CHAPTER III

Shipyard Tools

Following is a list of tools used by **Bolters, Erectors, Shipfitters, Linermen, Regulators:**

- ¾-in. and ⅞-in. Spud wrenches with offset,
- ⅝-in. wrenches with offset,
- Spud bars,
- 1-in. pipe handle,
- Testing knives,
- Center punches,
- 2-lb. and 8-lb. Mauls,
- ¾-in. and ⅞-in. Drift pins,
- Soapstone,
- Chalk,
- Yellow crayons,
- Turnbuckles,
- Steamboat ratchet,
- Heel wedges,
- Straight wedges,
- " C " clamps.

Reamers and **Drillers** use these tools:

- No. 2 and No. 3 Air drill machines,
- No. 9 Corner drill machines,
- Ratchets,
- 2-in., 4-in. and 12-in. Extension sockets, 3–3,
- Sleeve sockets, 3–4,
- 4-in. Sockets, 4–4, 2–4, 2–3, 1–3,
- 1⅝-in. and 1⅞-in. Countersinks,
- 15/16-in., 13/16-in. and 11/16-in. Reamers,
- 15/16-in., ⅞-in., ¾-in. and 27/32-in. Drills,
- Taps,
- Grease guns,
- Oil cans, 1 pt.,

- Drift pins, Nos. 1, 2, 3,
- Old men,
- Eye-safe goggles,
- Air hose,
- 1-in, Pipe handles,
- " C " clamps.

The following tools are used by **Riveters, Holders-on, Heaters and Passers:**

- No. 60 Guns,
- No. 2 Chippers,
- Holder-on machines,
- Jam riveter,
- ¾-in. and ⅞-in. Snaps,
- Concave dies, 1 7/16 in.,
- Flush dies, 1⅜ in.,
- ⅞-in. and ¾-in. Holder-on dies,
- Heating tongs,
- Passing tongs,
- Catching cans,
- " Y " Leader hose,
- Hot chisels,
- Eye-safe goggles,
- Pint copperized oil cans,
- Backing out punches,
- Hand riveting hammers,
- 12-lb. Mauls,
- Electric extension lights,
- 1-in. Pipe handles,
- Gooseneck dolly bars,
- Straight dolly bars,
- No. 0 Dies,
- No. 0 Countersunk dies and socket,
- Rivet forge,
- Testing knives,
- Rivet testing hammer,
- Red lead gun,

These tools are used by **Chippers** and **Caulkers:**

- No. 1 and No. 2 Chipping guns,
- Bobbing chisels,
- Cape chisels,
- Side cutters,
- Gougers,
- Roughing — straight, bent, fine,
- Rivet caulkers—bent,
- Rivet caulkers (Frenchman),
- Fullers—straight and bent,

Caulkers—round, straight, bent,
Rippers,
Caulkers' dies,
Oil cans,
Eye-safe goggles,
Hand chipping tools,
Cold chisels,
Caulking chisel, straight, bent, round, fine, coarse,
Roughing chisels, straight—bent,
Diamond points,
Straight rivet caulkers,
Cape chisels,
Fullers—straight, bent.

Spud Wrench (Fig. 17): This tool is used by erectors or plate hangers when putting the plates together. The pointed end is used to direct the plate so that one rivet hole runs center over the one below it and the other end of the wrench is used for setting up bolts and nuts on the plates.

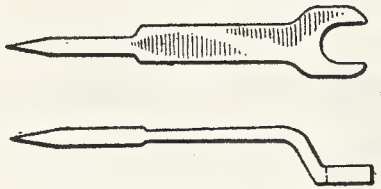

FIG. 17.—Spud Wrench.

Spud Bars (Fig. 18): These vary in length from 18 to 36 in. and are used in handling the plates when regulating them into the exact location required. One end is round and the other end tapers to a chisel point.

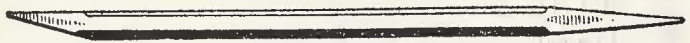

FIG. 18.—Spud Bar.

Rivet Testing Knives (Fig. 19): This knife is used by the rivet testers when examining the work to be sure that the joints between the plates are tight, without opening between them.

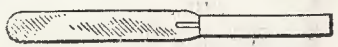

FIG. 19.—Rivet Testing Knife.

Figs. 20 and 21. These are the rivet testing knives which have been ground down to a shape as desired by the workers. They are shown to give an idea of the different types which the men prefer.

FIG. 20.

FIG. 21.

Rivet Testing Knives.

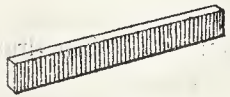

FIG. 22.—Soap Stone Marker.

Soap Stone Marker (Fig. 22): These are used as pencils by the steel worker as they give a clear line on the metal and can be sharpened down to a fine edge if required.

Mauls (Fig. 23): These are used for any heavy hammering about the ship, as by the regulating and bolting-up gangs.

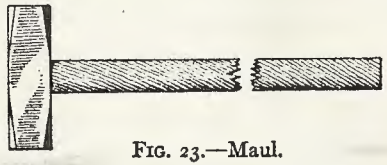

FIG. 23.—Maul.

Mauls (Fig. 24): This maul is used for backing-up when riveting and is used in place of the ordinary air tool for holding-on or in the place of a dolly bar.

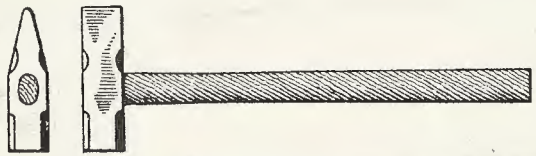

FIG. 24.—Maul.

Drift Pin (Fig. 25): This is used for centering the plates when regulating them into the exact location required. When a plate is laid and the rivet holes are not exactly in line or "fair," the drift pin is hammered in, and, being in this tapered shape "round," it draws the two plates in line so that the centers of the rivet holes come one over the other, thus forming a "fair" hole down between the two plates.

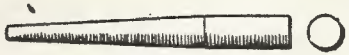

FIG. 25.—Drift Pin.

Turnbuckle (Fig. 26): This is often used when drawing plates into position.

FIG. 26.—Turnbuckle.

Steamboat Ratchet (Fig. 27): This is used for work somewhat similar to the turnbuckle, but because of the hooks on the end it is often preferred. By swinging the ratchet handle the casting revolves, the right- and left-hand threads inside draw the two end links together (both ends are alike).

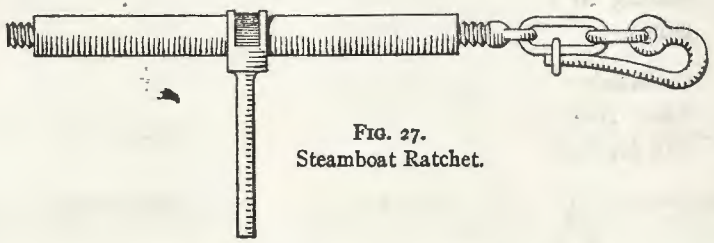

FIG. 27.
Steamboat Ratchet.

Straight Wedge (Fig. 28): This is used when regulating plates or when it is desired to raise the edge of a plate when fitting in liners or for some other reason.

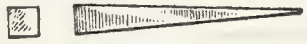

FIG. 28.—Straight Wedge.

Heel Wedges (Fig. 29): These wedges are used in the same kind of work as the straight wedge and have th advantage of the heel on top, which is used for hammering against and backing-out the wedge.

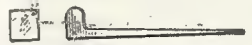

FIG. 29.—Heel Wedge.

Air Drilling Machine (Fig. 30): This machine is used for drilling and reaming. It is operated by means of two handles, air hose being attached to the valve which is on one of the handles. The screw extension at the top is adjustable to hold the machine up to the work and is extended as the drill enters the hole which it is boring.

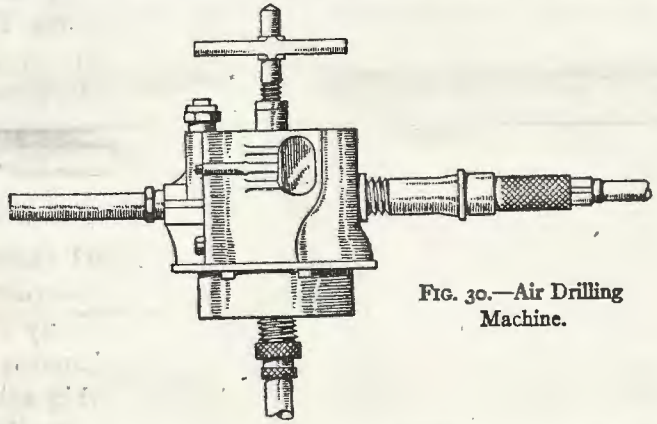

FIG. 30.—Air Drilling Machine.

Corner Drilling Machine (Fig. 31): This machine is used in corners or any other location where there is small

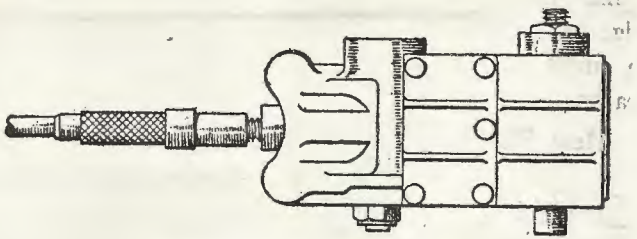

FIG. 31.—Corner Drilling Machine.

space. The screw at the top is set up with a lever which turns through a short arc. The valve is used as a handle on the back of the machine.

Wrench (Fig. 32): This is used for setting up the screw in the top of the Corner Drilling Machine, to raise the screw as the drill advances into the material.

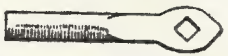

FIG. 32.—Wrench.

Steel Socket (Fig. 33): This is used in the Corner Drilling Machine and takes the drill.

FIG. 33.—Steel Socket.

Hand Ratchet (Fig. 34): This is the old fashioned ratchet which has been used for drilling holes for many years. It is used in conjunction with the "old man" (Fig. 43), one hand moving the handle and the other tightening the back screw to maintain the pressure on the drill.

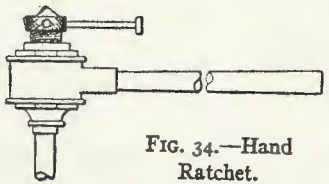

FIG. 34.—Hand Ratchet.

Countersink Drill (Fig. 35): This is used for countersinking any of the rivet holes as required.

FIG. 35.—Countersink Drill.

Reamers (Fig. 36): The reaming tool is used in the air drill and comes in various sizes to suit the different size rivet holes. It makes the hole uniform, so that the rivet will be able to slide through easily before it is riveted up.

FIG. 36.—Reamer.

Drills (Fig. 37): These are ordinary machine tool drills used in the air drilling machine and are used the same as for any work where a straight hole is required.

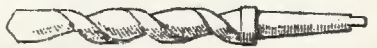

FIG. 37.—Drill.

Taps (Fig. 38): These are screw thread cutting tools which are turned down into a hole after it has been drilled, in order to cut a thread for a stud or bolt.

FIG. 38.—Taps.

Tap Wrench (Fig. 39): This wrench is used for turning the tap when threading a drilled hole.

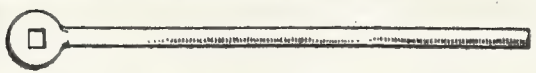

FIG. 39.—Tap Wrench.

Grease Gun (Fig. 40): This is a squirt can, or gun, used to lubricate the different air machines when they

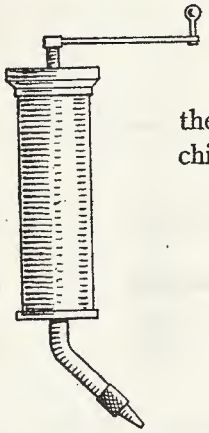

FIG. 40.—Grease Gun.

are not in use. By means of the plunger, grease is forced out of the gun and drops onto the bearings of the machine.

FIG. 41.—Oil Can.

FIG. 42.—Oil Can.

Oil Cans (Fig. 41): These are used for "oil" or "soup" (soap and water) for use of the Drillers in lubricating the work when drilling. Fig. 42 is another type of can used for the same purpose as Fig. 41.

"Old Man" (Fig. 43): This is a rig with a standpipe and base in one piece, a portable arm which can be raised and lowered or swung, to any angle, as desired. It is used when drilling, the base being on the material and the arm swung around until it is over the drill for which it forms a support and takes the thrust when the drill enters the material.

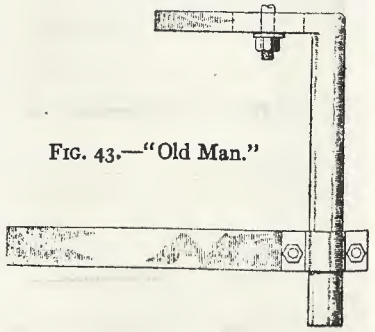

FIG. 43.—"Old Man."

Eye Goggles (Fig. 44): These are used by the Chippers and Caulkers or other men who are doing similar work as a protection against injury to the eyes. There are a number of designs, but any ordinary goggle is all right for this kind of work.

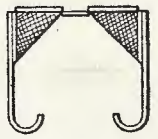

FIG. 44.
Eye Goggles.

"C" Clamp (Fig. 45): This is used by the Erectors or Plate Hangers and Regulators. It is designed to fasten the edges of two plates together and can be set up tight by means of a wrench on the head of the bolt.

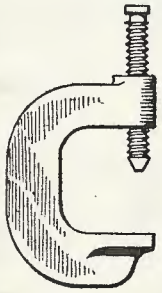

FIG. 45.
"C" Clamp.

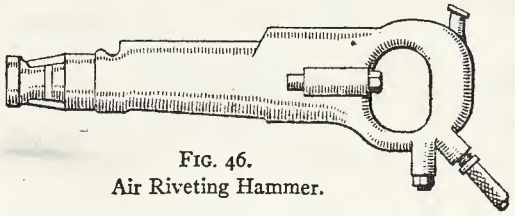

FIG. 46.
Air Riveting Hammer.

Air Riveting Hammer (Fig. 46): This is used for driving rivets, the quick action of the hammer forces the hot metal into the rivet hole and forms the point of the rivet before it has much time to cool off. It is commonly spoken of as an "Air Gun." Catalogue numbers are used in reference when speaking of the size of hammer. Running from No. 40 to No. 90, the size most commonly used being No. 50 for $\frac{3}{4}$-in. rivets, and No. 60 for $\frac{7}{8}$-in. rivets. The hammer is operated by a strong air pressure, released by the trigger (shown on top of the handle).

Plunger (Fig. 47): This is a steel plug which is a "go-between" for the hammer and the rivet die. It works loose in the air gun and drives on the end of the die. This plunger is loose and should be carefully handled by the inexperienced man as it can be shot out of the gun with sufficient force to badly wound another workman, if it should hit him. To be sure of it, many of the riveters carry it in their pocket, when not in use.

FIG. 47. Plunger.

Rivet Die (Fig. 48): The rivet die is also a loose member of the Air Riveting Hammer family, The stem of the die coming in contact with the plunger in the hammer, transmits the blow to the rivet and forms the point of the rivet according to the shape of the die. The die shown in this figure is for a "Button Point."

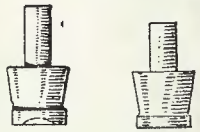

FIG. 48. FIG. 49. Rivet Dies.

Fig. 49. This die is similar to Fig. 48, but is used for a "Countersunk Point," often called "Flush."

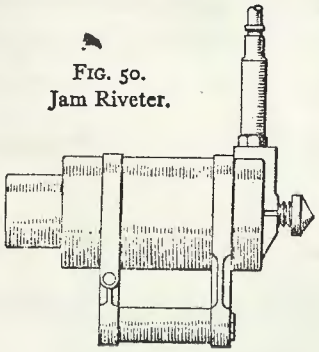

FIG. 50. Jam Riveter.

Jam Riveter (Fig. 50): This riveting machine is used where it is possible to place the butt end against another part of the structure. This takes the bearing strain off the riveter and he can do considerably more work under these conditions, but

it is seldom that this type of riveting machine hammer can be used on the general run of shipwork, because of the fact that it needs a back-up.

Air Holding-on Machine (Fig. 51): This is used by a holder-on who backs up the rivet on the other end from the riveter. The extension pipe with a set

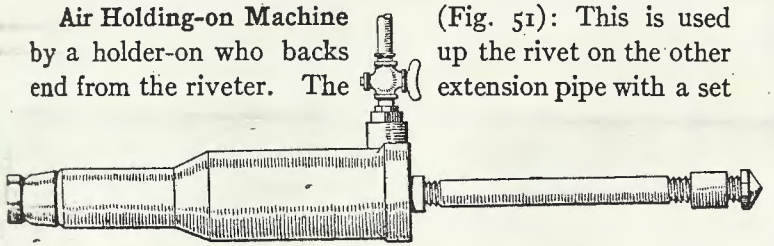

FIG. 51.—Air Holding-on Machine.

in the end fits directly against another part of the Hull structure and takes the force of the blow. Air comes in through the side and is under the control of the operator, and forms a cushion for the blow. The die in the end varies according to the kind of rivet being used.

Bevel Holder-on Die (Fig. 52): These are fitted up either pan head, concave, or flush, according to the type of rivet and are used in odd corners where it is impossible to handle an ordinary tool which is square to the surface (shown "pan head").

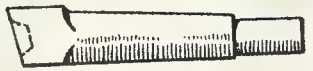

FIG. 52.

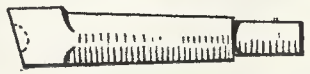

FIG. 53. Bevel Holder-on Dies.

Fig. 53. This tool is similar to Fig. 52, but is faced for a "Button Head" rivet.

Rivet Heating Tongs (Fig. 54): These are tongs which are used by the Heater Boy at the rivet forge putting rivets in and taking them out of the fire.

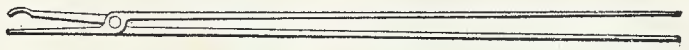

FIG. 54.—Rivet Heating Tongs.

Passing Tongs (Fig. 55): These tongs are used by the Passer Boy in relaying the rivet and when putting it in place in the rivet hole.

FIG. 55.—Passing Tongs.

Catching Cans (Fig. 56): These are used by the Passer Boy to catch the hot rivets as they are thrown to him by the Heater Boy near the forge fire.

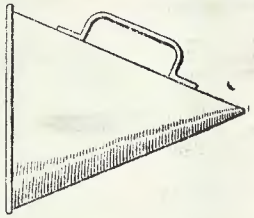

FIG. 56.—Catching Can.

"Y" Leader Hose (Fig. 57): Air hose for the riveter is generally branched for two leads. The main hose from the manifold is $\frac{3}{4}$ in. (rubber) and this is fitted to a "Y" which has a $\frac{3}{4}$-in. and a $\frac{1}{2}$-in. outlet. The larger one is carried to the riveting hammer and the smaller is carried to the chipping hammer, This branch is about 8 ft. long, giving sufficient length for working without having too much hose to drag around.

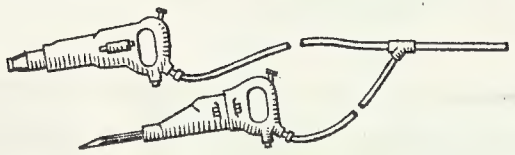

FIG. 57.—"Y" Leader Hose.

Air Chipping (or Caulking) Hammer (Fig. 58): This is similar to the Air Riveting Hammer except that it gives a lighter blow and is used for a different purpose. When any of the plates have a ragged edge or a part must be chipped off, this hammer is used. It is also used with caulking tools when that work is done after the riveting has been finished. The riveters use this hammer as part of their outfit when driving flush rivets, the stock of which is too long. After forming most of the point of the flush rivet, the excess (called the "Rag") is chipped off while still hot and the remainder of the material finished by the riveting hammer, before it has had time to cool off until hard.

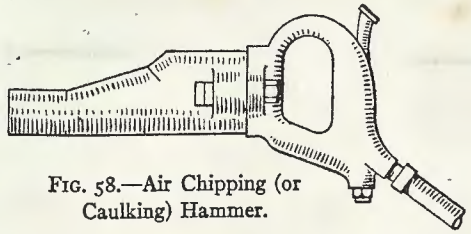

FIG. 58.—Air Chipping (or Caulking) Hammer.

Hot Chisel (Fig. 59): This is used in an air-gun to cut off the excess on the point of a flush rivet. When driving a flush rivet, the length of the rivet must be exactly right and the riveter must be on the safe side, so when the rivets are not just the length required, he will use those which are a little too long and then cut off the excess, called the "Rag."

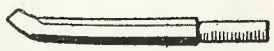

FIG. 59.—Hot Chisel.

Backing-out Punch (Fig. 60): This tool is used by riveters when it is found necessary to remove a rivet. The head of the rivet is cut off or burnt off and then the rivet is driven out through the hole by means of this punch, and a hand hammer.

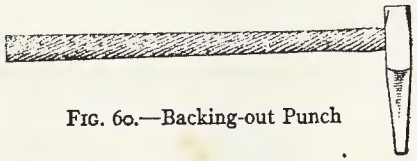

FIG. 60.—Backing-out Punch

Backing-out Countersunk Die (Fig. 61): This tool is used for backing-out countersunk rivets, the shape being adapted to the countersinking.

FIG. 61.—Backing-out Countersunk Die.

Die Socket (Fig. 62): This socket is used in conjunction with the backing-out die, Fig. 61.

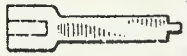

FIG. 62.—Die Socket.

Tomahawk (Fig. 63): This is a blunt-nosed backing-out punch and is used sometimes in place of the sharper-nosed punch, as shown in Fig. 60.

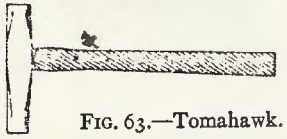

FIG. 63.—Tomahawk.

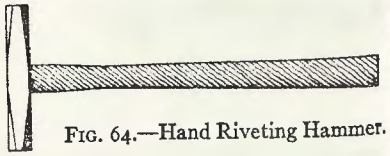

FIG. 64.—Hand Riveting Hammer.

Hand Riveting Hammer (Fig. 64): This hammer is used for riveting by hand when the work is of such a nature as to require handwork rather than the use of an air gun.

Gooseneck Dolly Bar (Fig. 65): This is used for hand work when holding-on for the riveter, in corners or some

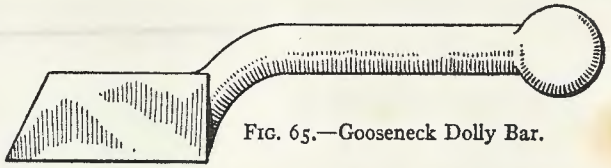

FIG. 65.—Gooseneck Dolly Bar.

places where there is little space behind the rivet. The tool weighs about 30 lb. and is used when the space is small and the air holder-on can not be fitted.

Straight Dolly Bar (Fig. 66): This is similar to the one shown above but is used when it is possible to get in

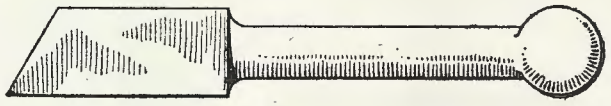

FIG. 66.—Straight Dolly Bar.

line with the rivet yet not convenient to use the air tool. (Both of these tools have different types of heads for the different kinds of rivets; as flush, button, and pan head.)

Rivet Forge (Fig. 67): This is used for heating rivets. It is a round pot of thick, cast iron, mounted on legs with a connection for an air hose. There is a portable tray above the air blast which forms the bed for the coke. Air passes up through the fire by means of numerous small holes in the tray. When the heater boy wishes to clean his fire, he turns on the air-cock wide open and the draft shoots the small cinders up out of the pot.

The sketch shows two handles which are used when hoisting the pot around on the ship. When the pot is to be cleaned, it is turned over on its side and dumped on deck. ("Cleaners" sweep up the cinders and carry them off the ship.)

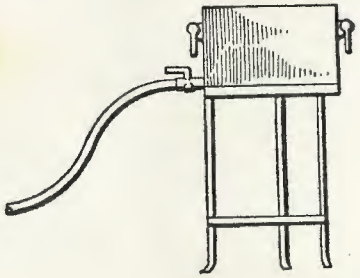

FIG. 67.—Rivet Forge.

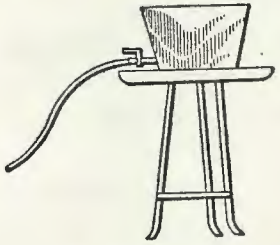

FIG. 68.—Rivet Forge.

Fig. 68. This forge is similar to Fig. 67, but is made with a smaller fire pot and is of lighter construction. It is more easily handled and does not carry so large a fire.

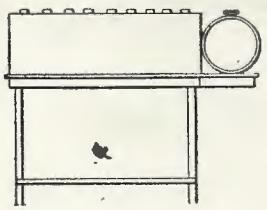

FIG. 69.—Rivet Forge.

Fig. 69. This oil rivet forge is shown as a sample of some now in use. The advantage which this type has over the coke-burning forge is in the handling of the fuel and the constant heat which is so easily controlled.

Rivet Testing Hammer (Fig. 70): This hammer is used in testing rivets to ascertain if they have been driven so that the material of the rivet completely fills

the hole. It is customary to lightly hit the head of the rivet with the hammer at the same time that a finger of the other hand is placed on the side of the rivet head and also against the plate, thus enabling the tester to detect any motion between the two.

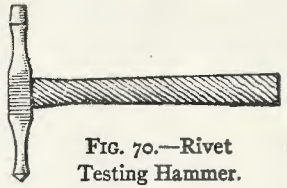

FIG. 70.—Rivet Testing Hammer.

Red Lead Gun (Fig. 71): This is a barrel with a screw plunger at one end and a $\frac{3}{8}$-in. pipe, with a nut, at the other end. When a leak is found and it is impossible to caulk it, due to the location, a $\frac{3}{8}$-in. tap is drilled and threaded, the "gun" filled with red lead putty. The gun is screwed into the tapped hole, plunger then screwed into the gun, thus forcing the putty out and into the space between the plates, or plate and angle, where the leak occurs. The $\frac{3}{8}$-in. hole is then filled with a metal plug, the putty hardens and stops up the leak.

FIG. 71.—Red Lead Gun.

Plunger (Fig. 72): The plunger of the Red Lead Gun has one end threaded to suit the inside of the barrel of the gun and the other end is square to fit the hand wrench, used when turning the plunger.

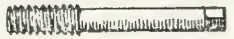

FIG. 72.—Plunger.

Hot Cutter (Fig. 73): This is used for cutting hot metal by means of a heavy maul, when doing hand riveting, or other work.

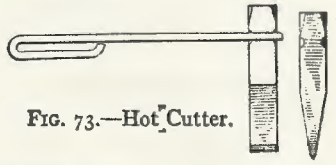

FIG. 73.—Hot Cutter.

Side Cutter (Fig. 74): This tool has a bevel edge and is used for side cutting with a hand hammer.

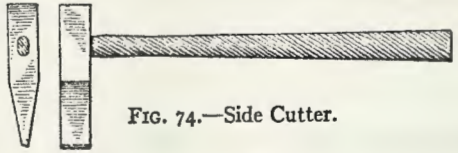

FIG. 74.—Side Cutter.

Cape Chisel (Fig. 75): This tool is used in an air hammer by chippers and caulkers for chipping work.

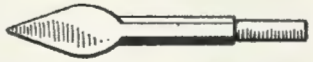

FIG. 75.—Cape Chisel.

Side Cutter (Fig. 76): This tool is used in an air hammer for chipping.

FIG. 76.—Side Cutter.

Straight Caulking Chisel (Fig. 77): This tool is used for ordinary caulking work where it is easily reached, and all straight work.

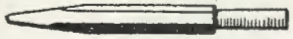

FIG. 77.—Straight Caulking Chisel.

Bent Caulking Chisel (Fig. 78): This is used for caulking in places which are difficult to reach with the straight chisel.

FIG. 78.—Bent Caulking Chisel.

Fine Caulking Chisel (Fig. 79): This tool is used for finishing and is also used for light work.

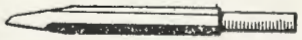

FIG. 79.—Fine Caulking Chisel.

Roughing Chisel (Fig. 80): This is similar to Fig. 77, except the face is knurled.

FIG. 80.—Roughing Chisel.

Roughing Chisel (Fig. 81): This bent chisel is similar to Fig. 78, except the face is knurled.

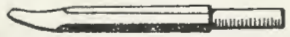

FIG. 81.—Roughing Chisel.

Roughing Chisel (Fig. 82): This chisel completes the set of Roughing-in tools which are used for preliminary work when the edge of the plate or angle is in poor condition for caulking. This tool (Fig. 82), has a rounded end, knurled, and is used before tool No. 79.

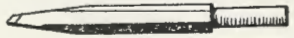

FIG. 82.—Roughing Chisel.

Straight Fuller (Fig. 83): This machine tool is used for finishing up a caulked joint on straight work.

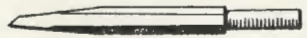

FIG. 83.—Straight Fuller.

Bent Fuller (Fig. 84): Similar to Fig. 83, but is used for finishing up caulking when the air-gun must be held at an angle.

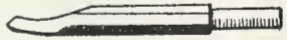

FIG. 84.—Bent Fuller.

Ripper (Fig. 85): This is used for opening up a seam or any straight line cutting in a steel plate.

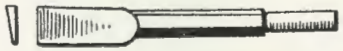

FIG. 85.—Ripper.

Gouger (Fig. 86): This tool is used for destroying a rivet point, before backing out the rivet, or other similar work.

FIG. 86.—Gouger.

Bobbing Tools (Fig. 87): This machine tool is used for smoothing out surface work when caulking. It is a straight tool with an extra piece of rub-

FIG. 87.—Bobbing Tool.

ber hose (usually added by the operator) for a handle.

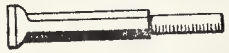

FIG. 88.

Fig. 88. Used by caulkers for caulking straight work.

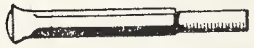

FIG. 89.

Fig. 89. This tool is used similarly to Fig. 88 on rounded work.

Fig. 90. Another machine tool used for caulking, particularly on bent work.

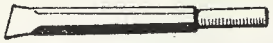

FIG. 90.
Bobbing Tools.

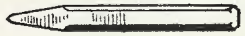

FIG. 91.—Cold Chisel.

Cold Chisel (Fig. 91): This is a hand tool used for any general work required, as it is like the ordinary cold chisel.

Center Punch (Fig. 92): This is the ordinary type used for marking the center of a hole to be drilled or punched.

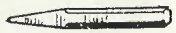

FIG. 92.
Center Punch.

Straight Caulking Chisel (Fig. 93): This tool is used for hand work on straight caulking. (Straight means where the work on the seam is all clear and easy to do, as regards any interference from other parts of the ship structure.) Similar to Fig. 77.

FIG. 93.
Straight Caulking Chisel.

Bent Caulking Chisel (Fig. 94): This hand tool is used for odd corners, around angle bars, under foundations, etc., where the straight hand tool would not work.

FIG. 94.
Bent Caulking Chisel.

Fine Caulking Chisel (Fig. 95): Used for finishing or light work. (These hand caulking tools are often used for testing tanks when the tank is full of water and leaks appear at different places. The hand caulking workman then travels over all the small leaks, and is able to caulk the metal by a few blows at a time, having more control over the caulking iron than when it is operated by air.)

FIG. 95.
Fine Caulking Chisel.

Diamond Point Chipping Tool (Fig. 96): This hand tool is ground down to a diamond point and is used for chipping a groove.

FIG. 96.—Diamond
Point Chipping Tool.

Gouge (Fig. 97): This hand gouge is used for groove work giving a flat surface and is often used for a deep cut.

FIG. 97.—Gouge.

Cape Chisel (Fig. 98): Used like Fig. 97 for a finer cut.

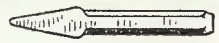

FIG. 98.—Cape Chisel.

FIG. 99.
Straight Fuller.

FIG. 100.
Bent Fuller.

Straight Fuller (Fig. 99): This hand tool is used to finish up a caulked seam.

Bent Fuller (Fig. 100). This is used for finish work when the seam is in a location which is difficult to reach with a straight fuller. (Both of these Fullers are used for light work when a mere tapping is all that is necessary. They are more easily handled and more sensitive than the air tools.)

Hand Fuller (Fig. 101): This tool is used with a heavy maul for creasing plates where a sharp knuckle is required. It is often used after the plate is in place on the ship. (Sometimes an acetylene torch is used to heat the plate locally, just where the knuckle is to be made.)

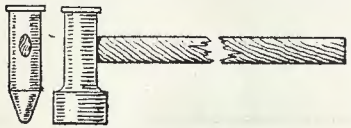

FIG. 101.—Hand Fuller.

Hand Flatter (Fig. 102): This is used to reverse the action of a Fuller. When a plate is accidentally creased or a correction is to be made, the Flatter is used to straighten out the plate and make it flat. A heavy maul and sometimes an application of heat is used, the same as when using a Fuller. (Both the Fuller and the Flatter will form the plate and make a finished job, whereas, if the maul itself were used, to come in contact with the plate, the plate would soon be scarred and present so poor an appearance that an inspector would not pass it.)

FIG. 102.—Hand Flatter.

CHAPTER IV

Shipway

Most of the shipyards have sufficient breadth of water surface so they are able to launch their vessels end-on (stern first) but some of the shipyards are located on narrow rivers or creeks where they are not so fortunate in the space needed and they must lay down their work so the vessel may be launched sideways.

It is customary to launch end-on where possible so the description of the Shipway will be for that arrangement.

The Shipway is the cradle or platform on which the hull of the vessel is laid down and from which the completed ship is finally launched into the water.

The shipways generally consist of a wood deck of planking carried on piling, where the ground is soft, for the whole length of the ship, or where the ground is firm, for the inboard end, under the bow.

The foundation is laid out in rows of piles or " bents " extending across the shipway and surmounted at the top by a heavy head " stringer " which is carried level. These bents vary in height according to the inclination of the ways and are spaced at a constant distance (see Fig. 103) according to the weight of the ship as heavier ships require a distance between bents to be less than in vessels of smaller dimension.