

No. 1771

U. S. Ordnance Dept.

HANDBOOK OF THE
4.7-INCH GUN MATÉRIEL

MODEL OF 1906

WITH INSTRUCTIONS FOR ITS CARE

(TWENTY-FIVE PLATES)

NOVEMBER 19, 1910
REVISED DECEMBER 11, 1914
REVISED SEPTEMBER 15, 1917



WASHINGTON
GOVERNMENT PRINTING OFFICE

1917

Univ Calif - Digitized by Microsoft®

UT 563
A 5
4.7 in
1917 b

UNIVERSITY OF CALIFORNIA
LIBRARY

L.C.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, September 15, 1917.

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

By order of the Secretary of War:

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

(3)

370989

Digitized for Microsoft Corporation
by the Internet Archive in 2008.

From University of California Libraries.

May be used for non-commercial, personal, research,
or educational purposes, or any fair use.

May not be indexed in a commercial service.

LIST OF CONTENTS.

	Page.
List of plates.....	7
List of equipment.....	7
Gun:	
Weights, dimensions, etc.....	9
Description.....	9
Care of.....	17
Ammunition:	
Cartridge case.....	18
Primer.....	18
Powder charge.....	20
Projectiles:	
Shell.....	20
Shrapnel.....	21
Simple tracer.....	21
Fuzes:	
Combination.....	22
Frankford Arsenal combination.....	22
Base detonating.....	25
Marking on ammunition packing boxes.....	26
Allowance of ammunition.....	26
Blank ammunition.....	27
Range tables.....	29
Hand fuze setter.....	32
Drill cartridge.....	33
Reloading and cleaning outfit.....	34
Misfires and hangfires.....	34
Carriage:	
Weights, dimensions, etc.....	34
Nomenclature of parts.....	35
Description.....	41
Dismounting and assembling.....	55
Care and cleaning of recoil cylinders and other parts.....	62
4.7-inch gun and 6-inch howitzer limber, model of 1905:	
Weights, dimensions, etc.....	65
Nomenclature of parts.....	65
Description.....	67
4.7-inch gun limber and caisson, model of 1908:	
Weights, dimensions, etc.....	69
Nomenclature of parts.....	69
Description of limber.....	73
Description of caisson.....	73
4.7-inch gun caisson, model of 1916:	
Weights, dimensions, etc.....	77
Nomenclature of parts.....	77
Description.....	79

	Page.
4.7-inch gun and 6-inch howitzer forge limber, model of 1908, and 4.7-inch gun and 6-inch howitzer store limber, model of 1908:	
Weights, dimensions, etc.	80
Nomenclature of parts.....	80
Description of forge limber.....	85
Description of store limber.....	87
Battery and store wagons, model of 1908:	
Nomenclature of parts.....	88
Description.....	91
Description of several tools and accessories.....	94
Cyclometer.....	95
Padlocks and bolt snaps.....	95
Artillery harness.....	95
Steel collars.....	97
Collar-lifting device.....	99
Care and preservation of leather.....	99
Sights and quadrant:	
Line sight.....	101
Front sight.....	101
Rear sight.....	102
Panoramic sight, model of 1904.....	103
Panoramic sight, model of 1915.....	106
Range quadrant.....	112
Use of.....	114
Care of.....	115
Adjustment of.....	119
Spare sights and quadrant.....	121
Adjusting instruments.....	122
Targets.....	122
General information:	
Painting artillery matériel.....	122
Oils for artillery matériel.....	123
Repairs for field artillery.....	124
Suggestions for care and maintenance of matériel.....	125
Supplies in general.....	128
Method of loading a battery for transportation by rail.....	129
Total equipment of one field battery together with expendable supplies.....	132
Index.....	147

LIST OF PLATES.

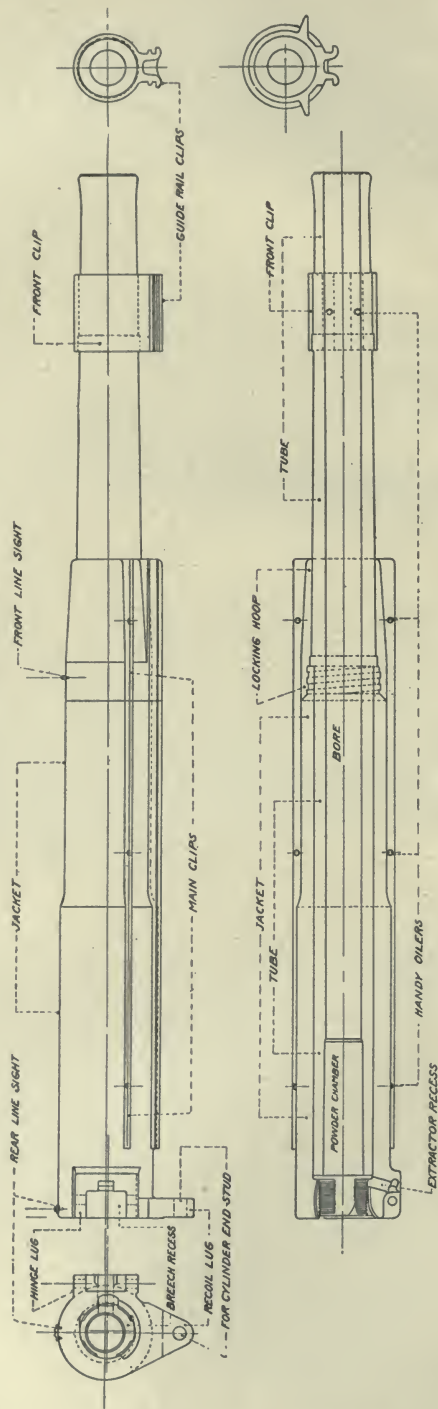
	Faces page.
I. 4.7-inch gun, model of 1906.....	9
II. Breech mechanism and nomenclature.....	10
III. Common steel shell, shrapnel, cartridge case, and primer.....	18
IV. Combination fuze, 31 seconds.....	22
V. Fuze setter, hand.....	32
VI. Carriage, side elevation (carriages 1 to 40, inclusive).....	41
VII. Carriage, plan (carriages 1 to 40, inclusive).....	41
VIII. Carriage, vertical sections (carriages 1 to 40, inclusive).....	42
IX. Views of carriages with serial numbers above 40.....	43
X. Traversing gear.....	48
XI. Elevating gear (carriages 1 to 40, inclusive).....	50
XII. 4.7-inch gun and 6-inch howitzer limber, model of 1905.....	67
XIII. 4.7-inch gun limber, model of 1908.....	73
XIV. 4.7-inch gun caisson, model of 1908.....	75
XV. 4.7-inch gun caisson, model of 1916.....	79
XVI. 4.7-inch gun and 6-inch howitzer forge limber, model of 1908.....	85
XVII. 4.7-inch gun and 6-inch howitzer store limber, model of 1908.....	87
XVIII. Battery and store wagons, model of 1908.....	91
XIX. Artillery harness.....	95
XX. Spare parts for steel collar.....	98
XXI. Collar-lifting device.....	99
XXII. Rear sight.....	102
XXIII. Panoramic sight, model of 1904.....	103
XXIV. Panoramic sight, model of 1915.....	106
XXV. Range quadrant.....	112

List of equipment of one 4.7-inch gun battery, on war footing.

Number.	Equipment.	Property classification.	
		Class.	Section.
4	4.7-inch guns, model of 1906.....	} IV	3
4	4.7-inch gun carriages, model of 1906.....		
4	4.7-inch gun and 6-inch howitzer limbers, model of 1905.....		
12	4.7-inch gun limbers, model of 1908.....		
12	4.7-inch gun caissons, model of 1908 or 1916.....		
1	4.7-inch gun and 6-inch howitzer forge limber, model of 1908.....	} IV	9
1	Battery wagon, model of 1908.....		
1	4.7-inch gun and 6-inch howitzer store limber, model of 1908.....		
1	Store wagon, model of 1908.....	} IV	8
55	Sets of artillery harness (lead).....		
19	Sets of artillery harness (wheel).....	} IV	8
1	Set of pack harness and special pack equipment.....		
1	Set of fire-control equipment.....	V	1

¹ This set of pack harness and special pack equipment will be issued to carry the fire-control equipment until the reel (2-horse) is available.

4.7 INCH GUN MODEL OF 1906



HANDBOOK OF THE 4.7-INCH GUN MATÉRIEL, MODEL OF 1906.

THE 4.7-INCH GUN, MODEL OF 1906.

WEIGHTS, DIMENSIONS, ETC.

Weight.....	pounds..	2,688
Caliber.....	inches..	4.7
Total length.....	do....	134.92
Length of bore.....	do....	129.22
Length of rifle portion of bore.....	do....	111.9
Number of grooves.....		42
Width of grooves.....	inch..	0.2116
Depth of groove.....	do....	0.04
Width of lands.....	do....	0.14
Twist of rifling, right hand, 1 turn in 50 calibers at origin to 1 turn in 25 calibers at 14.9 inches from muzzle, thence uniform.		
Rifling, semicubic parabola in form.		
Weight of projectile, filled and fuzed.....	pounds..	60
Weight of powder charge.....	ounces..	95
Weight of cartridge case.....	pounds..	7.4
Capacity of cartridge case.....	cubic inches..	251
Muzzle velocity.....	feet per second..	1,700
Maximum pressure per square inch.....	pounds..	33,000
Maximum range, approximately.....	yards..	11,000
Center of gravity of gun from rear face of breech.....	inches..	51

DESCRIPTION.

[Plate I.]

The gun is built up consisting of a tube, jacket, locking hoop, and clip. Guns numbered 1 to 21, inclusive, are of gun steel; those after No. 21 are of nickel steel. The jacket envelops the rear portion of the tube and projects beyond it to form the breech recess or seat for the breechblock. A lug, known as the recoil lug, projects from the under surface of the jacket at its extreme rear end and affords a point of attachment for the recoil cylinder of the carriage. To this lug is also attached the spring rod yoke, to the ends of which are secured the spring rods. A lug in the right of the jacket at its rear end provides a point of support for the block carrier, which is held in place by the hinge pin. A seat for the extractor is also formed in this lug, passing through it into the breech recess.

The locking hoop's function is to secure the jacket from any longitudinal motion to the rear with respect to the tube. It is joined to the forward end of the jacket by means of a left-hand screw thread of one and one-eighth turns. A shoulder in the hoop bears against a shoulder on the tube. The locking hoop, in addition to being screw threaded, is also assembled with a shrinkage.

The clip is a short hoop shrunk on the tube near the muzzle. A cylindrical surface having a shoulder is formed on the tube as a seat for the clip. In addition to the shrinkage, the clip is secured by a pin driven transversely through the hoop near its rear end.

On each side of the gun and extending the full length of the jacket and locking hoop is formed a supporting clip. The bottom surfaces of these clips are parallel to the axis of the bore and are in contact with the top surfaces of the cradle rails on which the gun slides during recoil. On the underside of the gun and extending the entire length of the jacket, locking hoop, and clip are formed recoil guides or clips which fit under and secure the gun to the rails of the cradle and also serve to guide the gun during recoil.

When the gun is assembled upon the carriage, a sheet-steel dust guard is secured to the front face of the locking hoop and the rear face of the clip, thus protecting from dust and dirt the bearing surfaces of the guide rails between these points. Eight oil holes closed by handy oilers are provided for oiling the guide rails and recoil surfaces.

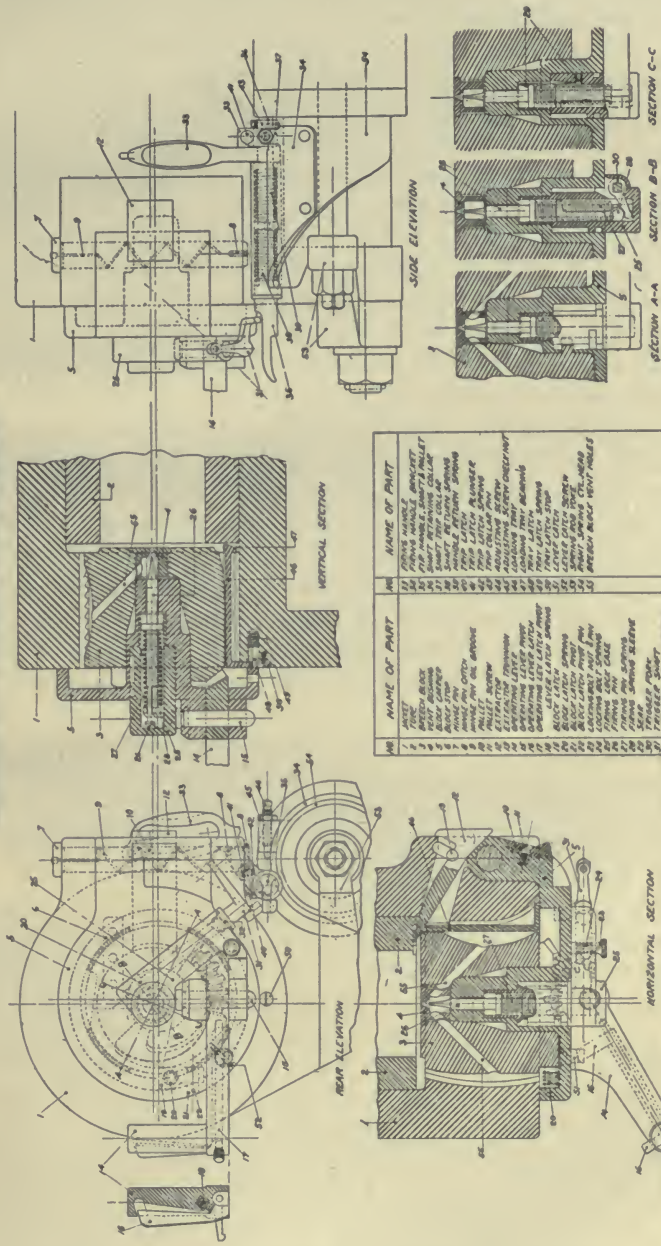
BREECH MECHANISM.

[Plate II.]

The breechblock is of the interrupted-screw type, and is provided with four threaded and four slotted sectors. The front end of the axial recess in the block for the hub of the block carrier is closed by a bushing. Three vent holes leading from a cavity in the bushing to the rear through the breechblock permit the escape of gas from a ruptured primer. On a semicircular boss on the rear face of the breechblock are cut gear teeth, in which the gear teeth of the operating lever bevel gear mesh. The upper end of the circular boss on which the gear teeth are cut serves as a stop to limit the rotation of the block in the unlocked position. This upper end of the circular boss comes in contact with a hardened steel stop riveted to the inner face of the block carrier. A radial lug or tooth projects from the inner surface of the breechblock and engages an L-shaped slot cut in the hub of the block carrier, so that when the mechanism is unlocked no relative movement between the breechblock and the block carrier can take place.

In order to surely maintain this relation between the breechblock and the block carrier, a block latch, pivoted on the inner face of the carrier in the lower left-hand quadrant, engages a notch or

4.7 INCH GUN MODEL OF 1906
BREECH MECHANISM, ASSEMBLED



NO	NAME OF PART	NO	NAME OF PART
1	TRIGGER	31	TRIGGER SPRING
2	TRIGGER PIN	32	TRIGGER SPRING PLATE
3	TRIGGER SPRING	33	TRIGGER SPRING PLATE PIN
4	TRIGGER SPRING PLATE	34	TRIGGER SPRING PLATE PIN
5	TRIGGER SPRING PLATE PIN	35	TRIGGER SPRING PLATE PIN
6	TRIGGER SPRING PLATE PIN	36	TRIGGER SPRING PLATE PIN
7	TRIGGER SPRING PLATE PIN	37	TRIGGER SPRING PLATE PIN
8	TRIGGER SPRING PLATE PIN	38	TRIGGER SPRING PLATE PIN
9	TRIGGER SPRING PLATE PIN	39	TRIGGER SPRING PLATE PIN
10	TRIGGER SPRING PLATE PIN	40	TRIGGER SPRING PLATE PIN
11	TRIGGER SPRING PLATE PIN	41	TRIGGER SPRING PLATE PIN
12	TRIGGER SPRING PLATE PIN	42	TRIGGER SPRING PLATE PIN
13	TRIGGER SPRING PLATE PIN	43	TRIGGER SPRING PLATE PIN
14	TRIGGER SPRING PLATE PIN	44	TRIGGER SPRING PLATE PIN
15	TRIGGER SPRING PLATE PIN	45	TRIGGER SPRING PLATE PIN
16	TRIGGER SPRING PLATE PIN	46	TRIGGER SPRING PLATE PIN
17	TRIGGER SPRING PLATE PIN	47	TRIGGER SPRING PLATE PIN
18	TRIGGER SPRING PLATE PIN	48	TRIGGER SPRING PLATE PIN
19	TRIGGER SPRING PLATE PIN	49	TRIGGER SPRING PLATE PIN
20	TRIGGER SPRING PLATE PIN	50	TRIGGER SPRING PLATE PIN
21	TRIGGER SPRING PLATE PIN		
22	TRIGGER SPRING PLATE PIN		
23	TRIGGER SPRING PLATE PIN		
24	TRIGGER SPRING PLATE PIN		
25	TRIGGER SPRING PLATE PIN		
26	TRIGGER SPRING PLATE PIN		
27	TRIGGER SPRING PLATE PIN		
28	TRIGGER SPRING PLATE PIN		
29	TRIGGER SPRING PLATE PIN		
30	TRIGGER SPRING PLATE PIN		
31	TRIGGER SPRING PLATE PIN		
32	TRIGGER SPRING PLATE PIN		
33	TRIGGER SPRING PLATE PIN		
34	TRIGGER SPRING PLATE PIN		
35	TRIGGER SPRING PLATE PIN		
36	TRIGGER SPRING PLATE PIN		
37	TRIGGER SPRING PLATE PIN		
38	TRIGGER SPRING PLATE PIN		
39	TRIGGER SPRING PLATE PIN		
40	TRIGGER SPRING PLATE PIN		
41	TRIGGER SPRING PLATE PIN		
42	TRIGGER SPRING PLATE PIN		
43	TRIGGER SPRING PLATE PIN		
44	TRIGGER SPRING PLATE PIN		
45	TRIGGER SPRING PLATE PIN		
46	TRIGGER SPRING PLATE PIN		
47	TRIGGER SPRING PLATE PIN		
48	TRIGGER SPRING PLATE PIN		
49	TRIGGER SPRING PLATE PIN		
50	TRIGGER SPRING PLATE PIN		

DPG-36-6-11

REDUCED 1/16" = 1"

shoulder cut in the rear face of the block adjacent to the circular hub on which the gear teeth are cut. This latch is so pivoted that as the mechanism is swung free from the gun it moves forward sufficiently to engage the notch in the block, and also to cause the forward plane of the latch to project beyond the front of the block carrier; consequently when the mechanism is swung to the closed position the front face of the latch comes in contact with the rear face of the breech of the gun, thus forcing the latch out of the notch in the breechblock back into a recess in the carrier, and by continuing the motion of closing the mechanism the breechblock is free to rotate on the hub of the carrier and engages its threads with those in the gun. When the breechblock is in the locked position, a lug on the firing-lock case engages the front face of the tooth or lug on the breechblock, which locks the breechblock to the block carrier. This engagement between the lug on the breechblock and the lug on the firing-lock case serves to lock the block carrier to the breechblock and prevent displacement due to a blowback. This is accomplished through the medium of four additional lugs on the firing-lock case, which are arranged to interlock with corresponding lugs on the block 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 a hub on the block carrier, in which the firing-lock case is fitted.

The firing-lock 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 bore of the gun. The bushing in the front end of the breechblock, through which the firing pin passes, when in the fired position is fitted eccentrically with reference to the breechblock and is provided with a cavity of such dimensions that the breechblock is permitted to revolve freely about the firing pin, which is fixed in the hub of the block carrier and does not rotate. 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, due to the eccentric arrangement of the breechblock, thus masking the point of the pin and preventing any possible contact between the firing pin and the primer in the cartridge case when the block is unlocked. The block will be practically fully locked before any contact between the firing pin and the primer can take place. The firing pin is provided with a shoulder a short distance in rear of the forward end, which comes in contact with the rear face of the bushing if an attempt is made to fire the gun when the breech is unlocked. This is done to prevent any blow from coming on the point of the firing pin and injuring the same.

The loading tray is located in the breech recess and serves to protect the two lowest threaded sectors in the breech recess from being

bruised by the cartridge when loading the gun. Its middle portion is cut away in order to clear the lowest threaded sector on the block when the latter is closed. It is locked to the gun when the breech is open by the tray latch which is located in the rear lower face of the jacket and engages a slot in the rear lip of the tray. The latch is so placed that as the block carrier strikes the face of the breech it forces the latch to disengage its seat in the tray. As the block rotates, its lowest threaded sector which engages the tray causes the latter to rotate, its front and rear lips sliding in seats provided for that purpose in the breech recess.

FIRING MECHANISM.

The firing mechanism belongs to that type known as a continuous-pull mechanism—that is, the mechanism is cocked and fired by the pull on the lanyard or the downward pressure on the firing handle. This arrangement gives greater safety against prematures and permits of a quick repetition of the blow from the firing pin in case of a misfire.

FIRING PIN.

The firing pin is mounted in the firing-lock case. Near its front end it is provided with a collar which serves to guide the pin axially, and as a shoulder for the front end of the firing spring. It also serves as a means for preventing the forward movement of the firing pin until the firing spring has been compressed by the action of the lanyard or firing handle. The rear end of the firing pin is rectangular in cross section and is provided with a double lug against which the trigger fork engages at a point between its upper end and its axis. The engagement serves as a means of forcing the firing pin to its retracted or normal position, after the pin has been released and forced forward. Opposite the double lug for the trigger fork, the firing pin is provided with a smaller lug, which fits into a slot in the firing-spring sleeve and serves to hold the sleeve in its proper position for assembling the trigger fork. This provides a space between the rear face of the sleeve and the double lug on the firing pin. Through this space the trigger fork may be inserted by hand to its proper position.

FIRING-PIN SPRING.

The firing-pin spring is threaded over the firing pin from the rear end. Over this is assembled the firing-spring sleeve in such a manner that when it is seated in its proper position the firing-pin spring is put under an initial tension by being compressed between the collar on the front end of the firing pin and a shoulder or seat formed on the inside of the sleeve at its rear end. The rear end of the firing spring has a tang which fits in a recess drilled in the bearing surface of the firing-spring sleeve.

SEAR.

The sear, which is in the form of a leaf spring, is seated in a slot in the firing-lock case. It is provided with a thickened forward end, having a notch cut in it, in which a hardened portion of the periphery of the collar on the firing pin engages. Immediately in rear of this notch in the sear an inclined surface is provided, upon which the forward end of the firing-spring sleeve acts in its forward motion to compress the firing-pin spring and fire the gun. After the sleeve under the action of the trigger fork has traveled the required distance forward to produce the proper compression to the firing-pin spring, the sear is forced outward, thus releasing the engagement between the sear and the collar of the firing pin. The firing pin being released moves forward under the action of the firing-pin spring and fires the gun. On the rear end of the sear a cylindrical projection is formed which fits into a hole drilled into the firing-lock case. This serves to hold the sear in place.

TRIGGER FORK.

The trigger fork is seated in the rear of the firing-lock case and is constrained from displacement laterally by the walls of the firing-lock case. It engages the squared end of the trigger shaft. The trigger fork is bifurcated on the end which engages the firing pin and sleeve, and it is seated so that the flat sides of the firing pin pass between the bifurcated end of the fork and the rear face of the bifurcated end bears against the front faces of the double lug on the firing pin at a point located about halfway between the end of the trigger fork and its axis. This point of contact between the firing pin and trigger fork is important, as it helps to maintain the proper operation of the firing pin in its return action after firing. The extreme bifurcated ends of the trigger fork are made in the form of a circle, and these ends bear against a flat surface on the rear end of the firing-spring sleeve perpendicular to the axis of the sleeve. The fork does not touch the firing-spring sleeve at any other point. The firing spring is under tension at all times and exerts an equal pressure between the collar on the front end of the firing pin and its seat in the rear end of the firing-spring sleeve. The pressure on the firing-pin collar is transmitted to the trigger fork at the bearing between the latter and the double lug on the firing pin, while the pressure on the spring seat in the sleeve is transmitted to the trigger fork at its extreme bifurcated ends. These two forces are equal and opposite in direction, but have different lever arms with respect to the axis of rotation of the fork. The fork is, therefore, acted upon by a varying couple the moment of which is sufficient, when the trigger shaft is released, to rotate the trigger fork to the rear, carrying with it the firing pin through the medium of the double lug on its rear end.

This motion continues until the firing-pin collar engages the sear, at which time the spring, sleeve, trigger fork, and firing pin are in the normal positions and the firing mechanism again ready for action.

TRIGGER SHAFT.

The trigger shaft is assembled in a projection which forms a part of the firing-lock case and is held in place by a wire detent. Its function is to rotate the trigger fork forward in firing. It has at its upper end a squared portion on which the fork is mounted. At its lower end are two projections, the larger of which is provided with a hole for the attachment of a lanyard by which the gun should be fired until the spade at the end of the trail is sufficiently embedded in the ground to hold the carriage in place. The other projection on the trigger shaft is acted upon by the firing pallet, which is an extension of the firing-handle shaft. This latter arrangement serves as a means of firing the gun from a seat on the carriage.

FIRING-LOCK CASE.

The firing-lock case is designed to contain the complete firing mechanism. By this means the entire firing mechanism can be replaced in an instant. It contains the firing pin, firing-pin spring, firing-spring sleeve, sear, trigger fork, trigger shaft, and detent. It is provided with four lugs by which it is locked in place in the hub of the block carrier, and one lug forward of the other four, which engages behind a lug on the breechblock. This lug, together with the other four which lock the case to the carrier, serves to lock the block and carrier together.

The firing-lock case is held from displacement due to rotation by a spring catch or locking bolt. This locking bolt is fitted in a projection of the firing-lock case and the inner end enters a recess or seat in the rear face of the block carrier.

OPERATING LEVER.

The handle and body of the lever is recessed to receive the lever latch. The inner end of the lever is provided with beveled gear teeth, which mesh with corresponding teeth on the breechblock and serve as a means for opening and closing the mechanism. The lever is seated between two lugs on the block carrier and is held in place by a pivot.

BLOCK CARRIER.

The block carrier is hinged at its right side to the gun by means of the hinge pin. It is provided with a central inwardly projecting hub, upon which the breechblock is concentrically mounted. The hub is bored out eccentrically to receive the firing-lock case, which is held

in place from axial displacement by four lugs formed on the firing-lock case and four lugs formed on the inside of the bore of the block carrier. In the forward end of the central hub a slot is cut which extends to the rear and terminates in an L. This receives the lug on the breechblock and holds the block from displacement when the mechanism is open. Two lugs are formed on the rear face of the carrier just below its center. They form a seat for the operating lever. On the inner face in the lower left-hand quadrant a seat and pivot for the block latch is provided. In the upper right-hand quadrant on the inner face a hardened steel block stop is riveted. This limits the rotation of the block in the open position. On the right side of the carrier a projecting pallet is attached which serves to operate the extractor.

BLOCK LATCH.

A recess in the latch contains a spring which presses against the inner face of the block carrier, forcing the latch forward into its locking recess in the block, when the breech is open. When the block is locked, the latch rests against the rear face of the jacket. The latch serves to prevent rotation of the block when in its open position.

THE EXTRACTOR.

The extractor is located in a seat formed in the jacket. It is operated by the block carrier, the pallet on the latter serving to give it a quick throw at the end of the swing of the carrier in opening the mechanism. The extractor rolls on its forward or convex face and is prevented from being displaced by its trunnions, which slide in grooves formed in the top and bottom of the extractor seat. A lip in the extractor engages the rim of the cartridge case and serves as a means for ejecting the same.

OPERATING-LEVER LATCH.

The latch is fitted in a seat formed in the operating lever and serves to lock the handle from rotation, which in turn prevents rotation of the block. The latch rotates about a long steel pivot, which is so fitted that it interlocks with the lever latch under the action of the lever-latch spring.

HINGE PIN.

This is a hardened steel pin, and is held from displacement by a spring catch fitted to its lower end. A handy oiler seated in its top surface supplies oil to a spiral groove formed on its surface.

ACTION OF THE BREECH MECHANISM.

To open the breech, grasp the operating-lever handle; at the same time compress the lever-latch handle. This releases the latch from the catch on the block carrier. Rotate the operating lever to the

rear. During the first part of this movement ($67\frac{1}{2}^\circ$) the block and loading tray are rotated to their unlocked positions, at which time the stop on the block comes in contact with the stop on the block carrier and the tray latch opposite its seat in the loading tray. The block latch will drop into its notch in the block and the tray latch engage the tray at the moment of swinging the block carrier from the gun. The block is now locked against further rotation in either direction. During a further rotation of the operating lever of about 101° the block and block carrier swing about the hinge pin clear of the breech recess, the block carrier operates the extractor, unseating the cartridge case before the end of the 90° movement, and finally, as the pallet on the block carrier engages the extractor, the latter is given a quick throw which ejects the case free of the gun.

When another round is inserted, the rim of the cartridge case comes in contact with the extractor and forces it partly home. In closing the mechanism the movements are simply the reverse of opening; as the block comes in contact with the breech face of the gun the block latch is forced rearward, the tray latch forward, unlocking the block from the block carrier and the loading tray from the gun. Further rotation of the operating lever rotates the breechblock and loading tray, causing the threads of the former to engage those of the gun. This engagement of threads moves the block forward, due to the pitch of the threads, and firmly seats the cartridge in the chamber. At the final motion of the operating lever its latch engages the catch on the rear face of the block carrier, locking the block in the closed position. The gun is now ready to fire.

TO DISMANTLE THE FIRING MECHANISM.

Take hold of the locking bolt situated at the lower end of the firing-lock case, pull it to the rear, then revolve the firing-lock case upward about 45° and pull it gently to the rear. This will remove from the gun the firing-lock case with the firing mechanism complete. Press the trigger-shaft detent until it disengages from the notch in the firing-lock case. This will allow the trigger shaft, with its detent, to be withdrawn. Then gently press on the front of the firing pin, forcing it back into the firing-lock case. This will allow the trigger fork to be removed. Then, with one finger placed on the front end of the sear, force it outward; at the same time grasp the front end of the firing pin. Give it a sharp pull. This will remove the firing-pin spring and sleeve from the firing-lock case. Then place the front end of the firing pin against a block of wood, bear down on the firing-spring sleeve until the spring is compressed sufficiently to disengage the slot in the rear end of the sleeve from the small lug on the rear end of the firing pin. Slightly turn the sleeve, and it can be separated

from the spring and pin. By an unscrewing motion the spring can be removed from the pin. The sear can be removed by gently pressing it toward the center of the firing-lock case.

To assemble, reverse these operations, taking care before driving too hard on the end of the trigger shaft that the square hole in the trigger fork is in position to receive the tapered end of the trigger shaft. No tools are required for assembling or dismantling the firing mechanism except possibly a small rod or stick to pry out the trigger fork.

TO DISMANTLE 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 block by pressing it into its seat in the carrier. Take hold of the block and revolve it to the left until it stops; then pull it to the rear off the carrier. The block latch can now be readily removed. After the firing-lock case has been removed, the operating lever can be removed by forcing its pivot up from beneath by a gentle pressure. The lever latch can be removed by pressing in on the latch at a point near its lower end and opposite its pivot. A hole in the latch is cut eccentric with reference to the pivot, and a shoulder on the pivot prevents their displacement until the latch is forced in and the hole is concentric with the pivot. When this occurs, the pivot can be readily pulled out and the latch removed. To remove the block carrier, force the hinge pin up by hand until it can be caught by the head; if the pin sticks, by swinging the block carrier back and forth it can readily be loosened. The extractor can now be removed from its seat. Pressing on the tray latch sufficiently to force it into its seat permits the loading tray to be removed from the breech recess. Reverse these operations for assembling the mechanism. No tools are required for dismantling this breech mechanism.

CARE OF THE GUN.

After firing, the bore of the gun should be cleaned to remove the residue of smokeless powder, and then oiled. In cleaning, wash the bore with a solution made by dissolving one-half pound of sal soda in 1 gallon of boiling water. After washing with the soda solution, wipe perfectly dry, and then oil the bore with a thin coating of the slushing oil furnished for the purpose. A slush brush for use in oiling the bore will be issued by the Ordnance Department upon requisition.

The breech mechanism should be kept clean and well oiled. It should be dismounted from time to time for examination and oiled when assembled.

AMMUNITION.

Fixed ammunition is used in the 4.7-inch gun and is made up with either shrapnel or high-explosive common steel shell. The rounds as made up vary slightly in length with the type of projectile used. The ammunition chests of the battery are of sufficient size to take either kind of ammunition furnished, so that the number of each kind to be carried is a matter for regulation by proper authority. Each round is issued with projectile filled and fuzed. The weight of the projectile is 60 pounds, and the total weight of each round is about 73.8 pounds. The components of each round are the cartridge case with primer, the powder charge, projectile, and fuze.

A cast-iron shell has been designed having the same center of gravity and the same exterior dimension as the common steel shell. These cast-iron shells are at present used without bursting charge for proof firing, etc. A high-explosive shrapnel, having a base charge of black powder and a head charge and matrix of high-explosive compound, is being designed and tested with a view to its adoption to supersede the ordinary shrapnel and high-explosive shell.

CARTRIDGE CASE.

[Plate III.]

The cartridge case is a solid drawn brass case 16.6 inches long. It has a capacity of 251 cubic inches, and weighs with primer 7.875 pounds. The head or base of the case has a projecting flange or rim under which the lip of the extractor engages.

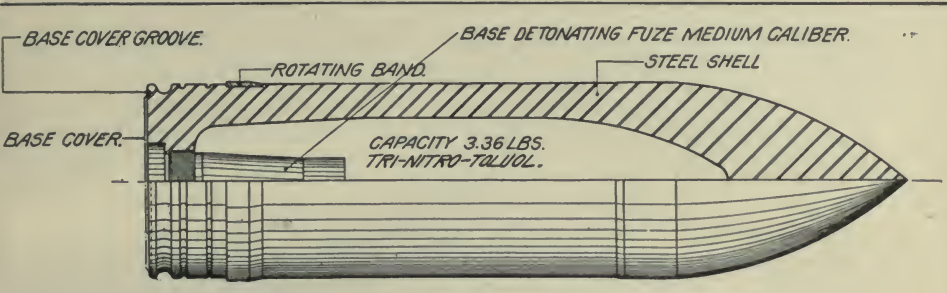
The center of the base is bored out to form a seat into which the primer is forced. The primer seats are mandreled to near the finished dimensions with a tapered steel plug to toughen the metal of the cartridge case around the primer seat and then reamed to finished size. This toughening is necessary to prevent expansion of the seat under gas pressure with a consequent looseness of the primer in subsequent firings. The primer is inserted in the case by means of a primer inserting press to avoid injury to the primer seat or explosion of the primer. Special decapping tools are issued for use in removing exploded primers from cartridge cases.

A circular groove is to be cut in the base of the cartridge case and is painted red to indicate rounds of shrapnel, but is not painted with rounds of high-explosive shell.

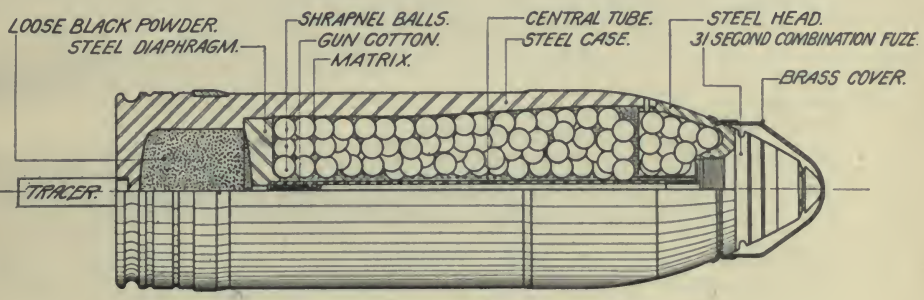
THE PRIMER.

[Plate III.]

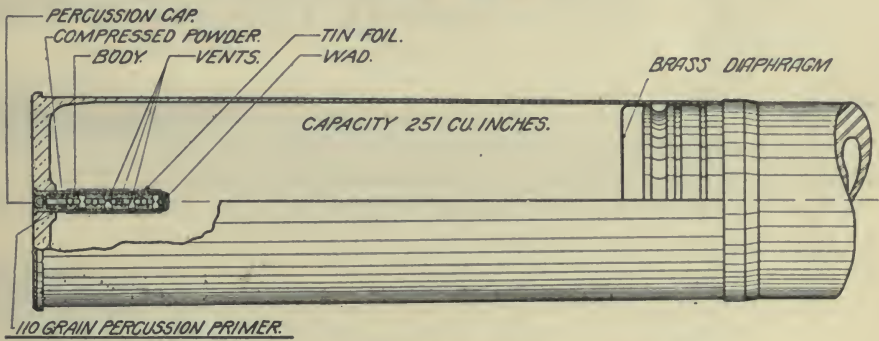
To insure the ignition of smokeless-powder charges in cartridge cases it is necessary that the primers either contain in themselves, in addition to the percussion composition, an auxiliary charge of black



COMMON STEEL SHELL MODEL OF 1905.



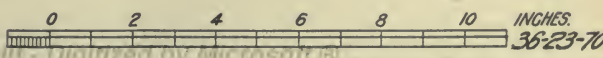
SHRAPNEL.



CARTRIDGE CASE.



HEAD OF CASE.



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.

The "110-grain percussion primer" is shown in Plate III, and 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, assembled as shown on Plate III. The percussion composition is known as the "No. 42" mixture, and contains the following ingredients:

	Per cent.
Flowers of sulphur.....	21.965
Antimony sulphide.....	30.829
Potassium chlorate.....	47.206

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 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 large primer-inserting press is provided for inserting both types of primers, which must be carefully pressed, and not hammered, into their seats in the cartridge cases. Special decapping tools are also issued for removing old primer cases from cartridge cases without injury to the latter.

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 95 ounces. The granulation is determined so that the charge placed loosely in the cartridge case will practically fill the space in rear of the projectile. In making up the cartridges a brass diaphragm is soldered in place next to the powder charge to avoid the possibility of moisture reaching the powder charge, thus holding the powder charge in contact with the primer. The charge gives a muzzle velocity of 1,700 feet per second, with a maximum pressure in the bore not exceeding 33,000 pounds per square inch.

Service smokeless powder *must not be used* for blank charges. For that purpose the Ordnance Department furnishes special powder. This is at present "black saluting powder." Effort is being made to develop a smokeless "maneuver powder," which, when used in blank charges, will simulate the flash and report of service rounds.

PROJECTILES.

COMMON STEEL SHELL.

[Plate III.]

The common steel shell is shown in Plate III. It 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 1.9 inches from the base.

Between the band and the base are cut three circumferential grooves, the front one of which is filled with material insuring a water-proof joint in the assembled cartridge. This groove and the middle groove are used as crimping grooves. The rear groove, which is somewhat deeper than the others, is to allow the projectile to be readily gripped to remove it from the limber or caisson when it is used for separate loading ammunition in the 4.7-inch howitzer. 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 the crimping grooves at several points, securely fixing the projectile in the case. The base of the shell is tapped for a base detonating fuze, medium caliber, and is fitted with a copper base cover secured in the base cover groove by lead calking wire. The base cover consists of a copper

cover and a lead disk, lying between the cover and the projectile. This base cover seals the joint between fuze and shell against the entrance of powder gases into the shell cavity. The latter contains a bursting charge of 3.36 pounds of trinitrotoluol. The weight of the shell with bursting charge and fuze is 60 pounds. The shell is always issued filled and fuzed.

SHRAPNEL.

[Plate III.]

The shrapnel is a base-charged shrapnel fitted with a combination fuze. The case is of forged steel with solid base. The rotating band is forced into an annular groove cut in the case 1.9 inches from the base. The front or mouth of the case is closed by a steel head, screwed in and tapped to take the service 31-second combination time and percussion fuze. The method of assembling the shrapnel to the cartridge case is the same as that described above for the common steel shell. The bursting charge is composed of a charge of loose black powder (9.44 ounces). The bursting charge, thus arranged, is covered by a steel diaphragm. The diaphragm supports a steel central tube which extends forward to the fuze, and thus affords a conduit for the flames from the fuze to the bursting charge. At the lower end of the central tube a stopper of dry guncotton is fitted to assist the ignition of the bursting charge and to prevent the loose powder charge from getting into the tube. The shrapnel filling is composed of 711 balls, each approximately 230 grains in weight. The balls are approximately 0.54 inch in diameter. The balls are poured around the central tubes and rest upon the steel diaphragm. The interstices contain a smoke-producing matrix, the lower half being white naphthalene and the upper half melted rosin. This matrix, in addition to serving as a smoke producer, also assists to prevent deformation of the lead balls.

In action the case is not ruptured upon the explosion of the bursting charge; the head is stripped and the balls are shot out of the case with an increase of velocity of about 275 feet per second. The remaining velocity of the shrapnel at 9,700 yards is approximately 892 feet per second, and the time of flight 31.6 seconds, so that at that range, with the increase of velocity due to the bursting charge, this shrapnel with the 31-second fuze is an efficient projectile. The weight of the shrapnel, with fuze, is 60 pounds.

SEMPLE TRACER.

The Semple tracer is a brass tube about 3 inches long 0.625 inch in diameter, threaded at one end in order that it may be readily attached to the base of the common shrapnel, a limited number of which will probably be tapped to receive the tracer.

The tube is filled with an illuminating composition and is provided with a percussion primer and a firing pin for igniting the illuminate. The firing pin is driven into the primer of the tracer when the piece is fired by the pressure of the powder gas. A counter bore 0.375 inch in diameter and 0.02 inch deep and filled with red paint will be formed in the base of the cartridge case to show that such rounds are fitted with tracers.

FUZES.

COMBINATION FUZES.

These fuzes are point fuzes with combination time and percussion elements for use with shrapnel. They are of the type known as the ring or "dial" fuze, in which the time train is set by turning a graduated ring which carries part of the time train. These fuzes may be reset as often as desired.

FRANKFORD ARSENAL COMBINATION FUZE.

[Plate IV.]

This fuze consists of the following parts, assembled as shown in the drawing:

- a* Body, bronze.
- b* Closing cap, brass.
- b'* Vents in closing cap.
- b²* Safety split pin.
- c* Upper time-train ring, Tobin bronze.
- c'* Washer for time-train ring, graduated, felt cloth.
- d* Time-train ring, graduated, Tobin bronze.
- d'* Washer for body, felt cloth.
- d²* Rotating pin, brass.
- e* Concussion plunger.
- e'* Concussion resistance ring, brass.
- f* Firing pin, brass.
- g* Vent leading to upper time train.
- h* Compressed powder pellet.
- i* Upper time train, compressed powder.
- j* Compressed powder pellet, in vent leading to lower time train.
- j'* Compressed powder pellet in lower time-train vent.
- k* Lower time train, compressed powder.
- l* Brass disk, crimped in place.
- m* Compressed powder pellet in vent *o*.
- o* Vent leading to magazine.
- p* Powder magazine.
- q* Percussion plunger.
- r* Percussion primer.
- s* Vents leading from percussion primer to magazine.
- u* Bottom closing screw, brass.
- v* Washer for closing screw, muslin.
- w* Washer for closing screw, brass.

31 SECOND COMBINATION FUZE MODEL OF 1907 M.

FIG. 1.

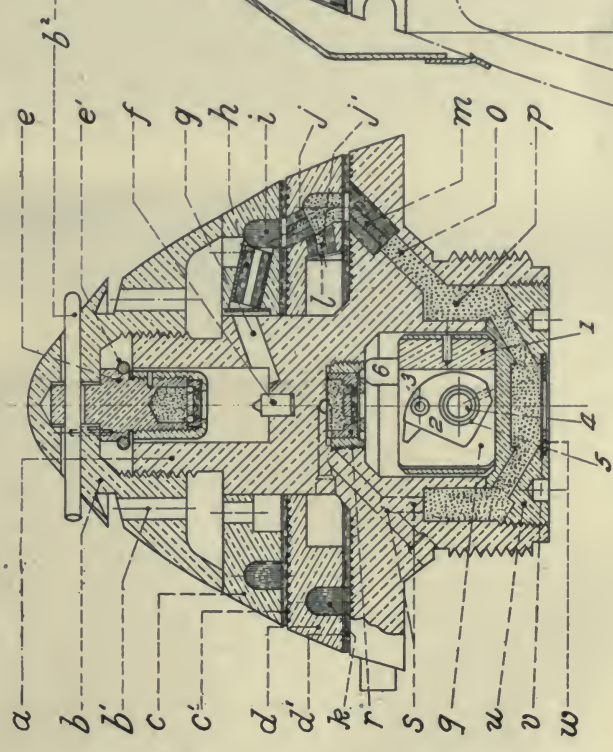
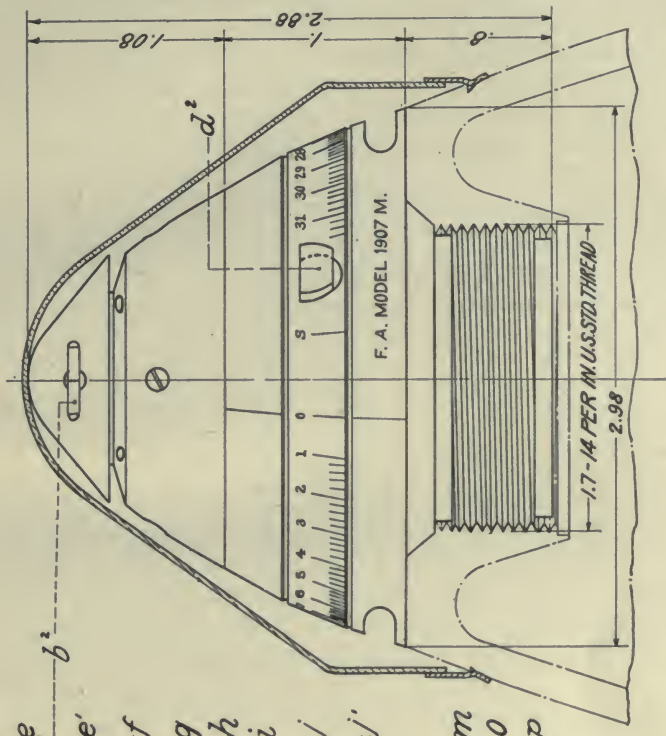


FIG. 2.



36-23-69

The body *a* of this fuze is machined from a bronze casting. The time-train rings *c* and *d* are turned from hard-rolled rods of Tobin bronze. An annular groove in the shape of a horseshoe is milled in the lower face of each of the time-train rings. Meal powder is compressed into these grooves under pressure of 51,000 pounds per square inch, forming a time train, the total length of which is 12.35 inches.

The time element of this fuze is composed principally of the following parts: The time or concussion plunger *e*, the concussion resistance ring *e'*, the firing pin *f*, the vent *g*, leading to the upper time train, the compressed powder pellet *h*, the upper time train *i*, the vent *j*, the lower time train *k*, the compressed powder pellet *m* in the vent *o*, leading to the powder magazine *p*.

The plunger *e* is cylindrical in shape and contains the percussion composition in a recess at its base. The weight of the plunger rests upon the concussion-resistance ring *e'*, which keeps the primer from contact with the firing pin. At discharge of the gun the resistance of the ring is overcome and the primer is exploded by contact with the firing pin.

As stated above, the annular grooves into which the meal powder of the time train is pressed are in the shape of a horseshoe, a solid portion being left between the ends of the groove in each ring or disk.

The upper time-train ring *c* is prevented from rotating by the pins *x*, which are halved into the fuze body and the inner circumference of the ring.

The vent *g* is drilled through the walls of the concussion-plunger chamber, and is exactly opposite a hole in the inner surface of the upper time train leading to the end of the train from which the direction of burning is anticlockwise.

The hole *j* is drilled through the upper face of the lower time-train ring *d* to the end of the lower time-train groove, from which the direction of burning is clockwise. The lower time-train ring is movable and is graduated on its outer edge in a clockwise direction from 0 to 31.6; these divisions are subdivided into five equal parts. A radial pin *d²* is provided in the lower ring for engagement with a notch in the fuze setter for setting the fuze. A line on the lower flange of the fuze stock is the datum line for fuze settings.

The vent *o* is drilled through the flange of the fuze stock to the powder magazine *p*, and leads to the same end of the lower time train as the vent *j*—that end from which the direction of burning is clockwise—when the fuze is at its “zero” setting.

The action of the fuze as a time fuze is as follows:

Assume first the “zero” setting as shown on the figure. At discharge of the gun the concussion plunger arms and fires its primer.

The flame from the primer passes out through the vent g , igniting the pellet h , the end of the upper time train i , down through the vent j , to the end of the lower time train k , and thence through the vent o to the magazine p , the flame from which is transmitted to the base charge in the shrapnel. It will be seen that for the "zero" setting of the fuze the origin of both upper and lower time trains are in juxtaposition. Assume any other setting, say twelve seconds: The vent j has now changed its position with respect to the vent h , leading to the beginning of the upper time train and the vent o , leading to the powder magazine p , both of which points are fixed by the angle subtended between the 0 and the 12 settings. The flame now passes out through vent g and burns along the upper time train in an anticlockwise direction until the vent j is reached, where it passes down to the beginning of the lower time train and burns back in a clockwise direction to the position of the vent o , whence it is transmitted by the pellet of compressed powder m to the powder magazine p .

For the 31.6-second setting the vent j , leading to the beginning of the lower time train, is opposite the end of the upper time train and the end of the lower time train is opposite the vent o , leading to the powder magazine. It will now be seen that to reach the magazine p and burst the shrapnel the entire length of time train in both rings must be burned.

As already stated, the annular grooves in the lower face of each ring for the powder trains do not form complete circles, a solid portion being left between the ends of the grooves in each. This solid portion is utilized to obtain a setting at which the fuze can not be exploded, known as the "safety point."

This point is marked by a line on the outer edge of the movable time train, surmounted by an "S" and is located about halfway between the zero mark and the 31.6-second graduation. When this point is brought opposite the line on the lower flange of the fuze body the vent j is covered by the solid metal between the ends of the upper train, and the vent o , leading to the powder magazine p , is covered by the solid metal between the ends of the lower or movable time train.

At the safety setting it will be seen that the upper train may burn entirely out in case of accidental firing of the time plunger, or in case it may be desired to burst the shrapnel by impact or percussion, without the flame being able to reach the magazine p .

The cloth washers c' and d' are glued to the upper face of the graduated time-train ring and to the upper face of the flange on the fuze stock. These surfaces are corrugated, as shown, to make the washers adhere more strongly. The function of the washers is to make a gas check and prevent premature action of the fuzes.

The compressed pellet j' , in the vent leading from the outside to the beginning of the lower time train, is to release the pressure of the gases due to the burning train. The gases from both time trains escape into the outer air through the annular spaces shown in the illustration and the vents b' in the closing cap.

The percussion element of this fuze as shown in the plate consists of a centrifugal percussion plunger q and an ordinary percussion primer r .

The centrifugal plunger (1) is provided with a slot to receive the firing pin (2), which is mounted on a fulcrum (3) and kept in the unarmed position by two safety pins (4) in recesses on opposite sides of the plunger and held in the hole in the firing pin by the tension of the springs (5). These springs are designed to suit the velocity of rotation of the particular projectile in which the fuze is used. The centrifugal force due to the rotation of the projectile forces the pins outward against the tension of the springs and releases the firing pin, which is rotated by the same centrifugal force into its armed position. The entire plunger and housing is held to the rear by two spring housings (6). These hold the plunger and pin away from the primer during handling, transportation, and flight.

The system of vents through the walls of the fuze shown in figure 3 conduct the flame from the percussion primer to the magazine p .

The bottom closing screw closes the percussion-plunger recess and keeps the powder in the magazine. The muslin washer v is coated with shellac and held in place by the brass washer w , over the outer edge of which a projecting lip is crimped.

These fuzes are issued assembled in shrapnel. For transportation in limbers and caissons the fuze should always be set at the safety point.

The fuze is provided with a waterproof hood of thin brass, hermetically sealed. The hood should be stripped off before an attempt is made to set the fuze. Remove the safety wire before setting the fuze, and if the round is not fired the safety wire should be replaced. If the safety wire can not be replaced the round should not be carried in ammunition chests or roughly handled and should be fired at the next firing.

BASE DETONATING FUZE.

The base of the shell is tapped for the medium caliber base detonating fuze. The percussion plunger of which is similar to that used in the combination fuze. Under no conditions should this fuze be disassembled when recovered in unexploded shell, as fatal accidents are known to have occurred by so doing.

MARKING OF AMMUNITION PACKING BOXES.

Both ends and sides of the box are marked with conspicuous characters to facilitate the rapid identification of the ammunition contained therein. The conspicuous marking consists of the following symbols:



The shell and flame are always in red for mobile artillery ammunition.

The numeral "4.7" refers to the caliber, and the letter "G" differentiates ammunition for the 4.7-inch gun from ammunition for the 4.7-inch howitzer. The numeral "4.7" and the letter "G" are in yellow for shrapnel and black for high explosive shell.

The star when present in the conspicuous marking indicates that the projectiles are provided with tracers. A red star indicates a night tracer and a black star a day tracer.

In addition to the conspicuous marking the quantity and type of ammunition are indicated without symbols by the marking "1 fixed common shrapnel," etc., so that in case one is not familiar with the conspicuous marking system he can immediately ascertain the key by this additional marking. Similarly the word "Tracer" is added in amplification of the star symbol.

Also on both ends of the box the word "Lot" followed by a number appears. This refers to the ammunition lot, and in case of any trouble arising with regard to the functioning of the ammunition this lot number should be quoted in the report.

On the sides of the box similar markings are found accompanied by a pictorial stenciled symbol indicating the type of projectile, the tracers, and the fact that the ammunition is fixed.

For blank ammunition when packed assembled, the numeral "4.7" and the letter "G" are in blue.

ALLOWANCE OF AMMUNITION.

Shell and shrapnel ammunition is issued by the Ordnance Department in moisture-proof boxes having a zinc lining, hermetically sealed, each box containing one round. A load for a four-mule Army wagon varies from 23 to 28 boxes, and for a six-mule wagon from 32 to 37 boxes, depending upon the condition of the roads.

The annual allowance of ammunition for the instruction of Field Artillery 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 4.7-inch guns, drill cartridges, subcaliber cartridges, revolvers and shotguns and care of the same, disposition of empty shells, etc.

BLANK AMMUNITION.

Blank metallic ammunition is for use in salute firing, morning and evening gun firing, maneuver firing, etc., and consists 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 for the 4.7-inch gun is identical with the service cartridge case.

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 post 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 for the 4.7-inch gun. 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 4.7-inch gun is $1\frac{1}{2}$ pounds of saluting powder.

PREPARATION OF BLANK METALLIC AMMUNITION.

Blank metallic ammunition will be assembled at posts or in the field under the personal supervision of a commissioned officer, who will be held responsible that it is prepared in the manner prescribed in current orders. For detailed information and instructions for the preparation of blank ammunition, see O. O. pamphlet No. 1658.

For this purpose there are issued cartridge cases, saluting powder in bulk, tight-fitting felt wads, rubberine, or other quick-drying paint, primers, and reloading and cleaning outfits.

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 saluting 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. Care should be taken that no paint gets into the powder charge, as it may form a mixture which will burn rather than explode and may ignite the next round, causing a premature explosion.

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.

CARE OF CARTRIDGE CASES.

As soon after firing as practicable the fired primers should be removed from the cartridge case by means of the decapping tool furnished with the reloading outfit. The case should be thoroughly washed in a strong solution of lye or soft soap to remove all powder residue. It should then be thoroughly rinsed and dried and lightly oiled.

If the cartridge cases are carefully cleaned and washed immediately after firing, not only will less labor be required but the life of the cases 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.
- 2½ ounces soft soap.
- 5½ 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.

Primers that misfire should be turned in with the cases to the ordnance establishment prescribed in the target-practice order.

Resizing of cartridge cases.—The resizing of 4.7-inch cartridge cases that have become deformed in service is done at designated ordnance establishments.

Range table for the 4.7-inch gun.

[Shell and shrapnel, weight 60 pounds. M. V.=1,700 feet per second.]

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Range.	Angle of elevation.	ΔX for $\pm \Delta V$ elevation.	ΔX for $\pm \Delta 10$ F. S. M. V.	ΔX for wind 10 M. P. H.	ΔX for change of $\pm \frac{1}{2} C$.	Time of flight.	Fuze setting.	Drift.	Deflection for 10 miles crosswind.	Angle of departure.	Slope of fall.	Terminal velocity.	Maximum ordinate.	Values of "C."	Values of $\frac{B c}{1a}$
Yds.	°	Yds.	Yds.	Yds.	Yds.	Secs.	Disc.	Mils.	Mils.	°	100—	F. S.	Ft.		
100	0 00.0	13.2	1.2	0.1	0.1	0.18	0.3	0.1	0.1	0 5.4	565	1,681	1.4	.....	.....
200	0 5.5	17.9	2.4	.2	.3	.36	.4	.1	.1	0 10.9	232	1,662	2.8	.....	.....
300	0 11.1	17.6	3.6	.3	.6	.54	.6	.2	.2	0 16.6	187	1,644	4.2	.....	.....
400	0 17.0	17.3	4.8	.4	1.0	.72	.8	.3	.3	0 22.5	139	1,625	5.6	.....	.....
500	0 23.1	17.0	5.9	.5	1.5	.91	1.0	.4	.3	0 28.6	110	1,607	7.0	.....	.....
600	0 29.4	16.7	7.0	.6	2.2	1.10	1.3	.4	.3	0 34.9	91	1,588	8.4	.....	.....
700	0 35.8	16.4	8.1	.7	3.1	1.24	1.6	.5	.4	0 41.4	77	1,570	9.8	.....	.....
800	0 42.5	16.1	9.1	.8	4.2	1.48	1.9	.6	.4	0 48.1	66	1,552	11.2	.....	.....
900	0 49.4	15.9	10.1	.9	5.5	1.67	2.2	.7	.5	0 55.0	58	1,535	12.6	.....	.....
1,000	0 56.4	15.6	11.1	1.0	7.0	1.87	2.5	.7	.5	1 2.1	51	1,517	14.0	3.43	0.7820
1,100	1 3.5	15.3	12.0	1.2	8.8	2.07	2.8	.8	.6	1 9.2	46	1,499	17	.....	.....
1,200	1 10.6	15.0	12.9	1.4	10.8	2.27	3.1	.9	.6	1 16.3	41	1,481	21	.....	.....
1,300	1 17.4	14.7	13.8	1.7	13.0	2.47	3.4	1.0	.7	1 23.5	37	1,464	25	.....	.....
1,400	1 24.9	14.5	14.7	2.0	15.4	2.68	3.7	1.1	.7	1 30.7	34	1,447	30	.....	.....
1,500	1 32.1	14.2	15.6	2.3	18.0	2.89	4.0	1.2	.8	1 38.0	32	1,430	35	.....	.....
1,600	1 39.4	13.9	16.5	2.7	20.7	3.10	4.2	1.3	.8	1 45.3	29	1,413	40	.....	.....
1,700	1 46.8	13.6	17.4	3.1	23.5	3.31	4.5	1.4	.9	1 52.7	27	1,396	45	.....	.....
1,800	1 54.3	13.4	18.3	3.6	26.4	3.53	4.8	1.5	1.0	2 0.2	25	1,379	51	.....	.....
1,900	2 1.8	13.1	19.2	4.2	29.3	3.75	5.1	1.6	1.0	2 7.7	23	1,363	57	.....	.....
2,000	2 9.3	12.8	20.0	4.8	32.3	3.98	5.4	1.7	1.1	2 15.3	22	1,347	64	3.37	0.8049

Range table for the 4.7-inch gun—Continued.

[Shell and shrapnel, weight 60 pounds. M. V.=1,700 feet per second.]

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Range.	Angle of elevation.	ΔX for $\pm 1'$ elevation.	ΔX for $\pm 10'$ elevation.	ΔX for F. S. M. V.	ΔX for wind 10 M. P. H.	ΔX for change of $\pm 1^\circ$ C.	Time of flight.	Fuze setting.	Drift.	Deflection for 10 miles crosswind.	Angle of departure.	Slope of fall.	Terminal velocity.	Maximum ordi-nate.	Values of "C."	Values of $\frac{B_c}{f_a}$
Yds.	°	Yds.	Yds.	Yds.	Yds.	Secs.	Dis.	Mils.	Mils.	°	100-	F. S.	Ft.			
2,100	2	17.1	12.5	20.8	5.5	35.4	4.21	5.7	1.8	1.2	2 23.1	20	1,331	71		
2,200	2	25.1	12.3	21.6	6.2	38.6	4.44	6.0	1.9	1.2	2 31.1	19	1,314	79		
2,300	2	33.2	12.0	22.4	6.9	41.8	4.67	6.3	2.0	1.3	2 39.3	18	1,297	87		
2,400	2	41.6	11.7	23.2	7.6	45.0	4.91	6.6	2.1	1.4	2 47.7	17	1,281	96		
2,500	2	50.2	11.4	24.0	8.4	48.3	5.15	6.9	2.2	1.4	2 56.3	16	1,267	105		
2,600	2	59.0	11.2	24.8	9.2	51.6	5.39	7.2	2.3	1.5	3 5.1	15	1,253	115		
2,700	3	7.9	10.9	25.6	10.1	55.0	5.63	7.5	2.4	1.6	3 14.1	14	1,239	126		
2,800	3	17.2	10.7	26.3	11.0	58.5	5.88	7.8	2.6	1.7	3 23.4	14	1,225	138		
2,900	3	26.7	10.4	27.0	11.9	62.0	6.13	8.1	2.7	1.8	3 32.9	13	1,212	150		
3,000	3	36.3	10.2	27.7	12.9	65.6	6.38	8.4	2.8	1.8	3 42.6	12	1,199	164	3.27 0.8301	
3,100	3	46.1	10.0	28.4	14.0	69.2	6.64	8.7	3.0	1.9	3 52.4	12	1,187	178		
3,200	3	56.0	9.8	29.0	15.2	72.8	6.90	9.0	3.1	1.9	4 2.3	11	1,175	192		
3,300	4	5.9	9.6	29.6	6.4	76.5	7.16	9.3	3.3	2.0	4 12.3	11	1,163	207		
3,400	4	16.0	9.5	30.2	17.7	80.2	7.42	9.7	3.4	2.1	4 22.4	10	1,151	222		
3,500	4	26.3	9.3	30.7	19.0	84.0	7.69	10.0	3.6	2.2	4 32.7	10	1,140	238		
3,600	4	36.8	9.2	31.2	20.3	87.8	7.96	10.3	3.7	2.2	4 43.2	9	1,130	255		
3,700	4	47.5	9.0	31.7	21.7	91.7	8.23	10.6	3.9	2.3	4 54.0	8	1,120	274		
3,800	4	58.5	8.9	32.2	23.1	95.7	8.51	10.9	4.0	2.3	5 5.0	8	1,110	294		
3,900	5	9.7	8.8	32.7	24.5	99.7	8.79	11.3	4.2	2.4	5 16.2	8	1,101	315		
4,000	5	21.1	8.6	33.1	26.0	103.8	9.08	11.6	4.4	2.5	5 27.7	7	1,093	336	3.19 .8509	
4,100	5	32.7	8.5	33.6	27.5	107.8	9.37	11.9	4.5	2.5	5 39.3	7	1,085	358		
4,200	5	44.4	8.4	34.1	29.0	111.8	9.66	12.2	4.7	2.6	5 51.0	7	1,077	381		
4,300	5	56.3	8.3	34.6	30.5	115.8	9.95	12.6	4.9	2.7	6 2.9	6	1,069	405		
4,400	6	8.3	8.2	35.0	32.1	119.9	10.24	12.9	5.0	2.7	6 15.0	6	1,061	430		
4,500	6	20.6	8.1	35.4	33.7	124.0	10.53	13.2	5.2	2.8	6 27.3	6	1,054	456		
4,600	6	33.0	8.0	35.8	35.3	128.2	10.82	13.5	5.4	2.9	6 39.7	6	1,047	482		
4,700	6	45.5	7.9	36.2	36.9	132.4	11.12	13.9	5.6	2.9	6 52.3	6	1,040	509		
4,800	6	58.2	7.8	36.6	38.6	136.6	11.42	14.2	5.7	3.0	7 5.0	5	1,034	537		
4,900	7	11.1	7.7	37.0	40.3	140.9	11.73	14.5	5.9	3.1	7 17.9	5	1,027	566		
5,000	7	24.2	7.6	37.4	42.0	145.2	12.04	14.9	6.1	3.1	7 31.0	5	1,021	597	3.15 .8620	
5,100	7	37.4	7.5	37.7	43.7	149.5	12.36	15.2	6.3	3.2	7 44.3	5	1,015	630		
5,200	7	51.0	7.4	38.0	45.3	153.8	12.68	15.6	6.5	3.3	7 57.9	5	1,009	664		
5,300	8	4.9	7.3	38.3	47.0	158.1	13.00	15.9	6.7	3.3	8 11.8	4	1,003	700		
5,400	8	19.0	7.2	38.6	48.7	162.4	13.32	16.2	6.9	3.4	8 26.0	4	997	736		
5,500	8	33.5	7.2	38.9	50.4	166.7	13.65	16.6	7.2	3.4	8 40.5	4	991	773		
5,600	8	48.2	7.1	39.2	52.1	171.0	13.98	16.9	7.4	3.5	8 55.2	4	985	811		
5,700	9	3.1	7.0	39.5	53.9	175.3	14.31	17.3	7.6	3.6	9 10.1	4	979	850		
5,800	9	18.1	7.0	39.8	55.7	179.6	14.64	17.6	7.8	3.6	9 25.2	4	974	891		
5,900	9	33.4	6.9	40.1	57.5	183.8	14.97	18.0	8.0	3.7	9 40.5	4	969	933		
6,000	9	48.9	6.8	40.3	59.3	188.0	15.30	18.3	8.3	3.8	9 56.0	3	964	976	3.08 .8809	
6,100	10	4.4	6.8	40.6	61.1	192.2	15.63	18.6	8.5	3.8	10 11.6	3	960	1,020		
6,200	10	20.0	6.7	40.9	63.0	196.4	15.96	19.0	8.8	3.9	10 27.2	3	956	1,064		
6,300	10	35.6	6.6	41.2	64.9	200.6	16.29	19.3	9.0	3.9	10 42.8	3	952	1,110		
6,400	10	51.1	6.6	41.5	66.9	204.7	16.63	19.7	9.2	4.0	10 58.4	3	948	1,157		
6,500	11	6.7	6.5	41.9	68.9	208.8	16.97	20.0	9.5	4.0	11 14.0	3	944	1,206		
6,600	11	22.3	6.5	42.2	70.9	212.9	17.31	20.4	9.7	4.1	11 29.6	3	940	1,256		
6,700	11	37.9	6.4	42.5	73.0	217.0	17.65	20.7	9.9	4.1	11 45.2	3	937	1,307		
6,800	11	53.4	6.4	42.8	75.2	221.1	18.00	21.1	10.2	4.2	12 0.8	3	934	1,360		
6,900	12	9.0	6.3	43.1	77.4	225.2	18.35	21.4	10.4	4.2	12 16.4	3	931	1,414		
7,000	12	24.6	6.3	43.4	79.5	229.3	18.70	21.8	10.7	4.3	12 32.0	3	929	1,469	3.13 .8688	
7,100	12	40.1	6.2	43.7	81.7	233.4	19.05	22.1	10.9	4.3	12 47.6	3	927	1,527		
7,200	12	55.9	6.2	44.0	83.9	237.5	19.40	22.5	11.2	4.3	13 3.4	2	925	1,585		
7,300	13	11.9	6.1	44.3	86.1	241.6	19.75	22.8	11.4	4.4	13 19.4	2	922	1,644		
7,400	13	28.1	6.1	44.6	88.4	245.7	20.10	23.2	11.7	4.4	13 35.6	2	919	1,704		
7,500	13	44.4	6.0	44.9	90.7	249.8	20.45	23.5	11.9	4.5	13 52.0	2	917	1,766		
7,600	14	1.0	6.0	45.2	93.0	253.9	20.81	23.9	12.2	4.5	14 8.6	2	916	1,828		
7,700	14	17.9	5.9	45.5	95.3	257.9	21.17	24.2	12.5	4.5	14 25.5	2	914	1,892		
7,800	14	35.0	5.9	45.8	97.7	261.9	21.53	24.6	12.7	4.6	14 42.7	2	912	1,956		
7,900	14	52.5	5.8	46.2	100.1	265.9	21.89	25.0	13.0	4.6	15 0.2	2	910	2,020		
8,000	15	10.3	5.8	46.4	102.6	269.9	22.25	25.3	13.2	4.6	15 18.0	2	908	2,084	3.23 .8415	

Range table for the 4.7-inch gun—Continued.

(Shell and shrapnel, weight 60 pounds. M. V.=1,700 feet per second.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Range.	Angle of elevation.	ΔX for $\pm 1'$ elevation.	ΔX for ± 10 F. S. M. V.	ΔX for wind M. P. H.	ΔX for change of $\pm 1^\circ$ C.	Time of flight.	Fuze setting.	Drift.	Deflection for 10 miles crosswind.	Angle of departure.	Slope of fall.	Terminal velocity.	Maximum ordinate.	Values of "C."	Values of $\frac{Bc}{Ia}$.
<i>Yds.</i>	<i>°</i>	<i>Yds.</i>	<i>Yds.</i>	<i>Yds.</i>	<i>Yds.</i>	<i>Secs.</i>	<i>Dir.</i>	<i>Mils.</i>	<i>Mils.</i>	<i>°</i>	<i>10m—</i>	<i>F. S.</i>	<i>Ft.</i>		
8,100	15 28.2	5.7	46.7	105.1	273.9	22.62	25.7	13.5	4.7	15 35.9	2.4	907	2,157		
8,200	15 46.1	5.6	47.1	107.7	277.9	22.99	26.1	13.7	4.7	15 53.9	2.3	906	2,231		
8,300	16 4.1	5.6	47.4	110.3	281.9	23.36	26.4	14.0	4.7	16 11.9	2.3	904	2,306		
8,400	16 22.2	5.5	47.8	113.0	286.0	23.73	26.8	14.3	4.8	16 30.0	2.2	903	2,382		
8,500	16 40.3	5.5	48.1	115.8	290.1	24.10	27.1	14.6	4.8	16 48.1	2.2	902	2,461		
8,600	16 58.4	5.5	48.5	118.8	294.2	24.48	27.5	14.9	4.8	17 6.3	2.1	901	2,541		
8,700	17 16.6	5.5	48.8	121.5	298.3	24.86	27.9	15.2	4.9	17 24.5	2.1	900	2,624		
8,800	17 34.8	5.5	49.1	124.5	302.4	25.25	28.3	15.5	4.9	17 42.8	2.0	899	2,707		
8,900	17 53.3	5.4	49.5	127.4	306.6	25.64	28.6	15.8	4.9	18 1.3	2.0	898	2,790		
9,000	18 12.0	5.3	49.8	130.4	310.8	26.04	29.0	16.1	5.0	18 20.0	2.0	897	2,875	3.35	0.8105
9,100	18 31.0	5.2	50.1	133.5	315.0	26.44	29.4	16.4	5.0	18 39.0	1.9	895	2,963		
9,200	18 50.4	5.1	50.4	136.6	319.3	26.84	29.7	16.7	5.0	18 58.4	1.9	894	3,053		
9,300	19 10.2	5.0	50.7	139.7	323.6	27.25	30.1	17.1	5.1	19 18.2	1.8	893	3,146		
9,400	19 30.4	4.8	51.0	142.9	327.9	27.66	30.5	17.4	5.1	19 38.4	1.8	893	3,241		
9,500	19 51.1	4.8	51.3	145.0	332.2	28.08	30.8	17.8	5.2	19 59.1	1.8	892	3,339		
9,600	20 12.2	4.7	51.6	148.1	336.5	28.50	31.2	18.1	5.3	20 20.2	1.7	892	3,440		
9,700	20 33.8	4.6	51.8	151.2	340.8	28.93	31.6	18.5	5.3	20 41.8	1.7	892	3,544		
9,800	20 55.8	4.5	52.0	154.3	345.1	29.36		18.8	5.4	21 3.8	1.7	892	3,651		
9,900	21 18.2	4.5	52.2	157.4	349.4	29.80		19.2	5.4	21 26.2	1.6	892	3,760		
10,000	21 41.0	4.4	52.4	160.5	353.7	30.24		19.5	5.5	21 49.0	1.6	892	3,872	3.46	.7850
10,100	22 4.3	4.3	52.7	163.6	357.9	30.69		19.9	5.5	22 12.3	1.6	892	3,987		
10,200	22 28.0	4.2	52.9	166.8	362.1	31.14		20.3	5.6	22 36.0	1.5	892	4,107		
10,300	22 52.1	4.1	53.2	170.1	366.4	31.60		20.8	5.6	23 0.1	1.5	893	4,231		
10,400	23 16.7	4.1	53.4	173.5	370.7	32.06		21.2	5.7	23 24.7	1.5	893	4,360		
10,500	23 41.7	4.0	53.7	177.0	375.0	32.54		21.6	5.7	23 49.7	1.5	894	4,493		
10,600	24 7.2	3.9	53.9	180.6	379.3	33.02		22.1	5.8	24 15.2	1.4	894	4,631		
10,700	24 33.1	3.9	54.2	184.3	383.6	33.51		22.5	5.8	24 41.1	1.4	895	4,773		
10,800	25 18.7	3.8	54.4	188.1	387.9	34.00		23.0	5.9	25 26.7	1.4	896	4,920		
10,900	25 26.1	3.7	54.7	191.9	393.2	34.50		23.4	5.9	25 34.1	1.3	897	5,071		
11,000	25 53.3	3.7	54.9	195.8	396.5	35.00		23.9	6.0	26 1.3	1.3	897	5,227	3.55	.7650

Class 27, Div. 23, drg. 5.

THE HAND FUZE SETTER, MODEL OF 1913.

[Plate V.]

DESCRIPTION.

The fuze setter is a device provided for the rapid and accurate setting of fuzes.

The hand fuze setter provided for the 4.7-inch gun consists principally of an aluminum case having a serrated rim forming a handle for turning; a range ring mounted on the range-ring carrier which is operated by the knob on the range worm; a corrector scale mounted on the corrector-scale support, which is operated by the knob on the corrector worm and a guide plate which rests on the projectile.

A slot is cut in the range-ring carrier, which engages with the pin on the graduated time train ring of the fuze. A stop pin is attached to the corrector-scale support and engages with the stop pin of the fuze to limit the motion of the fuze setter.

The range worm and corrector worm are mounted eccentrically in the range-worm case and the corrector-worm case. Upon rotation this provides an adjustment to accommodate slight variations in machine operations and to take up for wear between the teeth of the worms and gears.

The range-worm adjusting screw and the corrector-worm adjusting screw have fiber washers fitted in the end, which bear on the collar of the range and corrector worms for taking up the end motion and to provide sufficient friction to resist accidental turning.

Clamp plugs are provided for locking the range and corrector worm cases and the range-worm and corrector-worm adjusting screws.

OPERATION.

Turn the knob of the corrector worm until the index on the case registers with the line on the corrector scale which indicates the desired correction for height of burst.

To set a fuze, remove the waterproof cap and safety wire. Place the hand fuze setter over the fuze and turn until the slot in the range-ring carrier engages with the pin on the graduated time train ring of the fuze. The base plate and the upper part of the range-ring carrier will then bear firmly on the projectile. Then turn the fuze setter in a clockwise direction as indicated by the arrow on the top of the case until the stop pin on the corrector-scale support engages with the stop pin on the fuze and further motion is prevented.

An index to register with a line on the fuze to indicate when the stop pin on the fuze and fuze setter are in contact is attached to the corrector scale.

HAND FUZE SETTER.

[Plate V.]

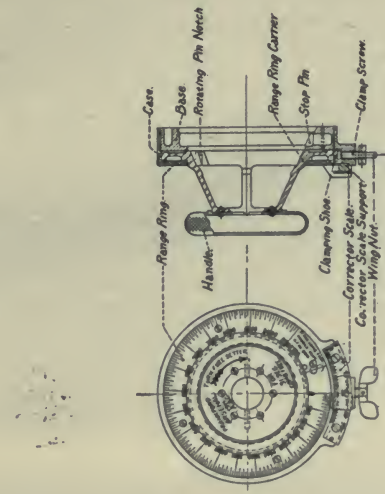
OLD MODEL.

This hand fuze setter consists of the following principal parts: Range-ring carrier, base, case, range ring, corrector scale, plunger, plunger spring, clamping shoe, and clamp screw.

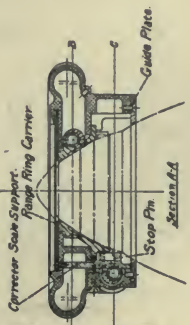
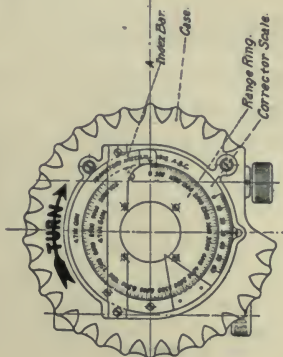
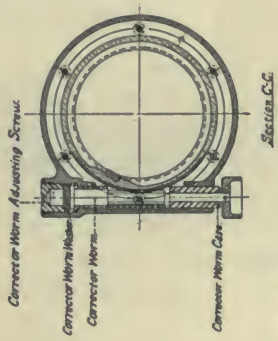
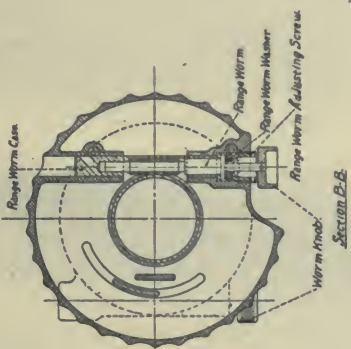
On the top of the base is mounted the range-ring carrier, to which is secured by four screws the graduated range ring. On the interior conical surface of the carrier is cut a notch, which engages the fixed pin of the graduated time train ring of the fuze.

The range-ring carrier is loosely mounted on top of the base and is held in place by means of the case in such manner that it can be freely revolved, so that the desired relation between the time-training notch cut therein and the fixed plunger in the base may be readily obtained for the desired setting of the fuze.

In the case, which is securely fixed to the base, is fitted the clamping screw and shoe, by means of which the range-ring carrier, with its graduated range ring may be securely clamped. On the top



Hand Face Setter (Old Model)



Hand Face Setter. Model of 1913.



surface of the case is fitted the corrector scale; this is held in place by two screws. If after a setting has been made for a given range it is found that the shrapnel does not burst at the desired point in its trajectory, the clamping screw is released and the range-ring carrier is revolved forward or backward as desired until the graduation mark on the range ring comes opposite the proper graduation mark on the corrector scale. For making the adjustment for different heights of burst, the corrector scale has been graduated and fitted to the case in such manner that if a lower point of burst is desired the range graduation on the range ring should be set to one of the lesser graduation marks on the corrector scale, and if a higher point of burst is desired, then the graduation on the range ring should be set to one of the higher graduations on the corrector scale.

ADJUSTMENT.

As the parts are adjusted by the manufacturer before issue and ample provision made for lubricating the parts by filling the interior of the case with a heavy grease, there should be but little need for adjustment for a long time.

Two oil holes closed by screws are provided in the case for emergency use only.

Reference marks are placed on the case and worm cases to indicate the normal adjustment.

ADAPTABILITY TO OTHER GUNS.

This fuze setter is adaptable to all projectiles using the 31-second combination fuze by using suitable range ring, corrector scale, guide plate, and index bar. The corrector scale for guns has 60 graduations, 30 being the normal. The range ring for guns has but one scale graduated thereon. The index bar for guns has a fixed projecting arm on which the index is engraved. The guide plates are suitably marked for the projectile to which they are fitted. The range rings and corrector scales are marked with the name of gun.

4.7-INCH GUN DRILL CARTRIDGE.

The drill cartridge is a dummy cartridge for use in drilling cannoneers in the service of the gun.

The principal parts are: Wood body, bronze base, body guard, stop pin, graduated ring, point nut, and bolt extending through entire length.

It is the shape of the service shrapnel ammunition, and is fitted at the point with a movable ring graduated the same as the ring upon the Frankford Arsenal 31-second combination fuze.

This arrangement is for the instruction of cannoneers in fuze setting.

THE RELOADING AND CLEANING OUTFIT.

This outfit consists of the following parts, and is furnished each battery and to each post where a saluting gun is kept.

Primer-inserting press, large.	} Class V, section 5.
Bushing.	
Powder measure, saluting.	
Decapping tool, with guide.	
Cleaning brush.	
Hammer.	
Case holder.	
Case-holder stand.	
Storage chest.	

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 HANGFIRES.

“Misfires” and “hangfires” are of exceedingly rare occurrence with this ammunition. In case of the failure of the cartridge to fire when the trigger is pulled the breechblock *should not be opened* until after the expiration of at least one minute. The gun may be immediately recocked without opening the breech mechanism and the cartridge tried again. Defective cartridges should be reported to the armament officer.

THE 4.7-INCH GUN CARRIAGE, MODEL OF 1906.

WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight of carriage, complete.....	pounds..	4, 732
Weight of gun and carriage, complete.....	do....	7, 420
Weight of gun and carriage on limber, gun in battery.....	do....	312
Weight of gun and carriage on limber, gun in traveling position.....	do....	1, 282
Diameter of wheel.....	inches..	60
Width of track.....	do....	60
Length of recoil of gun on carriage.....	do....	70
Height of axis on gun.....	do....	51. 29
Height of line of sight.....	do....	53. 62
Length of sight radius.....	do....	36. 75
Maximum angle of elevation (gun on carriage).....	degrees..	15
Maximum angle of depression (gun on carriage).....	do....	5
Amount of traverse of gun on carriage.....	millièmes..	140
Free height of spring column.....	feet..	12½

NOMENCLATURE OF PARTS.

[Details marked * apply to carriages with serial numbers 1 to 40, inclusive, only. Details marked † apply to carriages with serial numbers above 40 only.]

No.	Name	Location, etc.	Property classification.	
			Class.	Section.
1	Cradle, complete, including:			
1	Cradle, including—			
1	Cradle band, front.....	Front connections for cylinders.....		
1	Cradle band, rear.....	Rear connections for cylinders.....		
1	Trunnion band.....	Pivots cradle in pintle yoke.....		
1	Spring cylinder, right.....	.....	
1	Spring cylinder, left.....	.....	
1	Spring cylinder, reinforce, right.....	On rear end of spring cylinder, right.....		
1	Spring cylinder, reinforce, left.....	On rear end of spring cylinder, left.....		
1	Spring cylinder head, right.....	In rear end of spring cylinder, right.....		
1	Spring cylinder head, left.....	In rear end of spring cylinder, left.....		
2	Cradle rails, 1 right, 1 left.....	Riveted to bands and spring cylinders.....		
2	Cradle rail liner, top, 1 right, 1 left.....	Riveted to cradle rails at top.....		
2	Cradle rail liner, bottom, 1 right, 1 left.....	Riveted to cradle rails at bottom.....		
1	Recoil cylinder lock, complete, including—			
1	Lock bracket.....	Riveted to cradle band, front.....		
1	Lock catch.....	Pinned to bracket.....		
1	Lock pin.....	.....	
1	0.125 by 1.5 split pin.....	.....	
†6	Swing bolt forks.....	Riveted to spring cylinders at front.....		
1	Shoulder guard bracket.....	Riveted to spring cylinder reinforce, left.....		
1	Guide bracket.....	Riveted to spring cylinder, right.....		
1	Guide.....	Riveted to guide bracket.....		
1	Firing handle bracket.....	Riveted to spring cylinder reinforce, right.....		
1	Firing handle bracket reinforce.....	Riveted to firing handle bracket.....		
1	Front sight bracket support.....	} Riveted to spring cylinder, left.....		
1	Rear sight bracket support.....			
1	Range quadrant fastening.....	Riveted to spring cylinder, right.....		
1	Elevating bevel gear stop.....	Shrunk on cradle band, rear.....		
*4	Cylinder cover hinges.....	Riveted to spring cylinders at front.....		
†1	Spring cylinder cover.....	Bolted to front end of cylinders.....		
†6	Swing bolts with pins and split pins.....	.....	
†1	Extension rail pin.....	Pins rail to spring cylinder cover.....	IV	3
†1	Shoulder guard pin.....	.....	
†1	Shoulder guard.....	Pinned to bracket on spring cylinder, left.....		
†1	Recoil indicator.....	Slides in guide on spring cylinder, right.....		
†2	Extension rail plunger.....	Secures rail to cover.....		
†2	Extension rail plunger ring.....	.....	
†2	Extension rail plunger spring.....	.....	
1	Extension rail, complete, including—			
†1	Extension rail body.....	Secured to spring cylinder cover.....		
2	Extension rail liners, 1 right, 1 left.....	Riveted to rail body.....		
†2	Extension rail bearing plates, 1 right, 1 left.....	Riveted to outside of rail body.....		
†1	Extension rail top plate.....	Riveted to rail body.....		
†1	Extension rail diaphragm.....	Riveted in rear end of body.....		
†1	Latch base.....	Riveted to bottom of rail.....		
†1	Latch plunger.....	In latch base.....		
†1	Latch spring.....	.....	
†1	Plunger ring.....	.....	
*2	Extension rail bolts and nuts.....	Secure rail to cradle band, front.....		
*2	Extension rail bolt pins.....	Secure bolts to rail bracket.....		
*1	Extension rail body.....	Bolted to cradle band, front.....		
*2	Extension rail bearings, 1 right, 1 left.....	Riveted to sides of body.....		
*1	Extension rail separator.....	.....	
*1	Extension rail separator rivet.....	.....	
*1	Extension rail bracket.....	Riveted to rear end of body.....		
†1	Extension rail latch socket.....	Riveted to spring cylinders.....		
*1	Extension rail pin.....	Secures cylinder cover and rail.....		
*2	Spring cylinder covers.....	Pinned to front ends of cylinders.....		
1	Dust guard.....	On extension rail between clips on gun.....		
2	Dust guard pads.....	Pinned to dust guard.....		
3	Button head cap screws.....	Secure dust guard.....		
1	Recoil indicator throw.....	Pinned to dust guard.....		
2	Recoil indicator throw pins.....	.....	

NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Cradle, complete, including—Continued.			
1	Recoil and counterrecoil arrangement, including—			
1	Recoil cylinder, complete, including—			
1	Recoil cylinder.....	In cradle bands between spring cylinders.		
1	Cylinder head.....	On front end of recoil cylinder.....		
2	Cylinder gaskets.....	Oil-tight seat for cylinder head.....		
1	Stuffing box.....	On rear end of recoil cylinder.....		
1	Stuffing box gland.....	In end of stuffing box.....		
5	Rings, Garlock hydraulic waterproof packing.....	.....	
†3	Filling and drain plugs.....	In cylinder head and stuffing box.....		
†3	Gaskets.....	Under plugs.....		
*2	Filling and drain plugs.....	In cylinder head and stuffing box.....		
*2	Gaskets.....	Under filling and drain plugs.....		
1	Piston rod.....	In cylinder.....		
1	Piston.....	On front end of piston rod.....		
1	Piston rod nut.....	Secures rod to gun lug and spring rod yoke.....		
1	Counterrecoil buffer.....	In front end of piston rod.....		
1	Counterrecoil buffer nut.....	Secures buffer to cylinder head.....		
6	Outer counterrecoil springs.....	Assembled in spring cylinders.....		
6	Middle counterrecoil springs.....	In spring stirrups, outer.....		
6	Inner counterrecoil springs.....	In spring stirrups, inner.....		
2	Spring stirrups, outer.....	Connect outer and middle springs.....		
2	Spring stirrups, inner.....	Connect middle and inner springs.....		
2	Spring stirrup flanges, outer.....	On front end of spring stirrup, outer.....		
2	Spring stirrup flanges, inner.....	On front end of spring stirrup, inner.....		
2	Spring stirrup heads, outer.....	On rear end of spring stirrup, outer.....		
2	Spring stirrup heads, inner.....	On rear end of spring stirrup, inner.....		
*2	Outer stirrup reinforces, front.....	Secures flange to spring stirrup, outer.....		
*2	Outer stirrup reinforces, rear.....	Secures head to spring stirrup, outer.....		
*2	Inner stirrup reinforces, front.....	Secures flange to spring stirrup, inner.....		
*2	Inner stirrup reinforces, rear.....	Secures head to spring stirrup, inner.....		
4	Spring separators, outer.....	Between outer springs.....		
4	Spring separators, intermediate.....	Between middle springs.....		
4	Spring separators, inner.....	Between inner springs.....		
2	Spring rods.....	In inner springs.....		
2	Spring rod flanges.....	On front ends of rods.....		
2	Spring rod plugs and nuts.....	On rear ends of rods.....		
2	Spring rod keys.....	Seated in plugs.....		
1	Spring rod yoke.....	Connects spring rods and gun.....		
	Firing mechanism, complete, including—		IV	3
1	Firing shaft.....	Assembled in firing handle bracket.....		
1	Firing handle.....	On shaft.....		
1	Shaft trip collar.....	do.....		
1	Shaft retaining collar.....	do.....		
1	Trip collar pin.....	.....	
1	Shaft return spring.....	In firing handle bracket.....		
1	Handle return spring.....	do.....		
1	Trip latch plunger.....	In firing handle.....		
1	Trip latch.....	On end of plunger.....		
1	Trip latch pin.....	Pins plunger in latch.....		
1	Trip latch spring.....	.....	
1	Adjusting screw.....	In firing handle bracket.....		
	Pintle yoke, complete, including—			
1	Pintle yoke, with 4 handy oilers.....	Supports the gun at the trunnion band.....		
2	Trunnion bearing liners with 6 screws.....	.....	
3	Bolts and nuts.....	Secure pintle yoke to traversing bracket.....		
2	Trunnion caps, with pins and handy oilers.....	Cap over trunnions.....		
2	Trunnion cap bolts.....	.....	
	Pintle bearing, complete, including—			
1	Pintle bearing.....	On axle between axle bearings.....		
1	Pintle bearing liner.....	In pintle.....		
4	Bolts and nuts.....	Secure pintle bearing to trail.....		
1	Trail tie bolt and nut.....	do.....		
	Axle.....			
	Trail, complete, including—			
2	Flasks, 1 right, 1 left.....	Form sides of trail.....		
2	Axle bearings, 1 right, 1 left.....	Riveted to front end of flasks.....		
2	Axle bearing bolts and nuts.....	Clamp bearings to axle.....		
1	Traversing transom, front.....	First, in trail, riveted to flasks.....		
1	Traversing transom liner, front.....	Bearing surface on traversing transom, front.....		
1	Traversing transom, rear.....	Second, in trail, riveted to flasks.....		
1	Traversing transom liner, rear.....	Bearing surface on traversing transom bracket.....		

NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Trail, complete, including—Continued.			
1	Traversing transom bracket.....	On traversing transom, rear.....	IV	3
1	Tool box front transom.....	Third, in trail, riveted to flasks.....		
1	Tool box rear transom.....	Fourth, in trail.....		
1	Tool box top plate.....	Riveted to flasks and transom.....		
*1	Fastener (female) (for extension rail carrier).....	Riveted to tool box rear transom.....		
*1	Hinge (for extension rail carrier).....	Riveted to trail cover plate.....		
1	Tool box cover plate.....	Hinged to tool box top plate.....		
1	Name plate.....	On tool box top plate.....		
1	Tool box bottom plate.....	Forms floor of tool box.....		
*3	Tool box bottom hole, cover.....	Riveted to tool box bottom plate.....		
1	Trail cover plate.....	Top of lower trail.....		
1	Cover plate front liner.....	Reinforce trail cover plate at traveling lock.....		
1	Cover plate rear liner.....	.....do.....	
1	Trail end reinforce plate.....	Inside lower trail.....		
2	Spade brackets, 1 right, 1 left.....	Riveted to flasks and trail cover plate.....		
1	Spade-key bracket.....	Riveted to lower end of trail.....		
2	Seat supports, 1 right, 1 left.....	Riveted to flasks.....		
2	Seats.....	On supports at side of trail.....		
4	Cover hinges.....	On cover plates.....		
1	Tool box fastening, complete, includes—			
2	Clips.....	On tool box cover plate.....		
2	Eyes.....	Riveted to transom.....		
3	Stops.....			
1	Handle.....			
1	Lock eye.....	Riveted to tool box rear transom.....		
1	Chain rivet.....	On trail cover plate.....		
1	Yale lock, No. 840, with bolt snap and chain.....			
1	Traveling lock cover fastener, complete.....			
1	Traveling lock cover plate.....	Hinged to trail cover plate.....		
1	Chain rivet.....	Riveted to traveling lock cover plate.....		
1	Traveling lock cover pin.....	Fastens traveling lock cover plate.....		
1	Traveling lock cover chain.....	Secures the pin.....		
1	Sponge stop.....	On right flask.....		
1	Sponge-staff fastening.....			
1	Sponge-staff hasp.....			
1	Hinge pin.....	On right flask of trail.....		
1	Bolt with 0.135 twisted coil chain and ring.....			
1	Sponge-staff double fastening.....			
1	Sponge-staff double hasp.....			
1	Hinge pin.....	On left side of trail.....		
1	Bolt with 0.135 twisted coil chain and ring.....			
1	Sponge-staff socket.....	On right side.....		
1	Bar and sponge staff socket.....	On left side.....		
2	Liners (wheel guards).....	On sponge staff sockets.....		
2	Liner screws (wheel guard).....			
1	Maneuvering bar support.....	Riveted to left flask.....		
2	Maneuvering bar support pins.....			
1	Fastening lever.....	Pinned in support.....		
1	Fastening lever pin.....	Secures spring.....		
1	Fastening spring.....	Pinned in lever.....		
1	Maneuvering bar stop.....	Riveted to left flask.....		
4	Trail handles, 2 short, 2 long.....	Riveted to flasks.....		
2	Trail prop brackets, 1 right, 1 left.....	.....do.....	
2	Trail prop stops, 1 right, 1 left.....	Riveted to bottom flanges of flasks.....		
1	Prop chain bracket.....	Riveted to bottom flange of left flask.....		
1	Prop hook button.....	On right flask.....		
1	Azimuth scale bracket.....	Riveted to left flask.....		
1	Azimuth scale strip.....	On bracket.....		
1	Traveling lock, complete, including—			
1	Traveling lock frame.....	Riveted to flasks.....		
2	Traveling lock legs.....	Hinged in traveling lock frame.....		
2	Lock pins.....			
1	Leg prop.....	Supports one traveling lock leg.....		
1	Lock bolt.....	Secures gun to traveling lock.....		
1	Lock bolt sleeve.....			
1	Lock bolt nut.....			
1	Lunette transom.....	Riveted to lower ends of flasks.....		
1	Lunette transom bushing.....	In lunette transom.....		
2	Lunette transom rivets.....			
2	Lunette trail reinforce, 1 right, 1 left.....	Riveted to trail flasks.....		
*1	Elevating and traversing lock lever guide.....	Riveted to tool box top plate.....		
†1	Elevating and traversing lock lever fastening.....	Riveted to left trail flask.....		

NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Spade, complete, including—			
1	Spade frame.....			
*2	Spade braces, 1 right, 1 left.....	Interior framework of spade.....		
†1	Float.....	Riveted to spade frame.....		
*2	Floats, 1 right, 1 left.....	.....do.....		
1	Spade edge.....	Forms point of spade.....		
†2	Spade points.....	Riveted to spade edge and frame.....		
*2	Spade braces, 1 right, 1 left.....	Riveted to floats.....		
†2	Bearing plates, 1 right, 1 left.....	Riveted to floats and frame.....		
*1	Spade plate.....	Riveted to float.....		
1	Spade reinforce.....	Braces spade edge.....		
1	Spade key, complete.....	Locks spades in position.....		
1	Spade pin, with nut.....	Hinges spade to trail.....		
*2	Spade, center bearings, 1 right, 1 left.....	Riveted to spade braces.....		
*2	Spade, rear bearings, 1 right, 1 left.....	Riveted to spade brace and frame.....		
2	Handspikes, complete, including—			
2	Handspike webs, 1 right, 1 left.....	Pinned to spade.....		
2	Lower bands.....			
2	Middle bands.....			
2	Tips.....			
4	Handspike bodies, 2 inner, 2 outer.....			
1	Chain eye.....	On left handspike body.....		
2	Trail prop, complete, including—			
1	Prop tubes.....	Hinged under trail.....		
1	Prop foot.....			
2	Prop braces.....			
2	Prop eyes, with pins.....			
1	Trail prop chain, complete, including—			
1	Prop chain.....			
1	Prop hook.....			
1	Prop chain swivel, with pin.....			
*1	Extension rail carrier, complete, including—			
*1	Bottom plate.....			
*1	Bed.....	Riveted to trail bottom plate.....		
*1	Stop.....			
*1	Hanger pin.....			
*1	Hanger.....	Suspends carrier from hinge.....		
*1	Fastener (male).....	Riveted to trail bottom plate.....		
*1	Pin, including body, spring, head, and rivet.....	Hinge pin in fasteners.....		
*1	Chain.....	Secures pin.....		
*2	Chain rings.....			
*1	Catch.....	Secures extension rail to bed.....		
*1	Catch support.....			
*1	Catch spring.....			
*1	Catch pin.....			
1	Elevating mechanism, complete, including—			
1	Elevating gear bracket, with 2 handy oilers.....	Trunnioned in elevating yoke sides.....		
4	Bushings.....	Forced in bracket.....		
*1	Elevating screw cover.....	Closes lower end of elevating gear bracket.....		
†1	Elevating screw cover with split pin.....	.....do.....		
*3	Elevating screw cover springs.....			
1	Outer elevating screw.....			
1	Inner elevating screw.....			
1	Elevating pin.....	Assembles inner screw to rear cradle band.....		
2	Elevating yoke sides, 1 right, 1 left.....			
1	Elevating yoke transom with 1 spring cover, No. 1.....	Bolted to traversing bracket to form frame for elevating mechanism.....		
2	Elevating yoke bushings.....	In elevating yoke sides.....		
10	Bolts and nuts (8 short, 2 long).....			
1	Elevating bevel gear with pins.....	Assembled in bracket.....		
2	Keys.....	Riveted to elevating bevel gear.....		
1	Elevating bevel gear lug.....	.....do.....		
2	Elevating pinion shafts with 2 nuts.....	Assembled in bracket.....		
2	Elevating bevel pinions.....	Pinned to inner ends of shafts.....		
2	Elevating handwheels, complete, including—			
2	Wheel bodies.....	On outside ends of shafts.....		
2	Counterbalances.....			
†2	Instruction plates.....			
2	Spindles.....			
2	Sleeves.....			
2	Reinforce pieces.....			
2	Hubs.....			

IV

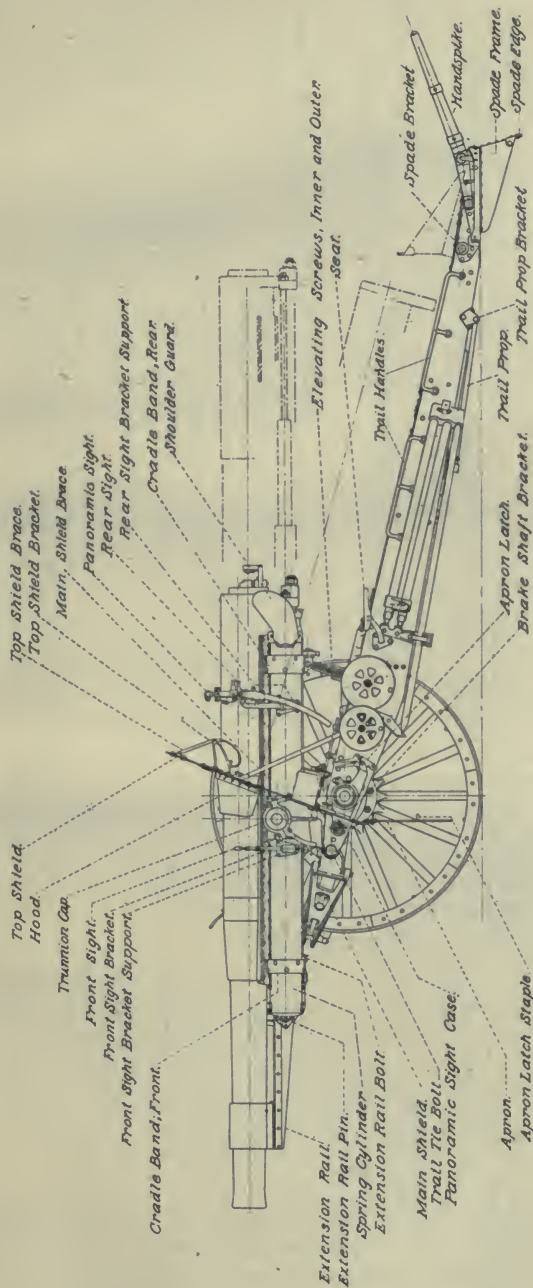
3

NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Traversing mechanism, complete, including—			
1	Traversing bracket with 1-spring cover, No. 1.	Bolted to pintle yoke.....		
1	Traversing yoke.....			
3	Bolts and nuts, 2 short, 1 long.....			
1	Azimuth pointer.....	On traversing bracket.....		
3	Traversing screw bracket.....	Bolted to left flask.....		
3	Bolts and nuts, 2 long, 1 short.....			
1	Traversing screw bracket cap.....	Bolted to bracket.....		
2	Bolts and nuts.....			
1	Traversing screw bearing with 1 handy oiler.....	Swivels in traversing screw bracket.....		
1	Traversing screw, with 1 nut.....	Assembled in bearing and nut.....		
1	Traversing nut with handy oiler.....	Swivels in traversing yoke.....		
1	Traversing handwheel, complete, including—			
1	Wheel body.....	On end of traversing screw.....		
1	Counterbalance.....			
†1	Instruction plate.....			
1	Spindle.....			
1	Sleeve.....			
1	Reinforce piece.....			
1	Hub.....			
1	Elevating and traversing lock, complete, including—			
+12	Lock bar bearing, 1 right, 1 left.....	Riveted to trail flasks.....		
†2	Bearing braces, 1 right, 1 left.....	do.....		
*1	Lock bolt casing.....	Bolted to trail transoms.....		
*4	Bolts and nuts, 2 long, 2 short.....			
†1	Lock bars.....	Assembled in lock bar bearings.....		
†1	Lock bar lever.....	On lock bar.....		
†1	Lever handle.....	On lock bar lever.....		
†1	Handle bushing.....	In handle.....		
†1	Handle plunger.....			
†1	Plunger spring.....			
*1	Lock bolt.....	In lock bolt casing.....		
*1	Lock bolt end.....			
*1	Link.....	Pinned to lock bolt end.....	IV	3
*2	Link pins, 1 long, 1 short.....			
*1	Elevating and traversing lock spring.....	In lock bolt casing.....		
*1	Lever.....	Pinned to lock bolt casing.....		
*1	Fulcrum pin.....			
1	Brake mechanism, complete, including—			
1	Brake shaft bracket, right, with 1 handy oiler.....			
1	Brake shaft bracket, left, with 1 handy oiler.....	Keyed to axle.....		
2	Bushings.....	In brackets.....		
4	Bolts and nuts.....	Clamp brackets to axle.....		
4	Bolts and nuts.....	Through brackets and shield.....		
1	Segment rack.....	Bolted to brake shaft bracket, right.....		
8	Bolts and nuts.....			
1	Brake shaft.....	Assembled in brackets.....		
2	Brake cranks and nuts and pins.....	On brake shaft.....		
2	Brake crank washers.....			
1	Brake lever hinge, with pin.....	On brake shaft.....		
1	Brake lever.....	Hinged to brake shaft.....		
1	Brake lever spring bracket.....			
1	Brake lever catch.....	Riveted to brake lever.....		
1	Brake lever spring.....	Assembled in brake lever hinge.....		
2	Brake beams.....	Hinged to pintle bearing.....		
2	Brake beam hinge pins.....			
2	Brake shoes.....	On ends of brake beams.....		
2	Brake shoe pins.....			
2	Brake rods, complete, including—	Secured to brake beams and brake cranks.....		
2	Brake rods.....			
2	Brake rod springs.....			
2	Brake spring cover.....			
2	Brake rod ends.....	Equalize pressure on brake shoes.....		
2	Brake spring cover ends.....			
2	Brake rod bushings.....			
2	0.25 by 3.5 split pins.....			
2	Brake rod pins.....	Secure rod to brake beams.....		
2	Brake rod keys.....	Seated in brake rod.....		

NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Shield, complete, including—		IV	3
1	Top shield, complete, including—			
1	Top shield			
2	Top shield braces	Lock top shield in either position		
4	Top shield hinges, upper half, with pins	Riveted to top shield at bottom		
2	Top shield fastenings with pins	Riveted to top shield		
1	Shutter panoramic sight port	Over panoramic sight port		
1	Hinge pin	Secures shutter		
4	Hinges, sight port shutter	Riveted to shield and shutter		
2	Fillers, shutter hinge			
*1	Shutter latch base	Riveted to top shield		
*1	Shutter latch plunger			
*1	Shutter latch spring			
†1	Shutter support	Riveted to shutter		
1	Main shield, complete, including—			
1	Main shield, right			
1	Main shield, left			
1	Hood	Riveted to main shield		
2	Main shield side pieces, 1 right, 1 left	Bolted to shield		
6	Bolts and nuts			
2	Main shield braces, upper end	Braces shield to trail		
2	Main shield braces, lower end, 1 right, 1 left			
2	Main shield brace tubes			
4	Bolts and nuts, 2 short, 2 long	Secure shield braces to shield and trail		
2	Top shield brackets	Riveted to main shield		
2	Top shield brace pins	Through top shield brace and bracket		
2	Top shield brace pin chains, complete, including—			
2	Chains			
2	End links	Fastened to top shield brackets		
2	Rings			
4	Top shield hinges, lower half			
2	Apron hinges, upper half, with pins	Riveted to main shield		
1	Shutter, peep-sight port	Over peep sight port		
1	Hinge pin			
4	Hinges, peep-sight port shutter	Riveted to shield and shutter		
2	Fillers, shutter hinge			
1	Shutter latch base	Riveted to top shield		
1	Shutter latch plunger			
1	Shutter latch spring			
1	Apron, complete, including—			
1	Apron			
2	Apron hinges, lower half	Riveted to apron		
2	Apron latch staples	do		
2	Apron latches, complete, including—			
2	Apron latch bodies	Suspended from brake shaft brackets		
2	Apron latch body pins			
2	Apron latch levers			
2	Apron latch lever pins			
2	Apron latch plungers			
2	Apron latch springs			
2	Apron latch plunger eyes			
2	Apron latch plunger eye pins			
2	Apron latch bushings			
2	Wheels, 60-inch, complete, including—			
2	Hub boxes			
2	Hub rings	Outer flanges of hubs		
2	Hub liners	Forced into hub boxes		
2	Hub bands	Screwed on hub boxes		
2	Lock washers	Between wheel hook bushing and hub band		
2	Wheel hooks, 1 right, 1 left	On outside of hubs		
2	Wheel-hook bushings	Under wheel hooks		
2	Hub caps	On end of hubs		
2	Hub latches	Actuate hub latch plungers		
2	Hub latch springs			
2	Hub latch plungers	Lock hub caps in place		
2	Oil valves, with rivets	Slide in hub caps		
2	Oil valve springs			
2	Oil valve washers			
32	Spokes			
16	Felloe segments, with rivets and washers			
16	Dowels	Hold felloe segments together		
2	Tires			
16	Tire bolts with washers and nuts			
16	Carriage bolts and nuts	Secure spokes to hubs		



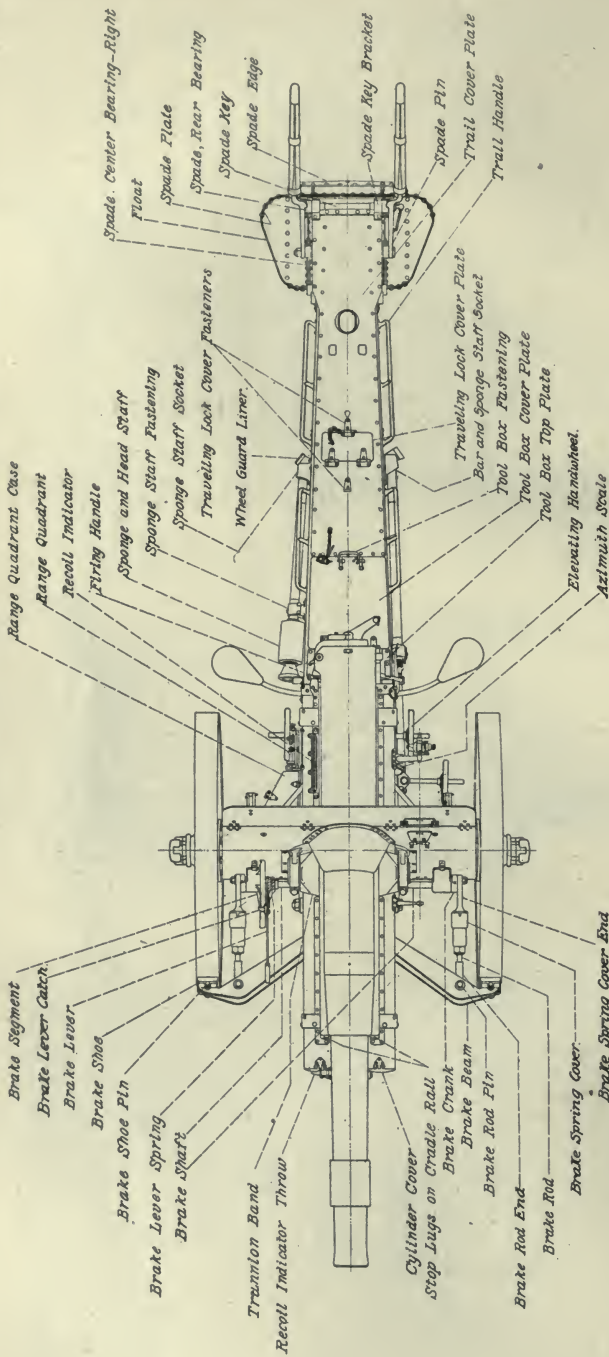
4.7-inch Gun Carriage Model of 1905

Side Elevation

Scale

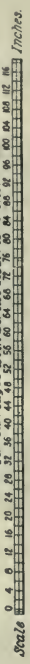
0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100		
Inches																											

For Carriages with Serial Nos. 1 to 40 inc.



4.7-Inch Gun Carriage, Model of 1906—Plat.

For Carriages with Serial Nos. 1 to 40 Inc.



NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Wheel fastenings, complete, including—		IV	3
2	Bodies	At ends of axle.....		
2	Wheel fastening plungers.....	.....	
2	Wheel fastening springs.....	.....	
2	Wheel fastening plugs.....	.....	
1	Sight packing, complete.....	In trail tool box.....		
1	Rear support.....	Bolted to right flask.....		
1	Front support (for range quadrant case).....	.....	
4	Bolts and nuts.....	For front and rear supports.....		
2	Supports (for panoramic sight case).....	1 right, 1 left, bolted to main shield.....		
4	Bolts and nuts, 2 long, 2 short.....	.....	
1	Range quadrant case, complete.....	Pinned to supports.....		
3	Support pins.....	For range quadrant case.....		
1	Panoramic sight case, complete.....	Pinned to supports.....		
4	Support pins.....	For panoramic sight case.....		
1	Sighting arrangement, complete, including—			
1	Front sight, complete.....	On sight fastening.....		
1	Sight bracket with shank socket.....	On rear support.....		
1	Sight shank.....	In shank socket.....		
1	Range quadrant.....	On quadrant fastening.....		
1	Panoramic sight.....	Fitted to rear sight shank.....		
1	Teat wrench for panoramic sight.....	In case.....		

DESCRIPTION OF THE CARRIAGE.

[Plates VI, VII, VIII, IX, X, and XI.]

The 4.7-inch gun carriage, model of 1906, is of the type known as the long recoil in which the gun is permitted a sufficient length of recoil on the carriage to render the latter stationary under firing stresses. A steel casting called a pintle bearing is mounted upon an axle and braced by the trail to form a swivel base for a steel yoke provided with bearings in which the trunnions of the cradle rest. The cradle is a framework, with heavy rails which support the gun, and contains the hydraulic cylinder which controls the gun in recoil and the springs that return the piece to the original firing position.

For the purpose of description, the carriage may be considered as composed of the following divisions, viz, wheels, axle, trail, and spade, pintle yoke and bearing, cradle, recoil cylinder, counter-recoil spring system, traversing mechanism, elevating mechanism, brake, shield, sights, firing mechanism, recoil indicator, and shoulder guard. The dust guard, actually attached between the front clip and jacket of the gun, is also to be considered as a part of the carriage.

WHEELS.

The wheels are a modified form of the Archibald pattern, 60 inches in diameter. The hub consists of a steel hub box and hub ring, the two having flanges which clamp the spokes and are drawn together by eight heavy bolts and a ring called a hub band, which is threaded to the hub box. The lock washer and the wheel hook bushing are located on the hub box between the hub band and the hub ring. The wheel hook bushing is assembled under the wheel hook and by

means of a flange secures the hook to the wheel. The wheel hook is used for attachment of ropes or chains in emergency traction. The lock washer is located between the wheel hook bushing and the hub band and prevents the latter from unscrewing.

A removable bronze liner is forced into the hub box to form a wearing surface, and the outer end of the hub is closed by a bronze hub cap screwed on the hub box and locked with a small bolt, called the hub latch plunger, which is withdrawn and held in the disengaged position by the hub latch when the cap is to be unscrewed. The hub cap is also fitted with the standard wheel oil valve, which is pulled out to expose the opening for oiling the wheel and closes to render the hub dust proof.

WHEEL FASTENINGS.

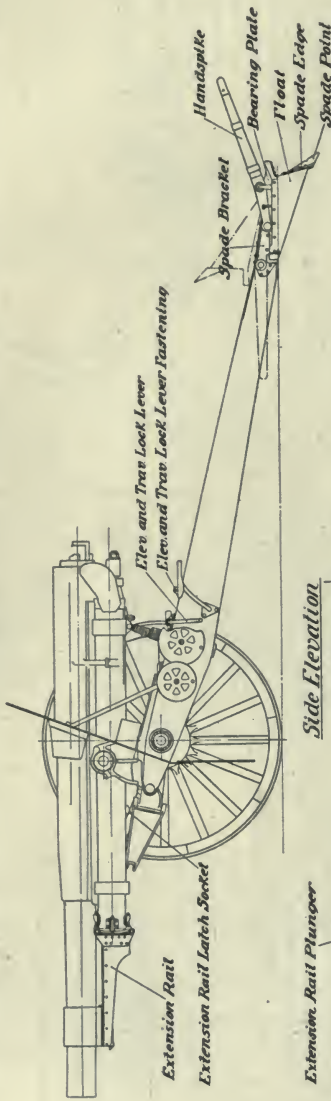
The wheel fastening, a yoke of bronze, fitting recesses in the outer end of the axle arm, secures the wheel to the axle and is exposed when the hub cap is removed. The yoke is secured to the axle arm by the wheel fastening plunger.

AXLE.

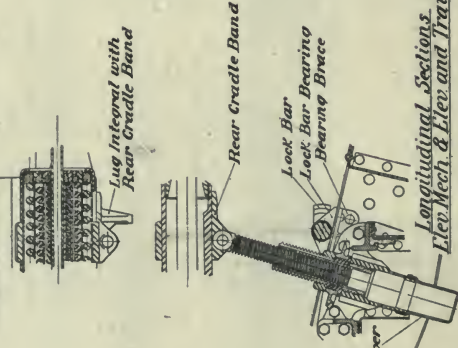
The axle is hollow and forged from a single piece of steel. The axle arms will take any of the standard 60-inch wheels, being similar to all others in the battery, and the key, solid with the axle, holds the trail axle bearings, brake shaft brackets, and pintle bearing in their proper interrelation.

THE TRAIL.

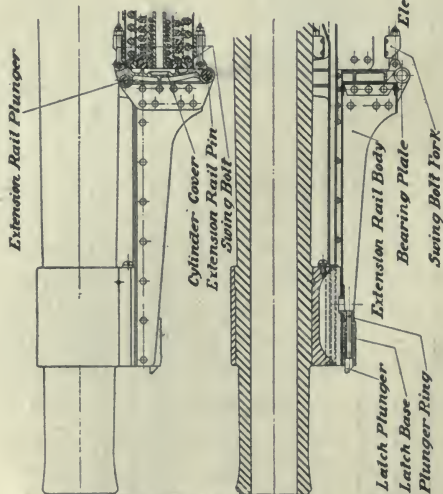
The flasks of the trail are of channel section with the flanges turned inward and are connected by several transoms and braced by riveted plates to form a rigid framework. The forward ends of these flasks extend beyond and surround the axle and are reinforced by cast-steel axle bearings, which are clamped to the axle by bolts. A short distance in rear of the axle are the traversing transom, front, and traversing transom, rear, riveted to the flasks, the first forming a rest for the traversing bracket and the other a seat for the frame of the elevating mechanism. The space between the third and fourth transoms is utilized as a tool box, having a floor and a hinged lid with a shot-bolt handle and padlock. The rest of the trail is covered with a single plate which extends around the lower end and for about 2 feet forward on the underside, and has an opening, with hinged cover for the traveling lock, the frame of which constitutes a fifth transom. The lunette transom, with its renewable bushing bored to receive the pintle of the limber, is riveted about 27 inches from the lower end. A spade bracket reinforces the lower end of each flask, while the spade key bracket braced by the trail end reinforce plate forms the extreme lower end of trail and seat for the spade.



Side Elevation



Longitudinal Sections, Elev Mech. & Elev and Trav Lock



Longitudinal Sections of Extension Rail

4.7 Inch Gun Carriage, Model of 1906.
Views of Carriages with Serial Nos. above 40



SPADE.

For carriages with serial numbers 1 to 40, inclusive, a spade of the following construction is used:

The spade frame is a plate of flange steel placed crosswise the center line of the trail with wings extending to the front; between these wings and parallel to them, with flanges butting against and riveted to the spade frame, are two braces, whose upper portions extend above the frame and receive steel fittings for attachment to the trail; resting on the wings of the frame and riveted to the spade braces are the floats which meet in rear and with a reinforce called the spade plate form a heavy rail across the top of the spade. The wings of the floats project on either side of the spade to give sufficient bearing in preventing the end of the trail from burying itself in the ground. A hardened-steel wearing edge is riveted to the lower edge of the spade frame. In service, when worn or broken, the spade edge may be replaced. The spade reinforce is a V-shaped beam of flange steel riveted to the inside of the spade frame and to the spade braces for the purpose of stiffening the construction. The fittings for attachment to the trail are the center bearings and rear bearings which are riveted to the spade braces. The spade pin passes through the center bearings and the spade brackets of the trail; the rear bearings serve in connection with corresponding bearings in the spade key bracket of the trail and a detachable pin called the spade key, to lock the spade in its position underneath the trail when the carriage is unlimbered.

For traveling the key is removed, the spade is rotated about the pin until the rear bearings coincide with the forward holes of the spade bracket, when the key is inserted to lock the spade in its new position. The spade key and spade pin also secure two handspikes, which are arranged to fold with the spade in limbering.

For carriages with serial numbers above 40 a spade of the following construction is used:

The spade frame is a flange steel plate placed crosswise the center line of the trail with wings extending to the front and riveted to the frame; on its rear and side wings is located the float. Bearing plates, right and left, are riveted to the float parallel with the center line of the trail and to the rear of the frame, and form seats for the spade pin and spade key. The spade edge and spade points are riveted to the lower rear edge of the frame, and in service, when worn or broken, may be replaced. The spade reinforce is a T-angle riveted to the inside of the spade frame and the bearing plates for the purpose of stiffening the construction. When unlimbered the spade pin is secured in the forward seats of the spade bearings and rear seats of the spade brackets, and the spade key is secured to the rear seats of the bearing plates and the seats in the spade-key bracket. For traveling the key is removed, the spade is rotated about the pin

until the spade key seats in the bearing plates coincide with the front holes of the spade brackets, when the key is inserted to lock the spade in its new position. The spade key and spade pin also secure two handspikes, which are arranged to fold with the spade in limbering.

This spade is interchangeable with the one used on carriages with serial numbers 1 to 40 and will be issued in case a spade of the older construction requires replacement, although it will also be necessary to replace the spade-key bracket.

TRAIL PROP.

A trail prop for supporting the trail in limbering is hinged in brackets riveted underneath the flasks and arranged to swing forward against the bottom of the trail when not in use, where it is held by a prop chain and hook. Four trail handles, two on either side, are riveted to the flasks.

The attachments for carrying the sponge and the head staff are placed on the right side of the trail, those for the two remaining sections of the staff upon the left. The lower attachments or sockets are used as bases for the wheel guard liners designed to prevent the wheels of the limber from damaging the trail when making short turns. These are to be renewed when worn. Two seats for the cannoneers serving the piece are riveted to brackets, one on either side of the trail.

A name plate giving the name and number of the carriage, model, name of manufacturer, year of completion, and initials of inspector is riveted to the tool-box top plate. *In all reports and correspondence the carriage should be designated by the number and model given on the name plate.*

PINTLE BEARING AND YOKE.

The pintle bearing is a steel casting assembled between the axle bearings of the trail and supported partly by the axle and partly by the bearings, to which it is secured by heavy bolts. Two hinge lugs cast upon its forward surface receive the inner ends of the brake beams. It is bored and lined with bronze to form a horizontal tapering seat for the pintle yoke and provided with three clips which engage mating parts on the yoke and firmly secure the two together while allowing rotation of the yoke about a vertical axis. Two arms on the pintle yoke extend from its base upward and form horizontal bearings for the trunnions of the cradle, having trunnion caps hinged at the rear and fastened with tap bolts in front. Replaceable bronze liners in these bearings receive the weight and wear due to the trunnions.

CRADLE.

Two parallel steel tubes 7 inches in diameter (spring cylinders), connected by three strong steel bands, are surmounted by heavy steel rails, shaped to fit the clips of the gun and faced with bronze wearing

surfaces, to form the cradle. The forward ends of the cradle rails being turned upward form stops against which the locking hoop of the gun strikes in counter recoil, limiting the forward movement of the gun on the cradle.

For carriages with serial numbers 1 to 40, inclusive, the cradle band, front, carries the recoil cylinder lock and also has lugs to receive the swing bolts of a detachable extension of the inner ways of the cradle. This extension rail is of flanged steel formed to shape and built up. It has at its rear end a bracket in which are pivoted the extension rail bolts, and about one-fourth of its length forward of this bracket are the extension rail bearings. The extension rail pin passes through the lugs provided for it on the cylinder covers and the extension rail bearings, forming a front support for the rail. The separator rivet secures the sides of the rail body together. The extension rail is designed as a guide for the front clips of the gun, and is not intended to support weight. For traveling, after the gun has been retracted to its traveling position, the extension rail pin is withdrawn (to be replaced later in the extension rail), the swing bolts are loosened, and the extension rail carried back and slipped upon the extension rail carrier, which hangs from suitable fastenings in the rear of the tool box in the trail. The carrier consists of a bottom plate hung by a hook, at its rear end, to the trail cover plate and secured by a pin with a spring catch at the front end, passing through the fastener (male) riveted to the bottom plate and the fastener (female) riveted to the tool-box rear transom.

The cradle band, rear, is bored to engage the head of the inner elevating screw and has a boss to admit the point of the elevating and traversing lock bolt. The trunnion band has a threaded seat for the recoil cylinder. The cylinder covers close the front ends of the spring cylinders and act as spring retainers whenever the spring rods are free, and also support the extension rail. Cylinder-cover hinge pins secure the covers to cylinder-cover hinges riveted to the spring cylinders. *For carriages with serial numbers above 40* the cradle band, front, carries the recoil cylinder lock only, and the cradle band, rear, is bored to engage the head of the inner elevating screw and also has a lug to engage the elevating and traversing lock bar. The trunnion band has a threaded seat for the recoil cylinder. The cylinder cover closes the front ends of the spring cylinders and acts as a spring retainer whenever the spring rods are free, and also supports the extension rail. Swing bolts pinned to the cover secure it to the swing bolt forks riveted to the spring cylinders. The extension rail is of flange steel formed to shape and built up. It is designed as a guide for the front clips of the gun and for that purpose has bronze liners mounted on its top side. Bearing plates on the sides of the rail at the rear have seats for the extension rail pin and plungers. This pin fastens the rail to the seats on the lower portion of the cylinder cover.

In the firing position, two plungers secure the rail to the cylinder cover in line with the main cradle rail. In traveling, after the gun has been retracted to its traveling position, the plungers are withdrawn from their seats in the cylinder cover, allowing the extension rail to swing around the pin. A latch secured to the front end of the rail engages a latch socket riveted to the underside of the cylinders, thus holding the rail out of the way.

For all carriages, regardless of serial number, the rear ends of the spring cylinders are flanged inward and riveted to its bronze heads, against which rest the spring columns. The left cylinder has also a bracket for the shoulder guard and the right cylinder a bracket for the firing mechanism. On the exterior of the left spring cylinder are riveted sight bracket supports for the front and rear sights. On the right spring cylinder are the recoil indicator guide and range quadrant fastening. All of these parts which are riveted together, and including the cylinder covers, cylinder cover hinge pins, or swing bolts and pins, and recoil cylinder lock, are considered integral parts of the cradle and are included in the designation of "one cradle, complete."

The recoil cylinder is a steel tube 77.4 inches long and 4.93 inches outside diameter. Its rear end is closed by a forged-steel stuffing box screwed into the cylinder with a fiber gasket to make an oil-tight joint, and forming, with a threaded stuffing-box gland, a stuffing box packed with five rings of Garlock's hydraulic waterproof packing for the piston rod. The cylinder head with a fiber gasket closes the front end. The front end of the cylinder is enlarged to form a flange 5.3 inches in diameter and notched to take a spanner, which also fits a similar flange on the cylinder head. The cylinder should be held by a wrench on this notched flange in assembling or removing the heads; it should never be clamped in a vise or similarly held, as its walls are thin, and while amply strong for the purposes for which intended, may be deformed or flattened by such violent usage. The ribs of the flanges are lashed with copper wire to prevent unscrewing. Both heads have small holes through their walls, closed by filling and drain plugs resting on oil-tight copper gaskets for the purpose indicated in the name of the plugs. *For carriages with serial numbers 1 to 40, inclusive*, the cylinder wall near the front end is provided with three notches to receive the recoil-cylinder lock. The notch into which the lock should fall is that which brings the threaded part of the cylinder nearest to being flush with the front of the trunnion band, as this insures proper relation of the piston and throttling bars. *For carriages with serial numbers above 40*, the cylinder wall near the front end is provided with one notch to receive the recoil-cylinder lock. The cylinder head forms a socket for the counter-recoil buffer, a tapered bronze rod which fits with a small clearance into the piston-rod bore when the gun

is in battery. The counter-recoil buffer is, for purposes of assemblage, a portion of the cylinder head, and is assembled in or removed from the cylinder with the cylinder head. On the interior of the recoil cylinder are machined three longitudinal ribs or throttling bars of uniform width but varying height. Corresponding notches cut in the piston form ports for the passage of the liquid from one side of the piston to the other. The height of the throttling bars along the cylinder determines the area of these ports and is calculated so as to make the resistance which the liquid offers, plus the resistance of the springs, such that the wheels will not jump from the ground when the piece is fired at 0° elevation. This object is accomplished by making at each instant the gravity moment of the system about a horizontal axis through the point of support of the end of the trail greater than the sum of the moments of the piston-rod pull and the spring resistance about the same axis. The piston rod is of steel, fitted with a bronze piston-rod head screwed on against a shoulder at the front end. The head has three notches cut in its perimeter which fit over the throttling-bar projections on the cylinder walls. The front end of the piston rod is bored out for a sufficient depth to take the counter-recoil buffer, which fits into the bore with a very small clearance. In counter recoil, the oil caught in this bore can escape only by the small clearance mentioned, with the result that the return of the gun into battery is so eased and regulated that all shock and consequent derangement of the aim of the piece is eliminated. The rear end of the piston rod is secured to the recoil lug on the gun and to the spring-rod yoke by its nut.

Inside each spring cylinder of the cradle is a column of helical springs of round wire in three sections, called the outer counter-recoil springs, separated by thin washers called spring separators, outer. Within this column is a spring stirrup, outer, with its front end enlarged to retain a spring-stirrup flange, outer, which bears against the front end of the outer-spring column. The rear end of this spring stirrup, outer, is contracted inwardly to retain a spring-stirrup head, outer, another bronze ring against which a second column of helical springs in three sections, called the middle counter-recoil springs, with the intermediate separators, bear. This in turn contains a second tube, the spring stirrup, inner, enlarged outwardly and provided with a bronze spring-stirrup flange, inner, at the forward end and turned inwardly with a bronze spring-stirrup head, inner, at the rear end, which connects and surrounds a third column of helical springs, also in three sections, called the inner counter-recoil springs, and the inner separators. Lastly, a spring rod, with a bronze spring-rod flange resting against a solid collar formed by enlarging the forward end of the rod, passes through the inner springs, the flange bearing against the front end of the spring, the rear end

passing through a heavy cross piece behind the lug of the gun, called a spring-rod yoke, and fastened to the same by a nut. When the gun with the spring-rod yoke and spring rods moves to the rear in recoil the flanges on the front of the spring rods act on the inner coils, the pressure being transmitted to the middle coils by the inner stirrup and to the outer coils by the outer stirrup and resisted by the rear heads of the spring cylinders. In this way the springs work in tandem and have a long stroke with short assembled length. To properly return the gun to battery at high angles of elevation, the springs are assembled with an initial compression of 1,000 pounds on each side.

THE FIRING DEVICE.

The firing device consists of a bracket bolted to the right spring cylinder head, firing handle, handle-return spring, shaft-return spring, firing-handle shaft and pallet, shaft trip collar, shaft-retaining collar, adjusting screw, trip latch, trip-latch spring, trip-latch plunger, and trip-collar pin.

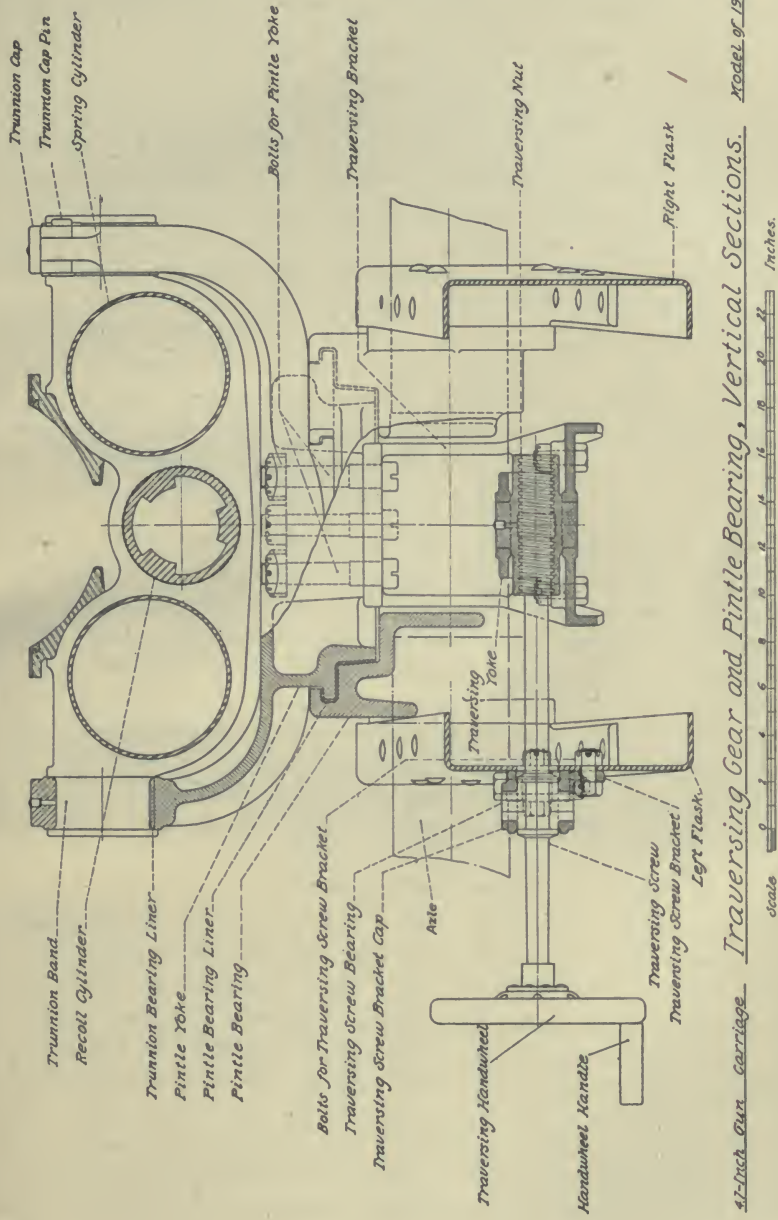
The bracket has a cylindrical portion, the cylinder having a central diaphragm or partition. In the rear portion of this cylinder is fitted the shaft-return spring which acts on the firing-handle shaft—that is, this spring causes the firing handle shaft and pallet to return to their normal position after the sear has been tripped and the gun fired, whether the operator releases the firing handle or not.

The firing handle is mounted loosely on the forward end of the firing-handle shaft and pallet and is connected therewith by means of a shaft trip collar and latch. The collar is provided with a squared opening which fits over a correspondingly squared end on the forward end of the firing-handle shaft.

The hub of the firing handle is provided with a trip latch so arranged that the latch is engaged in a notch in the periphery of the shaft trip collar.

By this means the firing handle is temporarily attached to the shaft. By a sufficient downward movement of the firing handle the head of the trip-latch plunger is caused to come in contact with the end of the adjusting screw located in the firing bracket. This engagement between the adjusting screw and trip-latch plunger forces the latter upward, thereby releasing the trip latch and permitting the firing-handle shaft and pallet to return to their normal position. Upon the release of the firing handle, the handle-return spring restores it to its original position.

On the rear end of the firing-handle shaft is formed the firing pallet, which projects far enough to the rear to engage a projection on the lower end of the trigger shaft. The firing pallet is of such length that the gun can be fired when within 2.5 inches of being in battery. By pressing down on the firing handle the following results: The firing-handle shaft and pallet are rotated, the shaft-return and handle-return



41-inch carriage Traversing Gear and Pintle Bearing, Vertical Sections. Model of 1906.

springs are put under additional tension, the trigger shaft rotates, which in turn rotates the trigger fork, compressing the firing-pin spring through the medium of the firing-spring sleeve until the front end of the latter trips the sear and releases the firing pin.

ACTION OF THE MECHANISM DURING RECOIL.

The action of the carriage when the gun is fired is as follows: The gun moves to the rear 70 inches on the cradle ways, carrying with it the piston rod, spring rods, and spring-rod yoke and compressing the counter-recoil springs. As the recoil cylinder remains stationary the oil behind the piston must pass to its forward side. The energy of recoil of the gun is absorbed by the resistance which the oil offers to being forced through small openings past the piston and by the resistance of the counter-recoil springs. The energy stored up by the springs returns the gun to its firing position. This return movement is eased and regulated by the counter-recoil buffer. The piston-rod pull and spring resistance are transmitted to the carriage, but owing to its weight and the resistance opposed to the trail spade by the earth the carriage remains stationary.

RECOIL INDICATOR AND DUST GUARD.

The length of recoil of the gun upon the carriage is shown by the recoil indicator, a simple friction slide working in the recoil indicator guide, which is mounted upon a bracket riveted to the right spring cylinder in a convenient position for observation. The slide is actuated by the recoil-indicator throw attached to a projecting arm of the dust guard with two pins. The bronze dust guard is secured by three button-head screws to the gun between the locking hoop and front clip and covers and protects the cradle rails from dust and dirt. It recoils with the gun, and has felt liners or wipers which sweep the cradle rails at each stroke of recoil and counter recoil.

TRAVERSING MECHANISM.

The traversing mechanism consists, first, of a bronze traversing nut pivoted on vertical trunnions mounted in the traversing bracket and in a part called the traversing yoke bolted to the traversing bracket; second, a traversing screw with a handwheel mounted in a bearing also swinging on vertical trunnions supported by the traversing screw bracket, with cap, bolted to the left flask of the trail.

The traversing bracket is a steel casting bolted at its rear end to the elevating yoke and at its front end to the under surface of the pintle yoke, the combination rotating as one piece in the pintle bearing.

Longitudinal movement of the screw is prevented by a shoulder on either side of its bearing. When the handwheel is turned the nut travels on the screw, carrying the traversing bracket

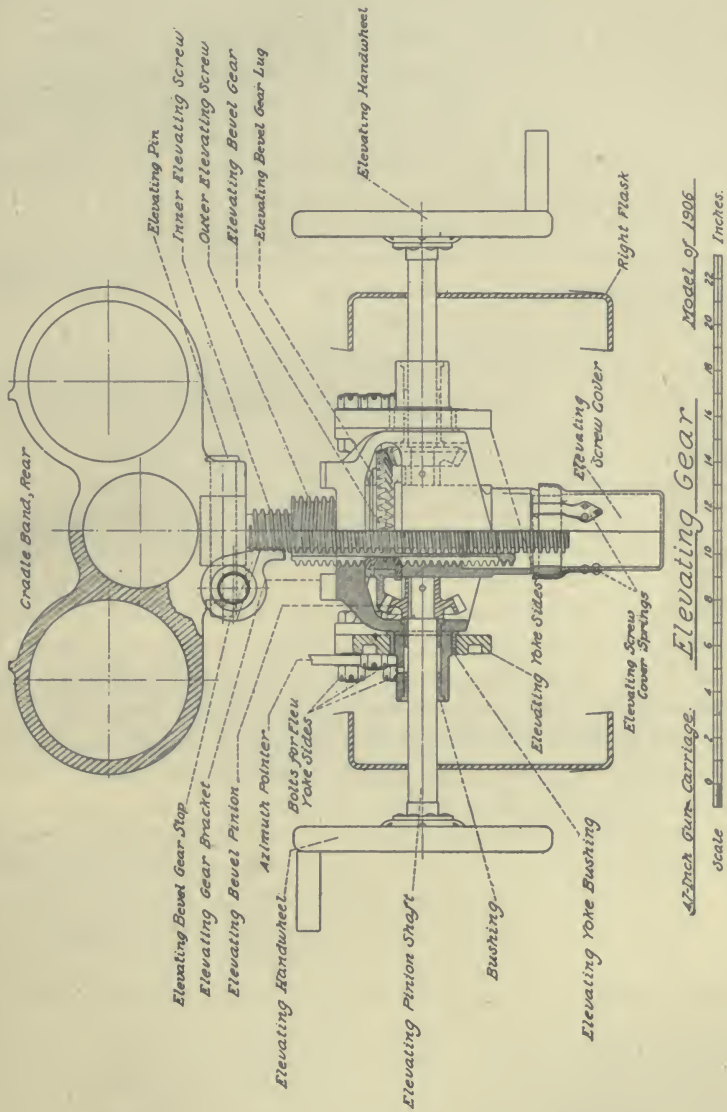
with it, angular motion of the screw with reference to the axis of the carriage being permitted by the vertical pivots of the nut and the bearing. An azimuth pointer bolted to the left side of the elevating yoke indicates upon the azimuth scale the position of the gun in azimuth. The scale is carried by a bracket riveted to the left flask of the trail. It shows an allowable traversing movement of 140 millimetres, 70 on each side of the axis of the carriage, with graduations of a least reading of 5 millimetres.

ELEVATING MECHANISM.

The traversing bracket is extended to the rear by two side plates, the elevating yoke sides and a rear cross piece called the elevating yoke transom, of cast steel held solidly together by five bolts. The elevating yoke transom has a wide bearing surface resting upon the traversing transom liner, rear, and is provided with a clip finished on a radius from the pintle bearing center which embraces a mating part of the liner and prevents vertical motion of the elevating yoke. The elevating yoke sides are bored about a horizontal axis normal to the center line of the yoke and fitted with bronze bushings to receive the elevating gear bracket.

The elevating gear (Pl. XI) is of the double screw type and consists of an inner and an outer elevating screw, an elevating gear bracket, a bevel gear, two bevel pinions, and two shafts with handwheels. The inner elevating screw is a steel screw, threaded with a right-hand thread. It is attached at its upper end by the elevating pin to the cradle band rear. The outer elevating screw is of bronze and is threaded on the exterior with a left-hand thread, while the bore is threaded with a right-hand thread to take the inner elevating screw. On the exterior are also cut two longitudinal keyways in which the keys of the bevel gear work.

The elevating gear bracket is bored out and threaded to take the outer elevating screw, and is provided with two trunnions, which rest in bearings in the elevating yoke sides. These trunnions are bored and bushed to form bearings for the elevating pinion shafts, of which there are two, one on each side, projecting through slots in the flasks of the trail. A steel elevating bevel pinion is pinned and keyed on the inner end of each pinion shaft and meshes with a bronze elevating bevel gear mounted on the outer elevating screw in a seat slotted through the gear bracket. The bore of the bevel gear is fitted with two steel keys, which fit into the keyways in the outer screw. This arrangement constrains the outer screw to rotate with the bevel gear while permitting it a relative longitudinal motion. The revolution of the elevating handwheel rotates the pinions and through them the bevel gear. The outer screw turns with the latter and moves up or down in the elevating gear bracket according to the



4 Inch Gun Carriage. **Elevating Gear** Model of 1906
 scale inches
 For Carriages with Serial Nos. 1 to 40 inc.

direction of its rotation. The inner screw is prevented from rotating by its attachment to the cradle and on account of the direction of its threads moves into or out of the outer screw as the latter is screwed into or out of the gear bracket.

For carriages with serial numbers 1 to 40, inclusive, an elevating screw cover of bronze is attached by three springs to the lower end of the bracket to exclude dust from below, while for carriages with serial numbers above 40, an elevating screw cover is attached to the bracket threads and is secured by a split pin. In traveling, the elevating gear should be run to the position of maximum elevation to house the screws in the elevating gear bracket. In this position, for carriages with serial numbers 1 to 40, inclusive, the face of the lug on the elevating bevel gear strikes against the elevating bevel gear stop on the rear cradle band, and for carriages with serial numbers above 40, the face of the lug strikes against a lug integral with the rear cradle band. The mechanism is designed to give a maximum elevation of 15° and a maximum depression of 5° .

ELEVATING AND TRAVERSING LOCK.

To relieve the pointing mechanism from all strains in traveling, an elevating and traversing lock is provided by which the cradle may be securely locked to the trail.

For carriages with serial numbers 1 to 40, inclusive, this arrangement is as follows:

A lock bolt is mounted in the lock bolt casing which is a bracket bolted to the traversing transom rear and tool box front transom. On the end of the lock bolt is riveted and pinned the lock bolt end on which is pinned the link. The lock bolt spring is located around the bolt in the casing and tends to keep the bolt toward the front. The lever fulcrum is threaded and pinned to the casing and acts as a fulcrum for the lever, one end of which is formed into a handle and the other is pinned to the link. On the tool box top plate is riveted the lever guide to which the lever is attached when the lock bolt is not secured in its seat on the bottom of the rear cradle band. The bolt is arranged to enter its seat when the gun is at 15° elevation and 0° azimuth.

Carriages with serial numbers above 40 have the following arrangement:

A lock bar is seated in bearings riveted to each flask. To the left end of the bar is pinned the lock bar lever on the end of which is threaded the handle and in the handle is located a spring and plunger. When the gun is at 15° elevation and 0° azimuth the lock bar may be rotated until the lock bar fully engages the lug of the rear cradle band. In that position the plunger in the handle engages the lever fastening riveted to the left flask and locks the bar.

TRAVELING LOCK.

These elevating and traversing locks are sufficiently strong to secure the gun when traveling short distances. For use on long marches it is desirable to equalize the load on the wheels of carriage and limber. The gun is disconnected from the spring columns and piston rod and retracted until the breech lug engages the traveling lock provided in the trail. A cast-steel bracket—traveling lock frame—is riveted between the flasks some distance below the tool box. Two cast-steel traveling lock legs are pivoted in this frame, one on each side, the right leg having a folding prop for supporting it in an inclined position. The shifting of weights must be done with the elevating and traversing lock bolt or lock bar engaged with the cradle and the carriage limbered to avoid lifting the weights of the gun in limbering and to avoid the tendency of the piece to slide off the inclined cradle ways when not held by the springs. The spring-rod and piston-rod nuts being removed, the spring yoke and piston-rod nut should be placed in the tool box and the spring-rod nuts reassembled on the spring rods and secured by their split pins to prevent loss. The right leg of the traveling lock being raised and supported by its prop, the gun is slipped back until the breech lug stops against the leg. The left leg is now raised into position in front of the breech lug and the lock bolt and sleeve inserted and secured by the lock-bolt nut. The traveling lock cover should be fixed in the fasteners provided for either the open or closed positions. No special tools should ordinarily be required for this operation, the standard pole or other improvised rod being used to start the gun.

ROAD BRAKE.

The road brake is of the lever type. Two brake-shaft brackets are keyed to the axle, one on each side of the trail. Each is split and clamped to the axle with two bolts which lie in notches in the axle key and prevent displacement of the brackets and longitudinal movement of the trail on the axle. These brackets have bearing lugs with bronze bushings forward of the axle for the brake cranks, arms extending to the rear upon which are suspended the apron latches, and lugs to which is bolted the main shield plate. The brake-shaft bracket, right, has also a fan-shaped flange to which is bolted a forged-steel brake segment. Two brake beams of cast steel are pivoted in lugs on the front of the pintle bearing and at their outer ends carry brake shoes of cast iron hinged on vertical pivots. Brake rods in tension connect the forward ends of the brake beams to the brake cranks upon the brake shaft. These rods are in several pieces; the brake-rod passes through a stiff helical brake-rod spring and the end of a bronze brake-spring cover and is screwed into the brake-rod end which is joined to the brake beam by the brake-rod

pin. The brake-spring cover end is screwed into the brake-spring cover, the spring being compressed between the forward end of the cover and a flange on the brake-rod, which is arranged to have a small longitudinal movement against the pressure of the spring. Adjustment to compensate for wear of the brake shoes is secured by varying the distance the brake-rod end is screwed upon the brake rod. The brake-rod springs insure the desired pressure of the brake shoes on tires of wheels having variable radii. The hubs of the brake cranks form sleeves, assembled from the outside in the bearings of the brake-shaft brackets. The brake shaft is squared at the ends to enter the brake cranks and is pinned to them to prevent longitudinal displacement. The squared right end of the shaft also carries a sleeve to which is hinged the brake lever. When the brakes are set, the lever is held by the teeth of the brake-segment rack engaging the brake-lever catch, a small steel piece riveted to the brake lever, and which may be replaced when broken or worn. A spring holds the lever and catch in contact with the segment. The brake is to be used as a firing as well as a road brake.

THE SHIELD.

The shield for the protection of the crew is hardened steel plate 0.15 inch thick, made in three parts—the apron, the main shield, and the top shield. The main shield is divided by the opening for the gun and cradle, the two sides being joined at the top by a flange-steel hood, riveted on. It is rigidly attached by bolts to the brake shaft brackets and is braced by two main shield braces reaching from its upper corners to the trail flasks. The port in the left plate for the peep sight, when the sight is not being used, is covered by the peep-sight port shutter. A catch on the rear of the shutter secures it in a closed position. To its lower edge, which is about 3 inches below the center line of the axle, is hinged the apron, 20 inches long. For traveling this is swung up to the rear and held by two apron latches attached to the arms of the brake-shaft brackets.

The apron-latch bodies are pivoted to the arms of the brake-shaft brackets; the lower end of the latch body is formed into a hook which engages an apron-latch staple riveted in the apron, and holds the latter in its traveling position. To prevent accidental disengagement of the hook from the staple, the opening of the hook is closed by the apron-latch plunger seated in the body and pressed outward into action by a coiled spring. A grip lever, called the apron-latch lever, is provided for withdrawing the plunger from the hook opening when it is desired to disengage the hook from the staple.

The top shield is hinged to the main shield and braced to two brackets on the main shield by the top shield braces, which serve to fasten the top shield in either the raised or folded positions.

Raised, the upper edge of the top shield is about 69.25 inches above the ground, sufficient to afford protection from long range or high angle fire to cannoneers on the trail seats. Folded, the top is lowered to the rear to allow the panoramic sight line to sweep above it. The port in the top shield for the panoramic sight may also be closed, when the sight is not in use, by the panoramic sight-port shutter, similar in design to the shutter used on the main shield.

SHOULDER GUARD.

For the protection of the cannoneer sighting the gun a shoulder guard is attached to the left spring cylinder at its rear end. The shoulder-guard bracket is riveted to the cylinder, but the guard itself is detachable and is secured in place by a steel pin.

SIGHT AND RANGE QUADRANT TRAVELING CASES.

A leather-lined flange-steel box, called the panoramic sight case, attached to the rear face (left side) of the main shield, provides a place for the panoramic sight in traveling. This box has a hinged lid, secured by a hasp and turnbuckle, and is provided with the usual padlock with chain for locking the box. The bronze supports for the sight case are fastened to the shield by four bolts. The sight case is supported between springs compressed in the supports and held in place by pins acting as spring rods. The mounting is such that the sight is well protected from injury due to shocks and jars. A similar case, called the range quadrant case, is mounted in essentially the same manner in supports bolted to the right flask of the trail, and is provided for the safe transport of the range quadrant. Packing blocks located in the tool-box in the trail form a seat for the rear right shank. Canvas covers are provided for the front-sight and rear-sight brackets, the rear-sight shank, and the sponge. They should be kept in place when these parts are not in use.

DESCRIPTION OF ONE OF THE ACCESSORIES.

Spring compressor No. 4 is now furnished for all carriages. It consists of a rope about 5 feet 7 inches long, having at one end a swivel and socket for attachment to the spring rod, and at the other end a socket for attachment to a plug on a 10-foot length of rope. This 10-foot rope is used only for passing the spring compressor through the spring columns. The spring compressor eye replaces it for attaching the compressor rope to the lifting hook of the duplex chain block. The operation is described on page 58.

This spring compressor is carried in the battery wagon, and two will be furnished per battery.

A list of the tools and accessories furnished with each carriage will be found on page 132.

DISMOUNTING AND ASSEMBLING GUN AND CARRIAGE.

To remove the recoil indicator throw: Withdraw the pins which attach the throw to the dust guard. The pins may be reassembled in the throw, with the split pins spread to prevent loss if the throw is to remain disengaged any length of time.

To dismount the gun: Remove the recoil indicator throw, unscrew the piston rod and spring rod nuts, remove the spring rod yoke, and shove the gun to the rear until the clips are free from the cradle. The weight of the gun is carried by the duplex chain block and the chain sling provided for this purpose. If the gun is dismounted in the gun shed, the block may be attached to the roof; if in the field, it may be slung from the branches of a tree or some improvised tripod. In either case, the chain sling is looped around the gun, in front beyond the front clip, and in the rear between the clips and the gun lug. Burlap should be placed between to protect the various parts. It should be noted that the center of gravity is located about 51 inches from the rear face of the breech.

To mount the gun: Reverse the order of dismounting. The dust guard is to be assembled with the gun.

In moving the gun on or off the cradle, particular care must be taken to support the breech end, so that the gun clips are in prolongation of the cradle rails. The firing shaft is also quite liable to injury during this maneuver, and care should be taken to prevent its being struck by the muzzle of the gun or by implements in the hands of the cannoneers. The cradle should be placed at the desired elevation and azimuth before beginning either of these maneuvers and not changed during its progress, since the working of either the elevating or traversing mechanisms when the gun is only part way in battery brings an excessive and unnecessary strain and wear upon these parts.

To dismount the extension rail on carriages with serial numbers 1 to 40, inclusive: The gun being ordinarily in retracted position, withdraw the extension rail pin, loosen the nuts of the extension rail bolts, and swing them free of the clips of the band, draw the rail forward and replace the extension rail pin in the extension rail. The extension rail is carried in the trail.

To assemble the extension rail in the trail for the same numbered carriages: Pull the pin in the forward fasteners of the extension rail carrier, shove the carrier to the rear and disengage the hook, slide the extension rail on the carrier, starting the front end of the rail on the forward end of the carrier until the catch of the carrier locks the two together; assemble the hook of the carrier in the trail first, and then engage the forward fasteners and pin.

To remove the extension rail of carriages with serial numbers above 40: The gun being ordinarily in the retracted position, disconnect

the extension rail plungers and allow the extension rail to swing downward around the extension rail pin. Swing the extension rail rearward until the latch plunger on the extension rail engages the extension rail latch socket on the cradle. Assemble in the reverse order.

To dismount the recoil cylinder: Bring the cradle to approximately 0° elevation, remove the extension rail and piston rod nut. Release the recoil cylinder lock on the underside of the cradle band front by pulling the split pin and allowing the lock to drop out of the slot in the cylinder (for carriages 1 to 40, inclusive, it will be necessary to mark the slot with chalk or pencil for identification in assembling), unscrew the cylinder from its seat in the trunnion band, moving the end of the spanner wrench from the right side of the carriage toward the left, and withdraw the cylinder forward from the cradle.

Do not allow the threads on the cylinder or piston rod to strike the front band or become damaged in any way. Should the piston rod stick in the gun lug, it may be started by light blows from a block of wood after the cylinder is partially withdrawn from the cradle. The front end of the piston rod is close to the front head of the cylinder when both are in firing position. Hence battering the rear end of the piston rod will result in driving the piston against the front cylinder head to the probable damage of both.

To assemble the recoil cylinder: Reverse the operation of dismounting, screwing the cylinder into the trunnion band and assembling the cylinder lock in the notch. For carriages with serial numbers 1 to 40, inclusive, this notch should be that one which brings the threaded part of the cylinder nearest flush with the front of the trunnion band and the filling plug in the stuffing box on top.

To drain the recoil cylinder: For carriages with serial numbers 1 to 40, inclusive, bring the cradle to 0° elevation or slight depression, remove the drain plug in the front cylinder head and loosen the one in the stuffing box. Should the front plug not be in the lowest possible position, the cylinder may be rotated by loosening the recoil cylinder lock, or the cylinder may be entirely dismantled. As soon as thoroughly drained, replace the drain plug and tighten securely.

For carriages with serial numbers above 40, elevate the cradle to nearly maximum elevation and remove the drain plug near the lowest element of the stuffing box, and loosen the filling plug near the top element of the box. After the cylinder is thoroughly drained, replace the lower drain plug and tighten securely.

To fill the recoil cylinder: If the cylinder is not completely filled, loss of stability will occur and higher stresses than normal will be developed in the carriage; for this reason the cylinder should be filled with the greatest care; a commissioned officer should himself verify that

the cylinder is full and that no air is left in it, with the exception of the void noted below.

The easiest way to fill the cylinder is to fill it when disassembled from the carriage. If this is impracticable, fill as follows: Depress the gun to maximum depression and remove the top filling plug in the stuffing box. Fill slowly through this hole, using the filling funnel furnished with the store limber. When apparently full, allow a few minutes for the oil to settle and pocketed air to escape and then refill. When satisfied that the cylinder is entirely full, remove the funnel and elevate the gun enough to allow about 10 cubic inches (about one-third pint) of oil to escape, thus providing a void for the expansion of the oil. Then screw the filling plug in tightly.

It may happen that after firing a few rounds the gun will not return to battery. This may be due to, first, weakness of springs; second, stuffing box gland being screwed up too tightly; or, third, the oil having expanded, due to heat.

In either case the cause must be ascertained and remedied; if due to expansion of oil, it is proven by the fact that the gun can not be pushed into battery by force exerted on the breech. In that case depress to maximum depression and remove the filling plug. The oil will now escape, permitting the gun to return to battery.

Approximately 32 pints of oil are required for filling the cylinder. Hydroline oil of a specific gravity of 0.85 is furnished by the Ordnance Department for use in these cylinders; it is characterized by its low freezing point and by its noncorrosive action on metals. The oil used in the cylinder is to be clean and free from grit and dirt; to insure this it is to be strained through a clean piece of linen or muslin before using.

In emergencies water may be used in the cylinder. *This should be done only when absolutely necessary and never in freezing weather, and as soon as practicable the cylinder is to be emptied, cleaned, and thoroughly dried, and filled with hydroline oil.*

To remove the piston and piston rod: With the cylinder in the cradle, bring the cradle to 0° elevation and drain out the oil. Unscrew the front cylinder head and remove it with the counter-recoil buffer. Take off the piston-rod nut, slacken the gland to release the pressure on the rod, and pull the piston and rod out to the front. In replacing the rod it will probably not be found necessary to remove the gland and packing. In dismounting or assembling the front cylinder head, the cylinder should never be clamped in a vise, as its walls are thin and not intended to withstand such usage. *The rear cylinder head—stuffing box—should never be unscrewed.*

To pack the stuffing box: The stuffing box is packed with five rings of Garlock's hydraulic waterproof packing, 0.375 square. The packing is issued cut into rings of such size that the ends meet around the

piston rod. The latter being assembled, each ring, placed so as to break joints with the preceding one, is forced in succession to its seat by a packing tool of copper or hard wood, one end of which is shaped like a carpenter's gouge and the other end forms a handle strong enough to stand light taps from a hammer. Such a tool may be readily improvised by the battery artificer. After the five rings are firmly seated in the box screw the gland down on the packing.

In assembling the gland be sure that *at least six* of its threads are engaged with the threads of the stuffing box; otherwise the threads of the gland may be stripped in firing. With new packing it may be found difficult to insert more than four rings and secure sufficient engagement of the gland. In such a case the box should be packed with four rings and the piece fired a few rounds, after which the fifth ring should be inserted.

Adjustment of the gland: The adjustment of the gland will require the exercise of some judgment. If screwed up too tight, the frictional resistance of the packing on the piston rod will be so much increased that the counterrecoil springs may fail to return the gun to battery, especially at high angles of elevation. It should be screwed up just tight enough to prevent the leakage of oil through the stuffing box.

The necessity for dismounting parts of the recoil cylinder will seldom arise. It should be done only in the presence of a commissioned officer, who should see that the parts are handled with the greatest care. In assembling, the parts should be thoroughly cleaned, as the clearances in the cylinder are very small and the presence of small foreign particles may interfere with the proper working of the assembled parts.

To assemble the spring system: With the cradle at maximum elevation and the trail horizontal shove the first section of the outer springs into its spring cylinder until its front end is about 2 inches in, set up a separator against the forward end of this section and enter the second section, keeping the separator upheld between the sections; similarly when the outer end of the second section is 2 inches inside the spring cylinder enter the second separator and third section of spring. Shove the column in against the rear end of the spring cylinder (the front end of the last section will project about 30 inches), enter the outer stirrup and shove it in the outer springs until its forward flange rests against the end of the spring; it will then hold the last section in line. Proceed in like manner to assemble the intermediate spring sections and separators; the forward end of the last section will project about 20 inches from the outer stirrup. Place one section of the inner spring column in the inner stirrup and the two others, with the separators, on the spring rod. Pass the spring-rod connection end of the spring compressor rope through the stirrup and

one section of spring from the rear and screw it on the rear end of the rod; the rope, stirrup, springs, and spring rod are now entered as one piece in the intermediate springs, the rope passing out the rear end of the spring cylinder. After the springs are located at their assembled free height as above, the spring compressor extension is disconnected and in its place is screwed the spring compressor eye. The lifting hook of the chain of the duplex block, secured to the rear end of the trail by passing the hook on the block under a crowbar placed across and in rear of the handspikes or held by means of a picket rope, is brought forward and attached to the eye. The carriage should now be slightly traversed so that the taut rope will lie in the center line of the spring cylinder.

In compressing the springs it will be found that the flange of the outer stirrup tends to sag and catch on the front end of the spring cylinder, and at the same time the rear end of the stirrup must be carefully guided through the rear spring cylinder head; similarly the inner stirrup must be watched and guided as its flanges enter the outer stirrup. When the springs are sufficiently compressed the spring cylinder cover is to be assembled, care being taken to insure the exact adjustment of hinge pins and split pins or swing bolts. The compressor rope may now be slackened and disengaged from the spring rod and the other side of the system proceeded with. In assembling the other side of the system for carriages with serial numbers 1 to 40, inclusive, the same method is used and the spring rod yoke is attached when the two spring cylinder covers are in place.

In assembling the other side of the system for carriages with serial numbers above 40, it is necessary to secure the spring compressor block to the assembled spring rod and then remove the spring-cylinder cover. When the two columns are assembled the cover is again attached, the block removed, and the spring-rod yoke assembled in place.

As the spring columns are assembled under a load of 1,000 pounds, serious results may attend a sudden release by breakage of the rope or other part while under tension. The ropes should be carefully inspected before using, and all persons be required to keep arms and bodies away from the front of the spring column during these operations. Due to the inequalities of the spring pressure of the inner intermediate and outer springs, the outer or inner stirrup may project more to the rear on one side than on the other.

To dismount the spring system: With the cradle at maximum elevation and the trail limbered, remove the spring-rod plug nuts and the spring-rod yoke. For carriages with serial numbers above 40, the spring compressor block should be attached to that spring rod, not being dismounted.

Screw the spring compressor rope or body in its position on the rod to be dismantled and make the rope taut by means of the block located as above. Traverse the cradle slightly so that the taut rope lies in the center line of the spring cylinder. Remove the cylinder cover and slowly unwind the rope until the springs are free. If necessary to remove the other column for carriages with serial numbers above 40, it will be necessary to replace the spring-cylinder cover before removing the spring compressor block.

To dismantle the shield: Disconnect the apron by pulling the hinge pins, remove the bolts fastening the main shield to the trail, take off the main shield braces and main shield side plates, and lift the shield plate off to the rear.

To dismantle the cradle: Remove the gun, shield and elevating pin, take off the trunnion caps, and lift the cradle from the pintle yoke.

To dismantle the traversing gear: Remove the bolts securing the traversing-screw bracket to the trail; the screw may then be disengaged from the nut and taken out with the bracket, bearing, and cap; the nut and traversing-screw bearings are freed by removing their cap bolts. In assembling, the oil plugs in the bearing and the traversing nut are to be placed on top.

To dismantle the elevating screws: Remove the elevating pin; unscrew the inner screw by hand; remove the elevating-screw cover; remove the outer screw by screwing it down through the elevating-gear bracket.

To dismantle the pinions and bevel gear: Remove the split pin in the pinion hub, after which the pinion shaft may be withdrawn and the pinion removed from its seat. The bevel gear may then be removed by dismantling the screws, as above.

To dismantle the elevating-gear bracket: Free the mechanism from the cradle by removing the elevating pin; dismantle the pinions and pinion shafts as above; remove the five bolts attaching either elevating yoke side to the traversing bracket and elevating transom; the bracket may now be slipped free from the other side of the yoke.

To assemble the elevating mechanism: The operations just described are reversed. The following should be noted: The pinions are a close fit on their shafts, and especial care should be taken not to burr the parts in assembling. As the outer screw is being assembled in the gear bracket from below, the bevel gear should be put in place with its keys engaging the keyways of the screw. Before attaching the inner screw to the cradle both screws should be run down to be sure that the upper end of the outer screw is flush with the face of the gear bracket when the inner screw is clear in and its head in position to engage the cradle and that the lug on the elevating bevel gear functions properly against the elevating bevel-gear stop on the rear cradle band or the lug integral with the band. If this condition is not ful-

filled, the mechanism may not give the maximum elevation for which it is designated and will not house properly in traveling nor will the elevating and traversing lock function correctly.

To dismount the brake: Disconnect the brake rods by pulling the pins in the beams and taking the nuts from the cranks; in reassembling, the rods will be first assembled to the cranks and then in the beams. To remove the beams from the pintle bearings it is necessary to dismount the recoil cylinder to get out the hinge pins; the brake shoe is freed from the beam by withdrawing the brake-shoe pin. The brake beams with shoes attached are rights and lefts and are properly assembled when the shoe has a full bearing upon the tire. To take out the brake shaft, remove the left wheel and the pin of the right crank; the shaft and left crank may be pulled out to the left. In assembling the shaft, note that the cranks are to be in line, with the brake lever and hinge *opposite* them on the shaft. The tension of the brake-rod spring is regulated by removing the split pin which passes through the brake-spring cover and screwing the brake-spring cover end in or out of the cover. The tension of the spring is increased by screwing the end into the cover. The length of the brake rod should be adjusted by screwing the front end of the rod into or out of the brake rod end.

To adjust the brakes: The brake rods are disconnected from the brake beams. The brake shoes are placed with the clearance from the tire desired and the brake lever with the brake-lever catch engaging the forward notch (extreme released position). The length of the brake rods should then be adjusted to correspond. Should test show that one shoe bears harder on the wheel than the other, the rod of the latter should be shortened.

To remove a wheel: Support the axle in order to bring the wheel clear of the ground. Lift up the flap of the hub latch, thus disengaging its bolt, and unscrew the hub cap; the wheel fastening which is now exposed is secured to the axle by a spring pin in one side; when this is pressed back the wheel fastening may be lifted free of the axle and the wheel slipped off.

To remove a hub liner: Take the wheel from the axle and drive the liner out by striking with a heavy hammer or sledge upon a suitable wooden or metal block placed against the small end of the liner. A hub liner driving tool is carried in the forge limber for this purpose. In assembling a new liner be sure the surfaces are perfectly clean and that no dirt gets under the flange of the liner to prevent its being driven solidly against the face of the hub. Unless the liner is forced completely into the hub the distance from the face of liner to the small end of the hub may be too great to allow the assemblage of the wheel fastening. Should the outer end of the liner project beyond the small end of the hub it may be filed flush.

To dismount the traversing bracket and pintle yoke: The gun, cradle, and main shield being off, dismount the traversing screw and elevating pinion shafts, withdraw the bolts connecting the traversing bracket and pintle shape; the bracket may be withdrawn forward, the pintle yoke given one-sixth of a turn and lifted from the pintle bearing.

To dismount the trail and axle: The wheels, shield, cradle, brake, etc., having been removed as described above, remove the clamping bolts from the brake-shaft brackets, slip the brackets off the axle, and loosen the clamping bolts in the axle bearings; the axle may then be withdrawn from the trail.

The parts of this carriage in general are made with sufficient clearance to permit of the assemblage of any part without the use of force. In assembling them no part should be directly struck with a hammer. If resort to force is necessary, a piece of wood or a copper drift should be interposed between the hammer and the part struck. Most of the nuts and pins are provided with split pins as keepers. The split pins must, of course, be removed to remove the nut, and when the nut or pin is assembled the split pin should be inserted and properly opened. When bolts are removed it is a good plan to screw the nuts back on the bolts to keep the threads of both clean and undamaged until they are restored to the carriage. A pair of wire-cutting pliers is provided for use in pulling split pins, cutting wire lashings, etc.

CARE AND CLEANING OF RECOIL CYLINDER AND OTHER PARTS OF THE CARRIAGE.

The carriage is a machine for controlling the recoil of the gun, and must be properly cleaned and cared for to insure its working correctly. The officers responsible for the efficiency of the battery should familiarize themselves with the carriage mechanism and with the foregoing instructions as to the methods of mounting and dismounting the various parts, and should see that the carriage is properly handled, cleaned, and cared for. The following general directions for its care and cleaning are given:

The recoil cylinder should be emptied and refilled once every three months, and thoroughly cleaned once every six months, or oftener if the conditions require it. The cylinder is most readily emptied and filled when removed from the carriage. For cleaning, it is dismounted and the cylinder head, counter-recoil buffer, and piston rod removed, as heretofore described. The interior of the cylinder, the piston, the counter-recoil buffer, and the stuffing box should then be thoroughly cleaned by the use of cotton waste and kerosene oil and wiped dry with cotton waste. The removal of the packing is not necessary in cleaning the stuffing box. The cylinder bore should be carefully inspected, and if any rust has formed it should be removed with kerosene oil, using, if necessary, *fine* emery cloth. The latter

must be used with great care to prevent any increase in the clearance between the cylinder and piston. If rubbing, burring, or scoring of the parts is noted, the rough spots should be carefully smoothed down by a skilled workman with a dead-smooth file or with emery cloth, and the cause of the roughness ascertained and removed. Where unusual rubbing or scoring has occurred, the facts will be reported to the officer of the Ordnance Department charged with the duty of keeping the battery in repair, for his information and action.

The parts should be reassembled immediately after cleaning and inspection and the cylinder filled with the hydroline oil issued for that purpose. The piston should be moved back and forth in the cylinder by hand to make sure that all parts are correctly assembled and are without interference. The cylinder should then be mounted in the carriage and the gun pulled from battery by hand, using the Duplex chain block and the retracting eye carried in the battery wagon, and permitted to counter recoil rapidly to insure that all parts are in proper position for firing. *This should never be done, however, unless the cylinder is known to be filled with oil.* In reassembling the parts the condition of the fiber washer between cylinder head and recoil cylinder should be noted; it should be replaced whenever necessary to prevent leakage. In removing and inserting the piston rod care should be taken to keep it central in the cylinder, so as not to bind, burr, or spring any parts. The dismounting and reassembling of the parts of the cylinder should in every case be supervised by a commissioned officer. Before firing, an inspection should be made to ascertain that the different parts, especially the piston rod and spring rod plug nuts, are correctly assembled.

The recoil-cylinder oil should be stored in the closed cans provided for the purpose, and be carefully protected from dirt, sand, or water. Oil withdrawn from cylinders and containing any sediment must not be used again for any purpose until it has been allowed to settle for not less than 24 hours. When sediment has thus been permitted to settle, great care must be taken not to disturb it in removing the oil. To insure the cleanliness of all cylinder oil it should be strained through a clean piece of linen or muslin before using.

The counter-recoil springs should be dismounted at least once every six months and be thoroughly cleaned. All rust should be removed and the springs well oiled before assemblage. When the springs are dismounted the interiors of the cradle should be cleaned and examined for defective riveting, missing rivet heads, and scoring. The stirrups should be carefully examined for bulged or cracked ends and loose rivets, and all burrs or scores on the bronze heads carefully smoothed off.

The recoil guide rails of the cradle should be kept well lubricated. Immediately before beginning to fire, they should be oiled through

all the oil holes of the gun. Lack of proper lubrication of these guide rails is the most frequent cause of failure of gun to return fully into battery.

The elevating and traversing mechanisms should be dismantled at least once every six months for thorough cleaning and overhauling. They should be kept well oiled and should work easily. If at any time either mechanism works harder than usual it should be immediately overhauled and the cause discovered and removed.

In traveling the cradle should be locked to the trail by means of the elevating and traversing lock, so as to relieve the pointing mechanisms of all travel stresses.

The wheels and wheel fastenings should be dismantled periodically and the fastenings, hub boxes, axle arms, and axle bore cleaned and examined. All roughness due to scoring or cutting should be smoothed off. In oiling the wheels in service a small quantity (about 1 gill) of lubricating oil should be placed in the axle bore through the oil valve in the hub cap. A short experience will enable the battery commander to determine how often the wheels should be oiled.

The nuts on the hub bolts should be tightened monthly the first year of service and twice a year thereafter. The ends of the bolts should be lightly riveted over to prevent the nut from unscrewing. When the hub bolts are tightened, the hub band should be screwed up as tightly as possible against the lock washer at the outer end of the wheel hook bushing.

The wooden parts of the wheels are made of thoroughly seasoned materials, and the hub bolts and bands, when the wheels are issued, are properly tightened; but all wood is susceptible to change with atmospheric conditions, so that the spokes speedily become loose, and if the wheel is used in this condition it will rapidly be made unserviceable and may be damaged beyond repair.

The importance of strict compliance with these instructions can not be overestimated.

All working and bearing surfaces of the carriage require oiling; those not directly accessible for this purpose are provided with oil holes closed by spring covers or bronze plugs. Each component part of a carriage is made interchangeable with the similar parts of other carriages of the same model, except that certain parts are not interchangeable between carriages with serial numbers from 1 to 40, inclusive, and those with numbers above 40, as noted in the table of nomenclature of parts, page 37, and is, except in the case of certain springs and very small parts, stamped with an individual symbol number and letter; this symbol may be followed by an additional number which indicates a slight change in design from the original. When requisitions for replacements are to be made *the symbol should be copied thereon, exactly as stamped upon the unserviceable piece.*

THE 4.7-INCH GUN AND 6-INCH HOWITZER LIMBER, MODEL OF 1905.

(This limber is common to the 4.7-inch gun and 6-inch howitzer batteries.)

WEIGHTS, DIMENSIONS, ETC.

Weight, complete, including spare connecting pole.....	pounds..	1, 545
Weight, with 4.7-inch gun and carriage, model of 1906.....	do....	8, 965
Diameter of wheels.....	inches..	50
Width of track.....	do....	60
Free height under limber and carriage.....	do....	16.37
Turning angle with 4.7-inch gun carriage.....	degrees..	54

NOMENCLATURE OF PARTS.

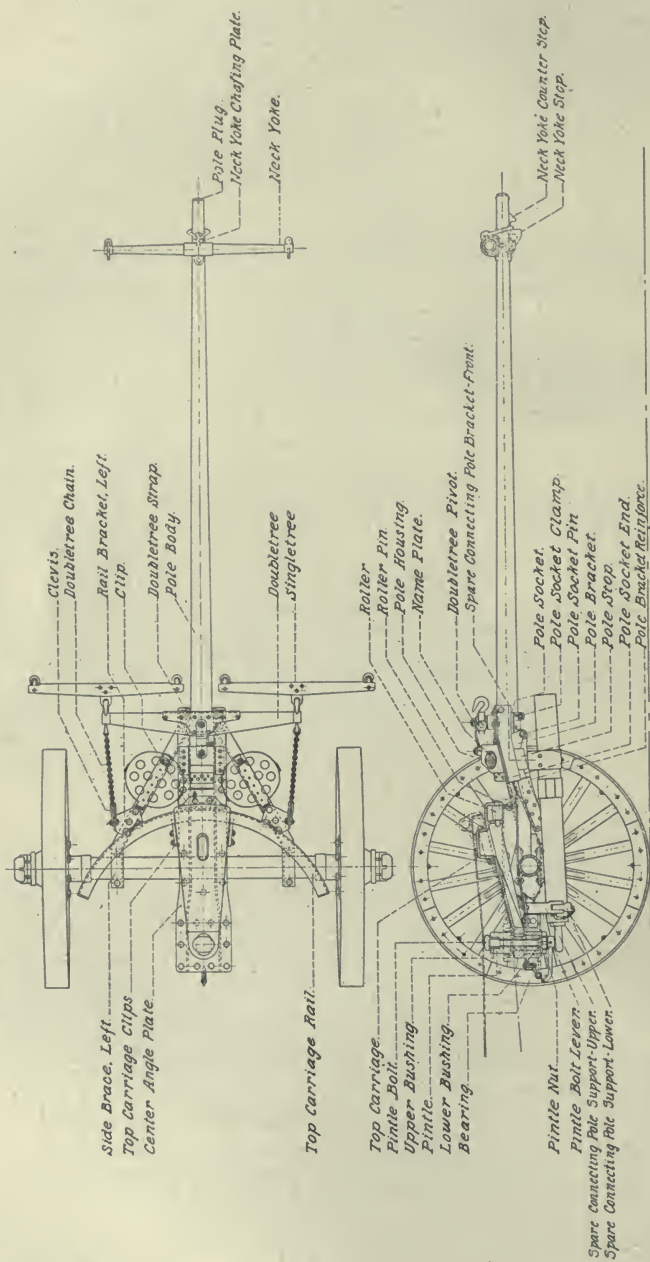
No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Axle.....			
2	Bucket holders.....	Riveted to side braces.....		
4	Bucket straps.....	In strap fasteners.....		
8	Bucket strap fasteners, Style No. 1.....	Riveted to bucket holders.....		
1	Center angle, left.....	Under axle.....		
1	Center angle, right.....	do.....		
1	Center angle plate.....	Over axle.....		
1	Clip.....	Braces top carriage rail at center.....		
1	Doubletree, complete, consisting of—			
1	Doubletree body.....			
2	Double hooks.....	At ends of doubletree.....		
1	Nipple.....	Through center of doubletree.....		
1	Nipple nut.....	On nipple.....		
1	Nipple separator.....	Around nipple.....		
1	Reinforce piece.....	Reinforces middle of doubletree.....		
14	Separators.....	Around rivets.....		
2	Doubletree chains, complete, consisting of—			
2	Chains.....	Limit movement of doubletree.....		
2	Clevises.....	Bolted to rail brackets.....		
2	End links.....	Loop over double hooks.....		
1	Doubletree pivot.....	In pivot strap.....		
1	Doubletree pivot strap.....	Bearing for doubletree.....		
1	Doubletree strap.....	Bolted to pole housing.....		
1	Eye rivet.....	On underside of pintle bearing.....		
1	Name plate.....	On right side of pole housing.....		
1	Neck yoke, complete, consisting of—			
1	Neck-yoke body.....			
1	Center eye sleeve.....	Around middle of body.....		
2	End eye sleeves.....	Riveted on ends of body.....	IV	3
2	Eye rings.....	Through end eye sleeves.....		
2	Eye-ring loops.....	In eye rings.....		
2	Loop sleeves.....	On eye-ring loops.....		
2	Martingale staples.....	Through neck-yoke body.....		
1	Pole ring.....	In center eye sleeve.....		
1	Pintle, complete, consisting of—			
1	Pintle.....	Through pintle bearing.....		
1	Lower bushing.....	In lower end of pintle.....		
1	Key.....	In side of pintle.....		
1	Pintle nut.....	On lower end of pintle.....		
1	Upper bushing.....	In upper end of pintle.....		
1	Pintle bearing.....	Riveted to rear ends of center angles and center angle plate.....		
1	Pintle bolt, complete, consisting of—			
1	Pintle bolt.....	Through pintle.....		
1	Pintle-bolt lever.....	On lower end of pintle bolt.....		
1	Bolt snap.....	Snaps into eye rivet.....		
1	Chain.....	Holds pintle bolt in locked position.....		
1	Ring.....	Through hole in end of pintle-bolt lever.....		
1	Pole, complete, consisting of—			
1	Pole body.....			
1	Pole pin bushing.....	Inside of body.....		
1	Pole plug.....	Riveted in front end of pole.....		
1	Butt reinforce.....	Riveted in rear end of pole.....		
1	Neck-yoke chafing plate.....	Riveted to upper side of body.....		
1	Neck-yoke counter stop.....	Hinges on counter stop pin.....		
1	Neck-yoke counter stop pin.....	Riveted in pole body.....		
1	Neck-yoke counter stop spring.....	Bears on neck-yoke counter stop.....		
1	Neck-yoke stop.....	Riveted in body.....		

¹ The components are for steel pole, which will be issued to replace the wooden pole when the latter becomes unserviceable and the present supply of wooden poles is exhausted.

NOMENCLATURE OF PARTS—Continued.

No.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Pole bracket, left.....	} Support pole socket.....		
1	Pole bracket, right.....			
1	Pole bracket reinforce, left.....	Riveted to pole bracket, left.....		
1	Pole bracket reinforce, right.....	Riveted to pole bracket, right.....		
1	Pole housing.....	Over rear of pole socket.....		
1	Pole pin.....	Secures pole in socket.....		
1	Pole-prop pocket.....	Riveted to side brace, left.....		
1	Pole-prop support.....	Riveted to side brace, left.....		
1	Pole-prop strap.....	In strap fasteners.....		
2	Pole-prop strap fasteners, style No. 2.....	Riveted to side brace, left.....		
1	Pole socket, complete, consisting of—	Hinges in pole brackets.....		
1	Pole-socket body.....			
1	Pole-socket clamp.....	Riveted to pole-socket body.....		
1	Pole-socket end.....	Over end of pole-socket body.....		
1	Pole-socket reinforce.....	Riveted to top of pole-socket body.....		
1	Pole stop.....	Under rear of pole socket.....		
1	Rail bracket, left.....	} Brace top carriage rail at sides.....		
1	Rail bracket, right.....			
1	Side brace, left.....			
1	Side brace, right.....			
2	Singletrees, complete, consisting of.....	Attached to doubletree.....		
2	Singletree bodies.....			
2	Singletree eyes.....	In middle of singletree.....		
4	Singletree hooks.....	At ends of singletree.....		
1	Spare connecting pole bracket (front).....	Riveted to center angles.....		
1	Spare connecting pole bracket (front) upper strap.....	Riveted to spare connecting pole bracket (front).....		
1	Spare connecting pole support complete, consisting of—			
1	Spare connecting pole support (lower).....	Hinged to spare connecting pole support (upper).....		
1	Spare connecting pole support pin.....	Lock's pole support (lower) in position.....		
1	Chain, with bolt snap and two rings.....	In end of connecting-pole support pin.....		
1	Chain rivet.....	In pole support (lower).....		
1	Top carriage, complete, consisting of—			
1	Top carriage.....	Turns in pintle bearing.....		
2	Top-carriage clips.....	Bolted to top carriage.....		
3	Rollers.....	On roller pins.....		
3	Roller pins.....	Pinned in top carriage.....		
1	Top carriage rail.....	Bearing for top carriage rollers.....		
2	Wheels, 50-inch, complete, consisting of—			
16	Carriage bolts and nuts.....	Through hub box and spokes.....		
16	Dowels.....	In ends of felloe segments.....		
64	Felloe rivets and washers.....	Through felloe segments.....		
16	Felloe segments.....			
2	Hub bands.....	Screwed on hub boxes.....		
2	Hub boxes.....			
2	Hub caps.....	On ends of hub boxes.....		
2	Hub latches.....	Actuate hub latch plungers.....		
2	Hub-latch pins.....	Pin hub latches to plungers.....		
2	Hub-latch plungers.....	Lock hub caps in place.....		
2	Hub-latch springs.....	On hub latch plungers.....		
2	Hub liners.....	Forced into hub boxes.....		
2	Hub rings.....	Outer flanges of wheel hubs.....		
2	Lock washers.....	Between hub bands and hub rings.....		
2	Oil valves.....	Slide in hub caps.....		
2	Oil valve springs.....	Around oil valves.....		
2	Oil-valve washers.....	On inner ends of oil valves.....		
32	Spokes.....			
2	Tires.....			
16	Tire bolts with nuts and washers.....	Through tires and felloe segments.....		
2	Wheel hooks.....	On outside of hubs.....		
2	Wheel-hook bushings.....	Bearings for wheel hooks.....		
2	Wheel fastenings, complete, consisting of—			
2	Wheel fastenings.....	On ends of axle.....		
2	Wheel-fastening plugs.....	In wheel fastenings.....		
2	Wheel-fastening plungers.....	Hold wheel fastenings in place.....		
2	Wheel-fastening springs.....	Actuate wheel fastening plungers.....		

IV 3



47-Inch Gun and 6-Inch Howitzer Limber, Model of 1905.

Scale 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
Inches.

DESCRIPTION OF THE 4.7-INCH GUN AND 6-INCH HOWITZER LIMBER,
MODEL OF 1905.

Plate XII.

The carriage limber is designed to afford the usual arrangement for the attachment of the team and to support the trail in traveling. Motor traction may also be employed by substituting a short connecting pole for the regular limber pole. The principal parts are the wheels, axle, frame, top carriage, pole socket, pole, doubletree, singletrees, and neck yoke. The limber is made of metal throughout, wood being used only in the spokes and felloes of the wheels.

The top carriage is formed for use with the trails of either the 4.7-inch gun carriage, model of 1906, or the 6-inch howitzer carriage. The trail of the carriage rests on the top carriage of the limber. When the limber is turning a corner the top carriage revolves about the pintle center, rolling on the top carriage rail of the limber frame.

A wide flange steel center angle plate is riveted to the axle as a middle rail, and with the braces of heavy steel angles underneath and at the sides forms a trussed frame for the vehicle. Sixteen inches to the rear of the axle a bronze bearing for the pintle is solidly riveted between the rear ends of the center angle plate and center angles. Forward, these converge with the side braces and form a yoke in which the pole socket may oscillate in a vertical plane. The front ends of this yoke are connected by the riveted doubletree pivot strap. A seat for the doubletree is formed on the top of the doubletree pivot strap; the doubletree pivot is screwed into this seat and projects up through the doubletree; its upper end is threaded for a crown nut and is braced back to the pole housing, a flange steel part which constrains the pole socket in its vertical plane and limits the upward movement of its rear end. The pole socket is of flange steel with its forward end split and furnished with a clamp bolt for drawing firmly about the pole.

The pole pin passes through pole brackets and pole bracket reinforces, riveted on each side of the yoke, and the clamp forging of the socket, securing the socket to the frame. Between the pole housing and the pole stop the socket may swing through an angle of about 31° with the socket pin as an axis. This pivoting of the pole is necessary, as the entire limber body rotates about the axle in passing over uneven ground.

The top carriage rail is a steel angle bent to the arc of a circle and located on the frame with the center of the arc at the pintle center. It is riveted to the side braces by the rail brackets and to the center angle plate by a suitable clip.

The top carriage is a steel casting. Its rear end fits in the bearing of the frame and is bored to receive the steel pintle, a heavy pin

with a long head of elliptical section, keyed in with the major axis of the ellipse on the center line of the top carriage. The pintle bolt in the center of the pintle has an elliptical head to match the pintle and at its lower end a lever with chain-and-snap fastening. When a carriage is to be limbered, the bolt is turned until its elliptical head coincides with the pintle so that both may enter the elliptical lunette transom bushing of the carriage trail; once so entered the pintle bolt is turned 90° in the pintle and secured by its chain in that position, the head thus preventing the disengagement of pintle and lunette.

The front end of the top carriage is provided with three bronze conical rollers which rest and run on the top carriage rail; and with clips which embrace the edge of the rail to prevent accidental dismounting. There is also a spur located on the top of the top carriage which enters the trail-end reinforce plate of the carriage and holds the trail and top carriage in line.

The wheels are 50 inches in diameter, with tires 5 inches wide. The hubs are exactly similar and interchangeable with those in the wheels of the carriage. The axle is hollow and is made from a single piece of forged steel.

The pole is now made of steel and is prevented from turning in its socket by the pole pin. A pole plug is riveted in the front end of the pole, and a neck-yoke stop near the end. Just forward of the neck-yoke stop is the neck-yoke counterstop, which, with its spring, is hinged inside of the pole and works through a slot cut in the underside of the pole. A neck-yoke chafing plate is riveted to the top of the pole above the neck-yoke stop.

The doubletree and singletrees are made of flange steel formed to a U shape. The hole in the former for the doubletree pivot is bushed with a bronze nipple, held in place by a steel nut, and may be replaced when worn. Two doubletree chains reach from the ends of the doubletree to the rail brackets on the frame, to which they are bolted. The neck yoke is of steel tubing with steel sleeves and rings. The spare connecting pole is carried in brackets under the frame; and a pole prop on the left side brace. A bucket holder with straps is located on each side brace for carrying the four canvas watering buckets. A name plate is riveted to the left side of the pole housing, giving number, name of limber, model, name of manufacturer, year of completion, and initials of inspector. *In all reports and correspondence, the limber should be designated by the number, name, model, etc., as given on the name plate.* As repairs to the limber may from time to time be required, the parts needed should be referred to by the names given in the nomenclature of parts, and the symbols should be copied exactly as stamped upon the unserviceable pieces.

**THE 4.7-INCH GUN LIMBER AND CAISSON, MODEL OF
1908.**

WEIGHTS, DIMENSIONS, ETC.

Weight of limber, empty, without implements or ammunition.....	pounds..	1,821
Weight of implements carried.....	do....	85
Weight of ammunition carried.....	do....	2,055
Weight of limber, completely equipped and loaded.....	do....	3,961
Weight of caisson, empty, without implements or ammunition.....	do....	2,058
Weight of implements carried, including spare connecting pole.....	do....	147
Weight of ammunition carried.....	pounds..	2,055
Weight of caisson, completely equipped and loaded.....	do....	4,260
Rounds of ammunition carried on limber.....		28
Rounds of ammunition carried on caisson.....		28
Diameter of wheels.....	inches..	60.0
Width of track.....	do....	60.0
Free height under caisson.....	do....	19.55
Turning angle.....	degrees..	76

NOMENCLATURE OF PARTS.

Number on limber.	Number on caisson.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
28	28	Ammunition chest connecting pieces.	Connect rear and middle diaphragms in chest.	IV	3
	1	Apron.....	Hinged to chest bottom.....		
	3	Apron hinges (male).....	Riveted to apron.....		
	3	Apron hinges (female).....	Riveted to chest.....		
	3	Apron-hinge pins.....			
	2	Apron latches, complete, including—			
	2	Latch bodies.....			
	2	Latch handles.....			
	2	Latch springs.....	On latch bases.....		
	2	Plungers.....			
	2	Handle pins.....			
	2	Apron-latch staples.....	Riveted to apron.....		
	1	Ax pocket.....	On top of chest.....		
	1	Ax-handle bracket.....			
	1	Ax strap.....	In fasteners.....		
	1	Ax-strap fastener, No. 2.....	On top of chest.....		
	1	Axle.....			
	2	Axle bearings, caisson, 1 right, 1 left.....	Each in two pieces, riveted to chest.....		
	2	Axle bearings, limber, 1 right, 1 left.....			
	4	Axle-bearing bolts and nuts.....	Clamp axle in bearings.....		
	4	Axle-bearing reinforce plates (front).....			
	4	Axle-bearing reinforce plates (rear).....			
	1	Bolt snap, with chain.....	On left side of chest.....		
	2	Brake beam, complete, including—			
	2	Bodies.....			
	4	Hinges.....			
	2	Brake-beam clips.....	Pivoted to brackets on chest.....		
	2	Brake-shoe bearings.....			
	2	Brake-beam stiffeners.....			
	2	Brake-beam brackets, 1 right, 1 left.....	Riveted to chest front.....		
	2	Brake-beam pins.....	Secure brake beams in brackets.....		
	1	Brake lever.....			
	1	Brake-lever catch.....	The spur which engages the rack.....		
	1	Brake-lever rest.....	On right side of chest.....		
	1	Brake-lever rest spring.....	On brake-lever rest.....		
	1	Segment rack.....			
	1	Brake guard.....	Riveted to right side of chest.....		
	2	Separators, 1 short, 1 long.....			

NOMENCLATURE OF PARTS—Continued.

Number on number.	Number on caisson.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
.....	2	Brake rods, complete, including—			
.....	2	Brake-rod springs.....	Attached to brake crank and brake lever and to the brake beams.		
.....	2	Brake-spring covers.....			
.....	2	Brake rods.....			
.....	2	Brake-rod bushings.....			
.....	2	Brake-spring cover ends.....			
.....	2	Brake-rod ends.....			
.....	2	Keys (for brake rod).....			
.....	2	Brake-rod pins.....			
.....	2	Brake-shaft bearings with 2 handy oilers.....	Riveted to sides of chest.....		
.....	2	Brake shoes.....	On end of beams.....		
.....	2	Brake-shoe pins.....			
.....	1	Brake shaft.....	Running through chest.....		
.....	1	Brake crank.....	On end of shaft.....		
.....	1	Bucket holder.....	Riveted to chest front.....		
.....	1	Bucket strap.....			
.....	2	Bucket strap fasteners.....	1 on chest, 1 on holder.....		
.....	2	Bushings.....	Pinned in brake-shaft bearings.....		
.....	1	Cartridge-hook bracket.....	On left side of chest.....		
.....	1	Cartridge-hook strap.....	In fastener.....		
.....	1	Cartridge-hook strap fastener, No. 1.....	On left side of chest.....		
.....	1	Cartridge-hook support.....			
.....	1	Caisson prop, complete, including—			
.....	2	Prop tubes.....	Under connecting pole.....		
.....	1	Prop foot.....			
.....	2	Prop eyes.....			
.....	2	Prop chain clamps.....			
.....	1	Prop bolt and nut.....			
.....	2	Prop chains.....			
.....	1	Prop hook.....			
.....	2	Center bearings, 1 right, 1 left.....	Riveted to intermediate plates.....		
.....	1	Chest, body, upper plate.....			
.....	1	Chest body, lower plate.....			
.....	1	Chest door (lower).....	Flange steel.....		
.....	1	Chest door (upper).....	Armor plate on caisson, flange steel on limber.....		
.....	1	Chest angle.....	Steel angle around chest front.....		
.....	1	Chest front.....	Armor plate on caisson, flange steel on limber.....	IV	3
.....	1	Connecting pole, complete, including—			
.....	1	Body.....	Of steel tubing.....		
.....	1	Key bearing.....	Riveted in rear end of body.....		
.....	1	Lunette bearing.....	Riveted in front end of body.....		
.....	2	Lunette pins, 1 front, 1 rear.....			
.....	1	Prop saddle.....			
.....	1	Connecting-pole socket, with bolt and nut.....	Riveted to flange.....		
.....	1	Connecting-pole socket base.....	Bolted to chest front.....		
.....	1	Spare connecting-pole hanger.....			
.....	1	Spare connecting-pole hanger, brace.....			
.....	1	Spare connecting-pole hanger brace hinge.....			
.....	1	Connecting pole hanger strap pin.....			
.....	1	Spare connecting-pole stop.....	On front of chest.....		
.....	1	Spare connecting-pole hanger hinge pin.....			
.....	2	Spare connecting-pole hanger reinforce, 1 right, 1 left.....			
.....	1	Spare connecting-pole hanger strap.....			
.....	1	Spare connecting-pole support.....			
.....	12	Diaphragm braces.....	Stiffen upper diaphragms.....		
.....	1	Door angle (lower).....	Stiffens edge of door.....		
.....	1	Door angle (upper).....			
.....	2	Door end stiffeners, 1 right, 1 left.....			
.....	2	Door handles (lower).....			
.....	1	Door handle bar (upper).....			
.....	7	Door hinges, female.....			
.....	7	Door hinges, male.....			
.....	7	Door-hinge pins.....			
.....	2	Door props.....			
.....	2	Door-prop rivets.....	On props.....		

NOMENCLATURE OF PARTS—Continued.

Number on limber.	Number on caisson.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
2	2	Door-prop brackets.....	On chest door (upper).....		
2	2	Door-prop guides, 1 right, 1 left.....	On sides of chest.....		
2	2	Door-prop pins.....	.....	
2	2	Door stiffeners (lower chest).....	.....	
2	2	Door handle base.....	.....	
4	4	Door stiffeners (upper chest), 2 right, 2 left.....	.....	
1	.....	Doubletree, complete.....	Same as for carriage limber.....		
2	.....	Doubletree chains.....	.....	
2	.....	Doubletree-chain pins.....	.....	
2	.....	Doubletree-chain eyes, 1 right, 1 left.....	Riveted to chest.....		
2	.....	Clevis.....	Pinned to doubletree chain eyes.....		
1	.....	Doubletree strap.....	Braces doubletree pin.....		
1	.....	Doubletree pin with nut.....	.....	
1	1	Filler plate.....	Under pintle spring.....		
21	21	Flange bolts with nuts.....	Secure pole-socket flange to chest front.....		
.....	1	Foot rest.....	.....	
.....	2	Foot-rest supports, 1 right, 1 left.....	Riveted to chest front.....		
1	1	Front diaphragm (lower).....	Riveted to chest front.....		
1	1	Front diaphragm (upper).....	.....	
3	3	Grip-strap fasteners, No. 3.....	On chest front.....		
.....	3	Grip straps.....	In fasteners.....		
4	4	Gusset plates, 2 right, 2 left.....	Brace pole-socket flange.....		
1	1	Hatchet-blade bracket body.....	On right side of chest.....		
1	1	Hatchet blade bracket.....	Handle rest.....		
1	1	Hatchet-handle bracket.....	.....	
1	1	Hatchet strap.....	In fastener.....		
1	1	Hatchet-strap fastener, No. 10.....	On right side of chest.....		
2	2	Handles, 1 right, 1 left, with steel pins.....	On lock bars.....		
2	2	Handle catches.....	On handle-catch bearings.....		
2	2	Handle-catch bearings, 1 right, 1 left.....	Riveted on sides of chest.....		
2	2	Handle-catch rivets.....	.....	
.....	2	Handralls, complete, including—	.....	
.....	2	Hand-rall tubes.....	.....	
.....	4	Hand-rall shanks.....	Riveted to chest body.....		
8	8	Hinge pins.....	Pinned in locking-lever bearings.....		
1	1	Intermediate angle (upper).....	Braces intermediate plate to chest front.....	IV	3
1	1	Intermediate angle (lower).....	do.....		
1	1	Intermediate plate (upper).....	Above axle.....		
1	1	Intermediate plate (lower).....	Below axle.....		
.....	1	Connecting pole key.....	Secures connecting pole in socket.....		
.....	1	Key bearing (for connecting pole).....	.....	
1	1	Lantern-bracket, complete, including—	.....	
1	1	Lantern-bracket body.....	Riveted to chest front.....		
1	1	Lantern-bracket bottom.....	.....	
1	1	Lantern-strap.....	.....	
2	2	Lantern-strap fasteners.....	.....	
.....	2	Latch bases (apron latch), 1 right, 1 left.....	Riveted to sides of chest.....		
.....	2	Apron latch washer.....	On latch base.....		
4	.....	Limber blanket straps (front).....	In strap fasteners.....		
4	.....	Limber blanket straps (rear).....	do.....		
8	.....	Limber blanket strap fasteners, No. 5.....	On top of chest.....		
1	.....	Limber prop, complete, consisting of—	.....	
1	.....	Prop eye.....	.....	
1	.....	Prop tube.....	.....	
1	.....	Prop foot.....	.....	
1	.....	Prop chain fastening.....	Bolted to pole socket.....		
1	.....	Prop chain.....	.....	
1	.....	Prop chain handle.....	.....	
1	.....	Prop chain button with rivet.....	Riveted to button bracket.....		
1	.....	Button bracket.....	Riveted to bucket holder.....		
1	.....	Prop chain eye.....	On right doubletree chain clevis.....		
2	2	Lock bar brackets, 1 right, 1 left.....	On outside of chest.....		
2	2	Lock bars.....	Operate locking levers.....		
4	4	Lock bar pins with 8 washers.....	On lock bars.....		
8	8	Locking levers.....	Secures the doors.....		
6	6	Locking lever bearings (notched).....	Riveted to intermediate plates.....		
.....	1	Lunette.....	Bolted in connecting pole.....		
1	1	Middle diaphragm (lower).....	.....	
1	1	Middle diaphragm (upper).....	.....	
1	.....	Name plate (limber).....	Riveted to chest front.....		

NOMENCLATURE OF PARTS—Continued.

Number on limber.	Number on caisson.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
.....	1	Name plate (caisson).....	Riveted to chest front.....	IV	3
1	.....	Neck yoke complete.....	Same as for carriage limber.....	
2	2	Nut strips.....	On ends of pintle bearing bolts.....		
.....	2	Oil can guides, 1 right, 1 left.....	Riveted to intermediate plates.....		
.....	1	Oil can lock.....			
.....	1	Oil can packing block with screws and nuts:			
.....	1	Oil can stop.....			
.....	2	Padlock chain rivets.....	Riveted to chest.....		
.....	1	2-inch Yale lock, No. 850, with bolt snap and chain.....	On right side of chest.....		
.....	3	Paulin straps.....	On strap fasteners.....		
.....	3	Paulin strap fasteners, No. 10.....	On chest top.....		
.....	3	Paulin strap fasteners, No. 3.....	.....do.....	
.....	1	Pick handle strap.....	In strap fastener.....		
.....	2	Pick handle strap fasteners.....	On right side of chest.....		
.....	2	Pick-mattock strap fasteners.....	On chest.....		
.....	1	Pick-mattock strap.....	In strap fasteners.....		
.....	1	Pick handle rest.....			
.....	1	Pick rest (front).....			
.....	1	Pick rest.....			
.....	3	Picket rope straps (upper).....	In strap fasteners.....		
.....	3	Picket rope straps (lower).....	.....do.....	
.....	6	Picket rope strap fasteners, No. 5.....	On top of chest.....		
.....	2	Pintle bearings.....			
.....	4	Pintle bearing bolts and nuts.....			
.....	1	Pintle bearing support (upper).....	Riveted to upper intermediate plate.....		
.....	1	Pintle bearing support (lower).....	Riveted to lower intermediate plate.....		
.....	1	Pintle, complete, including—			
.....	1	Pintle.....	Located in pintle bearings.....		
.....	1	Pintle latch.....			
.....	1	Pintle latch pin.....			
.....	1	Pintle latch spring.....			
.....	1	Pintle spring.....	Riveted to pintle support bearing (lower).....		
.....	1	Pintle spring guide.....			
.....	2	Plates, 1 right, 1 left.....	Riveted to sides of chest.....		
.....	1	Pole, complete.....	Same as for carriage limber.....		
.....	1	Pole pin.....			
.....	1	Pole prop bracket.....	On front of chest.....		
.....	1	Pole prop bracket plate.....			
.....	1	Pole prop pocket.....	On front of chest.....		
.....	1	Pole prop pocket plate.....			
.....	1	Pole prop strap.....	In strap fasteners.....		
.....	2	Pole prop strap fasteners, No. 1.....	In front of chest.....		
.....	1	Pole socket with bolt and nut.....	Riveted to limber pole-socket flange.....		
.....	2	Prop bracket, half.....	Bolted to pole socket.....		
.....	1	Pole socket base.....	Bolted to chest front.....		
.....	1	Pole socket key bracket.....	On left side of chest.....		
.....	2	Pole socket reinforce plates.....	At upper and lower flange bolts.....		
.....	1	Rear diaphragm (lower).....	In chest.....		
.....	1	Rear diaphragm (upper).....	.....do.....	
.....	2	Reinforce plates, 1 upper, 1 lower.....	Strengthen chest at pintle bearing supports.....		
.....	2	Roller pins.....	In wheel bearing rollers.....		
.....	1	Shovel handle rest.....	On left side of chest.....		
.....	1	Shovel handle strap.....	In strap fastener.....		
.....	1	Shovel handle strap fastener, No. 2.....	On left side of chest.....		
.....	1	Shovel support.....	.....do.....	
.....	2	Singletrees, complete.....	Same as for carriage limber.....		
.....	1	Spanner bracket.....	On lower intermediate plate.....		
.....	1	Spanner handle holder.....			
.....	1	Spanner strap.....	In strap fastener.....		
.....	1	Spanner strap fastener, No. 1.....	On lower intermediate plate.....		
.....	2	Staples.....	Riveted to plate on sides of chest.....		
.....	2	Tie rods.....	Brace connecting pole socket to chest sides.....		
.....	2	Tie rod fastenings.....	On corners of chest.....		
.....	4	Tie rod pins.....			
.....	2	Washers.....	On brake lever shaft and arm.....		
.....	2	Wheels, 60-inch diameter, complete.....	Same as for carriage.....		
.....	2	Wheel bearing rollers.....	On connecting pole socket.....		
.....	2	Wheel fastenings, complete.....	Same as for carriage.....		
.....	2	Wrench holders.....	On front of chest.....		
.....	1	Wrench strap.....	In strap fastener.....		
.....	1	Wrench strap fastener, No. 1.....	On front of chest.....		

DESCRIPTION OF THE 4.7 INCH GUN LIMBERS AND CAISSONS, MODEL
OF 1908.

THE LIMBER.

[Plate XIII.]

The limber is a two-wheeled vehicle provided with an ammunition chest for the transportation of ammunition for the 4.7-inch gun.

The principal parts are the wheels, axle, ammunition chest, pintle, pole socket, pole, doubletree, singletree, and neck yoke.

The wheels and the wheel fastenings are the same as and interchangeable with those on the carriage. The axle is hollow and is made from a single piece of forged steel.

The ammunition chest is built up of flange steel in two parts and is divided into an upper and lower compartment by means of the flange steel upper and lower intermediate plates, between which passes the axle. The axle is secured to the chest by the right and left axle bearings riveted to the sides of the chest and to the flanges of the intermediate plates. The two sections of each axle bearing are clamped together by bolts which engage notches on the axle, thus preventing any longitudinal movement of the axle. The front plate is a flange steel plate riveted to flanges on the intermediate plates and to the vertical flanges of the chest angle, a steel angle formed into a rectangle and riveted through its horizontal flanges to the body of the chest. Four flange steel gusset plates brace the intermediate plates to the front plate.

Inside the chest, in the upper compartment, are located 3 vertical diaphragms flanged all around and riveted to the chest body and intermediate plates. These diaphragms are each perforated with 21 holes and each is braced with 4 vertical tee braces. In the lower compartment are located 3 vertical diaphragms of the same size flanged all around and riveted to the chest body and transoms. The lower diaphragms have 7 perforations each for ammunition.

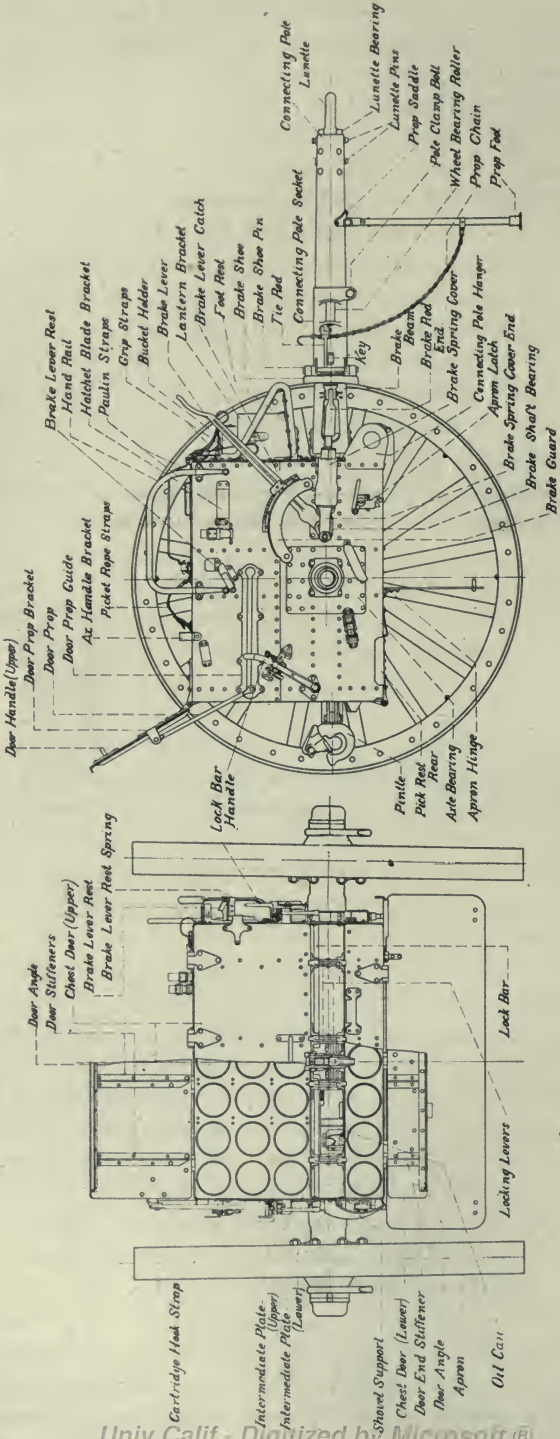
Corresponding holes in the middle and rear diaphragms are connected by conical brass tubes called connecting pieces, which are cut away on top to save weight. These connecting pieces support the front end of the cartridge case and serve to guide the projectiles and to carry empty cases. The rear end of the connecting piece is turned over the rear face of the flange of the perforation in the rear diaphragm and forms a stop for the rim of the cartridge case. The chest doors close against the heads of the cases so that the cartridges are firmly held in position. Suitable clearances are cut in the flange of each cartridge pocket to enable the cartridge hook to get back of the rim of the case in withdrawing it from the chest.

The chest door (upper) consists of a flange steel plate strengthened by a steel angle riveted to its lower edge and by four T's riveted to it vertically. Its top edge is secured to the chest body by four hinges, so that it can be opened to the rear and upward, in which position it is held by door props attached to each end of the door and to the sides of the chest, as shown in the plate. The chest door (lower) is of flange steel, strengthened by an angle along its upper edge and by four vertical T's; its lower edge is secured to the chest body by three hinges, so that it opens to the rear and downward. When closed, the lower edge of the upper door and the upper edge of the lower door are securely fastened by locking levers hinged to the intermediate plates and operated by lock bars having handle levers on the chest sides; these lock-bar handles are held in the closed position by suitable latches, the right having a padlock. One door handle is on the upper door and two are on the lower door to assist in opening and closing the door.

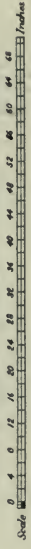
Through the front plate and intermediate plate flanges are 21 bolts, securing the pole-socket base. The cylindrical cast-steel pole socket is riveted to the pole-socket base and has its interior finished as a conical seat for the pole. The doubletree is mounted upon a doubletree pin projecting up through a boss on the forward end of the pole socket. The upper end of this pin is threaded for a nut and is braced back to the pole socket by the doubletree strap. The pole socket is split at its forward end and is provided with a clamping bolt for drawing the socket firmly about the pole. A limber prop is hinged to the pole socket and held by the clamping bolt. When traveling the prop is drawn up to the rear and held by a chain to a button on a bracket riveted to the bucket holder.

Pintle bearing supports are riveted to the upper and lower intermediate plates at the rear of the chest and form brackets for clamping the pintle bearing. This bearing is in two parts, secured together by bolts, and may be renewed when worn. The pintle may swivel 360° in the bearing, but is normally held in a vertical position by a spring bolted to the pintle bearing support (lower) which bears upon a flat at the front end of the pintle shank. The lunette ring of the caisson is retained upon the pintle hook by the pintle latch. The latter is pivoted by the latch pin upon the end of the pintle horn and is arranged to be held in either the open or closed position by the pintle latch spring. The latch is opened by the lunette in entering it upon the pintle hook, but must be closed by hand. The spring is peened in its seat, but if required may readily be driven out and a new one inserted.

Upon the left side of the chest front is riveted a box for carrying two canvas buckets, and in the center is a lantern bracket. A name plate above the lantern gives the name, number, and model of the



4.7-Inch Gun Caisson, Model of 1908



vehicle, name of manufacturer, year of completion, and initials of inspector. *In all reports and correspondence the vehicle should be designated by the number and model given on the name plate*

The fixtures for holding the pick on the right side will accommodate either a pickax or a pick mattock; those on the left side for the shovel will take either a short or long handled implement. A pickax and a short-handled shovel are issued with each limber, a pick mattock and long-handled shovel with each caisson.

The paulin on the top of the chest is held in place by three paulin straps suitably fastened. Other fastenings on top of the chest are for a picket rope, an ax, and a limber blanket. On the front are attachments for a wrench and the pole prop. On the right side is a hatchet and on the left a cartridge hook in suitable fixtures. The cartridge hook is for use in withdrawing the cases and projectiles from the chest. A spanner for tightening the hub bands of the wheels is carried in suitable fastenings between the intermediate plates.

The pole, doubletree and singletrees, and neck yoke are standard and interchangeable with those on any limber of the battery.

Doubletree chains attached to the chest body prevent excessive movement of either end of the doubletree.

THE CAISSON, MODEL OF 1908.

[Plate XIV.]

The 4.7-inch gun caisson is built upon the same general plan as the 4.7-inch gun limber, and many parts of the two vehicles—the wheels, axles, pintles and bearings, lock bars, and most of the implement fastenings and chest parts—are exactly similar and interchangeable.

The principal parts are the wheels, axle, axle bearings, ammunition chest, pintle, connecting-pole socket, connecting pole, prop, apron and apron latches, and brake.

The flange-steel front plate and chest door (upper) of the limber are in the caisson replaced by hardened armor plates, 0.15 inch thick, for the protection of the ammunition servers in the rear from small-arms and shrapnel fire. An apron of armor plate of the same thickness is hinged to the bottom of the caisson chest and extends to within a short distance from the ground for the same purpose. This apron swings forward against the bottom of the ammunition chest to clear obstructions in traveling and is held in that position by latches attached to the sides of the chest.

The pole socket of the caisson is made longer than on the limber and fitted with rollers which serve as wheel guards and is braced to the sides of the chest. The connecting-pole body is made of steel tubing, its rear end is finished to fit the pole socket and is provided

with a seat for the rectangular key which secures the connecting pole to the socket. A lunette bearing of bronze is riveted in the front end in which a lunette of forged steel is secured by two pins. A prop of steel tubing with a bronze foot is attached to the connecting pole for a support when the caisson is unlimbered. When not in use the prop is swung up under the connecting pole and held by chains leading from the prop legs to the rear of the brace lugs and uniting in a hook which is engaged with the head of the forward lunette pin.

The beams of the road brake are hinged in brackets riveted to the chest front. They are built up of flange and forged steel parts and carry cast-iron shoes to bear against the wheel tires. A brake shaft passes through the chest forward of the axle and is mounted at either end in bearings riveted to the chest sides. A spring-steel brake lever on the right end operates this shaft. Its renewable brake-lever catch engages a toothed rack riveted on the chest body to hold the brake when applied; a clasp spring secures it to a bracket in its extreme released position. The arms of the brake lever and shaft are connected to the brake beams by compound rods as on the carriage and adjustment for wear of the brake shoes secured in the manner provided for that vehicle.

Hangers for a spare connecting pole are provided on the chest front and a bracket for a spare key on the left side of the chest.

The opening at the rear between the upper and lower intermediate plates on the left side is utilized to carry an oil can. The oil can, with a capacity of 2 gallons, is held between two steel angles riveted to the lower plate, an oil-can packing block bolted to the upper plate, the axle and a stop on the door handle (lower). In each four caissons, three oil cans carry lubricating oil, and the fourth hydroline oil, the contents of each being indicated by a name plate.

The ax, hatchet, lantern, and watering bucket fastenings are similar and located the same as those on the limber; the shovel fastenings are similar, but the handle fastening is located somewhat higher than on the limber.

The paulin on the caisson chest serves as a seat cushion and is secured by three straps, as on the limber. On either side a handrail projects above the top of the chest and with the grip straps provides handholds for the cannoneers. A short foot rest is supported on brackets riveted to the right side of the chest front.

A name plate is attached to each caisson chest front above the lantern. *In all reports and correspondence the caisson should be designated by the name, number, and model given on this name plate.* In request for spare parts for repairs, etc., the parts should be asked for by the names given in the table, giving nomenclature of parts in this handbook and the symbol of the unserviceable piece copied exactly as stamped thereon.

THE 4.7-INCH GUN CAISSON, MODEL OF 1916.

WEIGHTS, DIMENSIONS, ETC.

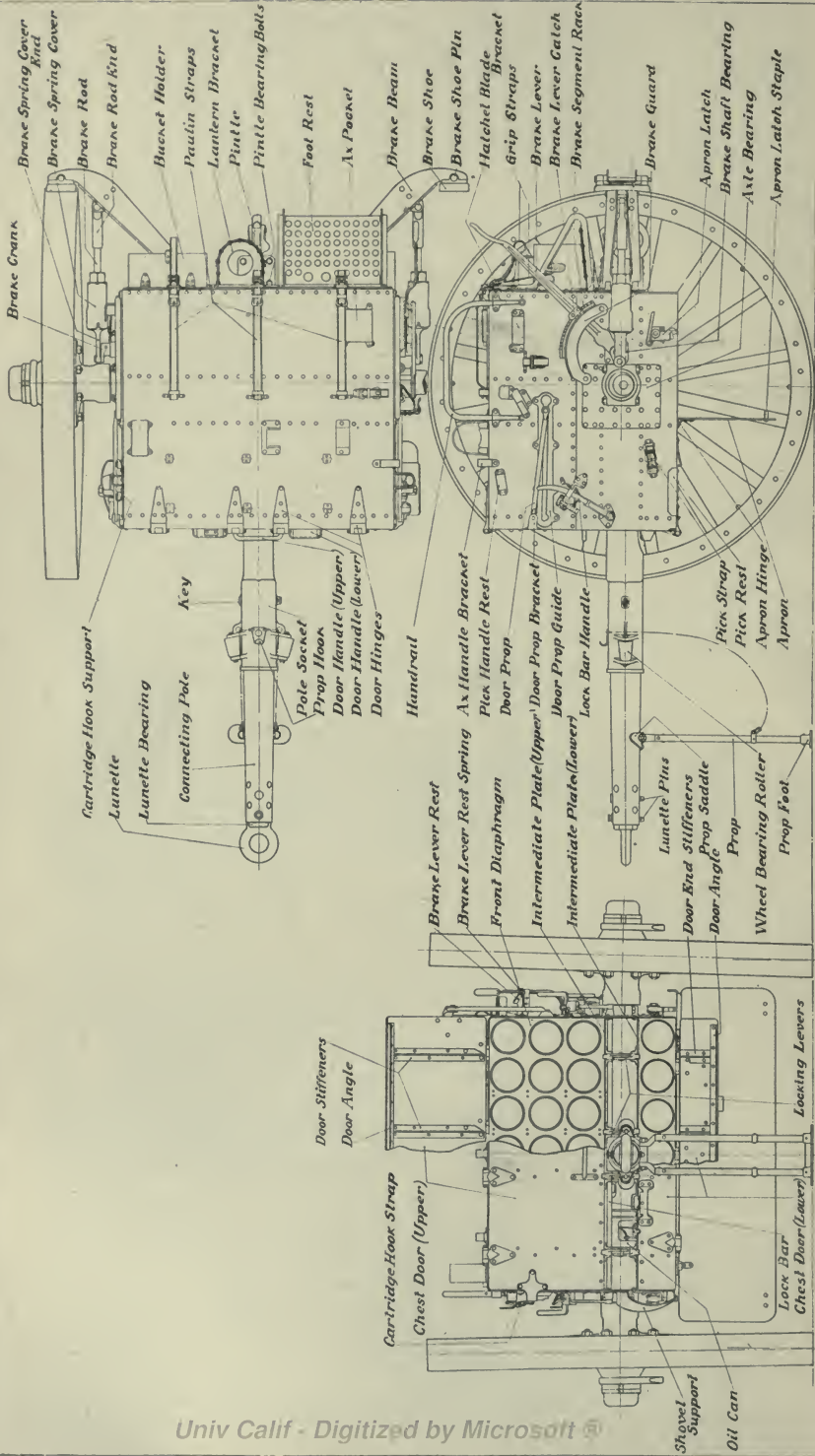
Weight of caisson, empty, without implements or ammunition.....	pounds..	2065
Weight of implements carried, including spare connecting pole.....	do....	179½
Weight of ammunition carried.....	do....	2055
Weight of caisson, completely equipped and loaded.....	do....	4299½
Rounds of ammunition carried.....		28
Diameter of wheels.....	inches..	60
Width of track.....	do....	60
Free height under caisson.....	do....	20.5
Turning angle.....	degrees..	75

NOMENCLATURE OF PARTS.

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
28	Ammunition chest connecting pieces..	Connect rear and middle diaphragms....	IV	3
1	Apron.....	Hinged to chest bottom.....		
3	Apron hinges, female, with pins.....	Riveted to chest.....		
3	Apron hinges, male.....	Riveted to apron.....		
2	Apron latches, complete, including—			
2	Latch bodies.....			
2	Plungers.....	On latch bases riveted to chest.....		
2	Latch handles with pins.....			
2	Latch springs.....			
2	Apron-latch bases, 1 right, 1 left.....	Riveted to sides of chest.....		
2	Apron-latch staples.....	Riveted to apron.....		
1	Ax-handle bracket.....	On top of chest.....		
1	Ax pocket.....	do.....		
1	Ax strap.....			
1	Ax-strap fastener, No. 2.....			
1	Axle.....			
2	Axle bearings with bolts.....	Riveted to chest.....		
8	Axle bearing reinforce plates.....	Riveted on inside of chest.....		
1	Bolt snap, with chain.....	On right side of chest.....		
2	Brake beams, complete, including—			
2	Bodies.....			
2	Brake-beam clips.....	Hinged to brackets on rear of chest.....		
2	Brake-beam stiffeners.....			
2	Brake-shoe bearings.....			
4	Brake-beam hinges.....			
2	Brake-beam brackets.....	Riveted to rear plate.....		
2	Brake-beam pins.....	Hinges beams to brackets.....		
1	Brake crank with washer.....	On right end of brake shaft.....		
1	Brake guard.....	Riveted to left side of chest.....		
2	Separator (for brake guard).....			
1	Brake lever with washer.....	On left end of brake shaft.....		
1	Brake-lever catch.....			
1	Brake-lever rest.....	Riveted to left side of chest.....		
1	Brake-lever rest spring.....			
2	Brake rods, complete, including—			
2	Brake rods.....			
2	Brake-rod key.....			
2	Brake-rod ends with pins.....	Attached to brake crank and brake lever and to the brake beams.		
2	Brake-rod bushings.....			
2	Brake-rod springs.....			
2	Brake-spring covers.....			
2	Brake-spring cover ends.....			
1	Segment rack.....	Riveted to left side of chest.....		
1	Brake shaft.....	Passes through chest.....		
2	Brake-shaft bearings with bushings.....	Riveted to chest.....		
2	Brake shoes.....	On brake beams.....		
2	Brake-shoe pins.....			
1	Handy oiler, .312 (1/8).....			
1	Bucket-holder body.....	Riveted to rear plate.....		
1	Bucket strap.....	In strap fasteners.....		
2	Bucket-strap fasteners.....	1 on chest, 1 on holder.....		

NOMENCLATURE OF PARTS—Continued.

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Caisson prop, complete, including—			
2	Prop tubes.....	Under connecting pole.....		
1	Prop foot.....			
2	Prop eyes.....			
2	Prop-chain clamps.....			
1	Prop hook.....			
2	Prop chains.....			
1	Cartridge-hook strap.....	On right side of chest.....		
1	Cartridge-hook strap fastener, No. 1.....	do.....		
1	Cartridge-hook support.....	do.....		
1	Cartridge-hook bracket.....	do.....		
1	Chest angle.....	Riveted around chest at rear.....		
1	Chest body, upper plate.....			
1	Chest body, lower plate.....			
1	Chest door, lower.....	Hinged on front of chest.....		
1	Chest door, upper.....	do.....		
1	Connecting pole, complete, including—			
1	Body.....			
1	Key bearing.....	Keyed to pole socket.....		
1	Lunette bearing.....			
2	Lunette pins, 1 front, 1 rear.....			
1	Prop saddle.....			
12	Diaphragm braces.....	Riveted to upper diaphragms.....		
1	Door angles (for upper chest).....	Stiffens edges of door.....		
1	Door angle (for lower chest).....			
2	Door-end stiffeners, 1 right, 1 left.....			
1	Door handle, bar, upper.....	On front of door.....		
2	Door handle base, upper.....	do.....		
2	Door handles, lower, 1 right, 1 left.....	do.....		
7	Door hinges, female, with pins.....			
7	Door hinges, male.....			
2	Door props.....	Pivoted to upper door.....		
2	Door-prop brackets.....	Riveted to upper door.....		
2	Door-prop guides, 1 right, 1 left.....	Riveted to chest sides.....		
2	Door-prop pins.....			
2	Door-prop rivets.....			
4	Door stiffeners, 2 right, 2 left, upper.....	Riveted to upper door.....		
2	Door stiffeners, lower.....	Riveted to lower door.....		
1	Filler plate.....	Riveted with pintle spring.....		
1	Foot rest.....	On rear plate of chest.....		
2	Foot-rest supports, 1 right, 1 left.....	do.....		
1	Front diaphragm, lower.....	In rear of chest.....		
1	Front diaphragm, upper.....	do.....		
3	Grip straps.....	On rear of chest.....		
3	Grip strap fasteners, No. 3.....	do.....		
2	Handrail tubes.....			
4	Handrail shanks.....	Riveted to sides of chest.....		
1	Hatchet-blade bracket, body.....	On left side of chest.....		
1	Hatchet blade bracket-handle rest.....			
1	Hatchet-handle bracket.....	do.....		
1	Hatchet-handle strap.....	do.....		
1	Hatchet-handle strap fastener, No. 10.....	do.....		
1	Intermediate plate, lower.....			
1	Intermediate plate, upper.....			
1	Lantern bracket, complete, including—			
1	Lantern bracket body.....			
1	Lantern bracket bottom.....	On rear of chest.....		
1	Lantern strap.....			
2	Lantern strap fastener.....			
2	Lock bars.....	On front of chest.....		
2	Lock-bar brackets, 1 right, 1 left.....	On sides of chest.....		
2	Lock-bar handles, 1 right, 1 left.....	On lock bars.....		
2	Lock-bar handle catches.....			
2	Lock-bar handle catch bearing, 1 right, 1 left.....	On sides of chest.....		
2	Lock-bar plates.....			
2	Lock-bar staples.....			
4	Lock-bar pins.....			
8	Lock bar washers.....	do.....		
8	Locking levers.....	On front of chest.....		
4	Locking lever bearings.....	do.....		
1	Lunette.....	In end of connecting pole.....		
1	Middle diaphragm, lower.....			
1	Middle diaphragm, upper.....			
1	Name plate.....			
2	Nut strips.....	Secure pintle-bearing bolts.....		
1	Oil-can lock.....	Riveted to lower door handle, right.....		
2	Oil-can guides, 1 right, 1 left.....	On intermediate plate, lower.....		
1	Oil-can stop, complete.....	Riveted between plates.....		
1	Padlock, bolt snap, clevis, and chain.....	On left side of chest.....		
3	Paulin straps.....	On top of chest.....		
3	Paulin strap fasteners, No. 10.....	do.....		



4.7 Inch Gun Caisson, Model of 1916

Scale: 0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 64 68

NOMENCLATURE OF PARTS—Continued.

Number on caisson.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Pick rest	On left side of chest	IV	3
1	Pick-handle rest	do		
1	Pick-mattock handle strap	do		
2	Pick-mattock handle strap fastener	do		
3	Picket rope straps, lower	On top of chest		
3	Picket rope straps upper	do		
6	Picket rope strap fasteners, No. 5	do		
1	Pintle	In bearings		
1	Pintle-bearing support, lower	Riveted to intermediate plates, upper and lower.		
1	Pintle-bearing support, upper			
2	Pintle bearings	In supports		
4	Pintle-bearing bolts			
1	Pintle latch			
1	Pintle-latch pin	On pintle		
1	Pintle-latch spring	do		
1	Pintle-spring guide	In supports		
1	Pintle spring with bolt	do		
1	Connecting-pole key	Connects pole to socket		
1	Connecting-pole socket	Riveted to intermediate plates		
1	Pole-socket key bracket	On right side of chest		
1	Rear diaphragm, lower			
1	Rear diaphragm, upper			
1	Rear plate			
1	Reinforce plate, lower	Riveted with pintle-bearing supports		
1	Reinforce plate, upper			
1	Shovel-handle rest	On right side of chest		
1	Shovel-handle strap	do		
1	Shovel-handle strap fastener, No. 2	do		
1	Shovel support	do		
1	Spare connecting-pole clip	On top of chest		
1	Spare connecting-pole clip pin			
1	Spare connecting-pole bracket			
1	Spare connecting-pole bracket band			
1	Spare connecting-pole support			
2	Wheels, 60-inch diameter, complete			
2	Wheel-bearing rollers with pins	On pole socket		
2	Wheel fastenings, complete			

DESCRIPTION OF 4.7-INCH GUN CAISSON, MODEL OF 1916.

[Plate XV.]

The model of 1916 caisson is built upon the same general plan as the model of 1908 caisson, and many parts of the two vehicles—the wheels, axles, pintles and bearings, lock bars, chest diaphragms, chest doors and apron, brake details, connecting pole, implement fastenings, and chest parts—are identical.

The general difference in the two models of vehicles lies in the fact that the model of 1916 chest is reversed, the doors opening on the front. This causes the rear diaphragms to become the front diaphragms and the front plate the rear plate. The oil can is located between the diaphragms in the front of the chest; the foot rest, lantern, bracket, and bucket holder are located on the rear, and the apron swings to the rear in traveling. The brake is located in the rear of the axle and functions similar to that of the model of 1908 vehicles, the only difference in the design being in the brake beam and its connection to the chest body. The pole socket is secured between the intermediate plates, and no tie-rods are used. The axle is located nearer the rear plate in the model of 1916 vehicle, and the chest body and axle bearings are of new design.

The location of some of the implements is changed, though the fastenings are identical with those of the model of 1908 caisson.

**THE 4.7-INCH GUN AND 6-INCH HOWITZER FORGE
LIMBER, MODEL OF 1908, AND THE 4.7-INCH GUN AND
6-INCH HOWITZER STORE LIMBER, MODEL OF 1908.**

[These limbers are common to the 4.7-inch gun and 6-inch howitzer batteries.]

WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight of forge limber, empty, without implements, etc.....	pounds..	1, 654
Weight of forge limber, fully equipped.....	do....	2, 499
Weight of forge limber and battery wagon, model of 1908, combined, fully equipped.....	pounds..	7, 568
Weight of store limber, empty, without implements, etc.....	do....	1, 629
Weight of store limber, fully equipped.....	do....	2, 184
Weight of store limber and store wagon, model of 1908, combined, fully equipped.....	pounds..	7, 711
Weight upon pintles of either forge or store limbers, from battery wagon or store wagon.....	pounds..	100
Diameter of wheels.....	inches..	60
Width of track.....	do....	60
Free height above track under wagon for either combination.....	do....	17
Turning angle.....	degrees..	65

NOMENCLATURE OF PARTS.

Number on forge limber.	Number on store limber.	Name of part.	Location, etc.	Property classification	
				Class.	Section.
2		Arbor clips.....	Part of grindstone packing.....		
1	1	Axle.....	Riveted to sides of chest..... Clamp axle bearings..... Under axle bearings' rivets.....		
2	2	Axle bearings, right and left.....			
2	2	Axle-bearing bolts, with nuts.....			
4	4	Axle-bearing reinforces.....			
1	1	Ax-blade bracket.....	} On left side of chest.....		
1	1	Ax-handle support.....			
1	1	Ax strap.....			
1	1	Ax-strap fastener, style No. 2.....	} Temporary locks for doors.....		
4	6	Bolt snaps with 4-inch chains.....			
2	1	Chain staples.....			
1	1	Chest body, right side.....			
1	1	Chest body, left side.....			
1	1	Chest bottom.....			
2	2	Chest braces, right and left.....	} Frames of upper front-door openings.....		
1	1	Chest floor, upper, with—			
2	2	Floor braces, right and left.....			
1	1	Chest floor reinforce.....	Middle rail, upper, to chest floor.....		
2	2	Chest frames, front and rear.....	Reinforce lower edge of chest.....		
2	2	Chest front doors, upper.....	Swing up under foot rest.....		
2	2	Chest front doors, lower.....			
2	2	Chest rear doors, upper, right, and left.....	} Swing down.....		
2	2	Chest rear doors, lower.....			
2	2	Chest reinforces.....	At foot rest, bracket rivets.....		
1	1	Chest-top angle.....	Around top of chest.....		
	1	Cushion, for battery commander's telescope, consisting of—			
	1	Block.....	} In compartment No. 5.....		
	2	Cleats.....			
	1	Cover.....			
	1	Filling.....			
	3	Cushions, for buzzers, consisting of—			
	3	Blocks.....	} In compartment Nos. 1, 2, and 3.....		
	3	Covers.....			
	3	Fillings.....			
	3	Grips.....			
2		Die-box holders, right and left.....	Riveted to inside of lid.....		
1		Die-box holder spring, with hinge and hinge pin.....			

NOMENCIATURE OF PARTS—Continued.

Number on forge limber.	Number on store limber.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1		Die-box pocket	Riveted to inside of lid		
4		Door hinges	On rear doors		
12	8	Door hinges, lower	On front and rear doors		
16	8	Door hinges, upper	On front and rear doors		
16	8	Door-hinge pins .....	.....	
8	4	Door-hinge filler pieces, lower .....	.....	
2		Door-hinge filler pieces, upper .....	.....	
1	1	Doubletree	Same as on carriage limber		
2	2	Doubletree chains	From doubletree to foot rest		
2	2	Doubletree chain bolts .....	.....	
1	1	Doubletree pin with nut	In pole clamp		
1	1	Doubletree strap	On doubletree pin		
1	1	End cleat, front, left .....	.....	
1	1	End cleat, front, right .....	.....	
1	1	End cleat, rear, left	In corners of upper chest		
1	1	End cleat, rear, right .....	.....	
2		End fillers	Back of hammer packing		
1	1	End lining, left	In ends of chest		
1	1	End lining, right .....	.....	
3		False bottoms, consisting of—			
3		Bodies .....	.....	
3		Braces	For compartments Nos. 1, 2, and 3		
6		Ends .....	.....	
1		False bottom, consisting of—			
1		Body .....	.....	
1		Brace	For compartment No. 4		
2		Ends .....	.....	
1		False bottom, consisting of—			
1		Body .....	.....	
1		Brace	For compartment No. 5		
2		Ends .....	.....	
2		False bottoms, consisting of—			
2		Bodies .....	.....	
2		Braces	For compartments Nos. 6 and 7		
4		Ends .....	.....	
2		False bottoms, consisting of—			
2		Bodies .....	.....	
4		Braces	For compartments Nos. 8 and 9	IV	9
4		Ends .....	.....	
1		False bottom, consisting of—			
1		Body .....	.....	
1		Brace	For compartment No. 10		
2		Ends .....	.....	
1		Fastener, clip stud	On grindstone, upper packing		
2		Filler strips, long	Riveted to underside of intermediate floors		
2		Filler strips, short	On packing block for small tools		
1		Flat bastard-file fastening .....	.....	
1		Floor lining, front piece	In bottom of upper chest		
1		Floor lining, rear piece .....	.....	
1		Front lining	In front of upper chest		
1		Front lining end cleat, left .....	.....	
1		Front lining end cleat, right	Screwed to front lining		
1		Front lining middle cleat .....	.....	
2		Floor stiffeners, right and left .....	.....	
2		Floor stiffeners	Brace rear of intermediate floors		
1	1	Foot rest	Riveted to chest and middle rail		
1	1	Foot-rest brace	Riveted to foot rest		
2	2	Foot-rest brackets, right and left	At sides of foot rest		
2	2	Foot-rest supports, right and left	Suspend outer corners of foot rest		
2		Fore punch and creaser fastenings .....	.....	
2		Forge fastenings	Riveted to lid		
1		Forge-legs fastening No. 1 .....	.....	
1		Forge-legs fastening No. 2	Riveted to transverse partition, right		
1		Grindstone-legs fastening	On hanger		
1		Grindstone-legs fastening clip	On right upper grindstone packing		
1		Grindstone-legs fastening lock	On fastener clip stud		
1		Grindstone-legs hanger .....	.....	
1		Grindstone-legs pocket	Riveted under chest floor		
2		Grindstone-packing tracks, inner and outer	Riveted to intermediate floor		
1		Grindstone strap .....	.....	
2		Grindstone upper packing, right and left	Bolted to chest floor		

NOMENCLATURE OF PARTS--Continued.

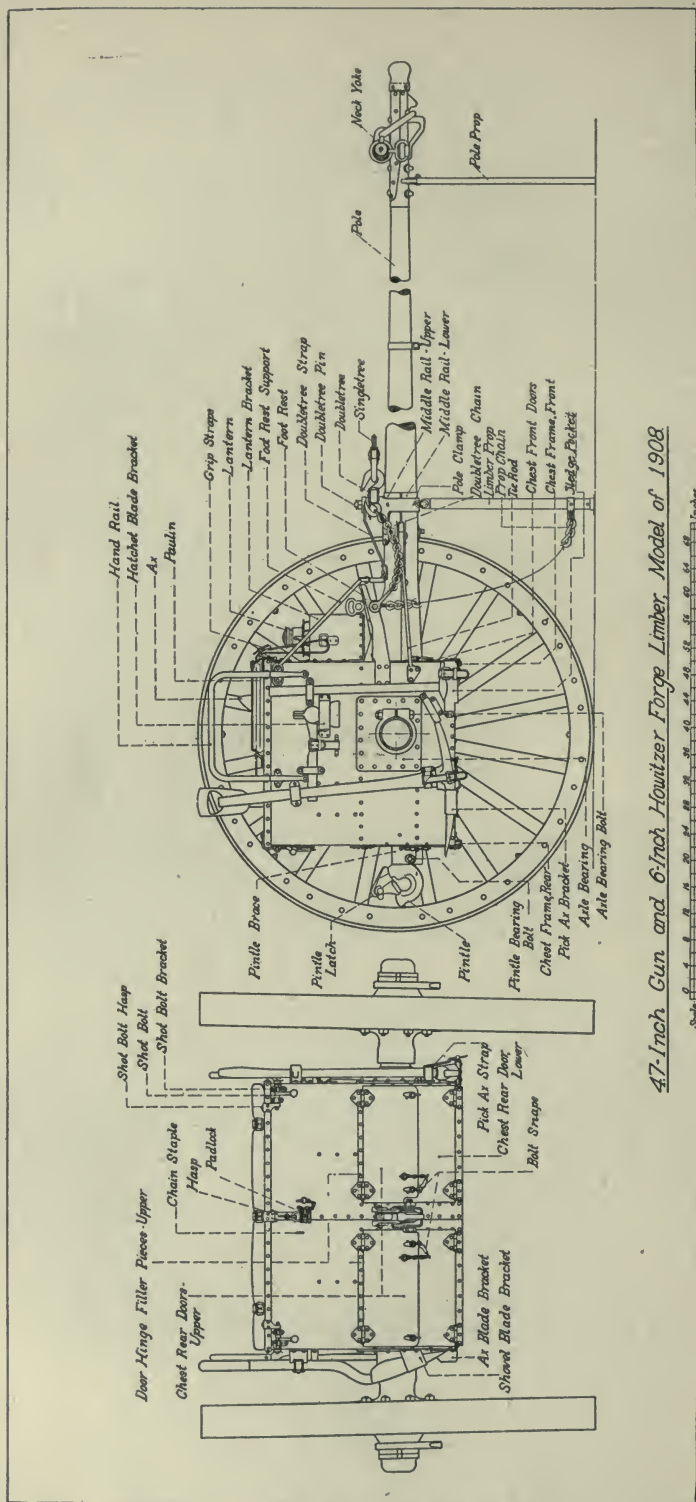
Number on forge limber.	Number on store limber.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1		Grindstone lower packing	Slides in left upper rear compartment.	IV	9
2		Grindstone-packing bolts and nuts.	For upper packing		
1		Grindstone plate	On lower packing		
3	3	Grip straps	On front of lid		
3	3	Grip-strap fasteners, style No. 7.			
1		Hammer packing, right, with cover plate.	In upper chest, rear compartment		
1		Hammer packing, left, with cover plate.			
2	2	Handrail brackets, rear	Riveted to side of chest		
2	2	Handrail brackets, front			
2	2	Handrail tubes	In handrail brackets		
2	2	Handreel seats	In compartments 8 and 9		
1	1	Hasp	On rear of lid		
1	1	Hasp hinge			
1	1	Hasp-hinge pin			
1	1	Hatchet-blade bracket	On right side of chest		
1	1	Hatchet-handle fastener			
1	1	Hatchet strap			
1		Horseshoe packing, right, consisting of—	Upper chest, horseshoe compartment		
1		Front			
1		Rear			
1		Inner			
1		Outer			
1		Bottom			
1		Horseshoe packing, left, consisting of—	do		
1		Front			
1		Rear			
1		Inner			
1		Outer			
1		Bottom			
2		Intermediate floors, right and left.	Between chest floor and chest bottom		
2	2	do			
1		Jack-lever bracket No. 1	Bolted to bottom of chest		
1		Jack-lever bracket No. 2			
2		Jack packing strap No. 1			
2		Jack packing strap No. 2			
1	1	Lantern bracket body	Riveted to front of chest		
1	1	Lantern bracket bottom			
1	1	Lantern strap	In strap fasteners		
2	2	Lantern strap fasteners	Riveted to lantern bracket body		
2		Lever jack packing, consisting of—	In bottom of chest		
2		Packing "A"			
2		Packing "B"			
2		Packing "C"			
2		Packing "D"			
4		Pins			
1	1	Lid			
1	1	Lid band	Reinforce edges of lid		
4	4	Lid hinges, lower	On chest front		
4	4	Lid hinges, upper	On lid		
4	4	Lid hinge pins			
1	1	Lid lining, front	Inside of lid		
1	1	Lid lining strip			
1	1	Lid lining, middle			
1	1	Lid lining, rear			
1	1	Lid prop, with rivet	Supports open lid		
1	1	Lid-prop bracket	On lid		
1		Lid-prop guide, right	On right longitudinal partition		
1	1	Lid-prop guide, left	Inside of chest ends		
1	1	Lid-prop guide, right			
4		Lid-prop guide fillers (end)	Under lid prop guides		
2		Lid-prop guide fillers (middle)			
1	2	Lid prop sliding rivets	In lid props and guides		
1	1	List of contents	Pasted to lid		
4	4	Lock-bar hinges, lower	On lower edge of chest, rear		
4	4	Lock-bar hinges, upper	On rear of chest		
2	8	Lock-bar hinge pins			
2		Longitudinal partitions, right and left.			

NOMENCLATURE OF PARTS—Continued.

Number on forge limber.	Number on store limber.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1	1	Middle rail, lower.....	} Extends through chest, front to rear..		
1	1	Middle rail, upper.....			
1	1	Name plate.....	} On front of chest.....		
1	1	Name plate.....			
1	1	Neck yoke, complete.....	Same as with carriage limber.....		
	4	Oil-can lock bars, lower.....	Secure lower oil cans.....		
	4	Oil-can lock bars, upper.....	Secure upper oil cans.....		
	8	Oil-can packing blocks, No. 1.....	} In oil-can compartments.....		
	4	Oil-can packing blocks, No. 2.....			
	2	Oil-can packing blocks, No. 3, right and left.....			
	2	Oil-can packing blocks, No. 4.....			
	2	Oil-can packing blocks, No. 5.....			
	2	Oil-can packing blocks, No. 6, right and left.....			
	2	Oil-can packing blocks, No. 7.....			
1	1	Oiler fastening.....	On packing for anvil.....		
1	1	Packing for anvil.....	In center compartment of upper chest.....		
1	1	Packing for forge.....	}do.....		
1	1	Packing for small tools.....			
	124	Pads, complete, with lining.....	In chest compartments.....		
	4	Padlock-chain rivets, long.....	} For lock chains.....		
4	2	Padlock-chain rivets, short.....			
1	1	Padlock, with 4-inch chain.....	Marked "4.7" gun and 6" how., Forge limber, Model 1908. No. —," Store limber, Model 1908. No. —,"		
	2	Partitions "A".....	Between compartments 1, 2, and 3.....	} IV	} 9
	1	Partition "B".....	Between compartments 3 and 4.....		
	1	Partition "C".....	Between compartments 4 and 5.....		
	1	Partition "D".....	Between partitions "B" and "C".....		
	1	Partition "E".....	Front longitudinal partition.....		
	1	Partition "F".....	Middle longitudinal partition.....		
	1	Partition "G".....	Between compartments 6 and 7.....		
	1	Partition "H," body.....	Between compartments 7 and 8.....		
	2	Partitions "H," guides (small).....	Screwed to partition "H," body.....		
	1	Partition "J," body.....	Between compartments 8 and 9.....		
	2	Partition "J," guides (small).....	} Screwed to partition "J," body.....		
	2	Partition "J," guides (large).....			
	1	Partition "K," body.....	Between compartments 9 and 10.....		
	2	Partition "K," guides (large).....	Screwed to partition "K," body.....		
	1	Partition "L".....	Right side of compartment 10.....		
	1	Partition brace.....	Over partition "H".....		
	2	Partition guides.....	For partition "E".....		
	2	Partition guides (bottom).....	Brace partition "F".....		
	22	Partition guides (side).....	For all partitions except "E".....		
	72	Partition guide stops.....	Riveted in partition guides.....		
	3	Paulin straps.....	} On top of chest.....		
	3	Paulin strap fasteners, style No. 10.....			
	1	Pick-ax bracket.....			
	1	Pick-ax bracket filler.....	On right side of chest.....		
	1	Pick-handle rest.....	On chest bottom.....		
	1	Pick-head strap.....			
	1	Pick-head strap fastener, style No. 12.....			
	1	Pick-point support.....			
	1	Pintle, complete, including—	} In pintle bearing.....		
	1	Pintle.....			
	1	Pintle latch.....			
	1	Pintle-latch spring.....			
	1	Pintle-latch pin.....			
	1	Pintle bearing.....	In rear end of middle rail.....		
	1	Pintle brace.....	Forms rear end of middle rail, riveted to chest floor.....		
	1	Pintle spring.....	Riveted to middle rail, lower.....		
	1	Pintle-spring pin.....	.....to middle rail, lower.....	
	1	Pocket for T. I. recorders, including—	} Attached to right end of partition "F".....		
	1	Box (2 side pieces, 1 bottom piece, 1 front piece).....			
	1	Fastener.....			
	1	Fastener chape.....			
	1	Lining.....			
	1	Flap.....			

NOMENCLATURE OF PARTS—Continued.

Number on forge limber.	Number on store limber.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1	1	Pole, complete.....	Same as on carriage limber.....	IV	9
1	1	Pole clamp.....	On middle rail.....		
1	1	Pole-clamp bolt, with nut.....	.....	
1	1	Pole pin.....	Secures pole in pole seat.....		
1	1	Pole-pin reinforce.....	Riveted to middle rail.....		
1	1	Pole-prop pocket.....	Under left side of foot rest.....		
1	1	Pole-prop support.....	.....	
1	1	Pole-prop strap.....	.....	
1	1	Pole-prop strap fastener, style No. 1.....	.....	
1	1	Pole stop.....	Riveted between middle rails.....		
1	1	Prop, complete, consisting of—	.....	
1	1	Prop eye.....	} Hinged to prop bracket.....		
1	1	Prop foot.....			
1	1	Prop tube.....			
1	1	Prop bracket.....	Riveted to pole clamp.....		
1	1	Prop chain, consisting of—	.....	
1	1	Prop chain.....	} Secures prop in folded position.....		
1	1	Prop-chain fastening.....			
1	1	Prop-chain handle.....			
1	1	Prop-chain button.....	Riveted to foot rest.....		
1	1	Prop-chain button rivet.....	.....	
1	1	Rear lining.....	In rear of upper chest.....		
1	1	Rear lining end cleat, left.....	} Hinged to prop bracket.....		
1	1	Rear lining end cleat, right.....			
1	1	Rear lining middle cleat.....			
2	2	Separators.....	Riveted between middle rails.....		
1	1	Shoeing-rasp fastening.....	On packing for small tools.....		
2	2	Shot bolts for grindstone packing.....	On lower packing.....		
2	2	Shot bolts, right and left.....	In shot-bolt brackets.....		
2	2	Shot-bolt brackets, right and left.....	Riveted to rear of chest.....		
2	2	Shot-bolt filler pieces.....	} Riveted to lid.....		
2	2	Shot-bolt hasps, right and left.....			
2	2	Shot-bolt stops.....			
1	1	Shovel-blade bracket.....	On left side of chest.....		
1	1	Shovel-handle support.....	.....	
1	1	Shovel-handle strap.....	.....	
2	2	Side fillers.....	Back of hammer packing.....		
2	2	Singletrees.....	Same as on carriage limber.....		
1	1	Sledge-handle support.....	On right side of forge limber.....		
1	1	Sledge pocket.....	.....	
1	1	Sledge strap.....	.....	
10	10	Sledge-strap fastener, style No. 10.....	.....	
10	10	Springs.....	Under cushion for buzzers and battery commander's telescope.....		
1	1	Square fastening.....	Riveted to lid.....		
6	6	Stamped washers.....	Under rivets in packing tracks.....		
2	2	Tie-rods, right and left.....	Brace forward end of middle rail to chest.....		
2	2	Transverse partitions, front, right and left.....	} In upper chest, extend from chest sides to longitudinal partition.....		
2	2	Transverse partitions, rear, right and left.....			
6	6	Washers.....	For buzzer cushion springs.....		
4	4	Washers.....	For cushion under battery commander's telescope.....		
2	2	Wheels, 60-inch.....	Same as carriage.....		
2	2	Wheel fastenings.....	do.....		
6	6	Wing nuts.....	Secure doors and lock bars.....		
4	4	Wing-nut brackets, with washers.....	Riveted to intermediate floors.....		
1	1	Wing-nut filler piece.....	On wing-nut pin.....		
2	7	Wing-nut pins, with washers.....	Riveted in chest braces.....		
16	20	0.312 ($\frac{1}{8}$) rivet reinforces.....	Under lid hinges.....		
8	8	0.375 rivet reinforces.....	Under handrail brackets.....		



47-Inch Gun and 6-Inch Howitzer Forge Limber, Model of 1908

DESCRIPTION OF THE 4.7-INCH GUN AND 6-INCH HOWITZER FORGE
LIMBER, MODEL OF 1908.

[Plate XVI.]

The forge limber is a two-wheeled vehicle designed to accompany the battery wagon, model of 1908, and fitted to carry the tools and supplies pertaining to a farrier's shop with the addition of some machinist's tools.

The principal parts are the wheels, axle, chest, middle rail, pintle, foot rest, pole clamp, pole, limber prop, doubletree, singletrees, and neck yoke.

The wheels and wheel fastenings are the same as those upon the carriage. The axle is hollow, made of a single piece of forged steel, and is made identical with the axles of the store limber, model of 1908, and battery and store wagons, model of 1908.

The axle passes through the chest between horizontal plates and is secured to the chest sides by axle bearings riveted to the chest.

The chest is formed from flanged steel plates and is divided by the horizontal plates above and below the axle into three sections, the upper being fitted to carry the forge, anvil, blacksmith's tools, horseshoes, and supplies, and entered from the top. The upper edges of the body plates are reinforced by a steel angle; the lid which covers this upper section is a steel plate with its edges reinforced by a steel band. The lid hinges are in front.

Two longitudinal partitions divide the upper chest into a middle compartment and two side compartments, and each side compartment is subdivided by two transverse partitions. The forward side compartments are wood lined and have a capacity of 350 pounds of horseshoes, to be carried loose in the box; the intermediate side compartments will take 50 pounds of horseshoe nails, either loose or in the 25-pound box of nails as issued; the rear side compartments are fitted for carrying tools. The middle compartment is fitted to take the field forge in front, the anvil in the center, and several small tools in fastenings on the rear wall. The anvil and forge are bedded in wooden seats on the chest floor and are held in position by attachments on the lid. The latter is held in its open position by a lid prop which is hinged to a door prop bracket riveted to the underside of the lid and having at its other end a button running in a lid prop guide riveted to the right longitudinal partition. Other attachments on the underside of the lid form fastenings for a steel square and a box of dies and taps for cutting threads. Shot bolts at each rear corner and a hasp and turnbuckle with padlock in the middle secure the lid when closed.

The space between the intermediate plates and in front of the axle is to be used for carrying the picket rope and water buckets; doorways

are cut through the front of the chest for admission thereto and closed by drop doors. The similar space to the rear of the axle is entered through doorways cut in the rear of the chest; the right side is intended for the tackle blocks, the left side being fitted with packing blocks for the grindstone and its frame. The grindstone-frame legs are to be assembled in their fastenings before the block containing the stone and frame is slid into place.

The lower section of the chest is fitted to carry two lever jacks, one on either side; 150 feet of 1-inch manila rope for the tackle blocks is to be carried either in this compartment or above as proves most convenient. Openings in the front and rear of the chest for admission to the lower compartment are closed by doors which swing down to open. Corresponding doors to the compartment above swing up to open and when closed overlap the lower doors to shed rain water. These doors are secured by wing nuts with bolt snaps.

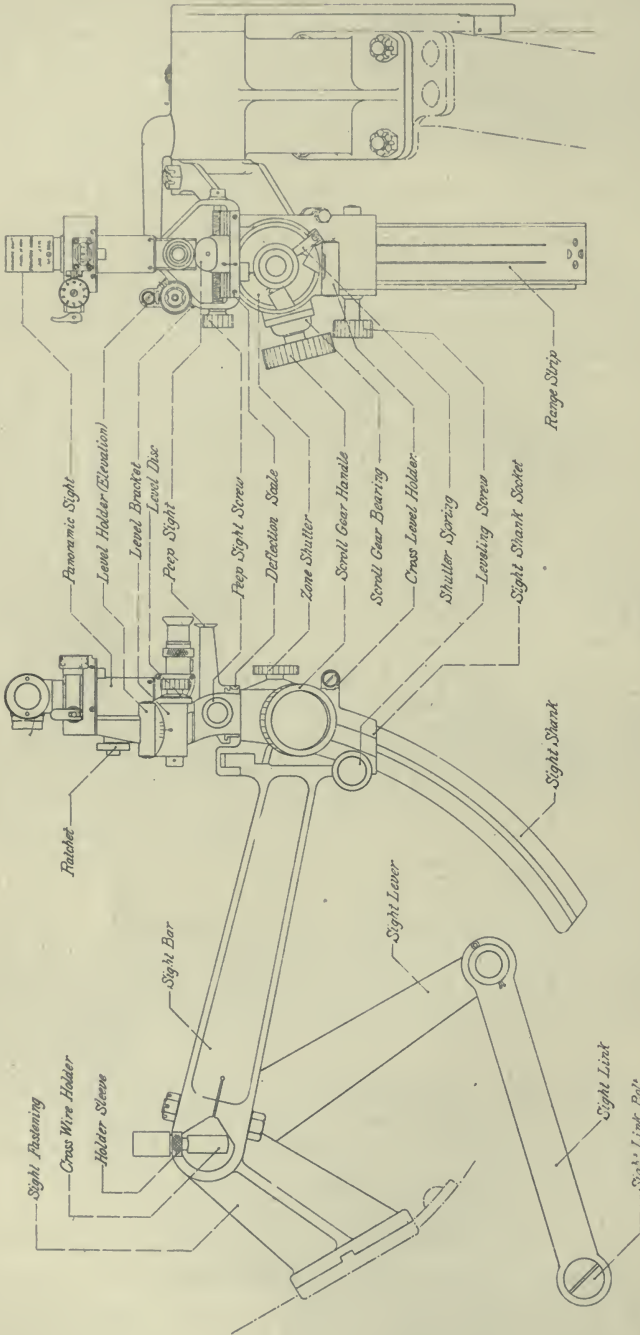
The socket for the pole, instead of being bolted to the chest front as in the limber and caisson, has for its lower member a flange steel channel or middle rail which extends to the rear through the chest, its rear end forming a seat for the pintle. This middle rail, lower, divides the lower horizontal plate or intermediate floor and is riveted to flanges turned downward on the two sections of the plate so formed.

The upper part of the pole socket middle rail, upper, is riveted to the upper horizontal plate or chest floor, upper, and to strong reinforces in the front of the chest as well as to the lower middle rail.

The pole clamp forms a seat for the doubletree pin and has a bolt in lugs on the left side for drawing the two parts of the middle rail firmly about the pole. On the underside of the pole clamp is riveted the prop bracket, to which the limber prop is hinged. The doubletree pin is exactly similar to that on the caisson limber and is braced by a doubletree strap as on that vehicle. The pintle and pintle latch are interchangeable with those of the limber and caisson; the pintle bearing is of bronze and in two sections and is secured by two bolts passing through the middle rail and pintle brace. The latter is formed of flange steel and braces the pintle and middle rail to the chest floor above.

A foot rest is riveted to the chest front, its forward edge being shaped to fit the middle rail, to which it is riveted, and its forward corners tied to the handrail brackets on the chest sides by round supports. Foot-rest brackets of flange steel reinforce the ends of the foot rest and to these are fastened doubletree chains extending to the doubletree and preventing excessive movement thereof.

The pole, neck yoke, doubletree, and singletrees are standard with those of the other battery vehicles. The paulin on the lid is to serve as a seat cushion; attachments for carrying a sledge hammer, a hatchet, and a pickax are on the right side of the chest; a lantern



Sights

Scale 0 2 4 6 8 10 12 14 16 Inches

bracket is riveted to the chest front, and fastenings for a short-handled shovel and an ax are on the left side of the chest. A folding pole prop is carried in fastenings on the underside of the foot rest. A name plate is riveted on the front of the chest and gives the name, number, and model of the vehicle for reference in correspondence and reports.

DESCRIPTION OF THE 4.7-INCH GUN AND 6-INCH HOWITZER STORE LIMBER, MODEL OF 1908.

[PL XVII.]

This vehicle, designed to accompany the store wagon, model of 1908, is very similar to the 4.7-inch gun and 6-inch howitzer forge limber, model of 1908; the wheels, axle, axle-bearings, middle rail, pintle brace, pintle and bearing, pole clamp, doubletree bolt, tie-rods, foot rest, etc., being identical in the two vehicles. The chests differ only in the fittings for the articles to be carried.

The upper chest of the store limber is fitted with compartments for carrying the fire-control equipment, viz:

- 5 buzzers, service model of 1914.
- 3 hand reels.
- 3 spools buzzer wire (0.5 mile per spool).
- 7 field glasses (type EE).
- 1 battery case (containing 6 tungsten type A batteries).
- 8 flag kits, combination artillery.
- 1 lineman's belt, 16 inch.
- 1 climbers (pair) with straps and pads.
- 12 flash lights (without hoods).
- 5 inspector's pocket kits, each containing—
 - 1 pocket knife.
 - 1 pair scissors.
 - 1 wire cutter.
 - 1 half-round file.
 - 1 pair tweezers.
 - 1 screw driver.
 - 1 2-foot rule.
- 2 infantry pick mattocks, model 1910.
- 2 carriers for pick mattocks.
- Spare parts for buzzers, consisting of—
 - 6 connectors (type A) without cords.
 - 6 connector studs (19 point, model A).
 - 10 cords, No. 305.
 - 2 plugs.
 - 6 rods, ground (type D).

The compartments for buzzers, pocket kits, battery commander's telescope, field glasses, and battery case are padded to protect the contents from injury.

The intermediate and lower sections of the store limber are arranged to carry six oil cans for the reserve supply of oils. In the intermediate section to the rear of the axle are two rectangular cans made of heavy sheet brass, each having a capacity of 7.5 gallons of coal

oil. In the lower section are four longer cans of 5 gallons capacity each, two for lubricating oil and two for hydroline oil. Each can is provided with a filling hole on top and with a special stopcock at the rear end. The stopcock is placed so that oil may be conveniently drawn without removing the cans from the limber. Wearing strips of brass are soldered to the bottoms of the cans, and contact blocks on the forward ends of each can embrace projections to hold each can in place when the others are removed. Wooden packing strips to serve as guides for the cans are bolted to the floors and walls of the compartments. Instead of doors on the rear of the chest the cans are secured by lock bars, held in closed position by wing nuts and bolt snaps.

No sledge-hammer fastenings are placed on the store limber. With this exception the implement fastenings are the same as on the forge limber. The name plate is riveted on the front of the chest.

THE BATTERY AND STORE WAGONS, MODEL OF 1908.

NOMENCLATURE OF PARTS.

Number in 1 bat- tery wagon.	Number in 1 store wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1	1	Axle.....	Same as on forge and store limber.....		
2	2	Axle bearings.....	Riveted inside rails.....		
4	4	Axle clamping bolts and nuts...	Assembled in axle bearings.....		
4	4	Axle clamping sleeves.....	do.....		
1	1	Brake beam, complete, includ- ing—			
2	2	Brake-beam bearing plates.....			
10	10	Brake-beam end fillers.....			
2	2	Brake-beam end plugs.....			
2	2	Brake-beam guide plugs, 1 right, 1 left.	In brake-beam guides.....		
10	10	Brake-beam middle fillers.....			
2	2	Brake-beam reinforce plates.....			
2	2	Brake-beam stops.....			
2	2	Brake-shoe bearings.....			
2	2	Brake-beam guides, 1 right, 1 left.	Riveted to side rails.....		
2	2	Brake-beam plungers.....	Assembled in guides.....		
2	2	Brake-beam springs.....	do.....		
1	1	Brake connecting rod.....	do.....		
1	1	Brake crank.....	On brake shaft.....		
1	1	Brake crank cover.....	Riveted to brake cross brace.....	IV	9
1	1	Brake cross brace.....	Connects side rails through front of chest.		
1	1	Brake cross brace stiffener.....	Riveted to brake cross brace.....		
1	1	Brake lever.....	On right end of brake shaft.....		
1	1	Brake lever catch.....	Riveted to brake lever.....		
1	1	Brake lever hook.....	do.....		
1	1	Brake nut.....	Assembled in brake beam.....		
1	1	Brake segment rack.....	Riveted to chest.....		
1	1	Brake shaft.....	In brake shaft bearing.....		
1	1	Brake shaft bearing.....	Riveted to brake cross brace.....		
2	2	Brake shoe.....	Pinned in brake shoe bearings.....		
2	2	Brake shoe pins.....	In brake shoes and bearings.....		
1	1	Brake stud.....	Screws into brake nut.....		
1	1	Brake stud bearing.....	Riveted in brake beam.....		
2	2	Chest bottom plates, 1 right, 1 left.			
1	1	Chest compartment.....			
2	2	Chest floor hoods, 1 right, 1 left.	All rivited together to form chest.....		
2	2	Chest floor stiffeners.....			
2	2	Chest intermediate floor plates, 1 right, 1 left.			

NOMENCLATURE OF PARTS—Continued.

Number in 1 battery wagon	Number in 1 store wagon	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1	1	Chest lower floor plate.....	All riveted together to form chest.....		
2	2	Chest lower front ends, 1 right, 1 left.			
1	1	Chest partition.....			
1	1	Chest rear end.....			
1	1	Chest rear end reinforce.....			
2	2	Chest reinforce strips.....			
2	2	Chest sides, 1 right, 1 left.....			
1	1	Chest top.....			
2	2	Chest top reinforces.....			
1	1	Chest upper floor plate, front.....				Close lower compartments.....
2	2	Chest upper floor plates, rear.....			
1	1	Chest upper front end.....			
1	1	Chest upper front end reinforce.....			
2	2	Chest lower doors, complete, including—			
2	2	Chest lower door center hinges.			
4	4	Chest lower door end hinges			
2	2	Chest lower door hasps.....			
2	2	Chest lower door hinge rivets.			
2	2	Chest lower door staples.....			
8	8	Door handles.....	Riveted to large doors.....	IV	9
32	32	Door-handle reinforces.....	Under door handle rivets.....		
8	8	Door-hinges, female.....			
6	6	Door hinges, male.....			
8	8	Door hinge, female, reinforces.....			
8	8	Door-hinge pins.....			
2	2	Fastening nuts.....	On spare pole fastening bolts.....		
4	4	Fastening washers.....	do.....		
1	1	Footrest.....	Riveted to footrest supports.....		
2	2	Footrest supports, 1 right, 1 left.	Riveted to upper front door plate.....		
2	2	Lid props, including—	Hold door in open position.....		
2	2	Eyes.....			
2	2	Fillers.....			
2	2	Guides.....			
2	2	Reinforces.....			
4	4	Lock bars.....	Secure doors.....		
4	4	Lock-bar hinges, front and rear.	Riveted to chest.....		
2	2	Lock-bar hinge, front, reinforces.	Inside of chest.....		
2	2	Lock-bar hinge, rear, reinforces.	do.....		
4	4	Lock-bar hinges, top.....	Riveted to chest.....		
4	4	Lock-bar hinge, top, reinforces.	Inside of chest.....		
1	1	Lunette.....	In lunette bearing.....		
1	1	Lunette bearing.....	At front end of rails.....		
2	2	Lunette pins.....	Secure lunette in bearing.....		
1	1	Name plate.....	Riveted to chest rear end.....		
6	6	Padlocks, with chains.....	Lock doors.....		
4	4	Padlock chain rivets.....	Attach chains to lock bars.....		
2	2	Prop chains.....	Hold prop in folded position.....		
2	2	Prop-chain guides.....	On wheel guard cross brace.....		
1	1	Prop-chain take-up.....	do.....		
1	1	Prop, consisting of—	Riveted or pinned together.....		
2	2	Prop-chain clamps.....			
1	1	Prop foot.....			
1	1	Prop head.....			
2	2	Prop legs.....			
1	1	Prop pin.....	Connects prop to lunette bearing.....		
1	1	Prop hook.....	Joins prop chains.....		
1	1	Rear-door casing.....	Riveted to chest.....		
1	1	Rear-door frame.....	Riveted to rear door plate.....		
2	2	Rear-door hinge, male, reinforces.	Inside of chest.....		
2	2	Rear-door hooks.....	Pinned in supports.....		
2	2	Rear-door hook pins.....	Pin hooks in supports.....		
2	2	Rear-door hook springs.....	In rear door hook support.....		
2	2	Rear-door hook support.....	Riveted to chest rear end.....		
1	1	Rear-door plate.....	Hinged to chest rear end.....		
2	2	Rear-door studs.....			
2	2	Side rails, 1 right, 1 left.....	Form frame of wagon.....		
2	2	Spare-pole compartment sides, 1 right, 1 left.	Riveted to chest.....		
2	2	Spare-pole fastening bolts.....	Support large end of poles.....		
1	1	Spare-pole fastening bracket.....	Riveted to side rails near lunette bracket.		

NOMENCLATURE OF PARTS—Continued.

Number in 1 bat- tery wagon.	Number in 1 store wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
1	.....	Spare-pole fastening bracket re- inforce, lower.	Riveted to bracket.....		
1	.....	Spare-pole fastening bracket re- inforce, upper.	.....do.....		
1	.....	Spare-pole rest.....	Riveted to spare-pole compartment sides.		
1	.....	Spare-pole rest cover.....	Sewed on spare-pole rest.....		
1	.....	Spare-pole support, inner.....	} Riveted together to spare-pole com- partment sides.		
1	.....	Spare-pole support outer.....			
1	.....	Spare-pole support cover, inner.	On spare-pole support.....		
1	.....	Spare-pole support cover, outer.	.....do.....		
2	2	Spare-wheel casings.....	Riveted to chest sides.....		
4	4	Spare-wheel fastenings, lower, consisting of—			
4	4	Lower wheel-fastening bolts.	Pinned in hinges.....		
4	4	Lower wheel - fastening guards, inside.	Riveted to chest.....		
4	4	Lower wheel - fastening guards, outside.	.....do.....		
4	4	Lower wheel-fastening hasps	Pinned in hinges.....		
4	4	Lower wheel - fastening hinges.	Strap outside of wheels.....		
4	4	Lower wheel - fastening hooks.	Riveted to chest sides.....		
4	4	Thongs.....	In eye of hooks.....		
4	4	Spare-wheel fastenings, upper, complete, consisting of—			
4	4	Upper wheel-fastening clips.	Nut levers.....		
4	4	Upper wheel-fastening bars, 2 right, 2 left.	Strap outside of wheel.....		
4	4	Upper wheel - fastening hinges.	Riveted on chest.....		
4	4	Upper wheel-fastening nuts.	On swing bolts.....		
4	4	Upper wheel-fastening pins.	In swing bolts and hinges.....		
4	4	Upper wheel-fastening rein- forces, 2 right, 2 left.	Riveted inside of chest.....		
4	4	Upper wheel-fastening riv- ets.	Hinge studs to bars.....		
4	4	Upper wheel-fastening sock- ets, 2 right, 2 left.	Riveted on chest.....		
4	4	Upper wheel-fastening studs	Screwed into sockets.....		
4	4	Upper wheel-fastening swing bolts.	Pinned in hinges.....		
4	4	Wearing plates.....	Riveted to chest.....		
1	1	Step.....	On rear of wagon.....		
2	2	Top-door frames.....	Riveted to top-door plate.....		
4	4	Top-door hinge, male, reinforces.	Riveted inside of chest.....		
2	2	Top-door plates.....	Hinged to chest.....		
1	1	Upper front door frame.....	Riveted to upper front door plate.....		
2	2	Upper front door hinges, male..	Riveted to chest.....		
1	1	Upper front door plate.....	Hinged to chest.....		
1	.....	Vise-handle strap.....	Secures vise handle.....		
6	6	Weather strips (leather).....	Riveted to doors.....		
2	2	Wheels.....	See nomenclature of parts of 6-inch howitzer carriage, model of 1908.		
2	2	Wheel fastenings.....	.....do.....		
2	2	Wheel guards.....	Riveted to side rails.....		
1	1	Wheel guard cross brace.....	.....do.....		
4	4	Wing nuts.....	Secure lock bars.....		
4	4	Wing nut clasps.....	On lock bars.....		
4	4	Wing nut pins, with—			
4	4	Washers.....	} Riveted to chest.....		
4	4	Reinforces.....			
1	1	Left packing, consisting of—			
1	1	Body.....	} Left end, upper rear compartment.....		
1	1	Front packing.....			
1	1	Lunette transom bushing pack- ing, consisting of—			
1	1	Back.....	} Right rear corner, upper rear compart- ment.		
1	1	Bottom.....			
1	1	End (left).....			
1	1	End (right).....			
1	1	Front.....			
1	.....	Packing "A".....	Left front corner, upper rear compart- ment.		

NOMENCLATURE OF PARTS—Continued.

Number in 1 bat- tery wagon.	Number in 1 store wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1		Packing "B," consisting of—			
1		Body.....	} Through middle, upper rear compart- ment.		
1		Steel angle.....			
1		Packing "C".....		} Between end of chest and packing "B," upper rear compartment.	
	1	Right packing.....	} Right middle, upper rear compart- ment.		
	1	Spare hub-liner packing, con- sisting of—			
	1	Body.....	} Left rear corner, upper rear compart- ment.		
	1	Bottom.....			
	1	Front-liner packing (middle)			
	2	Front liner packing (upper and lower).			
	1	Front (middle).....			
	2	Front (upper and lower).....			
	1	Rear liner.....			
	1	Rear-liner packing (lower).....			
	1	Rear-liner packing (middle).....			
	1	Rear-liner packing (upper).....			
	1	Rear (middle).....			
	1	Rear (upper).....			
	15	Ribs.....			
	1	Top.....			
	1	Spare pintle and lunette pack- ing, consisting of—			
	1	Center piece.....	} Right end, upper rear compartment..		
	1	End (rear).....			
	1	Filler cleat (bottom).....			
	1	Filler cleat (left).....			
	2	Filler cleats (right).....			
	2	Lunette blocks.....			
	2	Outer pieces.....			
	3	Partitions.....			
	1	Side (left).....			
	1	Side (right).....			

DESCRIPTION OF THE BATTERY WAGON, MODEL OF 1908, AND STORE
WAGON, MODEL OF 1908.

[Plate XVIII.]

The battery wagon is a rectangular steel box on wheels, provided for the transport of battery tools and supplies, spare parts of guns, carriages and harness, materials for cleaning and preservation, etc. The store wagon is exactly similar to the battery wagon, except in such minor details as pertain to the packing of various pieces of equipment.

To bring the center of gravity as low as possible, the axle of the battery wagon is made to pass through the chest.

The frame consists of two side rails of channel section, with flanges turning inward running parallel inside the sides of the chest. The rails are riveted to the sides of the chest, fastened to the axle by suitable bearings, and are joined in front to secure the bracket for the lunette, the latter exactly similar to that on the connecting pole on the caisson. At the front of the chest the brake cross brace connects the side rails and at the proper distance from the lunette

bracket the wheel cross brace stiffens the frame to withstand the impacts of the limber wheels in turning. A projection cast on the underside of the lunette bracket receives the hinge pin of a prop for use when the vehicle is unlimbered. The prop is formed of two steel tubes, united at the lower end by a bronze prop foot and at the upper end by the prop head. When not in use the prop is swung up under the spare poles and held in that position by chains leading from the prop legs through guides on the wheel guard cross brace and uniting in a hook which is engaged over one of the buttonlike heads of the lunette pins.

The chest is built up of flange steel plates and divided into 10 compartments for the convenient disposal of the load. A vertical transverse partition divides all that part of the chest above the lower flanges of the side rails and strengthens the chest against stresses resulting from lurching. The space forward of this transverse partition is floored to form a compartment entered through a flanged opening in the top. The compartment beneath has a flanged opening in the chest front. The edges of these doorways are reinforced by steel angles; the doors are metal sheets with angle flanges faced with leather to shed rain water.

The space in rear of the transverse partition is floored, forming a compartment entered from the top. Underneath, a central space with door in the chest rear accommodates two tool boxes, and on each side of this are two shallow compartments for small articles, access to these being through handholes in the walls of the tool-box recess.

To permit the transport of two spare pole bodies underneath the frame, that portion of the chest below the side rails is built with compartments on each side, leaving a central space. In this the poles are supported by suitable fastenings. The spare poles are carried only on the battery wagon. The lower side compartments are entered from the front, and may also be reached through apertures in the floor of the compartment for tool boxes. They are provided for transporting the spare counterrecoil springs of the carriages, which will occupy three of the four compartments of the two wagons. In the fourth may be carried spare sponge staves, shovel handles, or other long articles.

The doors of these lower compartments are hinged and fitted with hasps and padlocks.

The forward top door opens from the front and the rear top door from the rear; that on the chest front is hinged at its lower edge to open downward and that on the rear of the chest opens upward and is held in the open position by latches which engage studs on the door. These four larger doors are secured by lock bars with chained padlocks. Spring wing-nut clasps on the lock bars hold the wing

nuts in place. The foot rest is secured to the upper front door, and a step for convenience in unloading the upper rear compartment is attached to the rear of the chest.

Upon each side of the chest are provided arrangements for carrying a spare wheel. A hole in the side of the chest and the spare wheel casing riveted around this hole on the inside of the chest receives the inner face of the hub; while the tire and felloe are clamped to the side by four wheel fastenings. Forged steel lugs are riveted to the chest body against which the tire of the spare wheel rests.* Heavy metal straps are hinged to these, and passing outside the tire are secured in the lower fastenings by hasps to wheel-fastening hooks riveted to the chest and in the upper fixtures by swing bolts with lever nuts. To bring the center of gravity of the vehicle as low as possible, the spare wheel is so placed that the wagon axle passes between its spokes. To remove a wheel from the fastenings, therefore, the wagon wheel must first be taken off. To secure proper clearance between the spare wheel hub and the spokes of the wagon wheel, the spare wheel hub cap will not be carried on the spare wheel but in the battery-wagon chest and a special spare wheel hub cover put in its place to protect the threads of the hub box and exclude dirt. In the replacement of a damaged wheel it is probable that the original hub cap and wheel fastening may be used.

When speed is especially desirable in changing wheels the battery-wagon wheel may be taken to replace a broken one on a carriage limber, or caisson, and the spare wheel assembled on the battery wagon axle. The spare wheel fastening will fit either the 50-inch or 60-inch spare wheels. As issued three 60-inch and one 50-inch spare wheels are assembled in the fastenings of the two wagons.

A flange steel brake beam of box section passes through the side rails forward of the wheels and carries at each end a forged steel brake shoe bearing with renewable cast-iron shoes to bear against the tires. The side rails at these points are reinforced by bronze brake-beam guides riveted on, which contain spring plungers to force the beam forward and away from the wheels. The brake is set by a lever on the right side of the chest, which operates through the brake shaft, brake crank, and brake connecting rod to draw the shoes against the wheels. The brake shoes are interchangeable with those of the carriage and caissons.

A strong vise is fitted to the right side rail of the battery wagon; it may be dismantled and carried in the chest if desired. For other articles carried see list of equipment to follow.

In loading a battery or store wagon the weight must be so distributed as to bring *less* than 105 pounds load on the pintle of the limber, as more will tend to make the pole of the limber rise.

The duplex chain block should be packed in the battery wagon so that the nested galvanized steel water buckets may be inverted over it.

For convenience, the various compartments in the battery and store wagons are lettered and items in the tables of equipment marked to indicate the particular compartment in which they should be carried, in order that the weight at the pintle may be that desired. The following shows the lettering of the compartments:

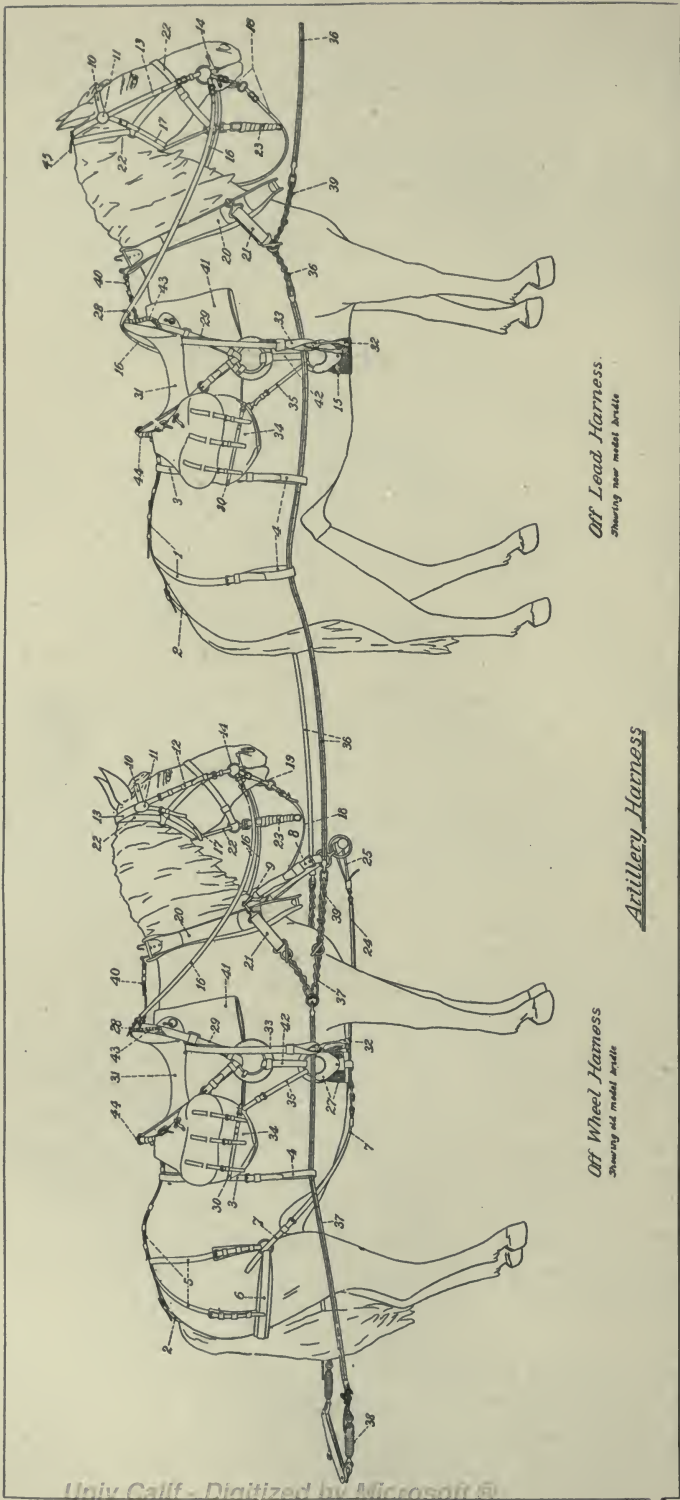
Letter.	Position of compartment.
A	Upper, rear.
B	Middle, rear.
C	Right, rear, upper.
D	Right, rear, intermediate.
E	Left, rear, upper.
F	Left, rear, intermediate.
G	Right, lower.
H	Left, lower.
J	Upper, front.
K	Intermediate, front.

DESCRIPTION OF SEVERAL TOOLS AND ACCESSORIES FOR THE BATTERY AND STORE WAGON.

Four chests containing tools and stores are carried in the rear compartments of the two wagons. They are a carpenter's tool chest, a saddler's chest, a chest for miscellaneous spare parts, and a chest for cleaning materials and small stores.

The carpenter's chest is an iron-bound wooden box containing an assortment of carpenter's tools so arranged that each tool may be taken from its place in the chest without removing any other. The saddler's chest is a combined tool chest and stitching horse. For the latter purpose the chest forming the seat rests upon four hinged legs, cross braced to each other. The stitching clamp is secured in a socket on one end of the chest, while the door swinging open on the left side brings the tools into convenient reach of the saddler. For transportation the clamp is removed from its seat and placed within the chest, the legs are folded over against each end and held by the leg braces, permitting the placing of the chest in a small compartment. Both the carpenter's and saddler's chests are provided with handles and locks and have sufficient capacity inside to take a canvas bag of small stores in addition to the articles given in the list at the back of this book. The chest for cleaning materials is a wooden box with hinged lid containing perishable materials. The chest for miscellaneous spare parts holds various small stores.

One chest for a spare breech mechanism, one level chest containing a testing level, and one chest for spare sights are issued to each battery; the latter contains provisions for the safe packing of one front and rear sight complete, one panoramic sight, and one set of bore sights.



Off Lead Harness.
Showing new metal device

Artillery Harness

Off Wheel Harness
Showing old metal device

CYCLOMETER.

One carriage limber in each battery is fitted with a device which registers the number of miles traveled. This instrument, called a cyclometer, is mounted on the limber axle near the left wheel, and is composed of a star wheel and shaft actuating a train of gears, which bring figures representing 0.1 mile to 9,999.9 miles before a glass window in the usual manner of such meters.

A tally pin riveted to the wheel hub strikes the star wheel and moves it one tooth at each revolution of the wheel.

In assembling a tally pin on the wheel hub two 0.312 ($\frac{5}{16}$) inch rivet holes must be drilled in the flange of the hub box 1.3 inches apart and 0.55 inch from the end of the hub. The dowel pinhole in the axle locating the cyclometer bracket is 21.437 ($21\frac{7}{16}$) inches from the center line of the limber, 2.437 ($2\frac{7}{16}$) inches from the shoulder of the axle, and at an angle of 16° to the rear of a vertical plane through the center line of the axle.

Nomenclature of cyclometer parts:

- 1 bracket.
- 1 bracket strap.
- 2 bracket-strap bolts.
- 1 bracket bolt with nut and split pin.
- 1 cover.
- 4 cover bolts with nuts and split pins.
- 1 stop.
- 1 spring.
- 1 tally shaft.
- 1 tally pin.
- 1 washer (felt).
- 1 counter.
- 1 case (for counter).
- 4 case screws.

PADLOCKS AND BOLT SNAPS.

The padlocks furnished for each separate vehicle, as carriage, forge limber, battery wagon, store limber, or store wagon, excepting the limbers and caissons, will have keys interchangeable for all locks of that particular vehicle but differing from all others.

Limbers and caissons are furnished with a lock, marked "AMMUNITION," which has only one key, these being universally interchangeable.

Bolt snaps for temporarily securing doors, etc., occur where no shot bolts are provided.

THE ARTILLERY HARNESS.

The component parts of the artillery harness are given in the table following. Plate XIX shows the harness for the off-wheel and off-lead horses. The nomenclature corresponding to the numbers in the plate will be found in the table.

No. in plate.	Component parts.	Wheel.		Lead.		Property classification.	
		Near horse.	Off horse.	Near horse.	Off horse.	Class.	Section.
1-4	Backstrap and crupper, complete.....			1	1		
	Consisting of—						
1	Body and hip straps.....			1	1		
2	Crupper dock.....			1	1		
3	Loin strap.....			1	1		
4	Trace loops.....			4	4		
	Backstrap hook.....			1	1		
	Belly band, complete.....			1	1		
	Consisting of—						
	Belly band.....			1	1		
	Holding-down strap.....			2	2		
	Holding-down strap loop.....			2	2		
8, 9	Breast strap, complete.....	1	1				
	Consisting of—						
8	Breast strap.....	1	1				
9	Breast-strap hooks.....	2	2				
2-7	Breeching, complete.....	1	1				
	Consisting of—						
5	Backstrap(1) and hip straps(4).....	1	1				
6	Body.....	1	1				
2	Crupper dock.....	1	1				
	Backstrap hook.....	1	1				
	Side-strap hooks.....	2	2				
3	Loin strap.....	1	1				
7	Side straps.....	2	2				
4	Trace loops.....	2	2				
10-19	Bridle, complete (old model).....	1	1	1	1		
	Consisting of—						
10	Brow band.....	1	1	1	1		
11	Brow-band ornaments.....	2	2	2	2		
12	Cheek pieces.....	2	2	2	2		
18	Coupling strap.....		1		1		
19	Connecting strap.....		1		1		
13	Crown piece.....	1	1	1	1		
14	Snaffle bits ¹	1	1	1	1		
16	Reins (pairs).....	1	1	1	1		
17	Throat latch.....	1	1	1	1		
	Bridle, complete (new model).....	1	1	1	1		
	Consisting of—						
10	Brow band.....	1	1	1	1		
11	Brow-band ornaments.....	2	2	2	2		
13	Crown piece.....	1	1	1	1		
18	Coupling strap.....		1		1		
14	Snaffle bit ¹	1	1	1	1		
16	Reins.....	1	1	1	1		
45	Crown-piece strap.....	1	1	1	1		
20	Collar, steel.....	1	1	1	1		
21	Hame tug (part of collar).....						
40	Collar strap.....	1	1	1	1		
22, 23	Halter, complete.....	1	1	1	1		
	Consisting of—						
	Crown strap.....	1	1	1	1		
	Cheek piece.....	2	2	2	2		
	Crown chape.....	1	1	1	1		
	Nose band.....	1	1	1	1		
	Chin strap.....	1	1	1	1		
	Throat band.....	1	1	1	1		
	Throat strap.....	1	1	1	1		
	Halter square.....	2	2	2	2		
	Tie rope.....	1	1	1	1		
23	Martingale, complete.....	1	1				
24, 25	Consisting of—						
24	Martingale.....	1	1				
25	Cincha strap.....	1	1				
26, 33	Saddle, complete.....	1	1	1	1		
	Consisting of—						
27	Cinchas with reinforces and loops.....	1	1				
15	Cinchas without reinforces and loops.....			1	1		
28	Lead rein roller and strap.....			1	1		
29, 42	Quarter straps, including rings, safes, and cincha straps (side).....	2	2	2	2		
	Quarter strap, cantle.....	1	1	1	1		
	Quarter strap, pommel.....	1	1	1	1		
43	Coat strap, 33-inch (pommel).....	3	2	3	2		
44	Coat strap, 45-inch (cantle).....	1	1	1	1		
30	Coat strap, 60-inch.....		2		2		
31	Saddletree, leather covered.....	1	1	1	1		
32	Stirrups (nickel steel).....	2	2	2	2		
33	Stirrup straps.....	2	2	2	2		
34	Saddlebags, pairs.....		1		1		
35	Saddlebag side straps.....		2		2		

¹ Twenty curb bits with chains are issued for use in place of snaffle bit on fractious draft horses.

No. in plate.	Component parts.	Wheel.		Lead.		Property classification.	
		Near horse.	Off horse.	Near horse.	Off horse.	Class.	Section.
36	Traces, lead, model of 1908. Consisting of—			2	2	IV	8
	1 trace body.....						
	1 trace cover.....						
	3 links.....						
	1 chain.....						
	1 toggle.....						
	2 sockets.....						
	2 cones.....						
	2 filler pieces.....						
37	Traces, wheel, model of 1908. Consisting of—	2	2				
	1 trace body.....						
	1 trace cover.....						
	1 ring.....						
	2 sockets.....						
	2 links.....						
	2 chains.....						
	2 toggles.....						
	2 cones.....						
	2 filler pieces.....						
	1 Mogul spring, assembled.....						
38	1 loop hook.....						
	1 ring.....						
	1 locking strap.....						
39	Trace chains.....			2	2		
	Whip.....	1		1			
	Sweat leathers.....	2		2			
41	Blanket ¹	1	1	1	1		

¹ In submitting requisitions and in filling requisitions, unless it is specifically stated that saddle blankets are wanted, these articles will not be included.

STEEL COLLARS.

SIZES AND DIRECTIONS FOR FITTING.

Steel collars are made in the following sizes: 2A, 2B, 4A, 4B, 5, 5A, 5B, 6, 6A, 6B, 7, 7A, 7B, and 8A. The number and shape of the collar are stamped on the front side under the extension bolt. The A and B shapes have straighter sides than the numbers without letters. When issued with harness, unless otherwise ordered, 20 per cent of the collars are No. 4A, 30 per cent No. 5, 40 per cent No. 5A, and 10 per cent No. 6. In requisitions, the size of collars desired should be given.

The steel collar pads are made in seven different sizes: No. 0 is 4 inches wide, No. 1 is 4.5 inches wide, No. 2 is 5 inches wide, etc., to No. 6, which is 7 inches wide. The pad connections are also furnished in seven sizes, from No. 0 to No. 6. For the plain number of collar (5, 6, or 7), the regular adjustment requires a pad connection of the same number as the pad. The A and B shapes have straighter sides and take a pad connection two sizes larger than the pad—that is, it would take a No. 3 connection with a No. 1 pad, etc., for the regular adjustment in these shapes. When the collar is very wide at the top and narrow at the bottom, the size of the pad connection must be increased one or two numbers to allow the collar to close

easily at the bottom. In the reverse case a smaller pad connection should be used. The collar pads are numbered on the front inner side. The pad connections are numbered on the side having the round holes, which side must be kept to the front on the collar. In requisitions for collar pads and pad connections the sizes desired must be stated.

The buckle is made in two sizes. No. 2 is 1 inch longer than No. 1 and is used with the larger sizes of collar pads.

The correct adjustment and fitting of collars is of the utmost importance. The variety of sizes and shapes of collars, pads, pad connections, and buckles issued by the Ordnance Department is sufficient to enable any horse to be correctly fitted. Efficient supervision by officers of the fitting of collars and of the adjustment of the point of draft (trace plate) is required to secure proper results.

TABLE OF DIMENSIONS.

Number of collar.	Size of collar fitted with No. 3 pads.				Size of collar fitted with No. 1 pads.			
	Length of collar in-side.	Width 6 inches down from top.	Width 8 inches down from top.	Width at draft.	Length of collar in-side.	Width 6 inches down from top.	Width 8 inches down from top.	Width at draft.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
2A	18	6 $\frac{3}{8}$	7 $\frac{1}{8}$	8 $\frac{3}{8}$	16 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{7}{8}$	7
2B	18	6 $\frac{1}{2}$	6 $\frac{3}{4}$	8	16 $\frac{1}{2}$	4 $\frac{3}{4}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$
4A	19 $\frac{1}{2}$	7	7 $\frac{1}{4}$	8 $\frac{3}{4}$	18	5 $\frac{3}{4}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$
4B	19 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{8}$	8 $\frac{3}{8}$	18	5 $\frac{1}{2}$	5 $\frac{7}{8}$	7 $\frac{1}{8}$
5	21	7 $\frac{1}{8}$	8 $\frac{1}{8}$	9 $\frac{1}{2}$	19 $\frac{1}{2}$	6 $\frac{1}{4}$	7 $\frac{1}{8}$	8 $\frac{1}{8}$
5A	21	7	7 $\frac{1}{4}$	9	19 $\frac{1}{2}$	5 $\frac{3}{4}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$
5B	21	6 $\frac{1}{2}$	7 $\frac{1}{8}$	8 $\frac{1}{4}$	19 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{7}{8}$	7 $\frac{1}{4}$
6	22 $\frac{1}{2}$	7 $\frac{3}{8}$	8 $\frac{1}{2}$	9 $\frac{1}{2}$	21	6 $\frac{1}{2}$	7 $\frac{1}{4}$	8 $\frac{1}{4}$
6A	22 $\frac{1}{2}$	7	7 $\frac{1}{4}$	9 $\frac{1}{4}$	21	6	6 $\frac{1}{4}$	8 $\frac{1}{4}$
6B	22 $\frac{1}{2}$	7	7 $\frac{1}{8}$	9 $\frac{1}{8}$	21	5 $\frac{3}{4}$	6 $\frac{1}{2}$	8 $\frac{1}{8}$
7	24	7 $\frac{3}{8}$	8 $\frac{3}{8}$	10 $\frac{1}{4}$	22 $\frac{1}{2}$	6 $\frac{3}{4}$	7 $\frac{3}{8}$	8 $\frac{3}{8}$
7A	24	7	7 $\frac{1}{8}$	9 $\frac{1}{8}$	22 $\frac{1}{2}$	5 $\frac{3}{4}$	6 $\frac{3}{8}$	8 $\frac{1}{8}$
7B	24	7	7 $\frac{1}{4}$	10	22 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{3}{8}$	8 $\frac{1}{8}$
8A	25 $\frac{1}{2}$	7	7 $\frac{3}{8}$	9 $\frac{3}{8}$	24	5 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$

The table of dimensions gives the largest and smallest size that each collar can be made with the No. 3 and No. 1 pads. Adding one-half inch in length and width to the smallest dimensions given in the table will give the size of the collars when fitted with the No. 2 pads. These examples are given to show the three regular adjustments in each size of collar, but these dimensions can be varied to suit the different shapes of necks. The largest pad can be put in the top of the collar and the bottom taken in to its smallest dimensions, or the smallest pad can be put in the top and the bottom left out. While each collar can be lengthened or shortened and taken in or let out at the bottom by means of the adjustments provided, the width at the top can not be changed without using a larger or smaller pad.

In fitting irregular shapes none of the connections may give just the proper tension on the pad. In such a case use the one that comes



COLLAR STRAP



SHOULDER PROTECTOR



BRACELLET



BOLT AND NUT FOR TOP CONNECTION



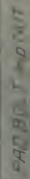
BOLT AND NUT CONNECTION TO COLLAR



CHEST SPRING



COLLAR PAD



BOLT AND NUT



BOLT AND NUT FOR BRACE PLATE



BOLT AND NUT FOR EXTENSION



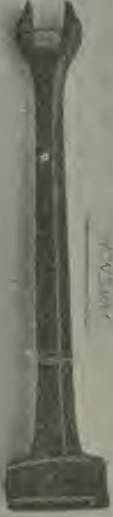
MUSCLE SPRING



HOOK

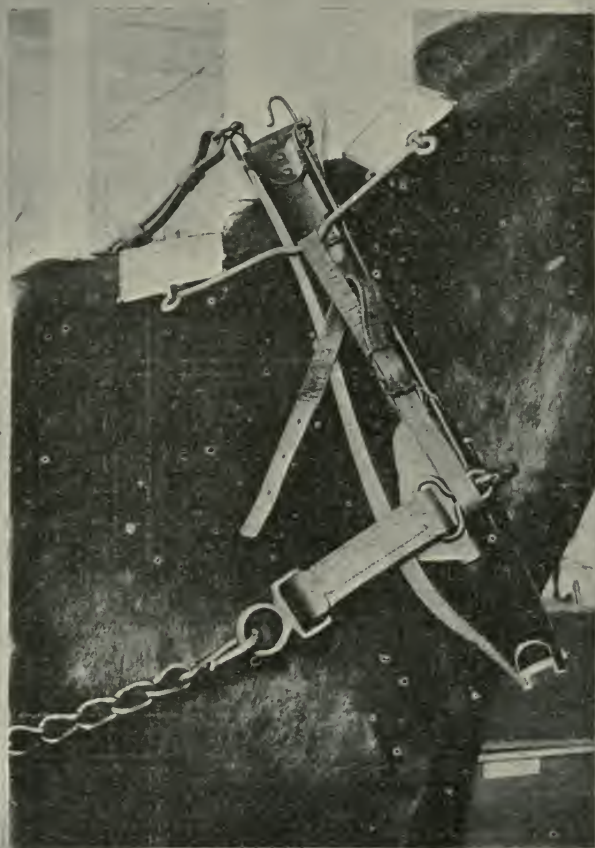


TRADE PLATE



WRENCH

COLLAR BACK STRAP CONNECTION



Collar Lifting Device.

nearest and straighten or bend the extension at the top. When the collar requires to be widened at top to relieve the pressure on the pad and make it lock easily at the bottom, open the collar wide and place a round piece of hard wood or iron, 1 inch in diameter and 2 inches long, between the connection and collar side close up to the hinge, then press the sides together and bend both sides alike, so that they will be the same length at the bottom. Do not let the fulcrum rest on the pad, for it will bend it. If the collar sides require straightening to close them tighter on the pad and give more tension on the latch at the bottom, open the collar at the bottom, hook the wrench over the top of collar side, and press down the lever, treating both sides alike. Both of these operations can be performed with the collar put together.

Parts furnished for the repair of the collars, with the correct names of the parts, are shown on plate XX.

Canvas collar pads are not part of the artillery harness, but are furnished upon requisition. They are made in sizes Nos. 2, 3, 4, 5, and 6, as called for; if no size is called for they are made in equal proportions of Nos. 4, 5, and 6.

COLLAR-LIFTING DEVICE.

[Plate XXI.]

This is a simple device for lifting the steel collar from the horse's neck, when, for any reason, the neck becomes sore. The straps securing it to the hame tugs afford easy attachment to or removal from the collar. By supporting the collar by canvas pads in front and in rear of the collar the pressure is removed from the surface of the neck directly beneath the collar and the weight is more evenly distributed along the neck.

In case of necessity, such a device, made by the organization mechanic, will allow working a horse when suffering with a sore neck.

THE CARE AND PRESERVATION OF LEATHER.

Attention is invited to the following:

"It is forbidden to use any dressing or polishing material on the leather accouterments or equipments of the soldier, the horse equipments for cavalry, or the artillery harness except the preparations supplied by the Ordnance Department for that purpose." (A. R. 293 of 1913.)

REASON FOR OILING LEATHER.

Leather, as it comes from the tannery in manufacture, is hard, rough, brittle, inflexible, and readily absorbs water. To remove these undesirable qualities and render the leather soft, pliable, flexible, and impervious to water, to increase the strength and

toughness of the fiber, and to give the leather such a surface color and finish as will make it most sightly and suitable for the purpose for which intended, the manufacture is continued by hand stuffing it with a dubbing made of pure cod-liver oil and tallow, which the experience of carriers has shown to be the best material for this purpose. This dubbing is thoroughly absorbed by the leather, penetrating it completely, and is not merely limited to the surface.

The russet leather now used by the Ordnance Department in the manufacture of all leather equipments is pure oak tanned, of No. 1 tannage and finish, hand stuffed with a light dubbing made of pure cod-liver oil and tallow to preserve the leather, the dubbing being so sparingly used that the oil will not exude. This leather as it comes from the manufacturer contains enough oil to materially improve its quality and prolong its life, but not enough oil to soil the clothing if the equipment is properly cared for. No oil whatever is added to the leather in the manufacture of the equipments at the Government arsenals.

CARE OF RUSSET LEATHER.

Leather equipments which have become wet should be dried in the shade. Wet leather exposed to the direct rays of the sun or to the heat of a stove or radiators becomes hard and brittle.

When russet-leather equipments become soiled in service they should be cleaned by carefully washing the leather with a sponge moistened with a heavy lather made of clean water and Castile or Frank Miller's soap, and then rubbing vigorously with a dry cloth until the leather is completely dry.

If the leather becomes harsh, dry, and brittle from exposure to water or other causes, clean as above described, and while the leather is still slightly moist apply an exceedingly light coat of neat's-foot oil by rubbing with a soft cloth moistened (not *saturated*) with the oil. If it is found that too much oil has been used, the surplus can be readily removed by rubbing with a sponge moistened with naphtha or gasoline. But these oils are not issued for this purpose.

Where a polish is desired, the leather should first be thoroughly cleaned and then the leather polish or dressing supplied by the Ordnance Department should be applied sparingly and thoroughly rubbed in with a soft, dry cloth. Scars, cuts, or abrasions of the leather may be improved in appearance but not obliterated by similar use of the leather polish.

Russet leather may be cleaned, oiled, and polished as described above, but it should be noted that if more than a light coat of oil be given the leather will be greatly darkened and will quickly soil the clothing. No method of cleaning will restore the original light color of the leather or remove stains or discolorations.

To clean and dress black leather, wash it in water (lukewarm preferred) with Castile soap. An old horse brush will be found very satisfactory for applying the soap and water. Dry in the shade; when almost dry, apply the blacking, rubbing it in thoroughly.

Dry in the shade and then apply neat's-foot oil with a sponge or rag, rubbing in well until the leather is soft and pliable.

When dry, a certain amount of oil and blacking will exude from the leather; this should be rubbed off with a dry cloth.

SIGHTS AND QUADRANTS.

The instruments provided for sighting and laying the piece include a line sight, a rear sight, a front sight, a panoramic sight, and a range quadrant.

LINE SIGHT.

The line sight consists of a conical point as a front sight and a V notch as a rear sight; the former is screwed into the locking hoop and the latter is attached to the breech end of the jacket; together they determine a line of sight parallel to the axis of the bore, useful in giving general direction to the gun.

FRONT AND REAR SIGHTS.

The front and rear sights are for general use in direct aiming. They consist of a front sight carrying cross wires and a rear sight of the peep variety. The length of the line of sight is 36.75 inches; its height from the ground with gun at 0° elevation is 53.5 inches. The sights are supported from the cradle; the peep of the rear sight is in such a position as to come opposite the eye of the gunner seated upon the left trail seat.

THE FRONT SIGHT.

The front sight complete consists of the front sight proper, the front-sight holder, the front-sight bracket sleeve, the front-sight bracket with spring catch riveted on, and two split pins; that is, it includes all parts except the front-sight bracket support.

The support for the front-sight bracket is riveted to the cradle in front of the shield. The lower end of the bracket fits into a socket in the bracket support. In sighting position the bracket projects from the cradle to the left, but for traveling it is arranged so that it may be swung toward the cradle to prevent its being injured. It is held in either position by the engagement of the spring catch in notches in the support socket.

The front sight proper consists of a pair of cross wires mounted in a ring. This ring is secured, with cross wires at an angle of 45° to the

horizontal, in the circular hole through the front-sight holder. The sight holder has the shape of an eyebolt; its shank screws into the top of the front-sight bracket sleeve, which screws over the upper end of the sight bracket. When adjusted, rotation of the sight holder in sleeve or of sleeve on bracket is prevented by split pins.

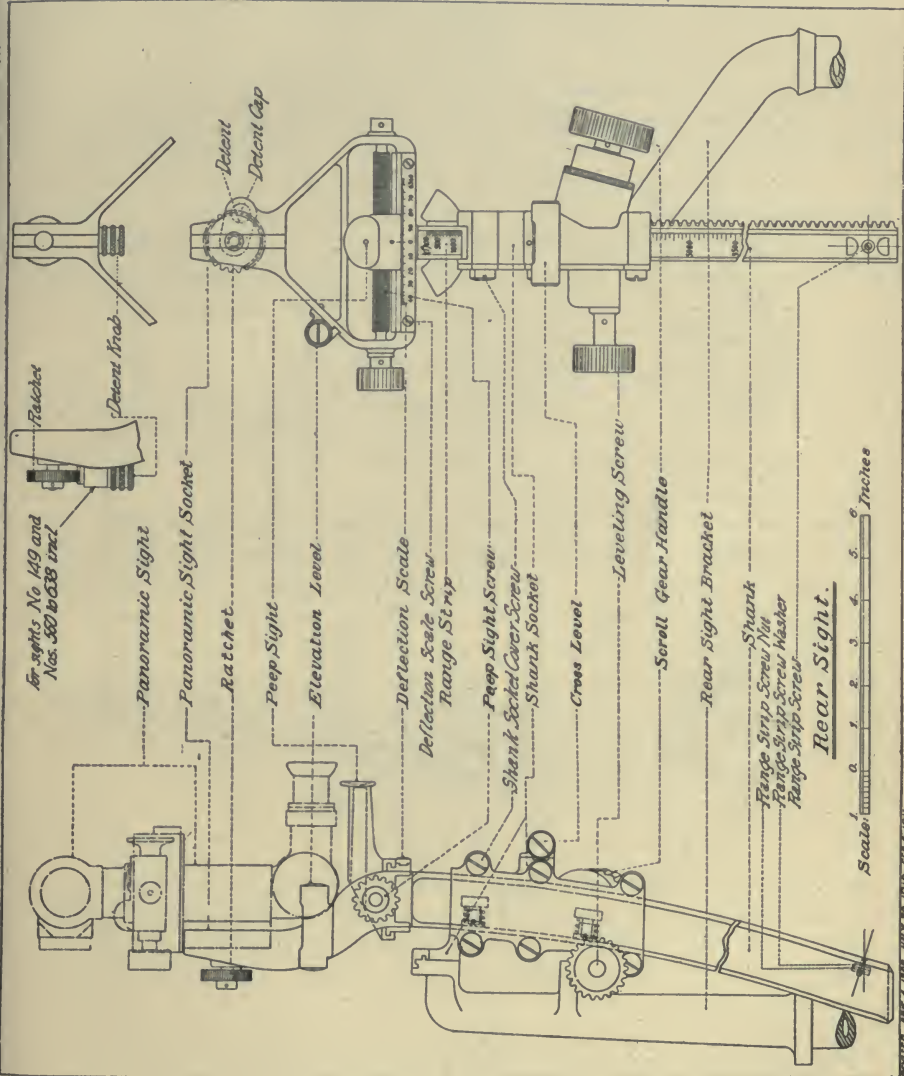
THE REAR SIGHT.

[Plate XXII.]

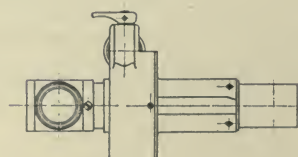
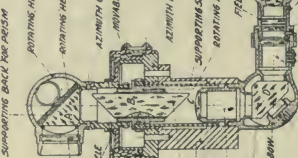
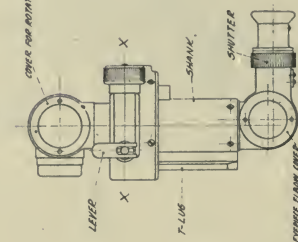
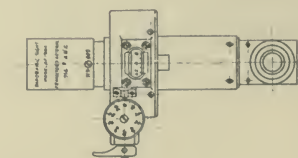
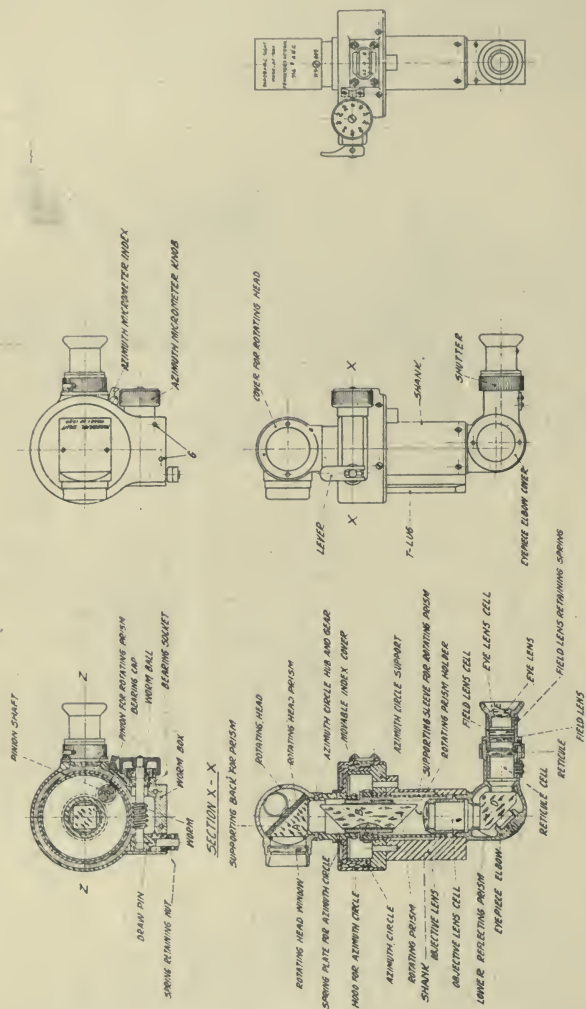
The rear sight includes all parts except the rear-sight bracket support and the panoramic sight. The rear-sight bracket support is riveted to the cradle and has a socket into which the lower end of the bracket is secured by a nut, lock nut, and split pin. The upper end of the sight bracket is provided with circular guides cut with the line of sight, gun at 0° elevation, as an axis, and upon these guides a socket for the shank or stem of the sight is mounted. In a support forming part of the shank socket is a leveling screw with threads engaging the segment of a worm wheel cut upon the bracket guides. A spirit level is mounted upon the shank socket. This arrangement enables correction to be made for difference of level of wheels, since turning the leveling screw revolves the shank socket and with it the sight shank about an axis parallel to the axis of the bore. A shank-socket cover is provided to strengthen the shank socket. The latest type of shank socket is made of bronze and the leveling-screw support is made integral with it. The cover has two lugs on its inner surface which support springs and shoes. These shoes are pressed by the springs against the shank and force it against the walls of the shank socket, thus taking up lost motion.

The sight shank consists of a steel arc whose center is the front sight; it slides in guides in the shank socket and is moved up and down in elevation by a scroll gear seated in a boss upon the shank socket and engaging in a rack cut upon the right face of the sight shank. A German-silver sight-range strip fits in a dovetail seat cut in the rear face of the sight shank, the index for the scale being placed upon the upper rear corner of the shank socket. The strip is graduated in yards up to 9,400; the smallest division is 50 yards, but smaller subdivisions may readily be made with the eye. The scroll gear is held in mesh with the rack on the shank by the scroll-gear spring. Large movements of the shank may be made by pulling the scroll-gear handle out far enough to disengage the scroll gear from the rack and then sliding the sight shank through the shank socket by hand.

To the left side of the shank is riveted the elevation-level holder, and in this holder is mounted a spirit level with axis parallel to the line joining the peep and front sights. This level enables quadrant elevations to be given by setting the sight at the desired range and



REVISED JUNE 4, 1916, JULY 20, 1916, FEB. 17, 1917 CLASS 36-OPTICIAN'S DRAWING 3



PANORAMIC SIGHT MODEL OF 1904

moving the gun in elevation until the level bubble is brought to the center. It would give the correct elevation for the range, provided the target and gun were on the same level.

The shank is fashioned into a deflection guide and mounting for the peep sight and is prolonged upward to form a support for the panoramic sight. The peep-sight guide is located in a transverse opening in the shank and is perpendicular to the shank and to the line of sight. The peep-sight is clipped to this guide and is traversed along it by the peep sight screw. The latter passes through a tapped hole in the peep sight and is supported at each end in bearings in the shank. The screw is turned by a knurled head at its left end.

The deflection scale is attached to the rear face of the peep-sight guide and the index for the scale is on the peep sight. The graduations are in mils. There are 45 mils upon each side of the zero, and the scale is marked from left to right as follows:

40 30 20 10 0 90 80 70 60

the actual mils being—

40 30 20 10 0 6,390 6,380 6,370 6,360

thus making deflection readings on this sight uniform with those of the panoramic sight and the battery commander's telescope. The scale allows for longitudinal adjustment.

The seat for the panoramic sight is a vertical T slot into which the guide lug of the panoramic sight fits. The panoramic sight is held in place and all wear of the parts is taken up by a clamp screw, ratchet, and detent.

In firing, the sight is left in its seat.

THE PANORAMIC SIGHT, MODEL OF 1904.

[Plate XXIII.]

The panoramic sight is a vertical telescope so fitted with reflecting prisms that the gunner with his eye at the eyepiece, which is fixed in a horizontal position, may bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

The details of the optical part of this instrument are shown in plate, and comprise the rotating head prism A, the rotating prism B, the objective lens C, the lower reflecting prism D, and the eyepiece E. The rays coming from the object are reflected downward from the prism A into the prism B, which rectifies them; after their passage through the objective lens C, the prism D reflects them in such a way that there is presented to the eyepiece E, a rectified image, which the eyepiece magnifies. The prism B, is of rectangular cross section.

Its peculiarity is that on rotation about its longitudinal axis the image of an object seen through it turns with twice the angular velocity of the prism. As, therefore, the prisms A and B are so mounted as to rotate about this axis, prism B following A with one-half of the angular velocity of the latter, the image always remains as it would appear to one observing it directly with an ordinary terrestrial telescope.

The image formed by the objective lens, would naturally be reversed and inverted. The lower inclined faces of the prism D by cross reflection transfer the rays to the opposite sides of the axis, thus correcting the reversal. The correction of the inversion is accomplished by the combined action of the three prisms A, B, and D, the nature of the action varying with the different positions of the prisms. In the position shown on plate prisms A and D act as parallel reflectors, and they without the lens system would present an erect image. Prism B, however, inverts the rays and corrects the inversion produced by the objective lens. It will be noted the effect would be the same whether the prism B occupies the position shown on the plate or be revolved 180° from that position. This latter position is the one it would assume if the prism A were rotated through 360° . If the prism A be now rotated through 180° the prism A and D would form two reflectors set at right angles and would give, without the lens system an inverted image, and in conjunction with the lens system an erect image. Prism B in this case will occupy a position 90° from that shown on the plate, in which position it causes no inversion, but counteracts the inversion produced by the prism D.

A glass reticule marked with cross lines is located in the focal plane of the instrument, with the intersection of the cross lines coincident with its optical axis. No provision is made for changing the focus of the eyepiece or objective lens. As issued, the instrument is focused for the usual range and the average eye. The magnifying power of the instrument is four; the field of view is 10° .

The mechanical construction of the instrument is as follows: The body consists of a shank, provided on its front surface with a T lug which fits into a corresponding slot in the head of the sight shank and is held in that position on sights by a detent, ratchet, and clamp screw. To the lower end of the body is screwed the eyepiece elbow, forming a housing for the prism D and the eyepiece E. The latter projects to the rear just above the peep of the rear sight. To the upper end of the shank is screwed the azimuth circle support, to which is screwed the hood for the azimuth circle, forming a seat for the rotating mechanism of the sight. The opening in the rotating head is closed by the rotating head glass window which forms a dust guard. The rotating head prism A is mounted opposite this opening.

The lower end of the rotating head is seated in the azimuth circle hub and gear. A worm located in worm box in the hood for azimuth circle engages in a worm gear cut on the azimuth circle.

The worm is pivoted at its rear end in the worm box by a ball and socket bearing. This bearing consists of the bearing socket worm ball, and bearing cap.

The worm-throw-out mechanism consists of the draw pin, draw-pin spring, spring-retaining nut, and lever.

The rotating prism B is secured in the upper end and the objective C in the lower end of the supporting sleeve for rotating prism resting in the hub and gear. The upper end of this supporting sleeve for the rotating prism and the lower end of the azimuth circle have gears which engage in a double pinion seated in the azimuth circle support. The gears and pinions are calculated so that the angular velocity of the rotating head is twice that of the rotating prism B, and is in the same direction. The motion of rotation is transmitted from the worm to the azimuth circle, thence to the azimuth circle hub and gear, thence to the pinion and through it to the supporting sleeve for rotating prism. The amount of motion of the rotating head prism is indicated by a graduated scale on the perimeter of the azimuth circle, visible through the glass azimuth window in the rear face of the hood for the azimuth circle.

The zero of the scale and the index on the headpiece are located so that the line of sight of the panoramic sight is parallel to that of the rear sight, and consequently to the axis of the gun, when both sights are set at 0 elevation and deflection.

The scale is formed by dividing the circumference into 64 equal parts. One complete turn of the worm moves the rotating head prism through one of these divisions, or $\frac{1}{64}$ of a circle. The rear end of the worm carries the azimuth micrometer knob with circumference graduated into 100 equal parts to form a micrometer scale. One of these subdivisions, therefore, equals $\frac{1}{100}$ of a division of the main scale, or marks a movement of the rotating head prism and line of sight through $\frac{1}{6400}$ of a circle. An angular movement of the line of sight through $\frac{1}{6400}$ of a circle corresponds very closely to a lateral displacement of $\frac{1}{1000}$ of the range. Practically, the subdivisions of the deflection scale on the panoramic sight are considered as points equal to $\frac{1}{1000}$ of the range and are called millimetres or mils.

The reading of the deflection scale or the size of an angle is given in units of the micrometer scale as 2763, 1521, etc., meaning $\frac{2763}{4000}$, $\frac{1521}{4000}$, etc., of 360°. The alternate divisions of the main scale are numbered in a clockwise direction 0, 2, 4, etc., to 62, inclusive. In reading the deflection scale, therefore, hundreds are read directly from the main scales and tens and units from the deflection-screw

micrometer scale. At 0 the line of sight is parallel to the vertical plane through the axis of the gun; at 16 (or 1,600 mils) it is perpendicular to that plane and pointing directly to the right, etc.

The azimuth micrometer knob is screwed on the rear end of the worm by a locking screw. This arrangement permits the 0 of the scale to be set opposite the index line on the azimuth micrometer index without movement of the worm in adjusting the sight.

The worm which is seated at its front end in the draw pin is held in contact with the worm gear on the azimuth circle by the draw-pin spring and is arranged so that it may be disengaged from the worm gear by movement of a lever. When disengaged the line of sight may be rapidly oriented to approximately the desired direction, the worm then thrown into gear, and finer adjustments made by turning the azimuth micrometer knob.

All panoramic sights have been made interchangeable, so as to fit in seats.

The following device for illumination of the crosslines of the reticule of panoramic sights is used:

A small slit is cut in the eyepiece elbow and the reticule cell on the side of the sight next the gun. A shutter is provided which encircles the eyepiece elbow opposite the slit, affording means for closing. On some sights this shutter is provided with a transparent celluloid window to prevent the entrance of dust.

On the latter sights a glass window is fitted in the side of the eyepiece.

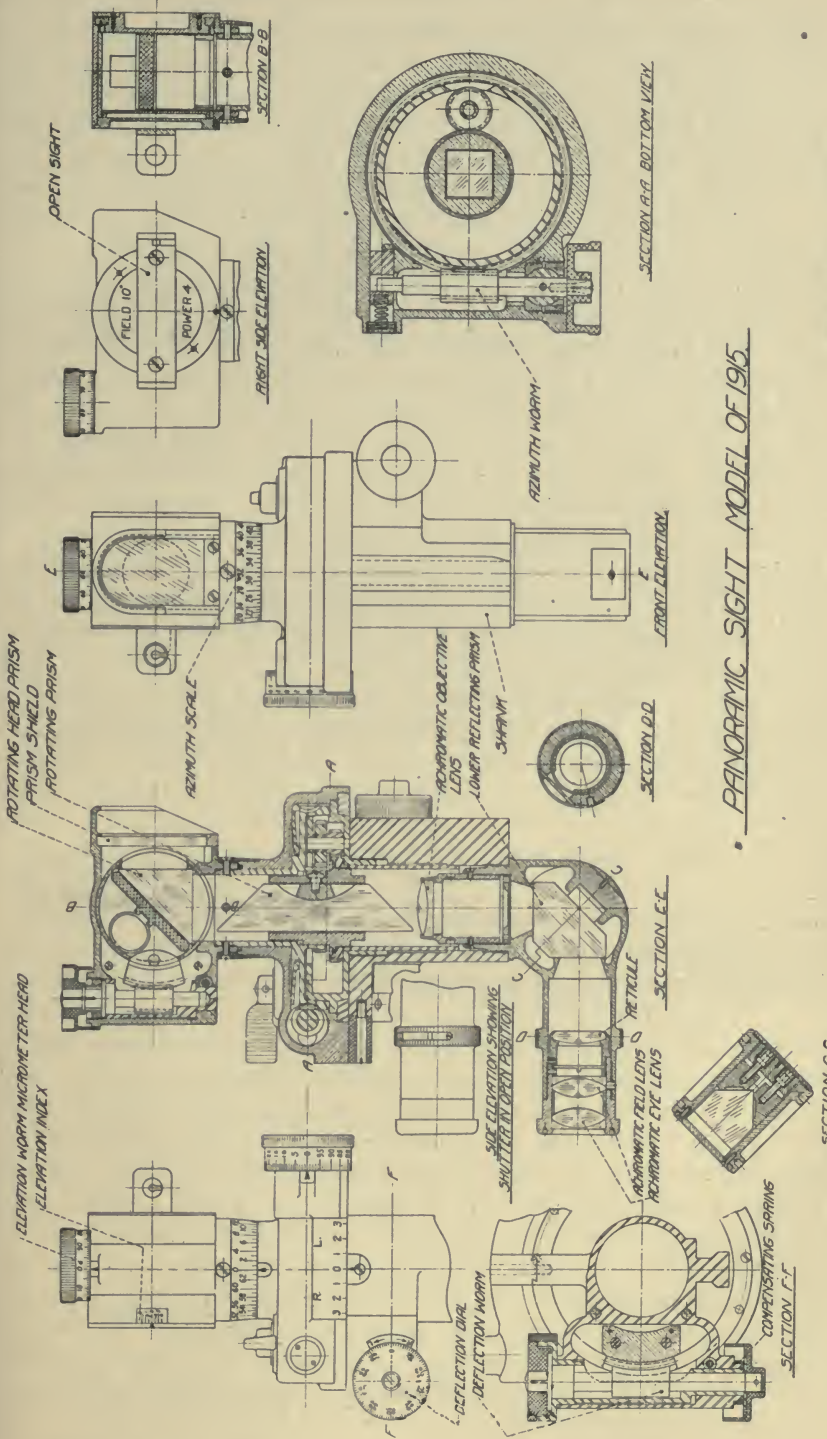
For illumination at night electric flash lights are used. They should be held close to the illuminating slot or window.

PANORAMIC SIGHT, MODEL OF 1915.

[Plate XXIV.]

The panoramic sight is a vertical telescope so fitted with an optical system of reflecting prisms and lenses that the gunner with his eye at the fixed eyepiece in a horizontal position can bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

The rays coming from the object are reflected downward from the rotating head prism into the rotating prism. The rotating prism rectifies the rays; after their passage through the achromatic objective lens the lower reflecting prism reflects them in such a way that there is presented to the eyepiece a rectified image, which the eyepiece magnifies. The peculiarity of the rotating prism is that upon rotation about its longitudinal axis the image of the object seen through it turns with twice the angular velocity of the rotating prism. The rotating head prism and rotating prism are so mounted



PANORAMIC SIGHT MODEL OF 1915.

CROSS-SECTION DRAWING OF A PANORAMIC SIGHT

as to rotate about this axis, the rotating prism following the rotating head prism with one-half of the angular velocity of the latter, the image always remains as it would appear to one observing it directly with an ordinary telescope. The image formed by the achromatic objective lens would then be reserved and inverted. The rays are cross reflected to the opposite sides of the axis by the inclined faces of the lower reflecting prism, thus correcting the reversal.

The combined action of the rotating head prism, the rotating prism, and lower reflecting prism and the nature of action varying with different positions of the prisms provide for the correction of the inversion of the image. The rotating head prism and lower reflecting prism as shown in position on plate act as parallel reflectors, and they without the lens system would present an erect image. The rotating prism, however, inverts the rays and corrects the inversion produced by the achromatic objective lens. It will be noted that the effect would be the same whether the rotating prism occupies the same position shown on the plate or be revolved 180° from that position. The rotating head prism must be turned through 360° to get a position of 180° for the rotating prism. If the rotating head prism is rotated through 180° , the rotating prism and lower reflecting prism would form reflectors set at right angles, and would give, without the lens system, an inverted image, and in conjunction with the lens system an erect image. The rotating prism in this case will occupy a position 90° from that shown on the plate, in which position it causes no inversion, but counteracts the inversion produced by the lower reflecting prism.

The instrument has a magnifying power of 4 and a field view of 10° .

The principal parts of the panoramic sight are the rotating head mechanism, the elevation device, the azimuth mechanism, the rotating prism mechanism, the deflection mechanism, the shank, and the eyepiece.

The rotating head mechanism consists principally of the rotating head, rotating head prism, rotating head prism holder, prism-holder cover, elevation index support, prism shield, and rotating head cover.

The rotating head forms a housing for its movable parts, and provides seats for the elevation worm bushing and rotating head prism holder. The front opening of the rotating head is closed by the prism shield, which forms a dust guard. The bottom threaded seat of the rotating head screws upon the upper end of the azimuth worm wheel and is locked in place by four azimuth scale retaining ring screws. Upon the rear face of the rotating head is engraved a scale which is used for measuring the elevation of the rotating head prism holder which retains the rotating head prism and has an index

mark upon the projection which coincides with the graduations of the elevation worm micrometer head.

The rotating head prism is mounted within the rotating head prism holder between the prism support front, prism support bottom, and prism support back, and secured in position by the rotating head prism spring which bears upon the prism support back. The rotating head prism is protected on the right side by the prism-holder cover and on the left side by the elevation index support.

The prism shield is held within the rotating head by the prism shield retaining piece, which is in turn secured by two prism shield retaining piece screws.

The prism-holder cover screws into its threaded seat located in the right side of the rotating head prism holder and locked in position by the prism-holder cover screws.

The rotating head cover screws into its threaded seat located in the right side of the rotating head and held in place by the rotating head cover screws. The exterior of the rotating head cover has two small holes for teat wrench, and engravings "Field 10°" and "Power 4" are located on the exterior surface.

The elevation-index support screws into its threaded seat located in the left side of the rotating head prism holder and secured in place by the elevation-index support screw. The small holes in the exterior surface allows the use of teat wrench to enable the elevation-index support to be screwed in place. The support-retaining ring retains the elevation-index support with rotating head prism holder within the rotating head and is locked in position by the support-retaining ring screw.

The elevation index is held upon the elevation-index support by the two elevation-index retaining screws. The arrow, engraved upon the German silver piece which is dovetailed in the elevation index, coincides with the graduations of the scale engraved upon the rear face of the rotating head.

The elevation device consists principally of the elevation segment, elevation worm, elevation-worm bushing, elevation-worm retaining nut, and elevation-worm micrometer head.

The elevation segment is held in its seat provided in the rotating-head prism holder by the segment lock pin. The movement of the elevation segment is limited between two dowel pins, which are driven through the rotating head.

The elevation worm is mounted eccentrically within the elevation-worm bushing, which, when turned, provides an adjustment to take up the wear between the worm threads and the worm teeth of the elevation segment.

The elevation-worm bushing has a screw driver slot in its lower end which is used for adjusting and is retained in position by the

elevation-worm bushing clamp plug, which is secured by the bushing-clamp plug screw.

The elevation-worm retaining nut retains the elevation-worm bushing and elevation worm lengthwise within the rotating head. The screw-driver slot, in the top of the elevation-worm retaining nut, is used for adjusting and is locked in position by the elevation-worm retaining nut screw.

The elevation-worm micrometer head is held upon the upper slotted end of the elevation worm by the locking screw. The scale engraved upon the periphery is graduated into 100 equal divisions, numbered every 10 divisions. The upper exterior diameter of the elevation-worm micrometer head is straight-knurled to facilitate turning. One complete revolution of the elevation-worm micrometer head is equal to the distance between each graduation upon the scale on the rear face of the rotating head.

The open sight is constructed of bronze plate bent to shape, having an arm projecting out at each end, each arm containing a hole. A bronze knee is soldered to the interior of the front projecting arm over the center of the hole in such a manner as to form a sight which is used for quick sighting. The open sight is secured to the rotating-head cover by two open sight retaining-screws.

The principal parts of the azimuth mechanism are the azimuth worm wheel, azimuth worm-wheel support, azimuth worm-wheel cover, azimuth worm, azimuth worm ball, throw-out cam, throw-out plunger, azimuth micrometer knob, and azimuth scale.

The azimuth scale is retained upon its bearings, provided on lower end of the rotating head, by the azimuth-scale retaining ring, which in turn is secured by four azimuth-scale retaining ring screws. The four elongated holes in the azimuth scale provide for adjusting. The scale engraved upon the lower exterior diameter is graduated into 64 equal divisions, numbered every two divisions.

The azimuth-worm wheel cover forms a housing for the movable parts of the azimuth mechanism and provides seats for the ball-and-socket bearing throw-out mechanism and deflection worm wheel and support ring. The arrow, engraved upon the upper exterior diameter of the azimuth worm-wheel cover, coincides with the graduations of the azimuth scale. The scale engraved upon a boss on the rear face of the azimuth worm-wheel cover is used for measuring the deflection of the object. The arrow, engraved upon the offset on the rear right side of the azimuth worm-wheel cover, coincides with the graduations on the azimuth micrometer knob.

The felt washer, which is retained in its seat, is located in the upper end of the azimuth worm-wheel cover, and provides for sufficient friction between the rotating head and the azimuth worm-wheel cover.

The azimuth worm-wheel support spring tends to retain the azimuth worm-wheel upon the azimuth worm-wheel support.

The gear teeth of the lower part of the azimuth worm-wheel mesh with the rotating head pinion, which upon rotation moves the rotating-head mechanism. The lower part of the azimuth worm-wheel support screws into its threaded seat provided in the upper part of the shank.

The azimuth worm is provided at one end with an azimuth worm ball, held in place by a bearing cap and bearing socket. A clearance space is provided so that the bearing cap can be adjusted to take up wear. A throw-out plunger, with a spring and spring-retaining nut, is provided for compensating for wear between the azimuth worm and azimuth-worm wheel. A throw-out lever, which is pinned to a throw-out cam, which in turning acts on the throw-out plunger, is a means provided for disengaging the azimuth worm and azimuth worm wheel. The azimuth micrometer knob is held on the slotted end of the azimuth worm by the locking screw. The scale is divided into 100 equal divisions, numbered every 5 divisions. One complete revolution of the azimuth micrometer knob is equal to the distance between each graduation on the azimuth scale.

The rotating prism mechanism consists principally of the rotating prism, rotating-prism holder, rotating-prism supporting sleeve, rotating-prism pinion, and rotating-prism block.

The rotating prism of rectangular cross section, mounted and retained in position within the rotating-prism holder by rotating-prism block, which is secured by the rotating-prism set screw. The rotating-prism holder is seated in the upper section of the rotating-prism supporting sleeve. The rotating-prism pinion is driven upon the pinion shaft. The rotating-head pinion is driven upon the hub of the rotating-prism pinion. The pinion shaft is mounted at both ends in its seat provided in the azimuth worm wheel support, which upon rotation moves the pinion shaft. This gear system is so designed that the rotating head moves twice the angular distance of the rotating-prism holder.

The principal parts of the deflection mechanism are the deflection-worm wheel and support ring, deflection worm, deflection-worm bushing, deflection dial, and deflection-worm knob.

The deflection-worm wheel and support ring is seated within the azimuth-worm wheel cover, located by two dowel pins, and then retained by six deflection-worm wheel and support-ring screws. A segment projecting downward into the shank carries a worm wheel which meshes with the deflection worm. The deflection-worm wheel support is located within the shank and against the deflection-worm wheel and support ring by two dowel pins and secured by two deflection-worm wheel support screws.

The deflection worm is mounted eccentrically within the deflection-worm bushing, which when turned provides an adjustment to take up the wear between the worm threads and the worm teeth of the deflection-worm wheel and support ring.

The deflection-worm bushing is adjusted by using the fingers upon the rear end, and is retained in position by the deflection-worm bushing clamp plug, which is secured by the deflection-worm bushing clamp-plug screw. A German silver piece is pinned and soldered to the rear end of the deflection-worm bushing, on which is engraved three arrows with letters "R" and "L." The middle or large arrow coincides with the graduations of the deflection dial. The compensating spring is provided for taking up all lost motion that appears lengthwise in the mechanism. The worm knob is secured to the deflection worm by a taper pin, the periphery being straight knurled to facilitate turning. The deflection dial is held on the front slotted end of the deflection worm by the locking screw. The scale, engraved upon the front end, is graduated into 100 equal divisions, numbered every 10 divisions. The shank forms a body for the instrument and provides seats for the azimuth worm-wheel support, deflection-worm bushing, and elbow. The front surface is provided with a T lug, which fits into a corresponding slot in the upper end of the shank of the rear sight. Upon the rear surface is dovetailed the deflection index, which is retained in place by the deflection-index screw.

The arrow engraved upon the deflection index coincides with graduation on the rear face of the azimuth worm-wheel cover.

The eyepiece consists principally of the reticule, the reticule cell, achromatic field lens, a chromatic eye lens, and eye-lens cell.

The achromatic objective lens is mounted in the upper end of the objective lens cell. This cell is secured in its threaded seat in the upper end of the elbow by two objective lens-cell retaining screws.

The elbow is screwed in the lower end of the shank and secured by the four elbow-retaining screws in such a manner that its projecting arm is horizontal to the axis of the instruments. The elbow provides seats for the lower reflecting prism and the eye-lens cell. The lower reflecting prism is held upon its bearing surfaces, provided in the elbow by two wedges, which in turn are secured by the two wedge screws. These screws are retained by the wedge-screw lock screw. The wedge-screw cover is provided to retain the wedge-screw lock screws in position. The wedge-screw cover is secured by the wedge-cover screw. The opening of the elbow upon the right and left sides are closed by the elbow covers, which are locked by the elbow-cover screws. Upon the left side of the elbow is an opening through which the light is thrown upon the reticule. This opening is covered by the window to protect the interior of the eyepiece from dust and dirt. The shutter is so designed as to slide over the opening in the

elbow, being guided by the shutter-stop screw, and movement limited by the elongated slot.

The reticule has two cross lines etched on its surface and is mounted in the forward end to the reticule cell, which is secured in the eye-lens cell by the reticule-cell retaining screw.

The achromatic eye lens is mounted in the eye lens cell and is separated from the achromatic field lens by the lens separator. The achromatic field lens is held within the eye lens cell by the field lens retaining ring, which in turn is locked by the field lens cell retaining ring screw. The eye lens cell is secured to the elbow by the eye lens cell retaining screw.

All interior metallic surfaces exposed to the refracted light are finished with dull black baking enamel. All exposed optical elements, covers, and non-rotating joints are sealed with the litharge cement or equal. All German silver graduated surfaces are sand-blasted and lacquered.

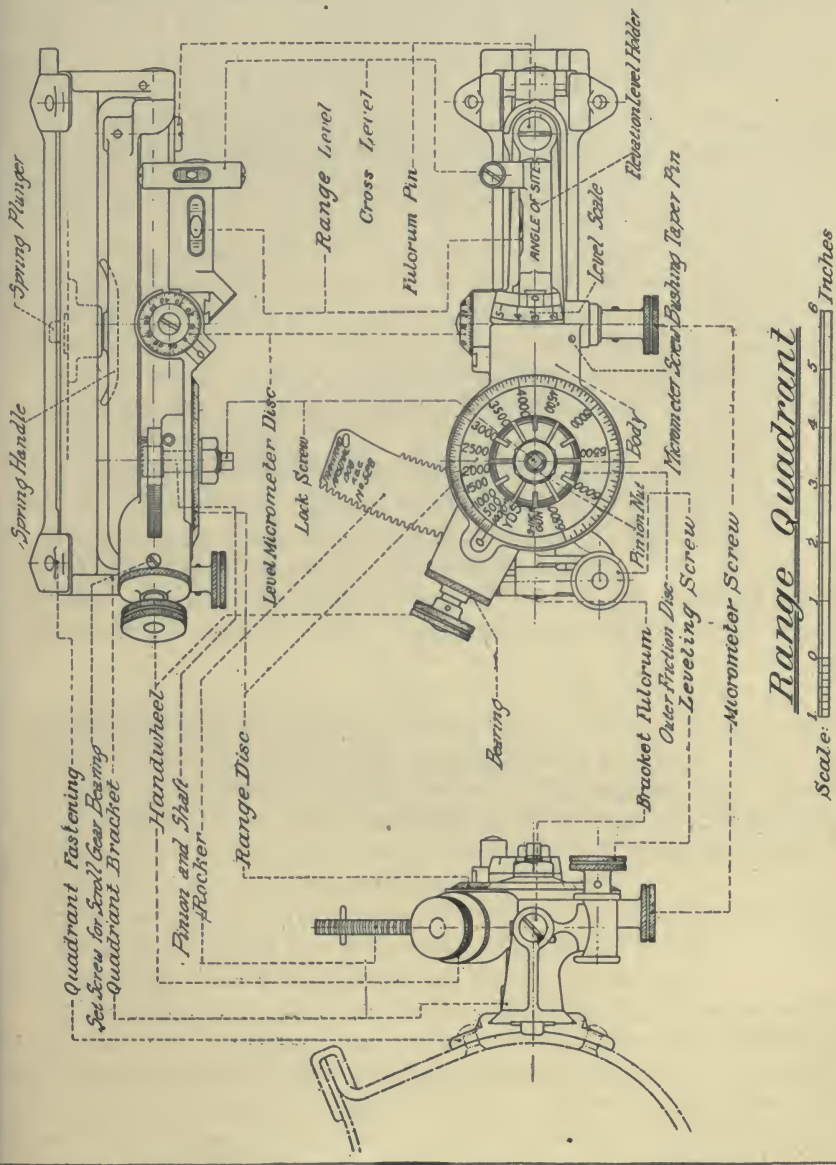
THE RANGE QUADRANT.

[Plate XXV.]

In this carriage the elevating and traversing mechanisms are entirely independent of each other, and the laying of the gun may be accomplished for indirect aiming by assigning to one gunner the laying for direction and to a second that for range. The gunner on the left of the piece using the open or panoramic sight lays for direction only, while the gunner on the right trail seat gives elevations by means of the range quadrant.

The range quadrant consists of the quadrant bracket, rocker, body, scroll, gear, range disk, and range and cross levels with suitable leveling screws.

A quadrant-bracket fastening riveted to the right side of the cradle has dovetailed guides in which the quadrant bracket fits and is held by a spring catch. Two bracket fulcrums screwed into arms on the bracket project into bearings in the ends of the rocker, assembling the latter to the bracket and at the same time permitting it a motion of rotation about an axis joining the centers of the bracket fulcrums or trunnions. As assembled, this axis of motion is parallel to the axis of the gun. A projection below the rear end of the rocker forms a seat for a leveling screw, the axis of which is in a plane perpendicular to the axis of the gun. The knurled head of this screw projects to the right and its threads mesh in the segment of a worm wheel cut on the quadrant bracket. This leveling screw is thus arranged to rotate the rocker on its trunnions and, in conjunction with the cross level mentioned below, enables the quadrant to be brought into a vertical plane parallel to the axis of the gun. This construction is



Range Quadrant

REVISED JUNE 4, 1908, JULY 30, 1910, FEB. 6, 1911 CLASS 36-DIVISION 22 DRAWING 5

necessary to correct for difference of level of wheels and to give true quadrant elevations. - At the front end of the rocker is the seat for a fulcrum pin, which forms the center of motion of the quadrant body. At the rear end of the rocker a curved arm projects upward which has circular racks cut on its front and rear edges. This curved arm passes through a slot in the body and the centers of the racks coincide with its center of motion.

The body, as stated above, is pivoted on the rocker. Its rear end affords a housing for the quadrant-elevating gear and a seat for the range disk. The elevating gear consists of a scroll gear, meshing with the rear circular rack of the rocker. The scroll gear is actuated by a knurled handwheel, which projects upward and to the rear. Turning the handwheel rotates the body on its fulcrum pin, moving its rear end up or down on the curved arm of the rocker. The scroll gear is pressed against its rack by a spring; large changes of position of the quadrant body may be made by pulling the handwheel out to disengage the gear from the rack and then moving the body by hand to the desired position.

The range disk is assembled on a steel shaft seated in the quadrant body; this shaft carries a pinion which meshes with the front circular rack on the curved arm of the quadrant rocker. The range disk is held on the shaft between two steel friction disks. The outer friction disk on quadrants is split radially and has a serrated edge. This combined with the slight spring allowed in the washer forms an adjustable yet secure lock for the range disk. A nut screwed on the shaft clamps the disks in position, and a lock screw in the end of the shaft prevents the nut from unscrewing. The inner friction disk is connected to the shaft by lugs projecting into a slotted collar. A spiral spring, the tension of which serves to take up any lost motion in the arrangement, is connected at its outer end to the inner friction disk by a pin. It is wound around the hub of the body and secured to the hub in a slot cut to receive it.

The face of the range disk, which is visible on the right side of the quadrant, is graduated to 9,400 yards. The caliber of gun for which the range disk is made is engraved on the face of the disk.

The least division is 100 yards below 500 yards and 50 yards above 500 yards, and the scale is dimensioned at each 500 yards. Divisions smaller than 50 yards may be readily made with the eye. The range disk is always in gear through its shaft and pinion with the rack on the curved arm of the rocker, and any change in position of the quadrant body with reference to the rocker arm is registered by the disk.

The elevation level holder is seated on the forward part of the body, with its front end pivoted on the fulcrum pin of the latter.

Its rear end is finished with a segment of a worm wheel, cut with the fulcrum axis as a center, which meshes with a vertical micrometer screw seated in the body. The amount of the relative motion of the level holder and body is measured by a level scale, consisting of an ordinary circular scale dovetailed in the body with an index on the elevation level holder supplemented by a level micrometer disk on the upper end of the micrometer screw. The level scale is graduated in sixty-fourths of the circumference, and one complete turn of the screw moves the level holder through one of these divisions. The level micrometer disk on the head of the micrometer screw has 100 divisions, so that one of these divisions corresponds to one mil. The divisions of the circular scale are marked 2, 3, 4, and 5, and in connection with the level micrometer disk are read 200, 300, etc., plus the indication of the latter. The 3 or 300 mark corresponds to the mean or zero position of the elevation level holder. The level holder is fitted with two spirit levels of a sensitiveness of 0.1 inch, which equals five minutes of arc. The longitudinal or range level is located so that its axis is parallel to the axis of the gun when the level scale is set at 3 and range disk at zero.

The axis of the transverse or cross level is perpendicular to that of the range level and also to the plane of motion of the quadrant body. The cross level in connection with the leveling screw enables the quadrant rocker and body to be kept vertical. The range level in connection with the elevation-level holder and its level screw is used as a clinometer to correct the range-disk readings for angle of site; in connection with the quadrant body it is used as the quadrant level. For purposes of reference, these levels are designated as the cross level and the range level, and their respective screws as the leveling screw and micrometer screw; the scale pertaining to the latter screw is called the level micrometer disk. The range level is also referred to at times as the quadrant or angle of site level.

The range quadrant remains in position on the cradle during firing. When not in use it is removed from the cradle and carried in the range-quadrant case on the rear face of the main shield. To remove range quadrant from the cradle, release the spring catch and slip the quadrant from the support.

USE OF SIGHTS AND QUADRANTS.

By construction and method of mounting with longitudinal and cross levels on the rear sight, the panoramic sight forms a horizontal angle measuring instrument. These angles are read directly from the deflection scale of the sight in units, mils, equivalent to $\frac{1}{6400}$ of a complete circle, or 360° .

For direct aiming: Set the rear sight at the required elevations and correct for difference of level of wheels; set off the desired deflection on the azimuth circle of the panoramic sight; bring the crosslines of the sight upon the target by means of the elevating and traversing devices of the carriage. For imparting the approximate initial direction the line sight may be used with advantage.

In using the model of 1915 sight for direct fire care must be taken that the rotating head be set at 300 mils and the deflection mechanism at 0.

For indirect aiming: Set the rear sight at the required elevation and make correction for difference of level of wheels; set the azimuth circle of the panoramic sight at the deflection ordered. Lay the gun for deflection by directing the vertical line of the panoramic sight at the auxiliary aiming point, the elevation of the gun being given by using the range quadrant.

The angle of deflection to be set off on the azimuth circle of the panoramic sight is the same as the angle made by joining the target and the auxiliary aiming point with the sight.

RANGE QUADRANT.

To give quadrant elevations with the range quadrant: Set the range disk for the desired range by turning the quadrant-elevating hand-wheel and correct for difference in level of wheels; correct for angle of site on the scale of the level holder; bring the bubble of the range level to the center by elevating or depressing the gun. The gun will then have the elevation (corrected for angle of site) corresponding to the range.

CARE OF SIGHTS AND QUADRANT.

Whenever convenient, and especially when in garrison and not in use, the front and rear sights with the range quadrants and panoramic sights should be removed from the carriages and kept in some dry place, as in the barracks' storeroom or office.

CARE OF FRONT AND REAR SIGHTS.

For traveling, the front sight is covered by the duck cover supplied for the purpose, and by means of the spring catch at the base of the bracket it is turned 105 degrees from its firing position and locked to the front-sight-bracket support. The sight shank is withdrawn from the shank socket, covered with the cover for rear-sight shank, and placed in the packing provided for it in the trail of the carriage. A duck cover, called the cover for rear-sight bracket, is provided to protect the surfaces of the shank socket and should be slipped over the socket when the shank is removed.

All parts of the sight shanks and shank sockets should be kept clean, free from rust, and lightly oiled. When stored or not used for short periods, they should be thoroughly cleaned and well coated with light slushing oil. Should any part become rusted, it should be carefully cleaned by softening the rust with coal oil and rubbing with a soft-pine stick.

In handling all parts of the sights care must be exercised to avoid injuring them by dropping, striking them upon or with other parts, etc. The front-sight bracket *must not* be used by the cannoneers as a handle to assist in mounting upon or dismounting from the carriage.

To clean the joint between the bracket and the shank socket, drive out the pin from the end of the leveling screw and remove the leveling screw. Disassemble the bracket from the shank, clean all parts and oil them with sperm oil. Assemble in the reverse order.

Oil the leveling screw from time to time through the oil hole provided in the sight bracket.

For instructions for the replacement of level vials see instructions given under the heading "Care of range quadrant."

CARE OF THE PANORAMIC SIGHT, MODELS OF 1904 AND 1915.

These sights are delicate instruments, and must not be subjected to any rough usage, jars, or strains. In firing they remain in position on the carriage; in the field when not in use they are kept in the padded leather cases prepared for them on the rear of the main shield.

To obtain satisfactory vision, the glasses must be perfectly clean and dry. The T lug on the sight and the slot forming its seat should be kept lightly oiled as a preventive of rust. The worm and worm rack should be oiled with vaseline. When dust accumulates on the pointers it should be removed by a fine camel's-hair brush in the hands of an experienced person.

To clean the rotating-head window and the front face of the rotating head, do not remove the rotating-head window from the window cell.

To clean the reticule and eyepiece lenses, remove the screw holding the eyepiece to the eyepiece elbow and unscrew the eyepiece. To disassemble the lenses remove the set screw on the underside of the eyepiece and unscrew the eye-lens cell. The field lens is held in place by a retaining spring, both of which may drop out as soon as the eye-lens cell is disassembled.

In assembling note that the flat surface of the fixed lens of the eyepiece is placed next to the reticule. Do not remove or change the adjustment of the reticule. Its rear surface may be cleaned with a camel's-hair brush after the eyepiece has been removed.

In panoramic sights of serial numbers after 752 the exposed optical elements and all nonmoving joints are sealed and no attempt should be made to remove them.

For serial numbers 873 and up, the slight change in the appearance and construction of the elbow and rotating head is made for the purpose of making these parts dust and moisture proof.

CARE OF RANGE QUADRANT.

The directions for the care of the range quadrant are practically the same as those for the care of the various sights. The parts should be kept clean, free from rust, and bearings lightly oiled. When stored they should be coated with light slushing oil.

To clean the micrometer screw, remove the screw in the center of the micrometer dial, turn the micrometer screw until the dial is forced off; drive (away from gun) the taper pin holding the screw bushing. Pull out the screw bushing, clean, oil with a heavy oil, and assemble in the reverse order and adjust.

Extra glass level vials assembled in brass tubes, to replace broken vials in sights and range quadrants, except for the range levers of quadrants, will be issued on requisition. In case the range level of the range quadrant requires replacement, the range quadrant will be turned in to an arsenal designated by the armament officer.

Only ordinary tools, such as a hammer and a punch or a piece of wire, are required for the removal of pins from level caps in order to replace vials. All pins on level caps are driven in toward the center of the instrument. They should be driven out in the opposite direction. Four radial screws in the vial tubes are used for adjusting the tubes in their holders.

ADJUSTMENT OF SIGHTS AND QUADRANT.

The sights are correctly adjusted when, at zero elevation and deflection, the line of sight is parallel to the axis of the bore.

The range quadrant is correctly adjusted when, with the range disk set at zero, level scale set at 300, and axis of gun horizontal and corrected for difference of level of wheels, the level bubble of the range level stands in the center of its vial. In adjusting sights, the panoramic sight should first be corrected. If the rear sight is adjusted first, it will require readjustment if the subsequent adjustment of the panoramic sight causes a change in position of the rear-sight range strip.

TO ADJUST THE PANORAMIC SIGHT, MODEL OF 1915.

Should backlash or lost motion appear lengthwise in the elevation device, it can be removed by loosening the elevation worm retaining-nut screw, setting up on the elevation-worm retaining nut and then

tightening up on the elevation-worm retaining-nut screw. To remove backlash between the threads of the elevation worm and worm teeth of the elevation segment, loosen the bushing clamp plug screw which releases the elevation-worm bushing clamp plug, and then turning the elevation bushing, in which the elevation worm is eccentrically mounted, so as to bring the elevation worm closer in contact with the worm teeth of the elevation segment. The elevation-worm adjusting clamp plug must be firmly clamped after adjusting by tightening up on the bushing clamp plug screw to secure the elevation-worm bushing against rotation. After adjusting, should the zero upon the elevation-worm micrometer head not coincide with index when the elevation index coincides with the graduations of the scale upon the rear face of the rotating head, it can be easily remedied by the loosening up on the locking screw and turning the elevation-worm micrometer head until the zero just coincides with its index, after which it must be firmly secured by tightening up on the locking screw.

Backlash which may occur between the threads of the azimuth worm and the worm teeth of the azimuth worm wheel is taken up automatically by the spring that forces the throw-out plunger which seats the azimuth at its left end in towards the azimuth worm wheel. The four elongated holes in the azimuth scale afford means for adjusting when its zero does not coincide with the arrow head upon the upper exterior diameter of the azimuth worm wheel cover when the zero of the deflection scale, upon the rear of the azimuth worm-wheel cover, coincides with arrow head upon the deflection index. After this adjustment is made the azimuth micrometer knob should be inspected similar to that elevation-worm micrometer head.

Backlash that appears between the threads of the deflection worm and the worm teeth of the deflection worm wheel and support ring can readily be removed when the method of adjusting similar to that of the elevation device is followed out.

TO ADJUST THE PANORAMIC SIGHT, MODEL OF 1904.

Direct the panoramic sight by means of the azimuth micrometer knob and rear sight scroll gear until its line of sight is parallel to the axis of the bore. The method of determining when this condition of parallelism exists is described hereafter. Without disturbing the direction of this line of sight move the azimuth micrometer knob of panoramic sight and the range strip of the rear sight until the zero marks come opposite their respective indices. The azimuth micrometer knob may be moved after loosening the locking screw in the end of the worm. This locking screw may be loosened by the combined teat wrench, and screw driver issued for the purpose. If the azimuth micrometer knob can not be readily removed, grasp the sight by the

azimuth micrometer knob, release the worm from the worm gear of the azimuth circle and gently tap the exposed end of the worm with a small piece of wood or soft metal.

To locate the index opposite the zero of the scale loosen the four screws that hold the movable index cover in place and move this cover until the index is properly located; then tighten the screws. Movement of the range strip of the rear sight is made possible by a slot in the shank in which the range strip screw can be moved when the nut has been loosened.

TO ADJUST FRONT AND REAR SIGHT.

Set the rear-sight shank at zero elevation and move the peep sight and the front sight until the line of sight is parallel to the axis of the bore. The method of determining when this condition of parallelism exists is given below. Now shift the deflection scale on the rear sight, after loosening the two screws, until its zero is opposite the index on the peep sight.

Movement of the front sight is accomplished by turning the front-sight bracket sleeve, after first removing the split pins.

TO ADJUST THE RANGE QUADRANT.

Elevate or depress gun until its axis is horizontal, correct for difference of level of wheels, set the level scale of the quadrant at 300, then turn the quadrant handwheel until the range-level bubble is centered. Now turn the range disk of the quadrant until its zero coincides with the index. The range disk is held between two friction disks secured by a nut and lock screw and it is only necessary to unscrew these to release the disk and correct its position. To test the horizontality of the gun, use the testing level issued for that purpose. This level has two arms perpendicular to each other, and a level vial is inserted in each arm. As the faces of the breech and the muzzle are perpendicular to the axis of the bore, the horizontality of the axis of the bore may be determined by placing one of the arms of the testing level against the face of the breech or muzzle and elevating or depressing the gun until the bubble in the level of the other arm is in the center. Then apply the other arm to the same face, and the bubble in the first arm should also be in the center of its vial. If not, the testing level requires adjustment.

VERIFICATION OF PARALLELISM OF LINES OF SIGHT AND AXIS OF BORE.

The adjustment of the sights and range quadrant is of such importance and should be verified so frequently that battery commanders will find it advantageous to make permanent arrangements for such verification. The leveled supports constituting the carriage emplacement should preferably be of stone. The site of the target (fig. 1)

should be prepared, and the exact locations of the target and horizontal reference points permanently marked. If these arrangements are properly made, subsequent verifications of sights and quadrants will become a simple matter.

A target of dimensions given in figure 1 is placed in a vertical position perpendicular to the line of sight, at such a height that the point "bore" is at the same height as the axis of the bore of the gun. The verticality of the target is assured by a plumb line attached at A, coinciding with the vertical line A B.

The carriage is placed with the wheels and trail resting upon solid supports of wood or stone, the surfaces of which have been carefully leveled so as to bring the axle axis horizontal. Now direct the gun

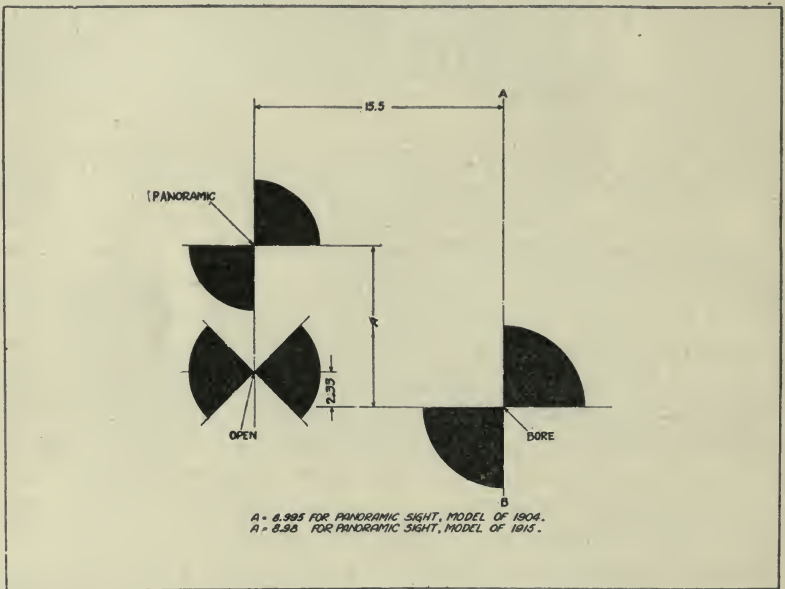


Figure 1.

so that the prolongation of the axis of the bore, as determined by the bore sights, pierces the target at the proper point; the lines of sight of the open and panoramic sights are then adjusted in direction by the means explained above until they pierce the targets in the points marked, respectively, "open" and "panoramic."

The axis of the bore is determined and prolonged by means of bore sights. In the absence of such means a breech-bore sight may be made from an empty cartridge case from which the primer has been removed; a piece of paper should be pasted over the primer seat and a pinhole made in its exact center to serve as a peep sight. If the cartridge case does not completely fill the bore, it should be shimmed all around with tissue paper until it does so. For a muzzle-bore

sight use should be made of the traces of the horizontal and vertical planes containing the axis of the bore, which are marked on the muzzle of the gun. Fine threads or hairs stretched across the muzzle to coincide with these lines form a good bore sight, and the ends of such threads may be conveniently fastened to a cloth strap buckled around the muzzle of the gun.

In the field, where from lack of time or proper facilities the method just given can not be followed, the adjustment of the sights may be verified by bringing the lines of sight at zero elevation and deflection to bear upon some sharply defined point of a distant object. At such a range (for instance, 2,000 yards or more) the parallax may be neglected, and if the sights are correctly adjusted the lines of sight and the prolongation of the axis of the bore will sensibly pass through the selected aiming point.

ADDITIONAL TESTS.

After the sights and range quadrant are adjusted they should be subjected to the following tests to insure their accuracy at extremes of elevation and azimuth:

(a) With carriage level and gun and sights at zero elevation and deflection, the lines of sight and axis of bore prolonged pierce the target (fig. 1) in the proper points.

(b) The gun is then moved to its maximum elevation; as the sight elevation is altered, the lines of sight should follow the vertical lines through the same points of the target (fig. 1).

(c) With conditions as in (a), the gun is moved upon the carriage to its extreme positions in azimuth; as the sight deflections are now altered, the lines of sight should follow the horizontal lines through the same points on the target (fig. 1).

(d) With conditions as in (a), the range-quadrant disk registers 0. As the gun is elevated and the sight elevation changed to bring the line of sight to bear upon the proper point of the target (fig. 1), the readings of the range disk, quadrant leveled, should agree at all ranges with those of the elevation scale of the sight.

By construction and assemblage the sights, if correctly adjusted, should fulfill the above conditions with substantial accuracy. If error be noted, a report of the facts of the case with the cause, if known, should be made to the Ordnance Officer charged with the repair of the matériel for his information and action.

SPARE SIGHTS AND QUADRANT.

To each battery is issued one set of spare sights, consisting of one front sight complete, one rear sight complete, one panoramic sight, and one range quadrant. These parts are carried in a special chest in the battery wagon. One set of bore sights (consisting of one breech

and one muzzle bore sight) and one level for use in adjusting sights, etc., are also issued to each battery.

ADJUSTING INSTRUMENTS.

A complete detailed description of the method of disassembling and adjusting the different instruments is given in Ordnance Office Pamphlet No. 1795, Instructions for the Care, Preservation, Repair, and Adjustment of Instruments for the Fire-Control Systems for Coast and Field Artillery. Attention is invited to General Orders No. 47, War Department, March 24, 1905, with reference to the care and repair of panoramic sights, battery commander's telescopes, and range finders.

No disassembling of instruments except as prescribed herein will be permitted. The disassembling of telescopic instruments allowed herein must be done only in the presence of a commissioned officer. Disassembling as permitted in pamphlet 1795 must be done only by officers or employees of the Ordnance Department.

TARGETS.

The description and allowances of targets and accessories for mobile Artillery are given in Ordnance Office Pamphlet, Form No 1994, "Mobile Artillery Targets and Accessories."

GENERAL INFORMATION.

PAINTING ARTILLERY MATÉRIEL.

The paint issued for this purpose is of olive-drab color, put up in 5-pound cans ready for use, and is applied to both wood and metal parts. If the paint is too thick, turpentine should be used as a thinner, but not to greater extent than 2 per cent by volume.

All steel and iron nonbearing surfaces will be painted, including that portion of the underside of the gun between the clips. Wearing and bearing surfaces, teeth of gear wheels, elevating screws, piston rods, cylinders, counterrecoil springs, and interiors of spring cylinders will not be painted.

Articles which can be easily cleaned and repainted may be immersed in the solution. It is forbidden to immerse articles which can not be entirely repainted; for example, ammunition chests, the joints and some parts of the interior of which it would not be practicable to repaint.

All parts to be painted should be free from dirt or grease. They may be washed in a liquid made by dissolving one-half pound sal soda in 8 quarts of warm water, then rinsed in clean water, and wiped thoroughly dry.

Where the matériel is in fair condition and only marred in spots, the marred places should be primed with olive-drab paint, second

coat, and permitted to dry. Then the whole surface should be sand papered with No. 1½ sand paper and a coat of paint applied and allowed to dry thoroughly before use.

Where the matériel is in bad condition all parts should be thoroughly sand papered with No. 2½ sand paper, be given a coat of paint, and be permitted to dry for at least 24 hours; then sand paper with No. 00 sand paper, apply a finishing coat, and permit the parts to dry thoroughly before use.

In general, two coats of paint per year will be sufficient to keep the matériel in good condition. After repeated painting the paint may become so thick as to scale off in places or give an unsightly appearance. It may then be removed for repainting, as follows:

Dissolve 1 pound of concentrated lye, powdered form, in 6 pints of hot water, and slake in enough lime to give the solution the consistency of paint. Use the solution freshly mixed and apply to the parts where paint is to be removed with a brush or with waste tied to the end of a stick. When the solution begins to dry on the surface use a scraper to remove the old paint, and complete the cleaning of the surface with cloth and water. If one application is not sufficient to loosen the paint, apply a second coat. Before painting wash the surface with sal-soda water, rinse with clean water, and then wipe thoroughly, as described above.

OILS FOR ARTILLERY MATÉRIEL.

For the service, cleaning, and preservation of this matériel the Ordnance Department issues hydroline oil, lubricating oil (or engine oil No. 1), clock oil, sperm oil, coal oil, neat's-foot oil, and light slushing oil. Each of these oils is suited for the particular purpose for which it is issued, as stated below, and care should be taken that it is not used for other purposes.

The hydroline oil is for use in the recoil cylinders of the carriages and *for no other purpose*.

The lubricating oil (or engine oil No. 1) will be used exclusively in all oil holes of the matériel, and in lubricating such parts as wheels and axles, gun and cradle slides, pintle bearing, elevating and traversing mechanisms, exterior of cylinders, brake bearings, hinges, different surfaces of breechblocks, threads of breech recess, etc.

Clock oil should be used on the spindle and all bearings of the battery commander's telescope, bearings of the panoramic sight, and fuze setters, and on the observation telescope, field artillery plotter, sextant telemeter, and worms of the rear sight. In all cases clock oil should only be used when the instruments mentioned are disassembled for cleaning. When used it should be applied by dropping from the end of the dropper attached to the end of the cork.

The sperm oil is a lighter lubricant than the engine oil No. 1, and may be used on the gears of sights, fuze setters, parts of revolvers, etc.; engine oil No. 1 may also be used on such parts.

Coal oil is used by the Ordnance Department for cleaning purposes. In the field it may be used for lanterns. Coal oil for general illuminating purposes is furnished by the Quartermaster's Department.

Neat's-foot oil is used for the care and preservation of all leather equipment, and should be applied as directed on page 101.

Light slushing oil is prescribed for use in the protection and preservation of all bright or unpainted surfaces of steel or iron on all parts of the equipment when the matériel is to remain unused for any appreciable length of time. Its use as a lubricant for mobile artillery is forbidden. Before applying the slushing oil to any surface, the part should be thoroughly cleaned, so as to be free from rust, water, coal oil, lubricant oil, etc., as their presence will cause rusting under the slushing oil. The slushing oil should then be applied in a *thin, uniform coat*, since this is ALL that is necessary to give good protection. Except in very cold weather it can be applied by using a paint brush as when painting; in cold weather it should be applied by stippling—that is, lightly tapping the surface with the end of the sash tool, held with bristles perpendicular to the surface to be covered. It can be applied to the bores of gun by the slush brush issued for the purpose. In cold weather it should be warmed before use for coating the bores of gun. It may be readily removed by the use of burlap or waste dipped in coal oil.

REPAIRS FOR FIELD ARTILLERY MATÉRIEL ISSUED TO THE UNITED STATES ARMY AND THE NATIONAL GUARD.

Instructions relative to making repairs to field batteries and furnishing ordnance stores and supplies for them will be found in the General Orders issued by the War Department from time to time.

Instructions in reference to the care, use, and repair of delicate instruments, such as sights, telescopes, and range finders, will be found in General Orders, No. 47, War Department, Washington, March 24, 1905, and in O. O. pamphlet, Form No. 1795.

INSTRUCTIONS FOR RIVETING.

Whenever a rivet is broken, loose, or needs replacing for any reason the rivets should be heated to a light yellow (just below white) color. They may be heated in the forges furnished with the battery equipment or in a permanent blacksmith's forge. While heating keep the rivets covered with coals in order to prevent scaling. Rivets one-fourth inch and less in diameter may be driven cold when it is im-

practicable to heat them. Drive them hot, however, when practicable. Drive all rivets greater than one-fourth inch in diameter hot in all cases. Do not overheat or burn the rivets. Remove all scale from rivets after heating and before driving. Drive the rivets home with a hammer before attempting to form the head. Hold rivets solidly in place with a sledge, crowbar, and fulcrum, railroad iron or similar heavy piece of steel. Partially form the head with the face and peen end of a hammer. When the head is practically formed by this operation use a rivet set for final forming of the head. The rivet set is only for this final operation. Loose rivets will result if they are not peened down with a hammer before the rivet set is used. The rivets must be held solidly in place while the riveting is being done, otherwise loose rivets result.

Before starting to heat the rivets the pieces to be riveted should be carefully fitted and bolted together. If the holes in the two pieces are not in perfect alignment the cause should be determined and rectified instead of attempting to drift the pieces into alignment. If necessary for perfect alignment a slight amount of reaming or filing will be permitted. In no case should a rivet hole be reamed larger than about one sixty-fourth inch in excess of the diameter of the rivet. On account of inaccessibility it is sometimes difficult to insert a rivet. In such cases it may be inserted with a twisted stiff wire or with a small wooden stick split at the end to hold the rivet. Arrangements must be made beforehand to back up or hold the rivet in place the instant it is located in order that it may not have cooled too much for proper riveting. Hot riveting is preferable to cold riveting as the head is more easily formed when hot and the contraction of the rivet in cooling gives a tighter fit.

SUGGESTIONS FOR CARE AND MAINTENANCE OF MATÉRIEL.

Various suggestions in reference to the care of this matériel and hints regarding things to be done or to be avoided are scattered throughout the text of this handbook; some of the more important are here condensed for more convenient reference. Careful compliance with these suggestions will avoid delay and possible injury to personnel or matériel.

The breechblock should not be opened for at least one minute after a misfire.

All work upon recoil cylinders, sights, and other optical equipment should be done in the presence of a commissioned officer.

The recoil cylinder should never be clamped in a vise, but when necessary to hold it from turning, a spanner applied to front end of cylinder should be used.

Never remove the spring-rod nuts when the piece is at an elevation.

See that proper kind of oil is used in cylinders and for lubrication.

Strain the oil used in filling the cylinders through a fine, clean cloth, and be sure that the receptacles used in handling the oil are clean.

Take every precaution to keep the interior of the cylinders clean and to prevent the entrance of foreign particles.

All unpainted surfaces should be kept clean and free from rust, but in no case is a polish required.

In assembling the gland, be sure that at least six threads of the gland are engaged with the threads of the stuffing box.

Lash parts with copper wire to prevent unscrewing.

Before firing, inspect to insure that cylinders are properly closed and that the piston-rod and spring-rod nuts are in place.

If time permits, oil slides before firing.

If the gun fails to return fully into battery, except when caused by expansion of oil, it is probably due (1) to dirt on slides and guides; (2) to cutting of sliding surfaces on account of dirt and lack of oil; (3) to gland being screwed up too tight; (4) to dirt or foreign particle in the cylinder, and especially in the counter-recoil buffer recess; (5) to weakness of springs. Ninety per cent of such cases will be found due to (1), (2), or (3).

To relieve the elevating and traversing mechanisms, the cradle should be locked when traveling. A definite rule can not be given as to when the traveling lock should be used. The object of the traveling lock is to permit the gun to be retracted from its firing position, thereby relieving the carriage axle and wheels of some of the weight and transmitting it to the carriage limber.

In view of the fact, however, that with the gun in this position the weight at the spade is excessive for limbering and unlimbering, the discretion of the battery commander should determine when the gun should be pulled back. For long marches and where the drills would not require unlimbering, the gun should be invariably placed in the traveling position.

The set of large covers now issued should be used whenever the gun is pulled back into the traveling position.

After unlimbering, release elevating and traverse lock before attempting to elevate or traverse gun.

The length of the recoil of the gun during firing should be carefully observed to see that the recoil mechanism is working properly.

For satisfactory action of the recoil-controlling parts it is necessary that the cylinder be filled with oil in the exact method previously given and that the parts be kept scrupulously clean.

Close down the ends of the recoil indicator guide to avoid loss of the indicator.

If the elevating screws do not house in traveling, they are incorrectly assembled.

Keep hub bolts and hub bands properly tightened.

To tighten hub bands, screw them as tightly as possible with the wrench and then force them farther by striking the end of the wrench with a hammer.

Tires on wheels should be reset as soon as the wheels have lost their initial dish given by shrinkage. In order to determine when this dish is lost without waiting for the felloe and spokes to actually become loose, the following method should be used:

Place a straightedge across the wheel, resting on the felloe and passing near the hub flange. Measure the distance from the straightedge to a spoke near the felloe and one near the hub box. If the difference in these two distances is less than three-sixteenths of an inch the tire should be reset.

Cold-set tires are much inferior to hot-set tires in that the dish given by the setting of the tire is lost much more rapidly when cold set. Cold setting should therefore be resorted to only when it is impracticable to have the tires hot set.

Do not permit brake levers to be released by a kick or a blow.

Prevent possible injury to cannoneers by causing them to stand clear of the counter-recoil spring column in assembling or dismounting.

In moving the gun on or off the cradle, provide ample support for the breech end, so that the gun clips are in prolongation of the cradle guides; if this is not done, the cradle guides may be ruined.

Do not strike any metal part directly with a hammer; interpose a buffer of wood or copper.

Frequently verify the adjustment of sights.

Require special care in handling sights.

Be sure that the range disk of the quadrant and the range strip of the rear-sight shank is graduated for the particular type of ammunition used by the battery.

Do not unnecessarily expose ammunition to the sun or load it into a warm gun before time for firing; if this is done, erratic shooting may result.

Battery commanders should frequently make a detailed inspection of all of the vehicles in the battery to see if any parts of them are broken and any nuts, screws, split pins, etc., missing. If any such defects are found, he should immediately take steps to replace broken or missing parts. This is of the utmost importance, and compliance with these instructions will do much toward prolonging the life of the vehicles.

It has been found that the apron hinges occasionally become broken, and that the apron-hinge pins are frequently lost. Whenever this happens the hinges or hinge pins should be immediately

replaced, for if this is not done the apron, which is a very expensive piece, is apt to become cracked or broken.

Whenever the lunettes become loosened the lunette nuts should at once be tightened up.

All wheels and pintle bearings should be frequently oiled.

All nuts are secured by split pins, which should be replaced and properly opened when nuts are screwed home.

All working and bearing surfaces of the carriage require oiling. Those not directly accessible for this purpose are provided with oil holes closed by spring covers or handy oilers.

Smokeless powder must not be used for blank cartridges.

See that fuzes are set at safety for transport.

Use the small primer-inserting press for inserting primers in cartridge cases and the decapping tools provided for removing old primers.

In all requisitions and correspondence the correct name of the part referred to (if known) should be given. If the name of the part is not known, submit a sketch showing the location, shape, matériel, etc., sufficient to establish definitely the identity of the parts in question.

The use of the word "complete" in requisitions to signify a combination of parts sometimes leads to misunderstanding of the exact parts wanted. The tables of nomenclature of parts have been arranged to show the parts included under the terms "one trail, complete; one wheel, complete," etc., and should be carefully studied before requisitions are made out, to insure that all the parts wanted are included and duplications avoided. For example, if a piston rod is wanted the order should state whether it is to be with or without the nut. If all details are itemized, it will avoid mistakes and unnecessary expense.

SUPPLIES IN GENERAL.

All bits, both curb and snaffle, are made of 27 per cent nickel steel, a practically noncorrosive metal.

The olive-drab saddle blanket is regulation for all arms of the service.

The supply of ammunition to be kept on hand in a 4.7-inch gun battery will be a sufficient amount to fill all the ammunition chests of the equipment, and in addition a sufficient number of rounds to cover the needs for annual target practice.

Pistol arm racks are issued for use of Field Artillery in such number as may be required to hold the pistols on hand in the battery. Each pistol arm rack holds 80 pistols.

The allowance of electric flashlights for each battery and their apportionment amongst the personnel is as follows:

5 with hoods:

1 for the chief of the fifth section.

4 to equip each gunner.

16 without hoods:

1 for the battery commander.

1 for the reconnaissance officer.

2 to equip each chief of platoon in the firing battery.

4 to equip each chief of gun section.

4 to equip each No. 3 in the gun sections.

4 to equip each No. 1 in the gun sections.

In addition 3 flashlights with hoods are issued to each regimental and battalion headquarters for use with instruments and range finders.

Such articles as may be needed for training the horse—the cavesson, longing rein, running rein, etc.—may be readily made up by the battery saddler from supplies furnished by the Ordnance Department.

For the training of enlisted men leather heads and wooden stands for supporting them will be needed. The saddler and the carpenter will be able to supply these by means of the tools in the forge limber and battery wagon.

A reloading and cleaning outfit for 4.7-inch guns for removing fired primers from and cleaning cartridge cases and for reloading blank ammunition is furnished to each battery.

METHOD OF LOADING ONE 4.7-INCH GUN BATTERY FOR TRANSPORTATION BY RAIL.

The flat cars usually obtained from railroad companies vary in length from 34 to 44 feet. Cars longer than 42 feet are unusual.

In loading a battery on cars during service operations it is very desirable to keep complete gun sections together as much as possible. Pursuing this idea, a 4.7-inch gun battery on *war footing* may be loaded as follows, when cars at least 38 feet long are obtained:

Four cars, each to contain:

1 4.7-inch gun and carriage.

1 4.7-inch gun and 6-inch howitzer limber.

2 4.7-inch gun limbers.

2 4.7-inch gun caissons.

One car to contain:

1 4.7-inch gun and 6-inch howitzer battery wagon.

1 4.7-inch gun and 6-inch howitzer forge limber.

2 4.7-inch gun limbers.

2 4.7-inch gun caissons.

One car to contain:

- 1 4.7-inch gun and 6-inch howitzer store wagon.
- 1 4.7-inch gun and 6-inch howitzer store limber.
- 2 4.7-inch gun limbers.
- 2 4.7-inch gun caissons.

A 4.7-inch gun battery on *peace footing* may be loaded as follows, when cars at least 38 feet long are obtained:

Four cars, each to contain:

- 1 4.7-inch gun and carriage.
- 1 4.7-inch gun and 6-inch howitzer limber.
- 2 4.7-inch gun limbers.
- 2 4.7-inch gun caissons.

One car to contain:

- 1 4.7-inch gun and 6-inch howitzer battery wagon.
- 1 4.7-inch gun and 6-inch howitzer store wagon.
- 1 4.7-inch gun and 6-inch howitzer forge limber.
- 1 4.7-inch gun and 6-inch howitzer store limber.

This car will be only about three-quarters filled if a 38-foot car is procured. The additional space may be utilized as the battery commander sees fit.

If cars less than 38 feet long are obtained, one limber or one caisson will have to be omitted. If cars 44 feet long are obtained, one additional limber or caisson can be loaded on each.

In loading the cars, if there is any permanent loading platform along the railroad tracks in the vicinity, the vehicles should be run onto these platforms and loaded from them. If there is no permanent platform in the vicinity, it will be necessary to build a temporary ramp. This should be built at the end of the cars. When loading vehicles from a permanent platform on the side of the cars it may be necessary, if short cars are obtained, to remove the pole of the last limber placed on the car in order to get it onto the car. The pole should, however, be replaced in its socket as soon as the vehicle is placed in position.

When loading the cars, care must be exercised to load them so that there can be no movement of the vehicles on the cars longitudinally, transversely, or vertically. All wheels and trails of carriages, poles of limbers, lunettes of caissons and wagons must be secured to the bottom of the car. The vehicles are secured as follows:

3 by 4 inch timbers nailed to the floor of the cars on both sides of all the wheels hold the wheels securely against transverse motion.

3 by 4 inch chocks nailed to the 4 by 4 inch pieces which lie along the sides of the wheels hold the wheels against longitudinal motion on the cars.

3 by 4 inch timbers, placed over the felloes, resting on the floor between the two lowest spokes and bolted to the floor of the car

with two $\frac{1}{2}$ -inch bolts, hold the wheels against vertical motion. The bolts should preferably be bolted through these braces on the outside of the wheels. If bolts for bolting these 3 by 4 inch cross-pieces can not be obtained, the crosspieces should be nailed down with 7 or 8 inch spikes. The poles and lunettes should be secured to the floor by nailing one 3 by 4 inch block on both sides of each and one 3 by 4 inch piece across the top near the end of the poles or lunettes.

The trails should be secured to the floor by nailing 3 by 4 inch blocks as follows:

- 1 on each side of the trail.
- 1 at the end of the trail in prolongation of the axis, and
- 1 across the top near the end.

All of the lumber used on the cars is 3 by 4 inch stock. To load a 4.7-inch gun battery on *war footing* will require 1,100 linear feet of 3 by 4 inch lumber, a battery on *peace footing* will require 920 linear feet.

For carrying all harness and all accessories of the vehicles which are not carried in compartments of these vehicles or rigidly attached to them, one box car should be obtained. The material in this box car should be packed in boxes if on hand. In case no box car can be obtained, all of the harness, etc., should be packed in boxes and placed on the flat cars near the vehicles. These boxes must be securely fastened to the floor to prevent them from falling off of the cars or from striking and injuring the vehicles.

EQUIPMENT.

The following table sets forth the total equipment of one 4.7-inch gun battery on war footing. The right-hand column shows in general where each article should be carried, but the battery commander may use his discretion as to the disposition of many articles for which no particular fitting or receptacle is provided.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.			
			Class.	Section.		
WHEELED MATÉRIEL.						
4	Guns and gun carriages	} IV	IV	3		
4	Gun-carriage limbers					
12	Caisson limbers					
12	Caissons					
1	Forge limber					
1	Battery wagon				} IV	9
1	Store limber					
1	Store wagon					
GUN AND GUN-CARRIAGE ACCESSORIES.						
4	Bar screw drivers	In trail tool box	} IV	3		
4	Breech covers	On guns				
4	Covers for guns	On gun in traveling position				
4	Covers for front sights	} On sights				
4	Cover for rear-sight brackets					
4	Covers for rear-sight shanks	} On wheels				
8	Dust guards for wheels					
4	Elevating-gear covers	On elevating gears				
8	Hand fuze setters with cases	In trail boxes				
4	Horizontal oilers, model of 1913	In oil-can boxes				
8	Lanyards	In trail tool box				
4	Leather pouches for spare parts	do				
4	Muzzle covers	On guns				
4	Oil-can boxes	In trail tool box				
4	Spanner wrenches, cylinder head, and stuffing-box gland	do				
4	Sponges and rammers	On trails				
4	Sponge covers	On sponges				
4	3-pound spools, No. 20 annealed bare copper wire	} In trail tool box				
4	Tool kits, each containing—					
	1 cross peen hammer.					
	1 large bronze drift.					
	1 pliers (wire cutting).					
	1 range quadrant wrench.					
	1 right-angle screw driver.					
	1 screw slot wrench and blade.					
	1 small bronze drift.					
	1 small punch.					
	1 0.75-inch cold chisel, 8 inches long.					
	1 6-inch, 3-square, dead smooth file.					
	1 8-inch hand smooth file.					
	1 10-inch screw driver.					
4	Wrenches, wheel hub and pintle yoke	} On trail				
4	Wrenches, 0.375 inch and 0.5 inch					
4	Wrenches, 0.625 inch and 0.875 inch					
4	Wrenches, 0.75 inch and 1 inch					
4	Wrenches, 1.125 inches and 1.5 inches					
4	Maneuvering bar					

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.	
			Class.	Section.
SPARE PARTS FOR GUNS AND GUN CARRIAGES.				
(For guns.)				
4	Block latches.....	In leather pouch for spare parts.		
4	Block-latch springs.....			
4	Firing pins.....			
4	Firing-pin springs.....			
4	Firing-spring sleeves.....			
8	Handy oilers.....			
4	Hinge-pin catches.....			
4	Lever-latch springs.....			
4	Locking bolts, nuts, and pins.....			
4	Locking-bolt springs.....			
4	Sears.....			
4	Tray-latch springs.....			
8	Trigger-shaft detents.....			
1	Breech mechanism, complete, including block carrier and loading tray.				In spare breech mechanism chest in battery wagon.
(For fuze setters.)				
16	Range-ring screws.....	In leather pouch for spare parts		
3	Stop-pin screws.....			
12	Guide-plate screws.....	In leather pouches for spare parts.		
6	Corrector-scale screws.....			
4	Range indices.....			
4	Index plungers.....			
4	Index springs.....			
4	Oil-hole screws.....			
8	Index-bar screws.....			
(For carriages.)				
1	Apron latch, complete.....	In miscellaneous spare parts chest, store wagon.		
1	Apron-latch (body) pin with split pin.....			
2	Apron-latch spring.....	In compartment K, store wagon.		IV
2	Brake lever with catch and spring bracket.....			
2	Brake-lever springs.....	In miscellaneous spare parts chest, store wagon.		
2	Brake-rod pins.....			
1	Brake-rod spring.....			
1	Brake-segment rack with bolts.....	In compartment K, store wagon.		
4	Brake shoes.....	In compartment G, store wagon.		
2	Brake-shoe pins.....	In miscellaneous spare parts chest, store wagon.		
6	Counter recoil springs, inner.....	In compartments G and H, battery wagon, and compartment G, store wagon.		
6	Counter recoil springs, middle.....			
6	Counter recoil springs, outer.....			
1	Cylinder cover hinge pins, with split pins.....	In miscellaneous spare parts chest, store wagon.		
12	Cylinder cover swing bolts with pins and nuts.....			
1	Elevating and traveling lock bolt spring.....			
1	Elevating screw cover with split pin.....			
1	Elevating screw cover with springs.....			
1	Elevating pin.....			
2	Extension rail pins with split pins.....			
4	Extension rail plunger springs.....			
2	Extension rail latch springs.....			
4	Filling and drain plugs (cylinder).....			
1	Firing mechanism, complete.....			
20	Garlock's waterproof packing, 0.375 ring.....				5 inches each, leather pouch for spare parts.
1	Handle return spring.....	In miscellaneous spare parts chest, store wagon.		
4	Handspikes, complete, 2 right, 2 left.....	In compartment H, store wagon.		
4	Handy oilers, 0.312 ($\frac{1}{8}$) inch.....	In miscellaneous spare parts chest, store wagon.		
20	Handy oilers, 0.375 inch.....			

¹ Parts required by batteries having carriages with serial numbers 1 to 40, inclusive, only.

² Parts required by batteries having carriages with serial numbers above 40 only.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.		
			Class.	Section.	
	SPARE PARTS FOR GUNS AND GUN CARRIAGES— continued. (For carriages)—Continued.				
2	Hub liners.....	In compartment A, store wagon.			
1	Lock washer.....	} In miscellaneous spare parts chest, store wagon.			
1	Recoil cylinder lock catch and lock pin.....				
1	Recoil indicator.....				
50	Rivets, assorted.....				
1	Shaft return spring.....				
1	Spade edge.....	In compartment K, store wagon.			
1 13	Spade-edge rivets.....	} In miscellaneous spare parts chest, store wagon.			
2 10	.....do.....			
2	Spade points.....	In compartment K, store wagon.			
2 20	Spade-point rivets.....	In miscellaneous spare parts chest, store wagon.			
1	Sponge and rammer, complete.....	} In compartment H, store wagon.			
1	Sponge cover.....				
12	Spring covers, No. 1, with screws and washers.....	} In miscellaneous spare parts chest, store wagon.			
2	Top shield brace pins, with chains.....				
2	Top shield fastening pins, with split pins.....				
1	Traversing nut.....				
1	Trip latch spring.....				
1	Wheels, complete.....		On battery wagon, the two hub caps in compartment H, battery wagon.		
2	Wheel fastenings, complete.....		In miscellaneous spare parts chest, store wagon.		
1	Set, crown nuts, standard, consisting of— 24 0.375 inch by 16 threads..... 26 0.5 inch by 13 threads..... 52 0.625 inch by 11 threads..... 36 0.75 inch by 10 threads..... 6 0.875 inch by 9 threads..... 2 1.25 inches by 7 threads..... 2 1.5 inches by 6 threads..... 2 1.5 inches by 13 threads.....	} Carried equally in the leather pouches for spare parts.			
1	Set, crown nuts, special, consisting of— 4 0.625 inch by 11 threads..... 8 1 inch by 8 threads..... 4 1.125 inches by 12 threads..... 2 1.625 inches by 10 threads.....				
1	Set, hexagon nuts, standard, consisting of—2 0.19 inch by 30 threads.....				
1	Set, hexagon nuts, special, consisting of— 2 0.187 ($\frac{3}{16}$) inch by 26 threads, F. A. standard..... 2 0.242 inch by 0.24 threads..... 2 0.375 inch by 16 threads.....				
1	Set, split pins, consisting of— 4 0.046 ($\frac{1}{4}$) inch by 0.312 ($\frac{1}{4}$) inch..... 4 0.062 ($\frac{1}{4}$) inch by 0.562 ($\frac{1}{4}$) inch..... 13 0.093 ($\frac{1}{4}$) inch by 0.5 inch..... 5 0.093 ($\frac{1}{4}$) inch by 0.75 inch..... 4 0.093 ($\frac{1}{4}$) inch by 1 inch..... 4 0.125 inch by 0.75 inch..... 8 0.125 inch by 1 inch..... 6 0.125 inch by 1.25 inches..... 2 0.125 inch by 1.5 inches..... 10 0.156 ($\frac{1}{4}$) inch by 1 inch..... 9 0.156 ($\frac{1}{4}$) inch by 1.5 inches..... 2 0.156 ($\frac{1}{4}$) inch by 1.75 inches..... 2 0.203 ($\frac{1}{4}$) inch by 1.5 inches..... 3 0.203 ($\frac{1}{4}$) inch by 2 inches..... 4 0.203 ($\frac{1}{4}$) inch by 2.25 inches..... 15 0.203 ($\frac{1}{4}$) inch by 2.5 inches..... 2 0.25 inch by 1.25 inches..... 2 0.25 inch by 1.5 inches..... 2 0.25 inch by 1.75 inches..... 2 0.25 inch by 2 inches..... 2 0.25 inch by 2.75 inches..... 2 0.25 inch by 3 inches..... 8 0.062 ($\frac{1}{4}$) by 1.125 inches..... 2 0.25 inch by 3.5 inches.....				

IV

3

¹ Parts required by batteries having carriages with serial numbers 1 to 40, inclusive, only.
² Parts required by batteries having carriages with serial numbers above 40 only.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.	
			Class.	Section.
TOOLS AND ACCESSORIES FOR GUN CARRIAGE LIMBERS.				
1	Cyclometer and tally pin.....	On one of the four limbers...	IV	9
8	Dust guards for wheels.....	On wheels.....	IV	3
16	Watering buckets.....	} On limbers.....	IV	9
4	Pole prop.....			
4	Neck yoke, complete.....	} On limber.....	IV	3
8	Singletree, complete.....			
20	Straps.....	do.....	IV	9
SPARE PARTS FOR GUN CARRIAGE LIMBERS.				
1	Doubletree pivot and nut.....	In miscellaneous spare parts chest, store wagon.	} IV	3
2	Doubletree hooks with screws and nuts.....	In compartment D, store wagon.		
1	Hub liner.....	In compartment A, store wagon.		
1	Lock washer.....	In miscellaneous spare parts chest, store wagon.		
1	Singletree.....	In compartment K, store wagon.		
1	Wheel, complete.....	On store wagon, the hub cap in compartment F, store wagon.		
1	Wheel fastening, complete.....	In miscellaneous spare parts chest, store wagon.		
TOOLS AND ACCESSORIES FOR CAISSON LIMBERS.				
12	Axes.....	On top of chests.....	} IV	9
12	Cartridge hooks.....	On left side of chests.....		
24	Dust guards for wheels.....	On wheels.....	IV	3
12	Hatchets.....	On right side of chests.....	} IV	9
12	Lanterns.....	On front of chests, in brackets.....		
12	Lantern-bracket pads.....	In bracket.....	IV	3
12	Paulins, 12 by 12 feet.....	On top of chests.....	} IV	9
12	Pickaxes.....	On right side of chests.....		
12	Picket ropes.....	On top of chests.....	} IV	3
12	Pole props.....	On front of chests.....		
12	Short-handled shovels.....	On left side of chests.....	} IV	9
12	Spanners for 60-inch wheels.....	On intermediate plates.....		
24	Watering buckets, canvas.....	On front of chests.....	} IV	3
12	Wrenches, 0.625 inch and 0.75 inch.....	do.....		
12	Neck yokes, complete.....	} On limber.....	IV	3
24	Singletrees, complete.....			
312	Straps.....	do.....	} IV	9
12	Lantern straps.....	On lantern bracket.....		
SPARE PARTS FOR CAISSON LIMBERS.				
1	Cartridge hooks.....	In miscellaneous spare parts chest, store wagon.	} IV	9
2	Doubletrees.....	In compartment K, store wagon.		
2	Doubletree pins and nuts.....	In miscellaneous spare parts chest, store wagon.		
2	Doubletree hooks.....	In compartment K, store wagon.		
2	Hub caps, complete.....	do.....		
2	Hub liners.....	In compartment A, store wagon.		
2	Limber-prop chains.....	In compartment G, battery wagon.	} IV	3
2	Lock washers.....	In miscellaneous spare parts chest, store wagon.		
2	Neck yokes.....	In compartment K, store wagon.	} IV	9
1	Picket rope.....	In compartment A, battery wagon.		
2	Pintle bearing bolts with 1 nut strip.....	In compartment A, store wagon.	} IV	3
2	Padlocks, chains, clevises, and bolt snaps.....	In miscellaneous spare parts chest, store wagon.		
1	Pintle, with bearing, complete.....	In compartment A, store wagon.		
1	Pintle latch.....	In compartment K, store wagon.		

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.			
			Class.	Section.		
SPARE PARTS FOR CAISSON LIMBERS—CON.						
2	Pintle-latch springs.....	In miscellaneous spare-parts chest, store wagon.	IV	3		
2	Pintle springs with bolts and nuts.....	do.....				
2	Poles, complete.....	1 under battery wagon, 1 under store wagon.				
4	Hub latch plungers.....	In miscellaneous spare-parts chest, store wagon.				
4	Hub latch springs.....					
4	Hub latch pins.....					
2	Pole props.....					
3	Singletrees.....	In compartment K, store wagon.			IV	9
1	Wheel hook.....	do.....				
2	Wheels, complete.....	In compartment H, store wagon.			IV	3
2	Wheel fastenings, complete.....	1 on store wagon with hub cap in compartment H, store wagon, and 1 in store at post.				
2	Wheel fastenings, complete.....	In miscellaneous spare-parts chest, store wagon.				
TOOLS AND ACCESSORIES FOR CAISSONS.						
12	Lantern straps.....	On lantern brackets.....	IV	9		
12	Axes.....	On top of chests.....				
12	Cartridge hooks.....	On left side of chests.....				
24	Dust guards for wheels.....	On wheels.....				
12	Hatchets.....	On right side of chests.....				
12	Lanterns.....	On front of chests.....				
12	Lantern-bracket pads.....	On front of chests, in brackets				
12	Oil cans.....	Between intermediate plates				
12	Paulins, 12 by 12 feet.....	On top of chests.....				
12	Pick mattocks.....	On right side of chests.....				
12	Picket ropes.....	On top of chests.....				
12	Shovels, long-handled.....	On left side of chests.....				
24	Watering buckets, canvas.....	On front of chests.....				
216	Straps.....	On front of chests.....				
SPARE PARTS FOR CAISSON.						
3	Apron hinges with pins.....	In miscellaneous spare-parts chest, store wagon.	IV	3		
1	Apron latch, complete.....	do.....				
2	Apron-latch bases with washers.....	do.....				
2	Apron-latch spring.....	do.....				
2	Brake levers, with catches.....	In compartment K, store wagon.				
12	Brake shoes.....	In compartment G, store wagon.				
6	Brake-shoe pins.....	In miscellaneous spare-parts chest, store wagon.				
1	Caisson prop with chain and hook.....	In compartment K, store wagon.				
1	Cartridge hook.....	In miscellaneous spare-parts chest, store wagon.				
12	Connecting poles, complete.....	On caissons.....				
12	Connecting-pole keys.....	do.....				
3	Hub liners.....	In compartment A, store wagon.				
3	Lock washers.....	In miscellaneous spare-parts chest, store wagon.				
1	Lunette.....	In compartment A, store wagon.				
2	Lunette pins.....	In miscellaneous spare-parts chest, store wagon.				
2	Padlocks, chains, clevises, and bolt snaps.....	do.....				
1	Pintle, with bearings, complete.....	In compartment A, store wagon.	IV	3		
1	Pintle latch.....	In compartment K, store wagon.				
2	Pintle-latch springs.....	In miscellaneous spare-parts chest, store wagon.				
2	Pintle springs with bolts and nuts.....	do.....				
2	Pintle bearing bolts with 1 nut strip.....	do.....				
300	Split pins (assorted).....	In miscellaneous spare-parts chest, store wagon.				
3	Wheels, complete.....	In store at post.....				
3	Wheel fastenings, complete.....	In miscellaneous spare-parts chest, store wagon.				
1	Caisson-prop chain and hook.....	do.....				

NOTE.—Batteries having the wooden pole will have the following spare parts: Four pole bodies, complete; 2 pole covers; 2 pole ferrules, complete; 2 pole pads.
Batteries having the wooden neck yokes will have 8 spare neck yokes.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.	
			Class.	Section.
TOOLS AND ACCESSORIES FOR FORGE LIMBER.				
1	Ax.....	On left side of chest.....	IV	9
2	Dust guards for wheels.....	On wheels.....	IV	3
1	Grindstone, with frame, complete.....	In chest.....	IV	9
1	Hatchet.....	On right side of chest.....		
1	Hub-liner driving tool.....	In chest.....	IV	3
2	Lever jacks.....	In lower compartment.....	IV	9
1	Lantern.....	On front of chest, in bracket.....		
1	Lantern-bracket pad.....	In bracket.....	IV	3
1	Paulin, 12 by 12 feet.....	On top of chest.....	IV	9
1	Pickax.....	On right side of chest.....		
1	Picket rope.....	In chest.....	IV	3
1	Pole prop.....	Under foot rest.....		
1	Set of blacksmith's tools.....	In chest.....	X	9
1	Shovel, short-handled.....	On left side of chest.....	IV	9
1	Wrench for grindstone.....	With grindstone.....		
4	Watering buckets, canvas.....		IV	9
1	Snatch block for 1½-inch rope.....	do.....	IV	3
1	8-inch double tackle block.....	do.....		
1	150 feet manila rope, 1 inch.....		IV	3
1	Neck yoke complete.....	On limber.....		
2	Singletrees, complete.....		IV	9
14	Straps.....	On lantern bracket.....		
1	Lantern strap.....		IV	9
TOOLS AND ACCESSORIES FOR BATTERY WAGON.				
1	Bore sight, breech.....	In chest for spare sights.....	IV	3
1	Bore sight, muzzle.....			
1	Carpenter's chest with tools.....	In compartment B, battery wagon.....	X	9
1	Chest for duplex chain block.....	In compartment A, battery wagon.....	IV	9
1	Chest for spare breech mechanism.....	do.....	IV	3
1	Chest for spare sights.....		IV	9
1	Duplex chain block, Y. & T., 2-ton.....	In chest in compartment A.....		
2	Dust guards for wheels.....	On wheels.....	IV	3
1	Forge coal bag.....	In compartment A, battery wagon.....	IV	9
1	Paulin, 12 by 12 feet.....	In compartment B, battery wagon.....		
2	Retracting eyes.....	In compartment A, battery wagon.....	IV	3
1	Saddler's chest with tools.....	In compartment B, battery wagon.....	X	9
2	Spring compressors, No. 4.....			
2	Spare wheel-hub covers.....	On spare wheels.....	IV	3
1	Testing level and chest.....	In compartment A, battery wagon.....	IV	9
1	Vise.....	On right side rail of wagon.....	X	9
2	Water buckets, galvanized steel.....	In compartment A, battery wagon.....	IV	9
1	Chain sling.....	In wagon.....	IV	3
1	Cleaning track.....	do.....		
1	Vise handle strap.....		IV	9
1	Strap.....			
TOOLS AND ACCESSORIES FOR STORE LIMBER.				
1	Ax.....	On left side of chest.....	IV	9
2	Dust guards for wheels.....	On wheels.....	IV	3
2	Filling funnels, cylinder.....	In chest.....	IV	9
1	Hatchet.....	On right side of chest.....		
1	Lantern.....	On front of chest, in bracket.....	IV	3
1	Lantern-bracket pad.....	In bracket.....		
4	Oil cans, 5 gallons.....	In lower compartment.....	IV	3
2	Oil cans, 7.5 gallons.....	In rear intermediate section.....		
1	Paulin, 12 by 12 feet.....	On top of chest.....	IV	9
1	Pickax.....	On right side of chest.....		
1	Picket rope.....	In forward intermediate compartment.....	IV	3
1	Pole prop.....	Under foot rest.....		
1	Shovel, short-handled.....	On left side of chest.....	IV	9
4	Watering buckets, canvas.....	In forward intermediate compartment.....		
1	Neck yoke, complete.....		IV	3
2	Singletrees, complete.....	On limber.....		
11	Straps.....		IV	9
1	Lantern strap.....	On lantern bracket.....	IV	9

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 cal- sions).	Article.	Where carried.	Property classification.	
			Class.	Sec- tion.
TOOLS AND ACCESSORIES FOR STORE WAGON.				
20	Bolos.....	} In compartment A, store wagon.	VII	5
20	Bolo scabbards.....			
1	Chest for miscellaneous spare parts.....	} In compartment B, store wagon.	IV	3
1	Cleaning material and small stores chest.....			
1	Crowbar.....	In compartment G, store wagon.	IV	9
2	Dust guard for wheels.....	On wheels.....	IV	3
1	Marking outfit for stamping metal.....	} In cleaning material and small stores chest.	X	5
1	Marking outfit for stamping leather.....			
1	Paulin, 12 by 12 feet.....	In compartment B, store wagon.	IV	9
1	Seal stamp.....	In cleaning material and small stores chest.	X	5
1	Slush brush.....	In compartment H, store wagon.	IV	3
2	Spare staff coupling caps.....	do.....		
2	Spare wheel hub covers.....	On spare wheels.....	X	
1	Stencil outfit.....	} In cleaning material and small stores chest.		
1	Ordnance Department insignia stencil.....			
MISCELLANEOUS SPARE PARTS FOR TOOLS AND ACCESSORIES.				
3	Padlocks with chains, clevises, and bolt snaps.....	In battery wagon.....	IV	9
4	Ax helves.....	In compartment K, store wagon.		
4	Hatchet handles.....	do.....		
4	Pickax handles.....	do.....		
2	Shovel handles, long.....	In compartment H, store wagon.		
3	Shovel handles, short.....	In compartment K, store wagon.		
SIGHTS AND QUADRANTS.				
4	Sights, complete.....	In fastening on cradles.....	IV	3
4	Panoramic sights.....	In case on shield.....		
4	Range quadrants.....	In case on right side of trail.....		
4	Teat wrenches for panoramic sights.....	In case on shield.....		
SPARE SIGHTS AND QUADRANTS.				
1	Sight, complete.....	} In spare sights chest in battery wagon.	IV	3
1	Panoramic sight.....			
1	Range quadrant.....			
1	Teat wrench for panoramic sight.....			
RANGE FINDING AND FIRE-CONTROL EQUIPMENT.				
110	Battery commander's rulers, wooden.....	On person or in store limber.	V	1
* 1	Aiming circle with tripod and cases.....	On pack horse.....		
2	Battery commander's telescope and mount.....	1 in store limber, 1 on pack horse.		
* 1	1 meter base range finder and tripod.....	On pack horse.....		
2	Prismatic compass.....			
2	Leather carrying case, with straps, for B. C. telescope and mount, containing—			
	1 camel's-hair brush.....	} 1 in store limber, 1 on pack horse.		
	1 pin wrench.....			
	1 screw driver.....			
	1 teat wrench.....			
5	Flash lights with hoods.....	} In store limber.....		
16	Flash lights without hoods.....			
1	Steel tape, 100 feet.....			
2	Time interval recorders with chains.....	} 1 in store limber; 1 on pack horse.		
2	Tripod for B. C. telescope with case.....			
1	Map and plotting board.....			
1	Protractor, xylonite, rectangular.....			
1	Ruler for solution of triangles.....			
1	Observation tower.....	On caisson in fifth section.....		

(Furnished by Signal Corps.)⁴¹ Metal B. C. rulers with cases are no longer part of the equipment. Those on hand may be retained.² Will be issued when available.³ One meter base range finder will be issued as soon as a supply is available. When issued, the sextant telemeter now on hand in some of the organizations will be turned in.⁴ For list of these parts see unit accountability equipment manual.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.	
			Class.	Section.
	HARNESSES.			
1	Set, 2-horse reel.....	On horses..... On horses, one is spare..... Not carried in the field.....		
19	Sets, wheel harness.....			
55	Sets, lead harness.....			
74	Harness sacks.....			
1	Set, pack harness and special pack equipment.....			
	<i>Spare parts of harness.</i>			
8	Breast straps.....	In compartment K, battery wagon.	IV	8
2	Bridles and bits, 1 off and 1 near.....	do.		
5	Steel collars, with 2 hame tugs each.....	1 in compartment J, 4 in compartment K, battery wagon.		
16	Cinchas, artillery, lead.....	In compartment K, battery wagon.		
8	Cinchas, artillery, wheel.....			
10	Collar straps.....	In compartment J, battery wagon.		
10	Feed bags.....	In compartment K, battery wagon.	IX	5
10	Grain bags.....			
8	Halter headstalls.....	In compartment H, battery wagon.		
25	Halter tie ropes.....			
8	Martingales, with cincha straps.....	In compartment K, battery wagon.		
5	Mogul springs, 320 pounds.....	In compartment G, battery wagon.		
8	Side straps, for breeching.....	In compartment K, battery wagon.	IV	8
6	Stirrup straps.....			
10	Traces, lead, with chains.....	In compartment A, battery wagon.		
5	Traces, wheel.....			
5	Whips, artillery.....	In compartment K, battery wagon.		
27	Collar pads, canvas.....	In compartment J, battery wagon.	IX	5
20	Curb bits.....	In compartment K, battery wagon.		
20	Curb chains with hooks.....			
	SPARE PARTS OF STEEL COLLARS.			
8	Bolts for bottom of collars, with nuts.....	In miscellaneous spare parts chest, store wagon.	IV	8
8	Bolts for extensions, with nuts.....			
8	Bolts for top connections, with nuts.....			
8	Bolts for trace plates, with nuts and washers.....			
3	Buckle latches.....	In miscellaneous spare parts chest, store wagon.		
8	Buckle springs.....			
5	Draft springs.....			
8	Pad bolts, with nuts.....			
8	Pad hooks, with collar back strap connections.....			
3	Trace plates with loops.....			
	INSTRUCTION EQUIPMENT.			
1	Common shrapnel, with fuze, sectionalized.....	Not carried in field.....	V	4
1	Common steel shell, sectionalized, with fuze, part sectionalized.....			
	MISCELLANEOUS EQUIPMENT.			
1	Reloading and cleaning outfit, consisting of—	In compartment A, store wagon.	V	
	1 storage chest, containing—			
	1 case holder.....			
	1 case-holder stand.....			
	1 cleaning brush.....			
	1 decapping tool.....			
	1 hammer.....			
	1 powder measure (saluting).....			
	1 press for inserting primer.....			
	1 bushing.....			

¹ This set of pack harness and special pack equipment will be issued to carry the fire-control equipment until the reel, 2-horse, is available.

² Not part of harness.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.	
			Class.	Section.
MISCELLANEOUS EQUIPMENT—continued.				
8	Drill cartridges with the following spare parts—	Not carried in field	IV	5
	16 rotating pins			
	16 stop pins			
	1 graduating ring with felt washer			
	4 locking screws			
	2 point nut screws			
1	Pistol cleaning kit	Where convenient	X	9
2	Arm racks for automatic pistols	Not carried in field	X	1
	(For targets see O. O. pamphlet No. 1994.)			
AMMUNITION.				
268	Shell, rounds	In ammunition chests	VI	3
404	Shrapnel, rounds			
75	Cartridge cases, saluting . . . . .				Not carried in field . . . . .
PERSONAL EQUIPMENT.				
The equipment of the enlisted men of Field Artillery will be as follows:				
(a) For each enlisted man—				
1	Can, bacon, model of 1913	Carried by man	IX	1
1	Canteen, model of 1910			
1	Canteen cover, dismounted			
21	Cartridges, ball, pistol, or 20 cartridges, ball, revolver	do	VII	2
1	Cup, model of 1910	do	IX	1
1	Fork	do	IX	1
1	Knife	do	VII	2
2	Magazines, pistol, extra, if pistol is used	do	IX	1
1	Meat can	do	VII	2
1	Pistol or revolver	do	IX	3
1	Pistol belt or revolver cartridge belt without saber ring	do	IX	1
1	Pistol holster or revolver holster	do	IX	1
1	Spoon	do	IX	1
1	Pouch for first-aid packet	do	IX	1
1	First-aid packet (Medical Department) furnished by Quartermaster Corps—			
1	Identification tag			
1	Shelter tent, half	do		
1	Shelter tent pole	do		
5	Shelter tent pegs	do		
(b) For each enlisted man individually mounted, in addition to (a)—				
1	Curry comb	On horse	IX	5
1	Horse brush			
1	Link			
1	Saddle, McClellan, Field Artillery	Carried on man	IX	2
1	Saddlebags, pair			
1	Spurs, pair			
1	Spur straps, set	On horse	IX	5
1	Bridle, Field Artillery	do	IX	2
(c) For each driver, in addition to (a)—				
1	Curry comb	do	IX	5
1	Horse brush	do	IX	2
1	Spurs, pair	do	IX	2
1	Spur straps, set	do	IX	2
(d) For each cannoneer, not mounted, in addition to (a)—				
1	Can, condiment	Carried by man	IX	1
1	Haversack, model of 1910			

¹ Until these articles are supplied the canteen, cavalry and canteen strap, cavalry, may be used.

² Saddle to be equipped with 1 stirrup gildon socket per battery or 2 per regimental headquarters.

³ Until the model of 1910 haversack is supplied, the haversack, old model, and 2 canteen-haversack straps may be used.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.	
			Class.	Section.
HORSE EQUIPMENT, FOR EACH HORSE.				
1	Halter tie rope.....	Carried on horse.....	IX	5
1	Halter headstall.....			
1	Feed bag.....			
1	Grain bag.....			
1	Saddle blanket.....			
1	Surcingle.....			
1	Horse cover.....				On horse.....
		Not carried in field.....		
CONTENTS OF SADDLER'S CHEST.				
12	Awl blades, harness, assorted.....	In saddler's chest in battery wagon.	X	9
1	Awl, pegging.....			
1	Awl, seat, handled.....			
1	Carriage, pricking, 3 wheels.....			
1	Compass, 6 inch.....			
1	Creaser, double, lignum-vitæ.....			
1	Claw tool.....			
1	Edge tool, No. 1.....			
1	Edge tool, No. 2.....			
2	Extra blades, with followers, for draw gage.....			
1	Gage, draw, brass.....			
2	Hafts, patent, awl, rosewood.....			
1	Hammer No. 3, riveting.....			
1	Handle, peg, awl, with wrench.....			
1	Knife, round.....			
1	Knife, splitting, 6-inch.....			
1	Needle case, leather.....			
1	Needle, gloves' No. 3, paper.....			
2	Needles, harness No. 4, papers.....			
2	Needles, harness No. 5, papers.....			
2	Needles, harness No. 6, papers.....			
12	Needles, sacking, assorted.....			
1	Nippers, cutting, 10-inch.....			
1	Oilstone, unmounted.....			
1	Pliers, 6-inch.....			
4	Punches, hand, round, assorted.....			
1	Punch, revolving.....			
1	Rivet set.....			
1	Rule, boxwood, 2-foot, 4-fold.....			
1	Screw driver, 3-inch blade.....			
1	Sewing palm, leather.....			
1	Shears, 10-inch bent trimmers.....			
1	Shoe knife, square point.....			
1	Shoe knife, broad point.....			
1	Slitker, steel.....			
2	Thimbles.....			
	In addition to the stores enumerated above, certain of the articles in the list of saddler's material, six months' supply, are carried in this chest.			
CONTENTS OF CARPENTER'S CHEST.				
<i>Carpenter tools.</i>				
1	Bench ax.....	In carpenter's chest in battery wagon.		
2	Bags, canvas, for small stores.....			
1	Bevel, 8-inch.....			
6	Bits, auger.....			
1	Bit, wood countersink.....			
1	Bit, expansive, 2 cutters.....			
3	Bits, screw driver.....			
1	Brace, ratchet, 10-inch sweep.....			
3	Chisels, socket, framing.....			
1	Dividers, wing, 10-inch.....			
4	Drills, twist.....			
1	File, 10-inch, flat, bastard.....			
6	Files, saw, 4 and 6 inch (3 of each).....			
1	Gage, marking, brass, thumbscrew shoe and face.....			

1 Part of harness for all draft horses.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.	
			Class.	Section
CONTENTS OF CARPENTER'S CHEST—CON.				
2	Gouges, socket firmer	In carpenter's chest in battery wagon.		
1	Hammer, claw, adze eye			
1	Handle, tool, containing 10 tools			
2	Handles, file, aluminum alloy			
1	Knife, drawing, 9-inch blade			
1	Mallet, 2 $\frac{1}{4}$ by 5 inches, maple, hickory handled			
1	Nail set			
1	Oiler			
1	Oilstone, unmounted			
1	Pincer, small, 8-inch			
1	Plane, jack, wood			
1	Plane, smoothing, wood			
1	Plate, auger handle			
1	Rasp, wood, 10-inch			
1	Reamer, half round, for wood or soft metal			
1	Rule, boxwood, 2-foot, 4-fold			
1	Saw, crosscut, 24-inch			
1	Saw, rip, 24-inch			
1	Saw set			
1	Screw driver, 5-inch blade, 10-inch			
1	Spokeshave, adjustable			
1	Square, steel, 12-inch body, 8-inch tongue			
1	Tape line, linen			
1	Vise, table, 2 $\frac{1}{2}$ -inch			
1	Wrench, screw, 12-inch			
BLACKSMITH'S TOOLS.				
1	Anvil, 100 pounds	In forge limber chest	X	9
2	Aprons			
2	Bags, canvas, for nails			
1	Leather shoeing box			
1	Cold chisel, 8-inch			
1	Chisel, handled, for hot iron			
1	Chisel, handled, for cold iron			
6	Drills, flat			
1	File, flat, 12-inch, bastard, double cut			
1	Flatter, handled			
1	Fore punch and creaser	On forge limber		
1	Forge, Empire, portable, modified for Army use			
1	Hand hammer, 2-pound			
1	Riveting hammer, 1 pound 2 ounces			
1	Shoeing hammer, 10-ounce			
1	Sledge, 11-pound			
1	File handle, aluminum			
1	Hardie, 0.75 square shank, 1.25 bit			
1	Cutting nippers, 14-inch			
1	Clinching iron			
2	Shoeing knives	In forge limber chest		
1	Toe knife			
1	Oiler			
1	Shoeing pincers, 12-inch			
1	Pritchel, 0.75 inch flats			
1	Punch, round, 0.375 inch diameter			
1	Punch, round, 0.312 ($\frac{1}{4}$) inch diameter			
1	Punch, nail			
1	Punch, square			
1	Rake, fire			
1	Shoeing rasp			
1	Ratchet drill for square shank drills			
5	Rivet sets, sizes $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{1}{2}$ inch			
1	Rule, boxwood, 2-foot, 4-fold			
1	Screw plate, taps, and dies, with tap wrench, include wooden chest			
1	Shovel, fire			
1	Square			
1	Tongs, horseshoer's			
1	Tongs for 0.25 inch iron			
1	Tongs for 0.5 inch iron			
1	Whetstone, farrier's			
1	Wrench, forge			
1	Wrench, screw, 12-inch			

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification	
			Class.	Section.
MATERIALS FOR CLEANING AND PRESERVATION.				
(Six months' supply, all expendable.)				
1	Black adhesive tape, 8-ounce roll.....	In cleaning material and small-stores chest.	X	1
5	Borax, pounds.....	In compartment J, battery wagon.		
1	Brush, camel's hair, No. 1 round.....	In cleaning material and small-stores chest.		
3	Brushes, sash, No. 3.....	do.....		
3	Brushes, sash, No. 5.....	do.....		
1	Brush, varnish, No. 4-0.....	In compartment J, battery wagon.		
2	Brushes, varnish, No. 5-0.....	do.....		
2	Brushes, varnish, No. 6-0.....	do.....		
2	Burners, lantern.....	In cleaning material and small-stores chest.		
2	Cloth, crocus, quires.....			
1	Cloth, emery, No. 3, quire.....			
1	Cloth, emery, No. 0, quire.....			
1	Cloth, emery, No. 00, quire.....			
2	Cosmic, No. 80, soft, quarts.....				In compartment J, store wagon.
2	Chamois skins.....	In cleaning material and small-stores chest.		
6	Dressing, russet leather, boxes.....			
2	Globes, lantern.....	do.....		
17	Lavalline, 10-ounce cans.....	In compartment J, store wagon.		
25	Lye, powdered, cans, 1 pound, approximate.....			
15	Naphthalene, pounds.....	In cleaning material and small-stores chest.		
1	Oil, clock, ounce.....			
15	Oil, hydroline, gallons.....	In cans on caisson and store limber.		
8	Oil, linseed, boiled, gallons.....	1 in compartment J, store wagon.		
1	Oil, linseed, raw, pint.....	In cleaning material and small-stores chest.		
15	Oil, lubricating (engine No. 1), gallons.....	In caisson and store limbers..		
25	Oil, neat's-foot, gallons.....	6 in compartment J, store wagon.		
5	Oil, slushing, light, gallons.....	2 in compartment J, store wagon.		
2	Oil, sperm, gallons.....	1 in compartment J, store wagon.		
5	Oil, coal, gallons.....	In cans on store limber.....		
100	Paint, olive drab, second coat, pounds.....	5 in compartment J, store wagon.		
100	Paint, olive drab, third coat, pounds.....			
5	Paint, rubberine, gallons.....	In cleaning material and small-stores chest.		
5½	Petrolatum (vaseline), ounces (in tin box).....			
17	Polish, Gibson's soap, 16-ounce cans.....	In compartment J, store wagon.		
3	Primer, brown enamel, quarts.....	20 in cleaning material and small-stores chest.		
100	Sal soda, pounds.....			
1	Sandpaper, No. 2½, quire.....	In cleaning material and small-stores chest.		
1	Sandpaper, No. 1½, quire.....			
1	Sandpaper, No. 3, quire.....			
1	Sandpaper, No. 00, quire.....			
60	Soap, castile, pounds.....	In compartment J, store wagon.		
6	Soap, H. and H., cakes.....			
90	Soap, saddle, Frank Miller's, pounds.....			
75	Sponges, 5 inches.....	In compartment A, store wagon in hub liners.		
10	Sponges, large, 5½ or 6 inches.....			
10	Turpentine, gallons.....	In compartments A, C, G, H, K, store wagon.		
50	Waste, cotton, pounds.....			
5	Wicks, lantern.....	In cleaning material and small-stores chest.		
21	Batteries, eveready Tungsten.....			
6	Bulbs, 2.7 volt, Mazda.....			

¹ Only one of these items will be issued to an organization.

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.	
			Class.	Section.
SADDLER'S MATERIAL.				
(Six months' supply, all expendable.)				
6	Awl blades, harness, assorted.....	In saddler's chest.....	X	9
1	Awl hafts, patent, No. 146, with wrench.....			
2	Buckles, bar, 1-inch, Saalbach, bronze.....			
9	Buckles, bar, tongueless, $\frac{3}{4}$ -inch, brass.....			
15	Buckles, bar, tongueless, 1-inch, brass.....			
6	Buckles, bar, tongueless, $1\frac{1}{2}$ -inch, brass.....			
40	Buckles, center bar, $\frac{3}{4}$ -inch, bronze.....			
6	Buckles, center bar, $\frac{3}{4}$ -inch, bronze.....			
12	Buckles, center bar, $\frac{3}{4}$ -inch, bronze.....			
2	Buckles, center bar, 1-inch, bronze.....			
12	Buckles, center bar, $1\frac{1}{4}$ -inch, bronze.....			
12	Buckles, center bar, $1\frac{3}{4}$ -inch, bronze.....				In canvas bag for small stores, battery wagon. } X 10
12	Buckles, roller, $\frac{3}{4}$ -inch, bronze.....			
2	Buckles, roller, $\frac{3}{4}$ -inch, bronze.....			
22	Buckles, roller, $\frac{3}{4}$ -inch, bronze.....			
6	Buckles, roller, 1-inch, bronze.....			
48	Buckles, roller, 1 $\frac{1}{2}$ -inch, bronze.....			
4	Buckles, roller, $1\frac{1}{2}$ -inch, bronze.....			
7	Buckles, satchel, $\frac{3}{4}$ -inch, bronze.....			
3	Buckles, wire, $\frac{3}{4}$ -inch, brass.....			
1	Buckles, wire, $\frac{3}{4}$ -inch.....			
28	Buckles, wire, $\frac{3}{4}$ -inch, brass.....	In compartment A, battery wagon.		
3	Cheeks, "D," bronze.....			
14	Conway loops, $\frac{3}{4}$ -inch, bronze.....			
23	Duck, cotton, olive-drab, 22-inch, No. 1, yards.....			
15	End buckles, 1-inch, bronze, with clip.....		In canvas bag for small stores, battery wagon. } X 10	
28	End clips, $\frac{3}{4}$ -inch, brass.....			
21	End clips, 1-inch, brass.....			
25	End clips, $1\frac{1}{2}$ -inch, brass.....		In saddler's chest..... IX 5	
12	Foot-staples, high, bronze.....			
24	Foot-staples, low, bronze.....			
12	Foot-staples, semicircular, bronze.....		In canvas bag for small stores, battery wagon. IV 8	
10	Hooks, back strap, M. I., with roller.....			
2	Hooks, breast strap, M. I., with roller.....			
12	Hooks, end, double, brass wire.....	In saddler's chest..... IX 1		
14	Hooks, end, single, brass wire..... IX 5			
2	Hooks, side strap, wheel..... IV 8			
6	Leather, bridle, sides.....	In canvas bag for small stores, battery wagon. 2 in compartment K, battery wagon. } X 10		
6	Leather, collar, backs.....			
200	Leather, harness, backs, pounds.....			
1	Leather, latigo, sides.....	In compartment K, battery wagon.		
9	Nails, saddle.....	In saddler's chest..... X 9		
1	Needles, Glover's, No. 3, paper.....			
1	Needles, harness, No. 4, paper.....			
1	Needles, harness, No. 5, paper.....			
1	Needles, harness, No. 6, paper.....			
10	Ornaments, brow-band, copper.....do..... IX 5		
10	Ovals, saddle, brass.....			
4	Ovals, saddlebag, brass.....do..... X 10		
2	Pins, screw, brass, $\frac{3}{4}$ -inch, No. 2, gross.....			
7	Rings, $\frac{3}{4}$ -inch diameter, rifle, scabbard, and saddlebag, bronze.....			
24	Rings, $1\frac{1}{4}$ -inch diameter, saddle.....do..... IX 5		
5	Rings, $1\frac{3}{4}$ -inch diameter, back strap, bronze.....			
6	Rings, $1\frac{3}{4}$ -inch diameter, throat strap and breeching, bronze.....			
12	Rings, 2-inch diameter, halter, bronze, style 2....	In canvas bag for small stores, battery wagon. } X 10		
12	Rings, 4-inch diameter, quarter strap.....			
10	Rings, "D," 0.85 by 1 inch, feed bag, M. I.....			
9	Rings, "D," $\frac{3}{4}$ by $1\frac{1}{2}$ inch, with clasp.....			
3	Rings, "D," $1\frac{1}{2}$ by 2 inch, with roller.....			
3	Rings, "D," 1.69 by 2 inch, with roller.....			

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY -
Continued.

War footing (4 guns and 12 caissons).	Article.	Where carried.	Property classification.				
			Class.	Section.			
SADDLER'S MATERIAL—continued.							
2	Rivets and burs, brass, $\frac{3}{8}$ -inch, No. 12, belt, pound	In saddler's chest.....	X	10			
1	Rivets and burs, brass, $\frac{1}{2}$ -inch, No. 10, belt, pound						
1	Rivets and burs, brass, $\frac{3}{8}$ -inch, No. 10, belt, pound						
1	Rivets and burs, brass, 1-inch, No. 8, oval head, pound.						
4	Rollers, lead rein, steel.....						
1,260	Rope, $\frac{1}{2}$ -inch, halter, manila hemp, feet.....	In compartment J, battery wagon.	IV	8			
2	Screws, brass, 1-inch, No. 6, wood, gross.....	In saddler's chest..... 2 in compartment K, battery wagon.	X	10			
10	Sheepskins, with wool on.....						
1	Shields, saddle, 11-inch, brass.....	In saddler's chest.....	IX	5			
2	Shields, saddle, 11 $\frac{1}{2}$ -inch, brass.....						
3	Shields, saddle, 12-inch, brass.....						
4	Snap hooks, canteen, Cavalry, bronze.....						
2	Snap hooks, Covert, $\frac{1}{4}$ -inch, M. I.....						
2	Snaps, Covert's 1-inch, M. I.....						
2	Snap hooks, German, $\frac{1}{4}$ -inch M. I, bronzed.....				do.....	X	10
6	Snap hooks, sack, 1-inch.....				do.....	IX	1
6	Snap hooks, swivel, 1-inch, No. 16, M. I.....				do.....	X	10
10	Snap hooks, German, 1-inch, M. I, bronzed.....				In canvas bag for small stores, battery wagon.	IX	5
36	Squares, halter, style 2, bronze.....	do.....	IX	5			
2	Strap loops, coupling, $\frac{3}{4}$ -inch, for bridle, bronze.....	do.....	IX	5			
10	Strap loops, feed bag, 1 by $\frac{1}{2}$ -inch, brass, wire.....	do.....					
5	Stud hooks, bronze.....	do.....					
6	Studs saddle bag, brass, style 1.....	In saddler's chest.....	X	10			
1	Tacks, copper, No. 12, $\frac{1}{2}$ -pound, paper.....						
1	Tacks, copper, No. 20, $\frac{1}{2}$ -pound, paper.....						
1	Thimble, aluminum-lined, steel, $\frac{3}{4}$ -inch.....						
1	Thread, carpet, No. 18, olive-drab, pound.....						
1	Thread, shce, No. 3, brown, pound.....						
1	Thread, shoe, No. 10, brown, pound.....						
2	Wax, stitching, brown, winter, pounds.....						
21	Webbing, olive-drab, cotton, heavy, $\frac{1}{2}$ -inch, yards.				In compartment F, battery wagon.		
32	Webbing, olive-drab, cotton, heavy, 1-inch, yards.....				In compartment A, battery wagon.		
14	Webbing, olive-drab, halter, 1 $\frac{1}{2}$ -inch, yards.....	do.....					
18	Webbing, olive-drab, jute, 3 $\frac{1}{2}$ -inch, yards.....	do.....					
<i>For polo equipment.</i>							
2	Buckles, wire, $\frac{1}{2}$ -inch, brass.....	In saddler's chest.....	X	10			
2	Buckles, wire, $\frac{3}{8}$ -inch, brass.....						
12	Buckles, wire, $\frac{3}{4}$ -inch, brass.....						
4	Buckles, wire, $\frac{1}{4}$ -inch, brass.....						
2	Buckles, nickel-plated, stirrup strap, 1 $\frac{1}{2}$ -inch.....						
6	Buckles, nickel-plated, girth, 1-inch.....	do.....					
4	Rings, $\frac{1}{4}$ -inch diameter, bronze.....	do.....					
5	Web, linen, straining, 3 $\frac{1}{2}$ -inch, yards.....	In compartment J. Battery wagon.	do.....				
7	Web, linen, straining, 5-inch, yards.....						

STATEMENT OF TOTAL EQUIPMENT OF ONE 4.7-INCH GUN BATTERY—
Continued.

No.	Article.	Where carried.	Property classification.				
			Class.	Section.			
RESERVE SUPPLIES FOR WAR SERVICE. ¹							
3	Buckles, bar, tongueless, $\frac{3}{8}$ -inch	In store	X	10			
5	Buckles, bar, tongueless, 1-inch						
12	Buckles, center bar, $\frac{3}{8}$ -inch						
2	Buckles, center bar, $\frac{3}{8}$ -inch						
4	Buckles, center bar, $\frac{3}{8}$ -inch						
4	Buckles, center bar, $\frac{1}{2}$ -inch						
4	Buckles, center bar, $\frac{1}{2}$ -inch						
4	Buckles, roller, $\frac{3}{8}$ -inch						
7	Buckles, roller, $\frac{3}{8}$ -inch						
12	Buckles, roller, $\frac{1}{2}$ -inch						
9	Buckles, wire, $\frac{3}{8}$ -inch						
2	Burners, lantern						
1	Chook "D"						
1	Chamois skin						
5	Conway loops, $\frac{1}{2}$ -inch						
4	Dressing, russet leather						
5	End buckles				do		
2	Gloves, lantern				do		
2	Hooks, back strap				do		
2	Hooks, collar strap				do	IV	8
4	Hooks, double, brass wire				do	IX	1
4	Hooks, end, brass wire				do	IX	5
2	Leather, bridle, backs				do	X	10
2	Leather, collar, backs						
40	Leather, harness, backs, pounds				do	X	10
1	Leather, lingo, side				do	IX	5
3	Nails, saddle						
1	Oil, clock, ounce				do	X	10
4	Oil, coal, gallons						
12	Oil, hydrofine, gallons						
12	Oil, lubricating (engine No. 1), gallons						
20	Oil, neat's-foot, gallons						
2	Oil, slushing, light, gallons						
1	Oil, sperm, gallon						
3	Ornaments, brow band	do	IX	5			
2	Rings, $\frac{7}{8}$ inch diameter, saddlebag	do	IV	8			
8	Rings, $1\frac{1}{2}$ inch diameter, saddle						
4	Rings, 2 inch diameter, halter						
4	Rings, 4 inch diameter, cincha strap						
4	Rings, 4 inch diameter, quarter strap						
3	Rings "D," 1 inch diameter, feed bag						
1	Rivets and burs, brass $\frac{1}{8}$ -inch, No. 10, pound				do	X	10
1	Rivets and burs, brass $\frac{3}{8}$ -inch, No. 10, pound						
25	Sal soda, pounds				do	IX	1
2	Snap hook, haversack, 1-inch				do	IV	8
3	Snap hook, feed bag	do	IX	5			
12	Squares, halter	do	X	10			
40	Soap, castile, pounds						
4	Soap, H. and H., cakes						
60	Soap, saddle, Frank Miller's, pounds						
25	Sponges, 5-inch				do	IV	8
3	Strap loops, feed bag						
2	Studs, saddlebag	do	IX	5			
1	Tacks, copper, 12-ounce, paper	do	X	10			
1	Tacks, copper, 20-ounce, paper						
1	Thread, carpet, No. 18, olive-drab, pound						
1	Thread, shoe, No. 3, brown, pound						
1	Thread, shoe, No. 10, brown, pound						
30	Waste, cotton, pounds						
1	Wax, stitching, brown, pound						
2	Wicks, lantern						

¹ No material will be drawn from this supply for making repairs and replacements except in sudden calls for field service if necessary to replace missing items of the regular supplies. To avoid deterioration, all perishable articles should be replaced by similar ones received with the regular 6 months' allowance.

INDEX.

A.

	Page.
Adjusting instruments.....	122
Ammunition.....	18
Ammunition, allowance of.....	26
Ammunition, blank:	
Care of cartridge case for.....	29
Precaution.....	28
Preparation.....	27
Ammunition chest, limber.....	73
Apron, caisson.....	75
Apron, carriage.....	53
Apron latch.....	53
Axle (caisson and caisson limber).....	73
Axle (carriage).....	42
Axle (carriage), to dismount.....	62
Axle (carriage limber).....	68
Axle (forge and store limber, battery and store wagon).....	85
Axle bearings, caisson limber.....	73
Azimuth pointer.....	50

B.

Battery wagon:	
Description.....	91
Nomenclature of parts.....	88
Block carrier.....	14
Block latch.....	15
Bolt snaps.....	95
Brake (battery and store wagon).....	93
Brake (caisson).....	76
Brake (carriage).....	52
Brake, to adjust.....	61
Brake, to dismount.....	61
Brake beam (caisson).....	76
Brake beam (carriage).....	52
Brake cross-brace.....	91
Brake lever (caisson).....	77
Brake lever (carriage).....	53
Brake rod.....	52
Brake segment.....	52
Brake shaft (caisson).....	76
Brake shaft (carriage).....	52
Brake shaft bracket.....	52
Brake shoe.....	52

	Page.
Breech mechanism:	
Action.....	15
Description.....	10
To dismantle.....	17
C.	
Caisson, model of 1908:	
Description.....	75
Nomenclature of parts.....	69
Weights, dimensions, etc.....	69
Caisson, model of 1916:	
Description.....	79
Nomenclature.....	77
Weights, dimensions, etc.....	77
Caisson prop.....	76
Care and maintenance of matériel, suggestions for.....	125
Carriage:	
Action of.....	49
Assembling.....	55
Description.....	41
Dismounting.....	55
Nomenclature of parts.....	35
Weights, dimensions, etc.....	34
Carriage parts, care and cleaning of.....	62
Carpenter's chest.....	94
Cartridge case.....	18
Chest (battery and store wagon).....	92
Chest (forge limber).....	85
Chest (store limber).....	87
Chest doors (caisson limber).....	74
Collar, steel.....	97
Collar-lifting device.....	99
Combination fuze, F. A.....	22
Compartments (battery and store wagons).....	92
Connecting pole body (caisson).....	75
Contents.....	5
Counter recoil buffer.....	46
Cradle, complete.....	44
Cradle, to dismount.....	60
Cradle band, front.....	45
Cradle band, rear.....	46
Cyclometer.....	95
Cylinder head.....	46
D.	
Diaphragms, limber.....	73
Doubletree.....	68
Drill cartridge.....	33
Dust guard.....	49

E.

	Page.
Elevating and traversing lock.....	51
Elevating bevel gear.....	50
Elevating bevel gear, to dismount.....	60
Elevating bevel pinion.....	50
Elevating bevel pinion, to dismount.....	60
Elevating gear bracket.....	50
Elevating mechanism:	
Action of.....	50
To assemble.....	60
Elevating pinion shafts.....	50
Elevating screw, to dismount.....	60
Elevating screws cover.....	51
Elevating yoke side.....	50
Elevating yoke transom.....	50
Equipment, list of.....	7
Equipment, table of total, of one battery.....	132
Extension rail, to assemble.....	55
Extension rail, to dismount.....	55
Extension rail body.....	45
Extension rail carrier.....	45
Extractor.....	15

F.

Firing bracket.....	48
Firing device.....	48
Firing handle.....	48
Firing handle shaft.....	48
Firing lock case.....	14
Firing mechanism (carriage), action of.....	48
Firing mechanism (gun):	
Description.....	12
To dismantle.....	16
Firing pin.....	12
Firing-pin spring.....	12
Flash lights, allowance of.....	129
Flasks.....	42
Foot rest (forge and store limbers).....	86
Forge limber:	
Description.....	85
Nomenclature.....	80
Weights, dimensions, etc.....	80
Frame (battery and store wagons).....	91
Frame (carriage limber).....	67
Fuzes.....	22

G.

General information.....	122
Gland:	
Adjustment.....	58
To assemble.....	58

Gun:	Page.
Care of.....	17
Care in dismounting.....	55
Description.....	9
To dismount.....	55
To mount.....	55
Weights, dimensions, etc.....	9
H.	
Hand fuze setter:	
Adaptability to other guns.....	33
Adjustment.....	33
Description.....	31
Operation.....	32
Harness, Artillery.....	95
Hinge pin.....	15
Hub liner, to remove.....	61
I.	
Inner counter recoil springs.....	47
Inner elevating screw.....	50
Intermediate plates.....	73
L.	
Leather:	
Black, care of.....	101
Care and preservation of.....	99
Reasons for oiling.....	99
Russet, care of.....	100
Limber, caisson:	
Description.....	73
Nomenclature of parts.....	69
Weights, dimensions, etc.....	69
Limber, carriage:	
Description.....	67
Nomenclature of parts.....	65
Weights, dimensions of.....	65
List of plates.....	7
Lock bolt.....	51
Lock-bolt casing.....	51
M.	
Main shield.....	53
Marking on ammunition packing boxes.....	26
Method of loading a battery for transportation.....	129
Middle rail (forge and store limbers).....	86
Middle counter recoil spring.....	47
Misfires and hangfires.....	34
O.	
Oils for artillery matériel.....	123
Oil can, caisson.....	76
Oil can, store limber.....	87
Operating lever.....	14
Operating lever latch.....	15
Outer counter recoil springs.....	47
Outer elevating screw.....	50

P.

	Page.
Padlocks.....	95
Painting artillery matériel.....	122
Panoramic sight case.....	54
Pintle, caisson limber.....	74
Pintle, carriage limber.....	67
Pintle bolt, carriage limber.....	68
Pintle bearing.....	44
Pintle bearing support, caisson limber.....	74
Pintle yoke.....	44
Pintle yoke, to dismount.....	62
Piston, to remove.....	57
Piston rod.....	47
Piston rod, to remove.....	57
Piston rod head.....	47
Pole.....	68
Pole clamp (forge and store limbers).....	86
Pole socket (caisson).....	75
Pole socket (caisson limber).....	74
Pole socket base.....	74
Powder charge.....	20
Plates, list of.....	7
Primer, 110 gr., percussion.....	19
Primer, saluting, percussion.....	19
Projectiles.....	20
Prop (battery and store wagons).....	92

Q.

Quadrant, range:	
Adjustment of.....	117
Care of.....	117
Case for.....	54
Description.....	112
Spare.....	121
To adjust.....	119
Use of.....	114

R.

Range table.....	29
Recoil indicator.....	49
Recoil indicator throw, to remove.....	55
Recoil cylinder:	
Care and cleaning of.....	62
Description.....	46
To assemble.....	56
To dismount.....	56
To drain.....	56
To fill.....	56
Reloading and cleaning outfit.....	124
Repairs for Field Artillery matériel.....	124
Riveting, instructions for.....	

	Page.
Saddler's chest.....	94
Sear.....	13
Semple tracer.....	21
Shell.....	20
Shield:	
Description.....	53
To dismount.....	60
Shoulder guard.....	54
Shrapnel.....	21
Sights:	
Additional tests for.....	121
Adjustment of.....	117
Care of.....	115
Spare.....	121
Use of.....	114
Verification of parallelism of lines of.....	119
Sight, front:	
Care of.....	115
Description.....	101
To adjust.....	119
Sights, line.....	101
Sight, panoramic, model of 1904:	
Care of.....	116
Description.....	103
To adjust.....	118
Use of.....	115
Sight, panoramic, model of 1915:	
Care of.....	116
Description.....	106
To adjust.....	117
Use of.....	115
Sight, rear:	
Care of.....	115
Description.....	102
To adjust.....	119
Spade.....	43
Spare wheel fastenings.....	93
Spring compressor.....	54
Spring cylinder.....	44
Spring rod.....	47
Spring-rod yoke.....	48
Spring stirrup, inner.....	47
Spring stirrup, outer.....	47
Spring-stirrup head, inner.....	47
Spring-stirrup head, outer.....	47
Spring system:	
To assemble.....	58
To dismount.....	59
Store limber:	
Contents.....	87
Description.....	87
Nomenclature of parts.....	80
Weights, dimensions, etc.....	80

	Page.
Store wagon:	
Description	91
Nomenclature of parts.....	88
Stuffing box.....	46
Stuffing box, to pack.....	57
Supplies in general.....	128

T.

Targets	122
Top carriage (carriage limber)	67
Top-carriage rail (carriage limber).....	67
Top shield.....	53
Trail:	
Description	42
To dismount	62
Trail prop.....	44
Traveling lock.....	52
Traveling-lock frame.....	52
Traveling-lock legs.....	52
Traversing bracket.....	49
Traversing bracket, to dismount	62
Traversing gear, to dismount	60
Traversing handwheel.....	49
Traversing nut.....	49
Traversing screw.....	49
Traversing-screw bracket.....	49
Trigger fork	13
Trigger shaft	14
Trunnion band.....	45

W.

Wheels:	
Description	41
To remove.....	61
Wheel fastening.....	42

WAR DEPARTMENT,

OFFICE OF THE CHIEF OF ORDNANCE,

Washington, September 15, 1917.

November 19, 1910.

Revised September 15, 1917.

Form No. 1771.

Ed. Sept. 15-17-5000.



370989

L. S.

U.F.S. 2

A. S.

4.7.21

976

UNIVERSITY OF CALIFORNIA LIBRARY

