tube is usually made in halves so that it can be removed easily.

**Stern Tube Retaining Strip.** A strip of metal of trapezoidal wedge shaped section, riveted or screwed to the inner surface of a stern tube bushing for the purpose of holding the lignum vitae bearing strips from falling out.

**Stern Tube Ring Nut.** A term applied to a large flat nut that is screwed onto the after end of the stern tube which projects a short distance aft of the stern post. The stern tube is shouldered at the forward end of the post so that when the ring nut is tightened up the tube can not move forward or aft.

**Stern Tube Stuffing Box.** A term applied to the receptacle for packing around the propeller shaft in the forward end of the stern tube.

**Stern Wheel.** A paddle wheel located at the vessel's stern and used for her propulsion.

**Stern Wheel Steamer.** A steam vessel driven by a paddle wheel located at the stern.

**Sternson.** A knee connecting the after end of the keelson with the stern post. Used in wood ships.

**Stiff, Stiffness.** The tendency of a vessel to remain in the upright position or a measure of the rapidity with which she returns to this position when inclined by any external force. The degree of stiffness is directly affected by the value of the vessel's metacentric height.

**Stiffeners, Bulkhead.** See Bulkhead Stiffeners.

**Stiles, Window Frame.** The vertical sides of the frame.

**Stirrups.** Short ropes suspended from the jackstay on a yard, having eyes spliced into the lower ends through which the foot rope reeves.

**Stock, Rudder.** See Rudder Stock.

**Stocks.** A term to the keel, blocks, bilge blocks, and timbers upon which a vessel is constructed.

**Stokehold.** That portion of the ship's boiler room from which the fires are fed and cleaned.

**Stokehold Ventilator.** A ventilator supplying air to the stokehold or fire room. If forced draft is supplied on the closed stokehold system the ventilator supplies air to the forced draft blowers, the quantity of air being that required for combustion in the boilers.

**Stoker.** An automatic gear for feeding coal to the fires in a boiler. Also a term applied to a fireman.

**Stokers.** Members of a ship's boiler room force who attend to the fires in the boiler furnaces.

**Stool, Pipe.** A term applied to small castings or fittings supporting piping. The small castings supporting the deck piping to capstans, winches and windlass are examples.

**Stools, Shaft.** See Shaft Stools.

**Stop Bead.** A thin and narrow piece of wood fitted around a door or window frame for the purpose of holding them in place when they are closed.

**Stop Valve.** See Valve, Stop.

**Stop Water.** A wood plug driven through a scarph joint to stop water from leaking into the ship. The term is also applied to pieces of canvas soaked in oils, red lead, etc., placed between the faying surfaces of plates and shapes where water or oil is apt to work its way through.

**Stopper Chain.** See Chain Stopper.

**Stops, Rudder.** See Rudder Stops.

**Store Rooms.** Any space or compartment in which are stowed the stores and supplies that are used aboard the ship.

**Storm Valve.** See Valve, Storm.

**Stow.** To pack away, to lash in place, or to otherwise secure in position for a sea voyage.

**Stowage.** The proper distribution and securing of cargo in a vessel so as to avoid damage to either cargo or vessel by the shifting of cargo or by the undesirable conditions of trim and stability resulting from such a shift.

**Stowage, Boat.** See Boat Stowage.

**Strain.** The measure of the alteration of form which a solid body undergoes when under the influence of a given stress.

**Strainer, Fuel Oil.** A strainer located in the pipe line to the oil pump to prevent refuse from reaching and clogging the pump.

**Strainer, Macomb.** A type of strainer located in a pipe line near a pump to prevent refuse from reaching and clogging the pump.

**Strainer, Strum.** A strainer fitted on a strum box where box and strainer are separate fittings. The strainer usually consists of a perforated plate or sometimes a bell-shaped casting with projecting lugs to permit flow of water under the edge of the bell.

**Strake.** A term applied to a continuous row or range of plates. The strakes of shell plating are usually lettered, starting with A at the bottom.

**Strake, Bilge.** A term applied to a strake of outside plating running in the way of the bilge.

**Strake, Bottom.** Any strake of plating on the bottom of a ship that lays between the garboard and bilge strakes.

**Strake, Doubling.** A term applied to a strake made up of two thicknesses of plates. Also to the extra range of plates fitted in conjunction with the regular strake. The sheer strake and topside plate are often doubled amidship for extra strength.

**Strake, Drop.** A term applied to a strake that is terminated before it reaches the bow or stern. The number of strakes dropped depends on the reduction of girth between the midship section and the ends.

**Strake, Garboard.** The strake of shell plating adjacent to the keel. This row of plates act in conjunction with the keel and are made heavier than the other bottom plates.

**Strake, Inner.** A term applied to the inner strake of an in and out system of shell plating. The strakes adjacent to the molded frame line.

**Strake, Limber.** A term applied to the inside strake nearest the keelson in wood ships.

**Strake, Outside.** A term applied to the outer strake of an in and out system of shell plating. The strakes which lap on the inner strakes and which are the thickness of the plating outside of the molded frame line.

**Strake, Topside.** The strake next below the upper or strength deck sheerstrake. The second range of shell plating down from the upper of strength deck.

**Strand (of a Rope).** An element of a rope; consisting in a fiber rope, of a number of rope yarns twisted together while in a wire rope a primary assemblage of wires.

**Strap, Butt.** See Butt Straps.

**Strap, Seam.** See Seam Straps.

**Strapped Joint.** See Joint, Butt.

**Straps, Seam.** See Seam Straps.

**Straw Boss.** A workman who, while working at his trade, directs the work of other tradesmen of the same kind. He usually receives slightly higher pay than the men whose work he directs.

**Stream Anchor.** See Anchor, Stream.

**Stream Forms.** Regular shapes conforming to the lines of flow of a liquid.

**Stream Lines.** The paths followed by particles of water as they pass over the immersed surface of a body moving through the water.

**Strength Girder.** See Girder, Strength.

**Strength Member.** Any plate or scantling which contributes to the strength of the vessel. Some members may be strength members when considering longitudinal strength but not when considering transverse or vice-versa.

**Stress.** The intensity of the force which tends to alter the form of a solid body; also to equal and opposite resistance offered by the body to the change of form.

**Stresses, Longitudinal.** See Longitudinal Stresses.

**Stresses, Pounding.** Stresses included in a vessel as she rides among waves by the beating of the water against her bottom. Pounding stresses are of special moment in

flat bottom vessels of shallow draft.

**Stringer.** A term applied to a fore and aft girder running along the side of a ship and also to the outboard strake of plating on any deck. There are three sets of fore and aft girders in the framing of a ship, viz.: Longitudinals or keelsons, which are the approximately vertical strength members in the bottom; Stringers, which are the approximately horizontal strength members on the sides; and Girders, which are the approximately vertical members under the decks. The word stringer is sometimes used to apply to all three groups but it should only be used for the side girders. Also applied to the side pieces of a ladder or stair case into which the treads and risers are fastened.

**Stringer Angle Bar.** A term applied to the angle bar connecting a deck stringer plate to the outside plating or bulwark. They are usually made up of short lengths running between frames. A continuous angle bar connecting the inner flange of the frames to the stringer plate is sometimes called a stringer bar.

**Stringer, Awning Deck.** A term applied to the outboard strake of plating on the awning deck.

**Stringer, Bar.** A continuous fore and aft strength member made up of angle bars or shapes attached to the inside flanges of the frames. Also applied to the angle bar connecting a stringer plate to the shell or frames in which case the name of the stringer is usually placed before it, as Main Deck Stringer Bar.

**Stringer, Bilge.** A term applied to the fore and aft girder running along the turn of the bilge.

**Stringer, Boat Deck.** A term applied to the outboard strake of the plating on the boat deck.

**Stringer, Bridge Deck.** A term applied to the outboard strake of plating on the bridge deck.

**Stringer, Bulkhead.** See Bulkhead Stringer.

**Stringer, Deck.** A term applied to the outboard strake of plating on any deck.

**Stringer, Forecastle Deck.** A term applied to the outboard strake of plating on the forecastle deck.

**Stringer, Gunwale.** A term applied to the stringer worked along the sides of a weather deck.

**Stringer, Hold.** Any stringer, plate or bar, fitted along the sides of a ship between the tank top and the lower decks.

**Stringer, Hold Beam.** A fore and aft plate attached to the top flanges of hold beams at the sides of a vessel and to the shell and frames.

**Stringer, Intercostal.** A stringer made up of plates cut to fit between frames. Each plate is attached to the frames and shell plating by short angle or bar clips. The plates are usually made deep enough to allow a continuous bar to be attached to the inner edge and to the inner edge of the frames.

**Stringer, Lower Deck.** A term applied to the outboard strake of plating on the lower deck.

**Stringer, Main Deck.** A term applied to the outboard strake or strakes of plating on the main deck.

**Stringer, Orlop.** A term applied to a stringer fitted about half way between the tank top and lower deck in vessels having deep holds. The plates are wider than those composing ordinary stringers and are supported by brackets attached to the frames.

**Stringer, Orlop Beam.** A fore and aft plate attached to the top flanges of the orlop beams at the sides of a ship and to the shell and frames. Applicable to a deep hold vessel with beams fitted between the lower deck and tank top.

**Stringer, Orlop Deck.** A term applied to the outboard strake of plating on the orlop deck.

**Stringer, Panting.** A fore and aft plate, angle, or built up girder fitted in between the side stringers in the bow and stern. Its purpose is to reduce the in and out vibrations or panting of the frames and plating.

**Stringer Plates.** A term applied to the outboard plates on any deck or to the plates attached to the top flanges of any tier of beams at the sides of a vessel.

**Stringer, Poop Deck.** A term applied to the outboard strake of plating on the poop deck.

**Stringer, Promenade Deck.** A term applied to the outboard strake of plating on the Promenade Deck.

**Stringer, Quarter Deck.** A term applied to the outboard strake of plating on the quarter deck.

**Stringer, Shade Deck.** A term applied to the outboard strake of plating on the shade deck.

**Stringer, Shelter Deck.** A term applied to the outboard strake of plating on the shelter deck.

**Stringer, Side.** A term applied to a fore and aft girder supporting the side plating and located between the bilge and lower deck. The stringer may be intercostal and attached directly to the shell plating, or it may be continuous and attached to the inner flanges of the frames.

**Stringer, Spar Deck.** A term applied to the outboard strake or strakes of plating on the spar deck.

**Stringer, Trunk Deck.** A term applied to the outboard strake or strakes of plating on the trunk deck.

**Stringer, Turret Deck.** A term applied to the outboard strake or strakes of plating on the turret deck.

**Stringer, Upper Deck.** A term applied to the outboard strake or strakes of deck plating on the upper deck.

**Stroke.** The distance traveled by the piston in moving from its extreme position at one end to its extreme position at the other.

**Structural Bulkhead.** See Bulkhead, Structural.

**Strum.** See Pump Strainer.

**Strum Box.** The enlarged terminal on the suction end of a pipe and forming a strainer which prevents the entrance of material liable to choke the pipe. Also called Rose box.

**Strut, Shaft.** See Shaft Strut.

**Stud Link Chain.** See Chain, Stud Link.

**Studding.** The vertical timbers of framing of a deck house, fitted between the sill and the plate.

**Stuffing Box.** A fitting designed to permit the free passage or revolution of a rod or pipe while controlling or preventing the passage of steam, water, etc.

**Stuffing Box, Bulkhead.** A fitting attached to a bulkhead where it is desired to pass a rod, pipe or shaft through without destroying the steam, air, or watertightness of the bulkhead. A hole of the proper size is bored through the fitting and a receptacle for packing concentric with it is bored part way through. The packing is held in place by a gland.

**Stuffing Box, Deck.** A fitting similar to a bulkhead stuffing box and attached to a deck where it is desired to pass a rod, pipe or shaft through without destroying the steam, air or watertightness of the deck.

**Stuffing Box Recess.** See Tunnel Recess.

**Stuffing Box, Rudder Stock.** A stuffing box fitted where the rudder stock pierces a flat or deck. According to where it is located, its purpose may be either to prevent the sea from coming up into the vessel or water on deck from coming down.

**Stuffing Box, Stern Tube.** See Stern Tube Stuffing Box.

**Submarine.** Beneath the surface of the sea. A vessel capable of service below as well as on the surface of the water.

**Suction Head.** The distance the pump has to lift the fluid to the suction cylinder plus the frictional resistance. For high lifts and relatively small quantities the reciprocating pump is desirable, while for low heads and large quantities of fluid the centrifugal pump is better. Hand pump suction may be dispensed with if there are separate boiler rooms, or if there is a donkey boiler installed above the upper deck and there are also pumps in separate compartments with connections to both main and donkey boilers. On a large ship hand pumps are not of much use.

**Suction Pipe.** See Pipe, Suction.

**Suction, Pump.** See Pump, Suction.

**Suctions, Ballast Tank.** Pipes and valves connecting the ballast tanks with the pumps for emptying the ballast tanks of water.

**Summer Load Line.** The waterline to which a vessel is allowed to load when going to sea in the summer time.

**Sun Dial.** This was a device to show the time, according to the sun, by the shadow cast on graduations from a center pointer.

**Sunk Forecastle.** A forecastle, the deck of which is raised only a partial deck height above the level of the upper or weather deck.

**Sunk Poop.** A poop, the deck of which is raised only a partial deck height above the level of the upper or weather deck.

**Superheated Steam.** See Steam, Superheated.

**Superheater.** A device fitted to steam boilers and intended to extract from the gasses of combustion heat which would otherwise escape. For cylindrical boilers of the Scotch and similar types the superheater is generally formed of a drum built into the uptake. The hot boiler gases pass through tubes in this drum and the steam from the boiler is brought into contact with these heated tubes. In water tube boilers the superheater consists of additional steam coils located within the boiler casing in the path of the gases through the tube nests.

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

**Surface Condenser.** See Condenser, Surface.

**Surfacer.** A type of wood planing machine.

**Swab.** A mop made of cotton rope or twine secured to a handle and used for cleaning decks; an opprobrious term applied to a worthless or useless person on board ship.

**Swallow.** The space or opening through which a rope passes between the rim of the sheave and the frame of the block. A term applied to an oval or round opening in a chock or mooring ring. What a Rivet Counter enjoys doing with a pint of Guinness.

**Swamp.** To become covered or filled with water.

**Swash Plate.** A term applied to a vertical plate fitted either athwartship or fore and aft in a tank for the purpose of retarding the flow of the liquid therein. Swash plates are especially necessary in fuel oil tanks and water tanks that are apt to be only partially full as the unrestricted flow of the liquid against the sides of the tanks would be severe.

**Sweet Line.** A term applied to a curved line when it is smooth and without humps or abrupt breaks. A fair line.

**Swifter.** The forward shroud on either side of a mast, a length of rope used to keep the capstan bars in their places or passed from bar to bar around the ends in order to distribute the stresses.

**Swinging Ship.** An operation for determining the local magnetic deviation of the ship's compass and making the proper adjustment. The ship's head is successively brought to each point of the compass and the bearing of a well defined distant object

observed.

**Switch, Air-Break.** An electric switch, the contacts of which make and break contact in the air as contrasted with an oil break switch in which the contacts make and break under oil.

**Switch, Knife.** A device with one or more hinged copper blades equipped with a handle and so arranged as to open or close an electric circuit.

**Switch, Lightning.** A switch used to disconnect Radio equipment from the antenna to protect the equipment from being damaged by lightning.

**Switch Oil.** An electric switch, the contacts of which are submerged in oil. Such switches are commonly used on high voltage alternating current circuits.

**Switch, Watertight Snap.** See Snap Switch.

**Switchboard, Power.** One or more panels made of some insulating material such as slate or marble, equipped with apparatus for controlling electrical machinery or circuits.

**Swivel.** A special link constructed in two parts which revolve on each other. It is used to prevent fouling due to turns in chains, etc.

**Swivel Block.** See Block Swivel.

**Symbols.** Conventional characters or marks indicating certain operations to be performed or observed.

**Synchronous Converter.** An electrical rotary machine having one armature and with the windings so arranged that it operates on alternating current and delivers direct current, or vice-versa. Sometimes called a rotary converter.

**Synchronous Motor.** See Motor, Synchronous.

## T

**Tabling.** The broad hem worked along the borders of a sail, awning or other canvas work.

**Tack, to tack.** So to change the course of a sailing vessel by coming about as to take the wind from over the opposite bow to that over which the wind previously came. When the wind is coming over the port bow the vessel is said to be on the port tack, and when it comes over the starboard bow she is on the starboard tack.

**Tackle.** Any combination of ropes and blocks that multiplies power. A single whip usually called a tackle though erroneously so classed, gives no increase of power but simply a change in direction of the power applied.

**Tackles, Relieving.** A term applied to a pair of tackles, generally stowed in the vicinity of the rudder quadrant or spare tiller. The tackle usually consists of a fixed double or multiple block with a hook or shackle for attachment to the structure and a movable block for attachment to the tiller.

**Tactical Diameter.** The horizontal distance from the original course to the position where the ship has turned through 16 points of the compass.

**Taff Rail.** A term applied to the rail around the top of the bulwark or rail stanchions on the after end of the weather deck, be it upper, main, raised, quarter or Poop.

**Tail or Guide Rod.** An extended portion of rod working in a bearing as a guide for parts in motion.

**Tail Plate.** See Horseshoe Plate.

**Tail Shaft.** See Propeller Shaft.

**Tallow, Launching.** See Launching Tallow.

**Tank, Ballast.** A space or compartment which may be filled with water to add weight when it is necessary to produce a change in trim or in the stability of the ship.

**Tank Foundation.** A term applied to the seating supporting a tank and given the name of the tank which it supports, as Oil Filter Tank Foundation.

**Tank, Peak.** All classification societies require that transverse bulkheads be built near each end of a ship to prevent water from flowing into the larger compartments should the ends of the ship become damaged. The observation of this rule leaves narrow "V" shaped compartments in which no cargo is stored, but they may be filled with water to alter the longitudinal inclination of the ship.

**Tank, Sanitary.** A tank arranged to receive the discharge from the various sanitary or plumbing fixtures located below or close to the water line and which cannot drain overboard by gravity. Contents of sanitary tanks are pumped overboard.

**Tank Testers.** Men from the calking and chipping gangs who test tanks or compartments for leaks and who perform such work as the tests indicate to be necessary in order to insure water or oil tightness.

**Tank Top Plating.** See Plating, Tank Top.

**Tank Trimming.** A space or compartment at the end of a ship which is filled with water in order to produce an alteration in the longitudinal inclination of the ship.

**Tank Vessel.** A vessel designed for the carriage of oil in bulk and fitted with especially constructed tanks for this purpose. The term is applied to both sail and power driven ships.

**Tanks.** Compartments for liquids or gases. They may be formed by the ship's structure as double bottom tanks, peak tanks, deep tanks, etc., or may be independent of ship's structure and installed on special supports.

**Tanks, Gunwale or Topside.** Compartments near the gunwale, or the top of the sides of the ship, used as water ballast tanks.

**Tanks, Settling.** See Settling Tanks.

**Tanks, Wing.** See Wing Tanks.

**Tapered Liners.** See Liners, Tapered.

**Tapered Rope.** See Rope, Tapered.

**Tar, Hard Wood.** A tar obtained from the destructive distillation of a hard wood.

**Tar, Pine, Kiln and Retort.** A dark, oily liquid obtained by slowly burning resinous pine wood in a kiln or by its destructive distillation in a retort. It is used as a paint and a preservative for cordage, etc.

**Tarpaulin.** A term applied to a pliable canvas hatch cover. One or more tarpaulins are stretched over the wooden hatch covers and the edges are held in place by battens wedged into cleats on the hatch coaming. Also applied to pieces of canvas used as a shelter for workmen or as a cover for deck equipment.

**Taximeter.** An early 20<sup>th</sup> century navigational instrument for taking bearings.

**Taut.** The condition of a rope wire or chain when under sufficient tension to cause it to assume a straight line, or to prevent sagging to any appreciable amount.

**Tee Bar.** A rolled shape, generally of mild steel, having a cross section shaped like the letter T. In ship work it is used for bulkhead stiffeners, bracket and floor clips, etc. The size is denoted by dimensions of cross section and weight per running foot.

**Tee, Branch.** A tee with side or branch outlets.

**Tee, Bull Head.** A term applied to a tee in which the outlet is larger than the entrance.

**Telegraph.** An apparatus, either mechanical or electrical, for transmitting orders from a ship's bridge to the engine room, steering gear room, or elsewhere, or between fire rooms, and from engine room to fire rooms. The transmitting apparatus, operated by the sender, is termed the transmitter, and the receiving apparatus, the indicator. A gong is usually fitted in order to call attention to the movement of the indicator.

**Telemotor.** A device for operating the valves of the steering engine from the pilot house either by fluid pressure or by electricity. When fluid pressure is utilized, two leads of pipe are necessary so that the fluid may move aft in one pipe and forward in the other, or vice-versa. The movement is provided for by a small pump or ram actuated by the steering wheel.

**Telemotor, Electric.** The function of a telemotor, either electric or other, is to control from the pilot house, the movement of the valve of the steam steering engine which turns the rudder. On small boats where the distance from the wheel house to the steam steering engine is short, satisfactory results have been obtained by the use of wire rope or shafting and gears to control the engine valve. On large boats the mechanical defaulters are multiplied and the physical exertion required, considerable and objectionable.

**Telephone, Intercommunicating.** See Intercommunicating Telephone.

**Telephone, Loud Speaking.** The performance of the loud speaking telephone on battleships and merchant vessels in the past three years has shown it to be the quickest, safest and most reliable means of communication yet developed for use on ships. The loud speaking telephone transmits a message so loudly and clearly that it can be heard at a distance from the instrument without the use of an ear receiver.

The person talking merely brings his lips to within a few inches of an opening in the housing containing the transmitter and the receiver and touches a key. This housing is made of heavy, non-corrosive metal and is waterproof. It need not be opened and the instrument is always ready for instant service. At the same time the sensitive parts of the instrument are protected from accidental injury and from the damp sea air which quickly ruins the ordinary telephone. The loud speaking telephone does not pick up ship noises and is always heard distinctly – even in the noisiest engine room. It does not destroy the watertight integrity of the bulkheads as does the voice tube. It is more convenient, more sanitary, and far more efficient than either the voice tube or the ordinary marine telephone.

**Telescope.** An optical instrument intended for the use of one eye only and designed to enlarge and clarify the images of distance objects. It consists essentially of a tube having a large converging lens that forms the optical image of the object observed and a small lens or combination of lenses which magnify the image.

**Tell Tale.** An indicating device employed on automatic machinery or in a specific operation which gives audible or visual indication, or both, as to the exact time a specific function is begun or completed.

**Telltale, Rudder.** A term applied to an instrument that indicates the angle of the rudder with the center line of the ship. It is generally fitted in front of the steering wheel.

**Tempering Furnace.** See Furnace, Hardening or Tempering and Furnace, Tempering Pot.

**Template.** A mold or pattern made to the exact size of a piece of work that is to be laid out or formed and on which such information as the position of rivet holes, size of laps, etc., is indicated. The most common types of template used in ship work are made out of paper or thin boards.

**Template, Pattern.** A wood frame, a paper or card board outline of a part of a ship showing the shape of the part, location of holes, and giving by means of notes made thereupon dimensions and information as to the fabrication of the part.

**Templates, Transferring.** Patterns made from the mold loft lines or from some part of the ship by means of which an outline and form of a part is retained and conveyed to wherever needed.

**Temporary Bulkhead.** See Bulkhead, Temporary.

**Tender.** A small boat, usually power driven, used for purposes of general utility by the personnel of a large vessel. A vessel of moderate size fitted with repair facilities, reserve stores of provisions, fuel, water, etc., for the use of a number of smaller naval vessels, such as destroyers or submarines.

**Tenoning Machine.** A power operated machine which usually has a hand feed and cuts a tenon on pieces of timber by means of knives carried in short revolving cutter heads.

**Tensile Strength.** The measure of a material's ability to withstand a tensile or pulling stress without rupture. Tensile strength of a material is usually measured in pounds or tons per square inch of cross section.

**Theodolite.** An instrument which, superseding the circumferentor and graphometer, is used for general surveying purposes and by naval hydrographers.

**Test Head.** The head of water corresponding to the pressure prescribed as a test for bulkheads, tanks, compartments, etc. Test heads are prescribed to insure satisfactory water or oil tightness and also as tests of strength.

**Thermometer.** An instrument for measuring the degree of heat or temperature.

**Thermotank.** A box or tank containing steam coils through which air for ventilation is heated in passing.

**Thimble.** An iron ring, oval or heart shaped fitting whose outer surface is concave in order that it may be held in place when worked into the corner of a sail as a cringle or in the bight of a rope. It serves as a lining to prevent the chafe of a hook, shackle, pin, etc.

**Tholes; Thole Pins.** A term applied to the pins of wood or metal that are fitted snugly into holes in the gunwale of a pulling boat for the purpose of forming a rowlock for the oars.

**Thread.** The spiral part of a screw.

**Thread, Common.** A standard machine thread as distinguished from a pipe thread.

**Threading Machine.** A machine used for cutting screw threads. This would apply to a lathe, bolt cutter, pipe threading machine, etc.

**Three-Ply Riveting.** See Riveting, Three-Ply.

**Throat.** A term applied to that part of a boom or a gaff lying immediately behind the jaw.

**Throat Sheet, Boiler.** See Boiler, Throat Sheet.

**Throttle Valve.** See Valve, Throttle.

**Throttle Valve Lever.** A lever used to operate the throttle valve.

**Through Fastening.** See Fastening Through.

**Thrums.** Short pieces of rope yarns used in making mats, being sewed by their bights to the canvas or cloth. Thrums are made by cutting old and worn out gear into lengths and unlaying the strands.

**Thrust.** The net reaction of a propeller or wheel tending to force the vessel through the water. For a model propeller the thrust is generally measured in pounds, but for full sized vessels it is oftentimes reduced to pounds per ton of displacement.

**Thrust Bearing.** A bearing designed primarily to take the propeller thrust from the shaft and transfer it to the structure of the ship. It is constructed with a series of rings and channels for the reception of the collars of the thrust shaft. The rear faces of the thrust bearing rings and the forward faces of the thrust shaft rings bear on one another when the screw is turning ahead. The opposite takes place in backing. The faces of the bearing channels are usually of white metal so as to provide steel on white metal wearing surfaces. At the forward and after ends of the thrust bearing

casing spring bearings of the usual type are fitted to carry the weight of the thrust shaft. Special methods of lubricating and cooling are provided.

**Thrust Block.** Thrust Stools are to be of ample size and strength in proportion to the power transmitted to the thrust bearing; they are to extend well beyond the thrust block and are to be stiffened and supported by extra intercostals, double reverse angles, etc. All shaft stools are to be of ample strength and stiffness, in proportion to the weight of shaft and height of stool.

**Thrust Block Foundation.** A term applied to the seating to which the thrust block is attached. As the whole push or pull exerted on the ship by the propeller is taken through the thrust block it is necessary to construct a strong foundation that will distribute the pressure to the hull of the ship without undue local strain. This foundation should be built as high up to the center line of the shaft as possible to decrease the overturning moment on the bolts holding the thrust block in place.

**Thrust Horsepower.** See Propeller Thrust.

**Thrust, Propeller.** See Propeller Thrust.

**Thrust Recess.** A small compartment off the main engine room designed to contain and give access to the thrust shaft and block.

**Thrust Shaft.** That length of shafting which is fitted for the purpose of transferring the thrust of the propeller to the thrust bearing. This is effected by means of circular collars or rings worked on the thrust shaft.

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

**'Thwartship Bunker.** A bunker having its largest dimension in a transverse direction. It is frequently a fore hold compartment located immediately forward of the boiler spaces. Such a bunker is sometimes used as a reserve bunker or it may be used for cargo.

**Tides.** The alternate rise and fall, averaging twice in 24 hours and 51 minutes, of the level of the ocean and the accompanying inflow and outflow of rivers, bays, channels, etc. Corresponding high and low tides, therefore, occur 51 minutes later each day. The cause of tides is the combined result of the mutual attraction of the earth, moon and sun for each other. When the sun and moon are in conjunction or in opposition, that is, both on the same side or on opposite sides of the earth, their tide producing effects conspire to produce the SPRING TIDES. These occur at the time of and for two or three days after the full and new moon. When the moon and sun form a right angle or the moon is in quadrature, the crest of the solar tide occurs in the trough of the lunar tide or vice-versa, and the NEAP TIDES result. These occur after the first and third quarter of the moon. The semi-diurnal variations of the tide are HIGH TIDE, when the tide ceases to rise and before it begins to recede; EBB TIDE, the falling tide; LOW TIDE, when the tide ceases falling and before it begins to rise; FLOOD TIDE, the rising tide.

**Tie Plates.** A term applied to long narrow plates used for the purpose of tying deck beams together where there is no steel deck plating.

**Tiller.** A heavy bar or lever having one end bored to fit on the rudder stock and having the other end fitted for connection to steering leads or relieving tackle. The

function of the tiller is to turn the rudder, but as on most ships this is accomplished by a steering engine through a quadrant or yoke, the tiller is only a spare fitting to be used with the relieving tackles when there is a breakdown in the steering engine.

**Tiller Rope.** See Rope, Tiller.

**Timber, Horn.** The center line frame in the stern of a wooden ship, extending aft from the stern post.

**Timber Sizer.** A machine used for the conversion of logs into timber. Usually a huge band saw mounted alongside a heavy track along which a carriage is designed to travel.

**Timbers, Counter.** The inclined frames projecting aft from the wing transom and forming the counter. (Wooden ship.)

**Timbers, Ship's.** A general term referring to the individual sticks or members of which a wood vessel's frame work is composed.

**Timbers, Stern.** The aft upper stern frames in a wooden ship corresponding to the cant frames in a steel ship.

**Timenoguy.** A rope stretched between two points to prevent gear from fouling or chafing.

**Tin Knocker.** A workman who fabricates articles from thin sheet metal.

**Tip Clearance.** The clearance or distance between the circumference of the tip circle of a propeller and the hull of the vessel.

**To Overhaul a Tackle.** To separate the blocks of a tackle thus giving a greater drift to the moving blocks.

**Toggle Pin.** A pin, usually having an eye worked on the head, and having a point so constructed, that a portion of it may turn on a pivot pin, forming a tee shaped locking device to keep the pin in place.

**Tomahawk.** A riveting hammer with a long heavy head used in driving large rivets.

**Tongue and Groove.** A term applied to a plank one of the edges of which is cut away to form a tongue and the other recessed to form a groove. The tongue on one plank is matched with the groove on the other.

**Tongue and Groove Deck.** See Deck, Tongue and Groove.

**Tonnage Deck.** See Deck, Tonnage.

**Tonnage, Gross.** The entire internal cubic capacity of a vessel expressed in tons of one hundred cubic feet each.

**Tonnage, Gross Registered.** The gross tonnage as entered on the register or other official certificate of the tonnage of the vessel.

**Tonnage, Net.** The internal cubic capacity of a vessel which remains after the capacities of certain specified spaces have been deducted from the gross tonnage. These deductible spaces include principally crew's quarters, working spaces and

machinery compartments.

**Tonnage, Net Registered.** The net tonnage as entered on the register or other official certificate of the tonnage of a vessel.

**Tons Per Inch of Immersion.** The number of tons of additional weight required to immerse a vessel one additional inch of draft. The approximate tons per inch of immersion at any draft for salt water is equal to the area of the waterplane in square feet divided by 420.

**Tool Grinders.** Men who shape and sharpen the cutting tools for the several machines by grinding.

**Tool Re-manufactured.** Tools which have been reconditioned. They are sometimes reground to a smaller size and again they are restored to their original size.

**Tool Steel** See Steel, Tool.

**Tools, Calking.** Hand operated tools used in calking either wood or metal.

**Tools, Pneumatic Calking.** Tools used for metal calking in which the power is supplied by compressed air.

**Top Timbers.** A term applied to upper portions of frames in wood ships.

**Topgallant Mast.** See Mast, Topgallant.

**Topmast.** See Mast, Top.

**Topmast, Fidded.** A term applied to a topmast that laps over the upper portion of the lower mast. This form of topmast is supported at its lower end by a bar, called a fid, which passes through a slot in the topmast and also a slot in a pair of brackets which are attached to the lower mast. A band is worked around both masts at the level of the top of the lower mast. Withdrawal of the fid allows the topmast to be lowered.

**Topmast Stay.** Stay secured to the topmast near the upper end, set up with turnbuckles located near the stem on deck. Sometimes both forestay and topmast stay are secured to the same pad on deck near the stem.

**Topping Lift.** A rope or chain extending from the head of a boom or gaff to a mast or to the vessel's structure for the purpose of supporting the weight and permitting the boom or gaff end to be raised or lowered.

**Topping Lift Tackle.** Tackle between the boom and masthead used for lowering and raising a boom.

**Topside.** That portion of the side of the hull which is above the designed waterline.

**Topside Planking.** The outside planking on a wooden ship which is above the waterline.

**Topside Strake.** See Strake, Topside.

**Torpedo.** A steel plug, sometimes of spherical shape, designed for use in expanding a lead lining tube against its outer jacket of steel or iron pipe. To accomplish this the

torpedo is forced through the lead tubing from end to end.

**Torpedo Boat.** A type of war vessel now practically obsolete. Its principal characteristics are high speed, light construction, small displacement, and a main battery of torpedo tubes. The type was intended for use in the attacking of capital ships by means of the torpedo. The advent of the destroyers together with the increasing demands for greater seaworthiness and personal comfort has ended the building of vessels of this type.

**Torque.** The moment of a system of forces that causes rotation.

**Tow Rope.** See Rope, Tow.

**Tow Rope Resistance.** See Resistance, Tow Rope.

**Towboat.** See Tug.

**Towing Machine.** A machine that automatically, according to the strain on the rope, reels in or out a towing hawser. They act as shock absorbers preventing sudden tension and danger of parting. Their drums are designed to reel up and stow the hawser.

**Towing Winch.** See Towing Machine.

**Trailing Lines.** Light lines fastened to the handles of oars and secured to the boat inboard. They are used for trailing the oars alongside when the crew is not pulling.

**Transfer Pump.** See Pump, Transfer.

**Transformer, Electric.** A stationary electric machine consisting of primary and secondary coils, insulated from each other, wound, on a laminated iron core. They are usually designed to transform a high voltage to a low one or conversely to transform a low voltage to a high one.

**Transom Beam.** See Beam, Transom.

**Transom Floor.** See Floor, Transom.

**Transom Frame.** See Frame, Transom.

**Transom, Wing.** An athwartship timber attached to the top of the stern post. (Wood ship)

**Transoms, Filling.** Athwartship timbers attached to the forward side of a stern post.

**Transport.** A vessel intended for the carriage of troops, equipment, ordnance, military or naval stores, etc. The carriage aboard ship of passengers or merchandise.

**Transverse.** At right angles to the ship's fore and after center line.

**Transverse Bulkhead.** See Bulkhead, Transverse.

**Transverse Frames.** See Frame, Transverse.

**Transverse Number or Numeral.** A key number used by classification societies in their rules for determining the scantlings of the frames and transverse members.

These numbers with the corresponding scantlings are tabulated in the rules and are the results of experience and comparison.

**Transverse Stability.** The tendency of a ship to return to the upright position when inclined transversely by an impressed force.

**Transverse Stresses.** Stresses acting at right angles to the center line of a vessel or, if referring to a beam or girder, acting at right angles to the length.

**Transverse Subdivision.** The subdivision of a ship resulting from the fitting of transverse or athwartship bulkheads.

**Trap, Steam.** See Steam Trap.

**Traverse Board.** A device for keeping a record of the course steered and distance covered by a ship.

**Trawler.** A vessel designed for fishing and fitted for handling sweeping nets. Vessels of this type are of robust construction, have considerable sheer, great draft aft, good maneuvering qualities and large fish holds.

**Tread.** The length of a vessel's keel.

**Treads.** The steps or horizontal portions of a ladder or staircase upon which the foot is placed.

**Treads, Safety.** A special non-slipping metal tread fitted to the deck at the foot of ladders and stairways. They are also often fitted to the upper surface of the steps of ladders and stairs. When the steps themselves are safety treads they are called safety steps.

**Treble Purchase.** A purchase in which two treble blocks are used.

**Treble Riveting.** See Riveting, Treble.

**Tree Nail Turners.** Men who operate wood cutting machines which make tree nails.

**Tree Nails (Trunnels).** A cylindrical wooden pin used to secure the planks of a wooden ship to the frames. After the tree nail is firmly driven into place and cut off flush with the planking its head is expanded by means of a small wedge.

**Trestle-Trees.** A term applied to fore and aft pieces, whether of wood or steel, that are fitted at the hounds of a mast for the purpose of supporting the cross trees or platform at the top of a mast.

**Trim.** The longitudinal deviation of a vessel from her designed waterline at a given draft. When expressed in feet and inches it is equal to the sum of the distances that points on the waterline at the bow and stern are above or below the designed waterline at the mean draft at which the vessel is floating. The variation in a vertical direction of the fore and aft extremities of the actual position of a vessel's plane of flotation from its designed position.

**Trim by Head.** That condition of trim in which a vessel inclines forward so that her actual plane of flotation is not coincident with or parallel to her designed plane of flotation.

**Trim by Stern.** That condition of trim in which a vessel inclines aft so that her actual plane of flotation is not coincident with or parallel to her designed plane of flotation.

**Trimming Tank.** See Tank, Trimming.

**Trochoidal Wave.** A wave, the contour of which is the curve traced out by a point on a radius of a circle, which latter is rolled on the underside of a given line. This is the wave contour which is usually adopted for use in connection with calculations of bending moment for a vessel among waves.

**Trough Tool.** A smoothing tool for use on structural shapes.

**Truck.** The pedestal or ball at the extreme top of the topmast or topgallant mast.

**Trundle Head.** The circular portion of the capstan

**Trunk.** A vertical or inclined shaft formed by bulkheads or casings extending one or more deck heights, around openings in the decks, through which access can be obtained, cargo stores, etc., handled or ventilation provided without distributing or interfering with the contents or arrangements of the adjoining spaces.

**Trunk Bulkhead.** See Bulkhead, Trunk.

**Trunk Cabin.** A cabin which extends but a partial deck height above the upper or weather deck.

**Trunk Deck.** See Deck, trunk.

**Trunk Deck Stringer.** See Stringer, Trunk deck.

**Trunk Deck Stringer Bar.** See Bar, Stringer.

**Trunk Deck Vessel.** A vessel having a long continuous opening or hatch in the weather deck. The longitudinal coamings of this hatch are carried up about a deck height above the weather deck and connected at their upper edges by a flat or deck.

**Trunk Hatchway.** See Hatchway, Trunk.

**Trunk, Ventilating.** Trunks through which air is led for supplying fans and blowers, or through which heated air is allowed to escape.

**Truss.** An iron band around a lower mast having a pivot attachment to the center of a lower yard, thus forming the center of motion for bracing the yard around and at the same time holding it in position at the mast; to brail up a sail.

**Tub.** A short cask or half barrel. Also an opprobrious or contemptuous term applied to a vessel to signify that it is out of date or faulty in design.

**Tube Cleaners, Boiler.** See Boiler Tube Cleaners.

**Tube Expander.** A tool used to expand the end of tubes into the sheets or headers of boilers, and into flanges, etc.

**Tube Sheet, Condenser.** See Condenser, Tube Sheet.

**Tube Sheets.** See Boiler Tube Sheets.

**Tubes, Boiler.** See Boiler Tubes.

**Tubes, Condenser.** See Condenser Tubes.

**Tubes, Sounding.** Small pipes leading vertically up from a tank and arranged with the lower end opening into the tank so that the liquid rises in the pipe so its height can be measured by lowering a sounding rod into the pipe.

**Tug; Tugboat.** A vessel, equipped with heavy duty engines and machinery, used for towing miscellaneous types of floating craft.

**Tug or Towboat.** A small, handy, power-driven vessel fitted with slow-turning powerful machinery, especially designed for towing.

**Tumble Home.** The decreasing of a vessel's beam above the waterline as it approaches the rail. (The opposite of flare.)

**Tumbler.** An attachment to the jaws of a gaff to prevent the chafing of the mast.

**Tunnel Frames.** See Frames, Tunnel.

**Tunnel Plating.** The plating composing the structure of a tunnel.

**Tunnel Recess.** The enlarged end of a shaft tunnel. At the forward end this enlargement is termed the thrust recess and at the after end the stuffing box recess.

**Tunnel, Shaft.** (Shaft alley) A long narrow compartment running from the propelling machinery to the stern tube and containing the line shafting and its bearings. Fitted in order to provide access to the shaft and shaft bearings as well as to protect the shafting from the cargo in the after holds.

**Turbine.** A machine in which the kinetic energy of the steam is transformed into direct rotary motion. A reciprocating engine produces work by the relatively slow overcoming of resistance by the pressure of the steam up to the cut off and by the hyperbolic expansion of the steam up to the release while a turbine does its work through the impulse reaction of steam or steam jets at high velocity on rotary vanes.

**Turbine Annulus Area.** The net area available for steam flow through the blade rings of a turbine.

**Turbine Blades.** The vanes either on rotor or casing which are subject to and directly effect the travel of the steam through the turbine.

**Turbine Blade Friction.** The friction produced by the flow of steam across the turbine blades. This friction is much increased by the presence of water in the steam. It is accordingly advantageous to make the surfaces of all blading as smooth as may be and to use superheated steam.

**Turbine, Compound Impulse Reaction.** A turbine in which the principal expansion of the steam occurs in the vanes. The steam velocity is moderate but for good efficiency the peripheral speed of the rotor must be about three-quarters that of the steam speed. Owing to the low rotor speeds used, this type is especially suited to ship propulsion.

**Turbine, Cruising.** A turbine designed for use at relatively low speeds as compared with the vessel's maximum. They are designed and fitted to give reasonable

economy under cruising conditions. They may be installed either as separate units or be built within the same casing as the high pressure turbine. When fitted independently they are placed on the low pressure turbine shaft.

**Turbine Cylinder or Casing.** The outer and stationary portion of the turbine. For purposes of construction and access it is made in two portions, the upper and lower half respectively. In large units each part may itself be made up of two or more parts.

**Turbine Diaphragm.** A division member or plate which separates two adjacent turbine stages from each other. It consists of a wrought or cast steel division plate riveted at its outer edge to a cast steel rim and at its center to a hub through which the rotor shaft passes. The rim dovetails into the turbine cylinder. The hub is provided with close fitting grooved packing to reduce steam leakage.

**Turbine Effective Blade Height.** The clear distance between the inner face of shroud ring and the top of foundation ring.

**Turbine Efficiency.** The ratio of theoretical to actual steam consumption in turbines. The principal turbine losses are those due to steam friction, both against itself and against the blades; exhaust steam velocity; leakage over blade tips at glands, etc.; mechanical friction; radiation. The above losses total almost 40 per cent. Hence the average efficiency to be anticipated in practice may be taken as slightly in excess of 60 per cent.

**Turbine Foundation.** See Engine Foundation.

**Turbine Guide Blades.** Fixed or stationary blades carried on the casing of an impulse-reaction type of turbine. These blades receive the steam from the moving blades and while changing its direction of flow also increase its velocity.

**Turbine Lifting Gear.** Gear designed for lifting the upper casing of the turbine for examination, erection, repairs, etc. When ready for use guides are provided so as to insure movement without damage to blading. The gear proper consists of a motor acting through a system of worms and worm wheels.

**Turbine Moving Blades.** Blades carried by the rotor and therefore having motion relative to the fixed blades carried by the casing. These blades, or blades having the same function, are fitted in both the impulse and impulse-reaction types of turbine. They receive the steam directly from the nozzles or guide blades and by changing its direction of flow are able to transmit a rotative effort to the turbine shaft.

**Turbine, Multiple Stage Impulse.** A turbine in which the expansion of the steam takes place in sets of nozzles and from which the steam impinges on vanes set on several revolving discs. Only a limited pressure drop is allowed for each set of nozzles. This keeps down the velocity of exit steam from same and thus reduces blade velocity. Several rows of moving blades are fitted on each wheel and the steam speed falls from row to row. It is accordingly possible to use a much lower peripheral disc speed in the single stage impulse type. Hence turbines of this class are successfully used for main propulsive units in marine installations.

**Turbine Nozzle.** A device for supplying steam in the proper amount and direction to the rotating buckets of the turbine. The number and size of nozzles are directly dependent upon the horsepower desired. In the first stage, nozzles occupy only a part of the turbine circumference, but in the last stages the entire circumference is

taken up. Nozzles are made in segmental castings of suitable size and shape for the location desired.

**Turbine Operating Gear.** A mechanism for turning the rotor over for repair or examination. It consists of worm wheels on the turbine shafts. These worm wheels are actuated by removable worms and shafts operated by turning engines or other means.

**Turbine Reduction Gearing.** See Reduction Gearing.

**Turbine Rotor.** The rotating part of the steam turbine. It is built up of the following principal parts: a cylinder or drum; wheels; shafting; dummy piston. In the construction of the rotor, balance and rigidity are of the first importance in order to insure absence of vibration and accuracy of clearance. The cylinder or drum is worked out of the solid ingot. In large installations two drums may be used, an additional wheel being fitted at the juncture of the drums. Great care is required in handling and boring the drum to avoid distortion due to concentrations of pressure. Wheels may be of various forms and are either cast or forged. Steel forgings are the best practice at the present time. The shafting is suitably turned and the wheels are shrunk thereon. Pins are fitted to guard against the motion of wheel on shaft. The cylinder or drum is then shrunk on to the wheels and secured thereto by riveted screws fitted with means to prevent backing off. The grooves for the reception of the moving blades are worked in the outer surface of the drum. Journals are provided on shafting and the entire weight of the rotor thus transmitted to the main bearings. A dummy piston is placed at the steam end of the rotor. It consists of a series of collars formed on the rotor extension and rings attached to dummy casing and fitted with small clearance corresponding to the collars. Steam leakage is prevented by the wire drawing action of this contrivance.

**Turbine Shroud Ring.** A ring designed to take the ends of turbine blading, so as to maintain alignment and protect against the action of centrifugal forces.

**Turbine, Single Stage Impulse.** A turbine in which the expansion of the steam takes place within a set of nozzles and from which the steam issues in jets of high velocity impinging upon vanes set securely upon a revolving disc. The jet velocity of this type has between 2,500 and 4,000 feet per second. The peripheral disc speed is always considerably less than half the jet velocity. Owing to the high speed of this type it is not suited to use for the main drive of an ordinary sea-going vessel. It is, however, much used for driving dynamos on shipboard.

**Turbo Generators.** A combination consisting of a steam turbine and an electric generator generally on the same shaft. The current furnished by the generator is used for lighting the ship and sometimes for motors on the auxiliary machinery and machines in the engineer's work shop.

**Turn.** To cause a rope or chain to encircle a spar, pin or bitt one or more times, also to pass the bight of a rope over a bitt or cleat. The act is generally referred to as taking or catching a turn.

**Turn In.** To retire for the night.

**Turn Turtle.** To capsize or to founder. To turn completely over.

**Turnbuckle.** A device for connecting two parts of a bar, rod or rope together with an adjustable tension. It consists of an internally threaded link turning on screws at

each end threaded in opposite directions or- one end may have a swivel and the other a screw. The link is operated by means of a wrench or a lever. Frequently the link is constructed with a hole through the center for applying a marline spike as a lever.

**Turning Circle.** The approximate circle described by a vessel in turning when the helm is hard over.

**Turning Engine.** See Engine, Turning.

**Turning Gear.** An arrangement or device for turning the main engine by power other than its own. In large installations a turning engine, either steam or electric, is used to actuate a large worm wheel carried on the main shaft. In smaller engines the worm wheel may be operated by hand lever or by jack. In very small engines the wheel may be operated by a pinch bar and toothed gear wheel.

**Turning Gear Wheel.** A large worm wheel mounted on the main shaft in power and the larger hand operated turning gears. In the smaller hand operated gears, a toothed wheel mounted on the main shaft and arranged for operation by means of a pinch bar.

**Turpentine, Wood.** The resinous juice of pine or fir trees used in mixing paints, varnishes, etc.

**Turret Armor.** Armor fitted to the turret structure for the protection of the gun and ammunition handling mechanism.

**Turret Deck.** See Deck, Turret.

**Turret Deck Stringer.** See Stringer, Turret Deck.

**Turret Deck Stringer Bar.** See Bar, Stringer.

**Turret Deck Vessel.** A merchant vessel constructed with a side having an abrupt round over or tumble home at about the level of the main deck from which point the sides are carried up in a reverse curve to the narrow deck termed the turret deck.

**Turret Ship.** A war vessel in which the main battery guns are mounted in structures (generally protected with armor) carried on rollers and capable of rotation.

**Turrets.** Structures designed for the mounting and handling of the guns and accessories (usually main battery guns) of a war vessel. Turrets are constructed so as to revolve about a vertical axis usually by means of electrical or hydraulic machinery.

**Turtle-Back.** Usually applied to the weather or forecastle deck forward as, in naval practice, to protective decks in the vicinity of the water line when of excessive camber or sharply sloped or curved down at side.

**Turtle Deck, Turtle-Back.** See Deck, Turtle.

**'Tween Deck.** See Deck, 'Tween.

**'Tween Decks.** A term applied to the space between any continuous decks.

**'Tween Deck Tonnage.** The enclosed space between decks expressed in tons of

one hundred cubic feet.

**Twice-Laid Rope.** See Rope, Twice-Laid.

**Twine.** Small cotton or flax cord or thread used by sail-makers in working on canvas.

**Twofold Purchase.** A purchase in which two double blocks are used.

## U

**Ultramarine Blue.** See Paint.

**Umbrella.** A metal shield in the form of a frustrum of a cone, riveted to the outer casing of the smoke stack over the air casing to keep out the weather.

**Under-Deck Tonnage.** The enclosed volume of a vessel below the tonnage deck expressed in tons of one hundred cubic feet.

**Under Way.** A vessel is under way according to the navigating laws, "when she is not at anchor, made fast to the shore or aground." Generally speaking, it means that she is proceeding on a course.

**Underhung Rudder.** See Rudder, Underhung.

**Union.** A fitting used to connect pipes, particularly where it is not desirable to disturb the position of the pipes as must be done with coupling.

**Union Jack.** A small flag flown from a jack staff forward. It is set out on Sundays and when dressing ship. The design embodies that of the upper inner corner of the national ensign. In the United States the design is stars on a blue field. In Great Britain the design is composed of the crosses of St. George, St. Andrew -and St. Steven, on a blue field.

**Universal Joint.** A joint designed to transmit torsional effort from a given length of shafting to another independent of alignment.

**Unship.** To remove anything from its accustomed or stowage place; to take apart.

**Unstable Equilibrium.** See Equilibrium, Unstable.

**Upper Deck.** See Deck, Upper.

**Upper Deck Sheerstrake.** The strake of outside plating adjacent to the upper deck.

**Upper Deck Stringer.** See Stringer, Upper Deck.

**Upper Deck Stringer Bar.** See Bar, Stringer.

**Upper Works.** Superstructures or deck erections located on or above the weather deck. Sometimes used with reference to a vessel's entire above water structure.

**Upsetting Lever.** See Righting Lever or Arm.

**Upsetting Machine.** A machine designed for increasing the diameter or size of the

ends of bar stock or pipe for a desired distance as in the case of boiler stay rods and tubes.

**Upsetting Moment.** The product of the displacement and the upsetting lever. The displacement is usually expressed in tons, and the lever in feet and the upsetting couple stated in foot-tons.

**Uptake.** A sheet metal conduit connecting the boiler smoke box with the base of the smoke stack. It conveys the smoke and hot gases from the boiler to the stack and should be made double thickness with an air space between to prevent radiation.

**Useful Load.** That portion of a vessel's designed displacement which is devoted more or less definitely to the particular object for which the vessel is intended. In merchant vessels it includes cargo, fuel, stores and water, both potable and reserve feed. In naval vessels it includes protection proper, battery, ammunition, fuel, stores and water, both potable and reserve feed. When reference is made to merchant vessels the term is synonymous with "dead weight." Like this latter term, it relates exclusively to weight, not volume.

## V

**Valve.** A mechanical contrivance used for controlling or shutting off the passage of air, steam, water, etc., into or out of a boiler, cylinder, tank, compartment; or through a pipe line.

**Valve, Air.** Any valve on a compressed air line. Also used in reference to the control mechanism on front of a boiler for regulating the supply of forced draft to the boilers.

**Valve, Alarm.** Any valve which automatically gives an alarm. Sometimes it used in a fuel tank to indicate when the tank is full and consists of a float valve with electric contacts. Also used as a small safety valve on a boiler, where it is set to open at a pressure of 5 or 10 lbs. below the regular safety valves, thus giving warning of the approach of the maximum allowable pressure.

**Valve, Angle.** A valve with a spherical shaped body having a screwed or flanged inlet at the bottom and a screwed or flanged outlet at the side. A circular valve, fitting snugly on a circular seat, is actuated by a valve stem or rod having a screw thread cut on it which engages in a thread cut in the bonnet or cover. The valve stem is turned by means of a hand wheel.

**Valve, Balanced Whistle.** See Whistle Valve, Balanced.

**Valve, Blow-Off.** A valve for discharging the contents of a boiler, evaporator or other container. Valves are used to discharge from the surface of the water in the boiler and also from the bottom.

**Valve, Brass Mounted.** A term applied to a valve where such parts as the disc and ring, stem, seat and bonnet are made of brass.

**Valve, Butterfly.** A valve in which a disc revolves on a diametrical axis similar to a damper. Also applied to a valve in which two semi-discs are hinged on a diametrical axis so that they both open and close similar in manner to the wings of a butterfly.

**Valve, By-Pass.** A small valve used on a larger valve for the purpose of by-passing the pressure from one side to the other of the larger valve so that it will open easily.

**Valve, Check.** A valve so arranged as to permit flow in one direction only. Usually it consists of a valve disc carried from a hinged support and hanging at an angle of about 45°, or it may be of the ordinary type of valve without valve stem and fitted with a spring to insure rapidity of closing.

**Valve, Check, Boiler Feed.** A screw down, non-return valve, installed in the pipe lines between the main and auxiliary feed pump and the boilers. Its object is to prevent the water in the boiler from backing up through the feed lines between strokes or when the pump has stopped or broken down.

**Valve, Cross.** A term applied to a valve fitted on a by-pass between two lines of piping, thus providing communication between them. It is usually an angle valve with two side outlets.

**Valve, Delivery.** Usually refers to the main outboard delivery valve controlling the discharge of water from the condenser to the sea.

**Valve, Engine-Room Control.** The main stop valve on the steam line to the main engines controlling the supply of steam to the engines and located in the engine room.

**Valve, Escape.** A valve on a steam engine or boiler intended for the relief of excessive pressure and for the escape of steam.

**Valve, Flap or Storm.** A simple form of check valve at the bottom of a scupper pipe which permits water to discharge from the scupper overboard but prevents sea water from backing up the pipe.

**Valve Gate.** A valve with an inlet on one side and an outlet directly opposite on the other side. The gate consists of a nearly flat tapered disc which slides in a groove that is perpendicular to the passage through the valve. When open the gate is drawn up into a slot in the bonnet of the valve leaving the passage clear. The valve stem is threaded and is worked by a hand wheel. The distance from face to face of the inlet and outlet flanges or connections is much less than in a globe valve.

**Valve, Globe.** A valve with a spherical shaped body having a screwed or flanged side inlet and outlet. A circular valve fitting snugly on a circular seat, is actuated by a valve stem or rod having a screw thread cut on it which engages in a thread cut in the bonnet or cover. The valve stem is turned by means of a hand wheel. Globe valves are strong, compact, and tight. When fitted, care should be taken to set them so that they will close against the pressure, otherwise they can not be opened if the valve stem is broken or becomes detached.

**Valve, Kingston.** A sea valve so arranged that the pressure of the sea forces the valve in its seat or closes it, thus differing from most valves which are so arranged that the pressure is in the direction of opening of the valve.

**Valve, Main Check.** Check valves located in the feed water discharge pipes at or near the boiler.

**Valve, Maneuvering.** The term applied to valves used to vary the speed in turbines.

**Valve, Needle.** A valve which controls the flow of a gas or liquid by a long tapered point, permitting extremely fine adjustments of the flow.

**Valve, Non-Return.** A type of check valve with a swinging valve disc.

**Valve, Outboard Delivery.** See Sea Chest.

**Valve, Pet.** A small valve used in the regulation of pump action by means of regulation of an air supply.

**Valve, Piston.** A steam valve consisting essentially of two pistons, one to each port, connected by a rod or spindle. The steam enters round the outer edges of the pistons and exhausts past the inner edges or vice versa. The steam ports and passages are cast in the cylindrical chamber in which the piston valves move. Thus the piston valve is perfectly balanced in so far as the steam pressure is concerned and the frictional load induced by the excess steam pressure on the back of the ordinary slide valve is eliminated, there remaining only such frictional resistance as is necessary to obtain tightness against steam leaks.

**Valve, Poppet.** See Valve, Throttle.

**Valve Quadrant.** That portion of the reversing gear on a steam engine to which the ends of the eccentric rods are attached and which is curved to the arc of a circle.

**Valve, Radiator.** A valve controlling the flow of hot water or steam to a radiator. It is usually an angle valve.

**Valve, Reducing.** It is located in the steam supply line in order to reduce the pressure of the steam supplied to auxiliaries. Such reductions are made in the interest of production economy and steadiness of operation.

**Valve, Reducing Steam.** A self-acting valve so arranged by means of diaphragms and springs that the steam pressure will be reduced after passing through the valve.

**Valve, Regulator.** A valve so constructed that it will deliver a liquid or a gas at a given pressure.

**Valve, Relief.** A valve designed to open automatically at a desired pressure. They are installed on the cylinders of reciprocating engines and sometimes on the valve casings.

**Valves, Safety.** Valves arranged to open at any predetermined pressure and, by permitting the escape of vapor, gas or other medium, to prevent explosion or damage to the boiler, tank or other container.

**Valve, Sea.** A valve located at or near the outside plating of a vessel to supply sea water to the fire pumps and for flooding the ballast tanks, etc.; also for discharging water overboard from bilge pumps, ballast pumps, condenser circulating pumps, boiler blows, etc.

**Valve, Sea Suction.** See Sea Chest.

**Valve, Sentinel.** See Valve, Alarm.

**Valve, Shifting.** A small sized valve placed on condensers, pipes or, in general, other low pressure parts to allow the escape of air trapped in pockets, the valve

closing automatically to prevent inflow from the atmosphere.

**Valve, Slide.** A device intended to regulate the admission of steam to and its exhaust from the cylinder of a reciprocating engine. For this purpose it is given a straight line reciprocating motion bearing a definite relation to the piston itself. This relation is such that the steam ports in opposite ends of the cylinder are alternately uncovered so that steam is admitted first to one side of the piston and then to the other at the proper points in its stroke, the exhaust taking place regularly meanwhile. The operation of the engine then becomes continuous.

**Valve, Sluice.** A valve secured to a bulkhead usually without any connecting pipes, for use in allowing water to flow to and from adjoining compartments.

**Valve Stem.** The rod connecting the valve with its means of motion, in the case of a steam engine with the eccentric and rod, and in the case of a water valve with the hand wheel.

**Valve Stem Guide Bracket.** The bracket forming a guide support for the outboard end of the valve-stem, some distance away from the valve chest, and intended to keep the valve stem in straight line motion.

**Valve-Stem Stuffing Box.** The box on the end of a valve, through which the valve-stem travels, containing the packing, which prevents the escape of a gas or fluid under pressure from the valve. The stuffing box generally consists of an enlargement in the valve for the reception of the packing and a gland for pressing the same into place against the rod.

**Valves, Stop.** Generally considered as the valves especially fitted to cut off the supply of steam from the boilers to the engines. Also designated to distinguish from check valve, stop check valve, stop check lift valve, etc. Stop valves are fitted in pipe lines where it is desired to permit flow or to shut off the flow, the check valve being intended to permit flow in one direction only, the stop check acting as a stop valve in shutting off flow and also a check, but limiting the flow at all times to one direction, while the stop check lift serves as a stop valve, may act as a check valve, and may, if desired, permit flow in both directions.

**Valve, Stop, Boiler.** A valve installed on the line connecting each boiler with the main steam line. By this valve any boiler may be cut off completely or the steam from it regulated.

**Valve, Storm.** A simple form of check valve or flap valve on the end of a pipe discharging through the ship's side above the waterline to prevent the sea from backing into the pipe.

**Valve, Throttle.** A valve designed to control the supply of steam to the engine when stopping and starting. It is fitted in the main steam pipe near its point of connection to the high pressure valve chest. The principal requirements to be met are rapidity of operation and minimum obstruction to the flow of steam when open.

**Valve or Steam Chest,** sometimes termed **Valve Box.** The casting in which steam passages and ports are formed and through which the rod which actuates the valve works. It is provided with covers for access and inspection, is fitted with a stuffing box through which works the valve rod and with openings for the attachment of the main steam pipe from the boiler as well as for the exhaust steam pipe to the open air or condenser.

**Valves, Under-water.** Valves such as sea valves which can only be repaired or replaced while the ship is in dry dock.

**Valves and Cocks, Sluice.** Sluice valves and cocks may only be fitted on watertight bulkheads under conditions where they are at all times accessible for examination; the control rods are to be workable from the bulkhead deck, and are to be provided with an index to show whether the valve or cock is open or shut, the control rods are to be properly protected from injury, and their weight is not to be supported by the valve or cock. No sluice valve or cock is to be fitted on a collision bulkhead.

**Vane.** A fly made of bunting and carried at the truck, which being free to rotate on a spindle, indicates the direction of the wind.

**Vangs.** Ropes secured, generally one on each side, to the outer end of a cargo boom, the lower ends being fastened to tackles secured to the deck. The vang is used for guiding and swinging the boom and for holding it in a desired position, as over a cargo hatch. The term is also applied to ropes secured to the after end of a gaff and led to each side of a vessel in order to steady the gaff when the sail is not

**Veer-Chain.** A command to allow the anchor chain to run out.

**Veering.** Changing direction, used in referring to the wind and also to the course of a vessel.

**Veneer Press.** A press designed to hold or clamp a thin layer of high class or expensive wood on a backing of inferior grades of wood until the glue uniting the two is hard and set.

**Veneering.** The art of facing inferior grades of soft wood with a thin layer of more expensive hard wood.

**Ventilating Flooring.** See Gratings.

**Ventilating Trunk.** See Trunk, Ventilating.

**Ventilating System.** A system consisting of light metal pipes, blowers, special intakes, etc., for supply of fresh air to and removing foul air from the various compartments in a vessel.

**Ventilation.** The process of providing fresh air to the various spaces and replacing foul or heated air by fresh air.

**Ventilation, Mechanical.** Ventilation supplied by fans or blowers and sometimes by compressed air, the fans being operated by electric motors, steam engines or other mechanical means. The ventilation in this case is forced or induced by the fan through a pipe or pipes to one or more compartments whereas natural ventilation would require a separate pipe and cowl for each compartment.

**Ventilation, Natural.** Ventilation depending on the wind blowing into the cowls and down the ventilators, and also on the natural tendency of heated air to rise and escape through the pipes and trunks provided.

**Ventilation, "Thermotank" System.** A ventilation system in which the air is heated by passing over or around tubes through which steam or hot water is circulated. The box or tank containing the steam coils is called the Thermotank.

**Ventilator, Mushroom.** See Mushroom Ventilator.

**Ventilator Turning Gear.** Simple form of rack and pinion with hand wheel and shafting arranged so that the ventilator of the cowl type located on an open deck can be turned so as to face the wind of a supply ventilator, and away from the wind if an exhaust ventilator.

**Ventilators, Bell-Mouthed or Cowl.** Terminals on open decks in the form of a 90 degree elbow with enlarged or bell shaped openings, so formed as to obtain an increase of air supply when facing the wind and to increase the velocity of air down the ventilation pipe.

**Ventilators, Goose-Neck or Swan-Neck.** Terminals consisting of a 180 degree bend used only on ends of exhaust pipes and so shaped as to make the clogging of the outlet difficult.

**Vertical Borer.** A vertical spindle drilling machine used for drilling holes in wood.

**Vertical Center Keelson.** See Keelson, Vertical.

**Vessel.** A craft designed to float on and pass from place to place over the water. The term usually refers to types larger than boats.

**Vessel, Sailing.** A vessel propelled by sails. Where there is an auxiliary power plant she is only a sailing vessel as far as the navigating laws are concerned when the machinery is not in operation or when she is not under steam.

**Vessel, Steam.** A vessel propelled by steam power. According to the rules to prevent collisions in the navigation laws, all vessels over sixty-five feet in length propelled by machinery and tugboats and towboats of any length propelled by steam are considered steam vessels. If both machinery and sails are installed, she is considered a sailing vessel only when not under steam.

**Virtual Center of Gravity.** The point at which the weight of a liquid with a free surface may be considered to be concentrated when taking account of its effect upon the initial stability of a vessel. The virtual center of gravity of a free liquid is in a vertical line directly above the actual center of gravity and the distance between the actual and virtual centers of gravity equals the moment of inertia of the free surface divided by the volume of the liquid.

**Vise, Combination.** A type of vise designed for securely holding work of irregular form while filing, etc.

**Vise, Hinged Pipe.** A type of vise especially designed for use on pipe works. It is usually mounted on a work bench or table and the frame is made in two parts hinged on one side and locked with a toggle pin on the other. The upper jaw is operated in a vertical direction by a threaded spindle passing through the upper frame. The jaws are made in a diamond shape to give a better grip on the pipe.

**Visor.** A small inclined awning supported by a pipe frame running around the pilot house of a steamer, over the windows, to exclude the glare of the sun or prevent rain from coming in over the tops of the window sashes.

**Voice Tube.** A tube designed for the carriage of the human voice from one part of or station in the ship to another.

**Volt.** The practical unit of electromotive force. It represents that pressure which produces a current of ampere in a resistance of 1 ohm.

**Voltage Regulators.** An instrument usually mounted on a switchboard for the purpose of keeping the voltage at a predetermined value.

**Voltmeter.** An instrument for measuring the difference in potential between two points in a circuit.

## W

**Wake.** The disturbed water left behind a moving vessel. When dealing with propellers and propeller design a special significance attaches, which may be explained as follows. When a ship moves through the water a forward motion is imparted to the particles of water lying close to the hull of the vessel. This forward motion of the water close to the hull increases in intensity as it approaches the stern of the vessel so that the propeller actually revolves in water which has a decided motion in the forward direction. This forward moving water has a marked influence upon the efficiency of the propeller and for convenience is referred to as the "Wake."

**Wake.** The water at and immediately abaft a vessel's stern which follows the vessel with differing velocities at various points as she moves ahead. The wake is due to several causes, among which are: the effect of the natural stream line flow round a vessel's after body; the increase in thickness and velocity of a vessel's frictional belt as the stern is approached; with very full lines the actual forward drag of the water behind the stern; and, under certain conditions, the vessel's own wave action.

**Wake Gain.** The increase in the effective thrust of a propeller, for a given power delivered thereto, on account of the forward motion of the water forming the wake behind a vessel's hull. The wake gain is only realized to its full extent when the water enters the propeller disc in unbroken lines of flow closely parallel to the propeller shaft and when the clearance between blade tips and hull and blade tips and surface of water is ample.

**Wales.** The side planking on a wood ship lying between the bottom and topside planking.

**Walk Way.** See Bridge, Connecting.

**Wall Crane.** See Crane, Jib.

**Wane.** Bark or lack of wood from any cause on edges of lumber.

**Wardroom.** A room or space on shipboard set aside for use of the officers for social purposes and also used as their mess or dining room.

**Wardroom Country.** All the space on a deck devoted to the quarters of the wardroom officers.

**Warp.** A light hawser or tow rope; to move a vessel along by means of lines or warps secured to some fixed object; the lengthwise threads in woven material so called from the operation of assembling and arranging the threads known as warping.

**Warping.** A term applied to the: operation of moving a vessel from one place to another about a dock or harbor by means of hawsers. The operation of changing a vessel's berth when it is not performed by tugs or its own propelling machinery.

**Warping Winch.** See Winch, Warping.

**Wash Bulkhead.** See Bulkhead, Wash.

**Wash Plates.** Plates fitted fore and aft between floors for the purpose of checking the flow of bilge water when the vessel is rolling.

**Wash Port.** See Port, Wash, Bulwark, Clearing or Freeing.

**Watches.** Nautical divisions of time usually four hours each for standing watch or being on deck ready for duty. The first watch extends from 8 p. m. to mid-night, the mid watch from midnight to 4 a.m., the morning watch from 4 a.m. to 8 a.m., the forenoon watch from 8 a.m. to noon, the afternoon watch from noon to 4 p.m.; the watch from 4 p.m. to 8 p.m. is usually divided into two equal parts known as the first and second "dog watches"; division, usually one-half, of the officers and crew who together attend to the working of a vessel during the same watch. These are designated as the starboard and port watches, each of which is alternately on duty.

**Water Ballast.** See Ballast, Water.

**Water Ballast Tank.** A tank in which sea water for ballast is confined.

**Water-courses.** A term applied to limber holes and to gutters in the lower portions of compartments between limber holes.

**Water Gage, Boiler.** See Boiler Gage, Water.

**Water Light.** An apparatus for automatically lighting a ring life buoy, life boat, or raft when in the water. The light, which is self-igniting and non-poisonous, consists of a cylindrical copper receptacle filled with calcium carbide and calcium phosphide. A plug fitting into the cylinder is automatically withdrawn when casting the buoy overboard. water is admitted to the chemical compound, thereby producing in about one minute a brilliant flame lasting an hour or longer.

**Waterline (Light).** See Light, Waterline.

**Waterline (Loaded).** The waterline to which a vessel sinks when fully loaded.

**Water-logged.** So saturated or filled with water as to be unmanageable.

**Waterplane.** A plane coincident with or parallel to the surface of the water and limited by the line of its intersection with the vessel's hull.

**Waterplane Area.** The area of the waterplane at which the ship floats.

**Waterplane, Coefficient.** See Coefficient.

**Water Pump.** See Pump, Water.

**Water Service Pump.** See Pump, Water Service.

**Water Tenders.** Members of a ship's boiler room force who are responsible for the

proper supply of water to the boilers.

**Watertight Bulkhead.** See Bulkhead, Watertight.

**Watertight Conduit Box.** See Conduit Box.

**Watertight Compartment.** A space or compartment within a ship having its top, bottom and sides constructed in such a manner as to prevent leakage.

**Watertight Door.** See Door, Watertight. .

**Watertight Electric Light Fixtures.** See Electric Light Fixtures, Watertight.

**Watertight Hatch.** See Hatch, Watertight.

**Watertight Plug, Electric.** See Plug, Electric Watertight.

**Watertight Snap Switch.** See Snap Switch.

**Water Tube Boiler.** See Boiler, Water Tube.

**Waterway.** On wood ships the margin plank running along the edges of the decks adjacent to the inside faces of the frames. This timber is always thicker than the regular deck planking. On steel ships with planked decks the gutter formed along the sides of a deck by the waterway and stringer angle bars.

**Waterway Bar.** A term applied to an angle bar attached to a deck stringer plate forming the inboard boundary of a waterway and serving as an abutment for the wood deck planking.

**Watt.** The unit of electrical power. It is the amount of power given by 1 ampere under a pressure of 1 volt. One watt equals 0.00134 horsepower.

**Wattmeter.** An instrument for measuring electrical power.

**Wave Profile.** In the case of the bow wave which for a given speed and ship assumes a fairly constant size, shape and position relative to the ship's length, it is the wave outline against the ship's side. For the purposes of the strength calculation a deep sea wave is assumed and its profile considered as conforming closely to a mathematical law.

**Ways.** A term applied to the tracks and sliding timbers used in launching a vessel. Also applied in a general sense to the building slip or space upon which a vessel is constructed.

**Ways, Ground.** The stationary timbers or tracks laid upon the ground or foundation cribbing upon which the sliding timbers or ways, supporting a vessel to be launched, travel.

**Ways, Launching.** Two sets of long heavy timbers arranged longitudinally under the bottom of a ship with one set on each side, and sloping towards the water. Each set is composed of two separate members with the adjoining surfaces well lubricated with oil and tallow. The lower members are called the ground ways and remain stationary while the upper members are called the sliding ways and support the weight of the ship upon the removal of the shores and keel blocks and slide overboard with the ship at its launching.

**Ways, Sliding.** Timbers supporting a vessel to be launched which slide with the vessel along the stationary track or ground ways.

**Weather Bow.** That side of the bow toward the wind.

**Weather Brace.** A brace leading to that side of a vessel from which the wind comes. The opposite of the lee brace.

**Weather Deck.** See Deck, Weather.

**Weather Quarter.** That quarter of a vessel toward the wind.

**Web.** That portion of a beam or girder between the flanges which acts to hold the flanges in place and to resist the internal sheer stresses of the girder.

**Web Frame.** See Frame, Web.

**Web Frame Angle Bars.** See Frame, Web, Angle Bars.

**Web Frame Angle Clips.** See Frame, Web, Angle Clips.

**Web Plate.** See Plate, Web.

**Wedge of Emersion.** Consider the waterplane of a vessel floating upright as a plane fixed in its relation to the vessel. Term this the U plane. Incline the vessel to an angle from the upright. In the process of inclination the U plane forms two wedges with the surface of the water. The wedge which is above the surface of the water with the ship in the inclined position is called the wedge of emersion, while the wedge below the surface of the water is the wedge of immersion.

**Wedge of Immersion.** See Wedge of Emersion.

**Wedges.** Wood or metal pieces shaped in the form of a V, used for driving up or for separating work. They are used in launching to raise a vessel up and on to the cradle from the keel blocks.

**Weeping.** The very slow issuance of water through the seams of a ship's structure or from a containing vessel in insufficient quantity to produce a stream.

**Weigh.** To take the weight of the anchor on the chain; to hoist the anchor.

**Welding.** The art of joining or uniting two pieces of iron, steel or other metal together into one piece. Welding iron and steel by heating the parts to be united to a plastic state and putting them together and hammering the joint has been practiced for centuries.

**Well-Deck Vessel.** A merchant vessel having a sunken deck fitted between the forecastle and a long poop or continuous bridge house or raised quarter deck.

**Well-Hole.** A companionway or staircase enclosed on three sides.

**Wells.** See Pump, Wells.

**Wet Dock, Wet Slip.** Wet docks are basins into which vessels are admitted at high tide through gates which when closed retain the water at a constant level, not being affected by change in tides without. A wet slip is an opening between two wharves or

piers where dock trials are usually conducted and the final fitting out is done.

**Wetted Surface.** The area of the immersed surface of the hull. It may or may not include the wetted surfaces of the appendages.

**Whaler.** A vessel designed for or used in the whale trade.

**Wharf.** A structure built on the shore of a harbor, river, canal or the like and extending out into deep water so that vessels may lie close alongside to receive or discharge cargo or passengers.

**Wheel Port.** See Aperture.

**Wheel, Steering.** See Steering Wheel.

**Wheelhouse.** A shelter built over the steering wheel. The term is generally used relative to the house in which a hand steering wheel is located.

**Whelp, Chain.** A term applied to wood drums on a windlass having iron strips attached to them to grip the anchor chain and prevent wear on the drums.

**Whip.** The term whip is loosely applied to any tackle used for hoisting light weights and serves to designate the use to which a tackle is put rather than the method of reeving the tackle. The "single whip" or the "double whip" is the usual reference when using the term. but hatch whips, mast whips, etc., are often rove as luff tackles or as two fold purchases. A single whip gives no increase in power but simply a change in direction of the power applied.

**Whip-Upon-Whip.** One whip arranged to haul on the fall of another.

**Whipping.** Turns of twine or small stuff wound around the end of a rope to prevent it from unlaying.

**Whistle.** A steam or air whistle should be fitted on the forward side of the smoke stack for signaling.

**Whistle Control, Electric.** To eliminate the danger of breakage to the whistle rope and to reduce the physical labor required to blow the whistle frequently in fog, the electric control has been developed. It consists of a controlling switch located in the pilot house and on the bridge and electrically connected to a relay located in the engine room. The closing of the control switch in the pilot house causes the relay to close which completes a circuit through a solenoid located just below the whistle valve. The pull of this solenoid operates the whistle valve.

**Whistle Pull.** A cord or rope of small diameter extending from the whistle to the pilot house and used to operate the same.

**Whistle Valve, Balanced.** To overcome the strong pull required to open the simple type of whistle valve against high pressure the balanced valve was developed. The principle involved is usually the same in different designs. The pull on the valve lever opens a small port which allows the full pressure of steam to pass to the atmospheric side of the valve or an extension of the main valve. This balances the pressure of the boiler side and makes the complete opening of the valve very easy. It is principally employed where the electric control is used.

**White Rope.** See Rope, White.

**Winch.** A hoisting or pulling machine fitted with a horizontal single or double drum. A small drum is generally fitted on one or both ends of the shaft supporting the hoisting drum. These small drums are called gypsies or winch heads. The hoisting drums are either fitted with a friction brake or are directly keyed to the shaft. The driving power is usually steam or electricity but hand power is also used. A winch is used principally for the purpose of handling, hoisting and lowering cargo from a dock or lighter to the hold of a ship and vice versa. It is also used to top the booms, take up on lines in miscellaneous work aboard ship, in warping a ship into dock and in some cases for working windlasses and pumps by messenger chain.

**Winch, Crab.** A term applied to a small winch.

**Winch Foundations.** In the first place the deck itself in the way of a winch should be sufficiently strengthened and stiffened by stanchions, heavier deck beams or both. In case the deck is not plated it is desirable that plating of the approximate size of the base of the winch should be fitted not only to reduce vibration but also to take the holding down bolts. It is recommended that this plating be placed both on the top and bottom of the deck beams and firmly connected to them, with wood filling between the plates. With thin deck plating a doubling plate under the winch should be fitted. While it has been the custom in some yards, particularly on the Pacific Coast, to place a wood sole on the deck under a winch, this practice is objectionable because of the difficulty of keeping the wood from rotting. It is better to set the winch on the deck or on channel bar bearers and in case of a wood deck to fit a bounding bar around the winch to form an abutment for the planking.

**Winch Head.** A small auxiliary drum usually fitted on one or both ends of a winch. The method of operating a winch head is to take a couple of turns with the bight of a rope around the drum and to take in or pay out the slack of the free end. The winch head is used for topping booms, handling whips, warping, etc.

**Wind-catchers.** Special devices, such as wind sails, air port at scoops, etc., placed facing the wind so as to create a draft of air into the space desired.

**Winder.** A tool used on the bending slab to handle heated shapes.

**Windlass.** See Windlass, Steam. A device for hoisting or hauling by means of a rope or wire wound on to a horizontal drum or barrel.

**Windlass Foundation.** A term applied to a seating prepared for a windlass foundation.

**Windlass, Spanish.** See Spanish Windlass.

**Windlass, Steam.** An apparatus in which horizontal drums or gypsies and wildcats are operated by means of a steam engine for the purpose of handling heavy anchor chains, hawsers, etc. The engines are usually of the simple reversible type, the cylinders being variously disposed and actuating worm shafts which in turn operate the gypsy and wildcat shaft through the worm wheels.

**Window Frame Sill.** See Sill, Window Frame.

**Window Sash.** See Sash, Window.

**Windsail.** A cylindrical canvas apparatus distended by hoops and used to admit air to the lower portions of a vessel. It consists of a head having two large flaps or wings extended by bowlines. These wings catch the air and direct it into an aperture in the sail. A barrel or tail led through hatches conveys the air below decks. In some cases the head is entirely open and is fitted with four flaps avoiding the necessity of constantly trimming the sail with the shift of the wind or the swing of the vessel.

**Wing Frames.** See Frames, Wing.

**Wing Girder.** See Girder, Wing.

**Wing Tanks.** Tanks located outboard and usually just under the weather deck. They are sometimes formed by fitting a longitudinal bulkhead between the two uppermost decks and sometimes by working a diagonal, longitudinal flat between the ship's side and the weather deck.

**Wing, Winging.** A term used to designate structural members, sails and objects on a ship that are placed at a considerable distance off the centerline.

**Winging Weights.** The moving of weights (already on board a ship) from the middle line towards the sides. This increases the moment of inertia and tends to lengthen the period of roll of the ship.

**Winter Load Line.** The waterline to which a vessel is allowed to load when going to sea in the winter time.

**Wire Mesh Bulkhead.** See Bulkhead, Wire Mesh.

**Wire Rope.** See Rope, Wire.

**Wire Rope Fittings.** See Rope Fittings.

**Wireless House.** A small house or enclosure usually built on the uppermost deck to house the wireless equipment and operators.

**Wood Deck.** See Deck, Wood.

**Wood Hatch.** See Hatch, Wood.

**Wood Grating.** See Grating, Wood.

**Working.** A term in current use having a variety of applications; as, "working fit," having sufficient clearance to facilitate ease of motion; "working load," the normal load under which a structure or machine is designed to operate; "working material," material that contributes to the strength of a structure; "working part," a movable part in a machine; "working loose," the loosening of a rivet, nut, screw, etc., under strain, vibration, etc.

**Worm, Worm Shaft.** A threaded shaft designed to engage the teeth of a wheel lying in the plane of the shaft axis. This type of gear is used for the transmission of heavy loads at low speeds.

**Worming.** Filling the contlines of a rope with tarred small stuff preparatory to serving. This operation gives the rope a smoother surface and at the same time aids in excluding moisture from the interior of the rope.

**Work Shop.** A small space fitted out with machines and tools in which the crew may do general repair work

**Wrench.** A hand tool used to exert a twisting strain, such as setting up bolts, nuts, piping and fittings.

**Wrench, Ratchet Socket.** A wrench designed to operate in confined spaces. It usually consists of a spindle with a socket at one end which fits over the bolt head or nut and a screw feed on the other end. The spindle is rotated by power supplied through a lever and pawl and ratchet arrangement.

**Wrinkling.** Slight corrugations or ridges and furrows due to the action of compressive forces.

**Wrought Iron.** Described under Steel and Iron.

**Wyper.** That shaft designed to operate the valve lifter arms on a beam engine.

## Y

**Yard.** A term applied to a spar attached at its middle portion to a mast and running athwartship across a vessel as a support for a square sail.

**Yard-arm.** A term applied to the outer end of a yard.

**Yardage.** A term applied to the length per unit of weight of ropes and small-stuff.

**Yaw.** The act of sheering suddenly and uncertainly from a vessel's course. It may be caused by poor steering, by the condition of the sea, or by the characteristics of the vessel's underbody or by any combination of the foregoing.

**Yield Point.** The maximum tensile stress which may be impressed upon a material without straining same beyond the elastic limit.

**Yoke.** A frame or bar having its center portion bored and keyed or otherwise constructed for attachment to the rudder stock. The connecting rods from the steering engine or the leads from the steering gear are connected to each end of the yoke for the purpose of turning the rudder.

**Yoke Lanyards.** Line attached at the extremities of the yoke and extending to the stern sheets for use in steering a small boat.

## Z

**Zee Bar.** A rolled shape, generally of mild steel, having a cross section shaped like the letter Z. In ship work it is used for frames and bulkhead stiffeners. The size is denoted by dimensions of cross sections and weight per running foot.

**Z Bar Frame.** See Frame, Z Bar.

**Zee Frame.** See Frame, Z Bar.

**Zig Zag Riveting.** See Riveting, Staggered.

**Zinc.** Described under Metals.

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