

HANDBOOK OF THE 5-INCH SIEGE GUN BATTERY

WITH
INSTRUCTIONS FOR ITS CARE

(NINETEEN PLATES)

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By order of the Secretary of War.

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

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HANDBOOK OF THE 5-INCH SIEGE GUN BATTERY.

EQUIPMENT OF BATTERY.

The equipment of the battery is as follows:

- 4 5-inch siege guns.
- 4 5-inch siege-gun carriages, each drawn by eight horses.
- 4 siege limbers.
- 4 artillery ammunition wagons, each drawn by eight horses.
- 1 forge and battery wagon, drawn by six horses.
- 1 artillery store wagon, drawn by six horses.
- 28 sets of artillery harness, lead.
- 10 sets of artillery harness, wheel.
- 38 harness sacks.
- 1 stirrup with guidon socket.
- 30 cinchas, extra.
- 2 arm racks, revolver.
- 1 battery commander's telescope, complete.
- 10 battery commander's rulers, wooden.

Three of the artillery ammunition wagons will be used as ammunition wagons and one as an implement wagon.

The forge and battery wagon and artillery store wagon are the same as issued to the batteries of the 3.2-inch field artillery.

Six Army wagons, of standard pattern, each drawn by six mules, will be furnished by the Quartermaster Corps to each battery when needed on marches and in the field.

INDIVIDUAL ARMS AND EQUIPMENTS FOR FIELD SERVICE.

(a) For each enlisted man:

- 1 pistol or revolver.
- 1 pistol or revolver holster.
- 1 pistol belt or revolver cartridge belt.
- 1 canteen, Cavalry.
- 21 cartridges, ball, pistol, or 20 cartridges, ball, revolver.
- 1 pouch for first-aid packet.
- 1 meat can.
- 1 cup.
- 1 knife.
- 1 fork.
- 1 spoon.
- 2 extra magazines, if pistol be issued.

(b) For each enlisted man individually mounted in addition to (a):

- 1 saddle, McClellan, field artillery.¹
- 1 saddlebags, pair.
- 1 spurs, pair.
- 1 spur straps, set.
- 1 Cavalry bridle, model of 1909, or curb bridle, model of 1902.
- 1 currycomb.
- 1 horse brush.
- 1 canteen strap, cavalry.
- 1 watering bridle if curb bridle, model of 1902, be issued.
- 1 link.

(c) For each driver in addition to (a):

- 1 currycomb.
- 1 horse brush.
- 1 spurs, pair.
- 1 spur straps, set.
- 1 canteen strap, cavalry.

(d) For each cannoneer in addition to (a):

- 1 haversack.
- 2 canteen-haversack straps.

(4) For regimental and battalion noncommissioned staff, officers and drum major in addition to (b):

- 1 cavalry saber and scabbard.
- 1 saber attachment.
- 1 saber knot.
- 2 saber straps.

The revolver cartridge or pistol belt will be provided with saber ring.

(f) The following horse equipment is provided for each horse:

- 1 saddle blanket.²
- 1 halter headstall.²
- 1 halter strap (halter tie rope).²
- 1 nose bag, or feed bag (with grain bag).
- 1 surcingle.

5-INCH SIEGE GUN, MODEL OF 1890.

TABLE OF WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight.....	pounds..	3, 660
Total length.....	feet..	12. 15
Length of bore.....	calibers..	27
Maximum diameter, breech.....	inches..	15
Diameter of muzzle.....	do....	8
Diameter of trunnions.....	do....	5. 8
Length of trunnions.....	do....	3. 3
Distance between rimbases.....	do....	15
Distance of axis of trunnions from muzzle.....	do....	96. 25

¹ This saddle differs from the Cavalry saddle in that two cantle coat straps are 60 inches instead of 45 inches long.

² Part of harness for all draft horses.

Rifling:

Number of grooves.....	30
Width of grooves.....inch..	0.3736
Depth of grooves.....do....	.05
Width of lands.....do....	.15
Twist, in calibers.....	1 in 50 to 1 in 25

Powder chamber:

Diameter.....	inches..	5.7
Length.....	do....	15.15
Capacity.....	cubic inches..	387.5
Total capacity of bore.....	do....	2,809

Projectile:

Kind.....	<i>C. I. shell.</i>	<i>C. S. shell.</i>	<i>Shr.</i>
Weight, filled.....pounds..	45	45	45
Ratio, weight to weight of piece.....	1 to 81	1 to 81	1 to 81
Weight of bursting charge (pounds).....	(R. P.) 2.21	(H. E.) 1.75	0.75
Length.....calibers..	3.0	2.6	2.4
Sectional density $\frac{W}{d^2}$	1.8	1.8	1.8

Travel of projectile, 119.8 inches.

Powder:

Kind.....	{	Brown.....	sphero hex. field cannon
	{	Smokeless.....	siege gun and howitzer
Weight ¹pounds..	{	Brown.....	pounds.. 13
	{	Smokeless.....	do.... 5.37
Density of loading.....	{	Brown.....	.9096
	{	Smokeless.....	.3836
Muzzle velocity.....	{	Brown.....	feet per sec.. 1,830
	{	Smokeless.....	do.... 1,830
Maximum pressure per square inch...	{	Brown.....	pounds.. 35,000
	{	Smokeless.....	do.... 35,000
Muzzle energy.....	{	Brown.....	foot-tons.. 1,045.9
	{	Smokeless.....	do.... 1,045.9

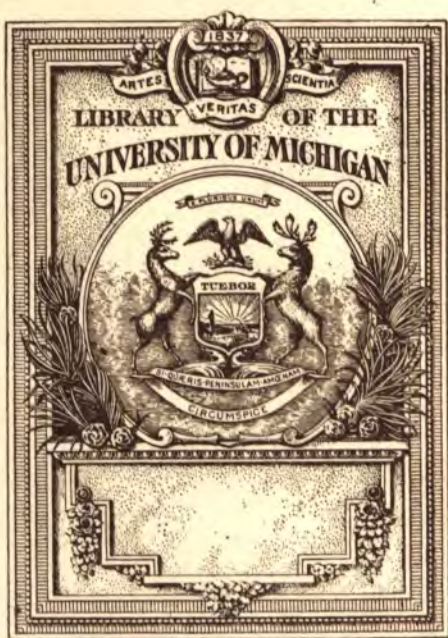
Penetration in steel at (De Marre formula,
normal impact):

Muzzle.....	{	Brown.....	inches.. 6.2
	{	Smokeless.....	do.... 6.2
1,000 yards.....	{	Brown.....	do.... 4.6
	{	Smokeless.....	do.... 4.6
2,500 yards.....	{	Brown.....	do.... 3
	{	Smokeless.....	do.... 3
3,500 yards.....	{	Brown.....	do.... 2.5
	{	Smokeless.....	do.... 2.5

DESCRIPTION OF THE GUN.

The 5-inch siege gun is a breech-loading gun, weighing 3,660 pounds, intended, as its name indicates, to form part of the siege train. Its weight permits of transportation over ordinary roads and pontoon bridges.

¹ The weights are approximate. The exact weight, giving the standard muzzle velocity, is determined from the acceptance test and the charges for issue are made up accordingly.



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lation. They also support the block in the carrier ring when the latter is swung away from the gun. Vent holes are drilled through these guide sectors to allow the air to escape in closing the breech. The latch cover is a separate piece which retains the latch and its spring in their seats and protects them from injury. It is fastened to the rear face of the carrier ring by two screws, so that by taking out the screws the cover may be removed and the latch and its spring taken out when the block is locked in the piece.

The latch is the locking device for the carrier ring. It fits in a mortise through the latter and is retained there by the latch cover. The end of the latch nearer the breechblock is called the stem, and the opposite end the head. On the rear face of the latch is a shoulder, between which and one on the latch cover a spiral spring, called the latch spring, is compressed and acts to push the stem of the latch against the breechblock. In the front face of the latch is a recess with beveled edges, into which a hardened conical stud in the breech bushing fits. This stud is called the latch stud, and the recess the latch-stud recess. In the jacket opposite the head of the latch, when the carrier ring is in its seat, is a recess called the latch recess.

The action of the latch is as follows: When the block is withdrawn the stem of the latch is forced by the latch spring into the locking recess at the end of the latch groove (longitudinal section) and firmly locks the block to the carrier ring. When the latter is swung into its seat, the latch stud bears against the beveled edge of the latch-stud recess and lifts the stem of the latch out of the locking recess and leaves the block free to move forward in the ring. As the block starts forward, the inclined bottom of the latch groove forces the latch away from the axis of the block and causes the head of the latch to enter the latch recess in the jacket, thereby locking the carrier ring to the jacket during the motion of translation. As the block is rotated into its seat, the stem of the latch rides down into the circular portion of the latch groove, withdrawing the head of the latch from the latch recess and releasing the carrier ring from the jacket while the piece is being fired. The carrier ring is securely held in place by the block during firing without interposition of the latch.

The office of the latch is therefore to lock the carrier ring to the breech of the piece while the block is being translated and to lock the block in place in the carrier ring while it is being swung to one side.

The stop is a bolt of rectangular cross section inserted through the carrier ring between the hinge lugs and projecting beyond the bore of the ring into the stop groove on the block. It is held in place by a screw which passes through the ring and stop from the front face of the former. This stop limits the longitudinal and rotary motions of the block.

The hinge pin is mounted on the left side of the gun. It passes through the two lugs on the carrier ring and the lug on the jacket. It is secured in place by two screws which pass through the carrier-ring lugs into the hinge pin.

The hinge ears are lugs projecting from the carrier ring on its left side, in which the hinge pin has its bearing.

OBTURATOR.

The obturator is composed of the following parts: The spindle, front and rear split rings, spindle split ring, gas-check pad, filling-in disk, obturator-spindle nut, spring, and spline screw.

The object of the obturator, complete, is to prevent the escape of gas from the powder chamber to the rear during the firing and to transmit to the breechblock the stress of firing resulting from the pressure of gases upon the bottom of the bore.

The obturator spindle is mounted in the block in the obturator-spindle recess, through which its stem extends. The rear end of the stem is threaded for the obturator-spindle nut, while the front end is enlarged into a mushroom-shaped head, which forms the bottom of the bore.

The vent is axial and is drilled through the spindle. A copper bushing, forced into an undercut in the face of the mushroom head, protects the vent from erosion and enables repairs to be easily made. In passing through this copper plug the vent is reduced in size from 0.2 to 0.1 of an inch in diameter. The rear end of the vent is enlarged and threaded for the obturating primer used to ignite the charge.

The split rings are of steel, accurately finished, and split diagonally through one side. The exterior ones are made of slightly greater diameter than the conical gas-check seat in the gun and are sprung into place. The interior one is slightly smaller than its seat on the spindle. The filling-in disk is merely a steel washer interposed between the gas-checking device and the front face of the breechblock. A slight shoulder on the rear face of the mushroom head supports and centers the front split ring. The rear split ring is similarly held by an offset on the front face of the filling-in disk.

The gas-check pad of the earlier model is a disk of asbestos and tallow (the later model is a composition of asbestos 3 parts, nonfluid oil 1 part, and is marked on the edge and both sides in black letters N. F. O. to distinguish it from earlier model) compressed under heavy pressure and covered with canvas. It forms a yielding medium for the transmission of pressure to the block. Under the pressure of firing the plastic nature of the pad causes it to press outward toward the gas-check seat and inward against the spindle, forcing the split rings firmly against their seats and completely stopping the passage of gas.

The obturator spring is of steel and surrounds the rear end of the stem, being compressed between the nut and the shoulder in the spindle recess, thus serving to take up any excess of length of the spindle due to compression of the pad.

The obturator-spindle nut is screwed on the rear end of the stem and holds the spindle in its position in the block.

The spline screw, with its seat partly in the nut and partly in the spindle stem, prevents unscrewing of the nut.

VENT COVER.

The vent cover consists of two parts—the cover proper and the vent-cover lever. The latter is a straight piece with a stud at one end, a square thread terminating in a thread for a nut at the other, and a longitudinal slot near its middle point. The cover is curved with a mortise in one end to fit on the tenon of the lever.

The lever is assembled in a radial mortise cut through the breech-block just in front of the projecting flange on the rear of the block and is held in place by a pin screwed into the block from the rear and passing through the slot referred to above. A slot way in the carrier ring receives the stud on the lever and is so placed and inclined to the radius that at the first movements of opening the breech the vent cover is moved in front of the vent; it is retained there by gravity and prevents the insertion of a primer until the breech is closed after firing. By the last motions of closing the breech the vent cover is withdrawn from in front of the vent.

ACTION OF MECHANISM.

The action of the breech mechanism is as follows:

TO OPEN THE BREECH.—Raise the lever handle as high as possible, releasing the cam from the cam seat; carry the lever to the left until the block strikes the stop, disengaging the threaded sectors of the block from those of the breech bushing. This rotation also pushes the head of the latch into the latch recess and locks the carrier ring to the jacket. Grasp the handle of the block and draw it to the rear. If it can not be easily withdrawn, bring the lever handle down against the rear face of the block, causing the cam to bear against the carrier ring and starting the gas check from its seat. At the end of the motion of withdrawal, the stem of the latch drops into the locking recess in the block and locks the block in place in the carrier ring. Swing the block and carrier ring about the hinge pin as a center, so as to uncover the bore.

TO CLOSE AND LOCK THE BREECH.—Raise the lever handle as high as possible; grasp the block handle and swing the block around, pushing the carrier ring quickly into its seat. As the ring strikes its seat, the latch stud enters the hole in the front face of the ring and,

bearing against the beveled edge of the latch-stud recess, lifts the latch out of the locking recess and frees the block for its forward movement; push the block forward.

In this movement the ramp in the latch groove forces the latch into the latch recess and locks the carrier ring to the jacket. Turn the lever to the right through one-sixth of a revolution, engaging the threads of the block in those of the breech bushing; throw the lever down against the rear face of the block. This brings the cam into its recess in the carrier ring and locks the block in position for firing.

The revolution of the block through its one-sixth of a turn withdraws the latch from the latch recess and frees the carrier ring from the jacket. This leaves both latch and carrier ring unstrained by the firing. The stress of firing is borne by the threads of the block and transmitted through the jacket forward to the trunnions.

The latch is an auxiliary part not essential to the firing of the piece, and if broken may be removed by taking off the latch cover. In firing under such circumstances great care must be taken in opening the breech to hold the carrier ring in place by hand until the block is withdrawn, and in closing it to avoid pushing the block home until it is revolved to its extreme position.

Ordinarily the various movements of the lever handle in opening and closing the breech are made successively without pause, the force of one hand being sufficient to operate the mechanism.

TO DISMOUNT THE BREECH MECHANISM.

TO REMOVE MECHANISM FROM THE GUN.—Remove the carrier-ring hinge-pin set screws; open the breech, swinging the block clear of the bore; support the block and carrier ring, and drive the carrier-ring hinge pin from its seat with a bronze drift; block and carrier ring are now free to be lifted from the gun.

TO REMOVE CARRIER RING FROM BREECHBLOCK.—The mechanism must first be removed from the gun, as described above. Remove stop screw; place extractor for stop in carrier ring with legs resting on carrier ring between the hinge lugs; screw extractor-screw bolt into threaded hole in end of stop until latter is drawn far enough from its seat to clear stop groove in breechblock; block is then free to be withdrawn from carrier ring. In using the extractor care should be taken to have its legs rest entirely on the carrier ring and not overlap the end of the stop bolt.

TO REMOVE THE VENT COVER.—Open the breech of the gun; remove vent-cover screw; remove the nut connecting vent cover and lever. The lever may then be withdrawn from the block.

TO REMOVE THE OBTURATOR SPINDLE FROM THE BLOCK.—Open the breech of the gun (if mechanism is mounted); remove the vent cover; remove the obturator-nut spline screw; remove the obturator

nut with special wrench provided for the purpose. Obturator spindle may now be removed from the gun and the filling-in disk, pad, split rings, and obturator spindle spring dismantled.

To DISMOUNT LEVER HANDLE.—Open breech of the gun; remove lever-handle hinge-pin set screw; drive hinge pin from its seat with bronze drift. Lever handle is now free.

To REMOVE THE LATCH.—Remove latch-cover screws and take off latch cover. Latch and latch spring may now be removed.

TO ASSEMBLE THE MECHANISM.

The converse of the above instructions is followed in mounting the breech mechanism on the gun.

5-INCH SIEGE GUN, MODEL OF 1898.

(Stockett Breech Mechanism.)

TABLE OF WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight.....	pounds..	3,639		
Total length.....	feet..	11.91		
Length of bore.....	calibers..	27		
Maximum diameter, breech.....	inches..	15		
Diameter of muzzle.....	do....	8		
Diameter of trunnions.....	do....	5.8		
Length of trunnions.....	do....	3.3		
Distance between rimbases.....	do....	15		
Distance of axis of trunnions from muzzle.....	do....	95.8		
Rifling:				
Number of grooves.....		30		
Width of grooves.....	inch..	0.3736		
Depth of grooves.....	do....	0.05		
Width of lands.....	do....	0.15		
Twist, in calibers.....	1 in 50 to 1 in 25			
Powder chamber:				
Diameter.....	inches..	5.7		
Length.....	do....	15.15		
Capacity.....	cubic inches..	402.5		
Total capacity of bore.....	do....	2,809		
Projectile:				
Kind.....	<i>C. I. shell.</i>	<i>C. S. shell.</i>	<i>Shr.</i>	
Weight, filled.....	pounds.. 45	45	45	
Ratio, weight to weight of piece.....	1 to 81	1 to 81	1 to 81	
Weight of bursting charge.....	pounds..		0.75	
Length.....	calibers.. 3.0	3.0	2.4	
Sectional density $\frac{W}{d^2}$	1.8	1.8	1.8	

Travel of projectile, 119.8 inches.

Powder:

Kind.....	{Brown.....sphero hex. field caannon.
	{Smokeless.....siege gun and howitzer.
Weight ¹	{Brown.....pounds.. 13
	{Smokeless.....do.... 5.37
Density of loading.....	{Brown..... 0.909
	{Smokeless..... 0.3693
Muzzle velocity.....	{Brown.....feet per sec.. 1,830
	{Smokeless.....do.... 1,830
Maximum pressure per square inch...	{Brown.....pounds.. 35,000
	{Smokeless.....do.... 35,000
Muzzle energy.....	{Brown.....foot tons.. 1,045.9
	{Smokeless.....do.... 1,045.9

Penetration in steel at—

(De Marre formula, normal impact):

Muzzle.....	{Brown.....inches.. 6.2
	{Smokeless.....do.... 6.2
1,000 yards.....	{Brown.....do.... 4.6
	{Smokeless.....do.... 4.6
2,500 yards.....	{Brown.....do.... 3
	{Smokeless.....do.... 3
3,500 yards.....	{Brown.....do.... 2.5
	{Smokeless.....do.... 2.5

DESCRIPTION OF THE GUN.

The model of 1898 5-inch siege gun is built up of precisely the same parts assembled in the same manner as the model of 1890 gun heretofore described. The gun of later design is fitted with an improved breech mechanism with a comparatively short breechblock, which permits the total length of the gun to be reduced without changing in any respect the size or capacity of the bore and powder chamber. A comparison of tables of principal dimensions, weights, etc., shows that in the characteristics given by the table the two models are practically identical.

The breech mechanism swings to the right in opening, so that the hinge lugs for the block carrier are on the jacket on that side of the gun. These lugs are carried by the cast-steel hinge plate, attached by six screws to the jacket. This change necessitates placing the rear-sight socket on the left side of the breech and the trunnion sight on the left rimbase.

A lifting eyebolt is screwed into the trunnion hoop over the center of gravity of the gun and is used in mounting and dismounting the gun and in shifting it from firing to traveling position and the reverse.

Two seats for the feet of the gunner's quadrant are squared off on the upper side of the piece near the breech end.

¹ The weights are approximated. The exact weight, giving the standard muzzle velocity, is determined from the acceptance test and the charges for issue are made up accordingly.

The mechanism used with this gun is of the interrupted-screw type, with four threaded and four slotted sectors. The interior of the base ring is threaded and slotted in the usual manner to correspond, after which certain parts of the threaded sectors are cut away and certain parts of the slotted sectors deepened to provide clearance for the breechblock in swinging it away from the gun.

5-inch siege gun, model of 1898, nomenclature of breech mechanism. (Stockett.)

Num-ber.	Name of part.	Location, etc.	Material.
1	Breechblock.....	In breech recess.....	Steel.
1	Breechblock pallet.....	In breechblock.....	Steel.
2	Breechblock-pallet screws.....	In breechblock.....	Steel.
1	Block carrier.....	Hinged to jacket.....	Cast steel.
1	Block-carrier hinge pin.....	Carrier to hinge plate.....	Steel.
1	Block-carrier hinge plate.....	Fastened to jacket.....	Cast steel.
6	Screws for above.....	Hinge plate to jacket.....	Steel.
1	Segment and rack.....	Rear end of block.....	Bronze.
2	Screws for segment and rack.....	Segment to block.....	Steel.
1	Pinion.....	On pinion seat.....	Steel.
1	Pinion pivot.....	Screwed into pinion seat.....	Steel.
1	Pinion-pivot nut.....	End of pivot.....	Steel.
1	Lever.....	Seated on pinion.....	Steel.
	Latch:		
1	Latch bolt.....	In radial hole through carrier.....	Steel.
1	Latch-bolt seat.....	Fitted into breech face of gun.....	Steel.
2	Latch-bolt seat screws.....	Screwed into breech face of gun.....	Steel.
1	Tripping stud.....	Fitted into breech face of gun.....	Steel.
2	Tripping-stud screws.....	Screwed into breech face of gun.....	Steel.
1	Latch lever.....	In slot in carrier.....	Steel.
1	Latch-lever pivot.....	Screwed into carrier.....	Steel.
1	Latch spring.....	In lever slot.....	Steel.
1	Spindle.....	In spindle recess of block.....	Steel.
1	Spindle key.....	In block carrier.....	Steel.
1	Spindle-key screw.....	In block carrier.....	Steel.
1	Spindle nut.....	Screwed on end of spindle.....	Steel.
1	Spindle pallet.....	In spindle.....	Steel.
2	Spindle-pallet screws.....	In spindle.....	Steel.
	Gas check:		
1	Exterior split ring, front.....	Rear face of mushroom head.....	Steel.
1	Exterior split ring, rear.....	Between pad and filling-in disk.....	Steel.
1	Interior split ring.....	On stem under pad.....	Steel.
1	Filling-in disk.....	Front face of block.....	Steel.
1	Pad, old model.....	Between mushroom head and filling-in disk.....	Asbestos and tal- low.
1	Pad, new model.....	Between mushroom head and filling-in disk.....	3 parts asbestos, 1 part nonfluid oil.
1	Spindle-ball washer.....	On stem between nuts and block.....	Steel.
2	Washer rings.....	Part of washer.....	Steel.
23	Hardened balls, $\frac{1}{4}$ inch diam-eter.....	Part of washer.....	Steel.
1	Washer clamp.....	Part of washer.....	Copper.
1	Vent bushing.....	Front end of vent.....	Copper.
	Firing attachment:		
1	Housing.....	End of spindle.....	Steel.
1	Slide.....	In housing.....	Steel.
1	Slide handle.....	On slide.....	Steel.
1	Slide stop.....	On housing.....	Steel.
1	Firing leaf.....	On slide.....	Steel.
1	Firing-leaf spring.....	On slide.....	Steel.
1	Firing-leaf pivot.....	On slide.....	Steel.
1	Firing-leaf stop.....	On gear segment.....	Steel.
1	Ejector.....	On housing.....	Steel.
1	Spline screw.....	On housing.....	Steel.

BREECH MECHANISM (STOCKETT).

[Plate II.]

The principal parts of the mechanism are the breechblock, segment and rack, block carrier, lever, pinion, latch, obturator, and firing attachment.

BREECHBLOCK.

The breechblock is a steel block with an axial hole for the reception of the obturator spindle and washer. The front part of the block for a distance of 0.4 inch back is reduced in diameter. This reduced part, or nose of the block, leaves a space in the breech recess of the gun in which fouling may collect without interrupting the working of the block.

The block is threaded with a V-shaped thread with rounded top and bottom. The threaded portion is divided circumferentially into eight equal parts and the threads cut from the alternate sectors. The sectors from which the threads are cut are called the slotted sectors and permit the entry of the block past the corresponding sectors in the block recess. The threaded sectors of the block are then engaged with the threaded sectors of the recess by revolving the block through an angle of 45 degrees about its longitudinal axis. Portions of the threaded sectors on the block are cut away and parts of the slotted sectors deepened to provide clearance between the block and breech recess when the former is swung to or from the gun.

The rear end of the block is turned down, and the cylindrical surface thus formed is prolonged into the block and increased in length by means of an annular groove cut in the rear face of the block. This cylindrical surface is called the guide cylinder, and the annular groove the guide groove of the block. That portion of the rear end of the block which lies outside of the guide groove is called the stop flange. When the block is withdrawn, the stop flange strikes the bottom of the stop groove in the block carrier and limits the rearward motion of the block. The guide cylinder supports the breechblock in the block carrier and guides it in its motions of rotation and translation. The guide flange of the block carrier fits into the guide groove of the block and assists in supporting and guiding the latter. Four oil holes are drilled radially from the exterior of the block to the bottom of the guide groove to facilitate oiling the bearing surfaces. These holes also act as air vents. An oil hole cut radially in the nose of the block, closed by a screw, is provided for oiling the front face of the block.

The locking recess, in which the head of the latch bolt fits, is cut in the surface of the guide cylinder. It consists of a circular portion joined to a longitudinal portion of increasing depth, terminating

at its front end in a well called the locking recess. When the block is withdrawn, the head of the latch bolt drops into the locking recess and bolts the block positively to the block carrier.

SEGMENT AND RACK.

The segment and rack is attached to the rear end of the breechblock by a spline and two screws. It is of bronze and consists essentially of a segment, a bevel gear, and a short rack. It gears with a steel pinion pivoted on the block carrier and actuated by the lever handle. Part of the periphery of the pinion is cut into a bevel gear and another part into a pinion, meshing into the corresponding parts of the segment and rack. The bevel-gear parts rotate the block and the rack-and-pinion parts translate it. These motions are successive; the termination of the motion of rotation in opening the breech brings the rack and pinion into the proper position to withdraw the block, and the termination of the motion of translating in closing the breech brings the bevel-gear segments into mesh to rotate it.

BLOCK CARRIER.

The block carrier is a steel casting swung by means of a hinge pin to the hinge plate attached to the jacket on the right side of the breech. As its name indicates, its principal office is to support the block in the various movements of the latter. It is bored to take the breechblock guide cylinder. On the front face of the carrier, surrounding this bore, is a projecting ring which forms a flange to enter the guide groove of the block and assist in supporting and guiding the latter. The flange is called the guide flange. An annular groove, called the stop groove, cut in the front face of the carrier at the base of the guide flange, increases the height of the latter and forms a stop against which the stop flange of the breechblock strikes, limiting the motion of the block to the rear.

A lug projects to the rear from the lower part of the block carrier and forms a seat for the pinion. The latter is mounted on this seat upon a pivot formed by a screw bolt which passes through the pinion and screws into the seat. The pivot pin is prevented from unscrewing by a jam nut screwed on under the seat. The lever for actuating the pinion is fitted on a squared seat upon the latter. The free end of the lever terminates in a vertical handle.

LATCH.

The latch is the locking device for the block carrier. It consists of a latch bolt, spring lever, and lever pivot mounted in the block carrier, and the latch-bolt seat and tripping stud screwed to the breech face of the gun.

The latch bolt is steel and lies in a radial hole drilled through the block carrier. The end of the bolt nearer the axis of the block is tapered to facilitate its entering the locking recess in the breechblock guide cylinder. It is also slightly beveled on the end so that it will more easily ride out of the locking recess and up the ramp at the longitudinal portion of the locking recess. The outer end of the bolt has a mortise cut through it in which one end of the latch lever works. This end of the latch bolt is also slightly beveled to make it ride out of the latch-bolt seat. The latch-bolt seat is a lug secured to the breech face of the gun by means of two screws, with a hole through it of proper size to take the outer end of the latch bolt. This lug is so located that the head of the latch bolt will enter the latch-bolt seat when the block carrier is against the breech face of the piece.

The latch lever is pivoted in a circumferential slot in the exterior surface of the carrier. The latch-lever pivot is a small screw bolt inserted from the outer face of the carrier. One end of the lever works in the mortise in the latch bolt; the other end is broadened, forming a shoulder against which a spiral spring, called the latch spring, bears. This spring is compressed between the block carrier and the latch-lever shoulder, and constantly urges, by means of the lever, the latch bolt toward the breechblock. When the block is swung away from the breech the head of the latch bolt rests in the locking recess in the guide cylinder and locks the block to the block carrier. In this position the end of the latch lever, against which the spring bears, projects slightly beyond the exterior surface of the block carrier. In closing the breech, just before the carrier comes in contact with the breech face of the gun, this projecting part of the lever strikes the beveled surface of the tripping stud and is forced toward the axis of the block. This motion of the lever lifts the latch bolt from the locking recess and leaves the block free to be translated through the block carrier.

The tripping stud is a stud secured to the breech face of the gun by two screws opposite the seat of the latch spring in the block carrier. The side of the lug toward the carrier is slightly beveled and serves, as just explained, to trip the latch and unlock the breechblock from the block carrier as the latter strikes the breech face of the gun.

The complete action of the latch is as follows: With the breech closed, the outer end of the latch bolt rests in the latch-bolt seat, locking the block carrier to the breech face of the gun; the inner end of the latch bolt rests on the guide cylinder of the block. During rotation of the block in opening the breech, the end of the latch bolt traverses the guide cylinder. In withdrawing the block, the latch bolt traverses the guide cylinder.

During the latter part of the translating motion, the bolt rides down the ramp of the locking recess and withdraws its outer end from the latch-bolt seat, freeing the block carrier from the breech of the gun.

At the end of the motion of withdrawal the head of the latch bolt is in the locking recess at the termination of the guide groove, with the end of the bolt about 0.15 inch from the bottom of the recess. As the block carrier is swung away from the gun the end of the latch lever clears the tripping stud so that the full force of the latch spring comes into play and the latch bolt is forced to the bottom of the locking recess, securely locking the block to the block carrier. In closing the breech the action of the latch is the reverse of that just given. With breech open the block is locked to the block carrier. As the latter is swung against the breech face of the gun the tripping stud, by means of the lever, raises the latch bolt far enough from the bottom of the locking recess for the end of the bolt to ride on the ramp as the block is moved forward through the block carrier. As the bolt rides up the ramp in the latch groove its outer end enters the latch-bolt seat and locks the block carrier to the breech face of the gun.

OBTURATOR.

The obturator is composed of the following parts: The spindle, front and rear exterior split rings, interior split ring, gas-check pad, filling-in disk, spindle nut, spindle-ball washer, and spindle key.

The object of the obturator, complete, is to prevent the escape of gas from the powder chamber to the rear during firing and to transmit to the breechblock the stress of firing resulting from the pressure of gases upon the bottom of the bore.

The obturator spindle is mounted in the block in the obturator-spindle recess, through which its stem extends. The rear end of the stem is threaded for the obturator-spindle nut, while the front end is enlarged into a mushroom-shaped head, which forms the bottom of the bore. The stem is also provided with a hardened-steel pallet, in which is cut a key seat, into which a key is fitted for preventing any rotation of the spindle.

The vent is axial and is drilled through the spindle. A copper bushing, forced into an undercut in the face of the mushroom head, protects the vent from erosion and enables repairs to be easily made. In passing through this copper plug the vent is reduced from 0.2 to 0.1 of an inch in diameter. The rear end of the vent is formed into a primer seat to take the primer used to ignite the charge.

The split rings are of steel, accurately finished and split diagonally through one side. The exterior ones are made of slightly greater diameter than the gas-check seat in the gun and are sprung into place. The interior one is slightly smaller than its seat on the

spindle. The filling-in disk is merely a steel washer interposed between the gas-checking device and the front face of the breech-block. A slight shoulder on the rear face of the mushroom head supports and centers the front split ring. The rear split ring is similarly held by an offset on the front face of the filling-in disk.

The gas-check pad of the earlier model is a disk of asbestos and tallow; a later model is a composition of asbestos 3 parts, nonfluid oil 1 part, and is marked on the edge and both sides in black letters N. F. O. to distinguish it from the earlier model, compressed under heavy pressure and covered with canvas. It forms a yielding medium for the transmission of pressure to the block. Under the pressure of firing, the plastic nature of the pad causes it to press outward toward the gas-check seat and inward against the spindle, forcing the split rings firmly against their seats and completely stopping the passage of gas.

The spindle-ball washer consists of two steel rings, with a groove cut in one face of each ring to form a pocket for twenty-three 0.3-inch hardened-steel balls. The rings, with the balls between them, are held together by a cylinder of $\frac{1}{2}$ -inch copper, which lines the bore of the rings and has its ends flanged outward over their end faces. The washer is interposed between the spindle nut and the breech-block and reduces the friction between them when the block is rotated.

The spindle nut is screwed on the rear end of the stem of the spindle with a left-hand thread, and holds the spindle in its position in the block. It is provided with a screw slot and plainly stamped to indicate direction of unscrewing.

The spindle key extends radially through the block carrier and block, and its inner end enters the key seat in the spindle and prevents the spindle from turning, thus holding the firing attachment, which is attached to the end of the spindle, in a vertical position. The spindle key also serves as a stop for limiting both rotation and translation of the breechblock.

FIRING ATTACHMENT.

This attachment is intended for use with an obturating friction primer, and it consists of the following principal parts: Slide, slide housing, ejector, and firing leaf.

The housing is attached to the rear end of the spindle by means of an interrupted screw thread, and is secured in place by a spline screw.

The slide has a vertical movement in guides, which project from the rear face of the housing, and its movement is limited by the slide stop, which is a screw bolt on the right side of the housing; its inner end projects into a groove in the side of the slide.

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TO CLOSE THE BRÉECH.—Move the lever handle to the left as far as it will go. The action of the various parts of the mechanism is the reverse of that given above. When the breech is open it will be noted that the block is locked in the block carrier, and that until it is unlocked relative motion of the lever handle with reference to the block and carrier can not occur, so that the first movement of the lever handle to the left swings the block into its recess and the carrier against the face of the gun. The action of the latch now frees the block from the carrier and locks the latter to the gun. Further motion of the lever handle forces the block forward in the breech recess and rotates it to its seat.

The movement of the lever handle to open or close the breech above described is one continuous motion.

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TO DISMOUNT THE MECHANISM.

TO REMOVE THE MÉCHANISM FROM THE GUN.—Open the breech, swinging the block clear of the breech recess; remove the block carrier hinge pin, driving it out with a bronze drift if necessary. Block and block carrier are now free to be lifted from the gun.

TO REMOVE OBTURATOR SPINDLE AND GAS CHECK.—Open the breech, unscrew the spline screw in the slide housing, revolve the housing 90 degrees to the right, when it may be drawn to the rear from the spindle; unscrew the spindle nut and spindle-key screw in the block carrier and remove the spindle key; the spindle, split rings, pad, etc., are then free to be removed from the block. Spindle may then be removed from block and parts of gas check from spindle.

TO REMOVE SEGMENT AND RACK.—Remove the two segment and rack securing screws.

TO REMOVE LEVER AND PINION.—Remove segment and rack and obturator, as described above; unscrew pinion-pivot nut; unscrew and remove pinion pivot. Lever and pinion may now be removed from the block carrier.

TO REMOVE PARTS OF LATCH.—Open breech; remove latch-lever pivot screw. Latch spring, latch lever, and latch bolt may now be removed from the block carrier.

TO REMOVE BREECHBLOCK FROM BLOCK CARRIER.—Remove segment and rack and latch bolt as described above. Block is now free and may be lifted from block carrier.

Be careful not to remove the spindle nut or key before opening the breech, as in that case the split ring will drop down and prevent the withdrawal of the block.

TO MOUNT THE MECHANISM.

The converse of the above instructions should be followed in assembling the parts of the breech mechanism.

Range table for the 5-inch siege gun.

M. V. = 1830 F. S. Shrapnel, weight, 45 lbs.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Range.	Angle of elevation.	ΔX for $\pm \Delta I'$ eleva- tion.	ΔX for $\pm \Delta I'$ F. S. M. V.	ΔX for wind 10 M. P. H.	ΔX for change of ± 15 C.	Time of flight.	Drift.	Deflection for 10 miles crosswind.	Angle of depar- ture.	Slope of fall.	Terminal velocity.	Maxi- mum ordinate.	Values of "C."	Values of $\frac{Bc}{fa}$.
Yards.	° ' "	Yards.	Yards.	Yards.	Yards.	Seconds.	Mils.	Mils.	° ' "	in-	F. S.	Fed.		
100	6	20.0	0.8	0.1	0.5	0.20	0	1.1	4	6	1,790	1	1.80	1.001
200	11	19.4	1.9	0.2	1.1	0.40	0	1.4	5	11	1,750	2	1.80	1.002
300	16	18.8	3.0	0.3	2.1	.60	0	1.6	6	16	1,712	3	1.80	1.003
400	21	18.2	4.0	0.5	3.4	.80	.3	1.7	6	21	1,675	4	1.79	1.004
500	26	17.6	5.0	0.7	4.9	1.01	.3	1.8	6	27	1,639	5	1.79	1.005
600	32	17.0	6.0	1.0	6.6	1.22	.4	1.9	6	33	1,603	6	1.79	1.006
700	38	16.5	6.9	1.3	8.5	1.43	.4	1.9	6	39	1,568	7	1.79	1.007
800	44	16.0	7.8	1.7	10.6	1.65	.5	2.0	6	45	1,533	8	1.79	1.008
900	50	15.5	8.7	2.2	12.9	1.87	.5	2.1	7	51	1,499	9	1.78	1.009
1,000	57	15.0	9.5	2.7	15.4	2.09	.6	2.2	8	58	1,466	10	1.78	1.010
1,100	64	14.5	10.3	3.3	18.1	2.32	.7	2.3	8	65	1,434	11	1.78	1.011
1,200	71	14.1	11.1	3.9	21.0	2.55	.7	2.4	8	72	1,403	12	1.78	1.012
1,300	78	13.7	11.8	4.6	24.1	2.78	.8	2.4	9	80	1,373	13	1.78	1.013
1,400	85	13.3	12.5	5.3	27.4	3.02	.8	2.5	9	87	1,344	14	1.78	1.014
1,500	92	12.9	13.2	6.1	30.9	3.26	.9	2.6	9	94	1,316	15	1.78	1.015
1,600	100	12.5	13.8	6.9	34.6	3.50	.9	2.7	10	101	1,289	16	1.77	1.016
1,700	108	12.1	14.4	7.8	38.5	3.74	1.0	2.7	10	108	1,263	17	1.77	1.017
1,800	116	11.8	15.0	8.8	42.5	3.99	1.1	2.8	10	115	1,238	18	1.77	1.018
1,900	124	11.5	15.6	9.8	46.6	4.24	1.1	2.9	10	122	1,214	19	1.77	1.019
2,000	132	11.2	16.1	10.9	50.8	4.49	1.3	3.0	10	129	1,191	20	1.77	1.020
2,100	140	10.9	16.6	12.0	55.0	4.75	1.5	3.1	11	136	1,169	21	1.76	1.021
2,200	148	10.6	17.1	13.2	59.3	5.01	1.6	3.1	11	143	1,149	22	1.76	1.022
2,300	156	10.3	18.6	14.4	63.6	5.27	1.7	3.2	11	150	1,130	23	1.76	1.023
2,400	164	10.0	18.1	15.7	67.9	5.54	1.8	3.2	11	157	1,112	24	1.76	1.024
2,500	172	9.7	18.5	17.0	72.3	5.81	1.9	3.4	11	164	1,096	25	1.76	1.025
2,600	180	9.4	18.9	18.4	76.7	6.09	2.1	3.5	12	171	1,080	26	1.75	1.027
2,700	188	9.1	19.3	19.8	81.1	6.37	2.3	3.5	12	178	1,064	27	1.75	1.029
2,800	196	8.8	19.7	21.3	85.5	6.65	2.5	3.6	12	185	1,050	28	1.75	1.030
2,900	204	8.6	20.1	22.8	90.0	6.94	2.7	3.7	13	192	1,037	29	1.75	1.031
3,000	212	8.4	20.5	24.4	94.5	7.23	2.9	3.8	13	200	1,025	30	1.74	1.033
3,100	220	8.2	20.8	26.0	99.0	7.52	3.1	3.9	13	207	1,013	31	1.74	1.035
3,200	228	8.0	21.1	27.5	103.5	7.82	3.3	4.0	14	214	1,002	32	1.74	1.036
3,300	236	7.8	21.4	29.0	108.0	8.12	3.5	4.1	14	221	991	33	1.74	1.038
3,400	244	7.6	21.7	31.3	112.5	8.43	3.7	4.2	14	228	981	34	1.73	1.039
3,500	252	7.4	22.0	33.1	117.1	8.74	3.9	4.2	15	235	971	35	1.73	1.040
3,600	260	7.2	22.3	35.0	121.7	9.06	4.1	4.3		242	961	36	1.73	

3,700	5	31	7.0	22.6	36.9	126.3	9.37	4.3	15	4.4	15	5	35	6.68	952	344	1.73
3,800	5	45	6.8	22.8	38.9	130.9	9.69	4.5	15	4.5	15	5	50	6.87	943	369	1.042
3,900	6	0	6.6	23.0	40.9	135.5	10.02	4.6	15	4.6	15	6	5	6.10	934	396	1.043
4,000	6	15	6.5	23.3	43.0	140.1	10.35	4.7	16	4.7	16	6	20	6.33	926	424	1.044
4,100	6	30	6.4	23.5	45.1	144.7	10.68	4.8	16	4.8	16	6	35	6.56	918	453	1.045
4,200	6	46	6.3	23.7	47.3	149.3	11.02	4.9	16	4.9	16	6	51	6.79	910	484	1.046
4,300	7	2	6.2	23.9	49.5	153.9	11.36	5.0	17	5.0	17	7	23	7.02	902	517	1.047
4,400	7	18	6.1	24.2	51.8	158.6	11.70	5.1	17	5.1	17	7	39	7.25	895	551	1.047
4,500	7	34	6.0	24.4	54.1	163.3	12.05	5.2	17	5.2	17	7	56	7.47	888	587	1.047
4,600	7	51	5.9	24.6	56.5	168.0	12.40	5.3	18	5.3	18	8	13	7.70	881	624	1.048
4,700	8	8	5.8	24.8	58.9	172.7	12.75	5.4	18	5.4	18	8	30	7.93	874	663	1.048
4,800	8	25	5.7	25.0	61.4	177.4	13.11	5.5	18	5.5	18	8	47	8.16	868	703	1.048
4,900	8	42	5.6	25.2	63.9	182.1	13.47	5.6	18	5.6	18	9	5	8.39	862	745	1.048
5,000	9	0	5.5	25.4	66.5	186.8	13.84	5.7	19	5.7	19	9	23	8.62	856	788	1.048
5,100	9	18	5.4	25.6	69.1	191.5	14.21	5.8	19	5.8	19	9	41	8.85	850	833	1.046
5,200	9	36	5.3	25.7	71.5	196.2	14.58	5.9	19	5.9	19	9	59	9.08	844	879	1.046
5,300	9	54	5.2	25.8	74.5	200.9	14.96	6.0	20	6.0	20	10	18	9.31	838	927	1.046
5,400	10	3	5.1	26.0	77.3	205.6	15.34	6.1	20	6.1	20	10	36	9.54	834	976	1.044
5,500	10	19	5.0	26.2	80.1	210.3	15.72	6.2	20	6.2	20	10	56	9.77	829	1,027	1.043
5,600	10	35	4.9	26.3	82.9	215.0	16.10	6.3	21	6.3	21	10	76	1.000	824	1,080	1.043
5,700	11	11	4.8	26.5	85.9	219.8	16.48	6.4	21	6.4	21	11	16	1.023	819	1,135	1.040
5,800	11	28	4.7	26.7	88.9	224.6	16.82	6.5	21	6.5	21	11	36	1.046	814	1,192	1.038
5,900	11	45	4.6	26.9	91.9	229.4	17.17	6.6	22	6.6	22	11	56	1.069	809	1,251	1.036
6,000	12	3	4.5	27.0	94.9	234.2	17.54	6.7	22	6.7	22	11	77	1.092	805	1,312	1.034
6,100	12	19	4.4	27.2	98.1	239.0	17.92	6.8	22	6.8	22	12	13	1.115	801	1,375	1.032
6,200	12	35	4.3	27.3	101.3	243.8	18.28	6.9	23	6.9	23	12	33	1.138	797	1,440	1.029
6,300	12	52	4.2	27.5	104.5	248.6	18.65	7.0	23	7.0	23	12	56	1.161	793	1,507	1.027
6,400	13	6	4.1	27.6	107.8	253.4	19.01	7.1	23	7.1	23	13	20	1.184	789	1,576	1.024
6,500	13	18	4.0	27.7	111.1	258.2	19.37	7.2	24	7.2	24	13	42	1.207	785	1,647	1.022
6,600	13	35	3.9	27.8	114.5	263.0	19.73	7.3	24	7.3	24	14	4	1.230	781	1,720	1.020
6,700	14	2	3.8	27.9	117.9	267.8	20.10	7.4	24	7.4	24	14	26	1.253	777	1,795	1.018
6,800	14	19	3.7	28.1	121.4	272.6	20.47	7.5	25	7.5	25	15	12	1.276	773	1,873	1.016
6,900	15	5	3.6	28.2	124.8	277.4	20.84	7.6	25	7.6	25	15	35	1.299	769	1,954	1.014
7,000	15	21	3.5	28.3	128.3	282.2	21.21	7.7	25	7.7	25	16	28	1.322	765	2,038	1.012
7,100	16	15	3.4	28.4	131.7	287.0	21.58	7.8	26	7.8	26	16	46	1.345	761	2,125	1.010
7,200	16	32	3.3	28.5	135.2	291.8	21.95	7.9	26	7.9	26	17	11	1.368	757	2,215	1.008
7,300	17	3	3.2	28.6	138.7	296.6	22.32	8.0	26	8.0	26	17	37	1.391	753	2,308	1.006
7,400	17	19	3.1	28.7	142.2	301.4	22.69	8.1	27	8.1	27	18	2	1.414	749	2,404	1.005
7,500	17	37	3.0	28.8	145.7	306.2	23.06	8.2	27	8.2	27	19	4	1.437	745	2,504	1.003
7,600	18	4	2.9	28.9	149.2	311.0	23.43	8.3	27	8.3	27	19	26	1.460	741	2,608	1.002
7,700	18	22	2.8	29.0	152.7	315.8	23.80	8.4	28	8.4	28	20	19	1.483	737	2,716	1.001
7,800	19	21	2.7	29.1	156.2	320.6	24.17	8.5	28	8.5	28	21	30	1.506	733	2,828	1.000
7,900	19	51	2.6	29.2	159.7	325.4	24.54	8.6	28	8.6	28	22	10	1.529	729	2,945	.999
8,000	20	2	2.5	29.3	163.2	330.2	24.91	8.7	29	8.7	29	23	2	1.552	725	3,067	.998
8,100	20	18	2.4	29.4	166.7	335.0	25.28	8.8	29	8.8	29	24	14	1.575	721	3,194	.997
8,200	21	5	2.3	29.5	170.2	339.8	25.65	8.9	29	8.9	29	25	6	1.598	717	3,326	.996
8,300	21	22	2.2	29.6	173.8	344.6	26.02	9.0	30	9.0	30	26	2	1.621	713	3,464	.995
8,400	22	10	2.1	29.7	177.3	349.4	26.39	9.1	30	9.1	30	27	14	1.644	709	3,608	.994
8,500	22	28	2.0	29.8	180.9	354.2	26.76	9.2	31	9.2	31	28	4	1.667	705	3,758	.993
8,600	23	6	1.9	29.9	184.5	359.0	27.13	9.3	31	9.3	31	29	18	1.690	701	3,915	.992
8,700	23	17	1.8	30.0	188.1	363.8	27.50	9.4	32	9.4	32	30	49	1.713	697	4,080	.991
8,800	24	1	1.7	30.1	191.7	368.6	27.87	9.5	32	9.5	32	31	25	1.736	693	4,254	.990
	24	17	1.6	30.2	195.3	373.4	28.24	9.6	33	9.6	33	32	3	1.759	689		.989
	24	34	1.5	30.3	198.9	378.2	28.61	9.7	33	9.7	33	33		1.782	685		.988
	24	51	1.4	30.4	202.5	383.0	28.98	9.8	34	9.8	34	34		1.805	681		.987
	24	68	1.3	30.5	206.1	387.8	29.35	9.9	34	9.9	34	35		1.828	677		.986
	24	85	1.2	30.6	209.7	392.6	29.72	10.0	35	10.0	35	36		1.851	673		.985
	24	102	1.1	30.7	213.3	397.4	30.09	10.1	35	10.1	35	37		1.874	669		.984
	24	119	1.0	30.8	216.9	402.2	30.46	10.2	36	10.2	36	38		1.897	665		.983
	24	136	0.9	30.9	220.5	407.0	30.83	10.3	36	10.3	36	39		1.920	661		.982
	24	153	0.8	31.0	224.1	411.8	31.20	10.4	37	10.4	37	40		1.943	657		.981
	24	170	0.7	31.1	227.7	416.6	31.57	10.5	37	10.5	37	41		1.966	653		.980
	24	187	0.6	31.2	231.3	421.4	31.94	10.6	38	10.6	38	42		1.989	649		.979
	24	204	0.5	31.3	234.9	426.2	32.31	10.7	38	10.7	38	43		2.012	645		.978
	24	221	0.4	31.4	238.5	431.0	32.68	10.8	39	10.8	39	44		2.035	641		.977
	24	238	0.3	31.5	242.1	435.8	33.05	10.9	39	10.9	39	45		2.058	637		.976
	24	255	0.2	31.6	245.7	440.6	33.42	11.0	40	11.0	40	46		2.081	633		.975
	24	272	0.1	31.7	249.3	445.4	33.79	11.1	40	11.1	40	47		2.104	629		.974
	24	289	0.0	31.8	252.9	450.2	34.16	11.2	41	11.2	41	48		2.127	625		.973
	24	306	0.0	31.9	256.5	455.0	34.53	11.3	41	11.3	41	49		2.150	621		.972
	24	323	0.0	32.0	260.1	459.8	34.90	11.4	42	11.4	42	50		2.173	617		.971
	24	340	0.0	32.1	263.7	464.6	35.27	11.5	42	11.5	42	51		2.196	613		.970
	24	357	0.0	32.2	267.3	469.4	35.64	11.6	43	11.6	43	52		2.219	609		.969
	24	374	0.0	32.3	270.9	474.2	36.01	11.7	43	11.7	43	53		2.242	605		.968
	24	391	0.0	32.4	274.5	479.0	36.38	11.8	44	11.8	44	54		2.265	601		.967
	24	408	0.0	32.5	278.1	483.8	36.75	11.9	44	11.9	44	55		2.288	597		.966
	24	425	0.0	32.6	281.7	488.6	37.12	12.0	45	12.0	45	56		2.311	593		.965
	24	442	0.0	32.7	285.3	493.4	37.49	12.1	45	12.1	45	57		2.334	589		.964
	24	459	0.0	32.8	288.9	498.2	37.86	12.2	46	12.2	46	58		2.357	585		.963
	24	476	0.0	32.9	292.5	503.0	38.23	12.3	46	12.3	46	59		2.380	581		.962
	24	493	0.0	33.0	296.1	507.8	38.60	12.4	47	12.4	47	60		2.403	577		.961
	24	510	0.0	33.1	300.7	512.6	38.97	12.5	47	12.5	47	6					

Range table for the 5-inch siege gun—Continued.

M. V. = 1830 F. S. Shrapnel, weight, 45 lbs.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Range.	Angle of elevation.	ΔX for $\pm \Delta i$ eleva- tion.	ΔX for $\pm \Delta i$ F. S. M. V.	ΔX for wind 10 M. P. H.	ΔX for change of $\pm 1^\circ C$.	Time of flight.	Drift.	Deflection for 10 miles crosswind.	Angle of depar- ture.	Slope of fall.	Terminal velocity.	Maxi- mum ordinate.	Values of "C."	Values of $B c$ f_a .
<i>Yards.</i>	<i>° ' "</i>	<i>Yards.</i>	<i>Yards.</i>	<i>Yards.</i>	<i>Yards.</i>	<i>Seconds.</i>	<i>Miles.</i>	<i>Miles.</i>	<i>° ' "</i>	<i>1 on—</i>	<i>F. S.</i>	<i>Feet.</i>		
8,000	25 33	2.5	31.0	215.7	373.5	32.51	1 37	9.1	25 43	1 18	752	4,439	1.82	0.989
9,000	26 15	2.3	31.1	222.1	378.4	33.22	1 42	9.2	26 25	1 14	753	4,438	1.82	.988
9,100	26 59	2.2	31.2	228.9	383.3	33.96	1 47	9.4	27 9	1 10	754	4,846	1.82	.988
9,200	27 45	2.1	31.2	236.1	388.2	34.73	1 52	9.5	27 55	1 07	756	5,070	1.82	.988
9,300	28 34	2.0	31.3	243.8	393.1	35.54	1 57	9.7	28 44	1 03	758	5,509	1.82	.987
9,400	29 26	1.9	31.4	252.0	398.0	36.40	2 3	9.8	29 36	.980	760	5,563	1.82	.987
9,500	30 21	1.8	31.5	260.8	402.9	37.22	2 9	10.0	30 31	.951	762	5,840	1.82	.987
9,600	31 20	1.6	31.5	270.4	407.8	38.11	2 16	10.2	31 30	.913	765	6,137	1.82	.987
9,700	32 23	1.5	31.6	280.6	412.7	39.38	2 23	10.4	32 33	.873	768	6,461	1.82	.987
9,800	33 31	1.4	31.6	291.5	417.6	40.54	2 31	10.7	33 41	.833	771	6,822	1.82	.987
9,900	34 47	1.2	31.7	303.1	422.5	41.81	2 41	11.0	34 57	.791	774	7,220	1.82	.987
10,000	36 21	1.0	31.7	315.5	427.4	43.20	2 53	11.3	36 31	.746	778	7,748	1.82	.986

This table is suitable for shrapnel fitted with either 15-second or 45-second fuzes.

AMMUNITION.

The ammunition for the 5-inch siege gun includes primers, cartridges, projectiles, and fuzes.

GENERAL REMARKS.

Formerly the components of the ammunition for this gun were packed separately and the projectiles were issued unfuzed. Now, however, this ammunition is packed for shipment and storage in wooden boxes, each containing two complete rounds, namely, two projectiles, shell or shrapnel, filled and fuzed; two propelling charges in hermetically sealed tin boxes, and three obturating primers (one extra obturating primer) in a hermetically-sealed tin box. To open these tin boxes, tear off the tin strip at the top; but this should not be done nor the cover of the fuze removed until the ammunition is to be used. Care should be exercised in handling the projectiles to prevent injury to fuze.

PRIMERS.

These guns, model of 1890, are made with vents taking the regular service friction primer No. 3, with screw thread, which is screwed into its seat at rear of the vent and fired by lanyard attached directly to the primer. The vents of guns, model of 1898, take the obturating friction primer No. 4. This primer has no exterior thread and is held in its seat by the firing mechanism to which the lanyard is attached.

CARTRIDGES.

The charge of smokeless powder is put in a cartridge bag made of raw silk. The cartridges are the full length of the powder chamber and of such diameter as to contain the proper amount of powder. The exact weight of the powder charge varies slightly with each lot of powder. It is determined from the acceptance test of the lot and gives the standard muzzle velocity for that particular lot. Each cartridge has a small igniting charge of black powder so placed at the bottom of the bag as to come in direct contact with the flame from the vent.

PROJECTILES.

The projectiles provided for use with the siege gun comprise cast-iron shell, common steel shell, and shrapnel.

CAST-IRON SHELL.

[Plate III.]

The cast-iron shell is made of the best quality of charcoal iron. It is 3 calibers in length, with an ogival head struck with a radius of 2 calibers. The rotating band of pure rolled copper is forced into an

undercut seat 1.5 inches from the base of the shell. The bottom of the band seat in the shell is roughened to prevent slipping of the band.

The walls of the cavity are lacquered to prevent danger of premature ignition of the bursting charge from friction with the walls of the shell.

The shell complete, filled and fuzed, weighs 45 pounds. It is painted the distinctive colors prescribed by the Ordnance Department.

COMMON STEEL SHELL.

[Plate III.]

The common steel shell for use with the siege gun has a total length of 12.65 inches and an ogival head struck with a radius of 2 calibers. The copper rotating band is seated in the same manner as that of the cast-iron shell above described.

The cavity of the shell is 7.38 inches long and 3.15 inches in diameter at its breech end, decreasing in size to the front. Its capacity is 35.83 cubic inches with fuze in place. The cavity is closed by a base plug, which screws into the base of the shell. A shoulder on the plug fits into a counterbore in the shell. When assembled it is provided with a base cover and calking wire to prevent powder gases entering the shell cavity.

The base is tapped for either a medium caliber base detonating fuze or a siege base detonating fuze, modified Peirce stock.

When finished, the cavity is lacquered to diminish danger of premature ignition of the bursting charge from friction, and the exterior is painted colors prescribed by the Ordnance Department. The shell, filled and fuzed, weighs 45 pounds. When these shells, filled with high explosives, are fired from the gun, the entire base is covered with a copper base cover, and a lead disk is fitted into a groove in the base.

THE FRANKFORD ARSENAL 5-INCH SIEGE-GUN SHRAPNEL, MODEL OF 1896.

[Plate IV.]

The shrapnel consists of the following parts: Head, case, base, band, central tube, balls, and separators.

The head is of cast iron, machined on the exterior, and has a screw thread cut around its base for attachment to forward end of case. The central tube is screwed into the base of the head, and this, together with the cavity of the head, furnishes space for the bursting charge, which consists of 12 ounces of black powder. The powder chamber is lacquered to prevent danger of premature explosion.

The case is made of steel tubing, machined inside and out and threaded at its two ends for attachment to head and base. It is weakened for fracture by 11 longitudinal grooves cut on the inside.

These grooves are V-shaped, and their depth increases from 0 at the rear to 0.12 inch at the forward end of case.

The case contains the filling, which consists of 280 $\frac{1}{2}$ -inch balls, 42 to the pound, and 59 cast-iron separators. The balls are made of an alloy of 15 parts lead and 1 of antimony. The separators are segmental rings, with hemispherical sockets in upper and lower surfaces to receive the balls.

The separators prevent deformation and relative motion of the balls under shock of discharge, and increase the effect of explosion by furnishing additional fragments.

The bottom separator has lugs which fit in recesses cast in the base and prevent relative rotation of interior filling.

The top separator has a flat surface on which the base of the head rests when shrapnel is assembled.

The base is of cast iron, finished on the exterior and threaded to fit the rear of the shrapnel case. Recesses to receive the lugs on bottom separator plate and sockets for first layer of balls are cast in its upper surface. The base supports the shrapnel case under the rotating band.

The rotating band is of copper, 0.6 inch wide and 0.155 inch thick, and is shrunk on its seat. The band seat is knurled, and after the band is shrunk in place and the base and case assembled the band is passed through a die to force the copper into the knurlings.

The central tube is of brass. It is screwed into the base of the head and has its lower end closed. The object of the tube is to place part of the powder charge in the center of the shrapnel, giving more fragments on explosion.

In assembling the shrapnel in manufacture, the base and case (the latter with band shrunk on) are first screwed together; then the filling, previously packed and compressed by applying to it longitudinally a pressure of about 10,000 pounds, is placed in the body and the head screwed on. The preliminary compression of filling is to solidify it by producing contact of iron on iron throughout the mass. When the head is screwed on, close contact between base of head and top plate of filling is essential, and is generally produced by interposing sheets of paper or of thin metal between them. When properly packed, the filling acts as a solid mass under the shock of discharge; the pressure due to inertia of the filling is borne entirely by the base, and no relative motion of the parts of the filling takes place.

The total number of balls and individual pieces in a complete shrapnel is 344. The usual number of fragments (including balls) on explosion is about 600.

The total weight of the 5-inch shrapnel is 45 pounds, including fuze and powder charge.

FUZES.**BASE PERCUSSION FUZE, MEDIUM AND MAJOR CALIBERS, WITH SEMPLE PLUNGER.**

This fuze is used in the cast-iron powder-charged shell.

This is a centrifugal fuze; that is, it depends upon the rotational velocity of the projectile for its arming. The fuze body and primer parts do not differ from those of the ring-resistance fuze. The primer composition is a mercuric fulminate composition consisting of—

- 50 parts glass.
- 40 parts fulminate of mercury.
- 20 parts chlorate of potash.
- 30 parts sulphide of antimony.

The Semple type of centrifugal plunger is used, and its springs are designed for the shell to function by the velocity of rotation of the shell. This fuze consists of the following parts:

- a, body, brass.
- b, closing cap screen, brass.
- c, primer shield, brass.
- d, primer body, brass.
- e, primer disk, paper.
- f, primer-closing screw, brass.
- g, reenforcing charge, loose shrapnel powder.
- h, end closing disk, brass.
- j, plunger, brass.
- k, plunger housing, brass.
- l, firing pin, brass.
- m, firing pin fulcrum.
- n, safety pin, brass.
- o, safety-pin spring, brass.
- p, restraining spring, brass.
- q, restraining spring housing, brass.

The plunger j is provided with a slot to receive the firing pin l, which is mounted on the fulcrum, and kept in the unarmed position by two safety pins in recesses on opposite sides of the plunger and held in the hole in the firing pin by the tension of the springs o. 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 also swung into its armed position by the centrifugal force acting on it. The entire plunger and housing is held to the rear by two springs p, pressing on the closing screw through the housing q. Rotation of the plunger is secured by a brass piece in the shape of two jaws fastened in the bottom of the fuze cavity. The threads of this fuze are 12 to the inch and 1.5 inches in diameter.

BASE DETONATING FUZE, MEDIUM CALIBER.

This fuze is used in the steel shell. No information as to the construction of this fuze is issued.

For shrapnel the 45-second combination fuze is used. It is a point insertion fuze and combines the elements of time and percussion arranged to act independently in one fuze body. It contains two plungers and two primers. The concussion plunger arms itself and fires the concussion primer on shock of discharge in bore of the piece, and ignites the time element. The percussion plunger is armed by the shock of discharge, and fires its primer on impact.

FRANKFORD ARSENAL 45-SECOND COMBINATION FUZE.

[Plate IV.]

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

- a, body, bronze.
- a', stop pin, brass.
- b, closing cap, brass.
- b', vents in closing cap.
- b², safety wire.
- 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.

This fuze is a low-resistance type and is provided with a safety wire, b², passing through the closing cap and concussion plunger, which renders transportation and handling safe. This fuze can be reset as many times as desired. 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. Mealed powder is compressed into these grooves under a high pressure, forming a time train.

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 pins 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 45, each full division corresponding to 1 second time of burning in flight; these divisions are subdivided into 5 equal parts corresponding to one-fifth second. 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 safety wire being removed, 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 time 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 12 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 12-second settings. The flame now passes out through vent g and burns along the upper time train in an anti-clockwise 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 45-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 45-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 percussion plunger q and an ordinary percussion primer r .

The system of vents through the walls of the fuze shown in fig. 2 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.

CAUTION.—Whenever a round of shrapnel ammunition has been withdrawn and the safety wire b^2 removed from the point of the fuze, it should never be replaced in the ammunition chest until the safety wire has been reassembled in the point of the fuze, in order to lock the concussion plunger in place.

THE HAND FUZE SETTER.

[Plate V.]

The hand fuze setter provided for the 45-second fuze consists principally of an aluminum case (55 A) having a serrated rim forming a handle for turning; a range ring (54 FA) mounted on the range-ring carrier (54 LA) which is operated by the knob (54 A) on the range worm (54 F); a corrector scale (54 Z) mounted on the corrector scale support (54 KA), which is operated by the knob (54 A) on the corrector worm (54 G) and a guide plate (54 JA) which rests on the projectile.

A slot is cut in the range-ring carrier (54 LA), which engages with the pin on the graduated time-train ring of the fuze. A stop pin (54 K) is attached to the corrector-scale support (54 KA) and engages with the stop pin of the fuze to limit the motion of the fuze setter.

The range worm (54 F) and corrector worm (54 G) are mounted eccentrically in the range-worm case (54 H) and the corrector-worm case (54 J). Upon rotation this provides an adjustment to accom-

moderate slight variations in machine operations and to take up for wear between the teeth of the worms and gears.

The range-worm adjusting screw (54B) and the corrector-worm adjusting screw (54C) 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 (54 L, M, N, P) are provided for locking the range and corrector-worm cases and the range-worm and corrector-worm adjusting screws.

The index bar (54Q), which is attached to the case by two index bar screws (55D), carries a range index (54R), which slides on its beveled sides to register with the scale for the desired zone and is held in position by the index plunger being forced into notches in the index bar by the index-plunger spring.

The range ring (54FA) has five scales for zones 1, 2, 3, 4, and 5.¹ The scale for each zone is graduated for ranges corresponding to the maximum and minimum elevations (65° and 45°). The least division is 50 yards. The corrector scale has 120 equal divisions numbered each 10 divisions, 60 being the normal position for a suitable height of burst. It is used to vary the height of burst of shrapnel and to compensate errors made in determining the angle of sight and variations in the rate of burning of the time train of the fuze. The guide plate (54JA) is attached to the bottom of the case and bears on the projectile.

OPERATION.

First. Set the range index on the index bar to indicate the zone corresponding to the powder charge used.

Second. Turn the knob of the range worm until the required range on the range ring registers with the range index.

Third. 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.

It should be remembered that 60 is the normal position for howitzers, mortars, and mountain guns for a suitable height of burst. An increased reading on the corrector scale increases the height of burst or shortens the range to point of burst; a decreased reading of the corrector scale decreases the height of burst or increases the range to point of burst. To set a fuze, first remove the waterproof cap, withdraw the 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

¹ The scales for zones 2 and 5 are placed at the outer edge of the ring, those for zones 1 and 4 at the middle part, and that for zone 3 at the inner part.

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. This pointer was added because the movable ring of the fuze sometimes sticks to such a degree as to indicate that the stop pin on the fuze and the fuze setter are in contact.)

Cards for recording the results of tests of fuze setters are furnished by the Ordnance Department for each size of gun or howitzer on which problems are given as indicated below. The examples given below are for the 6-inch howitzers. The cards for other calibers will be similar.

Hand fuze setter for 31-second combination fuze—Calculated fuze settings for 6-inch howitzer.

Range.	Corrector.	Calculated settings.		
		Zone 1.	Zone 2.	Zone 3.
0.....	60	0	0	0
1,000.....	10	8.9	7.04	6.08
2,000.....	90	18.26	8.65	5.94
3,500.....	60		23.5	13.56
5,500.....	60			23.47
6,500.....	60			31.18

To check the fuze setter, set the range ring and corrector scale to the readings given. Set the fuze with the fuze setter and compare the setting of the fuze with the result in the table. Use shrapnel and not a drill cartridge in making this test. When the range index registers with 0 on the range ring and the corrector scale is set at 60, the fuze will be set at 0 and will explode immediately on leaving the gun. When setting a fuze to explode on impact or for safe transportation, set the range index at S and the corrector scale at 60. Great care should be exercised in making this setting and to replace the safety wires before transporting.

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 (55E and 55H) are provided in the case (55A) for emergency use only.

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

Should backlash appear, it may be due to end wear between the collars of the worm and case or wear between the teeth of the worm and case.

To remove end play, loosen the clamp-plug screw about one complete turn, then turn the adjusting screw (using a screw driver for the corrector-worm adjusting screw and a pin for the range-worm adjusting screw) until the end play is removed and there is sufficient friction to prevent accidental rotation of the worm; then if there still be a very little backlash it may be removed by loosening the worm-case clamp plug, and rotating the worm case in which the worm is eccentrically mounted in order to move the worm in closer contact with the gear. This latter adjustment will seldom need be made.

The clamp-plug screws must be firmly tightened after this adjustment in order to secure the adjusting screws and worm cases against rotation.

ADAPTABILITY TO OTHER GUNS.

This fuze setter is adaptable to all projectiles using the 45-second combination fuze by using suitable range ring, corrector scale, guide plate, and index bar. The corrector scale for howitzers and mortars has 120 graduations, 60 being the normal. The corrector scale for guns has 60 graduations, 30 being the normal.

The range ring for howitzer has three scales engraved thereon which correspond to the ranges for the three zones.

The range ring for guns has but one scale graduated thereon. The index bar for howitzers has a sliding-range index. 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 or howitzer with which they correspond.

DISASSEMBLING AND ASSEMBLING.

To disassemble, remove the index bar (54Q), which is held in place by two index-bar screws. Take out the range-ring screws (55C) and corrector-scale screws and remove the range ring and corrector scale. Remove the guide-plate screws (55H) and guide plate (54JA). Drive out taper pins and remove knobs (54A) from corrector worm (54G) and range worm (54F). Loosen range-worm adjusting clamp screw and corrector-worm adjusting clamp screws. Remove worm-adjusting screws (54B) (54C). The worms may then be removed by turning. The corrector-scale support and the

ange-ring carrier may then be removed. To remove the range-worm case (54H) and the corrector-worm case (54J) loosen the range worm case clamp screw and corrector worm case clamp screw (55F) when the worm cases may be removed.

Assemble in reverse order, noting the index marks on the worm cases and fuze-setter case which indicate the original setting of those parts.

The nomenclature given below should be used when ordering spare parts:

Symbol.	Name of piece.
(55 A)	Case.
(55 B)	Index bar (for guns only).
(55 C)	Corrector-scale screw.
(55 C)	Range-ring screw.
(55 D)	Index-bar screw.
(55 E)	Oil-hole screw.
(55 F)	Corrector worm case clamp screw.
(55 F)	Corrector worm adjusting screw clamp screw.
(55 F)	Range worm adjusting screw clamp screw.
(55 F)	Range worm case clamp screw.
(55 G)	Stop-pin screw.
(55 H)	Guide-plate screw.
(54 A)	Worm knob.
(54 B)	Range-worm adjusting screw.
(54 C)	Corrector-worm-adjusting screw.
(54 D)	Range-worm washer.
(54 E)	Corrector-worm washer.
(54 F)	Range worm.
(54 G)	Corrector worm.
(54 H)	Range-worm case.
(54 J)	Corrector-worm case.
(54 K)	Stop pin.
(54 L)	Range worm adjusting screw clamp plug.
(54 M)	Range worm case clamp plug.
(54 N)	Corrector worm adjusting screw clamp plug.
(54 P)	Corrector worm case clamp plug.
(54 Q)	Index bar (for howitzers only).
(54 R)	Range index.
(54 S)	Index plunger.
(54 T)	Index-plunger spring.
(54 X)	Corrector scale (for 4.7-inch howitzer).
(54 DA)	Range ring (for 4.7-inch howitzer).
(54 HA)	Guide plate (for 4.7-inch howitzer).
(54 KA)	Corrector-scale support.
(54 LA)	Range-ring carrier.

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 "5" refers to the caliber and is in red for shrapnel and in black for common 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 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 "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 separate loading.

SUBCALIBER FIRING ATTACHMENT.

[Plate VI.]

This attachment for the model of 1890 gun is designed for the use of .30-caliber rifle ammunition and consists of the rifle barrel the axis of which is centered in the bore of the gun by means of the muzzle sleeve, the breech plate, and the breech-plate sleeve. The connecting tube which screws into the muzzle sleeve at one end and into the breech plate at the other end binds the parts together.

For the model of 1898 gun the breech plate and breech-plate sleeve are omitted, and in their place are the breech and chamber sleeves. These are held in place by three screw clamps, which admit of adjustment.

In the model of 1890 the breech plate has three elongated slots and three screws and washers for the purpose of adjustment.

The connecting tube is shortened for the model of 1898 gun to 22.675 inches.

The muzzle sleeve is the same for both models.

To fit the attachment to the gun, throw the block clear open, insert the muzzle sleeve, push forward, and turn in place the same as the block.

The attachment is furnished with a wrench for the purpose of starting it when it is desired to remove it from the gun.

One attachment will be furnished for each gun in the battery.

The annual allowance of ammunition for subcaliber practice is 500 rounds caliber .30 ammunition per gun.

5-INCH SIEGE-GUN CARRIAGE, MODEL OF 1896.

[Plates VII and VIII.]

Nomenclature, etc.

Number.	Name of part.	Location, etc.	Material.
<i>Parts of trail.</i>			
1 pr.	Flasks.....	Form trail.....	Steel.
1 pr.	Brace plates.....	Riveted to flasks.....	Steel.
1	Front transom.....	Riveted between flasks.....	Steel.
1	Rear transom.....	Riveted between flasks.....	Steel.
1	Screw buffer.....	Riveted to rear transom.....	Wood.
1	Top plate.....	Riveted to top of flasks.....	Steel.
1	Bottom plate.....	Riveted to bottom of flasks.....	Steel.
1	Firing-bracket plate.....	Riveted to top plate.....	Steel.
1	Firing-bracket plate.....	Riveted to bracket plate.....	Steel.
1	Firing-bracket washer plate.....	Riveted to bracket plate.....	Steel.
1	Firing-bracket pin.....	Piston-rod eye to bracket.....	Steel.
1	Hinge plate.....	Riveted to top plate.....	Steel.
1	Reinforce plate.....	Riveted to top plate.....	Steel.
1	Gun rest.....	Riveted to gun-rest bracket.....	Wood.
1	Gun-rest bracket.....	Riveted to reinforce plate.....	Steel.
1	Front-transom bracket.....	Riveted to front transom.....	Bronze.
2	Wheel guards.....	Riveted to flasks.....	Steel.
1	Lunette plate.....	Riveted to bottom plate.....	Steel.
1	Lash-chain eye.....	Riveted to lunette plate.....	Steel.
1	Trail-shoe plate.....	Riveted to bottom plate and flasks.....	Steel.
1	Maneuvering bracket.....	Riveted to shoe plate.....	Steel.
1	Trail-compartment plate, upper.....	Riveted between flasks.....	Steel.
1	Trail-compartment plate, lower.....	Riveted between flasks.....	Steel.
1	Trail-compartment housing.....	Riveted to top plate.....	Steel.
1	Trail-compartment cover.....	Hinged to housing.....	Steel.
1	Pinle thimble.....	Riveted to lunette plate.....	Bronze.
1	Maneuvering bolt.....	Through trail.....	Steel.
2	Maneuvering rollers.....	Ends of bolt.....	Bronze.
1	Maneuvering-bolt nut.....	End of bolt.....	Steel.
1 pr.	Traveling trunnion brackets.....	Bolted to flasks.....	Bronze.
1 pr.	Trunnion beds.....	Bolted to flasks.....	Steel.
8	Trunnion-bed bolts.....	Beds to flasks.....	Steel.
4	Cap-square eyebolts.....	Cap square to bed.....	Steel.
4	Cap squares.....	On trunnion beds.....	Steel.
2	Cap-square bolt keys.....	In eyebolts.....	Steel.
4	Cap-square bolt keys, chains, and eye studs.....	Stud screwed into flasks.....	Steel.
1	Axle plate, upper.....	Between flasks and axle.....	Steel.
1	Axle plate, lower.....	Riveted to upper plate.....	Steel.
2	Axle blocking.....	Between axle plates.....	Steel.
<i>Upper step.</i>			
1	Step plate.....	Hinged to riser.....	Steel.
1	Riser.....	Hinged to hinge eyes.....	Steel.
2	Hinge eyes.....	Riveted to reinforce plate.....	Steel.
1	Step-plate eye rivet.....	Riveted to step plate.....	Steel.
2	Hinge pins.....	Riser to step plate and eyes.....	Steel.
1	Hinge pin.....	Step plate to hinge plate.....	Steel.
1	Hinge-pin key.....	In hinge-pin eye.....	Steel.
<i>Lower step.</i>			
1	Step plate.....	Hinged to riser.....	Steel.
1	Riser.....	Hinged to eyes.....	Steel.
4	Hinge eyes.....	Riveted to top plate.....	Steel.
2	Hinge pins.....	Riser to step plate and eyes.....	Steel.
1	Hinge pin.....	Step plate to eyes.....	Steel.
1	Yale padlock, chain, and eye stud.....	In hinge-pin eye.....	Steel.

Nomenclature, etc.—Continued.

Num ber.	Name of part.	Location, etc.	Material.
<i>Wheels and axle.</i>			
1	Axle.....	Between axle plates.....	Steel.
2	Brake eye straps.....	Shrunk on ends of axle.....	Steel.
2	Brake eye-strap keys.....	Axle to eye strap.....	Steel.
2	Wheels.....	On axle spindles.....	Steel.
2	Linchpins.....	Ends of spindles.....	Steel.
2	Linchpin clasp.....	Riveted to linchpins.....	Steel.
2	Linch washers.....	Between nave and linchpin.....	Steel.
2	Washers.....	Between linch washer and nave.....	Vulcanized fiber.
<i>Hydraulic buffer, etc.</i>			
1	Cylinder.....	Under carriage.....	Steel.
1	Front cap.....	End of cylinder.....	Steel.
1	Rear cap.....	End of cylinder.....	Steel.
1	Gland.....	Screwed into rear cap.....	Bronze.
1	Cap packing.....	In rear cap.....	Leather.
1	Packing ring.....	In rear cap.....	Brass.
2	Supporting bands.....	On cylinder.....	Steel.
2	Side straps.....	On supporting bands.....	Steel.
4	Split keys for above.....	On supporting bands.....	Steel.
1	Pintle block.....	Bolted to platform.....	Cast iron.
8	Pintle-block bolts.....	Block to platform.....	Steel.
1	Pintle.....	In pintle blocks.....	Steel.
1	Pintle set screw.....	In pintle blocks.....	Steel.
1	Pintle yoke.....	Between side straps.....	Steel.
2	Split keys for yoke.....	On yoke.....	Steel.
1	Piston for buffer.....	In cylinder.....	Steel.
1	Packing for piston.....	On piston.....	Bronze.
1	Piston spline screw.....	Piston to piston rod.....	Steel.
1	Piston rod.....	Fastened to piston.....	Steel.
1	Piston-rod eye.....	End of piston rod.....	Steel.
1	Throttling bar.....	Bolted inside cylinder.....	Steel.
<i>Screws for bar.</i>			
1	Long.....	Bar to cylinder.....	Steel.
3	Short.....	Bar to cylinder.....	Steel.
1	Countersunk head.....	Bar to cylinder.....	Steel.
4	Washers for screw bolts.....	Bar to cylinder.....	Copper.
2	Filling and drain plugs.....	Screwed into cylinder.....	Steel.
1	Traveling axle bracket.....	Bolted on axle.....	Bronze.
4	Bolts for above.....	Bracket to axle.....	Steel.
1	Yoke suspension bolt.....	Yoke to bracket.....	Steel.
1	Suspension-bolt pin.....	On bolt eye.....	Steel.
1	Slit key for above.....	In pin eye.....	Steel.
<i>Elevating apparatus.</i>			
1	Fork.....	Flasks to elevating screw.....	Steel.
2	Fork bolts.....	Forks to flasks.....	Steel.
1	Fork bolt.....	Fork to elevating screw.....	Steel.
2	Breech-strap eye washers.....	On fork bolt.....	Steel.
1	Breech strap.....	In eye washers.....	Leather.
1	Inner screw.....	Inside outer screw.....	Steel.
1	Outer screw.....	Screws in crosshead.....	Steel.
1	Crosshead.....	Journalled between flasks.....	Steel.
2	Crosshead bearings.....	Bolted inside flasks.....	Bronze.
10	Bolts for above.....	Bearings to flasks.....	Steel.
1	Bevel gear.....	On crosshead.....	Bronze.
4	Bevel-gear keys.....	Gear to crosshead.....	Steel.
1	Feather key to bevel gear.....	Gear to outer screw.....	Steel.
1	Intermediate gear.....	On crosshead.....	Bronze.
1	Spur gear.....	On crank shaft.....	Bronze.
1	Spur-gear key.....	Gear to crank shaft.....	Steel.
1	Crank shaft.....	Through flasks.....	Steel.
2	Crank-shaft bearings.....	Fastened to flasks.....	Bronze.
8	Screws for above.....	Bearings to flasks.....	Steel.
2	Cranks.....	On crank shaft.....	Steel.
2	Taper pins.....	Through crank and shaft.....	Steel.
<i>Road brake.</i>			
1	Handwheel sleeve bracket.....	Bolted to axle plate.....	Steel.
4	Bolts for above.....	Bracket to plate.....	Steel.
1	Handwheel sleeve.....	Between bracket and plate.....	Bronze.
1	Oil plug for above.....	In sleeve oil hole.....	Brass.
1	Handwheel.....	Mounted in sleeve.....	Bronze.
1	Handwheel collar nut.....	Front of handwheel.....	Steel.
1	Handwheel collar-nut set screw.....	Collar to handwheel.....	Steel.
1	Brake screw.....	Screws into handwheel.....	Steel.
1	Brake truss.....	In slots in flasks.....	Steel.

Nomenclature, etc.—Continued.

Num-ber.	Name of part.	Location, etc.	Material.
<i>Road brake—Continued.</i>			
2	Brake stops.....	Riveted to truss.....	Steel.
1	Brake-truss pin.....	Truss to screw.....	Steel.
2	Brake springs.....	Between truss and shoes.....	Steel.
4	Brake pins.....	Springs to truss and to shoes.....	Steel.
2	Brake hinges.....	Riveted to flasks.....	Steel.
4	Brake-hinge pins.....	Levers to hinges.....	Steel.
4	Brake-lever eyes.....	Screwed and riveted to tubes.....	Steel.
4	Brake-lever tubes.....	Support brake shoes.....	Steel.
2	Brake shoes.....	End of brake levers.....	Bronze.
2	Wearing shoes.....	Bolted to brake shoes.....	Wood.
4	Wearing-shoe bolts.....	Brake shoe to wood shoe.....	Steel.
2	Brake-lever fastenings.....	Eyebolts on flasks.....	Steel.
2	Keys and chains for above.....	Fastened to flasks.....	Steel.
2	Brake-spring fastenings.....	Eyebolts on flasks.....	Steel.
9	Split keys.....	For all pins.....	Steel.
<i>Attachments for—</i>			
2	Rammer staves, front.....	Riveted to flasks.....	Bronze.
2	Rammer staves, rear.....	Riveted to flasks.....	Bronze.
1	Roller handspike, front.....	Riveted to axle plates.....	Steel.
1	Roller handspike, rear.....	Riveted to flasks.....	Steel.
1	Key and chain for above.....	Fastened to flasks.....	Steel.
1	Maneuvering handspike, front.....	Riveted to axle plates.....	Steel.
1	Maneuvering handspike, rear.....	Riveted to flasks.....	Steel.
1	Key and chain for above.....	Fastened to flasks.....	Steel.
1	Name plate.....	Fastened to right flask.....	Bronze.
2	Armament chests, front.....	Riveted to flasks.....	Steel.
2	Armament chests, rear.....	Riveted to flasks.....	Steel.

DESCRIPTION OF THE CARRIAGE.

[Plates VII and VIII.]

This carriage is used for both models of the 5-inch siege gun and is known as the model of 1896 carriage.

The carriage consists essentially of two flasks mounted upon an axle and wheels.

The flasks are $\frac{1}{2}$ -inch steel plates, placed 15.1 inches apart. They are parallel throughout, and are connected by the bottom and top plates, the front and rear transoms, and the axle plates. The front ends are reenforced on the outside by two $\frac{1}{2}$ -inch brace plates, riveted to the flasks, and extending from the axle to the trunnion beds. The lower edges of the flasks and brace plates are flanged and riveted through the flanges to the axle plates. The flasks have 2-inch flanges turned inward along their lower edges, and the bottom plate, made of $\frac{1}{4}$ -inch sheet steel, is secured by $\frac{3}{4}$ -inch rivets to these flanges. Along their upper edges the flasks have similar flanges turned outward, to which the top plate, $\frac{1}{4}$ of an inch thick, is secured by $\frac{3}{4}$ -inch rivets. This plate extends from the end of the trail to a point opposite the elevating-screw crosshead. The front end is cut out to clear the end of the elevating screw as it is swung into its traveling position.

The trail terminates in a forged-steel shoe plate $\frac{1}{2}$ inch thick, securely riveted to the bottom plate and the flask flanges.

The lunette plate is a separate plate on the underside of the trail in front of the shoe plate. A circular projection is let into the bottom plate, while the lunette plate proper is riveted to the flask flanges and the bottom plate. The lunette hole, $2\frac{1}{2}$ inches in diameter, is bored through the reenforced part of the plate.

A lash-chain eye, riveted to the front end of the lunette plate, is provided for the limber lashing chain.

The maneuvering bolt passes through the flasks and projects from the trail on each side, the flasks being stiffened at these points by projections from the trail shoe plate, which extend above the maneuvering bolt and are riveted to the flasks. The maneuvering bolt is fitted at each end with bronze maneuvering rollers.

A bracket, called the maneuvering bracket, is riveted to and projects to the rear of the shoe plate, and affords a point of application for the roller handspike.

The front transom, $\frac{1}{2}$ of an inch thick, lies between the flasks on a line from the trunnion beds to the axle and is secured to each flask by six $\frac{3}{4}$ -inch rivets. The rivets pass through flanges on the transom and through the flasks and brace plates. The transom is cut out above to clear the piece in its traveling position and has a bracket riveted to it which forms a support for the gun in the traveling position. The transom is cut out below to diminish the weight.

The rear transom, of $\frac{1}{2}$ -inch steel, is riveted by $\frac{3}{4}$ -inch rivets to each flask and stiffens them in the section between the trunnion beds and the elevating screw. The upper end is cut out to clear the piece in the traveling position. The lower end has riveted to it a hardwood block, which acts as a buffer to protect the threads of the elevating screw when in traveling position.

Each trunnion bed is made by bending a steel T bar, and is fastened by four 0.75-inch bolts through its web to the brace plate and flask. The bolts are provided with lock nuts. The exterior bolts carry the eyebolts to which the cap squares are secured. The cap squares are keyed on the eyebolts by the cap-square bolt keys. Each bolt key is secured by a chain to an eye stud screwed into the brace plate.

In traveling position the trunnions rest in a pair of bronze traveling trunnion brackets secured to the upper edges of the flasks by five bolts each. These brackets are located 30 inches to the rear of the firing trunnion beds, so as to distribute the weight more equally between the carriage and limber wheels. Their location also lowers the center of gravity of the piece, with resultant increase of stability in traveling.

The flasks are attached to the axle by means of the axle plates. The top axle plate rests directly upon the axle—a solid steel one 4 inches in diameter. The lower axle plate is formed to fit closely the underside of the axle and is securely riveted to the top plate. The flasks and brace plates are riveted through their flanges to the axle plates.

Heavy eye straps, shrunk and keyed on the ends of the axle, abut against the axle plates and form bearings for the inner ends of the nave boxes and wheels.

The wheels are of the Archibald pattern and have metal naves, wooden spokes and fellies, and steel tires. They are 60 inches in diameter, with 1-inch dish. The nave box is 12.75 inches long and is connected with the fellies with 16 spokes, each 2 inches thick. The steel tire is $4\frac{5}{8}$ inches wide and $\frac{3}{4}$ inch thick and is bolted to the fellies. Each wheel weighs 335.5 pounds.

The wheels are retained on the spindle of the axle by linchpins and drag washers. The linchpin is an eye pin of circular cross section. Mounted on a rivet through the eye is a semicircular clasp, which is passed around and under the spindle after the linchpin is in its seat. To reduce friction a leather or vulcanized-fiber washer is placed between the drag washer and the end of the nave.

The recoil is checked by the hydraulic buffer, which consists of a steel cylinder with a bore 5 inches in diameter and 42 inches in length. The cylinder has supporting bands with heavy eye lugs fitted to its front and rear ends and side straps keyed to these eye lugs. The straps project beyond the front end of the cylinder and terminate in eyes. A cast-iron pintle block is securely bolted to the gun platform between the wheels. A crosshead or yoke, carrying journals to fit the side-strap eyes, is fastened to the pintle block by a single stout pin, called the pintle, which forms the axis about which the yoke is free to move when the carriage is traversed. A set screw, engaging in an angular groove in the pintle, secures it to the pintle block.

The side straps are keyed to the eye lugs of the supporting bands and to the yoke journals by split keys.

The piston head is a bronze-packed steel head, shrunk on the front end of the piston rod and held in position by a spline screw seated half in the rod and half in the head. The rod passes through a stuffing box in the rear cap of the cylinder and terminates in an eye. This eye is connected by the firing-bracket pin with the firing bracket, which is riveted to the firing-bracket plate on the trail.

An obturator bar, screw-bolted in the inner wall of the cylinder, is made with a varying cross section for changing the size of the orifice for the flow of the liquid past the piston head, so as to make the resistance uniform.

The stuffing box in the rear cap of the cylinder contains a brass packing ring and a leather packing cup in addition to ordinary hydraulic packing, all held in place by a bronze gland screwed in.

The front end of the cylinder is closed by a steel cap. A hole in this cap for emptying and one in the rear cap for filling the cylinder are each provided with screw plugs.

The bottom plate is cut away to permit the buffer to swing. In traveling the front end of the buffer is carried by the traveling-axle bracket, a bronze piece screw-bolted to the lower side of the axle. A heavy bolt passes through the yoke and is pinned to the traveling bracket. The pintle block and pintle are transported with the platform.

The front end of the firing-bracket plate is riveted to the top plate of the flasks. The plate is then bent down at right angles to the direction of the pull of the hydraulic buffer, forming a support for the firing bracket; it is again bent at right angles to the rear and its rear end riveted to the top plate. The latter is strengthened on top at the points where the firing-bracket plate is fastened to it by $\frac{1}{2}$ -inch reinforced plates.

Riveted to the gun-rest bracket is a wooden block, which acts as a rest or bolster for the breech of the gun in traveling position.

For use in loading, two steps are constructed on the trail. The upper step is made so as to be folded down out of the way of the piece in traveling position. Each step consists of a step and a riser plate, which are hinged to the top plate and to each other. The hinge pin between the step plate and the top plate of flask is movable and permits the step to be knocked down or folded up, as stated above.

The trail tool compartment is under the lower step and has a sheet-steel cover. At the rear of this cover, and on its underside, are two curved straps of steel, which engage in openings in the rear edge of the projecting rim of the tool compartment.

The armament chest is carried on the trail of the carriage. To place the armament chest in its position on the trail, the lower step is knocked down. Two of the feet on the chest are engaged in the rear fasteners and the hinge rod is passed through the openings in the front fasteners and above the other two feet on the chest. A lock, which is fastened by a chain to the trail near the left upper fastener, may be used to lock the hinge rod in this position and thus secure the armament chest in place.

The elevating apparatus consists of a double screw, the motion of the head of which is governed by a radial fork attached at the fork end to the flasks below and slightly in rear of the trunnion beds, and at the screw end to the head of the inner screw. A bronze cross-head, which acts as a nut for the outer screw, is journaled in bronze

bearings bolted to the inside of the flasks, so that the screw can change its position in the vertical plane as it rises and falls.

Keyed to the lower side of the crosshead and mounted on the outer screw at its axis is a bronze bevel gear. It is keyed to the outer screw so that the latter turns with it. This bevel gear meshes with the intermediate gear (a combined bevel and spur gear) mounted on crosshead as an axis. The intermediate gear is actuated by a bronze pinion mounted on the elevating shaft. The latter passes through the flasks just in rear of the crosshead and is turned by crank handles fitted on each end outside the flasks.

The following method of assembling the elevating device will give the greatest elevation and depression:

Insert the outer screw in the crosshead from below and screw it up until it strikes the stop. The top of this screw will now be $11\frac{1}{2}$ inches above the upper surface of the crosshead.

With the outer screw in this position insert the inner screw from above and screw it down until the lower side of the inner screw head is 18 inches above the upper surface of the outer screw.

When the screws and the crosshead are in these relative positions, couple up the fork. This will give the piece a maximum depression of 5 degrees and a maximum elevation of 31 degrees.

For traveling, the fork is detached from the head of the screw and the latter revolved to the rear until it comes against the elevating shaft, to which it is secured by a leather strap. This revolution of the screw about the crosshead lowers the head and raises the lower end of the screw so as to clear the piece and hydraulic buffer, respectively, in traveling position.

The carriage is fitted with a road brake, consisting of the following parts: Handwheel, screw, truss, springs, levers, shoes, and hinges.

The handwheel is a bronzed wheel with the hub threaded to take the screw. The hub of the handwheel is fitted with a sleeve, which has vertical trunnions with bearings in the axle plate and in a bracket bolted to it between the flasks and in front of the axle.

The brass truss is an obtuse-angled isosceles triangle of steel. The obtuse angle is fastened between the flasks to the brake screw; the other two angles project through slots cut in flasks where they are keyed to the brake springs, which are in turn keyed to the brake shoes. Turning the handwheel to tighten the brake draws the screw to the rear (front of the carriage unlimbered) and by the aid of the truss and springs brings the shoes against the wheel.

The shoes are bronze castings with an eye lug, to which the spring is keyed, and two screw sockets to take the ends of the brake levers. The wearing face of the shoe is fitted with a maple block, which may be renewed when worn. Each brake lever consists of two steel tubes, which have one end screwed into the sockets on the shoe and the

other end, which terminates with an eye, secured to the hinge plate by a pin through the hinge ears. The hinge plate is firmly riveted to the flask. The hinge plate and lever support the shoes; the hand-wheel, screw, truss, and springs operate the brake. The entire system is free to move slightly about the trunnions of the handwheel sleeve, and thus both shoes are made to bear equally on the wheels. When not in use, the brake should habitually be entirely released. In this position two stops on the brake truss bear against the flasks and prevent the shoes from swinging and striking the wheels as the carriage lurches in traveling.

In firing, to avoid interference with the elevating cranks and to give free access to the trunnion for sighting, the springs and shoes are disconnected and separately folded back against the flasks, to which they are fastened by eyebolts and keys provided for the purpose.

A pair of bronze brackets are attached to the outside of each flask for carrying the sponge and rammer staves used with this piece. A sheet-metal bracket riveted to the lower side of the axle plate, and one riveted to the lower flange of one of the flasks, hold the two maneuvering handspikes, while similar brackets under the other flask are provided for the roller handspike.

When the gun is mounted upon this carriage, the axis of the trunnions is 72 inches above the platform, and the same axis is 10 inches in rear of the vertical plane containing the axis of the axle. The distance from the line joining the points of support of the wheels to the point of support of the trail is 100 inches.

The weight of the carriage, complete, without armament chest, is 3,800 pounds.

ARMAMENT CHEST.

The chest is made of sheet steel and is 21 inches long, 13.25 inches wide, and 9.5 inches deep. The bottom, ends, and lid are $\frac{1}{2}$ inch and the sides 0.15 inch thick. The front and back plates have $\frac{3}{4}$ -inch flanges turned over the ends, and the ends have similar flanges turned under the bottom plate. The parts are securely riveted together through the flanges by $\frac{3}{16}$ -inch rivets, spaced 1 inch between centers. The rivets are countersunk on the inside and have round heads on the outside of the box.

The top or lid has a 0.2-inch flange turned down all around to shed water. It is swung by two 2 by 4 $\frac{1}{2}$ inch steel hinges, each riveted to lid and back by eight $\frac{1}{4}$ -inch rivets. When closed the lid is held in place by a lock plate 1.125 inches wide, swung between hinge lugs 10.875 inches apart, riveted to the lid. Two $\frac{1}{2}$ -inch holes in the plate, 9 inches between centers, engage over projecting pins on front of the box, while the hasp at the middle of the plate engages with a turn-buckle on the chest.

A padlock to lock in the turnbuckle eye is chained to the chest and affords means for locking it when desired. A chain with one end fastened to the inside of the end of the chest and the other to an eye on the underside of the lid limits the backward swing of the lid. A steel handle is riveted to each end of the chest, just above the middle, by eight $\frac{1}{4}$ -inch rivets.

The inside of the chest is divided by wooden partitions into compartments for the axle grease, sperm oil, and vaseline cans and the telescopic sight. A fifth compartment carries the oiler, shot tray, rammer head, guard nut, and rear sight, which extends into an opening in the wooden partition. The quadrant is held by two brackets on the inner side of the lid.

The chest alone weighs 68 pounds; with contents complete as listed on page 85 it weighs 113 pounds. It is carried on the trail of the carriage.

THE SIEGE LIMBER.

[Plate IX.]

Nomenclature, etc.

Number.	Name of part.	Location.
1	Middle rail (fork).....	Made of two steel angles.
2	Understraps for middle rail.....	Fasten rail to axle.
4	Boils for understraps.....	Straps to rail.
1	Front brace.....	Axle to front end of middle rail.
4	Front-brace bolts.....	Brace to axle and rail.
2	Axle straps.....	Fasten braces to axle.
1	Pinle.....	Bolted to rear of middle rail.
1	Pintle plate.....	On rail around pintle.
2	Pintle-plate bolts.....	Plate to middle rail.
2	Pintle braces.....	Axle to rear end of middle rail.
2	Pintle bolts.....	Through rail, pintle, and pintle braces.
1	Lashing-chain eyebolt.....	Screwed into bottom of pintle.
1	Lashing chain and hook.....	Fastened to eyebolt.
1	Traverse circle.....	On middle rail and axle.
4	Traverse-circle bolts.....	Circle to pintle braces.
1	Axle.....	Under middle rail.
2	Wheels.....	On axle spindles.
2	Linchpins.....	On spindles.
2	Linchpin clasps.....	Pivoted to linchpin.
2	Linch washers.....	Between pin and nave of wheel.
2	Doubletree stay links.....	Doubletree to axle-strap eyes.
1	Doubletree.....	On doubletree bolt.
1	Doubletree bolt.....	Front end of middle rail.
1	Doubletree-bolt brace.....	Bolt to middle rail.
2	Bolts for doubletree-bolt brace.....	Brace to middle rail.
2	Singletrees.....	On doubletree hooks.
1	Neck yoke.....	Front end of pole.
1	Pole.....	Bolted to middle rail.
2	Pole bolts.....	Pole to rail.
1	Pole strap.....	Under pole at end of rail.
1	Pole pad.....	End of pole.
4	Pole-pad screws.....	Pad to pole.
1	Neck-yoke stop.....	Riveted to pole.
1	Copper sheathing.....	Around pole.
1	Pole prop.....	Hinged under pole.
	Consisting of—	
1	Hinge piece.....	Fastened to neck-yoke stop eye.
1	Hinge pin.....	Through hinge piece.
2	Legs.....	Pivoted to hinge piece.
1	Pivot bolt.....	Legs to hinge piece.
1	Eyebolt.....	Riveted to pole.
1	Hook and chain.....	Fastened to pole.

DESCRIPTION OF SIEGE LIMBER.

[Plate IX.]

The siege limber is used with both models of the 7-inch howitzer carriage and with the 5-inch siege-gun carriage.

It is simply a rolling support for the trail of the carriage in traveling and has no other office. It consists of a framework of angle steel, resting upon a solid forged axle $3\frac{1}{2}$ inches square. The wheels, linchpins, and washers are the same size and pattern as those used on the carriage. The middle rail is made up of two $3\frac{1}{2}$ -inch steel angles $\frac{3}{8}$ inch thick, placed $4\frac{1}{2}$ inches apart.

The lower flanges are cut away for the axle and the upper flanges are let in flush with its top surface. Steel straps pass under the axle and are bolted to the middle rail by four bolts, two in each part.

One of these bolts in each strap has a square head, which is counter-sunk in the upper surface of the traverse circle and serves to attach it to the middle rail.

The front brace for the middle rail is made of 3-inch angle steel $\frac{3}{8}$ -inch thick. It is a single piece bolted to the middle rail at the pole end and bent back diagonally so that its extremities rest upon and are bolted to the axle just inside of the shoulder washers. The vertical web is partly cut away and bent outward, resting against the front side of the axle, where it is secured by a strap which embraces the axle and forms an eye for the doubletree-stay links and a support for one end of the pintle braces. The pintle plate rests upon the middle rail in such a position as to bring the pintle $12\frac{1}{2}$ inches from the axle. It is 12 inches in diameter, made of $\frac{1}{2}$ -inch steel, and is solidly bolted to the horizontal web of the middle rail. The pintle is the frustum of a cone 2.375 inches in diameter at the plate, with a slight taper. It is firmly secured to the middle rail by two bolts which pass through the lower end of the pintle and the vertical web of the middle rail. These same bolts serve to fasten the rear ends of the pintle braces to the middle rail.

Below the pintle and screwed into it axially, is an eyebolt, which supports the lashing chain and hook. When hooked into an eye on the carriage on the front part of the lunette plate this chain limits the vertical motion of the trail in the traveling position.

The traverse circle is a steel plate over the axle $\frac{1}{2}$ inch thick and 7 inches wide, with its ends flanged downward. It is secured to the middle rail, as already stated, and its ends are bolted through the flanges to the pintle braces. It supports the weight of the trail in conjunction with the pintle plate and corresponds to the fifth wheel of a wagon.

The pole is of wood and has a leather pole pad fastened by four screws on its front end and a neck-yoke stop on its underside. It

is 11 feet 3½ inches in length, squared to 4½ inches, so as to enter its seat in the middle rail, where it is bolted in place by two 1-inch bolts. It is sheathed with copper from a point 33 inches from its end for a distance of 24 inches back.

The pole is provided with a pole prop consisting of a hinge piece and two sheet-steel legs. The hinge piece is swung to an eye on the rear of the neck-yoke stop. The legs are fastened to the hinge piece, about which they have a limited motion, enabling them to be spread to a V shape when the prop is in use and to be brought together, so as to be folded back under the pole when not in use.

The prop is held in the latter position by a hook on the end of a chain engaging in an eyebolt fastened to the pole and passing through a slot in the pole-prop legs. The neck yoke is of wood of the usual construction.

The doubletree and singletrees are of sheet steel. The former is pivoted on the doubletree bolt, which rises above the front connection to the middle rail and is braced back to the same by a forked steel brace, called the doubletree-bolt brace. At the extremities of the doubletree are double hooks, the front branches to hold the singletrees and the rear branches to engage the stay links, which form a connection with the axle and limit the motion of the doubletree above its pivot.

The weight of the siege limber complete is 1,400 pounds.

COMBINED FORGE AND BATTERY WAGON.

[Plate X.]

The dimensions and construction of the iron body for the battery wagon are the same as for the 3.2-inch caisson.

The limber, constructed in the same manner as the limber for the 3.2-inch carriage or caisson, except that the packing for ammunition in the chest and the primer and obturator boxes are omitted, carries all that pertains to the forge with the exception of the anvil, vise, and sledge.

The battery-wagon body is made of poplar and oak, with three compartments. The largest is entered from either side of the top, the openings being covered with hinged lids. A door at the front opens into the other two compartments, which are of equal size, and just contain, one a chest of saddler's and the other a chest of carpenter's and wheelwright's tools. The tools in the chests are all arranged so that they can be taken out one by one without disturbing the rest, except the jack plane, which is behind the smoothing plane. The chests are provided with handles, so that they can be taken out of the wagon and carried about; they are furnished with locks and keys. In addition to the space in these chests occupied by

the tools, there is enough for small stores, for which two small canvas bags are provided for each chest.

In the main compartment are carried the grindstone and cans for sperm and coal oil, secured by permanent packing.

There is also a space in this compartment for such stores and spare parts as may be designated by the battery commander. At the rear of the wagon body is a folding rack for forage, and there is a rail around the top to which forage can be lashed.

The lever road brake is used on the battery wagon.

The anvil is carried on the middle rail in front of the door of the chest compartment. It is secured by a bolt with a crank nut, passing through its body and the middle rail. A vise is permanently bolted to the middle rail in rear of the lunette, and a sledge hammer is secured along the rail between the vise and by a sheet-steel strap and turnbuckle, called the "sledge and lunette-prop attachment." The lunette prop is carried between the flanges of the middle rail, under the front end of the body. When the wagon is unlimbered the prop is removed from its fastening in this position and is placed under the lunette, its end being fitted in the lunette ring.

The articles carried in and on the forge and battery wagon are listed in the "Table of equipment" on page 85.

In addition to the above, the battery-wagon body contains such spare parts of the piece and carriage as may be prescribed.

SIEGE AMMUNITION WAGON.

[Plate XI.]

Nomenclature, etc.

Number.	Name of part.	Location, etc.	Material.
1	Front truck		
1	Rear truck		
1	Body		
1	Brake		
	<i>Front truck.</i>		
2	Wheels	On ends of axle	Archibald.
1	Axle	Fastened to lower bolster	Steel No. 1.
2	Linchpins	Secures wheel on axle	Steel No. 1.
2	Linch washers (R. and L.)	Between linchpin and nave box	Steel No. 1.
1	Linch fiber washer	Between linch washer and nave box	Fiber.
1	Lower bolster	Secured to top of axle	Oak.
2	Hound-brace lips	Attaches end of bolster to axle	Steel No. 1.
4	Hound-bolster bolts	Through hounds, attaching bolster and axle	Steel No. 1.
2	Hound-bolster bolt yokes	Connecting two hound bolts	Steel No. 1.
2	Hound-truss clips	Connecting bolster, axle, and hound truss	Steel No. 1.
1	Center bearing (male and female)	Between upper and lower bolster	Bronze No. 1.
2	Male center-bearing bolts	Attaches center bearing to lower bolster	Steel No. 1.
1	Hound	Attached to lower bolster	Steel angle.
2	Hound braces (R. and L.)	Connects front ends of hound to axle	Steel No. 1.
2	Hound trusses (R. and L.)	Under axle and attached to front and rear of hounds	Steel No. 1.
4	Hound-truss bolts	Connects hound and hound truss	Steel No. 1.
1	Fifth wheel	Attached to upper bolsters	Steel No. 1.
1	Kingbolt	Through bolsters and center bearings	Steel No. 1.
6	Fifth-wheel bolts	Attach fifth wheel to bolsters	Steel No. 1.
2	Female center-bearing bolts	Attach female center bearing to upper bolster	Steel No. 1.
1	Upper bolster	Attached to bed and supporting fifth wheel	Oak.

Nomenclature, etc.—Continued.

Num-ber.	Name of part.	Location, etc.	Material.
<i>Front truck—Continued.</i>			
1	Rear bolster	Attached to bed and supporting fifth wheel...	Oak.
1	Front bolster	Attached to bed and supporting fifth wheel...	Oak.
1	Pole socket	Attached to hound	Bronze No. 1.
1	Pole key	Secures pole in seat	Steel No. 1.
1	Pole-key lock	Attached to hound	Steel No. 1.
1	Pole understrap	Attached to front hound	Steel No. 1.
1	Pole overstrap	Attached to front of hound	Steel No. 1.
1	Doubletree bolt	Riveted to top of hound	Steel No. 1.
1	Doubletree-bolt brace	Boiled to hound	Steel No. 1.
1	Doubletree	Attached to hound by doubletree bolt	Steel No. 1.
2	Stay chains	Connects doubletree and front axle	Steel No. 1.
2	Singletrees	Attached to doubletree	Steel No. 1.
1	Pole	Held in its seat by pole key	Oak.
1	Pole prop	Attached to front end of pole	Steel No. 1.
1	Neck yoke	On end of pole	Hickory.
<i>Rear truck.</i>			
2	Wheels	On ends of axle	Archibald.
1	Axle	Fastened to bolster	Steel No. 1.
2	Linchpins	Secure wheels on axle	Steel No. 1.
2	Linch washers (R. and L.)	Between linchpin and nave box	Steel No. 1.
2	Linch fiber washers	Between linch washers and nave box	Fiber.
1	Bolster	Secured to top of axle	Oak.
4	Bolster clips, short	Secure bolster to axle	Steel No. 1.
2	Bolster clips, long	Secure bolster to axle	Steel No. 1.
4	Body-axle bolt yokes	Across bottom of axle	Steel No. 1.
4	Body-axle bolts	Secure body to bolster and axle	Steel No. 1.
2	Rear-axle braces, end (R. and L.)	Brace axle to bed	Steel No. 1.
2	Rear-axle braces, middle	Brace axle to bed in front	Steel No. 1.
<i>Body.</i>			
(Oak, attached to bolsters.)			
3	Box straps	Around outside of body	Steel T's.
3	Front-end rods	Through front end of box	Steel No. 1.
2	Tool-box corner angles	Attach sides and front of tool box	Steel angle.
2	Tool-box hinges	Attach tool-box lid to tool box	Steel No. 1.
1	Tool-box hasp and staple	For fastening tool-box lid	Steel No. 1.
4	Side braces	Brace sides of bed	Steel No. 1.
2	End-gate hinges, end (R. and L.)	Attach end gate to body	Steel No. 1.
1	End-gate hinge, center	Attaches end gate to body	Steel No. 1.
2	End-gate bolts (R. and L.)	Attached to sides of bed	Steel No. 1.
2	End-gate bolt keys	For fastening end gate when closed	Steel No. 1.
2	End-gate bolt plates, outside	Riveted to outside of end gate	Steel No. 1.
2	End-gate bolt plates, inside	Riveted to inside of end gate	Steel No. 1.
2	End-gate chains (R. and L.)	Attached to sides of bed and gate	Steel No. 1.
1	End-gate top strap	Screwed to top of end gate	Steel No. 1.
1	Truss rod	Under body between front and rear truck	Steel No. 1.
1	Truss-rod bearing	Between truss rod and bottom cleat	Steel No. 1.
1	Truss-rod yoke	Connects truss rod to bottom of body	Steel No. 1.
2	Truss-rod extensions	Pass through upper and rear bolster, front truck	Steel No. 1.
<i>Brake.</i>			
1	Brake shaft	Attached to body front of rear wheels	Steel No. 1.
2	Brake shoes	In brake-shoe holders	Oak.
2	Brake-shoe holders	On ends of brake shaft	Bronze No. 1.
2	Brake-shoe springs	Between brake-shoe holders and shaft	Spring steel.
2	Brake-shaft caps	Secures brake-shoe holders on ends of shaft	Steel No. 1.
2	Brake-shaft bearings (R. and L.)	Attaches brake shaft to body	Bronze No. 1.
2	Bearing-cap screws	In brake-shaft bearing	Steel No. 1.
4	Bearing bolts	Secure brake-shaft bearing to body	Steel No. 1.
2	Bearing-brace rods	Braces brake bearing to body	Steel No. 1.
6	Bearing-brace bolts	Secure bearing braces to body	Steel No. 1.
2	Bearing-bolt plates	In bottom of bed	Bronze No. 1.
1	Brake-lever pawl	Attached to brake-shaft lever	Tool steel.
1	Pawl weight	Attached to pawl	Bronze No. 1.
1	Pawl bolt	Secures pawl to lever	Steel No. 1.
1	Quadrant	Attached to side of body	Steel No. 1.
2	Quadrant brackets	Between quadrant and body	Bronze No. 1.
2	Quadrant-bolt nut locks	Secure quadrant to body	Steel No. 1.
2	Quadrant-bolt nut locks	On quadrant bolt	Steel No. 1.
1	Brake stake	Attached to brake-shaft lever	Oak.
1	Brake-stake ring	On end of brake stake	Steel No. 1.
1	Pawl handle and clasp	Attached to brake stake	Steel No. 1.
1	Pawl-handle connecting rod	Connects pawl and pawl handle	Steel No. 1.

DESCRIPTION OF THE WAGON.

[Plate XI.]

Four of these wagons are supplied to each battery, three to be used as ammunition wagons and one as an implement wagon.

The body of the wagon is constructed of oak and has a compartment at the front arranged for holding the tools, etc., supplied with each wagon.

The box is held together by box straps and by two oak cleats which project beyond the sides and support the side braces. The end gate has three strap hinges and is further strengthened by two oak cleats, one on each side.

The running gear is the stiff-pole type, without a reach. The axles are the standard axles used on the siege limber and the wheels are the standard 4-inch wheels, except that the front wheels are 38 inches in diameter to permit their turning under the bed.

The hound is supported by an oak bolster, which is strapped to the front axle. It is braced by two steel trusses passing under the axle, and is further strengthened by two steel braces strapped to the axle at the end of the bolster, and bolted in front to the underside of the flange at the ends of the hound.

The wagon is fitted with the new field artillery pole, which is held in place by a pole key. This pole key may be locked when the pole is in its seat. The pole is so fitted as to permit a vertical movement of 5 inches at the end of the pole to prevent a sudden jar on the horses' necks.

The fifth wheel is supported by three oak bolsters attached to the bed and is 36 inches in diameter. The kingbolt passes through the bottom of the bed and the center bolster and is readily removed.

The rear truck consists of an oak bolster strapped to the rear axle and fastened to the body. It is firmly secured in position by four braces, two of which are strapped to the axle and attached to the bed in front; the other two pass under the axle and are fastened to the bed in front and in rear.

The front and rear gears are connected by a truss rod and two auxiliary truss rods, which assist in holding them in place and prevent the bed from sagging between the gears.

The brake shaft has an arm on each end, to either of which may be attached the collars for holding the brake stake. The brake quadrant has a row of teeth in which the pawl engages when the brake is set. A connecting rod with a handle is fitted to this pawl, by means of which the brake may be operated by a man in the wagon. The brake stake, quadrant, and pawl are fitted for either side and are readily changed.

The singletrees, doubletree, and neck yoke are of the standard pattern.

No top is provided for this wagon, but screw eyes are placed on each side of the body for fastening a paulin when it is desired to cover the bed.

The weight of the wagon empty is 2,650 pounds.

The load should not exceed 9,000 pounds on good roads, and on bad roads it should be reduced to 6,000 pounds or less.

The tools and accessories carried on the wagons are listed on page 86.

FIELD ARTILLERY STORE WAGON.

Nomenclature, etc.

Number.	Name of part.	Location, etc.	Material.
1	Front truck.....		
1	Rear truck.....		
1	Body.....		
1	Brake.....		
	<i>Front truck.</i>		
2	Front wheels.....	On front axle.....	Archibald.
2	Linchpins.....	Through end of axles.....	Steel No. 2.
2	Linchpin springs.....	Riveted to linchpins.....	Spring steel.
2	Linchpin washers (R. and L.).....	Between nave box and linchpin.....	Steel No. 1.
2	Washers.....	Between nave box and linch washer.....	Fiber.
1	Front axle.....	Connects front wheels.....	Steel.
2	Axle-clip yokes.....	Bolster-plate clip to axle.....	Steel No. 1.
1	Axle bolster plate.....	Between lower bolsters.....	Steel No. 1.
1	Hound.....	Between upper and lower bolsters.....	Steel No. 1.
1	Hound truss.....	From hounds to axle.....	Steel No. 1.
1	Hound-truss clip.....	Hound truss to axle.....	Steel No. 1.
2	Hound braces (R. and L.).....	Hound to axle.....	Steel No. 1.
2	Hound-brace bolts.....	Hound to hound brace.....	Steel No. 1.
2	Hound-brace clips.....	Front axle to hound brace.....	Steel No. 1.
2	Hound stays (R. and L.).....	On hound, under fifth wheel.....	Steel No. 1.
2	Hound-stay chains.....	Doubletree to hound.....	Steel No. 1.
2	Hound-stay bolts.....		Steel No. 1.
1	Fifth wheel.....	Underside of front bolsters.....	Steel No. 1.
1	Doubletree bolt and brace.....	On front of hound.....	Steel No. 1.
2	Doubletree-bolt brace bolts.....		Steel No. 1.
1	Doubletree-bolt strap.....	On hound.....	Steel No. 1.
1	Lower bolster plate.....	On top of lower bolster.....	Steel No. 1.
2	Bolster-plate clips.....	Fastens bolster plate to bolster.....	Steel No. 1.
1	Pole strap.....	Between arms of hound.....	Steel No. 1.
1	Pole-strap reinforce.....	Between arms of hound.....	Steel No. 1.
1	Pole bolt.....		Steel No. 1.
1	Pole socket.....	Between front ends of hound.....	Bronze No. 1.
1	Body-bolster brace.....	Fastens front and rear upper bolster to middle upper bolster.....	Steel No. 1.
2	Bolster side bearings.....	On ends of middle upper bolster.....	Steel No. 1.
1	Upper bolster plate.....	In center, under middle upper bolster.....	Steel No. 1.
1	Bolster knuckle.....	In center of lower bolster.....	Steel No. 1.
1	Knuckle rod.....	Connecting rocker-shaft bearings.....	Steel No. 1.
2	Knuckle-rod pipes.....	Between rocker-shaft bearings.....	Pipe.
1	Knuckle-rod washer.....		Pipe No. 1.
2	Rocker-shaft body bearings.....	On undersides of front and rear and upper bolsters.....	Bronze No. 1.
1	Rocker-shaft fifth-wheel front bearing.....	On top of fifth wheel in front.....	Bronze No. 1.
1	Rocker-shaft fifth-wheel back bearing.....	On top of fifth wheel in rear.....	Bronze No. 1.
1	Lower bolster (2 pieces).....	Between hound and axle.....	Oak.
1	Front upper bolster.....	Connects wagon box and fifth wheel.....	Oak.
1	Middle upper bolster.....	Connects wagon box and fifth wheel.....	Oak.
1	Rear upper bolster.....	Connects wagon box and fifth wheel.....	Oak.
1	Pole.....	In pole socket.....	Red oak.
1	Pole prop.....	Underside of front end of pole.....	Steel.
1	Neck yoke.....	On end of pole.....	Oak.
1	Doubletree.....	On doubletree bolt.....	Steel No. 1.
2	Singletrees.....	On end hooks of doubletree.....	Steel No. 1.

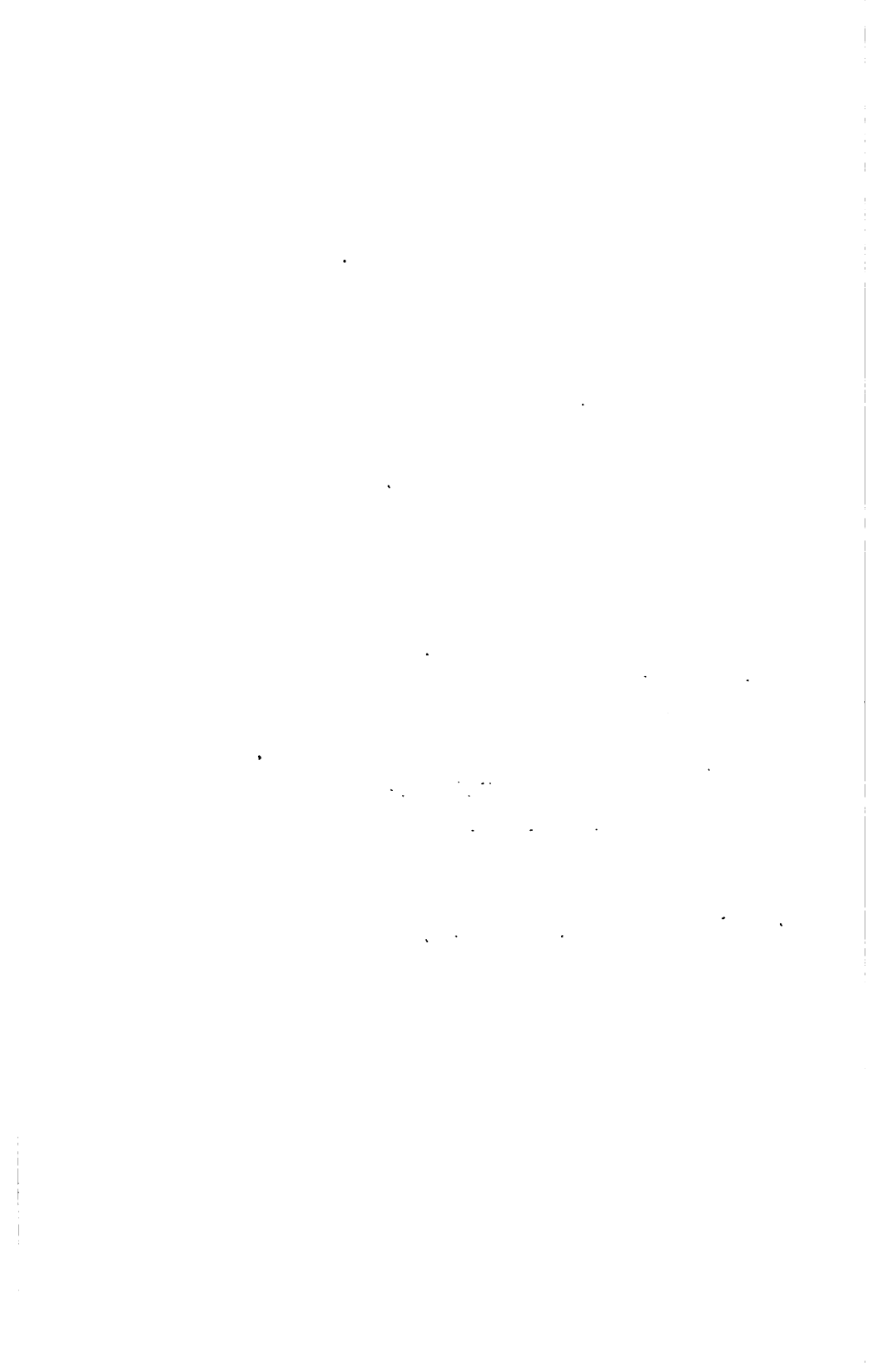
Nomenclature—Continued.

Number.	Name of part.	Location, etc.	Material.
<i>Rear truck.</i>			
2	Rear wheels.....	On front axle.....	Archibald.
2	Linchpins.....	Through end of axle.....	Steel No. 2.
2	Linchpin springs.....	Riveted to linchpin.....	Spring steel.
2	Linchpin washers.....	Between nave box and linchpin.....	Steel No. 1.
2	Washers.....	Between nave box and linch washer.....	Fiber.
1	Rear axle.....	Connects rear wheels.....	Steel.
2	Rear-axle braces.....	Connects wagon box and axle.....	Steel No. 1.
2	Rear-axle clips.....	Connects bolster with axle.....	Steel No. 1.
1	Rear-axle center brace.....	Connects wagon box and axle.....	Steel No. 1.
1	Rear-axle center clip.....	Connects bolster with axle.....	Steel No. 1.
2	Rear-axle end-bolster clips.....	Connects bolster with axle.....	Steel No. 1.
2	End-bolster clip yokes.....	Between axle and bolster clip nuts.....	Steel No. 1.
2	Rear-bolster head washers.....	Between wagon body and bolster brace nuts.....	Bronze No. 1.
1	Axle bolster.....	Between wagon body and axle.....	Oak.
<i>Brake.</i>			
1	Brake beam.....	Attached to body in front of rear wheels.....	Oak.
2	Brake-beam hangers.....	Attaches beam to body.....	Steel No. 1.
2	Brake-beam hanger bearings.....	Bearing for hanger.....	Steel No. 1.
2	Brake-beam washers.....	Under nuts of brake-beam hanger bolt.....	Steel No. 1.
2	Brake-shoe holders.....	Attached to end of brake beam.....	Steel angle.
2	Brake-shoe holder bolts.....	Attaches holder to beam.....	Steel No. 1.
1	Brake quadrant.....	Attached to wagon body.....	Steel No. 1.
1	Brake-quadrant bracket.....	Between body and quadrant, supports quadrant.....	Bronze No. 1.
1	Brake saddle.....	Attached to brake lever.....	Tool steel.
1	Brake shaft.....	Attached to rear-axle braces.....	Steel No. 3.
1	Brake-shaft spring hook.....	Attached to brake shaft.....	Steel No. 1.
1	Brake connecting rod.....	Connects brake shaft with brake beam.....	Steel No. 1.
1	Brake connecting-rod pin.....	Fastens connecting rod to brake beam.....	Steel No. 1.
2	Brake-quadrant yokes.....	Riveted to brake beam.....	Steel No. 1.
2	Brake-shaft upper loops.....	Riveted to brake beam.....	Steel No. 1.
2	Brake-shaft lower loops.....	Riveted to brake beam.....	Steel No. 1.
1	Brake spring.....	Connects brake-shaft spring hook with rear bolster.....	Steel wire.
1	Brake-spring eyebolt.....	Connects spring with rear bolster.....	Steel No. 1.
1	Brake latch pin.....	Fastens latch to sides of brake-shaft lever.....	Steel No. 1.
2	Brake shoes.....	Fastened to shoe holder.....	Oak.
3	Brake-shaft bearings.....	Brake shaft to rear-axle brace.....	Bronze No. 1.
3	Brake-shaft bearing bolts.....	Fastens brake-shaft bearing to rear-axle brace.....	Steel No. 1.
1	Brake ring and ferrule.....	On end of brake stake.....	Steel No. 1.
1	Brake stake.....	Attached to brake-shaft lever.....	Hickory.
<i>Wagon body.</i>			
1	Wooden body.....		Poplar.
2	Front end irons (R. and L.).....	Front end wagon box, sides to bottom.....	Steel No. 1.
2	End-gate end irons (R. and L.).....	Sides to end gate.....	Steel No. 1.
2	End-gate hooks (R. and L.).....	On back of gate.....	Steel No. 1.
2	End-gate chains.....	Fastens end gate to wagon box.....	Steel No. 1.
2	End-gate hinges.....	Fastens end gate to wagon body.....	Steel No. 1.
2	Side stays (end).....	At rear of box.....	Steel No. 1.
2	Side stays (center).....	At center of box.....	Steel No. 1.
4	T side stays.....	On sides of box between side stays.....	Steel T.
2	Front end rods.....	Across front of box.....	Steel No. 1.
12	Upper bow staples.....	Along upper edges of sides of box.....	Bronze No. 1.
12	Lower bow staples.....	12 inches below the upper bow staples.....	Bronze No. 1.
2	Rub irons.....		Steel No. 1.
6	Bows.....	In bow staples.....	Hickory.
1	Canvas cover.....		Canvas.
1	Tool box.....	Suspended under rear end of wagon box.....	Poplar.

DESCRIPTION OF THE WAGON.

This wagon will be used for carrying the knapsacks of the battery or such authorized stores and equipments as can not be accommodated on the other vehicles.

The body of the wagon is made of poplar and oak and is held together by side straps and two oak cleats bolted to the bottom of



SIEGE PLATFORMS.

To insure accuracy of fire and ease of manipulation in pointing, the carriage is mounted upon a wooden platform supplied by the Ordnance Department.

FOR PERMANENT POSITIONS.

[Plate XII.]

This platform is 12 feet wide and 14 feet long, its length being parallel to the direction of fire. It consists of a double deck of oak planking resting upon yellow-pine sleepers.

The sleepers are placed perpendicular to the line of fire; three of them are grouped near the forward end of the platform under the point where the carriage wheels rest, while five are placed farther to the rear at the point of support of the trail. The deck planking is oak, 3 by 6 inches in dimensions. The lower layer is placed lengthwise and the upper layer crosswise of the platform. The whole system is bound together by wood screws.

The pintle block is bolted to the platform near the center of its front end. The heads of the pintle-block bolts bear against the pintle-block plate under the platform.

In manufacture each platform is assembled and the timbers composing it are numbered as shown in the plate, so that in reassembling the platform on the battery site no difficulty will be experienced in fitting the parts together if attention is paid to the numbers of the various pieces. It will be noted that pieces are numbered 1 to 24 on the front end from right to left, and that all transverse timbers are numbered from 1 to 28 on the left end from front to rear; also that all numbers on the front of the platform are in black, while those on the side are in red paint.

In laying the platform the following method should be observed: Prepare the site by excavating the earth until the bed for the platform is horizontal. The earth, if not already firm, should be thoroughly tamped.

The two 3 by 6 yellow-pine sleepers (Nos. 1 and 28) are put in place first, No. 1 perpendicular to the line of fire, marking the front end, and No. 28 parallel to No. 1 and marking the rear end of the platform. The other sleepers are then placed in their proper positions. In locating them the two 14-foot side deck planks (Nos. 1 and 24) will be found very convenient. With these deck planks connecting the ends of the two end sleepers, all the intermediate ones can be quickly located by means of the screw holes in the different pieces.

The sleepers, when in position, should have their upper surfaces in the same horizontal plane. The earth should be firmly rammed

around and under, and filled in between them even with the upper surfaces.

The pintle-bolt plate, with bolts projecting upward, should then be located and the deck planking laid in place and screwed down. Each platform is provided with a special screw driver for this purpose. The longest wood screws pass through the deck planking into the larger sleepers; those of the intermediate length into the 3-inch sleepers at the ends of the platform, and the short screws bind together the deck planks at points where there are no sleepers.

The pintle block should finally be bolted in place, completing the platform. As finished, the platform should be horizontal. The earth should be graded as high as the platform all around, sloping outward to allow the water to run off.

Each platform is provided with two steel-shod wooden wedges, which are placed in rear of carriage wheels to facilitate the return of the carriage to firing position after recoil.

A complete platform includes the following parts:

Number.	Name.	Dimensions.	Remarks.
2	Sleepers.....	3 by 6 inches, 12 feet long.....	Yellow pine.
8	Sleepers.....	6 by 6 inches, 12 feet long.....	Yellow pine.
24	Deck planks.....	3 by 6 inches, 14 feet long.....	Oak.
28	Deck planks.....	3 by 6 inches, 12 feet long.....	Oak.
192	Wood screws.....	$\frac{1}{2}$ inch diameter, 10 inches long.....	Steel, threaded up 5 inches.
48	Wood screws.....	$\frac{1}{2}$ inch diameter, 9.75 inches long.....	Steel, threaded up 3.5 inches.
36	Wood screws.....	$\frac{1}{2}$ inch diameter, 5.75 inches long.....	Steel, threaded up 3 inches.
1	Pintle-block plate.....	20 by 20 inches, $\frac{1}{2}$ inch thick.....	Steel.
8	Pintle-block bolts.....	1 inch diameter, 9 inches long.....	Steel.
2	Wedges.....	8 inches wide, 38.5 inches long, 10 inches thick.....	Oak, shod with steel plate.
1	Screw driver.....		For wood screws.

Weight of platform, complete, 6,200 pounds.

FOR FIELD SERVICE.

[Plate XIII.]

The platform above described is to be used in permanent positions only. For service with pieces in the field the form of platform and anchorage described below is designed. It comprises:

- 1 trail rest.
- 1 buffer yoke bushing.
- 2 wheel rests.
- 2 wheel wedges.
- 1 trail-rest eye strap.
- 1 trail-rest chain.
- 1 anchor-rod beam.
- 1 anchor-rod clamp bolt.
- 1 anchor-rod clamp.
- 1 anchor rod.
- 1 anchor plate.

The trail rest is 5 feet long, 30 inches wide, and 6 inches thick. It is made of two tiers of 3-inch oak planks, the bottom tier laid lengthwise and the top tier crosswise, the whole securely fastened together by through bolts and washers. At the front end is fastened the trail-rest eye strap, to which is fastened one end of the trail-rest chain. The other end of the chain is fastened to the end of the anchor rod.

The wheel rests are each 6 feet long, 20 inches wide, and 4 inches thick. They are constructed in the same manner as the trail rest, except that the top tier of planks are of white pine.

The wheel wedges are of oak, 50.5 inches long, 8 inches wide, and 9 inches thick at their larger ends. Their upper surface is faced with a $\frac{1}{8}$ -inch steel plate.

The anchor rod beam is made from a 4 by 6 inch oak beam and is 80 inches long. When this beam is in position the wheel rests lie on the two surfaces formed by dressing off one edge for 20 inches from each end.

The anchor rod is made of 1-inch steel rod, which is $1\frac{1}{2}$ inches in diameter at the two ends. This rod is 11 feet long and jointed at a point 4 feet from the upper end.

The anchor plate is made from $\frac{3}{8}$ -inch steel plate and is 34 inches in diameter, with a 1-inch flange turned up all around.

The platform is laid as follows:

The ground is excavated, and the anchor plate attached to the longer section of the anchor rod is placed so that the lower edge of the plate is 8 feet below the surface.

The anchor-rod beam is embedded at the point where the upper end of the anchor rod emerges from the ground, as shown in the plate.

The anchor rod rests in the groove in the anchor-rod clamp, which is bolted to the anchor-rod beam. A clamp bolt passing through two openings in the clamp above the rod holds the latter in place.

The ground is prepared for the wheel rests and trail rest, which are then placed in position.

The ground which has been removed for sinking the anchor plate and rod in position is then replaced and well tamped, especially if the soil is not firm, and the platform is now ready for the carriage.

The implement wagon containing the platforms and the tools necessary for placing them in position may precede the battery and have the platform in position ready for the carriages when the latter arrive.

The carriage is now run upon the rests, the chain fastening is placed on the end of the anchor rod, and the buffer yoke, with the bushing, is also placed on the anchor rod and bolted in place.

The hook end of the chain is then passed through the trail-rest eye strap and hooked back through one of its links.

The wheel wedges are then placed under the wheels.

The platform weighs, complete, 900 pounds.

When this platform is used with the 5-inch siege gun carriage, model of 1896, and the 7-inch siege howitzer carriage, model of 1893, the straps on the hydraulic buffer must be lengthened $1\frac{3}{4}$ inches. If there are no facilities at the post for welding a piece to these straps, new straps of the proper length may be obtained on the usual requisition.

SIGHTS FOR 5-INCH SIEGE GUN.

[Plate XIV.]

For pointing, the 5-inch siege gun is provided with a front and rear sight.

THE FRONT SIGHT.

The front sight is composed of the following principal parts:

- Body.
- Cross carrier.
- Cross.
- Direction sight.

The body consists of a bronze standard fastened by four screws to a seat on the rimbases of the gun. In the upper part of the standard there is a circular aperture containing the cylindrical cross carrier, carrying the cross, which is made of two pieces of steel ribbon halved on each other, and having their planes parallel to the axis of the gun. Two cuts in the standard, one vertical and the other horizontal, with a clamp screw, form the means of holding the cross carrier in position.

Plate XIV shows the latest model, which differs from the previous only in the additional strength to resist bending given to the body by the substitution for the two cuts of a single vertical cut, as shown on plate.

THE REAR SIGHT.

The rear sight is made of bronze and brass, and is composed of the following principal parts:

- Graduated vertical limb.
- Base.
- Trunnion.
- Deflection scale.
- Level.
- Elevating screw.
- Sighting leaf.
- Vernier.
- Adjusting screw of spirit level.
- Trunnion-clamping screw.
- Deflection screw.
- Seating pin.

The base of the site is provided with a taper shank which fits into a corresponding socket on the rear of the gun. A small steel seating pin drops into a recess in the socket and insures the correct seating of the sight.

The trunnion is pivoted in the base in such a way as to admit of partial rotation in a plane perpendicular to the axis of the gun. This motion is limited in either direction by the clamp screw, and the trunnion can be fastened by it at any position.

The deflection scale forms the lower part of the vertical limb and is at right angles to it. The limb has a horizontal motion, guided by slots in the trunnion and actuated by the deflection screw. This permits the sight to be set for drift, windage, etc.

The deflection scale is graduated to show thousandths of range.

A spirit level is attached to the deflection scale and is provided with holding and adjusting screws. The trunnion clamp screw allows a motion of the vertical limb of about 25° in either direction, and the level enables the gunner to level his gun or make the limb of his sight vertical.

The elevating screw extends from end to end of the vertical limb and causes the sighting leaf to move along the limb. The vertical limb is graduated by horizontal lines to 12, and each degree is divided into sixths by diagonal lines.

The sighting leaf carries a vernier, which, in conjunction with the diagonal lines, permits of reading minutes. A peephole in the sighting leaf 0.05 of an inch in diameter is used with the cross of the front sight for accurate sighting. A quick sight can be taken by using the top of the leaf and the direction point of the front sight.

The latest model differs from the previous one in having a wider slot, a stronger brass tube for level, a more efficient trunnion-clamping screw, a notch in the sliding leaf for use with direction sight of the front sight, and in having four sets of graduations.

On the right side of the rear face of the vertical limb the scale is divided, as above described, into degrees and minutes up to 12° . On the left side the sight is graduated for range (shrapnel) and on the reverse side for range (shell), to 5,000 yards. On the left edge is a time scale (shrapnel) graduated in seconds for use in cutting the time fuzes.

Plate XIV shows this latest model, with exception of the range and time of flight graduations.

The rear sight should be removed from the gun before firing.

TELESCOPIC SIGHTS.

[Plates XV and XVI.]

The telescopic sights in service are the model of 1896 M1, the model of 1897, the model of 1898, and the model of 1898 M.

All consist of a telescope mounted on an adjustable frame, which is attached by trunnions and a projecting lug to a sight bracket fastened to the right trunnion of the piece.

The sight bracket, which is the same for all models of sights, is provided with two V's and a leveling screw. The sight trunnions are seated in the V's, and the leveling lug between them bears against the leveling screw. The latter, working against the lug, levels the sight. The bracket is located on the trunnions with the line joining similar points of the V's parallel to the axis of the bore.

In the model of 1896 M^r-sight, the telescope is supported by having its forward end pivoted and secured to the frame, while the other end has a sliding motion along the elevation arc, through contact with the vernier piece. The elevation arc, the center of which is the horizontal axis of the telescope, is graduated from -7° to $+22^{\circ}$, but for practical purposes, on account of the space taken by the vernier, these limits are -7° and $+16^{\circ}$. Any desired elevation within these limits is given by turning a milled-head micrometer screw which actuates a worm spindle attached to the frame; the worm engages in a worm rack cut in a projection on the right side of the telescope. The micrometer screw is graduated to minutes. The vernier, with which the arc is also provided, reads to 2 minutes.

The telescope is an ordinary noninverting one, provided with an achromatic objective, composed of two lenses in contact, and a Ramsden eyepiece to magnify the image formed by the objective.

The noninverting telescope is obtained by inserting the Hastings-Brashear compound erecting prism between the sliding diaphragm and the objective. This compound prism consists of two prisms, having angles of 30, 60, and 90 degrees, laid with their 30-degree angles toward each other on a parallel-sided glass plate; on the other side of this plate is laid a third prism having a true 90-degree angle. Successive reflections at the surfaces of these prisms erect the image without any lateral displacement of the rays of light, other than that necessary for the purpose, and without lengthening the telescopic tube or diminishing the field of view. This compound prism is mounted in a frame provided with two set screws, by means of which it is adjusted after being assembled in the telescope. Just forward of the sliding diaphragm the telescope tube is cut away on the top to admit the prism and its frame. Two screws passing through flanges on the latter secure it to the tube and determine its position. A roof-shaped plate screwed to the telescope tube protects the prism from dust or mechanical injury.

Within the telescope is a sliding diaphragm or frame carrying platinum cross wires 0.001 inch in diameter. The vertical wire indicates deflection and the intersection of the two wires is laid on the object sighted. Lateral motion is given this diaphragm by a deflec-

tion screw on the right side of the telescope. The movement of the sliding diaphragm is $2^{\circ} 15'$ on each side of the zero of the deflection scale, and the scale itself is graduated to indicate this movement. The degree marks only are numbered on this scale, and the value of the smallest division, 3 minutes, is indicated by the symbol $1/20^{\circ}$ directly under the zero hole of the scale.

Deflection is given by moving this sliding diaphragm along a graduated horn scale placed below the diaphragm. The amount of deflection is indicated by the vertical cross wire.

The telescope is properly focused when the plane of the cross wires is in the position of distinct vision and the image of the object is in the same plane as the cross wires. To obtain this condition, both the eyepiece and the objective are given the necessary motions within the telescope tube.

The motion of the eyepiece is given by screwing or unscrewing it in its housing and that of the objective by a focusing screw collar back of the sunshade.

In sighting, the intersection of the cross wires is brought to bear on the image of the object sighted, and this process is precisely the same as bringing the intersection of the cross wires on a material object in the same plane as the cross wires, and, provided the focusing is correct for each observer, there can be no variation in the sighting.

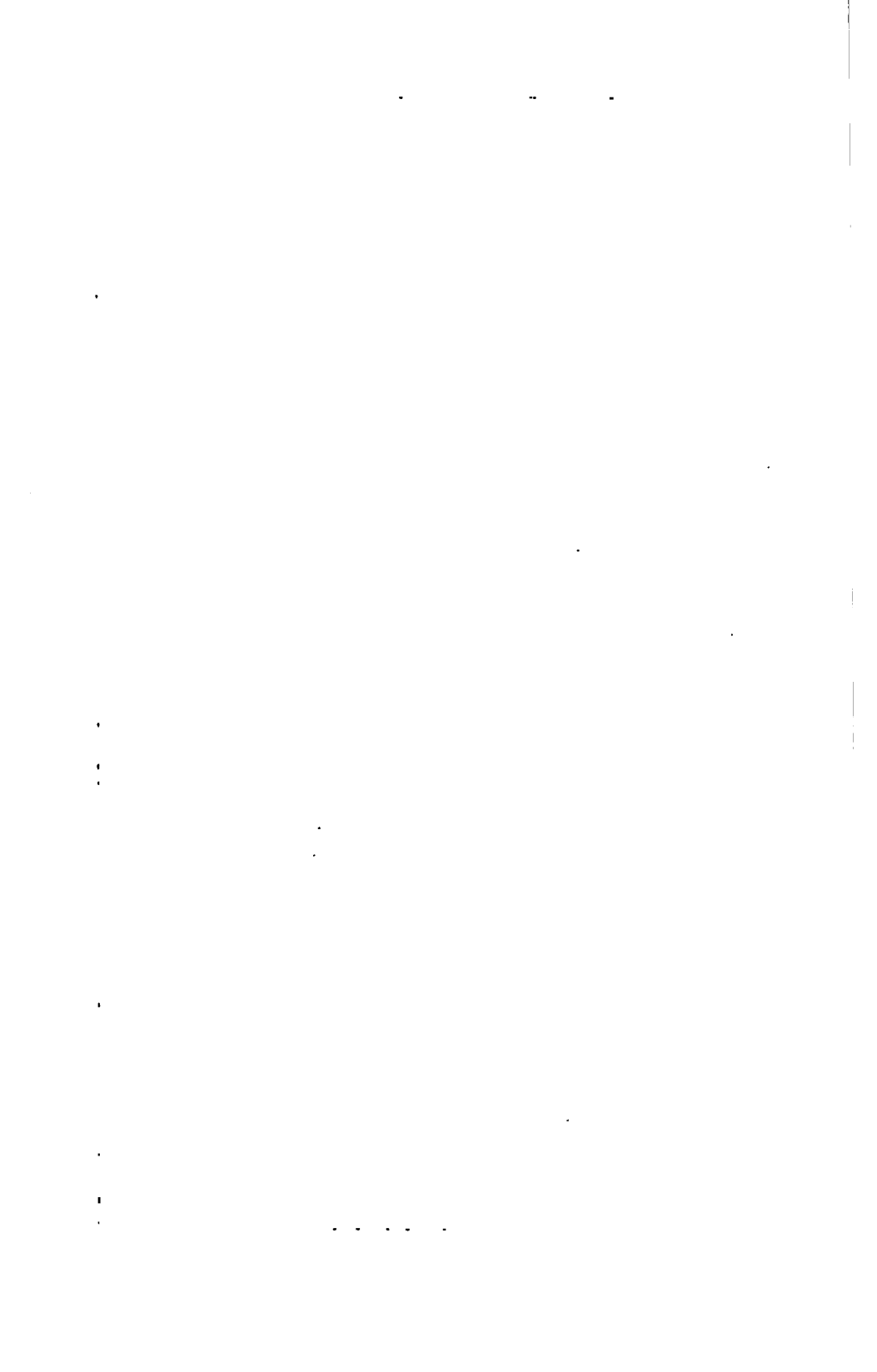
To obtain a correct angle of elevation it is essential that the elevating arc should be truly vertical. This is accomplished by means of a cross level fastened to the underside of the frame parallel to the horizontal axis of the telescope and perpendicular to the axis of revolution of the sight; that is, the axis of the sight trunnions. The cross level is provided with two openings, one on the top and one on the bottom, the latter permitting easy observation of the bubble in reverse laying.

A level is also attached to the left side of the telescope with its axis parallel to that of the sight trunnions. It enables the sight to be used as a quadrant in its own bracket.

The sight should be handled by a leather strap, fastened loosely to the frame, and should habitually be carried and kept in the leather case provided for the purpose.

TELESCOPIC SIGHT, MODEL OF 1898.

The telescopic sight, model of 1898, is similar to the earlier models in its method of attachment to the sight bracket, but differs from them in general construction and in important details. The sight consists of two principal parts, the trunnion casting and the telescope, which is pivoted to the casting at its forward end.



INSTRUCTIONS FOR USING.

Before using the sight the case containing it should be slung over the gunner's shoulder, and the sight should not be removed until the gunner is ready to use it. While the sight is in the case the cover should be kept fastened. In handling the sight always use the strap fastened to the frame.

See that the objective is screwed home.

To focus the sight, screw the eyepiece until the cross wires with every roughness on them are distinctly visible. The objective is focused by directing the telescope on a distant object and turning the focusing collar until, on shifting the eye over the eyepiece, the intersection of the cross wires remains on the same point of the object or, in other words, until there is no parallax. When the objective is focused, should the image not be clearly defined then the eyepiece is not correctly focused, and it must be screwed until the definition is satisfactory. An objective once focused is correct for all observers, but the eyepiece requires focusing for each individual.

To set the sight for deflection, take hold of it with the left hand and, looking into the telescope, move the deflection screw with the thumb and forefinger of the right hand until the required deflection is obtained. The deflection scales have indicated on them, by means of letters and arrowheads, the direction in which the pointers or cross wires must be moved in order to direct the gun to the right or left of the object sighted.

To set the sight for elevation, turn the micrometer screw controlling the elevating-worm spindle until the required elevation is obtained.

The sight is now ready to be placed on its bracket on the gun trunnion. It should be set very carefully by bringing the leveling lug to bear gently against the leveling screw. The sight is leveled by turning the leveling screw until the cross-level bubble comes to the center. The gun carriage should then be traversed until the target is brought into the field of view. The intersection of the cross wires is laid accurately on the target. If, when this is done, the bubble is still at the center of the cross level, the gun is laid correctly; if the bubble is not in the center of the cross level, the sight must be releveled and the operation of laying repeated until the condition for correct laying, mentioned above, obtains. In all cases the last act of the gunner before taking the sight from its bracket preparatory to firing should be to verify the leveling of the sight.

The telescopic level enables the gunner to use the quadrant angle of elevation. To do this the sight is first set for deflection only and the gun aligned on the target. The sight is then set for the required quadrant angle of elevation and the gun elevated or depressed until

the bubble in the telescopic level comes to its center. It should be noted that a correction must be applied to the angle of elevation to obtain the quadrant angle, and that this correction depends on the difference of elevation to obtain the quadrant angle, and that this correction depends on the difference of elevation of the gun site and the target.

For reverse laying the sight is reversed in its bracket and leveled, the cross level being exposed on its underside to render the bubble visible.

Before firing the sight must in all cases be removed from its bracket.

CARE AND PRESERVATION.

These sights are delicate instruments and must not be subjected to any rough usage, jars, or strains. They must, when not in use, be kept in their leather cases in a dry place. To obtain satisfactory vision, the glasses should be kept perfectly clean and dry. The glasses will seldom require cleaning on the inside, but, when necessary, they should be unscrewed and cleaned by a competent person. A piece of chamois skin or clean linen handkerchief will answer for cleaning purposes. Care should be taken that the cleaning material contains neither dirt nor grit.

The object glass should be screwed home and should be kept in that position. The erecting prism in the noninverting telescopes should not be removed.

The trunnions on these sights are purposely left bright; the other portions are generally lacquered. Sandpaper or emery paper should not be used on the trunnions; when a trunnion has rusted a slight rubbing with crocus paper will remove the rust. A little vaseline should always be kept on them as a preventive of rust. The worm and worm rack should be oiled with machine oil. When dust accumulates on the cross wires it should be removed by a fine camel's-hair brush in the hands of an experienced person.

The V bearings of the sight brackets should be kept slightly greased, and the finger drawn through them before inserting the sight to remove dust, etc. Before putting the sight in its case it should be carefully examined and all traces of dust or moisture removed and every precaution taken to prevent rusting.

Place the sight in its case with the trunnions downward. When sights are stored in their cases they should be inspected periodically.

More detailed description of these sights, with minute instructions for their care, use, and adjustment may be found in the "Handbook of sights for field and seacoast carriages not covered by other pamphlets," prepared for the service by the Ordnance Department.

DIRECTIONS FOR REPAIRING CROSS WIRES OF TELESCOPIC SIGHTS.

Remove the four screws which hold the cap containing the eyepiece.

In the model of 1896 M₁ and model of 1897 sights, next unscrew the two screws which secure the deflection scale and remove the scale. Then unscrew the knob from the deflection screw, when the sliding diaphragm can be readily removed for the insertion of new cross wires. The cross wires are laid in a small groove at each end and securely fastened by a small screw and clamp. The parts are then replaced in the reverse order in which they were removed. If the micrometer slide is moved to the extreme right of its motion before replacing the deflection scale, there is less danger of breaking the vertical cross wire.

In the models of 1898 and 1898 M sights, after removing the cap containing the eyepiece unscrew the three screws which fasten the horizontal cross-wire frame and remove this frame. Then unscrew the two screws which secure the horn deflection scale and remove it. Now unhook the two spiral springs which are attached to the end of the micrometer box and unscrew the knob from the deflection screw, when the slide can be removed. After renewing the cross wires replace the parts in the reverse order in which they were removed.

The spiral diaphragms are easiest replaced on their hooks when the sliding diaphragm is at the extreme right of its motion, in which position there is also less danger of breaking the vertical cross wire when replacing the horn deflection scale.

The model of 1896 M₁ and model of 1897 sights may require no readjustment further than a correct setting of the deflection scale, as explained in the directions for adjusting these sights.

The models of 1898 and 1898 M sights will require in addition an adjustment of the frame carrying the horizontal cross wire, and perhaps an adjustment of the graduated ring of deflection knob, as explained in the directions for adjusting these sights.

Care should be had that the platinum wires lie in the bottom of the small grooves which are cut in the micrometer slide and frame to receive them, otherwise they will not be vertical and horizontal, respectively, when placed in the sight.

THE GUNNER'S QUADRANT.

[Plate XVII.]

This instrument is used with the siege gun either to give the elevation directly or to verify the angles obtained by the use of the sights. Two seats for the feet of the quadrant are squared off on the upper side of the piece near its breech end.

The model of 1898 is composed of two main parts, the body carrying the graduated arc and the movable arm carrying the index and

the level. The movable arm also carries a graduation in minutes from 0 to 60, and the level, which is capable of longitudinal movement along the arm, carries a second index for reading this scale.

Degrees are read on the graduated arm of the body, minutes by the sliding level and scale on the movable arm.

The graduated arc is provided on the inside with a toothed circular rack, each tooth of which corresponds to a degree mark. The movable arm is hollow and holds a spindle which carries on its end a small toothed sector. A spiral spring contained inside the hollow arm constantly presses the spindle and sector outward, thus engaging the teeth of the sector with those of the graduated arc and holding the index of the arm against the degree marks opposite which it may be placed. To move the arm it is necessary to press back the sector against the action of the spring until its teeth clear those of the graduated arc. The arm may now be moved to a new position, and when the pressure is removed from the sector its teeth will again engage with those of the graduated arc.

The principle by which the scale of the movable arm is constructed to read to minutes is as follows:

The movable arm is a portion of the arc of a circle having a radius of 113.45 inches.

The lower surface of the brass case supporting the level is a chord of this circle, with the index at its middle point, and the angle between any two of its positions will therefore be that subtended by the arc over which the index moves.

In a circle of 113.45 radius an arc of 1° is 1.98 inches long; the graduation of the movable arm is therefore made of that length and divided into 60 equal parts or minutes.

USE OF THE QUADRANT.

In using the quadrant it should be noted that a correction must be applied to the angle of elevation used with the sights to obtain the quadrant angle of elevation, and that this correction depends on the difference in height above sea level of the gun sight and the target.

Set the quadrant at the required quadrant elevation by placing the index mark of the sector of the movable arm opposite the required degree mark on the graduated arc of the body, and by sliding the level along the arm until its index is opposite the required minute division of the scale on the movable arm.

Place the quadrant on its seats or on surfaces parallel or perpendicular to the axis of the bore, with the arrow, indicating "line-of-fire elevation" or "line-of-fire depression," as the case may be, pointing toward the target. Elevate or depress the piece, as the case may be, until the bubble of the level comes to rest at the center. This will be the elevation or depression required.

RANGES BY TRIAL SHOTS.

The method of obtaining ranges by trial shots is given in Artillery Memoranda No. 2, pages 8 and 9.

DISTANCES BY TIME-INTERVAL RECORDERS.

This method is based on the fact that sound travels about 1,100 feet per second in air. Hence, if the time in seconds between the flash and the report of the gun, or between the flash and the report of a shell fired from the battery, be noted, the distance is obtained by multiplying the time in seconds by 1,100 feet.

THE ARTILLERY HARNESS.

[Pl. XVIII.]

The component parts of the artillery harness are given in the table below. Plate XVIII 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 XVIII.	Component parts.	Wheel.		Lead.		Class.	Section.
		Near horse.	Off horse.	Near horse.	Off horse.		
1-4	Backstrap and crupper, complete.....			1	1	IV	
	Consisting of—						
1	Crupper, backstrap, and hip straps.....			1	1		
2	Dock.....			1	1		
3	Loin strap.....			1	1		
4	Trace loops.....			4	4		
	Backstrap hooks.....			1	1		
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	Dock.....	1	1				
	Backstrap hook.....	1	1				
	Side-strap hook.....	2	2				
3	Loin strap.....	1	1				
7	Side straps.....	2	2				
4	Trace loops.....	2	2				
10-19	Bridle, complete.....	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		
19	Connecting strap.....		1		1		
13	Crownpiece.....	1	1	1	1		
14	Snaffle bit (watering) ¹	1	1	1	1		
16	Reins (pairs).....	1	1	1	1		
17	Throatlatch.....	1	1	1	1		
20	Collar, steel.....	1	1	1	1		
21	Hame tug, a part of the collar.....						
40	Collar strap.....	1	1	1	1		
22, 23	Halter, complete.....	1	1	1	1		
	Consisting of—						
22	Headstall.....	1	1	1	1		
23	Strap.....	1	1	1	1		
24, 25	Martingale, complete.....	1	1				
	Consisting of—						
24	Martingale.....	1	1				
25	Cincha strap.....	1	1				

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

No. in Plate XVIII.	Component parts.	Wheel.		Lead.		Class.	Section.
		Near horse.	Off horse.	Near horse.	Off horse.		
26-33	Saddle, complete.....	1	1	1	1	IV	
	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	Quarter straps, including rings, safes, and cincha straps.....	1	1	1	1		
42	Cincha strap, a part of the saddle quarter strap.....						
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, brass (new style nickel steel).....	2	2	2	2		
33	Stirrup straps.....	2	2	2	2		
34	Saddlebags, pairs.....	1	1	1	1		
35	Saddlebag side straps.....	2	2	2	2		
36	Traces, lead, model of 1908.....			2	2		
	Consisting of—						
	1 trace body, 2A.....						
	1 trace cover, 2E.....						
	3 links, 2B.....						
	1 chain, 2C.....						
	1 toggle, 2D.....						
	2 sockets, 2F.....						
	2 cones, 2H.....						
	2 filler pieces, 2G.....						
37	Traces, wheel, model of 1908.....	2	2				
	Consisting of—						
	1 trace body, 10C.....						
	1 trace cover.....						
	1 ring, 10B.....						
	2 sockets, 2F.....						
	2 links, 2B.....						
	2 chains, 2C.....						
	2 toggles, 2D.....						
	2 cones, 2H.....						
	2 filler pieces, 2G.....						
38	Mogul spring, a part of wheel trace.....						
	1 loop hook, 10F.....						
	1 ring, 10E.....						
	1 Mogul spring loop, 10D.....						
	1 locking strap, 10G.....						
	Whip.....	1		1			
	Sweat leathers.....	2		2			
41	Blanket.....	1	1	1	1		

STEEL COLLARS.

SIZES AND DIRECTIONS FOR FITTING.

Steel collars are made in the following sizes: 2 A, 2 B, 4 A, 4 B, 5, 5 A, 5 B, 6, 6 A, 6 B, 7, 7 A, 7 B, and 8 A. 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. 4 A, 30 per cent No. 5, 40 per cent No. 5 A, 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, No. 2 is 5 inches, 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.

[Size of collars fitted with No. 3 pads.]

Number of collar.	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>
2 A	18	6½	7½	8½
2 B	18	6½	6½	8
4 A	19½	7	7½	8½
4 B	19½	6½	7½	8½
5 A	21	7½	8½	9½
5 B	21	7	7½	9
6 A	21	6½	7½	8½
6 B	22½	7½	8½	9½
7 A	22½	7	7½	9½
7 B	22½	7	7½	9½
8 A	24	7½	8½	10½
8 B	24	7	7½	10½
8 A	25½	7	7½	10½

[Size of collar fitted with No. 1 pads.]

2 A	16½	5½	5½	7
2 B	16½	4½	5½	6½
4 A	18	5½	6½	7½
4 B	18	5½	5½	7½
5 A	19½	6½	7½	8½
5 B	19½	5½	6½	7½
6 A	21	6½	7½	8½
6 B	21	6	6½	8½
7 A	21	5½	6½	8½
7 B	22½	6½	7½	9½
8 A	22½	5½	6½	8½
8 B	22½	5½	6½	8½
8 A	24	5½	6½	8½

ad

ma



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 curriers 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 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 radiator 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 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.

CARE OF BLACK LEATHER.

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.

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, counter-recoil springs, and interior of cradle will not be painted.

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 sandpapered with No. 1½ sandpaper 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 sandpapered with No. 2½ sandpaper, be given a coat of paint, and be permitted to dry for at least 24 hours; then sandpaper with No. 00 sandpaper, 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 material 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 materiel the Ordnance Department issues cylinder (or hydroline) oil, lubricating oil (or engine oil No. 1), 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 cylinder (or 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 material, and in lubricating such parts as wheels and axles, gun and cradle slides, pintle socket, elevating and traversing mechanisms, exterior of cylinders, brake bearings, hinges, different surfaces of breechblocks, threads of breech recess, etc.

The sperm oil is a lighter lubricant than the engine oil No. 1, and may be used on the gears of sights, fuze setters, range quadrants, 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 Corps.

Neat's-foot oil is used for the care and preservation of all leather equipment, and should be applied as directed on page 79.

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 material is to remain unused for an 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, kerosene, lubricating 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

name, if known) should be given. If the marking or name of the part is not known, submit a sketch showing the location, shape, material, etc., sufficient to establish definitely the identity of the part 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.

GENERAL INFORMATION WITH REFERENCE TO ORDNANCE SUPPLIES FOR FIELD ARTILLERY.

Cavalry saddles are usually supplied in three sizes, in the following proportions:

	Per cent.
No. 1, 11-inch seat.....	15
No. 2, 11½-inch seat.....	50
No. 3, 12-inch seat.....	35

Since November, 1901, the adjustable quarter straps have been made 3 inches shorter on either side than they formerly were.

Surcingle are regularly supplied in three sizes, in equal proportions, as follows:

- No. 1, length of webbing, 48 inches; billet, 26 inches.
- No. 2, length of webbing, 63 inches; billet, 18 inches.
- No. 3, length of webbing, 63 inches; billet, 30 inches.

Twenty curb bits for use with fractious draft horses are issued in various sizes, determined by the length of the mouthpiece:

	Per cent.
No. 1, length of mouthpiece, 4½ inches.....	15
No. 2, length of mouthpiece, 4¾ inches.....	75
No. 3, length of mouthpiece, 5 inches.....	10
No. 4, length of mouthpiece, 5½ inches, and No. 5, length of mouthpiece 5½ inches, issued only when specially called for.	

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

On marking outfit and 1 stencil outfit are issued to each battery of Field Artillery to enable the requirements of paragraph 295, Army Regulations, to be carried out.

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

Lanyards with metal snap are issued with revolvers when called for.

If necessary, the leather blacking issued may also be used in lieu of stencil plate. The stencil brush should be dipped in the blacking and as much of the blacking as possible should then be taken from the brush until it is left nearly dry; it is then applied by a vertical movement of the brush. A little practice will enable one to make a clear-cut marking, perfectly black, and perfectly indelible.

One stencil plate, "Shell and flame," for marking boxes will be issued to separate organizations upon requisition.

EQUIPMENT.

The following table sets forth the list of tools and accessories and miscellaneous equipment carried by the several vehicles and the allowances of the expendable supplies. The battery commander may use his discretion as to the articles and quantities of supplies to be carried.

TOOLS AND ACCESSORIES.

(For each gun and carriage:)

2 sections sponge and rammer staves (attached to carriage).	
2 maneuvering handspikes (attached to carriage).	
1 roller handspike (attached to carriage).	
2 buckets (as convenient).	
1 lantern (in bucket).	
1 breech cover (on gun).	
1 muzzle cover (on gun).	
1 trunnion sight (attached to gun).	
1 wrench for hydraulic buffer gland (in trail tool compartment).	
1 wrench, firing-bracket screw bolt (as convenient).	
3 bar screw-drivers.	In canvas roll in trail tool compartment.
1 primer key.	
1 grease knife.	
1 obturator-nut wrench, gun, model of 1890.	
2 bronze drifts, } In same pocket.	
1 cold chisel, }	
1 pair cutting pliers.	
1 screw wrench, 12-inch, }	
1 hammer, machinist's, 16-ounce, }	
1 file, flat, hand, dead smooth, 8-inch.	
1 file, round, $\frac{1}{2}$ -inch, second cut.	In leather pouch in trail tool compartment.
1 file, half round, smooth, 8-inch.	
1 pin punch.	
1 wrench for vent shield, gun, model 1890.	
1 wrench for throttling-bar screws.	
1 vent punch.	
1 vent drill.	
1 extractor for stop in carrier ring.	
1 vaseline brush.	
1 fuze punch.	
1 primer-seat brush.	
1 primer-seat cleaner.	

1 axle-grease can, 1-gallon, filled.	
1 sperm-oil can, $\frac{1}{2}$ -gallon, filled.	
1 vaseline can, $\frac{1}{2}$ -gallon, filled.	
1 quadrant, model of 1898, in quadrant box.	
1 rear sight, in leather case.	
1 oiler, brass, $\frac{1}{2}$ -pint.	In armament chest.
1 shot tray.	
6 fuze-punch pins.	
1 quire emery cloth, No. 00.	
1 rammer head, bronze.	
1 guard nut.	
1 sponge head, bore.	Where most convenient.
1 sponge head, chamber.	
2 sponge covers.	
3 wagon sponges.	
12 silk wipers.	
1 gunner's pouch.	
1 lanyard, 30-foot	
1 mallet.	

(For each forge and battery wagon:)

1 axle-grease can, in footboard compartment.	
1 axle-grease knife, in footboard compartment.	
1 coal bag, canvas, 3 bushels.	
200 pounds horseshoes.	In forge chest; issued by the Quarter-
50 pounds horseshoe nails.	
2 paulins, 12 by 12 feet, dyed duck.	Carried on limber of forge and battery wagon.
2 watering buckets, canvas, in footboard compartment.	
1 anvil (100 pounds).	Carried on body of forge and battery wagon.
2 water buckets (galvanized iron).	
1 grindstone, arbor, crank, and frame (iron), complete.	
1 hammer, sledge, medium.	
2 jackscrews.	
2 lanterns.	
1 oil can, coal, 3 gallons.	
1 oil can, sperm, $2\frac{1}{2}$ pints.	
1 vise, forge.	
1 double block, 8-inch.	
1 single block, 8-inch.	In battery wagon body.
150 feet 1-inch rope.	
1 set of blacksmith's tools (see p. 88).	
1 carpenter's and wheelwright's tool chest, containing	
1 set of carpenter's tools (see p. 89).	
1 saddler's tool chest, containing 1 set of saddler's tools (see p. 89).	

(For each siege ammunition wagon:)

- | | | |
|--|---|-----------------------|
| 1 galvanized-iron tool box, containing— | } | In front compartment. |
| 1 screw wrench, 12-inch. | | |
| 1 chisel, hand, cold, $\frac{3}{4}$ -inch. | | |
| 1 hand bastard file, 8-inch. | | |
| 1 hand hammer. | | |
| 1 steel punch. | | |
| 3 screw-driver bits, $\frac{1}{4}$ -inch. | | |
| 3 screw-driver bits, $\frac{3}{4}$ -inch. | | |
| 1 hatchet. | | |
| 1 claw hammer. | | |
| 2 braces. | | |
| 2 nail pullers. | | |
| 1 axle-grease can. | | |
| 1 axle-grease-can knife. | | |
| 10 pounds axle grease, in axle-grease can. | | |
| 1 lantern. | | |

(For the implement wagon:)

The articles above as enumerated, and—

- 2 hydraulic jacks.
- 2 lifting jacks.
- 14 pieces pine plank, 3 by 12 inches by 8 feet.
- 30 canvas sandbags.
- 8 pickaxes, handled.
- 8 shovels, long-handled.
- 1 Yale-Weston 2-ton triplex differential pulley.
- 1 pintle block, complete.
- 8 shovels, short-handled.
- 8 spades.
- 8 axes, handled.
- 4 lanterns.
- 4 tamps.
- 1 saw, crosscut.
- 2 sledge hammers.
- 1 keg spikes (100 pounds).
- 1 tripod, complete.
- 5 gallons oil (hydrolin) for hydraulic cylinders.
- 5 gallons coal oil.
- 1 spirit level.

(For the store wagon:)

- | | | |
|---|---|--------------|
| 1 axle-grease can. | } | In tool box. |
| 1 axle-grease-can knife. | | |
| 1 coal-oil can. | | |
| 1 hand hammer, 12 $\frac{1}{4}$ -inch handle. | | |
| 1 lantern, railroad. | | |
| 1 iron nut wrench, 10-inch. | | |
| 1 screw wrench, 12-inch. | | |

SPARE PARTS FOR HARNESS.

8 breast straps.
 2 bridles and bits, artillery.
 5 collars, steel, with 2 hame tugs each.
 7 collar pads.
 10 collar straps.
 16 cinchas, artillery, lead.
 8 cinchas, artillery, wheel.
 20 curb bits, model of 1909.
 20 curb chains, with hooks, model of 1904.
 10 feed bags.
 10 grain bags.
 8 halter headstalls.
 25 halter tie ropes, model of 1912.
 8 martingales with cincha straps.
 5 mogul springs, 320 pounds.
 8 side straps for breeching.
 16 curb straps.
 10 traces, lead, with chains.
 5 traces, wheel.
 5 whips, artillery.

In forge and battery wagon.

SPARE PARTS FOR COLLARS.

8 bolts for bottom of collars with nuts.
 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.
 8 buckle springs.
 5 draft springs.
 8 pad bolts with nuts.
 8 pad hooks with collar backstrap connections.
 5 trace plates and loops.

In forge and battery wagon.

MISCELLANEOUS TOOLS AND IMPLEMENTS.

3 vent drills.
 3 gunner's (vent) punches.
 3 priming wires.
 4 fuze punches.
 24 fuze-punch pins.
 4 pickax handles.
 4 ax helves.
 2 sponge head and sponge, bore.
 4 sponges.
 1 rammer head, bronze.
 2 primer keys.
 2 lanyards, siege.
 4 hatchet handles.

In forge and battery wagon.

MISCELLANEOUS SUPPLIES.

- | | | |
|---|---|-------------------|
| 1 fuze, "High A," base percussion, sectional. | } | In battery wagon. |
| 1 fuze, "High C," base percussion, sectional. | | |
| 1 fuze, combination, 15 seconds, sectional. | | |
| 1 marking outfit, complete. | | |
| 4 gunner's quadrants. | | |
| 2 range finders, Weldon. | | |
| 1 steel tape, 100-foot. | | |
| 1 seal stamp. | | |
| 1 shrapnel for instruction, 45 pounds, sectional. | | |
| 4 sights, telescopic. | | |
| 1 stencil outfit, complete. | | |
| 3 time-interval recorders. | | |
| 2 azimuth instruments. | | |
| 2 sound telemeters. | | |

BLACKSMITH'S TOOLS (IN LIMBER OF FORGE AND BATTERY WAGON).

- 2 aprons, leather.
- 2 canvas bags, small, for nails and small stores.
- 1 chisel, hand, cold.
- 1 chisel, handled (for cutting cold iron).
- 1 chisel, handled (for cutting hot iron).
- 1 clinching iron.
- 1 file, flat, bastard, 12-inch.
- 1 file handle, iron, 6-inch.
- 1 fire rake.
- 1 fire shovel.
- 1 fore punch and creaser (on one handle).
- 1 forge, portable, Empire (modified for Army use).
- 1 hammer, hand, handled.
- 1 hammer, riveting.
- 1 hammer, shoeing.
- 1 hardie.
- 2 knives, shoeing.
- 1 knife, toe.
- 1 nail punch.
- 1 oiler, brass.
- 1 padlock and key (part of forge and battery wagon).
- 1 pritchel.
- 1 punch, round, hand.
- 1 rasp, shoeing, 16-inch.
- 1 rule, 2-foot, 4-fold.
- 6 drills, flat, $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$ inch, square shank, 6 inches long.
- 1 flatter, handled, $1\frac{1}{2}$ -inch square face.
- 1 screw plate, 22 inches long, combination, dies and taps, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$, $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{3}{4}$ inch.
- 1 pair hoof and cutting nippers, 10-inch.
- 1 punch, square.
- 5 rivet sets, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{5}{8}$ inch.
- 1 screw wrench, 12-inch.
- 1 shoeing box, leather.
- 1 shoeing pincers.
- 1 square, steel.
- 1 ratchet for square-shank drills.

- 1 pair tongs for holding $\frac{1}{4}$ -inch iron.
- 1 pair tongs for holding $\frac{1}{2}$ -inch iron.
- 1 pair tongs, smith's.
- 1 wrench, small, for forge.

CARPENTER'S TOOLS (IN BODY BATTERY WAGON).

- 6 auger bits, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, and $1\frac{1}{2}$ inch.
- 1 auger handle, patent.
- 2 bags, carryas, for small stores.
- 1 brace, with 12 bits, assorted.
- 10 brad awls, assorted, with (and contained in) handle.
- 3 chisels, framing, $\frac{1}{4}$, 1, and $1\frac{1}{2}$ inch.
- 1 compass, 10-inch wing.
- 1 drawing knife, 12-inch.
- 6 files, saw, assorted, 4 and 6 inch.
- 1 file, wood, 10-inch.
- 2 file handles, aluminum, 5-inch.
- 1 gauge.
- 2 gouges, framing, $\frac{1}{2}$ and 1 inch.
- 1 hammer, claw.
- 1 hand ax, No. 7.
- 1 mallet, wood.
- 1 oiler, brass.
- 1 oilstone, 8-inch.
- 1 pincers, small.
- 1 plane, jack.
- 1 plane, smoothing.
- 1 rasp, wood, 10-inch.
- 1 rule, 2-foot, 4-fold.
- 1 saw, hand, 20-inch.
- 1 saw, rip, 26-inch.
- 2 screw-driver bits, $\frac{1}{4}$ and $\frac{3}{4}$ inch.
- 1 spokeshave.
- 1 square, trying, 9-inch.
- 1 tapeline, linen, 100 feet.
- 1 vise, table.
- 1 wrench, screw, 12-inch.
- 1 bevel, 8-inch.
- 1 bit, countersink, for wood, $\frac{1}{4}$ -inch.
- 1 bit, extension cutters, $\frac{1}{4}$ -inch and 3-inch.
- 1 file, flat, bastard, 10-inch.
- 1 nail set, No. 93.
- 1 reamer, half round.
- 1 screw-driver.

SADDLER'S TOOLS (IN BODY OF BATTERY WAGON).

- 12 awls, stitching, assorted.
- 1 awl, peg, with patent handle.
- 1 awl, seat, handle.
- 1 awl, stub, 2 inches long, with handle not patent.
- 2 bags, canvas, for small stores.
- 1 claw tool.
- 1 pair compasses, common, 6-inch.

- 1 creaser.
- 2 edge tools (Nos. 1 and 2).
- 1 gauge, draw.
- 1 hammer, riveting.
- 6 handles, plain, for stitching awls.
- 1 handle, patent, for stitching awls.
- 1 knife, half round, 5-inch.
- 1 knife, head.
- 2 knives, shoe.
- 1 knife, splitting, 6-inch.
- 1 mallet head, 14 to 16 ounces.
- 6 papers needles, harness, Nos. 4, 5, and 6.
- 1 paper needles, glover's No. 3.
- 1 pair nippers, cutting.
- 1 oilstone.
- 1 pliers, large, 6-inch.
- 1 pricking carriage, 3 wheels, Nos. 7, 8, and 10.
- 1 punch, revolving, 4 tubes, Nos. 4, 5, 6, and 7.
- 4 punches, hand, Nos. 5, 7, 8, and 10.
- 1 rule, 2-foot, 4-fold.
- 1 rivet set, two holes.
- 1 screw-driver, 3-inch.
- 1 sewing palm.
- 1 pair shears, 6-inch blade.
- 1 slicker, steel.
- 1 stitching clamp, not carried in tool chest.
- 1 stitching horse, complete.
- 2 thimbles.
- 1 needle case, leather.
- 1 paper sacking needles, Nos. 4 and 4½, assorted.

SIX MONTHS' ALLOWANCE OF CLEANING AND PRESERVING MATERIAL
(ALL EXPENDABLE).

So much of these supplies as is practicable will be carried in the forge and battery wagon and store wagon.

Borax	pounds..	5
Brush, camel's-hair, No. 1, round		1
Brush, sash, No. 3		3
Brush, sash, No. 5		3
Brush, varnish, No. 4-0		1
Brush, varnish, No. 5-0		2
Brush, varnish, No. 6-0		2
Burners, lantern		2
Cloth, crocus	quires..	2
Cloth, emery, No. ½	do.	1
Cloth, emery, No. 0	do.	1
Cloth, emery, No. 00	do.	1
Cosmic, No. 80, soft	quarts..	2
Chamois skins		2
Dressing, russet leather, boxes		6
Drier, Japan	quarts..	5

Lavaline, 16-ounce cans ¹	7
Lye, powdered.....	pounds.. 25
Naphthaline.....	do.... 15
Oil, clock.....	ounce.. 1
Oil, hydrolene.....	gallons.. 15
Oil, linseed, boiled.....	do.... 8
Oil, linseed, raw.....	pint.. 1
Oil, lubricating (engine No. 1).....	gallons.. 15
Oil, neat's-foot.....	do.... 25
Oil, slushing, light.....	do.... 5
Oil, coal.....	do.... 5
Oil, sperm.....	do.... 2
Paint, olive drab, second coat.....	pounds.. 100
Paint, olive drab, third coat.....	do.... 100
Paint, rubberine, gallons.....	5
Paste, stencil.....	(issued as required)
Petrolatum (vaseline), in tin box.....	ounces.. 5½
Polish, Gibson's soap, 16-ounce cans ¹	7
Primer, brown enamel.....	quarts.. 3
Sal soda.....	pounds.. 100
Sandpaper, No. 2½.....	quire.. 1
Sandpaper, No. 1½.....	do.... 1
Sandpaper, No. ½.....	do.... 1
Sandpaper, No. 00.....	do.... 1
Soap, castile.....	pounds.. 60
Soap, H. and H.....	cakes.. 6
Soap, saddle, Frank Miller's.....	pounds.. 90
Sponges, 4-inch.....	75
Sponges, large.....	10
Turpentine.....	gallons.. 10
Waste, cotton.....	pounds.. 50
Wicks, lantern.....	5

SIX MONTHS' ALLOWANCE OF SADDLER'S MATERIAL (ALL EXPENDABLE).

So much of these supplies as is practicable will be carried in the forge and battery wagon and store wagon.

Awl blades, harness, assorted.....	6
Awl handles, flat.....	3
Buckles, bar, 1-inch, Saalbach.....	2
Buckles, bar, tongueless, ¾-inch.....	9
Buckles, bar, tongueless, 1-inch.....	15
Buckles, bar, tongueless, 1½-inch.....	6
Buckles, center bar, ¾-inch.....	40
Buckles, center bar, ¾-inch.....	6
Buckles, center bar, ¾-inch.....	12
Buckles, center bar, 1-inch.....	2
Buckles, center bar, 1½-inch.....	12
Buckles, center bar, 1¾-inch.....	12
Buckles, roller, ¾-inch.....	12
Buckles, roller, ¾-inch.....	2
Buckles, roller, ¾-inch.....	22
Buckles, roller, 1-inch.....	6
Buckles, roller, 1½-inch.....	48

¹ Only one of these two items will be issued as called for.

Buckles, roller, 1½-inch.....	4
Buckles, satchel, ½-inch.....	7
Buckles, wire, ½-inch.....	3
Buckles, wire, ¾-inch.....	1
Buckles, wire, 1-inch.....	28
Buckles, roller, Royal, 1½-inch.....	2
Buckles, roller, tongueless, ¾-inch.....	0
Cheek "D".....	3
Conway loop, ¾-inch.....	14
End buckle, 1-inch.....	15
End clip, ¾-inch.....	28
End clip, 1-inch.....	21
End clip, 1½-inch.....	25
Foot staple, high.....	12
Foot staple, low.....	24
Foot staple, semicircular.....	12
Hook, back strap.....	5
Hook, breast strap.....	2
Hook, collar strap.....	5
Hook, double, brass wire.....	12
Hook, end, brass wire.....	12
Hook, side strap.....	2
Hook, wire (for link).....	2
Leather, bridle, sides.....	6
Leather, collar, backs.....	6
Leather, harness.....	pounds.. 200
Leather, latigo.....	side.. 1
Nails, saddle.....	9
Needles, Glovers, No. 3.....	paper.. 1
Needles, harness, No. 4.....	do.. 1
Needles, harness, No. 5.....	do.. 1
Needles, harness, No. 6.....	do.. 1
Ornaments, brow band.....	10
Ovals, saddle.....	10
Ovals, saddlebag.....	4
Pins, screw, brass, ¾-inch, No. 2.....	gross.. 2
Ring, ¾ inch diameter (saddlebag).....	7
Ring, 1 inch diameter (connecting strap, rifle scabbard).....	5
Ring, 1½ inches diameter (saddle).....	24
Ring, 1¾ inches diameter (back strap).....	5
Ring, 1¾ inches diameter (throat strap).....	6
Ring, 1¾ inches diameter (breeching).....	3
Ring, 2 inches diameter (halter).....	12
Ring, 4 inches diameter (cincha strap).....	12
Ring, 4 inches diameter (quarter strap).....	12
Ring "D," 1 inch diameter (feed bag).....	10
Ring "D," 1½ inches diameter, with clasp.....	9
Ring "D," 1½ inches diameter.....	3
Ring "D," 2 inches diameter (special).....	3
Rivet and burs, brass, ¾-inch, No. 12.....	pounds.. 2
Rivet and burs, brass, ½-inch, No. 10.....	do.. 1
Rivet and burs, brass, ¾-inch, No. 10.....	do.. 1
Rivet and burs, brass, 1-inch, No. 8, oval head.....	do.. 1

Roller, lead rein.....	4
Rope, $\frac{1}{2}$ -inch (halter).....	feet.. 124
Screws, brass, 1-inch, No. 6.....	gross.. 2
Sheepskins, with wool on.....	10
Shields, saddle, 11-inch.....	1
Shields, saddle, 11 $\frac{1}{2}$ -inch.....	2
Shields, saddle, 12-inch.....	3
Snap, canteen, cavalry.....	4
Snap, covert, $\frac{1}{2}$ -inch.....	2
Snap, covert, 1-inch.....	2
Snap, German pattern, iron, $\frac{1}{2}$ -inch, bronzed.....	2
Snap, haversack.....	6
Snap, swivel, 1-inch, No. 16.....	6
Snap hook (feed bag).....	10
Strap loop, coupling (for bridle).....	2
Strap loop, feed bag, 1 by $\frac{1}{2}$ inch.....	10
Strap hook, crown piece.....	5
Studs, saddlebag.....	6
Tacks, copper, 12-ounce.....	paper.. 1
Tacks, copper, 20-ounce.....	do.. 1
Thimble, aluminum lined steel.....	1
Thread, carpet, No. 18, olive-drab.....	pounds.. 1
Thread, shoe, No. 3, brown.....	do.. 1
Thread, shoe, No. 10, brown.....	do.. 1
Wax, stitching.....	do.. 2
Webbing, olive-drab, cotton, heavy, $\frac{3}{4}$ -inch.....	yards.. 21
Webbing, olive-drab, cotton, heavy, 1-inch.....	do.. 32
Webbing, olive-drab, halter, 1 $\frac{1}{2}$ -inch.....	do.. 14
Webbing, jute, 3 $\frac{1}{2}$ -inch.....	do.. 18
For polo equipment:	
Buckles, wire, $\frac{1}{2}$ -inch.....	2
Buckles, wire, $\frac{3}{4}$ -inch.....	2
Buckles, wire, $\frac{1}{2}$ -inch.....	12
Buckles, wire, $\frac{1}{2}$ -inch.....	4
Buckles, stirrup strap, 1 $\frac{1}{2}$ -inch.....	2
Buckles, girth, 1-inch.....	6
Ring, $\frac{1}{2}$ -inch diameter.....	4
Web, linen straining, 3 $\frac{1}{2}$ -inch.....	yards.. 5
Web, linen straining, 5-inch.....	do.. 7

SUPPLIES KEPT IN RESERVE FOR WAR SERVICE.¹

Articles	Number issued to 1 battery.
Buckle, bar, tongueless, $\frac{3}{4}$ -inch.....	3
Buckle, bar, tongueless, 1-inch.....	5
Buckle, center bar, $\frac{3}{4}$ -inch.....	12
Buckle, center bar, $\frac{1}{2}$ -inch.....	2
Buckle, center bar, $\frac{1}{2}$ -inch.....	4
Buckle, center bar, 1 $\frac{1}{2}$ -inch.....	4
Buckle, center bar, 1 $\frac{1}{2}$ -inch.....	4

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.

Articles.	Number issued to 1 battery.
Wax, stitching.....	pounds.. 1
Wick, lantern.....	2

WAR DEPARTMENT,

OFFICE OF THE CHIEF OF ORDNANCE,

Washington, June 9, 1914

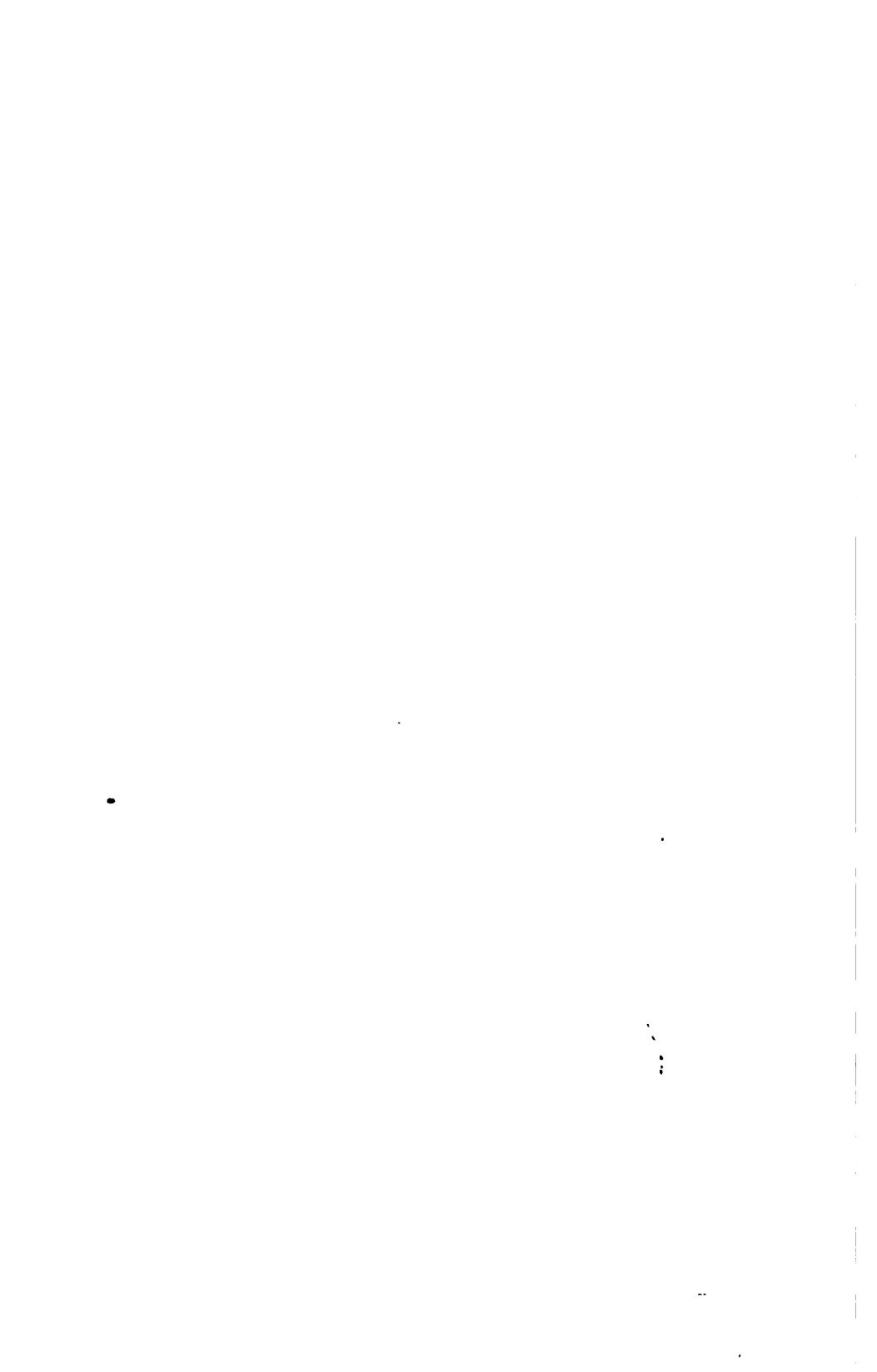
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COLLAR STRAP



COLLAR PAD CONNECTION



BUCKLE LATCH



DRAFT SPRING



COLLAR PAD



WRENCH



BOLT AND NUT FOR TOP CONNECTION



BOLT AND NUT FOR BOTTOM OF COLLAR



PAD BOLT AND NUT



BOLT AND NUT FOR TRACE PLATE



BOLT AND NUT FOR EXTENSION



BUCKLE SPRING



PAD HOOK



TRACE PLATE
COLLAR BACK STRAP CONNECTION

