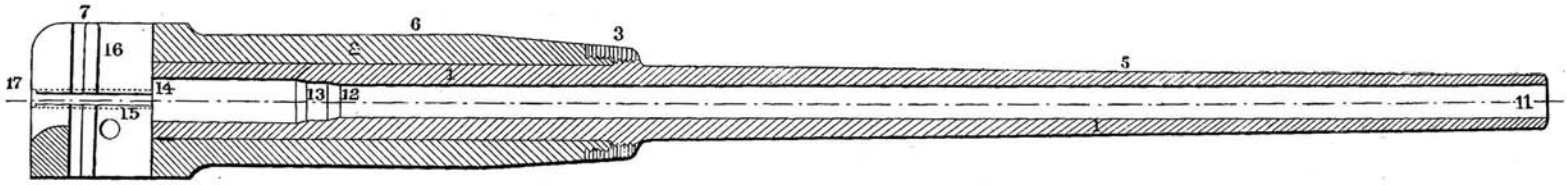


Fig. 1.

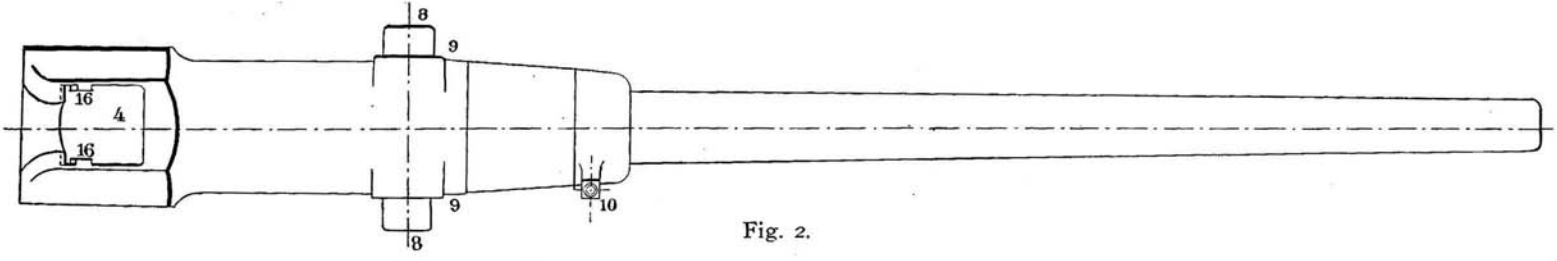


Fig. 2.

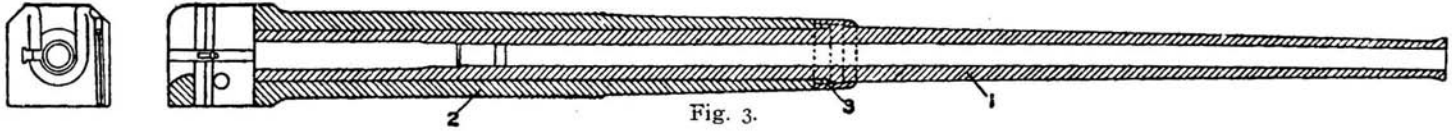


Fig. 3.

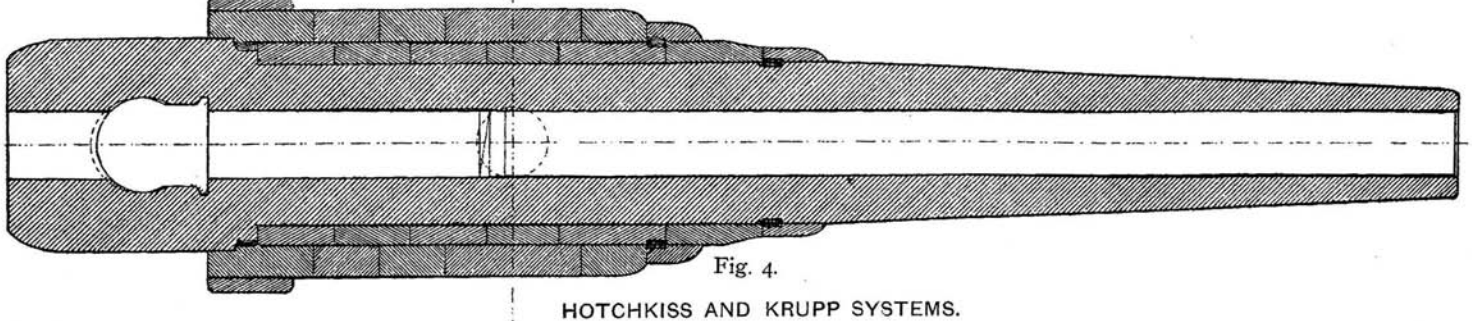


Fig. 4.

handle lock). The runway in the cocking cam is of such length that, in turning the crank handle to the rear, the overrun permits the engagement of the two cocking toes before the crank itself moves at all, and vice versa; the hammer is left undisturbed in closing.

The rock-shaft toe is upturned and moves to the rear in cocking. The rock-shaft catch is similar to that of the 6-pounder Mark II.

The stop bolt works similarly to the 6-pounder Mark II, but the catch differs. It consists of a conical plug, having a spring extension, with a lug on its inner end that takes in the annular grooves in the stop-bolt hole. The catch lies parallel with the axis of the bolt,—a taper hole being cut through the head of the bolt.

As in the Mark II 6-pounder, there is no trigger; the free arm of the sear acts as such, the hook of the lanyard being attached to it. The extractor is in one piece.

(Detail notes on the care and handling, dismounting and assembling, may be found in the Gun and Torpedo Drill Book of 1900, pages 53 and 115 to 118, inclusive.)

12. **The Safety of the 6-pounder Mark I Hotchkiss Breech Mechanism** lies in the following:

As to Opening when Fired.—The block is held closed—first, by its own weight pressing down on the crank beyond its center; second, by the reaction of the crank handles, the tendency being for them to fly forward; and third, by the small spring catch on the crank-handle toe seated in a notch in the gun.

As to Firing before Breech is Closed.—It is impossible to fire the gun—first, because the firing pin would not be in line with the primer; second, the cocking toe would strike the cocking cam before the firing pin could attain its full throw, or reach the primer.

As to Firing by Shock in Closing.—It is impossible to do so, as the block slides along the cartridge head, and hence gives no blow, which gives the sliding-wedge system an advantage.

13. Plate III gives various guns to which the Hotchkiss system is applied; Figs. 1 and 2 show an old style trunnioned 6-pounder built up with a tube and jacket which are held together by the *screwed* locking ring (3), which also bears the front sight. Fig. 3 shows a 3-pounder of recent construction, trunnionless, with much longer jacket. Fig. 4 is an old style 10-inch Krupp gun to which

the sliding-wedge system is applied. This system, is of all types of breech closure, the most universally used and is employed in the navies and armies of nearly all nations. It is particularly a favorite with the Germans, for whom it is successfully applied to all sizes of guns by the Krupp factories. In the gun shown in Fig. 4, and usually in all main battery guns, the block works horizontally instead of vertically, so that its weight may be more easily handled, and the mortise is kept as small as possible and is closed to the rear, leaving an aperture for loading. As may be seen, the system has the disadvantage of heaviness,—the block is heavier than that of most other systems and its housing must extend some distance to the rear, contributing greatly to the weight of the gun itself.

14. With each Hotchkiss gun in the U. S. Navy is furnished an *Accessory Box* containing:

Spare Parts.—Stop bolt, hammer, firing points, main spring, sear, sear spring and an extractor.

Accessories.—Sponge brush, cleaning brush, oil can, combination dismounting tool (a different kind is used for the two marks), dismounting pin, monkey wrench, hand extractor (except for 1-pounder), drill hook (for 3- and 6-pounder, Mark I), and lanyard.

CHAPTER XII.

GENERAL DISCUSSION ON GUN MOUNTS.

1. The term "gun mount" is, in the naval sense, applied to a structure that carries a gun, provides for pointing and sighting it in azimuth and in elevation, and checks and controls its recoil. Rapidity and accuracy of fire depend on the excellence of the mount, which is second in importance only to the gun itself.

2. The principle requirements of a modern gun mount are: (a) safety under all conditions, which necessitates proper design and requisite strength of materials; (b) rapidity, ease and smoothness of working; (c) durability; (d) simplicity; (e) gradual absorption of the shock of recoil and its dispersion over a sufficient area of the ship to prevent injury to the latter; (f) good control of the motive power, which, whether it be hand or other power, should be powerful and reliable; (g) provision for substituting hand power, as far as practicable, if other motive power is ordinarily used; (h) interchangeability of parts of mounts of same mark.

3. All modern gun mounts give the gun an arc of elevation of from 15° to 25° and the train is usually limited only by the form of the gun emplacement; mounts are conveniently divided into classes according to the kind of recoil mechanism used. These classes are (a) non-recoil mounts, (b) hydraulic-recoil spring-return mounts, (c) hydraulic-recoil and return mounts, and (d) hydraulic-recoil and gravity-return mounts; to which must be added (e) field mounts. In all recoil mounts means are afforded for returning the gun to battery, i. e., its initial position; this mechanism usually *assists* in checking the recoil. In all but the smaller mounts, buffers of some form are provided for cushioning the counter recoil. The gun recoils in the line of fire except in mounts of class (d).

4. **A Non-Recoil Mount** is one in which the gun cannot recoil

except in so far as the elasticity of the metal permits it to; obviously, this class can be used only for very light guns.

5. **A Hydraulic-Recoil Spring-Return Mount,** (all modern mounts are of this class), is one in which the recoil is checked by hydraulic cylinders, closed and kept constantly filled with a "recoil liquid" (glycerine and water), the gun being returned to battery by the extension of spiral springs, also inside the cylinders, which are compressed during recoil. The cylinders are usually secured to a stationary part of the mount and the piston rods to the gun, though in some mounts the reverse obtains. During recoil the pistons move along the cylinders and the recoil is checked by the friction of the liquid as it passes from one side of the piston to the other through apertures of variable area. The apertures consist of shallow grooves in the cylinder, not filled by the piston, and the variable area is obtained by tapering the width of the grooves, which finally disappear when the limit of safe recoil is reached; when the gun is in battery, the position of the piston is at the widest part of the grooves, which are from three to five in number. During the counter-recoil the liquid again passes over the pistons, aiding in controlling the counter recoil. The counter-recoil springs surround the piston rods, being held between the piston and cylinder head under initial compression to keep the gun in battery as the ship rolls. Thus, when the recoil is checked, the springs are highly compressed and immediately shoot the gun out to battery. The counter recoil is violent, and in large gun mounts a "counter-recoil check" is fitted which may consist of spring buffers or of hydraulic checks. In the latter case, an extension of the piston rod beyond the piston enters a tapered hole in the front cylinder head, or, vice versa, a rod projecting inward from the cylinder head enters a tapered counterbore in the piston rod, which hole, of course, fills with liquid at the beginning of the counter recoil and acts in the same manner as the main cylinder, when the gun nears its position in battery.

6. **A Hydraulic-Recoil and Return Mount,** to which class the earlier turret mounts belong, is one in which the recoil is checked as in (5), the gun being returned to battery by hydraulic motive power. The recoil cylinders may be independent of the hydraulic system, or they may act also as motor cylinders. In the first case,

the recoil is checked exactly as in (5), and the gun is returned by separate motor cylinders, connected with the hydraulic system, whose piston rods act on the gun cradle. In the second case, during recoil the piston rods are driven *into* the cylinders, which are connected to the hydraulic system through check valves at the opposite ends; during recoil these valves close and the cylinders act as in (5), the water displaced by the piston rods escaping through valves which are spring-weighted to the pressure of the hydraulic system. After recoil, the check valves open and the hydraulic pressure, acting on the effective area of the piston rods, returns the gun to battery; as this is done comparatively slowly, spring counter-recoil checks are sufficient. The 13-inch mounts of the "Indiana" are of this latter class and the 12-inch mounts of the "Texas" of the former.

7. **A Hydraulic-Recoil Gravity-Return Mount,** is one in which the gun recoils up inclined rails *not* in the line of fire; recoil being mainly checked by closed hydraulic cylinders acting as in (5), and the gun sliding back down the inclined rails to its position in battery by force of gravity. The gun, by its trunnions, is secured to a movable part of the mount, (comprising the cylinders), that slides on and is held to the inclined rails of a lower carriage; the piston rods are secured to the lower carriage at the bottoms of the inclined rails. The counter recoil is checked by spring buffers on the lower carriage. These mounts were fitted to the main battery guns of our first steel ships, but are now obsolete and are no longer being fitted; the 8-inch turret mounts of the "New York" are of this class.

8. **A Field Mount** is one intended for shore use, and consists essentially of an axle mounted on two wheels, bearing a trail piece with a small trail wheel and a socket, to which is secured the gun mount proper. Except for machine guns, which have non-recoil mounts, hydraulic-recoil spring-return mounts are used. Train is effected mainly by swinging the whole mount on its wheels; the elevating gear is fitted to the non-recoiling part of the mount. The general navy method is to carry ammunition on the gun mount, as a combination of "limber" hooked to the trail of the mount is too heavy to be dragged by men.

9. **A Turret Mount** is one in which one or two,—usually two

in U. S. ships,—heavy guns of at least 6-inch calibre are mounted in an armored structure which is revolved on rollers by suitable machinery, the guns being elevated independently of the structure.

10. **The Gun Slide** is a general term applied to that non-recoiling part of a gun mount which provides surfaces on which the gun and recoiling part of the mount travel during recoil. Being constructed in many different forms, it may consist of simple rails, as in gravity-return and hydraulic turret-mounts; but in recent ones, the slide is identical with the sleeve which fits around the gun body. The recoil cylinders and the trunnions are parts of the slide, the elevating gear raises and lowers its breech end and, in all but secondary battery and turret mounts, the gun sights are fitted to it.

11. **The Gun Cradle or Saddle** is, in general, a term applied to that part of the mount which contains the trunnion seats. The elevating gear is secured to it, and the gun is trained by revolving it on roller or ball bearings; the lower part is called the pivot. In turret mounts, the *deck lugs,* a part of the permanent structure of the turret, contain the trunnion seats.

12. **The Training Gear,** hand or power, is the machinery that revolves the movable parts of the gun mount, to which parts it is, in all except turret mounts, secured.

13. **The Elevating Gear,** hand or power, is that machinery secured to the saddle which, working on the breech end of the gun slide, elevates or depresses the gun's muzzle. On firing, the gun's muzzle makes a violent effort to move in the vertical plane, describing a small angle which is called the *jump.* The gun being pivoted at its trunnions, the jump brings a strain upon the elevating gear, which is relieved of the shock by (1) spring buffers or by (2) friction disks. In the first method, a worm which is indirectly secured to the saddle, gears in an arc which is part of the slide; this worm works on its shaft by a feather, being capable of longitudinal motion along it and is supported from below by a spiral spring surrounding the shaft. When the jump occurs, the worm is forced downward and the spring takes up the shock without injury to the mechanism and returns the gun to its first position. In heavy turret mounts, the same principle is applied in a different manner, and a hydraulic cylinder called the " dash

pot" is associated with the spring. In the second method of controlling the jump, the gun slide and saddle are connected by rack and pinion gearing instead of worm gearing. The elevating pinion is not secured directly to its shaft but is held to it by two friction disks which *are* so secured and hold the pinion between them by friction alone. When the jump occurs these disks permit the pinion to slip around between them, as long as the elevating arc puts sufficient pressure on its teeth, and thus cushions the shock. In this latter method the gun will not return to its former position, but will be elevated (usually) a few degrees above it after firing; that is a disadvantage, but since the spring method violently strains the connecting parts, the friction device is preferred.

14. **The Pivot Stand** is that part of the mount which is strongly bolted to the structure of the ship, inside of which the pivot fits and on which the gun and upper carriage rest; ball or roller bearings being interposed to reduce friction; the training rack is secured to the pivot stand (except in turret mounts in which the training gear is stationary). The pivot stand is often called the "pedestal," from which comes the name "pedestal mount" for rapid-firing guns. The term "central pivot mount" was formerly of much significance, but of course all modern mounts are central pivot mounts. The term "top carriage" usually includes all parts of the mount above the pivot stand, but occasionally it is,—much less properly,—applied to the slide or saddle alone.

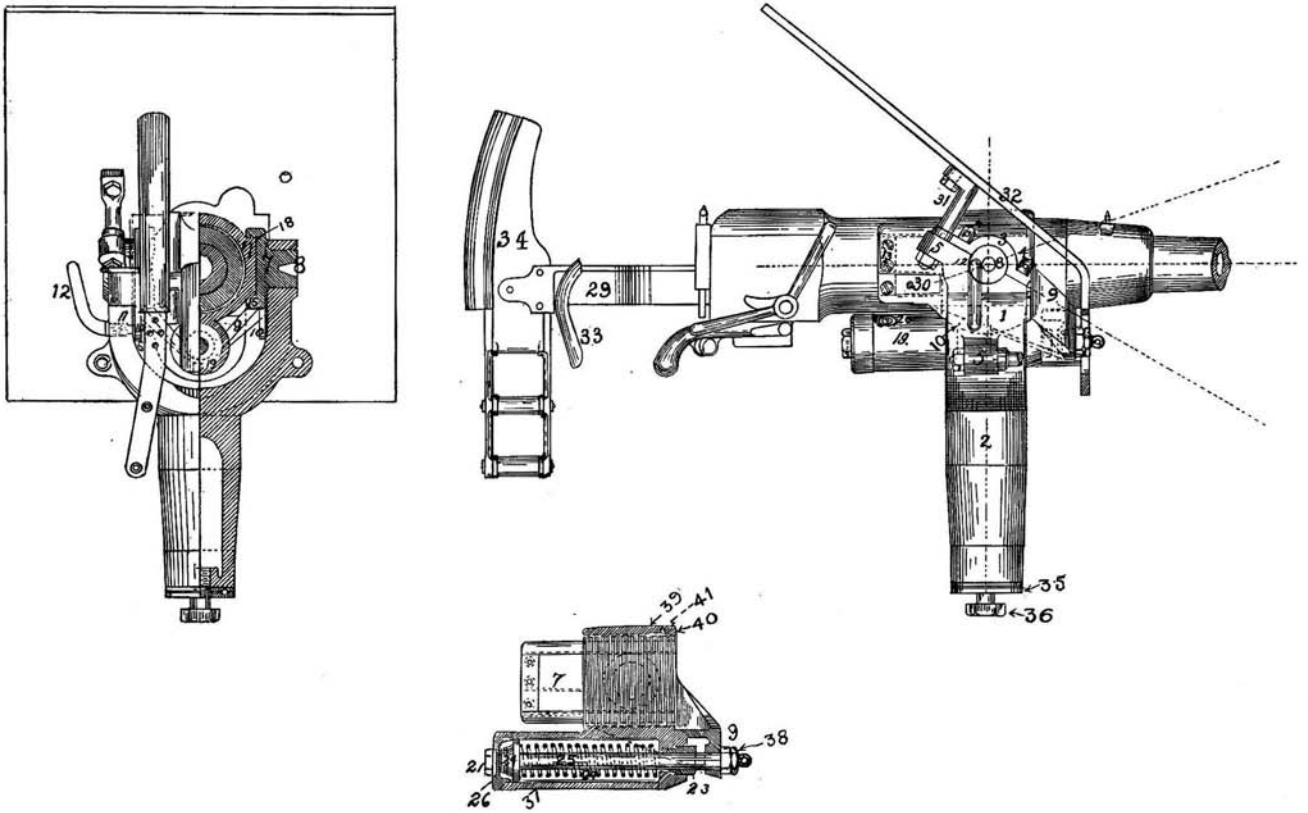
15. **Metals used in Gun Mounts.**—Gun-metal is commonly used for most parts of all 6-pounder and smaller mounts. For larger mounts this metal is not reliable, particularly for the large parts, such as the pivot stand, saddle, etc., for which parts cast steel of good quality is used. The castings are made by private contractors and, after being tested, inspected and passed upon by the government inspectors, are sent to the Naval Gun Factory at Washington, D. C., where the parts are machined and assembled. The principle in designing is to avoid having steel on both sides of a working surface; this is accomplished by making one of the parts of gun-metal if small, or, if both parts are large, by bushing one of them with it. For example, the insides of the sleeve and trunnion seats are so bushed in recent mounts and the pistons of gun-metal work inside cast steel recoil cylinders.

6-pounder Mount, Mark III.

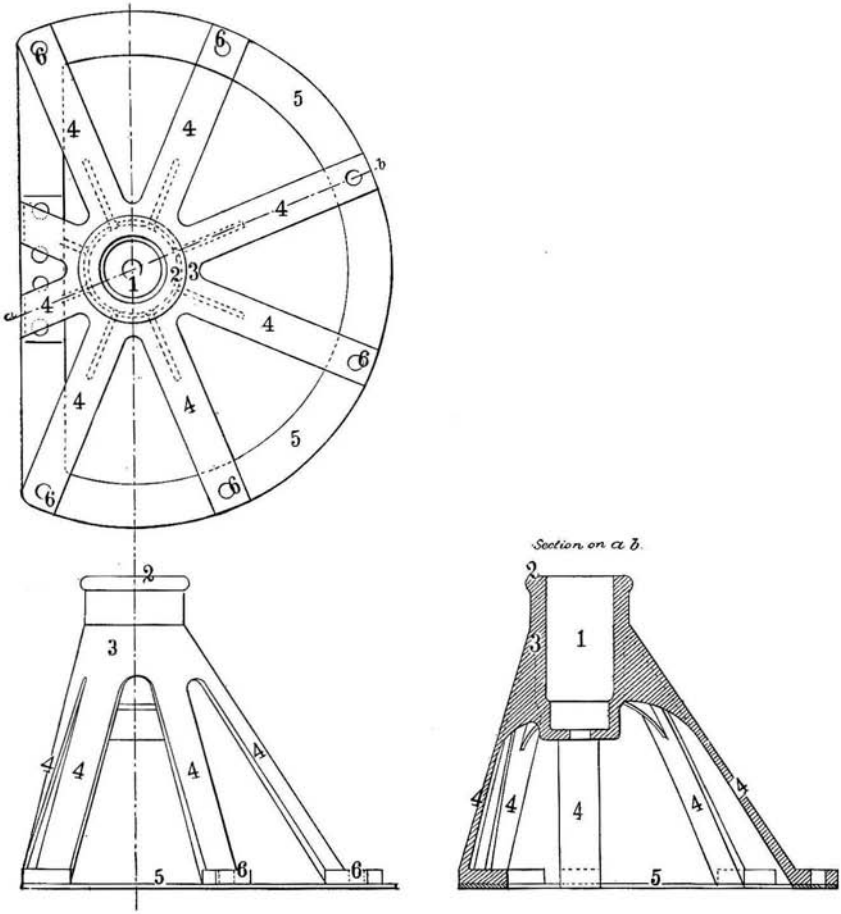
16. The Mark III mount is a hydraulic-recoil spring-return mount for trunnionless R. F. 6-pounders, in which the recoil cylinder and sleeve, with which it is combined, recoil with the gun, the piston rod being secured to a stationary part of the mount; the principal parts, with the exception of the cage stand which is of cast steel, are machined from bronze castings. The mount shown in Plate I is adapted for Hotchkiss R. F. 6-pounders; with the exception of a different form of shoulder bar secured to the *right* side of the slide, the mount for trunnionless Driggs-Schroeder R. F. 6-pounders is in all respects the same (see Plate III).

17. The **Sleeve** (17) and **Recoil Cylinder** (19).—The gun, which is threaded on the outside, screws into the sleeve (17) and is secured by the key (40) inserted from the forward end. Suitable surfaces for fitting into the slide guides (16) of the oscillating slide are machined on each side of the sleeve. Cast in one with the sleeve is the recoil cylinder (19), closed at its rear end by a bonnet (21) and having at its forward end a stuffing box (23), through which the piston rod (25) passes. Upon the inside surface of the cylinder are cut the recoil grooves (37), three in number, which taper rapidly from a wide opening at the normal position of the piston to nothing at the limit of recoil. The cylinder is filled with the recoil liquid through the plug (20). The piston rod, secured by locking nuts at its forward end to the oscillating slide transom (9), carries the piston on its inner end. The counter-recoil spring (27) is held in a state of initial tension between the front cylinder head and the piston; there is no counter-recoil check.

18. **The Oscillating Slide** (7) is fitted with trunnions (8) which rest in the trunnion seats of the saddle and are there secured by the cap squares (3). The slide transom (9) connects the two sides of the slide and affords a non-recoiling place for attaching the piston rod. The recoil stops (13) are secured by screws to the rear ends of the slide guides, at the extreme limit of recoil. The shoulder bar (29), by which the gun is pointed in train and in elevation, is dovetailed to the left outer part of the slide; the gun pointer grasps the handle at the lower end of the bar and



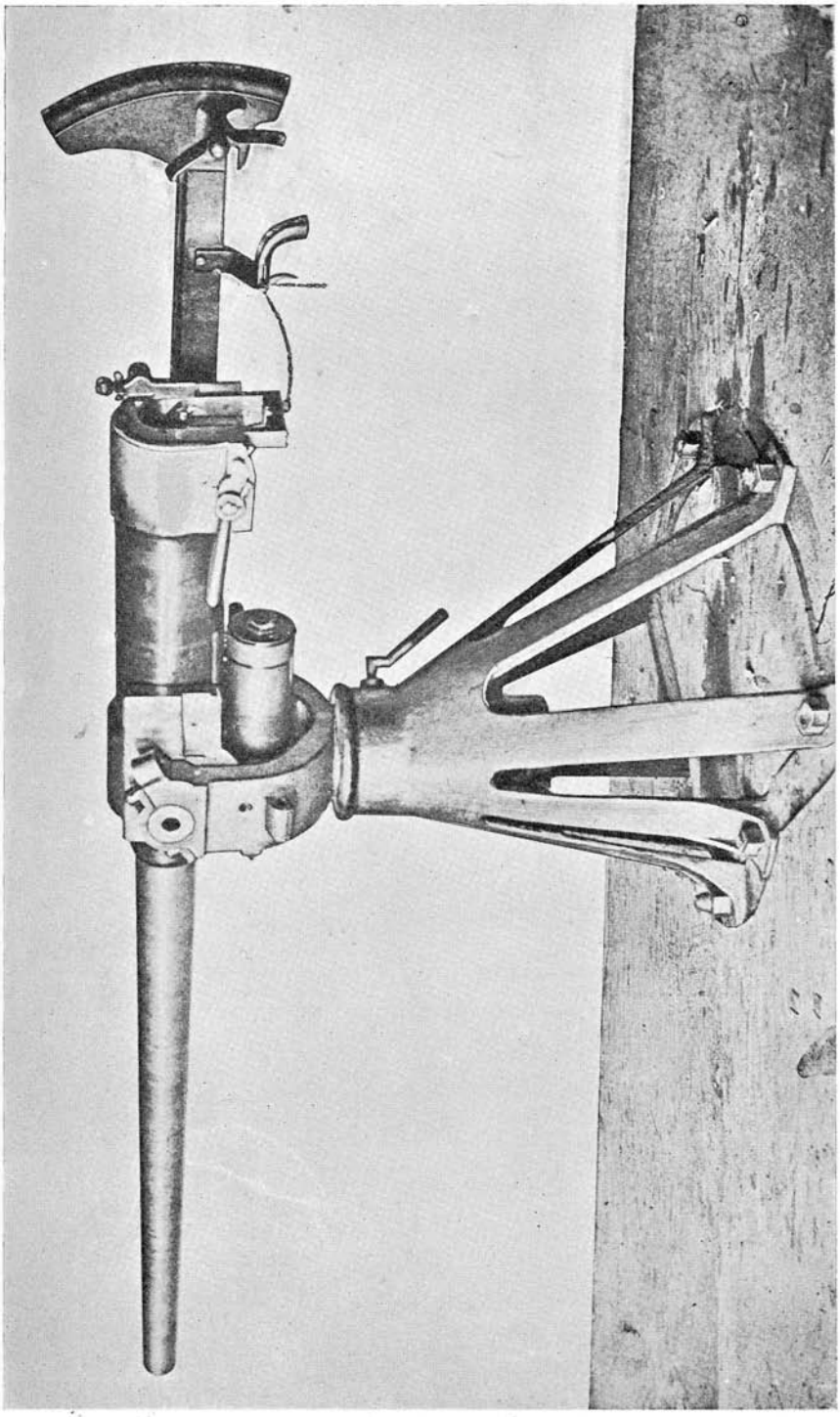
HYDRAULIC RECOIL MOUNT FOR 6-POUNDER D.-S. AND H. GUNS, MARK III.



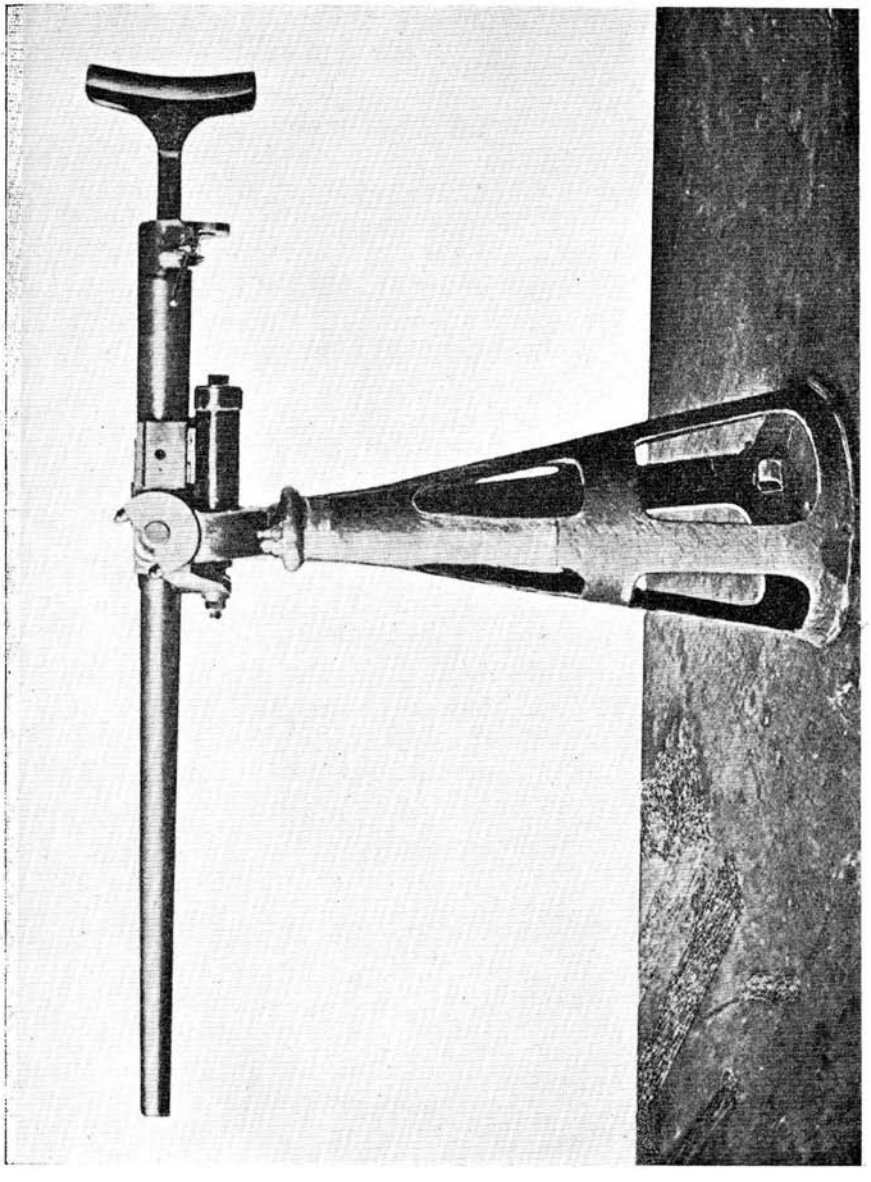
STEEL CAGE STAND FOR 3-POUNDER AND 6-POUNDER RAPID-FIRING GUNS.

Nomenclature.

1. Pivot Socket. 2. Cage Head. 3. Cage Body. 4. Cage Legs. 5. Cage Deck Plate. 6. Cage Deck Fastenings.



DRIGGS-SCHROEDER 6-POUNDER RAPID-FIRING GUNS.
On Mark III Mount.



DRIGGS-SCHROEDER 1-POUNDER RAPID-FIRING GUN.
On Recoil Mount.

rests his shoulder on the rubber buffer (34); the deflector (33) throws the ejected cases downward.

19. **The Saddle** (1) is a Y-shaped casting having the trunnion seats on its arms and the pivot (2) forming its lower part. The shield (32), a ½-inch forged steel plate, is, when used, secured to the lugs (5) by the shield supports (31). The slide clamp (12) passes through the saddle, and, when set up, bears firmly against the slide, locking the two parts together. The surfaces of the *pivot* (2) are accurately machined to fit the socket of the pivot stand; the securing bolt (36) is inserted through the bottom of the socket from beneath and screws into the lower end of the pivot. The weight of the gun and movable part of the mount rests directly upon the bottom of the socket through the frictionless washer (35), which contributes to ease in training.

20. **The Pivot Stand** (Plate II).—The pivot stand for a gun mounted on the rail is simply a socket built into the rail; for a gun mounted on deck, a cage stand as shown in the plate is used. The stand is secured to the deck by eight bolts through the deck plate (5), and the pivot rests in the socket (1). The pivot clamp (not shown) screws through the top of the pivot stand, and, when set up, bears firmly against the pivot and locks the two together.

21. All recoil mounts for 1-pounders are similar to the above (see Plate IV); Mark I and Mark II mounts are designed for trunnioned R. F. guns, and, except in the mode of securing the gun to the mount, are similar to the above Mark III mount.

CHAPTER XIII.

3-INCH AND INTERMEDIATE GUN MOUNTS.

Battery Arrangement.

1. The composition and arrangement of ships' batteries is a matter of perhaps more rapid and constant evolution than any other in the whole subject of Ordnance and Gunnery. In matters of detail, such as breech mechanisms, projectiles, powder, etc., the practice of all the great navies is much the same, but, in this other broader subject, the widest divergence of opinion exists; it is needless to say that upon it the whole design of ships largely depends. The proportion of displacement to be given to armament and ordnance stores having been decided upon in the preliminary design, it remains to determine the number, sizes and arrangement of the guns of her battery with the view of delivering the greatest possible *effective* fire; it is usual to follow a fixed rule as to the number of rounds per gun to be carried by each size.

Within limits for a given weight of armament, the smaller the calibre of the guns, the greater will be the weight of the projectiles that the battery will deliver per minute; or, to express it differently, 100 tons of secondary battery guns will fire several times the weight of metal per minute that 100 tons of main battery guns will—and the muzzle velocity may be the same for all sizes. However, there is neither space nor crew enough for the great number of say 6-pounders that such an arrangement would call for. Besides, it is the greatest *effective* fire that is sought after and not merely getting overboard great quantities of metal that will do but little damage even if it does find the enemy's side,—which would not be likely. The policy of most navies at the time of writing, to which there is little objection from authoritative quarters, is to divide the weight of the battery into the largest guns that can be readily handled, keeping in view the desirability of having several units, for all sizes and classes of ships. For ships of the line, the

great extent of armored side of recently built ships, which may be their opponents, forces the above policy, since a gun below seven inches in calibre will not, under battle conditions, do effective work against moderate armor; the value of the policy is enhanced by the fact that it entails such advantages as increased accuracy over small guns, because of flatter trajectories; better protection; a smaller number of gun-pointers who should consequently be, on the average, more expert; fewer and better communications and easier fire control; an easier system of ammunition supply which is also simplified if but two or three calibres are used on the same ship. It is the same policy that in 1812 opposed the 18-pounders of the enemy's frigates with 24-pounders on slightly heavier vessels, and was a factor that largely contributed to our success.

2. In determining the battery arrangement of a ship there must be kept in mind: (a) The conflicting problems of mounting the guns at a fair height above the waterline, where they will not be interfered with by seas, and at the same time retaining the proper stability of the ship; (b) the facility of ammunition supply; (c) the necessity for gaining the best protection for the guns on the allowed weight of armor; (d) the desirability of large arcs of fire for all guns without undue "interference"—the blast of any gun seriously disturbing the crew of another. The latter problem is the subject to be now considered, as concerned with the battery arrangement of battleships and armored cruisers.

In the present development of naval tactics, it is evident that the favorite formation for fleet actions is in column, or "line ahead," as it is sometimes called; this and the fact that a ship is several times as long as she is broad and that we cannot, without great sacrifices, have many tiers of guns, makes it inevitable that most of the guns shall be mounted in broadside—able to fire over a small part of the circle on each beam. The same conditions obtained on the sailing battleships, and the largest of them were able to point as many as 60 guns on the broadside, but they could rarely fire dead ahead with more than four, or perhaps six; structural requirements for one thing, then, forced such a condition. In steam ships, the structural difficulties can be overcome to as great an extent as desired; but the possibilities in the case are approached only to a moderate degree, on the principle that, while

end-on fire is valuable, what is really essential is broadside fire with the greatest number of guns possible.

It may readily be seen that a gun mounted amidships, able to fire on both sides, is practically two guns; when first so installed, they were called *pivot guns* and were the most important pieces in the battery; this is still the case. Theoretically then, the best arrangement, as giving the heaviest broadside fire, is with all the guns on the center line and able to fire on each side; practical considerations such as boat stowage, fire- and engine-room hatches, etc., prevent this arrangement and we are limited to two positions, at bow and stern, for "pivot" guns. But we make the most of it by installing a turret at each of these two positions, each containing two of the heaviest guns in the battery. The only practicable extension of the principle is to use another middle line turret position, as has been tried in a class of German battleships which originally carried six 11-inch guns each; also the U. S. battleships which have turrets, containing 8-inch guns, superimposed on the 12- or 13-inch turrets. Guns of 8-inch or larger calibre, other than those in the main turrets, are as a rule installed on each side in turrets, which, next to the midship guns, have the largest arcs of fire. Coming next under consideration in the assignment of gun positions, as being next in importance, is that part of the battery known as the "*intermediates*"—guns of from 4- to 7-inch calibre. Their mounts are generally hand worked and they are mounted in broadside in armored positions. The favorite system is to mount four that may fire from dead ahead to a few degrees abaft the beam, the same number firing from right astern to a few degrees forward of the beam and the remaining ones with arcs of about 100 degrees on each beam. The principal purpose of the secondary battery is to repulse torpedo attack; 3-inch guns may be relied upon to do some effective work against any variety of ship, but the others will probably be put out of action anyhow long before the enemy is within their effective range. Being then the least important guns in the battery, they are given whatever room is left for them after the main battery is arranged; they are placed under the main deck in the unarmored ends, along the superstructure rail, on the bridges and in the fighting tops. In their proper role, meeting torpedo attack, they will not be subjected to gun fire and

hence need not be protected; in battle, they need not be manned, save perhaps with the exception of the 3-inch guns, which are often protected by thin armor.

The requirements for an unarmored ship's battery are, in the main, very similar; these ships have no turrets and their main battery guns are about alike in size. As a rule, two of the largest guns are installed amidships in bow and stern and have the same large arcs of fire of turret guns—250 degrees or more; all the other guns are arranged, as far as possible, as are those of the armored ships.

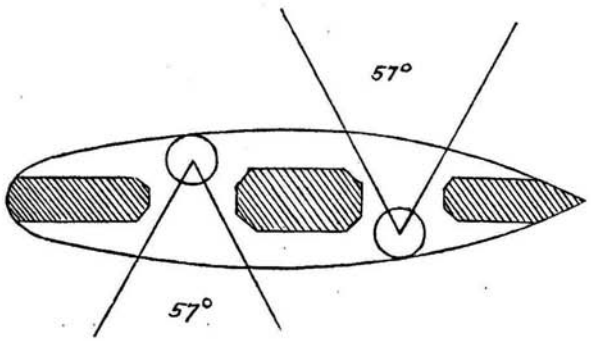


Fig. 1.

Two or three decades ago, the idea was prevalent that the advent of steam propulsion had set tactics back to the days of Grecian supremacy on the seas; it was held by many, in whose minds the battle of Lissa was fresh, that the ram was the supreme weapon and that, as with the fighting galleys, the best defensive and offensive fleet formation was in line abreast. As long as the idea held sway, end-on fire, particularly ahead, was sought after at the expense of broadside fire and ships were built which were able to fire as many guns ahead as on the beam. The "echelon" arrangement of the two main turrets was then a favorite one. The figure, which is a plan of the "Maine" that was blown up in Havana harbor, shows it. The upper works are cut away to permit each turret to fire forward and astern and, for a small arc, across the deck. This fallacy endured for but a short time, however, as it was found that column is the easiest fighting formation

to maintain and that the arrangement gives a fire on bow or quarter from only one turret. Besides, there remains no good place for the large intermediate battery needed and the blast of the turret guns, when used as designed, makes such positions as do remain untenable; the superstructure, unless unnecessarily strong, will not bear the blast of the turret guns when fired in line with the keel, or across the decks. The "Texas" is the only armored ship in the U. S. Navy with the echelon arrangement.

3-inch Mount Mark III. (See Plate I.)

3. The Mounting resembles a Mark III 6-pounder mount to which is added a geared elevating device; the main difference is that the gun recoils through a sleeve, drawing the pistons through the recoil cylinders, which are stationary. The principal parts are: the combined slide and recoil cylinders; the saddle and pivot; the elevating gear; the cage pivot stand.

The *slide* (73), of cast steel, is cast in one with the two recoil cylinders; a large hole on each side in rear of the trunnions is for lightness and its whole inner surface, on which the gun slides, is bushed with bronze—in the bushing are cut spiral oil ways. The gun has ribs on top and bottom which fit wide longitudinal grooves in the slide and prevent the gun from turning. There is a lifting eye on the top of the slide which is directly in line with the trunnions (76); the latter are bushed with bronze, as are all the working surfaces. The elevating arc (53) is bolted to a heavy projection, on the left rear side, in which is machined the box for the sight (3); the front sight is also secured to the slide (the sights shown are night sights,—the wires are shown leading to the battery box on the right side). The two hydraulic recoil cylinders (79) are rifled as heretofore described,—the ends are closed by bonnets. The cylinders are filled through the holes (78) which are in line with the equalizing pipe (77) which connects the two cylinders and makes the pressure, during recoil, uniform; the recoil liquid may be removed through the plugs (71). The piston rods (89), with the pistons (88) on their forward ends, pass through stuffing boxes in the rear bonnets and are secured by heavy nuts to a steel yoke (2) around the breech of the gun. The counter-recoil springs (85) are each in two sections separated by disks; they are

assembled under initial tension and hold the gun in battery. The counter-recoil check (81) is a device in each cylinder which cushions the counter recoil in the same way that the cylinder checks the recoil—by the friction of the liquid in passing a small orifice. The piston rod projects through the piston and at the end of the counter recoil enters a tapered hole in the front bonnet and forces out the liquid.

4. **The Trunnions** are held in the *saddle* (12) by cap squares (13). The *pivot* (5), a part of the saddle, fits the cavity of the pivot stand only at top and bottom, where the surfaces have bronze bushings. The entire upper mounting may be raised by the lifting screw (6) working through a bronze cap bolted to the stand; the screw also holds the parts together. Friction in training is reduced by the conical rollers (8) through which the weight of gun and upper mounting rests on the stand. The rollers are spaced by floating rings on their axles; their upper and lower paths are separate steel pieces set into saddle and stand. The rollers may be removed for cleaning and lubrication by raising the saddle a few inches by means of the lifting screw (6). The pivot clamp (4) sets up, through a lug on the saddle, to the pivot stand.

5. **The Elevating Bracket** (39), a part of the saddle, bears the training and elevating mechanism. It has been decided that the 3-inch gun is not too large to be *trained* by a shoulder bar on the saddle. To point the gun in *elevation* in the same manner, however, would involve fitting the bar to the slide and the gun is too heavy and the shock of recoil too great for this; besides, a gun may be pointed more accurately by gearing, and it has been proposed to give even smaller guns regular elevating gears. The shoulder bar ships in a socket in the projection (17) of the elevating bracket. An upright (19) bears the shoulder piece which the gun-pointer holds under his right arm-pit; as may be seen in the plate, the shoulder piece may be adjusted and secured at the most convenient height by the clamp (18). To keep the pointer from leaning against the gun and being injured by its recoil, the brass guard plate (14) is bolted to the slide.

The *elevating wheel* (40) turns a horizontal shaft on which a worm (46) is held between two frictionless washers (59). The worm gears with a worm wheel on the cross-shaft (45), on the

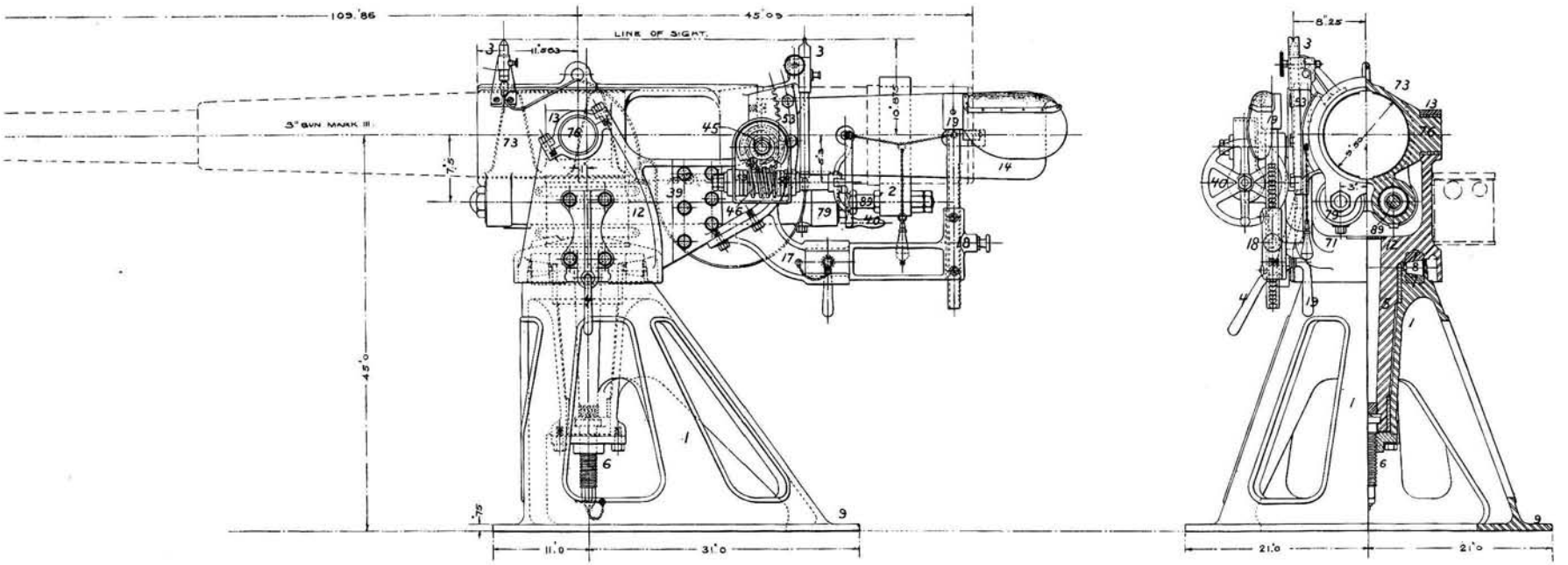
other end of which is a pinion gearing in a rack on the *concave* side of the elevating arc; it has been found that the strain on the elevating gear during firing is greater if the rack is cut on the convex side. To cushion the jump, the worm wheel is held between friction disks on the cross-shaft (45) instead of being directly secured to it; (a few 3-inch mountings of this type have been built with geared training as well as elevating devices).

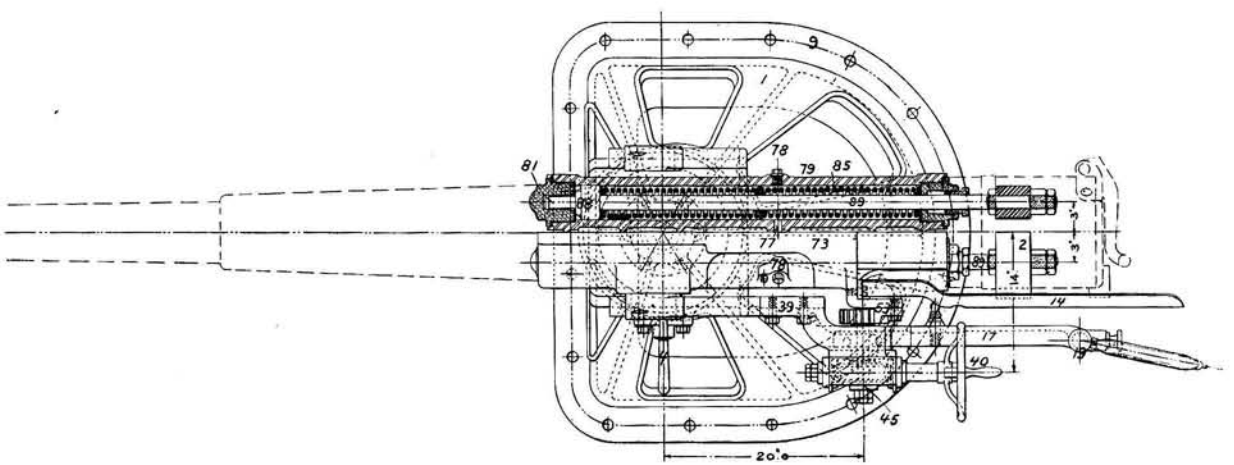
6. The Pivot Stand (1), of cast steel, is designed with a view toward lightness; in other services, cone stands, without lightening holes, are largely used for secondary battery guns. The inner portion of the stand is supported by deep webs running out to the legs of the cage; the entire mounting is secured to the deck by bolts through the deck circle (9).

"Pedestal" Mounts. (See Plates II, III and IV.)

7. These mounts were so named because of the pedestal form of the pivot stand, which permits mounting the gun close to the side, thereby keeping down the size of the straight gun port for a prescribed arc of train. All mounts are now designed to this end and are "pedestal" mounts, but it was formerly not the case, and the center of motion in training used to be much farther from the gun port. To obtain a fair arc of fire, the port then had to be circular, or very large, and guns were mounted in *sponsons;* these latter project inconveniently from the side, are expensive to build and their use has been abandoned.

The pedestal mounts for 4-, 5- and 6-inch R. F. guns are similar in their principal features; the one shown in the plates is for a 4-inch gun. The slide, recoil mechanism, saddle and pivot are, in general, like those of the recently designed 3-inch mounts. The *bronze* slide did not extend far to the rear and has in some cases proved too weak; hence a strengthening band running from the elevating arc over the gun to the opposite recoil cylinder has been added. The counter recoil is cushioned by buffer springs (58); in the 6-inch, and in most of the 5-inch mountings, dash-pot checks in the forward bonnet are employed instead. The outside of the pivot stand is solid in all mounts of 4-inch and larger guns. The nut (10), screwed on the lower end of the pivot, serves to lock the top carriage to the stand or to raise it, giving access to the rollers





3-INCH MOUNT, MARK III.

Page 177b
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Chapter XIII.
It was added to maintain
proper pagination when the file
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double page "tipped in" plate,
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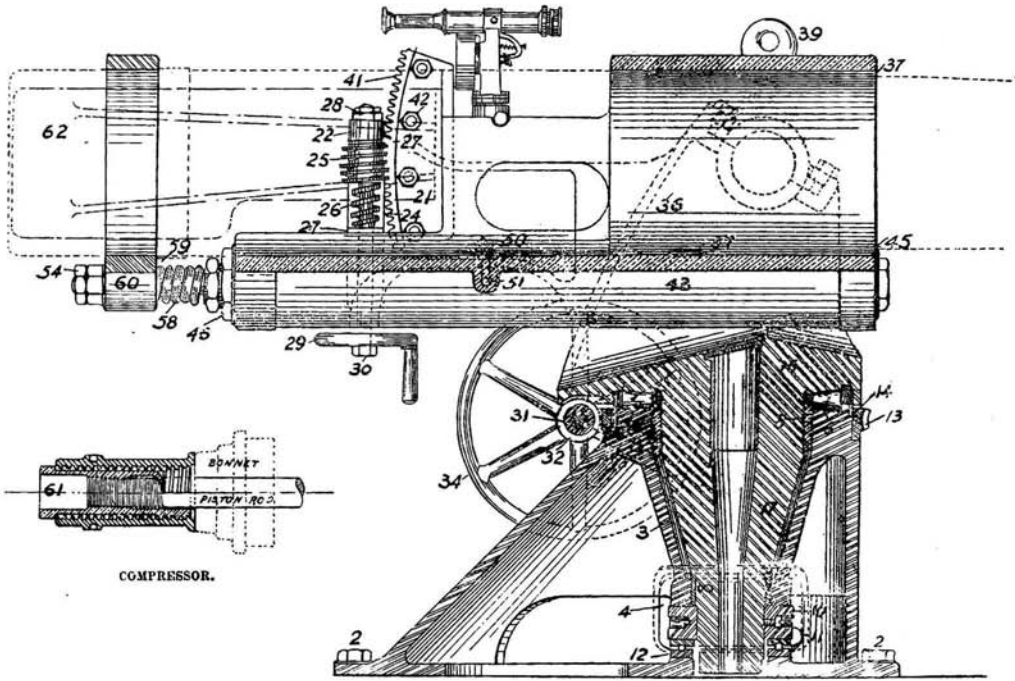
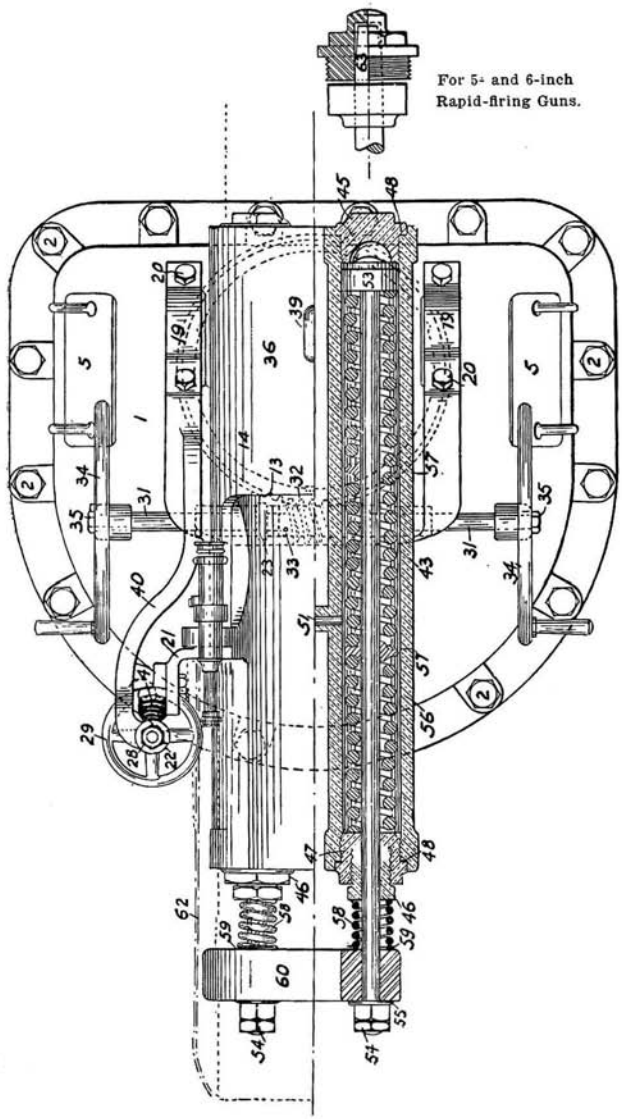


COMPRESSOR.

PEDESTAL MOUNT—4-INCH RAPID-FIRING GUN.



PEDESTAL MOUNT.

(7); to do this, remove the water-tight doors (5), insert heavy rods into the holes (11) in the nut and turn it in the proper direction—after removing the set screw. The frictionless washer (12) is interposed between the nut and the deck plate of the stand to facilitate the operation.

All main battery guns are trained by gearing; the training rack (13) is secured to the pivot stand—a general rule. The training shaft (31), turned by hand wheels, rests in bearings on the saddle and its worm engages the rack. The elevating shaft (24) of the 4-inch mount is vertical and carries a worm (25) which gears in a worm rack (41), cut on the *convex* side of the elevating arc. The worm is loose on its shaft, but is constrained to turn with it by a feather; it is held upward in position by a spring (26) which permits it to slip downward, cushioning the jump as the gun is fired, and then forces it back to its former position.

8. At the time the first pedestal mounts were designed, it was intended that the gun-pointer do all the work of pointing, sight setting and firing,—assisted in training if necessary. To this end, the elevating and training gears were arranged on several different plans; one way placed the elevating wheel on a sleeve around the training shaft and the two wheels were concentric and close together. It was found, at about the same time in other services, that the best results are not obtained in this way and that pointing in elevation and firing are quite enough for one man. In the division of duties, the *trainer* has to do solely with lateral pointing,—he may work from the left side conned by the pointer or he may use the training gear and sight on the right side. Good results may be obtained in either way.

Under the modern requirements, in which the sights are to be held on the target throughout a string of shots, fired while the ship is rolling, the pointer has the most difficult and fatiguing duty, and the elevating wheel should be placed advantageously for him. With it fitted as in Plate II, it is nearly impossible to maintain a "continuous aim" for any length of time. The proper place for the elevating wheel is a little below the pointer's shoulder with its plane vertical and nearly parallel to the vertical plane through the axis of the bore; all future mounts will fulfill this condition; those pedestal mounts otherwise constructed are rapidly being converted.

The installation of the training wheel is not of so great importance, but any hand piece, which controls the pointing of a heavy gun, needs great leverage to obtain the delicate movements required.

In the future the elevating and training gears will be installed as follows:

Size.	Elevating arc.	Elevating wheel.	Training wheel.
3-inch.....	Left side.	Left side.	None.
4 "	" "	" "	Both sides.
5 "	" "	" "	" "
6 "	Both sides.	Left side (usually).	" "
7 "	" "	Both sides.	" "

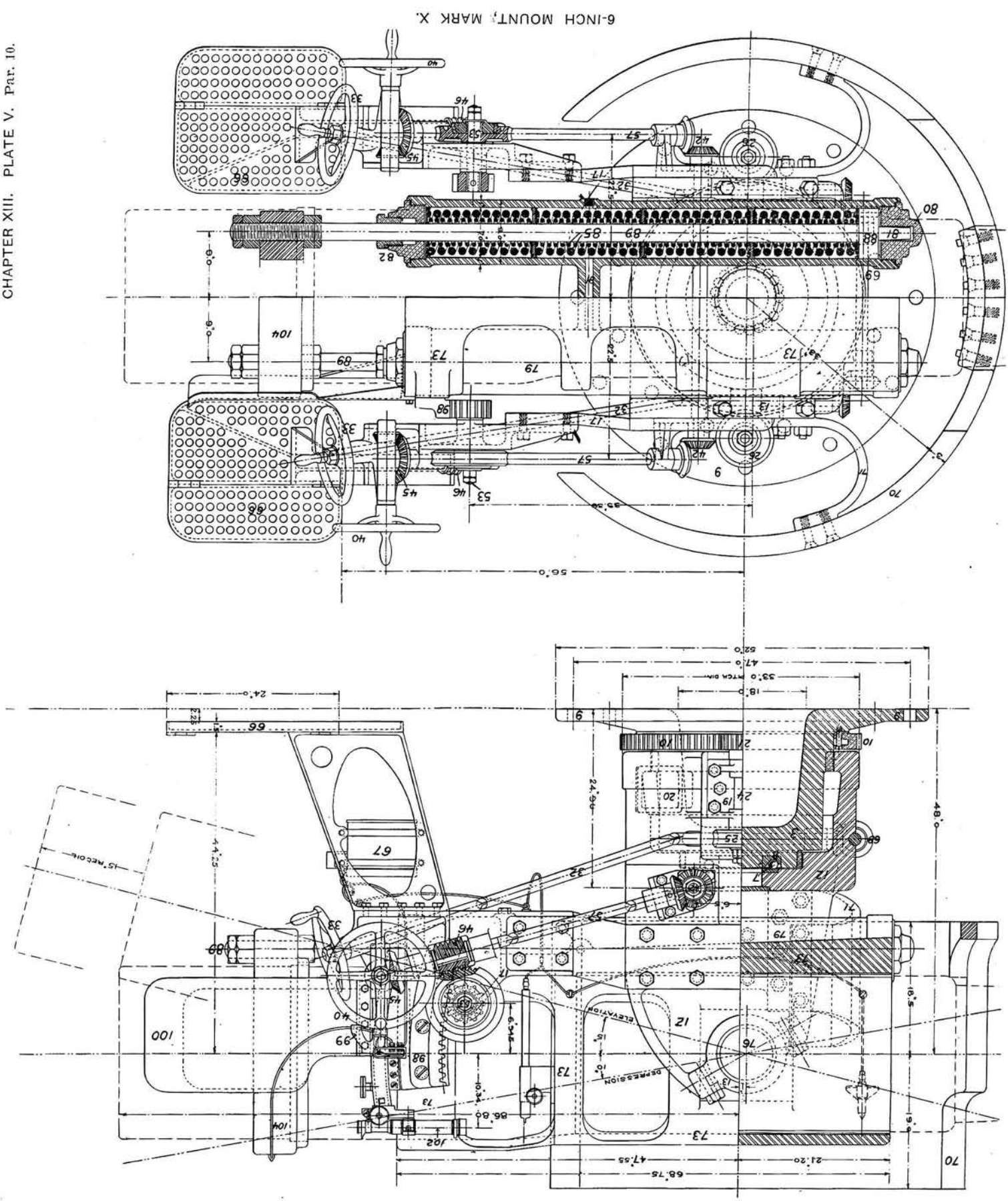
9. A Compressor, for use in dismounting or assembling recoil cylinders, is supplied to all ships (see Plate II). In dismounting, detach the gun from its piston rods and run it in out of the way. Screw the compressor on the end of the piston rod until it brings up against the rear bonnet of the cylinder. Then an inner sleeve, which has engaged the thread on the rod, is screwed to the rear by a threaded shaft and brings the rod with it, compressing the springs. When the piston is clear of the forward cylinder bonnet, the latter may be removed; the compressor is then worked backward, easing the piston rod through the cylinder until the springs are fully extended, whereupon the compressor is removed and the recoil mechanism withdrawn.

6-inch Mount Mark X. (See Plates V and VI.)

10. This mount, constructed for the "Maine" and class, is designed to meet modern requirements. The left elevating wheel is often omitted; if retained, it may be readily disconnected, as may either training wheel. It is to be noted that: (a) Ball bearings instead of rollers are employed; (b) the trainer and pointer stand on platforms hung from the saddle instead of having to walk along the deck as the gun is trained; (c) the saddle is not formed into a pivot which fits a socket in the stand, but embraces it as a huge collar fitting around it.

The *slide* (73), recoil, and counter-recoil, mechanism is like that

6-INCH MOUNT, MARK X.



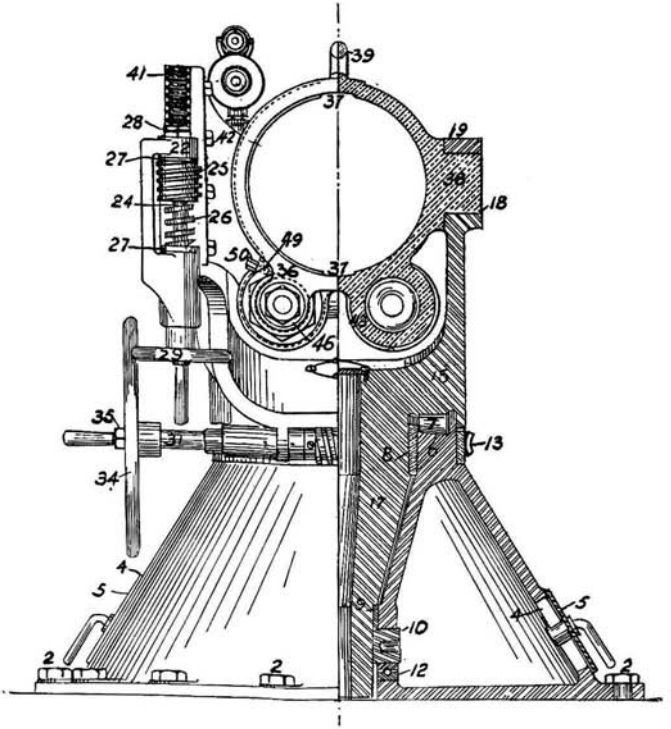
of the 3-inch mount; the counter-recoil springs are double, divided by disks into four sections in each cylinder. There is an elevating arc (98) bolted to the slide on each side; the three sets of sights are also secured to the slide; in Plate V, the night sights are shown on the left side with the leading wires connected to the firing battery (67).

The upper part of the saddle (12) is of the usual form; an elevating bracket (17) is bolted on each side; they support the pointing gear, the firing key (99) and the platforms (66). The lower part of the saddle is socketed over the stand; the two vertical bearing surfaces, rings at the top and bottom, are bushed with bronze. The ball bearings (8) travel on top of the stand in a hard forged-steel trough and an upper path, also of hardened steel, is set into the saddle. The cast steel pivot stand (3) is a short thick column held to the deck by bolts through the deck circle (9); the training rack (10) is secured to the stand.

11. The vertical training shafts (24) turn in bearings in lugs (19) bolted to the saddle. They bear pinions (21), gearing in the rack, and worm wheels (25) which are turned by worms on the training shafts (32); the latter, turned by hand wheels (33), have bearings in the saddle and are cross-connected by the shaft (69), through bevel gearing. Knuckle joints are placed in the four elevating and training shafts.

Turning in bearings in each elevating bracket, is a horizontal elevating shaft (53) which has at one end a pinion, gearing with the elevating arc, and holds a worm wheel between friction disks at the other. These worm wheels are turned by worms (46) on the elevating shafts (57), which are connected to each other by the cross-shaft (42) through bevel gearings; they are turned, through similar gearing, by the hand wheels (40) working in the vertical plane. Ball-bearing frictionless washers are interposed between the ends of all four worms and their thrust bearings.

12. In addition to the stationary armor around the gun emplacement, the gun is protected by a 3-inch cylindrical shield secured to the saddle by the U-shaped brackets (71); the latter are arranged to give as much cushioning under a blow as possible. The shield, training with the saddle, is concentric with the mount and completely closes the gun port. The only opening is the port through the middle of the shield, which is only sufficient to



PEDESTAL MOUNT.

Page 180b
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Chapter XIII

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Chapter XIII

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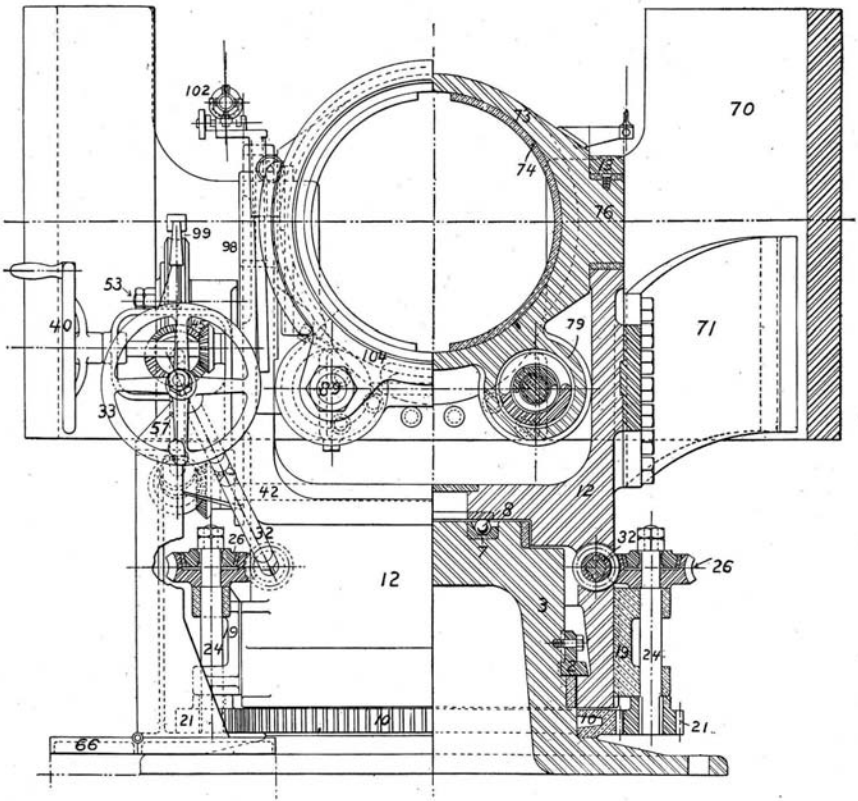
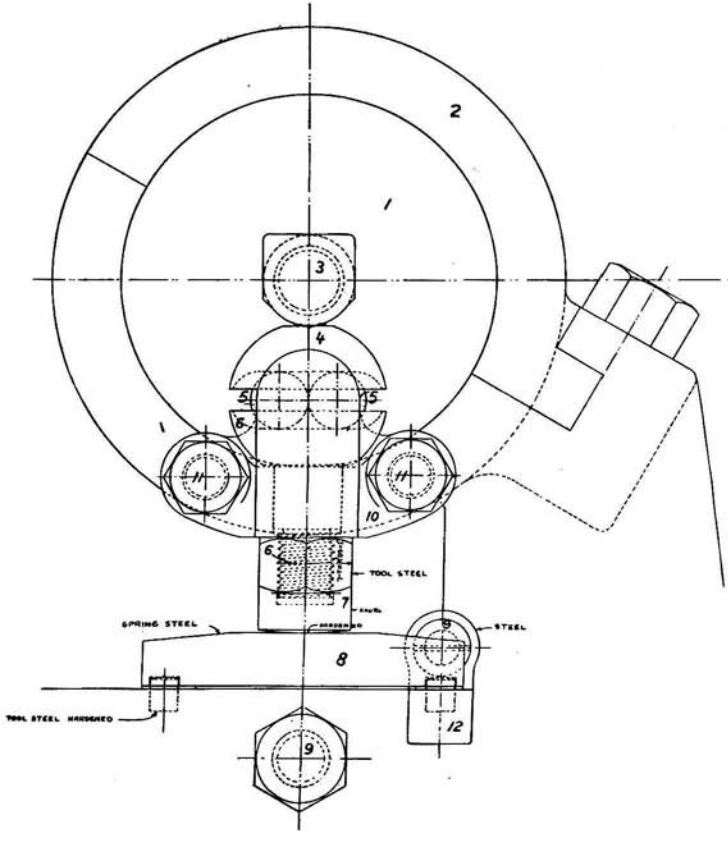
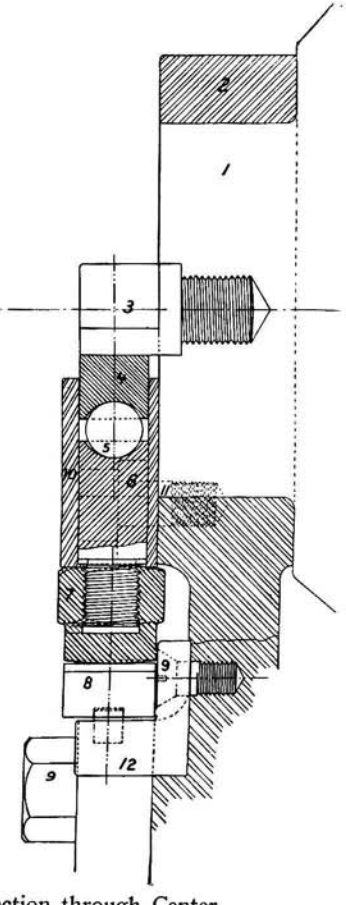


6-INCH MOUNT, MARK X.

Rear view.



Side View.



Section through Center.

FRICTION TRUNNION DEVICE.

permit the gun to be elevated through its prescribed arc and give the pointer an opening to see through. Shields of various forms, designed to protect the mounting and gun servants from small projectiles, are in many cases supplied to unarmored ships as well. They are built on the deflective system with the thickest portion normal to the line of fire; obviously, shields must be attached to the *saddle*.

Frictionless Trunnion Bearings. (See Plate VII.)

13. We have seen how friction in training is greatly reduced by suitable bearings; the same weight, less that of the saddle, has also to be moved in elevation and, since a great deal of elevating is required in maintaining a "continuous" aim, an arrangement that will minimize friction at the trunnions is also needed. A device which utilizes spherical rollers has recently been adopted and will be fitted, to intermediate mounts at least.

A small supplemental trunnion (3), with rounded lower side, is screwed into the slide trunnion (1) which is held to the saddle by an ordinary cap square (2). The small trunnion bears on a shelf (4) which in turn rests on two hard steel balls in a shallow trough (6), which is supported from the saddle. While the gun is being worked, its weight is to rest on the shelf (4) which is moved back and forth on the rollers by the motion of (3), the lower side of which is *not* at the center of rotation of the trunnion,—as may be seen in the plate. The saddle and cap square embraces the slide trunnion closely and, when the gun is fired, the elasticity of the parts of the frictionless device permits most of the shock of recoil to be received by these heavier parts.

The trough (6) rests on an elastic steel bar (8) which is secured to the saddle by lugs (12) and tap bolts (9). The trough is held from turning or falling outward by a bracket (10) secured to the saddle by bolts (11). The height of the shelf must be such that all the weight rests upon it; the adjustment is made by the nut (7) which raises or lowers the trough by its support. In making the adjustment, the rule is to raise the shelf until a thin piece of paper can be inserted under the slide trunnion—about the same space should be left all around it. Another device, that came into use several years ago, the "knife-edge" trunnion, will be described in a subsequent chapter.

CHAPTER XIV.

10-INCH TURRET MOUNT MARK II.

1. (Plates VIII and IX give general arrangement of a turret containing two 10-inch guns.) The Mark II turret mount, usually called the hydraulic turret mount, is a hydraulic recoil and return mount in which one cylinder serves to check the recoil and to return the gun to battery; all the gun working machinery, except the turning engine, is actuated by hydraulic power. The 10-inch and 12-inch guns of the monitors "Monterey," "Monadnock," "Amphitrite" and "Puritan" are installed on this type of mount as are the 13-inch guns of the battleships "Indiana," "Massachusetts" and "Oregon;" the description is written for the "Indiana."

The hydraulic systems of the two turrets are connected and power at 600 lbs. pressure is maintained in the piping by powerful steam pumps located below the armored deck. Each turret has its own magazines and shellrooms, which are under the charge of the turret officer, opening into a handling room from which the hydraulic hoists convey the ammunition to the guns.

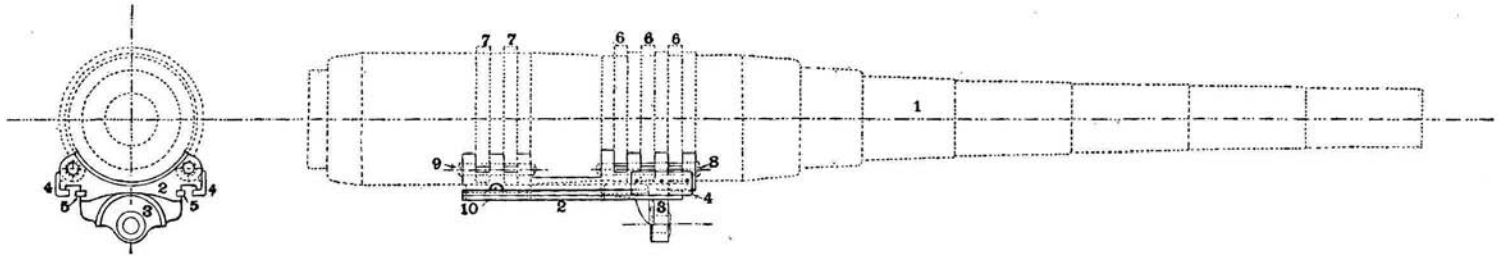
The *turntable,* or main foundation for all the revolving parts of the turret, is built up of steel plates and angle irons and is arranged to rotate on live rollers (67) which travel on a roller path (68) built into the barbette structure well inside the armor; the rollers are spaced by floating rings secured to their axles. The weight of the revolving part of the installation, about 490 tons, for 13-inch guns, rests upon these rollers and the horizontal thrust of the guns in recoiling is transmitted to the ship by their flanges. The circular barbette (69), 17 inches in thickness, extends from the armored deck well above the turntable, while the guns and upper parts of the mountings are protected by a 15-inch vertical-sided turret, resting on the turntable and extending a little below the top of the barbette. The turntable is revolved by a two-cylinder steam

turning engine in a compartment directly below the handling room; hand turning gear, which can be connected only after disconnecting the engine, is fitted in the same compartment. The pinion of the training shaft, which is actuated by the turning engine through connecting shafting, gears in the circular training rack of the turntable; there is a suitable friction band on the training shaft which yields when one gun of the turret is fired, thus protecting the training gear from the distortion that would be caused by the severe lateral jump of the turret,—the line of recoil being outside the center of rotation. When not in use, the turret is secured by: (1) locking bolts, which set up through the turntable to a bearing on the barbette; (2) outside turnbuckles, securing turret armor to barbette armor; and (3) wedges, setting up between upper inside edge of barbette and lower outside edge of turret. (None of the training or of the securing gear is shown in the plates.) The main pressure pipe (61) conveys the water from the pump to the water section (60) only part of which is stationary, the revolving part furnishing pressure to all the hydraulic machinery of the turret. The exhaust is conveyed from the turret to the feed tank through (60) and (61) in a similar manner. The principal parts of the mounting are:

Gun and Saddle, Plate I.	Elevator, . . . Plate V.
Recoil Check, " II.	Ammunition Hoist, " VI.
Gun Slide, . . " III.	Rammer, . . . " VII.
Deck Lugs, . . " IV.	

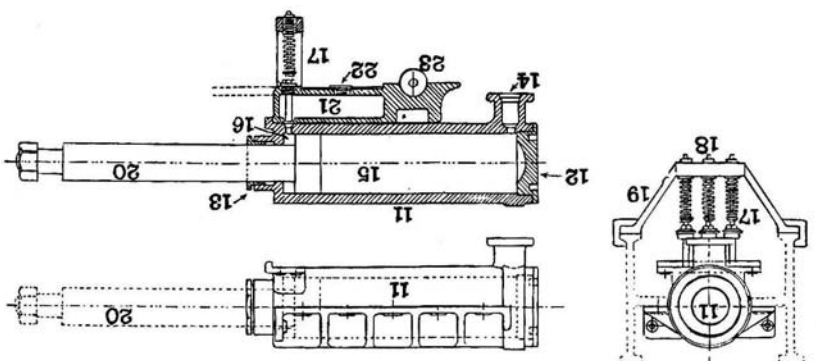
2. **The Saddle** [Plate I (2)] is a large bronze casting to which the gun is secured by three front (6) and two rear (7) collars which fit in recesses machined in the gun body; a key, fitting in grooves between gun and saddle prevents the gun from turning. The saddle rests on and is held to the slide rails by clips (4) and (5). The piston rod is secured to the lug (3) and recoils with the gun and saddle.

3. **The Recoil Check** (Plate II) is of the hydraulic type, one cylinder being used both to check the recoil and to return the gun to battery. The cast-steel recoil cylinder (11), rifled with three tapered grooves, is bolted between the rails at the after part of the slide. It receives hydraulic pressure through (14) from a pipe



SADDLE AND GUN 10-INCH TURRET MOUNT, MARK II.

1. 10-in. B. L. R.
2. Saddle.
3. Recoil lug.
4. Holding down clips.
5. Holding down gibs.
6. Front straps.
7. Rear straps.
8. Front saddle bolts.
9. Rear " "
10. Hole for locking bolt.



RECOIL CHECK, 10-INCH TURRET MOUNT, MARK II.

11. Recoil cylinder.
12. Rear bonnet.
13. Stuffing box and gland.
14. Opening for pump pressure and check valve.
15. Pressure side.
16. Reverse side.
17. Relief valve spring.
18. Relief valve (center one).
19. Yoke.
20. Piston rod, head and nut.
21. Over-flow chamber.
22. Connection for waste pipe.
23. Lug for elevator connecting rod.

leading from the water collar [Plate IV (29)] at the trunnions. A check valve in the pipe at (14) closes and prevents the escape of water through it during recoil. The three relief valves (16) are spring weighted to 600 pounds and open downward to the overflow chamber (21). The piston rod (20) is of forged steel, partly bored out for lightness; it enters the cylinder through the stuffing box (13) and bears the piston, which is shown in its "run out" position.

When the gun is run out and in position to be fired, the piston rod is drawn out of the recoil cylinder to its full length, and the latter would consequently be full of water, as the pump must be in operation and the cylinder and hydraulic system filled, before the gun can be fired. The pumps are to be kept in operation during the firing. The walls of the recoil cylinder being cut with rifled grooves, the pump pressure is exerted on both sides of the piston, and the fluid would escape through the three spring valves (17) at the front end of the cylinder were the springs not set up sufficiently to resist the pump pressure, which is required to be maintained at 600 pounds per square inch.

Water is admitted to the recoil-cylinder only at the rear end, through the aperture (14), and can escape only at the front end, as there is a check-valve in the supply pipe (14), which closes when recoil takes place; otherwise the pipes or pump would be burst by the violent and sudden pressure due to recoil. When the gun is fired the piston rod is driven into the recoil cylinder, and consequently must displace a quantity of water equal to the volume of the entering piston rod. The fluid thus displaced escapes by the spring valves (17) into the overflow chamber (21), and thence by a flexible hose attached to the opening (22) to the exhaust or waste pipe, and back to the tank.

Recoil is taken up by the restriction of the fluid in passing from the pressure to the reverse side of the piston by means of the grooves in the cylinder, and, while the spring valves are on the reverse side, the tension on their springs does, in a manner, affect the recoil, and if they are set up too tightly, the length of recoil will be reduced. These springs should be set up so that the valves will be tight under the normal pressure of 600 pounds per square inch and no more. Care should be taken to see that the valves

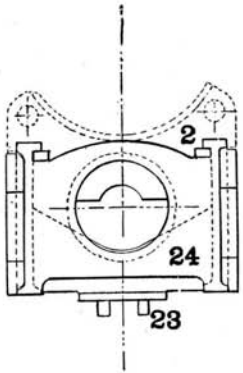
have a lift of not less than three-fourths inch, as this is necessary to give a proper valve opening for the escape of the water when the gun is fired.

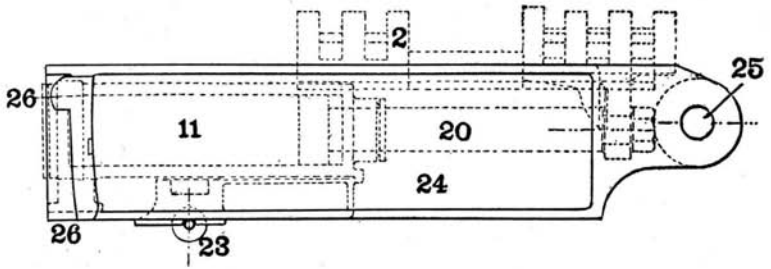
When recoil takes place the check valve in the pressure pipe closes, but as soon as the gun is at rest the relief valves close, pressure is admitted to the cylinder and its action on the rear face of the piston returns the gun to battery. The effective area for doing this work is the area of the piston rod, since the same pressure acts on both sides of the piston.

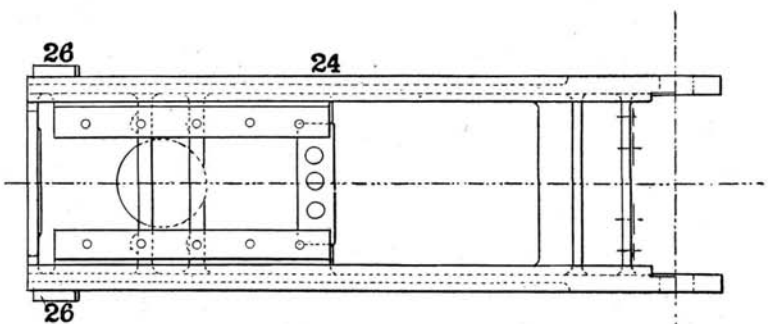
In securing the turret for sea, the guns are secured in the loading position, at 10 degrees elevation, and are run in on the slides the full distance. This is done by closing the valve in the pressure pipe, opening the central relief valve, which is specially fitted for the purpose, and then raising the muzzle a few degrees whereupon the gun will run in by gravity; if it starts in too rapidly, its velocity may be checked by quickly lowering the muzzle. To run out again, see the springs of all relief valves set up and open the valve in the pressure pipe, whereupon the gun will be forced out as in its counter recoil.

4. The Slide (Plates III and IV) is a large steel casting with rails planed to fit the saddle which, with the gun, is held to and rests upon them. It is trunnioned by the bolts (32) to the *deck lugs* which are securely bolted to the turntable. The recoil cylinder is bolted to the after end of the slide and bears on its lower side the lug (23) to which the connecting rod of the elevator is secured. The locking lugs (30), or rest lugs, are operated by the hand lever (31), and bear upon the stop piece (26). The gun has two locking positions; level, as shown, for use when ship is in port, and the loading position at 10° elevation; in the latter position the bearing surface near the top of (26) rests on the lug. The gun must be unlocked before firing.

5. The Elevator (Plate V) consists of a heavy cylinder (33) suspended from the turntable, beneath the rear end of the slide. The connecting rod (35) is bolted at its upper end to lug (23) and its lower end rests in a ball and socket joint in the leather packed ram (34); the elevator cylinder has a ring around its top (inside) which prevents the ram from being raised too high. A pipe connects the lower end of the elevator with the valve (36) which is





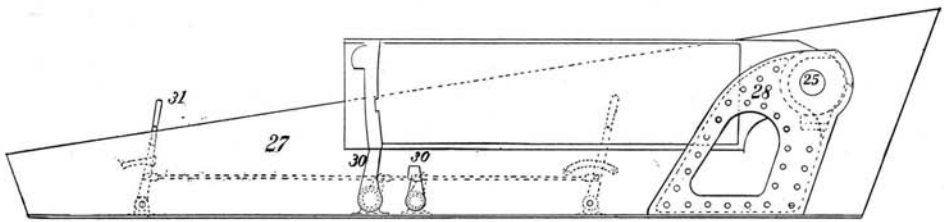


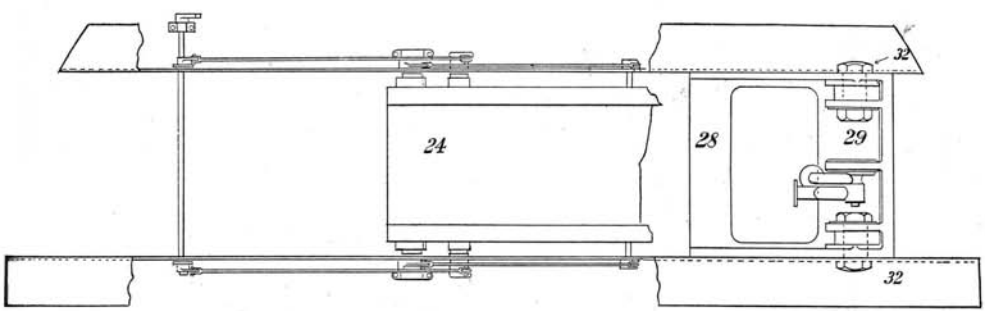
SLIDE, 10-INCH TURRET MOUNT, MARK II.

24. Slide.

25. Holes for pivot bolts.

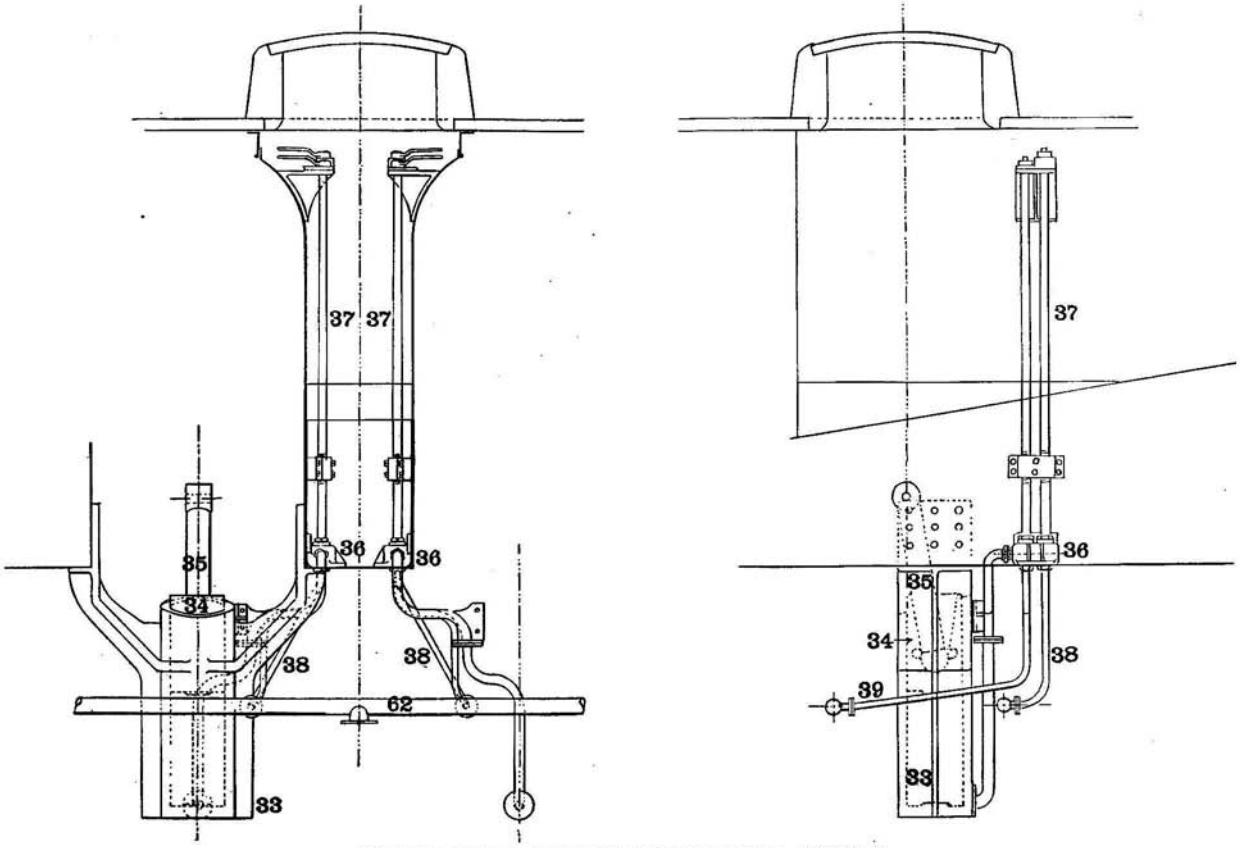
26. Stop piece.





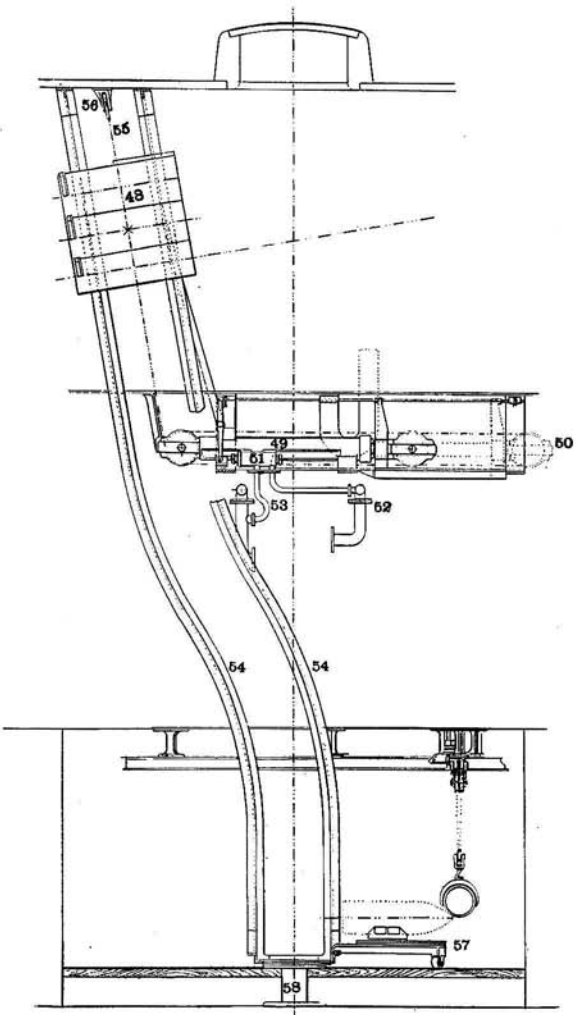
DECK LUGS AND LOCKING LUGS, 10-INCH TURRET MOUNT, MARK II.

27. Turret girders.
28. Deck lugs.
29. Collar for pressure pipe.
30. Locking lugs.
31. Locking levers.
32. Pivot bolts.



ELEVATOR, 10-INCH TURRET MOUNT, MARK II.

33. Elevator.
34. " piston.
35. " connecting rod.
36. Elevator valves.
37. " valve rods and levers.
38. Elevator pressure pipe.
39. " exhaust pipe.



AMMUNITION HOIST, 10-INCH TURRET MOUNT, MARK II.

48. Ammunition car.
49. " motor, run in.
50. " " run out.
51. " " valves.
52. " " pressure pipe.
53. Ammunition motor exhaust pipe.
54. " " guide rails.
55. " " wire fall.
56. Bracket and sheave.
57. Car and turntable for handling projectiles.

operated by levers from the central sighting hood. The pressure pipe (39) and the exhaust pipe (38) lead to this valve, by which either may be connected with the elevator cylinder. If pressure is turned on, the ram will raise the breech of the gun; if the cylinder is opened to exhaust, the gun, being mounted breech heavy, will be elevated.

6. The Ammunition Hoist (Plate VI), of which there is one for each gun, is operated by the hydraulic motor (49), the controlling lever of which leads upward in rear of the gun. The motor is, in effect, a three-fold purchase worked backward, thereby gaining motion and losing power in the proportion of six to one. The outer end of the piston rod and the closed end of the cylinder bear three sheaved blocks through which the wire fall of the hoist is rove. The standing part is secured to the motor and the other end reeves through the block (56), thence downward and is secured to the car (48); when power is turned on the motor, the blocks are separated, the cable "overhauls" through the sheaves and the car is hoisted; the hoist of the car is to the extension of the motor piston rod as six is to one. When for any reason there is not power enough to hoist the car, the fall may be unrove from one sheave, making the above proportion five to one and gaining power accordingly. When the motor is opened to exhaust, the piston rod is forced in and the car descends by its own weight. The guide rails (54), on which the car travels, train with the turret and are curved to bring the car to the proper position for loading. The car (48) has three compartments, the two upper ones for powder, the lower one for the projectile; there are latches for preventing the contents from falling out when the car is inclined during hoisting. Stops, or hooks on the guide rails, fix the position of the car in loading, and each compartment is in turn brought in front of the rammer. The car travels on the guide rails by its rollers, and has pawls which will catch projections on the inside of the guide rails in the event of any accident which would cause the car to fall.

The powder is brought from the magazine and placed in the car by hand; each gun having its own magazine and shellroom on the same level with, and opening into, the handling room. Overhead trolley rails lead from each shell room to the ammunition

hoist; the projectiles are handled by differential purchases, the upper blocks of which are hooked to cars travelling on the trolley rails. From the purchases the projectiles are landed on the car (57) which is wheeled around a track, by hand or hydraulic power, until the projectile is pointed fairly into its compartment, when it is forced in by hand power.

7. **The Rammer** (Plate VII) is secured to the turntable in rear of the gun in such a position that it delivers its stroke along the axis of the bore, when the gun is in its loading position. In the 10-inch turret mounts, the rammer is, after loading, turned on its trunnions (44) into a vertical position to keep it clear of the recoil. The rammer, worked by hydraulic power, is telescopic; the sections are packed with U-shaped leather washers—one at the forward and two at the after end of each. The rammer head is borne on the inmost section, which has the greatest travel. The controlling valve (45), actuated by the hand lever (46), is a piston valve with pressure space at each end and an exhaust space in the middle; it operates as follows in extending and retracting the rammer. When the valve is moved forward, pressure is admitted through the right trunnion, while the contents of the rammer exhaust through the left trunnion, as shown by the arrows; this pressure, acting on the combined area of the rear ends of all the sections, extends the rammer with great force—each section starts as it feels the pressure, not being contrained by the others as to time of moving. To retract the rammer, the valve is moved aft, opening the right trunnion to exhaust and the left one to pressure; each section has a collar around its rear end which affords the effective area for the pressure to act upon in retracting, since the pressure admitted through the left trunnion acts in both directions but upon different areas.

The high pressure of 600 pounds gives this type of rammer very severe shocks, similar in effect to water hammering, particularly when the projectile suddenly stops on reaching its seat. Serious break downs have been the result, and in some turrets, hydro-pneumatic rammers, working on the same principle but having the advantage of air cushioning, have been substituted.

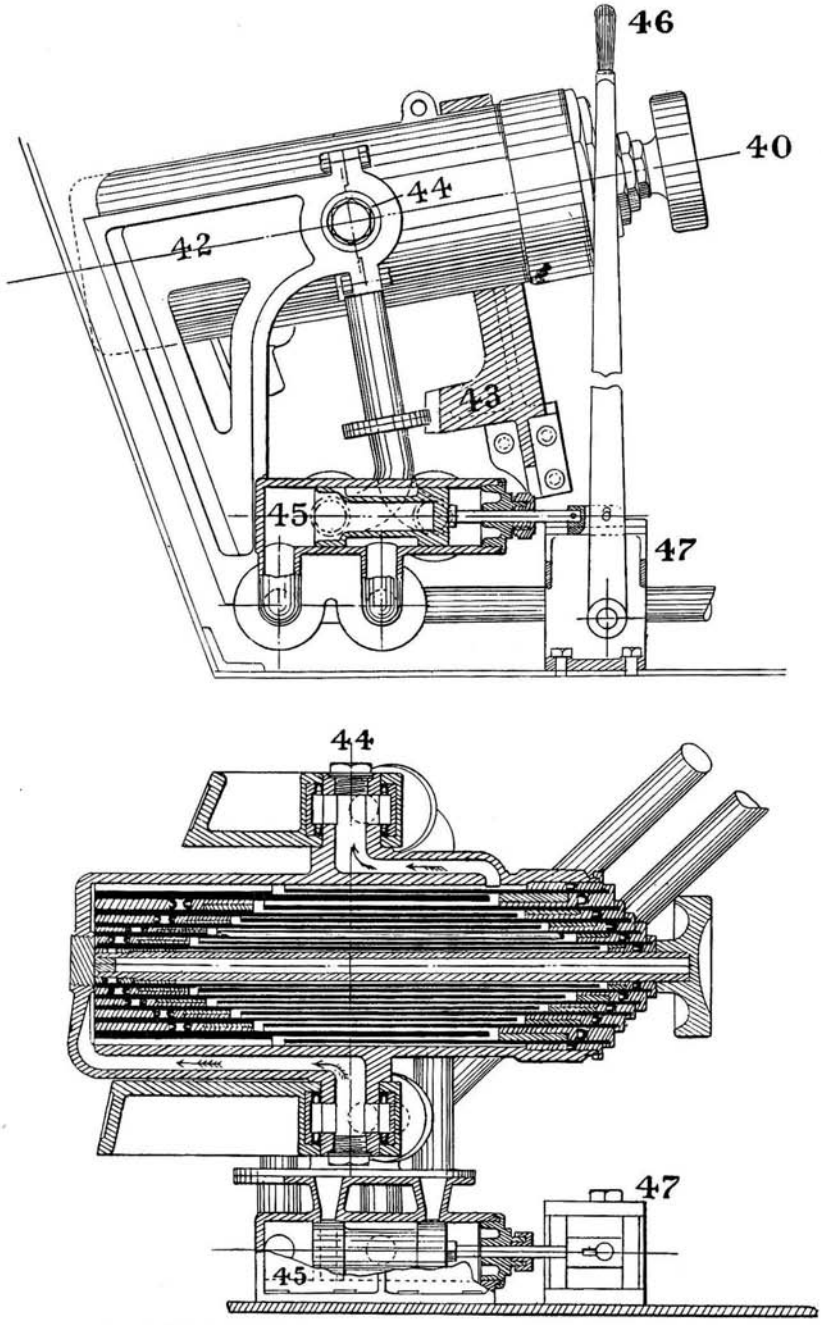
8. **Miscellaneous Fittings.**—The turret is covered with three-inch armor plates, built in which are the sighting hoods with plat-

forms directly below,—on which the trainer and the gun pointer stand. The training hood, situated forward, outside the left gun, contains the trainer's sight and a control lever for the turning engine. The gun-pointer's hood, usually occupied by the turret officer, is between the guns, near the center of the turret. This station contains a control lever for the turning engine and a clutch for connecting and disconnecting it and the lever in the training hood, both of which cannot be in operation at the same time; a speaking tube to the training hood; a telescopic sight and a firing key for each gun; and the control levers for the elevators.

An electric fan is placed behind each gun to drive the smoke out of the turret. A hinged grating, on which the loader stands when performing his duties, covers the opening up which the ammunition car passes; it must be hinged up when the car is raised. There are suitable ladders for gaining access to the handling room; an opening on each side of the turret roof is protected by armor gratings; hand gear is fitted only to the turning gear. Valves are placed in each exhaust and pressure pipe in the turret as well as in the main exhaust and pressure pipes.

The 12-inch turret mounts of the U. S. S. Texas have a closed recoil cylinder and two auxiliary running out motors for each gun; the auxiliary or gun working motors have no part in checking the recoil.

(The "Special Notes on Turret Mounts," pp. 101 to 114 inclusive, in the Gun and Torpedo Drill Book (Edition of 1900), apply very extensively to the Hydraulic Turret Mount.)



HYDRAULIC RAMMER, 10-INCH TURRET MOUNT, MARK II.

Page 188b
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Chapter XIV.

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