No. 1772

DESCRIPTION

OF

3-INCH (15-pounder) GUN

MODEL OF 1903

AND ITS

BREECH MECHANISM

(ONE PLATE)

AUGUST 31, 1912
REVISED JUNE 5, 1917

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, June 5, 1917.

This Manual is published for the information and government of the Regular Army and National Guard of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

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THE 3-INCH (15-POUNDER) GUN, MODEL OF 1903.

WEIGHTS, DIMENSIONS, ETC.

Weight, including breech mechanism	pounds	2,690
Caliber	inches	3
Total length	do	170
Length of bore	calibers	55
Maximum diameter of breech	do	12.2
Length of rifled portion of bore	do	137.28
Rifling:		
Number of grooves		24
Width of grooves	inches	0.2927
Depth of grooves	do	0.03
Width of lands	do	0.10
Twist of rifling, right hand, 1 turn in 50 calibers at origin to 1 turn in 25 calibers at 9.28 inches from muzzle, thence uniform.		
Rifling: Semicubic parabola in form.		
Powder-chamber seat for case:		
Diameter in rear	inches	4.31
Diameter, beginning of choke	do	3.81
Diameter, front	do	3.12
Length	do	27.22
Powder charge:		
Kind of powder		Nitrocellulose.
Weight of charge (about)	pounds	5.5
Density of loading (for 5.5-pound charge)		0.5143
Cartridge case:		
Weight of cartridge case	pounds	8.375
Capacity of cartridge case	cubic inches	296
Projectile:		
Weight (filled and fuzed)	pounds	15
Ratio of weight to that of piece		1-:179
Sectional density $\frac{W}{d^2}$		$1\frac{2}{3}$
Travel of projectile in bore		139.28
Muzzle velocity	feet per second	2,600
Maximum pressure per square inch in powder chamber	pounds	32,000
Muzzle energy	foot-tons	703.8
Maximum range, approximately	yards	8,771
Penetration in Krupp armor at muzzle	inches	2.9
1,000 yards	do	2.2
5,000 yards	do	0.8

Spare parts per battery for 3-inch (15-pounder) gun, model of 1903:

Cocking lever	1
Extractor and extractor pallet—	
For batteries of 1 and 2 guns	1
For batteries of 3 and 4 guns	2
For batteries of 6 guns	3
Firing pin	1
Firing mechanism complete	1
Firing spring	1
Firing-spring follower	1
Latch spring	1
Sear	1
Sear spring	1
Trigger shaft	1
Trigger-shaft detent	1

NOTE.—For insular possessions double quantities for all spare parts except extractor and extractor pallet.

DESCRIPTION OF THE GUN.

STRUCTURE OF THE GUN.

The gun is made of nickel steel, and consists of the tube, the jacket, and the breech bushing.

The tube is enveloped for a distance of 105.15 inches from its breech end by the jacket. These two are locked together by the shoulder between the tube and jacket and by the breech bushing, which is screwed into the breech end of the jacket, which projects a distance of 4.85 inches in rear of the tube. The breech bushing is prevented from rotation by three spline screws. On the right-hand side of the rear end of the jacket is located the hinge lug. The jacket is machined out on the hinge-lug side for the reception of the extractor.

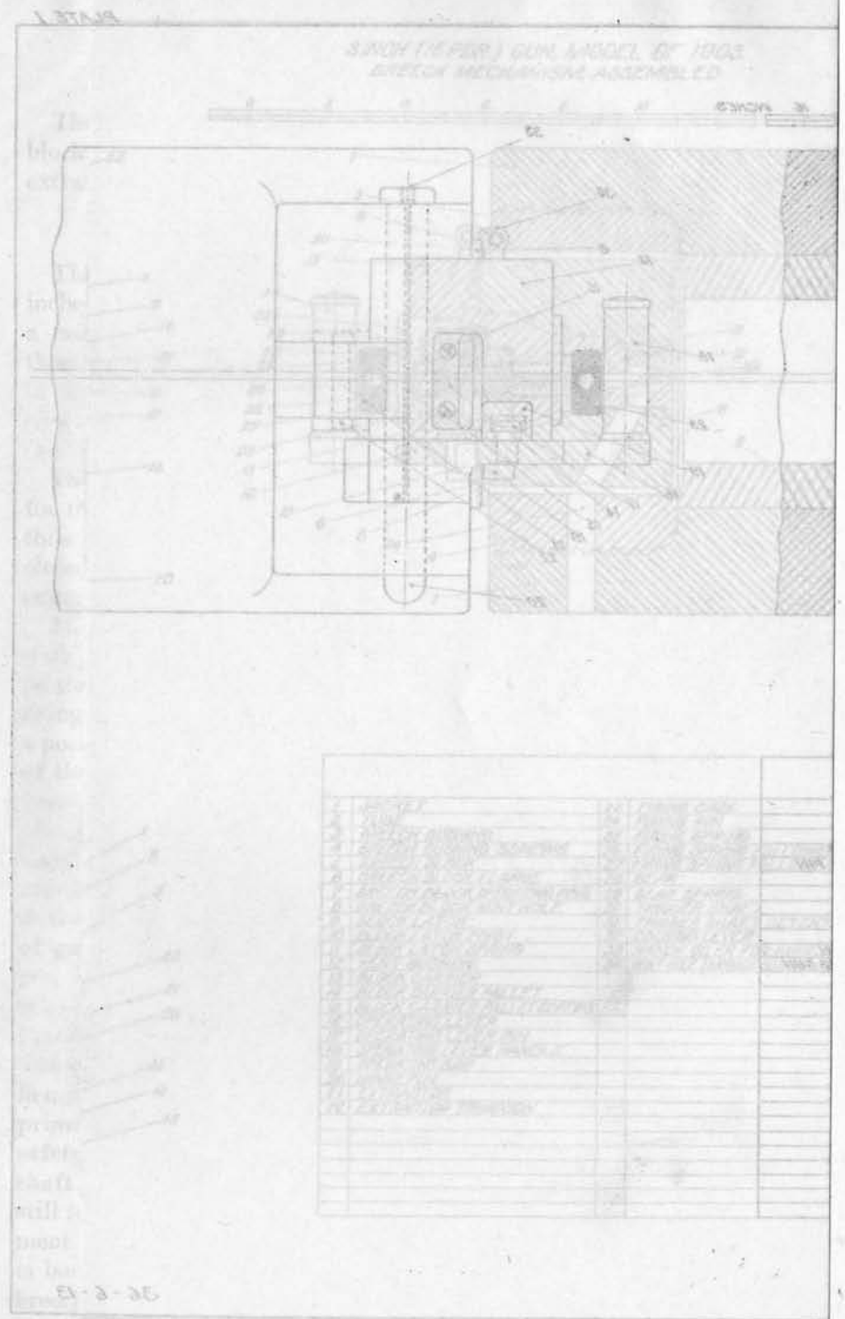
On the underside of the jacket is located the recoil lug, with a hole for receivng the cylinder-end stud.

On the underside of the jacket and extending to the front end of its cylindrical portion are recoil guides or clips containing recesses which fit the cradle guide rails and serve to guide the gun during recoil.

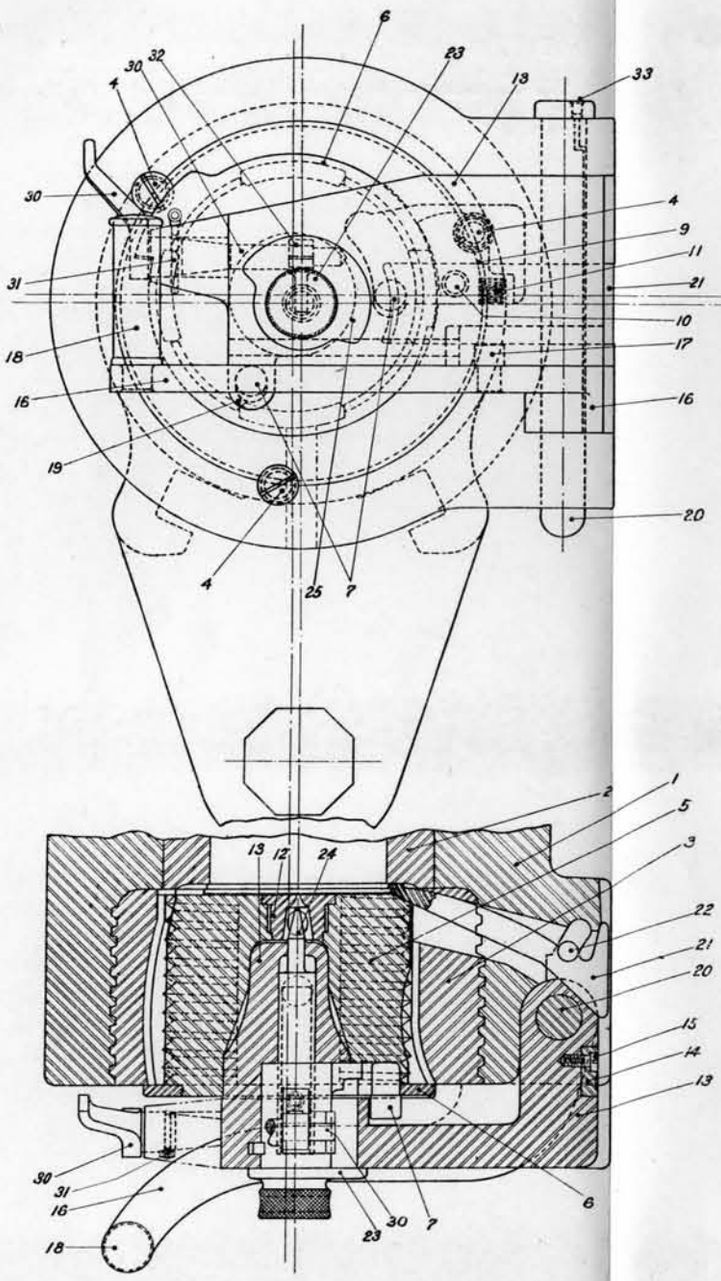
Six oil holes, three on each side, closed by handy oilers, are provided for oiling the guide rails and recoil surfaces.

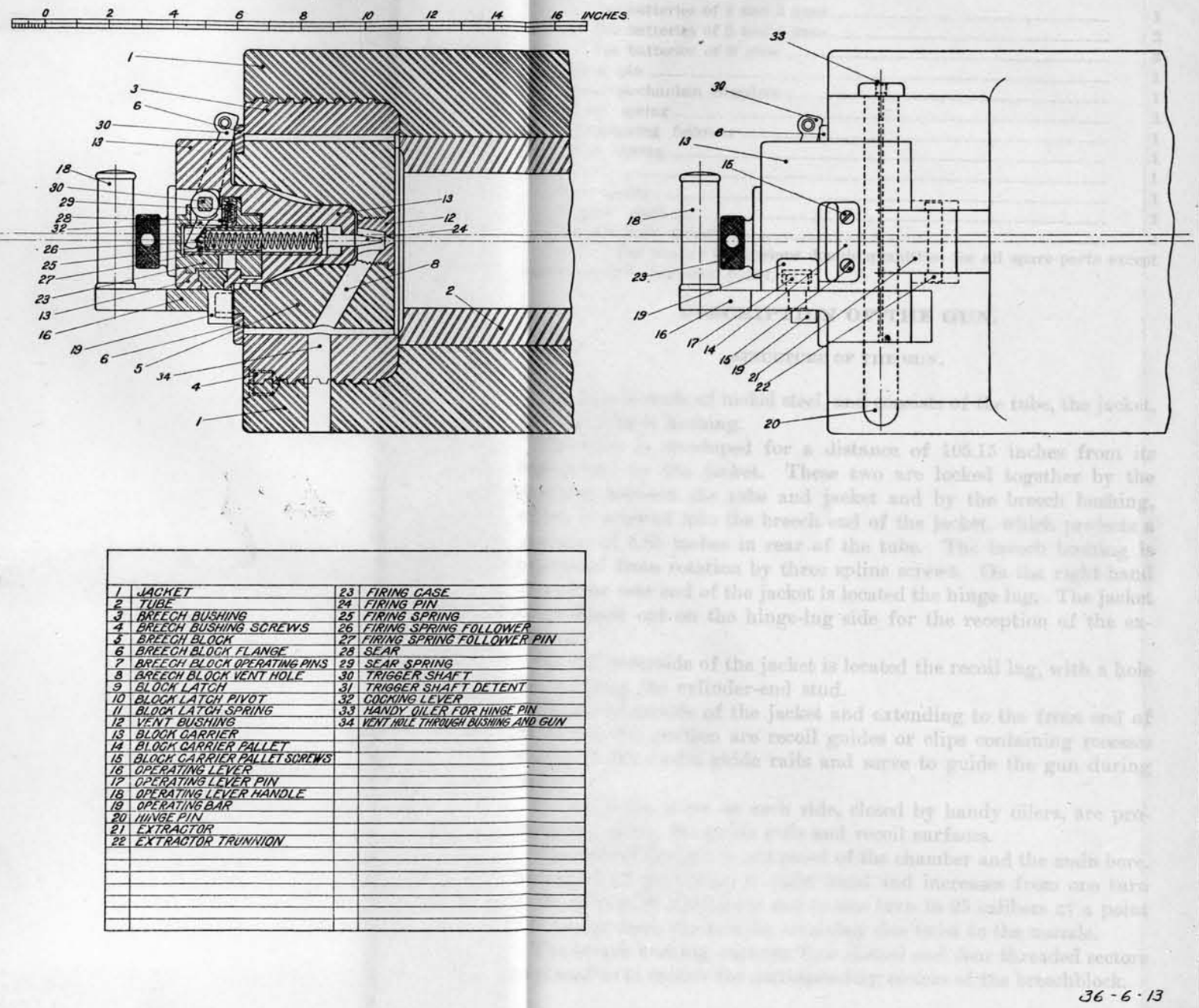
The bore of the gun is composed of the chamber and the main bore. The twist of the rifling is right hand and increases from one turn in 50 calibers at the breech end to one turn in 25 calibers at a point 9.28 inches from the muzzle, retaining this twist to the muzzle.

The breech bushing contains four slotted and four threaded sectors so placed as to receive the corresponding sectors of the breechblock.



3 INCH (15 PDR.) GUN, MODEL OF 1903.
BREECH MECHANISM, ASSEMBLED.





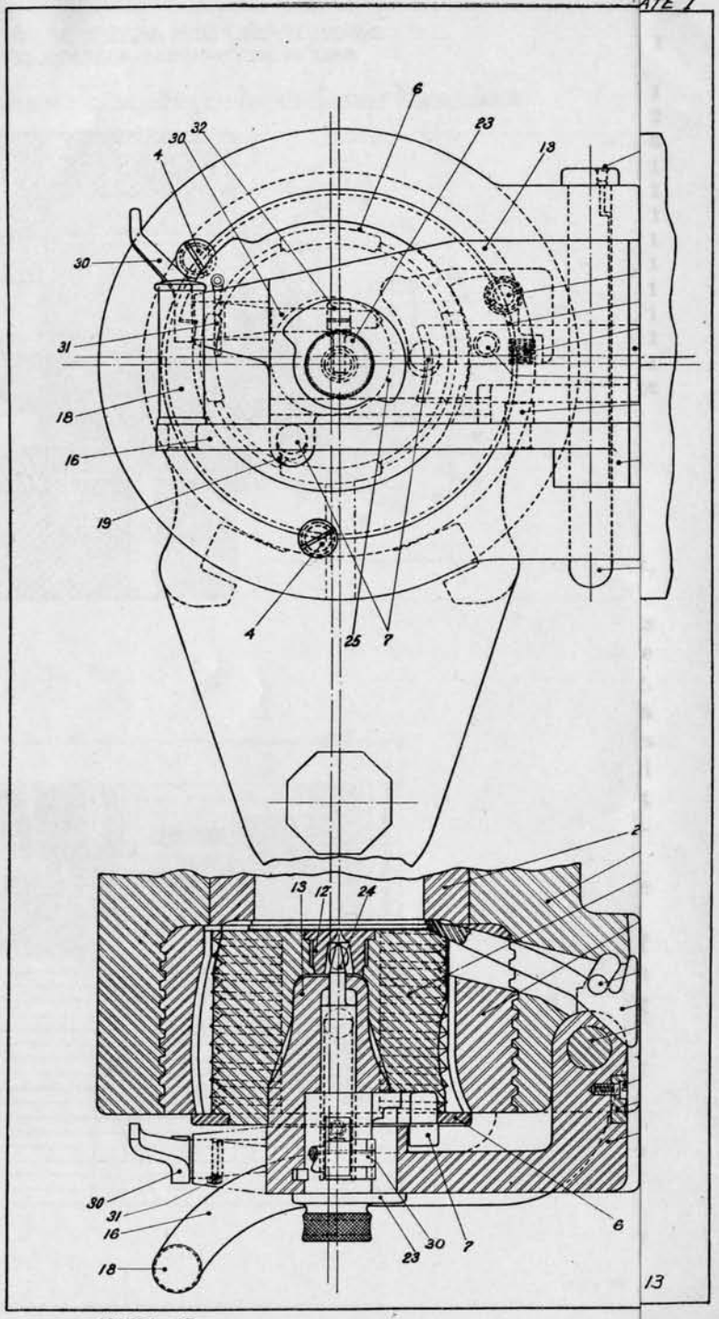
1	JACKET	23	FIRING CASE
2	TUBE	24	FIRING PIN
3	BREECH BUSHING	25	FIRING SPRING
4	BREECH BUSHING SCREWS	26	FIRING SPRING FOLLOWER
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REVISED – JUNE 18, 1917.

PLATE I.



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THE BREECH MECHANISM.

(Plate 1.)

The breech mechanism consists principally of the breechblock, block carrier, block latch, operating lever, operating bar, hinge pin, extractor, trigger shaft, and firing mechanism.

BREECHBLOCK.

The breechblock is cylindrical in form, 5.01 inches long, and 6.41 inches exterior diameter. To the rear end an irregular flange with a radius varying generally between 3½ and 4 inches is secured by threads, and held in place by two studs on the rear face. The part in front of the flange consists of four threaded and four slotted sectors, the metal in each sector being cut away sufficiently to allow the block to swing clear of its recess.

The flange on the rear face is partly cut away, leaving a projection for the toe of the trigger shaft to engage when the block is unlocked, thus preventing firing of the gun until the breeckblock is entirely closed. A notch cut into the flange forms a seat for the block latch to engage when the breechblock is locked to the carrier.

The breechblock is mounted eccentrically in the breech of the gun, with reference to the axis of the bore, and is concentrically mounted on the hub of the block carrier, in which the firing case is fitted. The firing case is eccentrically fitted in the hub of the block carrier in such a position that the axis of the firing pin is always in line with the axis of the bore of the gun. A bushing is fitted in the front face of the breechblock eccentrically with the axis and is provided with a cavity of such dimensions that the breechblock is permitted to revolve freely about the point of the firing pin, which is fixed in the hub of the block carrier and does not rotate. A vent hole leading from this cavity in the bushing rearward through the breechblock permits the escape of gas from a ruptured primer. The point of the firing pin when at rest is always within the enlarged cavity in the bushing, and when the block is revolved to the unlocked position the hole in the bushing through which the point of the firing pin passes is moved to one side. The eccentric arrangement of the breechblock masks the point of the firing pin and prevents any possible contact between it and the primer in the cartridge case when the block is unlocked. Should the safety flange on the breechblock or the projecting toe on the trigger shaft become broken so that they would not engage, the gun could still not be fired in the unlocked position due to the eccentric arrangement of the bushing in the breechblock. The axis of the breechblock is bored to form a seat for the block-carrier hub, upon which the breechblock is free to rotate. A spiral groove cut into this bore with the same pitch as the threads on the exterior of the block forms a seat

for a projecting toe on the firing case, thus locking the breechblock to the block carrier longitudinally.

Two studs are inserted in the rear face of the breechblock; one serves as the operating pivot, the other as a stop pin for limiting the rotation of the block.

BLOCK CARRIER.

This consists of a steel plate having a lug on the right for the hinge pin. A slot cut across this lug on an angle forms a seat for the extractor toe when the breechblock is closed. A hardened steel pallet is inserted in the side of this lug to provide a cam surface for the toe of the extractor. This cam surface gives the final movement to the extractor when the breech mechanism is swung to the open position. The block carrier has a hub extending to the front, upon which the block is mounted. This hub is bored and slotted out to form a seat for the firing case. A slot cut through the hub permits the toe on the firing case to engage a spiral groove in the breechblock, locking the block to the carrier.

On the left side of the block carrier a hole is bored to receive the trigger shaft, forming a bearing in which it rotates. A T-shaped groove is cut in the bottom of the carrier in which the operating bar slides to the right and left. A recess is milled into the front face of the carrier plate to provide a seat for the block latch, a pin being inserted in this recess to serve as the latch pivot. In the front face of the block carrier two semicircular seats are provided which engage a stud on the breechblock, thus limiting the rotation of the breechblock.

BLOCK LATCH.

This locks the block against rotation when its threads are disengaged from those of the breech recess. It operates on a pivot inserted in the carrier. A spring is placed in a pocket in the bottom of the latch which constantly presses the latch on the rim of the breechblock flange, and engages the notch when the breech mechanism is open, thus preventing any movement of rotation between the block and carrier. When the carrier is closed against the breech of the gun, a conical point pin in the latch slides against a similar face recess in the breech of the gun, withdrawing the latch from the notch in the flange of the breechblock, thus allowing the block to rotate.

OPERATING LEVER.

The operating lever of the breech mechanism is hinged to the hinge pin directly under the block carrier.

A pin inserted in the top face of the lever engages a cam slot near the end of the operating bar.

OPERATING BAR.

The operating bar slides to the right and left in a T-shaped groove in the bottom of the carrier, deriving its motion from the operating lever. At its end an elongated hole is provided which engages a stud in the rear face of the breechblock, thus rotating the breechblock in the breech of the gun.

HINGE PIN.

The hinge pin connects the carrier and operating lever to the breech end of the gun. A handy oiler is set in the head and the pin is grooved to permit oiling.

EXTRACTOR.

This operates in a rectangular slot in the right-hand side of the breech of the gun and has a trunnion on the top and bottom face which slide in grooves in this slot.

The inner arm of the extractor engages the rim of the cartridge case. The outer arm or toe engages the oblique face on the hinge lug of the carrier, slides along the surface of the carrier, and engages the pallet in the carrier when the latter is opened.

The oblique surface of the carrier and a cam surface on the pallet are so shaped as to give the extractor an accelerated movement. The cam surface on the pallet tends to give the extractor a final kick, throwing the cartridge case clear of the gun.

TRIGGER SHAFT.

The trigger shaft is pivoted in a bearing on the left-hand side of the block carrier, a split-pin detent engaging a groove in the trigger shaft prevents it from working out to the side.

A projecting arm extends down and to the front and engages the flange on the breechblock, thus preventing any movement to the trigger shaft until the breechblock has been closed. An eye for the lanyard hook is provided in the upper arm. The small bearing end of the trigger shaft is squared to fit the cocking lever.

FIRING MECHANISM.

The firing mechanism belongs to the type known as the continuous pull, percussion type—that is, no cocking of the firing pin is required other than a pull on the lanyard or trigger shaft. This arrangement permits repeating the blow from the firing pin in case of a misfire as often as desired, without the opening of the mechanism or recocking of the firing pin. It consists principally of the following parts: Firing case, firing pin, firing spring, firing-spring follower, sear, sear spring, and cocking lever.

FIRING CASE.

The firing case is designed to contain the complete firing gear, and, if necessary, the entire firing mechanism can be replaced in an instant. It contains all parts of the firing mechanism. It is provided with three lugs by which it is locked in place in the hub of the block carrier. Another lug which is forward of the other three engages the spiral groove in the breechblock, the four lugs locking the block and carrier together. The firing case is held from displacement by the trigger shaft. It can be removed from its seat, in the event of becoming tight, by inserting the end of the trigger shaft in the hole drilled in the knurled portion of the case and revolving it to the left. Through the bottom of the firing case near the center a hole is bored and slotted through which the sear and sear spring is passed to its seat on the opposite side of the firing case. To the rear of this seat is a rectangular slot cut through to the center and which forms a clearance pocket and seat for the cocking lever to engage.

FIRING PIN.

The firing pin is mounted in the firing case and has projecting surfaces on its exterior which serve to guide the pin axially. The forward end of the firing pin is reduced in diameter to provide a shoulder which engages the bottom of the seat in the block carrier, limiting the amount of travel forward when fired. It is bored out in the center to receive the firing spring and firing-spring follower. At the rear end a rectangular slot is cut through the firing pin which provides a web against which the cocking lever engages at a point between its lower end and its axis. This engagement serves as a means of withdrawing the firing pin to its retracted or normal position after the pin has been released and forced forward. Opposite to this slot is cut another narrow groove in which the projecting pin of the firing-spring follower travels and engages, serving to connect the firing pin, firing spring, and firing-spring follower to facilitate assembling and disassembling. A little forward of this rectangular slot another opening is cut which serves as a seat for the engagement of the sear.

FIRING SPRING.

The firing spring is made of such length that it will when assembled inside of the firing pin and firing-spring follower be under an initial compression.

FIRING-SPRING FOLLOWER.

The firing-spring follower is made to slide inside the firing pin. It has a pin projecting from its surface, engaging a groove in the firing pin which serves to guide it.

The closed end is slotted to receive the end of the cocking lever with which it engages.

SEAR.

The sear is so designed that one end engages the seat cut into the firing pin, thus holding the firing pin until released. At the other end of the sear a rectangular projection is formed, which the cocking lever engages during its rotation, releasing the firing pin after the spring has been compressed. The center is drilled out to receive the sear spring, which is so assembled as to cause the sear to always press against the firing pin.

SEAR SPRING.

The sear spring is a small coiled spring with a projection on one end which engages a small hole drilled in the sear, thus preventing the spring from falling out of the sear while assembling.

COCKING LEVER.

The cocking lever is seated in the rear end of the firing case and is prevented from displacement laterally by the walls of the case. It is mounted on the square end of the trigger shaft. The cocking lever passes through the rectangular slot cut in the rear end of the firing pin, engaging the firing pin and firing-spring follower.

ACTION OF THE BREECH MECHANISM.

To open the breech, grasp the operating lever handle, and rotate the operating lever to the rear. During the first part of this movement ($38\frac{1}{2}°$) the block is rotated through the medium of the operating bar, its threads disengaged from those of the gun, at which time the stop pin on the block comes in contact with the stop recess on the block carrier. At this time the block latch drops into its notch in the block flange. The block is now locked against further rotation in either direction.

During a further rotation of the operating lever of 90° the block and carrier swing about the hinge pin clear of the breech recess. The extractor seat on the carrier forces the extractor lever inward, unseating the cartridge case before the end of the 90° movement, and finally, by means of the cam surface on the pallet, ejects the case free of the gun. When another case is inserted the rim of the case comes in contact with the extractor. In closing the mechanism the movements are simply the reverse of opening; as the block carrier comes in contact with the breech face of the gun, the block latch is forced to the right, unlocking the block from the carrier. Further rotation of the operating lever rotates the breechblock, causing its threads to engage those of the gun. This engagement of the threads, moves the block forward, due to the pitch of the threads, and firmly seats the case in the gun. The gun is now ready to fire.

ACTION OF FIRING MECHANISM.

When the trigger shaft is rotated, it in turn rotates the cocking lever to which it is engaged. The circular-formed toe of this lever forces forward the firing-spring follower, thereby increasing the tension on the firing spring. The firing pin is prevented from movement forward, due to the sear locking it and the firing case together. When the cocking lever has rotated a certain amount the projecting lug engages the sear, raising it from its seat, thereby releasing the firing pin, which is stopped in its forward travel by the shoulder coming against its seat in the carrier. Immediately the firing-spring follower, actuated by the compressed firing spring, comes to the rear. The end of the cocking lever still resting against its rear end is carried with it. This cocking lever also engages at a point between its axis and toe the lug or web on the firing pin, which engagement was made when the firing pin was released. Due to the difference in lever arms (the pivot being on the axis of the trigger shaft) the force on the toe of the cocking lever is able to bring to the rear the firing pin until it is engaged again by the sear.

TO DISMANTLE THE FIRING MECHANISM.

Remove the trigger shaft split-pin detent, at the same time pushing the trigger shaft to the left, removing it from its seat. Take hold of the knurled headed end of the firing case and revolve it to the left until it stops, then pull it gently to the rear. This will remove the case with the firing mechanism complete from the gun. Then gently press on the front end of the firing pin, forcing it back into the case. This will allow the cocking lever to be taken out. Then grasp the front end of the firing pin and turn it sufficiently to disengage the sear after which it can be removed from the case. Press the end of the firing spring follower and revolve it sufficiently to disengage projecting pin on the follower from the firing pin.

The follower and spring can then be disassembled. Turning the firing case in the hand will allow the sear and spring to fall out of its seat.

To assemble, place the sear with spring in its seat in the case, assemble the firing pin, spring, and follower. Insert them into the case, holding the case in such a manner that the sear will not fall out of its place. Hold the firing pin tight against the sear and through the opening in the side of the case insert the cocking lever arm, which has a small cut across for the purpose of engaging the lug on the sear. Pull the sear down on its spring and the firing pin will pass over it. Turn the firing pin so that the cocking lever can be inserted in its seat, being careful to note that the circular face engages the firing-spring follower. Press the cocking lever tightly into its seat. The initial tension on the firing spring will hold it into place unless the

firing pin is pressed back to release it. Insert the case into its seat in the block carrier and revolve it to the right until it stops; then insert the trigger shaft in its bearing and engage the detent. No tools are required for assembling or disassembling this mechanism.

To disassemble the breech mechanism, grasp the operating lever and open the mechanism. When the mechanism is open, force the block latch out of its seat in the breechblock flange, revolve the breechblock to the right until it stops, remove the trigger shaft and firing mechanism, then pull the breech block from the hub of the carrier, taking care not to drop it. The block latch can now be easily removed. Take hold of the carrier and operating lever and pull out the hinge pin. Slide the operating bar out of its seat; remove the extractor from its recess.

To assemble, reverse these operations, being careful not to assemble the firing case until the breechblock is in place on the carrier. No tools are required to assemble or disassemble the breech mechanism.

DUMMY 3-INCH (15-POUNDER) GUN, MODEL OF 1911.

The dummy 3-inch (15-pounder) guns, model of 1911, are intended for use in armories for the instruction of Coast Artillery reserves.

These guns are similar in appearance and dimensions to the service 3-inch 15-pounder guns, model of 1903. They are made of cast iron and use the same breech mechanism as the service guns.

The gun weighs approximately 2,500 pounds, including the breech mechanism.

AMMUNITION.

Fixed ammunition is used in the 15-pounder guns. Service ammunition is made up with common steel shell loaded with explosive D. Each round is issued with projectile filled and fuzed. The weight of projectile is 15 pounds, and the total weight of one round is 29.5 pounds. The components of one round are the cartridge case with primer, the powder charge, igniter, projectile, fuze, and base cover. Target-practice ammunition is made up with cast-iron solid shot.

THE CARTRIDGE CASE.

The cartridge case is a solid drawn-brass case 27.15 inches long; it has a capacity of 296 cubic inches, and weighs, with primer, 9 pounds. The head of the case has a projecting flange or rim under which the lip of the extractor engages. The center of the head is bored out to form a seat into which the primer is forced. These primer seats are first mandreled to near the finished dimensions with a tapered steel plug to toughen the metal of the cartridge case around the primer seat and then reamed to finished size. This toughening is necessary to prevent expansion of the seats under gas pressure and consequent loose fit of the primers in subsequent firing.

Base is stamped with name of gun, initials of place, and year of manufacture, and ammunition lot number.

THE PRIMER.

To insure the ignition of smokeless-powder charges in cartridge cases, it is necessary that the primers either contain in themselves, in addition to the percussion composition, an auxiliary charge of black powder, or that an auxiliary charge of such powder be placed at the rear of the cartridge case to communicate the flame from the percussion primer and thoroughly ignite the smokeless powder. The percussion primer, known as the "110-grain percussion primer," contains an igniting charge of 110 grains of black powder in addition to the essential elements of a percussion primer.

A second igniting or priming charge, to insure the uniform and complete ignition of the smokeless-powder charge, is also used. It consists of 1 ounce of black powder, contained in a disk-shaped bag, placed in the case directly in front of the smokeless-powder charge.

The "110-grain percussion primer" consists of a brass case resembling in shape a small-arms cartridge case. The head or rear end of the primer case is countersunk, forming a cup-shaped recess, in which is seated the cap or percussion primer proper. The latter consists of the cup, the anvil, and the percussion composition. The percussion composition is known as the "H-42" mixture, and contains the following ingredients:

	Per cent.
Chlorate of potash	47.206
Tersulphide of antimony	30.829
Flowers of sulphur	21.965

The percussion-cap recess is connected with the interior of the primer case by a small vent. The body of the case contains 110 grains of black powder, constituting the rear "priming" or igniting charge for the smokeless powder. This black powder is inserted under a pressure of 36,000 pounds per square inch, and is pressed into the primer body around a central wire, which is then withdrawn, leaving a longitudinal hole the full length of the primer. Eight radial holes are drilled through the primer and compressed powder, affording 16 vents for the free exit of the black-powder flames. After filling the case the front end is closed by a cardboard wad covered with shellac, and the radial perforations in the body of the case are covered by a tin-foil wrapper to retain in the case any loose black powder, as well as to exclude all moisture.

In action the blow of the firing pin explodes the percussion cap, which ignites the black powder; the flames of the latter shoot out through the vents in the primer case and ignite the smokeless-powder charge.

The primer just described is known as the "110-grain percussion primer," and is used only with smokeless-powder charges. A shorter

primer, known as the "saluting primer, percussion," is issued by the Ordnance Department for use in blank cartridges. The percussion elements and the dimensions of the seat in the cartridge case for both types of primers are identical. The primer charge of the saluting primer consists of 20 grains of loose rifle powder, held in place by a paper wad shellacked in the mouth of the primer case. The "20-grain saluting primers" are issued in hermetically sealed tin boxes, 25 in a box. The boxes should not be opened nor the cases primed until shortly before they are required for use.

THE POWDER CHARGE.

The powder is a nitrocellulose powder composed of multiperforated (7 perforations) cylindrical grains. The charge varies slightly for different lots of powder, but is approximately 5.5 pounds. In making up the cartridges a packing of paper, felt, or excelsior is placed next to the projectile if necessary to fill the cartridge case, thus holding the powder charge in the rear portion of the cartridge case in contact with the primer. A front igniter of black powder weighing 1 ounce is used. The charge gives a muzzle velocity of 2,600 feet per second, with a maximum pressure in the bore not exceeding 32,000 pounds per square inch.

Smokeless powder *must not be used* for blank charges. For that purpose the Ordnance Department furnishes special saluting powder.

PROJECTILES.

The projectiles comprise common steel shell base fuzed for service and cast-iron shot for target practice.

COMMON STEEL SHELL.

The common steel shell is provided with an ogival head struck with a radius of 2 calibers, and is fitted with a copper rotating band forced into an annular groove 1.2 inches from the base. Between the band and the base are cut two shallow annular grooves, the front one of which is filled with material insuring a waterproof joint in the assembled cartridge; both grooves are known as crimping grooves. In assembling the ammunition the shell is forced into the cartridge case up to the band, and the metal of the cartridge case is then set into both grooves at four points, securely fixing the projectile in the case. The base of the shell is tapped for a base detonating fuze and is fitted with a base cover secured in the base-cover groove by the calking wire. The base cover consists of a copper cover, lead disk, lying between the cover and the projectile, and a lead calking wire. This base cover seals the joint between fuze and shell against the entrance of powder gases into the shell cavity. The steel shell contains a bursting charge of 5.6 ounces of explosive D. The weight of the shell with bursting charge and fuze is 15 pounds. The shell is always issued filled and fuzed.

Range table for 3-inch 15-pounder gun, model of 1903.

[Muzzle velocity=2,600 f. s.; projectile, 15 pounds.]

[Prepared under the direction of the Chief of Artillery, by the Artillery Board, Fort Monroe, Va.]

Steel shell.						
Range, X.	Angle of departure, ϕ.	Change in ϕ for 10 yards in range.	Time of flight, T.	Slope of fall.	Perforation of Krupp armor.	Drift.
Yards.	° ′	′	*Seconds.*	*1 on—*	*Inches.*	*Yards.*
500	0 16.2	0.3	0.61	246	2.5	0.1
600	0 19.1	0.3	0.70	185	2.4	0.1
700	0 22.0	0.3	0.85	155	2.3	0.1
800	0 25.0	0.3	0.98	134	2.3	0.2
900	0 28.0	0.3	1.12	120	2.2	0.2
1,000	0 31.1	0.3	1.27	107	2.2	0.2
1,100	0 34.3	0.3	1.41	95	2.1	0.3
1,200	0 37.5	0.3	1.55	84	2.1	0.3
1,300	0 40.9	0.3	1.70	75	2.0	0.4
1,400	0 44.3	0.4	1.85	67	2.0	0.4
1,500	0 47.9	0.4	2.00	60	1.9	0.5
1,600	0 51.7	0.4	2.16	54	1.9	0.6
1,700	0 55.6	0.4	2.32	49	1.8	0.7
1,800	0 59.6	0.4	2.49	45	1.8	0.8
1,900	1 03.7	0.4	2.66	42	1.7	0.9
2,000	1 08.0	0.4	2.84	40	1.7	1.0
2,100	1 12.4	0.5	3.02	38	1.6	1.1
2,200	1 17.0	0.5	3.20	36	1.6	1.2
2,300	1 21.7	0.5	3.38	34	1.5	1.4
2,400	1 26.5	0.5	3.57	32	1.5	1.6
2,500	1 31.4	0.5	3.76	30	1.5	1.8
2,600	1 36.4	0.5	3.95	28	1.4	2.0
2,700	1 41.5	0.5	4.15	26	1.4	2.2
2,800	1 46.8	0.5	4.35	24	1.4	2.4
2,900	1 52.2	0.6	4.55	22	1.3	2.6
3,000	1 57.7	0.6	4.76	20	1.3	2.9
3,100	2 03.4	0.6	4.97	19	1.3	3.2
3,200	2 09.4	0.6	5.19	18	1.2	3.5
3,300	2 15.6	0.6	5.41	17	1.2	3.8
3,400	2 22.0	0.7	5.64	16	1.2	4.2
3,500	2 28.6	0.7	5.88	15	1.1	4.6
3,600	2 35.4	0.7	6.12	14	1.1	5.0
3,700	2 42.5	0.7	6.37	13	1.1	5.4
3,800	2 49.8	0.8	6.62	12	1.1	5.9
3,900	2 57.3	0.8	6.87	11	1.0	6.4
4,000	3 05.0	0.8	7.13	11	1.0	7.0
4,100	3 13.0	0.8	7.39	10	1.0	7.6
4,200	3 21.1	0.8	7.65	10	1.0	8.2
4,300	3 29.4	0.9	7.92	10	0.9	8.9
4,400	3 38.0	0.9	8.19	9	0.9	9.6
4,500	3 46.8	0.9	8.47	9	0.9	10.3
4,600	3 55.8	0.9	8.75	9	0.9	11.1
4,700	4 05.1	0.9	9.03	8	0.9	11.9
4,800	4 14.5	1.0	9.32	8	0.9	12.8
4,900	4 24.1	1.0	9.61	8	0.8	13.7
5,000	4 34.0	1.0	9.91	7	0.8	14.6
5,100	4 44.1	1.1	10.21	7	0.8	15.6
5,200	4 54.6	1.1	10.51	7	0.8	16.7
5,300	5 05.4	1.1	10.82	6	0.8	17.8
5,400	5 16.5	1.1	11.13	6	0.8	19.0
5,500	5 27.8	1.2	11.44	6	0.8	20.3
5,600	5 39.4	1.2	11.76	5	0.8	21.7
5,700	5 51.3	1.2	12.08	5	0.8	23.1
5,800	6 03.5	1.3	12.40	5	0.8	24.6
5,900	6 16.0	1.3	12.72	5	0.8	26.2
6,000	6 28.8	1.3	13.05	4	0.8	27.9
6,100	6 41.9	1.3	13.38	4	0.7	29.6
6,200	6 55.2	1.4	13.72	4	0.7	31.4
6,300	7 08.8	1.4	14.06	4	0.7	33.3
6,400	7 22.7	1.4	14.41	4	0.7	35.2
6,500	7 36.9	1.5	14.76	3	0.7	37.2
6,600	7 51.4	1.5	15.12	3	0.7	39.3
6,700	8 06.2	1.5	15.48	3	0.7	41.5
6,800	8 21.3	1.5	15.85	3	0.7	43.8
6,900	8 36.7	1.6	16.22	3	0.7	46.2
7,300	8 52.4	1.6	16.59	3	0.7	48.8
7,100	9 08.5	1.7	16.97	3	0.7	51.6
7,200	9 25.0	1.7	17.35	3	0.7	54.6
7,300	9 41.8	1.7	17.74	3	0.7	57.9
7,400	9 59.0	1.8	18.13	3	0.7	61.4
7,500	10 16.6	1.8	18.53	3	0.7	65.2

NOTE.—ϕ includes the "jump"; three minutes of depression. Ballistic coefficient $= C = f\frac{\delta_1}{\delta}\frac{w}{\beta c d^2}\frac{\delta_1}{\delta} = 1$.

βc is variable for range constant for velocity. According to experimental data furnished by the Chief of Ordnance see C. of O. file No. 36380-34—Encs. 1, 2, and 3.

FORT MONROE, VA., *Dec. 4, 1904.*

SUBCALIBER CARTRIDGE.

The subcaliber cartridge is used for subcaliber practice. It consists of a .30-caliber rifle barrel 36.8 inches long, mounted axially in a bronze subcaliber cartridge case, and resembles in weight and exterior dimensions the ammunition regularly used with the gun. The breech end of the rifle barrel is screwed into the base of the subcaliber cartridge, while the muzzle end is threaded to take the ogival-shaped head, which accurately fits the bore at the front end of the subcaliber cartridge case and is capable of longitudinal motion to allow for expansion of the barrel. Two flat steel extractor springs are each assembled to the base by an extractor-spring screw.

During subcaliber practice the extractor of the gun will be removed in order to prevent the breechblock from defacing the base of the subcaliber cartridge. Under no circumstances will the subcaliber cartridge be used as a drill cartridge, as such use invariably results in dishing the head of the cartridge, thus increasing the head space for caliber .30 cartridges and rupturing their cases. The subcaliber cartridge is inserted and pushed home in the gun. The subcaliber cartridge, caliber .30, is then inserted in the chamber of the subcaliber barrel until its rim comes in contact with the extractor springs. The breech of the gun is closed, the face of the breechblock coming in contact with the subcaliber cartridge, caliber .30, shoves it to its seat, compressing the extractor springs. When the breech is opened the extractor springs throw the case of the subcaliber cartridge, caliber .30, far enough to the rear to permit its removal by the fingers.

The ammunition for United States magazine rifles of any model must not be used in subcaliber cartridges, the primers not being adapted for the blow of the firing pins of cannon. A special caliber .30 cartridge has been adopted for this purpose, and requisitions for subcaliber ammunition should call for "subcaliber cartridges, caliber .30."

As the residue from the primer, if not completely removed corrodes the bore in a short time, the subcaliber cartridges should be carefully cleaned after use. The bore should be cleaned with a rag saturated with soda water (one-half pound sal soda to 1 gallon boiling water) and wiped thoroughly dry with a clean rag. Then oil the bore with a light coating of light slushing oil or other suitable oil.

DRILL CARTRIDGE.

The "drill cartridge" is a dummy cartridge for use in drilling cannoneers in the service of the gun. It is a bronze casting of the shape of the service ammunition.

SUBCALIBER AND DRILL CARTRIDGE KIT.

The subcaliber and drill cartridge kit consist of—

3 drill cartridges, 1 extra base.	1 eyepiece.
1 subcaliber cartridge, 1 extra base.	1 extension piece.
2 extractor springs.	1 bristle-cleaning brush.
2 extractor-spring screws.	1 pin wrench.
1 cleaning rod.	1 storage chest.

One subcaliber and drill cartridge kit is issued for each gun.

ALLOWANCE OF AMMUNITION.

Ammunition is issued by the Ordnance Department in hermetically sealed wooden or metal packing boxes, 4 rounds per box.

The annual allowance of ammunition for instruction is prescribed from time to time in War Department orders. These orders give full information as to the allowance of fixed and blank ammunition for the 3-inch (15-pdr.) guns and subcaliber cartridges.

BLANK AMMUNITION.

Blank metallic ammunition is for use in salute firing, morning and evening gun firing, maneuver firing, etc., and consist of the following components: A brass cartridge case, a percussion primer, a charge of black powder, and a tight-fitting felt wad.

THE CARTRIDGE CASE.

The cartridge case for blank ammunition resembles the service case, except that it is shorter. Cartridge cases are issued unprimed, and primers should not be inserted until the ammunition is to be prepared for use.

Cartridge cases that have become deformed in service should be turned in to the posts or arsenals designated in current orders for resizing and re-forming.

THE PRIMER.

The saluting primer (percussion) is used in the preparation of blank metallic ammunition. The primer should be a tight fit in the primer seat in the cartridge case, and must be pressed into place with the primer-inserting press provided for the purpose, and not hammered in. No primer should be used that is not a tight fit in its seat in the case.

Cartridge cases should be primed just before the insertion of the powder charge, and under no circumstances will primers be inserted after the powder charge has been inserted.

Primers are issued in hermetically sealed tin boxes, which should not be broken open until the primers are to be used, as they deteriorate when exposed to atmospheric influences.

THE CHARGE.

The charge to be used in the preparation of blank metallic ammunition for the 3-inch (15-pdr.) gun is 2 pounds of saluting powder.

PREPARATION OF BLANK METALLIC AMMUNITION.

Blank metallic ammunition will be assembled at posts under the personal supervision of a commissioned officer, who will be held responsible that it is prepared in the manner prescribed by orders.

For this purpose there are issued blank-cartridge cases, black powder in bulk, tight-fitting felt wads, rubberine, or other quick-drying paint, primers, etc.

Before assembling the cartridge cases should be carefully inspected to see that they are in sound condition and thoroughly clean and dry. They should also be tested by trying them in the gun, to determine whether they have become deformed. Any cases that do not readily enter the chamber in the gun or that are otherwise seriously deformed should be laid aside for resizing. After inspecting the cartridge cases the blank ammunition should be prepared as follows:

(*a*) Insert the primers with the primer-inserting press.

(*b*) Pour into the cartridge case the proper weight of black powder and shake it down well.

(*c*) Insert the felt wad and press it down hard until it rests squarely on the powder charge.

(*d*) Give the upper surface of the felt wad and the inside of the cartridge case just above the wad a good coat of the rubberine or other quick-drying paint furnished for the purpose, using a brush, and allow the case to stand until this coat is dry. Then apply another coat of rubberine paint in a similar manner. The object of using rubberine paint, which is strongly adhesive, is to thoroughly seal the joint between the wad and the case to prevent any powder grains from leaking out and at the same time to firmly hold the wad in place.

PRECAUTIONS TO BE OBSERVED.

Firings with blank metallic ammunition will be greatly facilitated by a careful observance of the following:

Before all firings a careful examination should be made of the assembled rounds to see that the felt wads have not become displaced or the cartridge cases dented or deformed by careless handling. If the cartridge cases have been properly resized and are clean no difficulty should be experienced in inserting them in the gun, provided the chamber of the latter is clean. The continued insertion of cartridge cases that are not clean causes an accumulation in the gun chamber which may make the insertion of subsequent rounds difficult or impossible.

In firing blank ammunition the gun chamber will be sponged after each round with a damp sponge, to extinguish sparks and remove powder residue resulting from the previous round, before the insertion of another round.

Care will be taken to see that the sponges are not worn and that they thoroughly fit the chamber. The interval between rounds in firing blank ammunition should be sufficient to allow thorough sponging of the chamber and examination to ascertain that all sparks have been extinguished.

Wads for the preparation of blank metallic ammunition are made to tightly fit in the cartridge case. No wads should be used that are not a tight fit in the case, and particular care must be taken that no paint runs down around the wad into the powder charge.

Before firing a salute with blank metallic ammunition all the cartridges to be used should be inserted in the gun to ascertain if they will fit. In preparing ammunition for salutes, a few rounds in addition to the required number should be prepared for use in case of misfires. Lightly oiling the outside of cartridge cases just before use will facilitate their insertion and extraction.

CARE OF CARTRIDGE CASES.

As soon after firing as practicable the exploded primers should be removed from the cartridge case by means of the decapping tool furnished with the reloading outfit. The case should then be thoroughly washed and dried.

If the cartridge cases are carefully cleaned and washed immediately after firing, not only will less labor be required, but the life of the cartridge case will be greatly prolonged.

A good solution for washing cartridge cases may be prepared by using ingredients in the following proportions: 1 gallon of water, $2\frac{1}{2}$ ounces soft soap, $5\frac{1}{2}$ ounces soda. The mixture should be boiled and stirred until the ingredients are entirely dissolved.

In washing cartridge cases this solution should be used hot and in sufficient quantity to completely immerse the cases.

Neither acids nor solutions of acids will be used for cleaning cartridge cases.

THE RELOADING AND CLEANING OUTFIT.

This outfit consists of the following parts, and is furnished to each post when needed and to each post where a saluting gun is kept:

Primer-inserting press, large.	Hammer.
Bushing.	Case holder.
Powder measure, saluting.	Case-holder stand.
Decapping tool, with guide.	Storage chest.
Cleaning brush.	

The bushing is used in the primer-inserting press for the insertion of new primers.

The decapping tool and case holder and stand are used for removing exploded primers from the cartridge cases. A light blow on the rod with a piece of wood or the bronze hammer generally removes the primer.

A powder measure to suit the saluting charge for the gun is furnished, and when level full holds the required charge.

The cleaning brush is furnished for cleaning the cartridge cases after they have been used and should be ordered to suit the size of case for which intended.

MISFIRES AND HANG FIRES.

Misfires and hang fires are rarely due to defective primers. In case of the failure of a cartridge to fire when the trigger is pulled, the pull should be repeated without opening the breech. The breech block *should not be opened* until after the expiration of at least 1 minute from the time that the trigger is last pulled, nor to exceed 10 minutes, as prescribed by C. A. C. drill regulations.

Lack of complete rotation of the breech block, and too much oil in the recoil cylinder, preventing full counter recoil, are the most usual causes of misfires, although they are occasionally due to defective primers or to a weakened firing spring.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, June 5, 1917.

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