No. 1714

HANDBOOK OF THE

3.6-INCH AND 7-INCH MORTAR CARRIAGES

MODEL OF 1895

FOR

3.6-INCH FIELD MORTAR

MODEL OF 1890

AND

7-INCH SIEGE MORTAR

MODEL OF 1892

WITH INSTRUCTIONS FOR THEIR CARE AND USE

(EIGHT PLATES)

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
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This Manual is published for the information and government of the Regular Army and Organized Militia of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

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3.6-INCH FIELD MORTAR, MODEL OF 1890.

(PLATE I.)

These mortars are intended for field use in operations, such as sieges and the landward defense of coast batteries, which do not involve rapid movements of the artillery. The mortars, which are made of gun steel, are not built up, but consist of one piece. The interior of the mortars consists of the breech recess, gas check seat, centering slope, forcing cone, and bore. The 3.6-inch mortar weighs 245 pounds and is 24.6 inches long over all. The bore is rifled with 20 grooves increasing in twist from 1 turn in 40 calibers to 1 turn in 25 calibers. The projectile for this gun weighs 20 pounds. The muzzle velocity is from 292 to 750 foot-seconds.

BREECH MECHANISM, 3.6-INCH MORTAR.

(See Plate I.)

This mechanism is similar in its action to the mechanism for the 7-inch mortar, the main point of difference being the obturator. This mortar uses the Freyre obturator, in which all the parts are of metal. This obturator has a spindle passing through the breechblock and held in place with a spring and nut, as shown in the plate, in such a manner that the spindle is normally held forward as far as it will go. The head is shaped like the frustum of a cone, and fits into a metallic gas check ring (22) which is coned to receive it. On firing the mortar the pressure of the gas forces the conical obturator back into the ring, expanding it against the gas check seat and stopping the escape of gas. The gas check ring has several grooves cut around it to act as air packing.

Other points of difference between this mechanism and the one for the 7-inch mortar are the hinge pin and the vent cover. The hinge pin is held in place by two hinge pin screws (6). Instead of sliding radially, as in the 7-inch mortar, the vent cover of this gun swings around the center of the vent cover handle as an axis. It is made of spring steel, and when in position is prevented from dropping down by its pressure on the head of the vent cover screws (8), which fit into small depressions shaped to receive them in the vent cover.

The action of the breech mechanism is as follows:

To open the breech.—Turn the vent cover handle to the right, grasp the breechblock handles with both hands and turn the breech-

block to the left as far as it will go; draw the block to the rear until the stop strikes the end of its slot; swing the breechblock to the left to clear the bore.

To close and lock the breech.—Reverse the above operation of opening.

TO DISMOUNT THE MECHANISM.

Open the mechanism, unscrew and remove the lock bolt set screws and remove lock bolt and vent cover by pulling on vent cover handle. The vent cover handle, vent cover, and lock bolt can be separated after driving out the taper pin.

Unscrew latch cover screws and remove latch cover. Remove latch and latch spring. Take out obturator spindle spline screw. Unscrew obturator spindle nut, remove spindle and spring.

Remove hinge screws and drive out hinge with a copper drift.

Lift block and carrier ring from the gun.

Unscrew stop. Remove block from carrier ring. Ordinarily it is not necessary to remove block handles. Should this become necessary, remove block handle screws, drive out block handles with a copper hammer.

TO ASSEMBLE THE MECHANISM.

Reverse the above operation of dismounting.

NOMENCLATURE, BREECH MECHANISM, 3.6-INCH MORTAR.

Carrier ring.
Hinge.
Hinge screws.
Hinge pin.
Hinge pin screws.
Vent cover.
Vent cover screws.
Vent cover stops.
Vent cover washer.
Vent cover handle.
Lock bolt.
Lock bolt set screws.
Taper pin.
Pallets.
Pallet rivets.
Breechblock.
Block handles.
Block handle screws.
Stop.
Gas check ring.
Obturator spindle.
Obturator spindle nut.
Obturator spindle spline screw.
Obturator spindle spring.
Vent bushing.
Latch.
Latch cover.
Latch cover screws.
Latch spring.
Retracting stud.

CARRIAGE MODEL OF 1895 FOR THE 3.6-INCH FIELD MORTAR, MODEL OF 1890.

(PLATE IV.)

The carriage is made of cast steel. The body of the carriage consists of two side pieces united by two transoms, all cast in a single piece. The side pieces are 1 inch thick and have the general form of an isosceles triangle, of which the base is the front line of the frame, 14 inches long, and the two sides are 36 inches long. The carriage frames are cast with flanges about their edges and with triangular openings in front and rear of a $1\frac{1}{2}$-inch web, which stands vertically under the trunnion beds. The thickness of the frames at the trunnion beds is increased on the outside so as to give a bearing of $2\frac{1}{2}$ inches to the trunnions. The cap squares are held in place by chin bolts at the rear, and by key bolts and keys at the front. The cap square key is attached to the carriage by a chain. A pintle fork, whose interior radius is 1 inch, is bolted to the front transom. This fork, in the firing position, partially encircles the pintle block, which is bolted to the platform, and allows the carriage to be readily pointed, but does not prevent it from recoiling. The carriage is stiffened by bolting through the side pieces about 5 inches from their rear edges with a $\frac{3}{4}$-inch steel bolt, passing through a piece of $1\frac{1}{8}$-inch gas pipe.

A circular hole, 3 inches in diameter, is left in the side frames about midway between the trunnion beds and the rear of the carriage, through which a handspike can be thrust when it is desired to carry the mortar and carriage by hand. At the center of the front transom is bolted the elevating clamp, which embraces an arc bolted to the under side of the mortar. A lever on the left side of the carriage turns a shaft which, having a left-hand screw on one side of the center and a right-hand screw on the other, causes the clamp to take hold of the arc when the elevation has been given with the quadrant. At the front lower corner and on the outside of each carriage frame is bolted a toggle to which a restraining rope can be attached to check the recoil. This rope passes around an anchor stake, 4 inches in diameter and 4 feet long, sunk in the ground in front of the mortar platform.

The platform for the mortar consists of 2 side pieces of 3-inch oak or yellow pine, into which are framed and secured by iron rivets 11 crosspieces of the same material. A 4 by 3 anchor block is bolted to the rear crosspiece by three bolts. The pintle block is of

cast iron and is bolted to the front of the platform by 4 wrought-iron bolts. The platform is held in position by 8 stakes—2 on each side, 2 in rear, and 2 in front, the last passing through square wrought-iron straps, attached to eyepieces, which are bolted to the front end of the platform.

At a suitable point in the axis of the platform is placed a brass socket in which turns the brass pivot at the end of the pointing scale.

The pointing scale is of hardwood with graduated brass strips on two sides, the unit of the scale being one one-thousandth of the range, and each division one five-hundredths of the range. A brass index slide moves with friction along the length of the scale and is clamped by a screw when regulated. For reference marks a brass screw is placed at the rear end of each frame cheek, and the scale is so arranged that it can be applied to either side. The carriage has a motion around its pintle of about 15° on either side of the axis of the platform.

The pointing scale is intended to be used in conjunction with the range table to make corrections for drift. To use the scale, the mortar being pointed at the target, place the scale on the platform with the lug at the zero end of the scale in the scale socket and bring the scale against the pointing screw on either side of the carriage. Then slide the movable index along the scale until the index pointer is opposite the slot in the head of the pointing screw. To the reading on the scale thus obtained add algebraically the correction for drift obtained from the range table; move the sliding index to the new reading, and clamp it in this position. The rear end of the mortar is then moved laterally until the slot in the head of the pointing screw is opposite the new position of the index. The drift being to the right for all range table elevations, the correction for drift will in all cases be made to the left; that is, the rear end of the carriage moved to the right.

DIRECTION SIGHTS FOR THE 3.6-INCH MORTAR.

These are mere direction sights, the elevation being given by the gunner's quadrant, described later, and the deviation by the pointing scale.

The front sight consists of a simple steel point, fixed at the muzzle in a plane passing through the axis of the piece, perpendicular to the axis of the trunnions.

The central line of the rear sight lies in the same plane, and its base is secured to the rear of the mortar by two screws. The sight somewhat resembles the buckhorn sight for small arms, and consists of a notch in the top, which is not allowed to come to a vertex, but terminates in a circular aperture.

THE GUNNER'S QUADRANT.

The seats for the feet of the quadrant are squared off on the upper side of the piece in the rear of the trunnions. There are three models in service—1892, 1897, and 1898.

The quadrant 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 a longitudinal movement along the arm, carries a second index for reading this scale.

Degrees are read upon 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 urges the spindle and sector outward, thereby engaging the teeth of the sector with those of the graduated arc and holding the arm in any position it may be placed. To move the arm it is necessary to press back the sector against the action of the spiral 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, in this case having a radius of 113.45 inches. The level is a chord of this circle, and the angle between any two of its positions will, therefore, be that subtended by the arc over which the index moves.

In the model of 1892 the frame is of bronze and graduated on one side from 0 to 44° and on the other side from 45 to 89°.

The quadrant, model of 1897, is of the same design as model of 1892, with the following modifications: The bronze frame is made heavier, the better to withstand the accidents of service. The housing of the level is heavier and the feet are shod with steel plates held fast to the bronze frame by dovetailing and by screws.

The models of 1892 and 1897 are being gradually replaced in the service by the model of 1898, which possesses the following improvements: The frame is aluminum and the feet are shod with steel plates, as model of 1897. The arc is graduated for a maximum of 66° of elevation or depression. The level is of a stronger and improved design.

USE OF THE QUADRANT—MODELS OF 1892 AND 1897.

In using the range quadrant it should be noted that a correction for the angle of site should be made to the angle of elevation given in the range tables. The angle of site is the angle, in a vertical plane, between a horizontal line and a line joining the gun and target. It may be determined by actual measurement or by estimate. The battery commander's telescope measures this angle in mils. To convert the reading into minutes, multiply by 3.4. If the target is above the gun, add the angle of site to the range-table angle of elevation. If the target is below the gun, subtract the angle of site from the range-table angle of elevation.

For angles of elevation: 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 of the movable arm. All elevations below 45° (both degrees and minutes) are read from the scales on one side of the quadrant and those above 45° from the scales on the other side of the quadrant.

Place the quadrant on its seats, always being careful to keep the side of the graduated arc in use to the left, looking in the direction of the target, and to keep the arrow showing the line of fire pointing in the direction of the target. Elevate the piece until the bubble of the level comes to rest at the center. This will be the elevation required.

MODEL OF 1898.

The mode of setting this quadrant for a given reading is the same as in the other models, using the graduation on either side of frame. Its use is simplified in that it is only necessary after having set it for a given angle of elevation or depression to place it on its seat on the gun with the arrow marked "Line of fire, elevation," or "Line of fire, depression," as the case may be, pointing toward the target.

AMMUNITION.

Separate ammunition is used in 3.6-inch mortars with either cast-iron shell or shrapnel. The weight of the projectile filled and fuzed is 20 pounds. The components of one round are the primer, charge, projectile, and fuze.

PRIMER.

(PLATE VI.)

The primer used with the ammunition is No. 3 friction primer. The friction primer is ordinarily known as the obturating friction primer for siege and seacoast cannon with old-model vents. It consists of the following parts:

(*a*) Body, brass.
(*b*) Safety block, brass.
(*c*) Serrated wire, brass.
(*d*) Gas check, brass.
(*e*) Paper cylinder.
(*f*) Friction composition.
(*gg'*) Primer charge, two cylinders powder, 22 grains.
(*h*) Loose rifle powder, 1 grain.
(*i*) Closing cup, brass.

The friction composition consists of the following ingredients:

Chlorate of potash	35.13
Sulphide of antimony	52.17
Flowers of sulphur	4.23
Ground glass	4.23
Gum arabic	4.23

The gum arabic is dissolved in water and mixed with the other ingredients after they have been thoroughly incorporated, to form a hardening matrix.

The friction pellet A is molded around the shank of the serrated wire C just below the teeth, so that they are not embedded in the composition. When the serrated wire is pulled quickly through the pellet, the frictional heat developed ignites the composition, which in turn ignites the primer charge *gg'*. The paper cylinder *e* incloses the pellet to prevent disintegration. When the wire *c* is pulled to the rear in the act of firing, the gas check *d* comes to a bearing in the coned seat in the rear of the cavity, effectually checking the escape of gas at this point. The safety block *b* is soldered to the wire *c*, and prevents any forward movement of the wire through the pellet which might cause premature firing of the primer in transportation of handling.

The primer charge consists of two cylinders of compressed powder *g*, weighing 22 grains, and 1 grain of loose rifle powder *h*. The rear cylinder has a single perforation, and the serrated extension of the wire *c* extends into this. The free space is filled with loose black powder for ready ignition. The front cylinder is solid. The compressing of the powder of the primer charge increases the power of the charge and decreases the chances of the charge jolting out in transportation.

The brass closing cup *i* fits tightly in the mouth of the primer and is shellacked to the primer body. It keeps the powder charge in place and keeps out the moisture. The primer at its front end is a close fit in its seat in the spindle, and the walls are made thin so that on discharge they will be forced out by the gas pressure against the primer seat, obturating the gas at this point. It requires a pull of 35 pounds to fire this primer. These primers are packed 10 in a box and are hermetically sealed.

THE POWDER CHARGE.

(PLATE VI.)

The powder is a nitrocellulose powder, single perforated and graphited. The grains are about one-quarter inch in length and one-tenth inch in diameter. One-eighth ounce of black igniting powder is used with every charge. The zones, muzzle velocities, approximate charges, and approximate pressures are indicated below. The maximum pressure allowed for this gun is 17,000 pounds per square inch.

Table giving approximate powder data.[1]

Zone.	Muzzle velocity.	Charge.[2]	Pressure, per square inch.
	Ft.-seconds.	*Ounces.*	*Pounds.*
1	292	2-5/16	2,450
2	388	3-11/16	3,500
3	537	5-13/16	5,300
4	740	8-6⅜/16	16,100

[1] From firings made with P. A. lot 98.
[2] Does not include one-eighth ounce igniting charge of black powder.

The charges for this mortar are put up on the increment system; that is, the charges are put up in four small bags which are sewed together by four sewing strips. The base charge is for the first zone and is plainly marked with the figure 1 to indicate that it is the first zone charge. To the rear end of this section is sewed the one-eighth ounce igniting charge. The increment to make the first zone base charge into the second zone charge is attached to the front end of the base charge. It contains enough powder to make, with the first zone base section, the charge for the second zone. This increment is

plainly marked with the figure 2 to indicate that this increment raises the base section to the second zone charge.

Similarly the third and fourth zone increments are added and marked plainly 3 and 4. Thus, adding the third zone increment to the bags marked 1 and 2 makes up the third zone charge, and adding the fourth zone increment to the bags marked 1, 2, and 3 makes the fourth zone charge. The fourth zone increment can be torn from the other three by hand and similarly third and second zone increments to obtain the charge for the zone desired.

The charge should always be inserted with the igniter end of charge to the rear.

PROJECTILES.

(PLATE VI.)

The projectiles prescribed for this mortar are cast-iron shell and black rifle powder charged shrapnel.

CAST-IRON SHELL.

This shell is 11.67 inches long. It is provided with an ogival head struck with a radius of 2 calibers and is fitted with a rotating band forced into an annular groove three-fourths of an inch from the base. The base is covered with a base cover consisting of a copper cover, lead disk, and calking wire. This base cover prevents the passage of gases into the shell through the base plug threads. This shell contains 9.6 ounces of black rifle powder as a bursting charge.

COMMON SHRAPNEL.

This shrapnel (9.29 inches in length, not including fuze) is a point-fuzed, point-charged shrapnel using a combination fuze. The ogive is of 1.5 calibers and the rotating band is three-fourths of an inch from the base of the shrapnel. The steel base and steel bursting charge chamber screw into the cast-iron shrapnel chamber, the combination fuze screwing into the bursting charge chamber. The bursting charge is 4 ounces of loose black powder. A central tube extends from the rear wall of the bursting charge chamber to the base of the shrapnel. The shrapnel filling is composed of 208 balls, each weighing about 167 grains. The balls are arranged concentrically about the central tube by means of separators. The matrix is smoke producing.

FUZES.

(PLATE VI.)

3.6-inch mortar C. I. shell were originally tapped for base percussion fuze M. Model 1894, but this fuze will not be used in the shell except in case of emergency and the shell will be retapped to take the base percussion fuze, medium and major caliber, with Semple plunger.

The base percussion fuze M. 1894 is a ring resistance fuze whose resistance is so low that it is not advisable to transport this fuze in the shell, and other type ring resistance fuzes can not be used, due to high arming resistances. It was contemplated that the M fuze should be assembled at or near the firing point. For obvious reasons, then, the fuze has been practically eliminated in favor of the base percussion fuze, medium and major caliber, with Semple plunger. A description of the M fuze may be found in Ordnance Pamphlet No. 1727. It has 14 threads per inch, and the diameter of the threads is 0.875 inch.

BASE PERCUSSION FUZE, MEDIUM AND MAJOR CALIBER, WITH SEMPLE PLUNGER.

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, and 30 parts sulphide of antimony.

The Semple type of centrifugal plunger is used, and its springs are designed for the 3.6-inch mortar and 7-inch mortar shell to function at 1,300 revolutions per minute. The velocity of rotation of the 3.6-inch mortar shell at the muzzle varies from 2,220 revolutions per minute to 5,520 revolutions per minute and for the 7-inch mortar shell from 2,427 to 5,485 revolutions per minute, depending upon the zone in which fired. 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 *m*, and kept in the unarmed position by two safety pins *n*, one shown 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, shown 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.

For shrapnel, the 28-second and 45-second combination fuzes have been adopted. Combination fuzes are point insertion and combine the elements of time and percussion and are arranged to act independently in one fuze body. They contain two plungers and two primers. The concussion plunger arms itself and fires the concussion primer on shock of discharge in the 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.

There are two general classes of combination fuzes in service. They differ principally in the details of the time-train elements. In the first class, of which the 28-second combination fuze is an example, the time element consists of a wire-drawn lead tube filled with mealed powder wound in a spiral groove around a lead cone. In the second class, of which the 45-second combination fuze is an example, the time element consists of two superposed trains of mealed powder compressed under heavy pressure into annular grooves in disks of brass.

28-SECOND COMBINATION FUZE—LOW RESISTANCE.

(PLATE VI.)

This fuze is provided with a wire passing through the walls of the fuze and the percussion plunger to prevent the latter from arming prematurely in transportation or handling. This fuze consists of the following parts, assembled as shown on the drawing:

(a) Body, bronze.
(b) Powder ring.
(b') Retaining ring, brass.
(b^2) Brass washer.
(b^3) Gas-check cup.
(b^4) Felt washer.
(c) Time train.
(d) Time-train cone, lead.
(e) Cone cover, brass.
(f) Cap, brass.
(g) Clamping nut, brass.
(h) Concussion or time plunger, brass.
(h') Time-plunger safety ring, brass.
(i) Safety pin, copper wire.
(j) Connecting tube.
(k) Closing screw, brass.
(k') Powder magazine.

(*l*) Percussion primer.
(*m*) Concussion firing pin, steel.
(*n*) Percussion-plunger sleeve, brass.
(*o*) Percussion plunger, brass.
(*p*) Cone dowel pins, brass.
(*q*) Cover dowel pins, brass.
(*r*) Percussion composition.
(*r'*) Tin-foil disk.
(*s*) Vents (4).
(*t*) Percussion-plunger safety ring, brass.
(*u*) Wrench hole.
(*z*) Bottom closing screw, brass.
(*z'*) Paper disk.
(z^2) Base cover, brass.

The time element is composed of the concussion or time plunger *h*, the firing pin *m*, the cone *d*, the time train *c*, the cone cover *e*, the cap *f*, and the clamping nut *g*.

The plunger *h* is cylindrical in shape and contains the fulminate primer *r* in a recess at its base. Its upper extremity is pierced to receive a safety pin *i*, which retains the plunger in its safe or unarmed position in handling and transportation. When the safety pin is removed, which is done just before firing, the weight of the plunger rests on the time-plunger safety ring *h'*.

The action of the latter on discharge is similar to that of the arming resistance ring of other ring-resistance fuzes.

The cone *d* is an alloy of soft metal, held in place on the fuze body by the clamping nut *g* and a groove at the bottom, and is prevented from turning by four steel dowel pins *p*.

The lip on the bottom of the cone, entering the groove in the body, acts as a gas check to prevent ignition of the powder in the connecting tube. On the exterior of the cone *d* is a left-handed groove which carries the time train *c*, and this time train communicates at its lower end with the priming charge in the tube *j* and thence with the magazine *k'*.

The time train *c* is formed of a lead tube filled with meal powder and wire drawn.

The cone cover *e* is of brass, and is held in place by the cap *f*, and prevented from turning by a small pin *q*, projecting from the body *a*, and fitting in a slot in its lower edge. On the exterior of the cone is a left-handed groove corresponding to that on the time cone *d*, and this groove is pierced with holes numbered from 1 to 28, corresponding to the number of seconds, the spaces between the holes being divided into five parts.

The percussion element of this fuze consists of a ring resistance plunger and an ordinary percussion primer.

ACTION OF THE FUZE.

As a time fuze.—A hole is punched through the cover, time train, and lead cone at the point in the cover corresponding to the number of seconds desired. Just before loading, the safety pin *i* is removed. This allows the time plunger *h* to rest on the fuze body, where it is held by the safety ring *h'*. The projectile is now inserted in the gun. By shock of discharge the safety ring is expanded and the plunger forced to the rear, the primer *r* striking the firing pin and exploding. The flame from the primer passes through the four radial holes *s* and ignites the ring of compressed powder *b*. The only vent for these gases is the punched hole, and they ignite the time train at that point. The latter burns and ignites the powder in the tube *j* and the magazine *k*. The flame from the magazine charge passes through the percussion primer and percussion-plunger chamber and ignites the bursting charge in the shrapnel.

As a percussion fuze.—The percussion plunger arms by shock of discharge and fires the percussion primer on impact as in other percussion fuzes. The percussion plunger is grooved or fluted to permit ready passage of the flame from the front to the rear. In order to use this fuze in base-charge shrapnel an extension piece of the form shown on the drawing is screwed into the base of the fuze in place of the bottom closing screw *z*. The ignition of the pellet of compressed powder in the extension piece transmits the flame through the central tube to the base charge.

The fuze punch used with this fuze is seen in Plate VIII and consists of two legs joined and pivoted at one end. One leg is shaped to fit the cone cover while the other carries the fuze punch pin which is adjustable for length. The fuze punch pin is replaceable, extra pins being issued for this purpose.

FRANKFORD ARSENAL 45-SECOND COMBINATION FUZE.

(PLATE VI.)

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, B^2, 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. Meal 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 D^2 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 anticlockwise direction until the vent J is reached, where it passes down to the beginning of the lower time train and burns back in a clockwise direction to the position of the vent O, whence it is transmitted by the pellet of compressed powder M to the powder magazine P.

For the 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 figure 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 fuses 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.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Remarks.
				Inches.	*Inches.*	
Cap square	On frame	Steel or wrought iron	2			
Cap square keys	do	Steel	2			
Cap square key chain	do	Wrought iron	2			
Cap square key chain eye pin	do	Steel	2	0.5	1.4	Diameter of thread; length over all.
Chin bolt	Part of frame	Cast steel	2			
Clamps, elevating	On clamp shaft	Steel	2			
Clamp shaft	On frame	do	1			
Clamp shaft nut	On clamp shaft	do	1	.75	.625	
Clamp shaft nut locking pin	Through clamp nut and shaft	do	1			
Clamp shaft nut washer	On clamp shaft	Bronze	1			
Clamp shaft handle	do	do	1			
Clamp shaft handle set screw	Through clamp handle and shaft	Steel	1	.25	.75	Length over all.
Clamp shaft bushing	On clamp shaft	Bronze	1			
Clamp shaft bushing screws	Through bushing and frame	Steel	3	.25	.75	Do.
Clamp guide pins	Through clamp and clamp guide pin bracket	do	2	.625	1.375	Length over all; diameter of pin.
Clamp guide pin brackets	Bolted to front transom frame	do	2			
Clamp guide pin bracket bolts	On clamp guide pin brackets	do	2			
Clamp separator	On clamp pivot bolt	Bronze	1			
Clamp pivot bolt	Through clamps and pivot bolt bracket	Steel	1	.5	4.375	Diameter of pin; length over all.
Clamp pivot bolt split pin	Through pivot bolt	do	1			
Clamp pivot bolt bracket	Bolted to front transom of frame and pintle fork	do	2			
Clamp pivot bolt bracket nuts	On pivot bolt bracket	do	2			
Eyebolts	Part of frame	Cast steel	2			
Elevating arc	On mortar	Steel	1			
Elevating arc bolts	Through elevating arc and mortar	do	4	.625	2	Diameter of thread; length over all.
Elevating arc bolt washer	On elevating arc bolt	do	4			
Frame		Cast steel	1			
Frame separator	Between cheeks of frame	Gas pipe	1			
Frame separator bolt	do	Steel	1	.75	13.375	Length over all.
Frame separator bolt nut	On frame separator bolt	do	1			
Frame, right cheek	Part of frame	Cast steel	1			
Frame, left cheek	do	do	1			
Frame, front transom	do	do	1			
Frame, rear transom	do	do	1			
Pintle fork	Bolted to front transom of frame	Steel	1			
Pintle fork bolt	Through front transom and pintle fork	do	1	.75	2.67	Do.
Pintle fork bolt nut	On pintle fork bolt	do	1			
Pointing screws	Screwed to rear of cheeks of frame	do	2			
Toggles	Attached to toggle brackets	do	2			
Toggle pins	Through toggle and toggle bracket	do	2	.5	1.75	Do.
Toggle pin split pin	Through toggle pins	do	2			
Toggle brackets	On frame	do	2			
Toggle bracket bolts	Through frame and brackets	do	2	.5	$1\frac{13}{16}$	Do.

3.6-INCH FIELD MORTAR CARRIAGE PLATFORM—LIST OF PARTS AND MATERIALS, WITH CORRECT NOMENCLATURE, ETC.

Name of part.	Location.	Material.	Number.	Diameter.	Length.	Remarks.
				Inches.	*Inches.*	
Anchor block	Bolted to rear of platform	Yellow pine or oak	1			
Anchor-block bolts	Through anchor block and platform	Wrought iron	3	0.75	7.25	Length over all
Anchor-block bolt nuts	On anchor block bolts	do	3			
Anchor-block bolt washers	do	do	3	2		Outside diameter.
Anchor stake	In ground in front of platform	Wood	1	4	48	Length over all.
Anchor-stake band	On head of anchor stake	Wrought iron	1	3		Inside diameter.
Anchor-stake pins	Through anchor stake	Wood	2	1.25	8	
Deck planks	Part of platform	Yellow pine or oak	11		32	
Deck-plank rivets	Through deck planks and side pieces	Wrought iron	16			
Deck-plank rivet washers	On deck-plank rivets	do	16			
Deck-plank dowels	Connecting deck planks	Wood	15			
Pintle block	Bolted to platform	Cast iron	1	2	3	Diameter of pintle, length over all.
Pintle-block bolts	Through pintle block and platform	Wrought iron	4	.5	4.37	Length over all.
Pintle-block bolt nuts	On pintle-block bolts	do	4			
Pintle-block bolt washers	do	do	4			
Platform stakes	In ground about platform	Wood	8			Dimensions, 2 by 3 by 48 inches.
Platform-stake loops	Attached to front of platform by loop straps	Wrought iron	2			
Platform-stake loop straps	Attached to front of platform	do	2			
Platform-stake loop-strap bolts	Through loop straps and platform	do	4			
Platform-stake loop-strap bolt nuts	On loop-strap bolts	do	4			
Platform-stake loop-strap bolt washers	do	do	4			
Scale socket	Set in platform	Brass	1			
Side pieces	Part of platform	Yellow pine or oak	2			
Side-piece straps	do	Wrought iron	4			
Side-piece strap rivets	Through straps, side pieces, and deck plank	do	8			

With each platform there is also furnished 1 recoil rope complete.

SPARE PARTS FOR 3.6-INCH FIELD MORTAR, MODEL OF 1890.

Number of parts.	Designation.	Spare parts for 2 mortars.	Drawing.
1	Gas-check ring	1	54-1-3
2	Hinge-pin screws	2	.....
1	Latch	1	.....
2	Latch-cover screws	2	.....
1	Latch spring	1	.....
1	Retracting stud	1	.....
1	Obturator spindle nut	1	.....
1	Obturator spindle nut spline screw	1	.....
1	Obturator spindle spring	1	.....
1	Vent cover	1	.....
2	Vent-cover screws	2	.....
2	Vent-cover stops	2	.....

SPARE PARTS FOR 3.6-INCH FIELD-MORTAR CARRIAGE AND PLATFORM.

The following spare parts of carriage and platform will be issued to be carried with equipment:

1 anchor stake (complete).
8 platform stakes.
1 recoil rope (complete).

Contents of steel armament chest for 3.6-inch mortar and carriage:

1 boiler maker's hammer.
1 pointing scale.
1 screw wrench, 12-inch.
1 vaseline can, ½-gallon.
1 sperm-oil can, ½-gallon.
1 gunner's quadrant, model 1898.
1 gunner's gimlet.
1 gunner's reamer.
1 priming wire.
1 vent punch.
1 oiler, ½-pint.
1 file, flat, dead smooth, 8-inch.
1 file, half-round, smooth, 8-inch.
1 file, round, second cut, 8-inch.
1 screw driver, 10-inch (for small screws).
1 screw driver, double-ended, 10-inch (for large screws).
1 obturator-nut wrench.
1 pin wrench.
1 copper drift, small.
1 copper drift, large.
1 cold chisel, ¾-inch.
1 vaseline (cosmic) brush.
1 pair cutting pliers.
1 cartridge pouch.
1 pound copper wire, No. 16.
1 primer pouch.
6 silk wipers.
1 rope sling.
1 lanyard.
½ quire emery cloth, No. 00.
2 wagon sponges.
2 balls of twine.
1 tool chest.

The following additional implements and equipments not contained in armament chest are furnished with each 3.6-inch mortar:

1 breech cover.
1 combined tompion and muzzle cover.
1 maneuvering handspike.
1 maul.
1 paulin, 6 by 8 feet.
1 sponge cover.
1 sponge and rammer combined.

The complete equipment of the 3.6-inch mortar comprises the gun, carriage, platform, implements, and tools, all to be transported in the ordinary army wagon, or in the siege ammunition wagon for siege batteries furnished by the Ordnance Department.

In garrison service or in field emplacements, when the mortar is not in use, the recoil-check rope will be wound about the carriage, the

combined sponge and rammer, the maneuvering handspikes, and mauls placed along the sides, and the whole covered by the paulin for weather protection.

TABLE OF WEIGHTS, DIMENSIONS, ETC., OF 3.6-INCH MORTAR.

Weight	pounds	245
Total length	inches	24.6
Length of bore	calibers	5.25
Max. diameter, breech	inches	7.8
Diameter of muzzle	do	5.4
Diameter of trunnions	do	3.8
Length of trunnions	do	2.5
Distance between rim bases	do	9.5
Distance of axis of trunnions from muzzle	do	14.6
Rifling:		
Number of grooves		20
Width of grooves	inch	0.4454
Depth of grooves	do	0.045
Width of lands	do	0.12
Twist, in calibers, 1 in 40; increasing to		1 in 25
Powder chamber:		
Diameter	inches	3.8
Length	do	2.835
Capacity	cubic inches	33.2
Total capacity of bore	do	203
Projectile weight	pounds	20
Ratio weight to weight of piece		1 to 12
Sectional density		1.543
Travel of projectile	inches	16.065
Weight of charge	ounces	$8\frac{3}{5}$
Muzzle velocity	feet per second	292 min. 750 max.
Muzzle energy	foot-tons	78.05
Maximum pressure	pounds per square inch	17,000
Extreme range	yards	4,000

RANGE TABLE FOR 3.6-INCH MORTAR—PROJECTILE, WEIGHT 20 POUNDS—HOWITZER FIRE (BELOW 45° ELEVATION).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Zone.	Range.	Angle of elevation.	ΔX for ± Δ1′ elevation.	ΔX for ± Δ10 F. S. M. V.	ΔX for wind 10 M. P. H.	Δ for change of ± 1/10 C.	Time of flight.	Drift.	Deflection for 10 miles cross-wind.	Angle of departure.	Slope of fall.	Terminal velocity.	Maximum ordinate.	Values of "C."	Values of $\frac{Bc}{fa}$	Muzzle velocity.
	Yards.	° ′	*Yards.*	*Yards.*	*Yards.*	*Yards.*	*Seconds.*	*Mils.*	*Mils.*	° ′	*1 on—*	*Foot-sec.*	*Feet.*			*Foot-sec.*
	400	13 19	0.4	27.0	1.0	1.1	4.31	11.4	1.00	13 47	3.97	281	74	1.452	1.063	292
	500	17 25	.4	33.6	1.7	1.6	5.54	15.0	1.34	17 53	3.00	279	122	1.427	1.081	
	600	22 1	.3	40.0	2.8	2.3	6.88	19.1	1.71	22 29	2.32	277	190	1.397	1.104	
1	700	27 46	.3	46.0	4.5	3.3	8.47	24.2	2.19	28 13	1.77	275	289	1.343	1.149	
	800	36 45	.2	52.0	7.8	4.7	10.80	32.6	3.05	37 12	1.24	273	469	1.237	1.247	
	815	39 34	.2	52.9	8.6	5.0	11.43	35.8	3.24	40 0	1.13	273	529	1.202	1.283	
	825	42 54	.2	53.5	9.5	5.2	12.26	39.7	3.57	43 20	.992	273	605	1.163	1.326	
	715	13 44	.7	35.3	2.8	3.4	5.91	11.9	1.42	14 12	3.73	363	141	1.448	1.066	388
	800	15 55	.7	39.5	3.5	4.0	6.71	13.6	1.68	16 23	3.23	361	181	1.435	1.075	
	900	18 27	.6	44.3	4.7	5.0	7.71	15.8	1.95	18 55	2.75	358	238	1.421	1.086	
	1,000	21 14	.6	49.0	6.2	6.3	8.77	18.3	2.24	21 41	2.36	355	308	1.403	1.100	
2	1,100	24 21	.5	53.5	8.2	7.9	9.92	21.2	2.56	24 48	2.01	352	395	1.378	1.120	
	1,200	28 3	.4	57.7	11.0	9.8	11.24	24.6	2.92	28 30	1.69	349	508	1.339	1.152	
	1,300	32 52	.3	61.5	15.3	12.1	12.92	29.3	3.44	33 19	1.38	347	671	1.285	1.201	
	1,377	39 34	.2	64.0	21.0	14.1	15.15	35.8	4.58	40 0	1.07	347	940	1.202	1.283	
	1,389	42 54	.2	64.7	22.1	14.5	16.08	39.7	4.69	43 20	.918	347	1,039	1.163	1.326	
	1,277	13 26	1.3	44.0	6.9	10.2	7.82	11.4	1.83	13 54	3.73	477	245	1.452	1.063	537
	1,300	13 41	1.3	44.8	7.3	10.6	7.99	11.7	1.89	14 9	3.65	476	256	1.449	1.065	
	1,400	14 59	1.2	48.0	8.7	12.3	8.70	12.9	2.09	15 27	3.31	472	303	1.441	1.071	
	1,500	16 22	1.2	51.2	10.3	14.1	9.43	14.2	2.30	16 50	3.00	468	357	1.432	1.077	
	1,600	17 50	1.1	54.3	12.1	16.0	10.20	15.5	2.51	18 18	2.72	464	418	1.425	1.083	
	1,700	19 23	1.1	57.3	14.1	18.1	11.00	16.9	2.73	19 51	2.48	460	487	1.416	1.090	
	1,800	21 2	1.0	60.2	16.4	20.3	11.83	18.4	2.96	21 30	2.25	456	563	1.405	1.098	
3	1,900	22 49	.9	62.9	19.0	22.7	12.71	20.0	3.20	23 16	2.04	453	651	1.392	1.109	
	2,000	24 46	.8	65.5	22.0	25.3	13.69	21.7	3.46	25 13	1.85	450	755	1.374	1.123	
	2,100	26 58	.7	68.0	25.7	28.2	14.77	23.6	3.78	27 25	1.67	447	878	1.352	1.142	
	2,200	29 32	.6	70.3	30.4	31.6	15.98	25.9	4.18	29 59	1.49	444	1,029	1.323	1.166	
	2,300	32 45	.4	72.3	37.0	35.8	17.45	29.0	4.69	33 12	1.29	442	1,227	1.287	1.200	
	2,400	37 53	.2	74.0	47.3	41.1	19.67	34.0	5.33	38 20	1.05	441	1,559	1.224	1.261	
	2,419	39 34	.2	74.3	51.0	42.2	20.50	35.8	5.63	40 0	.983	442	1,704	1.202	1.283	
	2,430	42 54	.2	74.4	55.2	43.0	21.69	39.6	6.10	43 20	.872	443	1,896	1.163	1.326	

RANGE TABLE FOR 3.6-INCH MORTAR—PROJECTILE, WEIGHT 20 POUNDS—HOWITZER FIRE (BELOW 45° ELEVATION)—Continued.

Zone.	1 Range.	2 Angle of elevation.	3 ΔX for ± Δ1′ elevation.	4 ΔX for ± Δ10 F. S. M. V.	5 ΔX for wind 10 M. P. H.	6 Δ for change of ±1/6 C.	7 Time of flight.	8 Drift.	9 Deflection for 10 miles cross-wind.	10 Angle of departure.	11 Slope of fall.	12 Terminal velocity.	13 Maximum ordinate.	14 Values of "C."	15 Values of $\frac{Bc}{fa}$	16 Muzzle velocity.
	Yards.	° ′	*Yards.*	*Yards.*	*Yards.*	*Yards.*	*Seconds.*	*Mils.*	*Mils.*	° ′	*1 on—*	*Foot-sec.*	*Feet.*			*Foot-sec.*
4	2,220	13 2	2.2	52.2	16.5	29.7	10.33	11.3	2.38	13 30	3.61	602	429	1.454	1.062	740
	2,300	13 37	2.2	53.9	18.0	31.9	10.77	11.9	2.48	14 5	3.43	598	466	1.450	1.064	
	2,400	14 24	2.1	55.9	20.0	34.7	11.33	12.5	2.62	14 52	3.22	593	516	1.447	1.067	
	2,500	15 13	2.0	57.8	22.2	37.6	11.91	13.1	2.76	15 41	3.02	588	570	1.441	1.071	
	2,600	16 4	1.9	59.7	24.6	40.6	12.51	13.8	2.90	16 32	2.84	583	628	1.436	1.075	
	2,700	16 57	1.9	61.5	27.1	43.7	13.13	14.5	3.04	17 25	2.67	578	692	1.430	1.079	
	2,800	17 52	1.8	63.3	29.8	47.0	13.77	15.3	3.19	18 20	2.51	573	762	1.424	1.083	
	2,900	18 50	1.7	65.0	32.7	50.4	14.43	16.1	3.34	19 18	2.36	569	838	1.418	1.088	
	3,000	19 51	1.6	66.7	35.8	53.9	15.11	17.0	3.49	20 19	2.21	565	920	1.412	1.093	
	3,100	20 56	1.5	68.3	39.1	57.5	15.82	17.9	3.64	21 23	2.07	561	1,008	1.405	1.098	
	3,200	22 3	1.5	69.9	42.7	61.3	16.57	18.9	3.80	22 30	1.94	557	1,104	1.397	1.105	
	3,300	23 13	1.4	71.4	46.7	65.3	17.35	20.0	3.97	23 40	1.81	553	1,212	1.387	1.113	
	3,400	24 29	1.3	72.9	51.2	69.5	18.17	21.3	4.17	24 56	1.69	549	1,335	1.375	1.122	
	3,500	25 54	1.2	74.3	56.3	74.1	19.06	22.7	4.42	26 21	1.57	546	1,473	1.362	1.133	
	3,600	27 20	1.0	75.6	62.2	79.2	20.05	24.2	4.73	27 57	1.46	543	1,629	1.346	1.147	
	3,700	29 19	.8	76.8	69.3	85.0	21.15	25.9	5.11	29 46	1.35	540	1,810	1.326	1.164	
	3,800	31 26	.6	77.8	78.3	91.6	22.42	27.9	5.58	31 53	1.23	538	2,030	1.302	1.186	
	3,900	34 13	.4	78.7	90.4	99.3	24.04	30.5	6.30	34 40	1.10	538	2,333	1.268	1.217	
	3,996	39 34	.2	79.3	113.0	108.1	27.80	36.0	7.84	40 0	.839	543	3,160	1.202	1.283	
	4,000	42 54	.2	79.3	120.0	108.6	28.72	39.5	7.90	43 20	.770	544	3,320	1.163	1.326	

MORTAR FIRE (ABOVE 45° ELEVATION).

Zone.	1 Range.	2 Elevation.	3 Time of flight.	4 Drift.	5 Drift.	6 Angle of fall.	7 Striking velocity.	8 Muzzle velocity.
	Yards.	°	*Seconds.*	° ′	*Mils.*	° ′	*Foot-sec.*	*Foot-sec.*
	825	45	12.44	2 24	42.8	45 19	273	292
	820	47	13.00	2 34	45.7	48 48	272	
	811	49	13.44	2 46	49.3	51 4	272	
	798	51	13.84	3 0	53.6	53 14	272	
	781	53	14.22	3 15	58.0	55 22	272	
1	759	55	14.57	3 32	63.0	57 29	271	
	734	57	14.90	3 52	69.1	59 35	271	
	706	59	15.21	4 14	75.5	61 38	271	
	675	61	15.51	4 38	82.6	63 37	271	
	642	63	15.79	5 3	90.1	65 33	271	
	607	65	16.05	5 30	98.2	67 25	272	
	1,389	45	16.37	2 24	42.8	46 53	347	388
	1,385	47	17.05	2 34	45.7	49 20	346	
	1,370	49	17.66	2 46	49.3	52 6	346	
	1,344	51	18.20	3 0	53.6	54 36	345	
	1,309	53	18.68	3 15	58.0	56 56	345	
2	1,265	55	19.13	3 32	63.0	59 6	344	
	1,217	57	19.54	3 52	69.1	61 12	343	
	1,164	59	19.92	4 14	75.5	63 16	342	
	1,106	61	20.27	4 38	82.6	65 19	341	
	1,045	63	20.60	5 3	90.1	67 21	341	
	980	65	20.92	5 30	98.2	69 19	340	
	2,430	45	22.42	2 24	42.8	50 36	439	537
	2,420	47	23.38	2 34	45.7	52 50	440	
	2,399	49	24.13	2 46	49.3	55 10	442	
	2,367	51	24.82	3 0	53.6	57 13	445	
	2,322	53	25.48	3 15	58.0	59 8	449	
3	2,268	55	26.13	3 32	63.0	60 57	453	
	2,205	57	26.76	3 52	69.1	62 42	458	
	2,137	59	27.36	4 14	75.5	64 25	462	
	2,064	61	27.94	4 38	82.6	66 3	466	
	1,984	63	28.50	5 3	90.1	67 36	471	
	1,900	65	29.05	5 30	98.2	69 5	475	
	3,986	45	30.32	2 24	42.8	55 49	529	740
	3,960	47	31.33	2 34	45.7	57 45	534	
	3,920	49	32.30	2 46	49.3	59 35	539	
	3,865	51	33.24	3 0	53.6	61 21	544	
	3,793	53	34.16	3 15	58.0	63 5	550	
4	3,708	55	35.05	3 32	63.0	64 47	556	
	3,611	57	35.90	3 52	69.1	66 18	563	
	3,504	59	36.71	4 14	75.5	67 45	570	
	3,383	61	37.48	4 38	82.6	69 18	578	
	3,250	63	38.22	5 3	90.1	70 36	586	
	3,103	65	38.94	5 30	98.2	72 5	594	

SANDY HOOK PROVING GROUND, *December 31, 1913.*

Powder charges are put up in four sections marked "1," "2," "3," "4." These sections are tied together and form the charge for the fourth zone. To make up the charge for the third zone, section 4 is removed; for the second zone, sections 3 and 4 are removed; and for the first zone, sections 2, 3, and 4, are removed.

7-INCH SIEGE MORTAR, MODEL OF 1892.

These mortars are intended for field use in operations, such as sieges and the landward defense of coast batteries, which do not involve rapid movements of the artillery. The mortars, which are made of gun steel, are not built up, but consist of one piece. The interior of the mortar contains breech recess, gas check seat, centering slope, forcing cone, and bore. The 7-inch mortar weighs 1,715 pounds and is 58.3 inches long. The rifling of 28 grooves increases from 1 turn in 40 calibers to 1 turn in 15 calibers. The projectile weighs 125 pounds and the muzzle velocity is from 476 to 800 foot-seconds.

BREECH MECHANISM.

(PLATE III.)

The principal parts of the breech mechanism are: The breechblock, carrier ring, obturator, block handles, and vent cover. The breechblock is of the interrupted screw type and has three threaded and three slotted sectors, which permit the block to be entered past the corresponding sectors in the breech recess and locked by one-sixth of a revolution about its longitudinal axis. The front part of the breechblock is reduced in diameter to allow of its partial entry into the gas check seat, and to allow a space where fouling may collect without obstructing the working of the block. This part is called the nose. On top of the block is a longitudinal groove called the stop groove, into which the stop in the carrier ring projects, thus limiting the longitudinal motion of the block. The stop groove also has a circular branch which limits the rotation of the block. This part of the groove is cut on the same pitch as the threads on the block, to allow the block to advance properly as it is screwed home. The breechblock also contains a latch groove, which is in two parts, one longitudinal in one of the slotted sectors of the block, the other circular in the rear portion of the block. The front end of the groove terminates in a well, called the locking recess, into which the inner end of the latch drops when the block is withdrawn, thus bolting it positively to the carrier ring.

In the rear of the threaded sectors is a circular recess called the guide groove, in which the guide sectors of the carrier engage when the block is rotated. Dovetailed on to the rear of the block are two handles (7) which serve to rotate the block.

While it is out of the gun, the breechblock is supported by the carrier ring (2), which consists of the following principal parts: Guide sectors, latch cover, latch, latch spring, stop, hinge lugs, and pallets. The guide sectors are three projections from the interior

of the carriage ring which fit in the corresponding slotted sectors in the block and guide and support it in its motion of withdrawal from the gun.

The latch cover is a separate piece, screwed to the carrier by two screws, by which the latch and latch spring are protected and retained in their seats. It is assembled from the rear in order that, by the removal of the two latch-cover screws, the latch and spring may be taken out while the breech is closed.

The latch is a locking device for the block carrier. It fits in a mortise in the same, and is actuated by a spiral spring which pushes it toward the center of the ring. Its inner end slides in the latch groove until it reaches, in closing the breech, the end of the circular branch, and in its rear motion, in opening the breech, the well at the end of the longitudinal branch. In either case the spring thrusts the latch bolt toward the center of the carrier, which is unlocked from its seat when the latch reaches these positions. When the breech is closed, the breechblock holds the carrier in place without requiring aid from the latch. When the carrier is unlocked in opening the breech the block is securely bolted into it by the action of the latch, and is firmly supported while being revolved to the side. At every point between the recesses at the ends of the latch groove, the head of the latch projects into the recess in the jacket and fastens the carrier to its seat. In the front face of the latch there is a beveled recess into which fits a conical hardened steel stud projecting from the face of the block-carrier seat. When the block carrier is swung into its seat, this stud, passing through a hole in the front face of the block carrier, bears against the beveled surface above mentioned in the latch, and thus lifts it out of the well at the end of its groove.

The latch spring is a spiral spring compressed between a shoulder on the latch and one on the latch cover; it is designed to thrust the latch toward the axis of the block carrier.

The stop (4) is a rectangular block of steel set into the upper part of the carrier ring, and held in place by the stop screw (5). The stop is designed to limit the longitudinal and rotary motions of the block.

The hinge lugs are ears projecting from the carrier ring. The hinge pin has its bearing in these lugs and a lug on the jacket.

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 nut clamping collar and screw, and antifriction washers.

The object of the obturator 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 spindle is mounted in the block

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

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 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 is a disk of asbestos and tallow for the older pads manufactured prior to September, 1908. Those manufactured subsequent to that date are composed of 3 parts asbestos and 1 part nonfluid oil and are marked in black letters "N. F. O.," 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 nut is screwed on the rear end of the stem and holds the spindle in its position in the block.

A spindle nut clamping collar is mounted on the rear end of the spindle and serves to prevent the unscrewing of the spindle nut. Three antifriction washers are placed in front of the spindle nut in a counterbore in the breechblock. These are used to facilitate the adjustment of the pad.

The vent is axial and passes through the axis of the obturator spindle. A copper bushing is inserted around the front end of the vent to protect the vent and enable repairs to be easily made.

The vent cover (9) is an arm mounted on the rear face of the block by means of two screws passing through slots, so as to allow its motion in a radial direction. The vent cover can be moved by means of the vent-cover handle (11) so as to cover or uncover the vent. The vent-cover handle is connected to the lock bolt (13), which from its shape will not allow the handle to be turned to uncover the vent except while the breechblock is in the locked position or clear out of the gun. The pallet (18) is so beveled on its rear end that, should the breechblock be closed with the vent uncovered, the beveled part of the pallet acting on the lock bolt will cause the vent-cover handle to turn, covering the vent. The pallet (17) is so shaped that when the breech is closed and locked and the vent uncovered the breechblock can not be turned until the vent is covered.

The action of the breech mechanism is as follows:

To open the breech.—Turn the vent-cover handle to the right, grasp the breechblock handles with both hands, and turn the breechblock to the left as far as it will go; draw the block to the rear until the stop strikes the end of its slot; swing the breechblock to the left to clear the bore.

To close and lock the breech.—Reverse the above operation of opening.

TO DISMOUNT THE MECHANISM.

Drive out taper pin in vent-cover handle. Remove vent-cover handle by pulling to the rear. Remove vent-cover screws and lift off vent cover. Unscrew bushing for lock bolt. Remove lock-bolt plunger and plunger spring.

Remove latch-cover screws and latch cover. Lift out latch and latch spring.

Remove the spindle-nut clamping collar and set screw.

Open the breech mechanism. Unscrew obturator spindle nut. The spindle, with gas-check pad, split rings, and filling-in disk, can now be lifted from the block, and the antifriction washers can be removed.

Remove stop screw. Place extractor for block stop with legs resting on carrier ring. Screw extractor screw bolt into threaded hole in end of stop until the stop is withdrawn far enough to clear the breechblock, which can now be removed from carrier.

Drive out hinge pin. Remove carrier ring.

TO ASSEMBLE THE MECHANISM.

Reverse the above operation of dismounting.

NOMENCLATURE BREECH MECHANISM, 7-INCH MORTAR.

Carrier ring.
Breechblock.
Stop.
Stop screw.
Block handles.
Block-handle screws.
Vent cover.
Vent-cover screws.
Vent-cover handle.
Taper pin.
Lock bolt.
Bushing.
Plunger.
Plunger spring.
Pallets.
Pallet rivets.
Guide screw.
Hinge pin.
Obturator spindle.
Obturator-spindle nut.
Obturator-spindle nut clamping collar and screw.
Obturator spindle antifriction washers.
Vent bushing.
Front split ring.
Rear split ring.
Small split ring.
Filling-in disk.
Pallet for locking recess.
Pallet screws.
Latch.
Latch cover.
Latch-cover screws.
Latch spring.
Gas-check pad.
Retracting stud.
Obturator-spindle spring washer.

CARRIAGE MODEL OF 1895 FOR THE 7-INCH SIEGE MORTAR, MODEL OF 1892.

The carriage consists essentially of two chassis connected by three transoms. Each chassis rests on footplates. The carriage rests on a wooden platform. Bolted to the upper surface of this platform are two clips, segments of circles, under which the ends of the footplates rest. The carriage is turned in azimuth by pinch bars about its central point, the footplates traveling under the clips.

The chassis are 0.5-inch forged steel plates placed 19.5 inches apart. Each chassis has two triangular pieces cut out to reduce the weight. They are parallel throughout and are connected by three transoms. The chassis have 2-inch flanges turned outward along their front vertical edges. The footplates are of 0.5-inch forged steel. Each footplate has two 2.5-inch webs 0.5 inch apart on its upper surface. The lower edge of the chassis is riveted between the webs on the footplates by 0.75-inch bolts.

The rear transom is formed of two forged steel plates, the transom proper and a 0.5-inch plate riveted to the under surface and extended 1.5 inches beyond the rear edge of the transom and forming a flange which slides in the rear clip on the platform. The upper plate has a 2-inch flange on each side by which it is riveted to the chassis with 0.75-inch rivets.

The front transom is of 0.5-inch forged steel without flanges and is riveted to the front end flanges of the chassis, the upper edge being 12.5 inches below the highest point of the chassis.

The second transom is of 0.5-inch forged steel and has a 2.5-inch flange on each side by which it is riveted to each chassis. A large triangular section is cut out to reduce weight. The second transom has a 5.4-inch flange set at an angle of 50° upon which the toe plate rests.

The toe plate is of 0.5-inch forged steel. It has a 2.75-inch flange on its rear side set at an angle of 50° to conform to the angle of the flange on the front end of the second transom, on top of which it is riveted. The toe plate and the 5.4-inch flange of the transom are flush at the front end and reinforced by the toe plate knee. They form the flange which travels under the front clip on the platform when the carriage is traversed.

A traversing lug of wrought iron 0.5 inch thick is riveted to the flange on the front vertical edge of each chassis at a point 3 inches from the lower edge of the chassis.

The guides of 0.5-inch forged steel are 3 inches wide and have two webs on their lower surface ½ inch apart. The upper edge of each

chassis, which is at an angle of 40° with the horizontal, is riveted between the webs of the guides with two rows of ¾-inch rivets staggered, the upper row with countersunk heads flush on both sides. The guides form the path of the trunnion carriage in recoil and counter recoil. Two ear straps of forged steel are provided as a reinforce to hold the upper ends of the guides to each chassis.

The trunnion carriage is of cast steel, cast in two pieces, the trunnion cap and the trunnion bed. The cap is secured to the bed by four cap screws, two at each end of each cap. The trunnion cap has a hole 2 inches in diameter and 1.8 inches deep drilled in its front end and threaded for receiving the piston rod. In the rear end is a hole 1.5 inches in diameter and 1.5 inches deep and threaded into which the inner spring center is screwed. There is a taper hole drilled through the inner spring center and its seat. A taper pin is driven in to secure the inner spring center in its seat. The under surface of the trunnion carriage is provided with clips to hold it on the guides. The surfaces of the trunnion carriage that bear on the guides are provided with bronze liners secured with 10 countersunk brass screws. The left trunnion cap is provided with a trunnion clamp which secures the mortar at any fixed elevation.

The spring bolsters are of cast steel and are riveted to the lower ends of the top surface in continuation of the guides of each chassis. The spring bolsters form the bearing surface for the end of the counter recoil spring column. A hole is provided into which the outer spring center is screwed. A traversing lug forms an integral part of each casting.

The recoil cylinder is of forged steel 14 inches long over all and 6.5 inches outside diameter. Its rear end has a stuffing box which forms, with a stuffing-box gland, a screwed stuffing-box cap and six rings of Garlock hydraulic waterproof packing 0.25 inch square, an oil-tight joint around the piston rod. The front end is closed by the cylinder head. There is a copper gasket between the cylinder and the cylinder head. The cylinder head contains the counter recoil buffer as an integral part of the forging.

On the interior of the cylinder are two throttling bars of uniform width but of varying height. These are located at the opposite ends of the horizontal diameter and are secured to the walls of the cylinder by three 0.5-inch fastening screws. Corresponding notches in the piston form ports for the passage of the liquid from one side of the piston head to the other.

The piston is of forged steel; the head is 5.48 inches in diameter and the rod 2 inches in diameter. The piston is 20.2 inches long over all. The front end of the piston is bored out for a sufficient depth to take the counter recoil buffer which fits into the bore with a very small clearance. In counter recoil the oil caught in this bore can

escape only by the small clearance mentioned, with the result that the return of the gun into battery is eased and regulated. The rear end of the piston rod is screwed into the trunnion carriage and secured by the piston-rod lock nut.

At the front end of the top element of the cylinder are two holes 1.5 inches apart. The front and larger hole is the oil-filling hole and is closed by the filling plug, which rests on an oil-tight leather gasket. The rear and smaller hole is an air hole and is closed with an air plug resting on a fiber washer.

The front end of the cylinder is provided with two webs which straddle the front end of the guides and are bolted through the guides and ear straps to the chassis. The rear end of the cylinder is secured to the guides by two cylinder fastening screws.

The counter recoil springs are mounted in rear of the trunnion carriage, on top of the guides of each chassis. There are four of these springs, two on each side. They are helical steel springs. The two springs of each column are assembled with a bronze spring separator between them, over an inner and outer spring center. The outer spring centers are of forged steel. The inner spring centers are of bronze. The outside diameter of the inner spring center is so arranged that it will slide smoothly inside the outer spring center. Thus as the springs are compressed these centers telescope. The front end of the inner spring center has a threaded section 1.5 inches in diameter, which is screwed into the trunnion carriage with a spanner wrench which fits into one of six equidistant notches on the outer face of the bearing shoulder of the inner spring center. A bronze adjusting screw screws into the spring bolster. The rear end of the outer center fits into the adjusting screw, a shoulder on the outer spring center resting against the front surface of the spring bolster and the adjusting screw where the adjusting screw is screwed in, so that the front end is flush with the front surface of the spring bolster. This position gives the maximum length of the spring column. To shorten the column the adjusting screw is screwed forward, thus pushing the shoulder on the outer spring center away from the spring bolster.

For assembling and disassembling the spring column a compression bolt is provided. This bolt fits through a hole in the rear end of the outer spring column and screws into a bronze nut plug screwed into and keyed into the rear end of the inner spring center. Screwing this bolt in draws the inner spring center into the outer spring center, and thus compresses and shortens the spring column. The hole for this compression bolt is closed by the dust plug when the compression bolt is not in use.

To mount the spring column on the carriage, with the mortar in firing position, the springs and separator are placed on the spring centers and the compression bolt inserted from the rear and screwed up until the length of the assembled column is such that it can be

inserted between the rear face of the trunnion carriage and front face of the spring bolster. The column is then held in place while the front or inner spring center is screwed into the trunnion carriage and the compression bolt removed.

The compression bolt should always be removed and the dust plug screwed in before firing. To dismount the spring column the converse of the above is followed.

The action of the carriage when the mortar is fired is as follows: The mortar moves to the rear on the guides carrying the trunnion carriage, the piston rod, and inner spring center and compresses the counter recoil springs. As the recoil cylinder remains stationary, the oil behind the piston must pass to the forward side. The energy of the recoil of the mortar is absorbed by the resistance which the oil offers to being forced through small openings in the piston head and by the resistance of the counter recoil springs. The energy stored up by the springs returns the mortar into its firing position. The return movement is eased and regulated by the counter recoil buffer. The piston-rod pull and spring resistance are transmitted to the carriage and through the carriage to the platform.

To pack the stuffing box: The packing is cut into rings of such size that the ends meet around the piston rod. The latter being assembled, each ring, placed so as to break joints with the preceding one, is forced in succession to its seat by a packing tool of copper or hard wood, one end of which is shaped like a carpenter's gauge and the other end forms a handle strong enough to stand light taps from a hammer. Such a tool may be readily improvised by the battery artificer. After the six rings are securely sealed in the box, place the gland in position and screw on the stuffing-box cap, which will force the gland down on the packing. With new packing it may be found difficult to insert more than five rings and secure sufficient engagement of the stuffing-box cap. In such a case the box may be packed with five rings and the piece fired a few rounds, after which the sixth ring should be inserted.

Adjustment of the gland and stuffing-box cap will require good judgment. If screwed up too tight, the frictional resistance of the packing on the piston rod will be so much increased that the counter recoil springs may fail to return the mortar to battery, especially at high angles of elevation. It should be screwed up just tight enough to prevent the leakage of oil through the stuffing box.

A bronze name plate is provided for the carriage. It shows the serial number, model, name of manufacturer, year of completion, and a blank for the inspector's initials.

In order to facilitate traversing the mortar, two center traverse plates, a rear traverse plate, a front and rear clip, and two clip braces are provided. The two clip braces cross each other in the twelfth deck strip from the front end, which is the center about which the

mortar is traversed. The clip braces are let into the deck strips 0.5 inch. The traverse plates form the surface upon which the mortar slides in traversing and are secured to the platform by 6-inch lag screws. The front and rear clips are secured to the platform by holding-down bolts 1.5 inches in diameter and 18.5 inches long. The upper surface of each clip is provided with pinching teeth. Two 42-inch steel pinch bars are provided for traversing.

A steel elevating bracket is secured to the left trunnion by three wrought-iron elevating bracket screws. This bracket has three slots 60° apart, 1.27 inches wide and 1.25 inches deep. By placing the large end of one of the pinch bars in one of these slots the mortar may be elevated and depressed to any desired position from 0°, the loading position, to 70°, the maximum elevation. The mortar is held at any set elevation by the trunnion clamp in the left hand trunnion cap.

A platform is provided upon which the carriage rests. This platform is 134.25 inches long and 75 inches wide, its length being parallel to the direction of fire. It consists of a deck of oak planking resting upon six yellow-pine stringers, which in turn rest upon bottom timbers of yellow pine.

The deck strips are of two sizes: 28 of them are 3 by 4 inches and 5 are 3.5 by 4 inches. They are laid perpendicular to the line of fire. The six stringers are 6 by 6 by 134.25 inches and are placed parallel to the line of fire. The bottom timbers are of two sizes; two are 6 by 10 inches and two 6 by 6 inches. They are placed perpendicular to the line of fire. Three of these bottom timbers extend 6 inches on each side of the platform, forming shoulders behind which are driven 6 by 6 inch stakes 3 feet long. A row of six of these stakes is also driven along the rear edge of the platform at the ends of the stringers.

The deck oak strips are secured to the end and two center stringers by 1.75-inch wrought-iron lag screws, 6 inches long, countersunk. The stringers are bolted to the deck strips by 1.75-inch wrought-iron bolts 15.25 inches long. These bolts pass through the stringers and the deck strips.

In manufacture each platform is assembled and the timbers composing it are numbered as shown in Plate VI. The platform is then knocked down and crated. 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.

The site should be prepared by excavating the earth until the bed for the platform is horizontal. The earth, if not already firm, should be thoroughly tamped.

SIGHTS AND QUADRANTS.

These are the same as described under the 3.6-inch mortar.

AMMUNITION.

Separate ammunition is used in 7-inch mortars with either cast-iron shell or shrapnel. The weight of the projectile filled and fuzed is 125 pounds. The components of one round are the primer, charge projectile, and fuze.

PRIMER.

The primer is the same as used by the 3.6-inch mortar.

POWDER CHARGE.

(PLATE VII.)

The powder is a nitrocellulose powder, single perforated and graphited. The grains are about one-quarter of an inch in length and about one-twelfth inch in diameter. One ounce of black igniting powder is used at the rear end of each charge. The zones, muzzle velocities, approximate charges, and approximate pressures are indicated below. The maximum pressure allowed for this mortar is 20,000 pounds per square inch.

Table giving approximate powder data.[1]

Zone.	Muzzle velocity.	Charge.[2]		Pressure, per square inch.
	Foot-seconds.	*Lbs.*	*oz.*	*Pounds.*
1	476	1	11¼	5,700
2	541	2	2¼	7,500
3	619	2	9¾	10,200
4	702	3	¾	13,650
5	800	3	8¼	19,550

[1] Firings made with P. A. lot 136. [2] Does not include 1 ounce igniting charge of black powder.

The charges for this mortar are put up on the increment system; that is, each charge put up is made with sufficient powder for the fifth zone, and in five increments tied together by tying straps.

The base section, in the rear end of which is placed the 1 ounce of igniting powder, contains enough powder for the first zone charge, and has the four tying straps sewed to its side. It is in the form of a flat cylinder, and is plainly marked with the figure 1 to indicate that it is the charge for the first zone. The increment to raise the first zone base charge to the charge for the second zone is placed next in front of the base charge. It is in the form of an annular ring of powder of the same exterior diameter as the base charge, with a cloth center to keep this increment in shape. This increment is plainly marked with the figure 2 to indicate that it is the increment, which,

taken together with the charge for the first zone, gives the second zone charge. The increment to raise the first and second zone sections to the third zone charge is placed in front of the second zone increment and is in the form of a flat disk and it fits into the annular ring-shaped second and fourth zone increments. It is plainly marked with the figure 3 to indicate that it is the increment, which, taken together with the first and second zone increments, makes up the third zone charge. The fourth and fifth zone increments are of the same annular-ring form as the second zone increment and are plainly marked with the numbers 4 and 5, respectively.

The charge should always be inserted with the igniter end to the rear.

PROJECTILES.

(PLATE VII.)

The projectiles prescribed for this mortar are cast-iron shell, steel shell, shrapnel black rifle powder charged.

CAST-IRON SHELL.

The shell is 25.25 inches long. It is provided with an ogival head struck with a radius of 2 calibers and is fitted with a copper rotating band forced into an annular groove $1\frac{1}{4}$ inches from the base. The base of the shell is tapped for the base percussion fuze, medium and major calibers, Semple plunger type. The base is covered with a base cover about 6.25 inches in diameter, consisting of a copper cover, lead disk, and calking wire. This base cover prevents the passage of powder gases into the shell through the base plug thread. This shell has a bursting charge of 11.87 pounds of black powder.

STEEL SHELL.

This shell is 20.87 inches long. It is provided with an ogival head struck with a radius of 2 calibers and is fitted with a copper rotating band forced into an annular groove 1.4 inches from the base. The base of the shell is tapped for the base detonating fuze, medium caliber. The base is covered with a base cover about 6.25 inches in diameter, consisting of a copper cover, lead disk, and calking wire. This base cover prevents the passage of powder gases into the shell through the base plug threads. This shell has a bursting charge of 11.9 pounds of high explosive.

COMMON SHRAPNEL.

This shrapnel, not including fuze, is 16.2 inches in length. It is point fuzed and point charged, and uses the Frankford Arsenal 45-second point combination fuze. The ogive is 1.5 calibers radius at bourrelet and decreases toward point to slightly greater than 1 caliber radius. The copper rotating band is 1.4 inches from the base. The cast-iron head and base screw into a cast-steel tubing case. A central tube extends from rear wall of bursting charge chamber to base of shrapnel. The bursting charge is 30 ounces of black powder. The shrapnel case contains 449 shrapnel balls, each weighing about 438 grains. The balls are arranged concentrically about the central tube by means of separators. The matrix is smoke producing.

7-inch mortar ammunition is issued in wooden boxes which contain one projectile filled and fuzed, one powder charge in a hermetically sealed can, and at the present time two friction primers, also in a hermetically sealed can.

FUZES.

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 7-inch mortar 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.

This fuze is further described under the 3.6-inch mortar.

Name of part.	Location.	Material.	No.	Diameter.	Length.	Nuts.	Washers.	Remarks.
				Inches.	*Inches.*			
Air plug	Top of cylinder	Steel	2	0.25	0.47		2	Hexagon head, leather washer, 0.05 inch thick.
Bolts	Throttling bars	Wrought iron.	4	.5	.7		4	Hexagon heads, copper washers.
Do	do	do	8	.5	.9		8	Do.
Do	Trunnion car	Steel	4	1	2.25			Round heads, slotted for wrench.
Do	do	do	4	1	2			Do.
Do	Clips to platform	Wrought iron.	11	1.5	18.5	11	15	11 round washers and 4 square washers.
Do	Cylinder to chassis	do	8	.75	4.1	8		Hexagon heads and nuts.
Cap square	Trunnion car	Cast steel	1					Right hand.
Do	do	do	1					Left hand, tapped for trunnion clamp.
Chassis	Riveted to transoms	Forged steel No. 1.	1					Right hand.
Do	do	do	1					Left hand.
Clip	Bolted to platform	Cast steel	1					Front clip.
Do	do	do	1					Rear clip.
Clip braces	Bolted to clips	Steel	2					1 top and 1 bottom.
Compression bolt	Recoil springs	do	2	.75	25			Brown & Sharpe worm thread cut 18 inches from end.
Counter recoil springs	Between trunnion car and spring bolster	do	4					
Cylinders	Bolted to chassis	Forged steel No. 3.	2					
Cylinder heads	Top of cylinder	do	2					Slotted for spanner wrench. Male part of counter recoil buffer on inside.
Dust plug	Lower end of outer spring center	Bronze	2	.875	1			Hexagon head, 12 threads per inch, 0.125-inch hole through center for vent.
Ear straps	Riveted to chassis at top	Forged steel No. 1.	4					2 right and 2 left.
Elevating bracket	Left trunnion of mortar	Steel	1					Slotted for pinch bar.
Filling and emptying plug.	Screwed into cylinder	Wrought iron.	4	.5	.55		4	Hexagon head, leather washers.
Gland stuffing box	Lower end of cylinder	Bronze	2					
Guides	Riveted to top of chassis	Forged steel	2					1 right and 1 left hand.
Liners	Screwed to trunnion car	Bronze	2					
Lag screws	Traverse plates	Wrought iron.	12	.75	6			Countersunk head, slotted.
Name plate	Fastened to right chassis	Brass	1					
Nut plug	Lower end of inner spring center	Bronze	2	2.125	3			
Lock nut	Piston rod	Wrought iron.	2	2				Hexagon, 2.75 inches across the flats, 0.5 inch thick, tapped, 10 threads per inch.
Pinch bar	For elevating and traversing	Steel	2					
Piston	Inside cylinders	Forged steel No. 3.	2					Hexagon on one end and 1.75 inches across flats for wrench.
Plate, foot	Riveted to bottom of chassis	Forged steel	2					1 right and 1 left.
Separator	Between springs	Bronze	2	5	1.625			
Screws, adjusting	Screwed into spring bolster	do	2	3	3.375			

7-INCH MORTAR CARRIAGE, MODEL 1895—LIST OF PARTS, MATERIAL, ETC., WITH CORRECT NOMENCLATURE—Continued.

Name of part.	Location.	Material.	No.	Diameter.	Length.	Nuts.	Washers.	Remarks.
				Inches.	*Inches.*			
Screws	Liners to trunnion car	Brass	20	.25	.5			Countersunk head.
Do	Elevation bracket	Wrought iron.	3	1	3			Round head, slotted.
Do	Name plate	Brass	2	.25	.5			Round head.
Do	Fastens nut plug into inner spring center	Steel	2	.375	.75			Headless, slotted for screw driver.
Screws, cylinder fastening.	Fastening cylinder to chassis	Wrought iron.	4	.5	1.6			Round head, slotted.
Spring center	Screwed into trunnion car	Bronze No. 3.	2					Inner.
Do	Fitted to spring bolster	Steel	2					Outer.
Spring bolster	Riveted to chassis	Cast steel	1					Left hand.
Do	do	do	1					Right hand.
Stuffing-box cap	Lower end of cylinder	Bronze	2					Screwed onto lower end of cylinder and slotted for spanner wrench.
Transom	Riveted to chassis	Forged steel No. 1.	1					Front 8, 0.75 inch rivets.
Do	do	do	1					Second 12, 0.75-inch rivets.
Do	do	do	1					Rear 12, 0.75-inch countersunk rivets.
Traversing	do	Wrought iron.	2					1 right and 1 left.
Traverse plate	Screwed to platform	Steel	2					
Do	do	do	1					Rear.
Throttling bars	Bolted inside cylinders	Forged steel	4					
Trunnion carriage	On guides	Cast steel	1					Left hand.
Do	do	do	1					Right hand.
Trunnion clamp	Left trunnion car	Steel	1	.75				
Toe plate	Riveted to transom	Forged steel No. 1.	1					
Toe-plate knee	Riveted to second transom and toe plate	Cast steel	1					

7-INCH SIEGE MORTAR, MODEL OF 1892.

No. of parts.	Designation.	Spare parts for 2 mortars.	Drawing.
[1] 1	Gas check pad	1	54-2-3
1	Front split ring	1	.....
1	Rear split ring	1	.....
1	Small split ring	1	.....
1	Latch	1	.....
2	Latch cover screws	2	.....
1	Latch spring	1	.....
1	Retracting stud	1	.....
1	Obturator spindle nut	1	.....
1	Obturator spindle nut clamping collar and screw	1	.....
1	Vent cover	1	.....
2	Vent cover screws	2	.....

[1] Two for land-defense cannon in insular possessions and Panama.

Tools and equipment.

Each mortar and carriage is provided with all the tools and equipment necessary for the assembling, service, and care of the mortar and carriage.

CONTENTS OF ARMAMENT CHEST FOR 7-INCH MORTAR AND CARRIAGE.

(Articles packed in chest.)

1. Vent punch.
2. Vent drill.
3. Socket wrench, long.
4. Compression bolts (2).
5. Cold chisel, 1¼-inch.
6. Spanner wrench, lock bolt bushing.
7. Gunner's quadrant.
8. Pin punch.
9. Wrench, socket tit retracting stud.
10. Screw driver, L.
11. Oiler, brass.
12. Funnel, brass.
13. Vaseline can, ½ gallon.
14. Sperm oil can, ½ gallon.
15. Drift, bronze, small.
16. Pin punch, small.
17. Drift, bronze, large.
18. Wrench for clamping collar nut.
19. Wrench for spindle nut.
20. Wrench, double, ¼-inch and ½-inch nuts.
21. Screw driver, 12 inches long.
22. Brush, vaseline.
23. File, half round, smooth, 8-inch.
24. File, flat, dead smooth, 8-inch.
25. File, three cornered, second cut, 8-inch.
26. File, ½-inch round, second cut.
27. 5 and 7 fuze wrench.
28. Screw driver, 15½ inches long.
29. Screw driver block handle screws.
30. Wrench, double, ⅝-inch and ¾-inch nuts.
31. Metal scraper.
32. Emery cloth No. 00, one quire.
33. Rammer head and guard nut.
34. Mallet, hand.
35. Wrench, piston rod, hexagonal.
36. Screw wrench, 15-inch.
37. Hammer, machinist's.
38. Loading tray.
39. Cutting pliers, 6-inch.
40. Wrench, P. R., lock nuts and adjusting screws.
41. Wrench, 1½-inch.
42. Spanner wrench.

(Carried loose in chest.)

Gunner's pouch.
Gunner's sleeves, pair.
Lanyard, 15-foot.
Primer key.
Sponge head with sponge.
Sponge head cover.
Silk wipers (12).
Sponges (3).

(Issued with chest.)

1 water bucket.
2 pinch bars.

TABLE OF WEIGHTS, DIMENSIONS, ETC., OF 7-INCH MORTAR.

Weight	pounds	1,715
Total length	inches	58.3
Length of bore	calibers	7.0
Maximum diameter, breech	inches	13.8
Diameter of muzzle	do	10.5
Diameter of trunnions	do	7.0
Length of trunnions	do	4.0
Distance between rimbases	do	14.3
Distance of axis of trunnions from muzzle	do	34.15
Rifling:		
Number of grooves		28
Width of grooves	inch	.6354
Depth of grooves	do	.055
Width of lands	do	.15
Twist, in calibers 1 in 40; increasing to		1 in 15
Powder chamber:		
Diameter	inches	7.25
Length	do	4.18
Capacity	cubic inches	182.8
Total capacity of bore	do	1,958
Projectile weight	pounds	125
Ratio, weight to weight of piece		1 to 14
Sectional density		2,551
Travel of projectile	inches	44.82
Weight of charge	ounces	56
Muzzle velocity	feet per second	476 min., 800 max.
Muzzle energy	foot tons	555.3
Maximum pressure	pounds per square inch	20,000
Extreme range	yards	5,310

RANGE TABLE FOR 7-INCH SIEGE MORTAR.

PROJECTILE, WEIGHT 125 POUNDS.

ZONE I.

	2	3	4	5	6	7	8
Range.	Elevation.	Change in elevation for 10 yards in range.	Time of flight.	Drift.	Angle of fall.	Striking velocity.	Muzzle velocity.
Yards.	° ′	′	*Seconds.*	° ′	° ′	*F. s.*	*F. s.*
1,615	65 0	14	26.33	8 46	66 53	440	476
1,700	62 55	15	25.78	8 11	64 58	440	
1,800	60 23	16	25.09	7 32	62 36	439	
1,900	57 34	19	24.28	6 52	59 57	438	
2,000	54 4	25	23.22	6 10	56 33	436	
2,100	48 27	48	21.43	5 19	51 5	434	
2,131	45 0	.....	20.24	4 53	47 39	433	

ZONE II.

2,031	65 0	11	29.40	8 10	67 17	489	541
2,100	63 45	11	29.07	7 48	66 11	488	
2,200	61 52	12	28.54	7 18	64 27	488	
2,300	59 51	13	27.98	6 49	62 37	487	
2,400	57 29	16	27.26	6 18	60 25	485	
2,500	54 35	20	26.33	5 48	57 40	483	
2,600	50 42	30	25.04	5 15	53 57	481	
2,682	45 0	.....	23.00	4 34	48 22	476	

RANGE TABLE FOR 7-INCH SIEGE MORTAR—Continued.

PROJECTILE; WEIGHT 125 POUNDS—Continued.

ZONE III.

1	2	3	4	5	6	7	8
Range.	Elevation.	Change in elevation for 10 yards in range.	Time of flight.	Drift.	Angle of fall.	Striking velocity.	Muzzle velocity.
Yards.	° ′	′	*Seconds.*	° ′	° ′	*F. s.*	*F. s.*
2,582	65 0	8	33.19	7 41	67 48	551	619
2,600	64 43	9	33.10	7 36	67 34	551	
2,700	63 14	9	32.64	7 12	66 17	549	
2,800	61 41	10	32.17	6 48	64 36	548	
2,900	60 4	10	31.66	6 26	63 27	546	
3,000	58 18	11	31.08	6 4	61 51	544	
3,100	56 19	13	30.41	5 42	60 3	542	
3,200	53 55	16	29.57	5 18	57 48	540	
3,300	50 34	25	28.34	4 53	54 38	536	
3,389	45 0	.....	26.01	4 16	49 11	531	

ZONE IV.

3,189	65 0	7	37.24	7 21	68 23	609	702
3,200	64 52	7	37.18	7 19	68 17	609	
3,300	63 41	8	36.75	7 1	67 17	607	
3,400	62 28	8	36.32	6 43	66 14	606	
3,500	61 10	8	35.84	6 24	65 7	604	
3,600	59 49	9	35.37	6 6	63 54	603	
3,700	58 20	9	34.83	5 48	62 35	601	
3,800	56 44	10	34.25	5 30	61 9	599	
3,900	54 49	13	33.53	5 11	59 23	597	
4,000	52 23	17	32.58	4 51	57 8	593	
4,100	49 2	24	31.10	4 27	53 58	589	
4,175	45 0	.....	29.04	4 1	50 1	585	

ZONE V.

3,975	65 0	6	41.80	7 6	69 3	673	800
4,000	64 46	6	41.71	7 2	68 50	672	
4,100	63 46	6	41.35	6 46	68 0	671	
4,200	62 46	7	40.97	6 31	67 10	669	
4,300	61 45	7	40.57	6 16	66 19	667	
4,400	60 41	7	40.15	6 1	65 25	665	
4,500	59 33	8	39.69	5 46	64 27	663	
4,600	58 19	8	39.19	5 32	63 24	661	
4,700	56 58	9	38.63	5 18	62 14	659	
4,800	55 27	9	38.00	5 3	60 55	656	
4,900	53 47	10	37.27	4 49	59 24	653	
5,000	51 51	12	36.37	4 34	57 38	650	
5,100	49 30	17	35.15	4 17	55 27	646	
5,200	45 28	41	32.90	3 49	51 24	639	
5,206	45 0	.....	32.62	3 46	50 55	638	

SANDY HOOK PROVING GROUND,
November 29, 1913.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, December 22, 1913.

THE HAND FUZE SETTER.

(PLATE III.)

The hand fuze setter, model of 1913, provided for the 45-second fuze, consists principally of an aluminum case (55A) having a serrated rim forming a handle for turning; a range ring (54FA) mounted on the range ring carrier (54LA) which is operated by the knob (54A) on the range worm (54F); a corrector scale (54Z) mounted on the

corrector scale support (54KA), which is operated by the knob (54A) on the corrector worm (54G) and a guide plate (54JA) which rests on the projectile.

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

The range worm (54F) and corrector worm (54G) are mounted eccentrically in the range worm case (54H) and the corrector worm case (54J). Upon rotation this provides an adjustment to accommodate slight variations in machine operations and to take up for wear between the teeth of the worms and gears.

The range worm adjusting screw (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 (54L, 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) for 3.6-inch mortar shrapnel has four scales for zones 1, 2, 3, and 4. The scale for each 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.

The range ring (54FA) for 7-inch mortar shrapnel 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.

[1] The scale 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.

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 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 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 howitzers 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 gliding-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 the 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 range-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 these parts.

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

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

Piece mark.	Name of piece.
(54X)	Corrector scale (for 4.7-inch howitzer).
(54DA)	Range ring (for 4.7-inch howitzer).
(54HA)	Guide plate (for 4.7-inch howitzer).
(54KA)	Corrector-scale support.
(54LA)	Range-ring carrier.

MARKING ON AMMUNITION PACKING BOXES.

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



The shell and flame are always in red for mobile artillery ammunition. The numeral "3.6" or "7" refers to the caliber; and the letter "M" differentiates ammunition for mortar from gun ammunition. The numeral "3.6" and the letter "M" are 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.

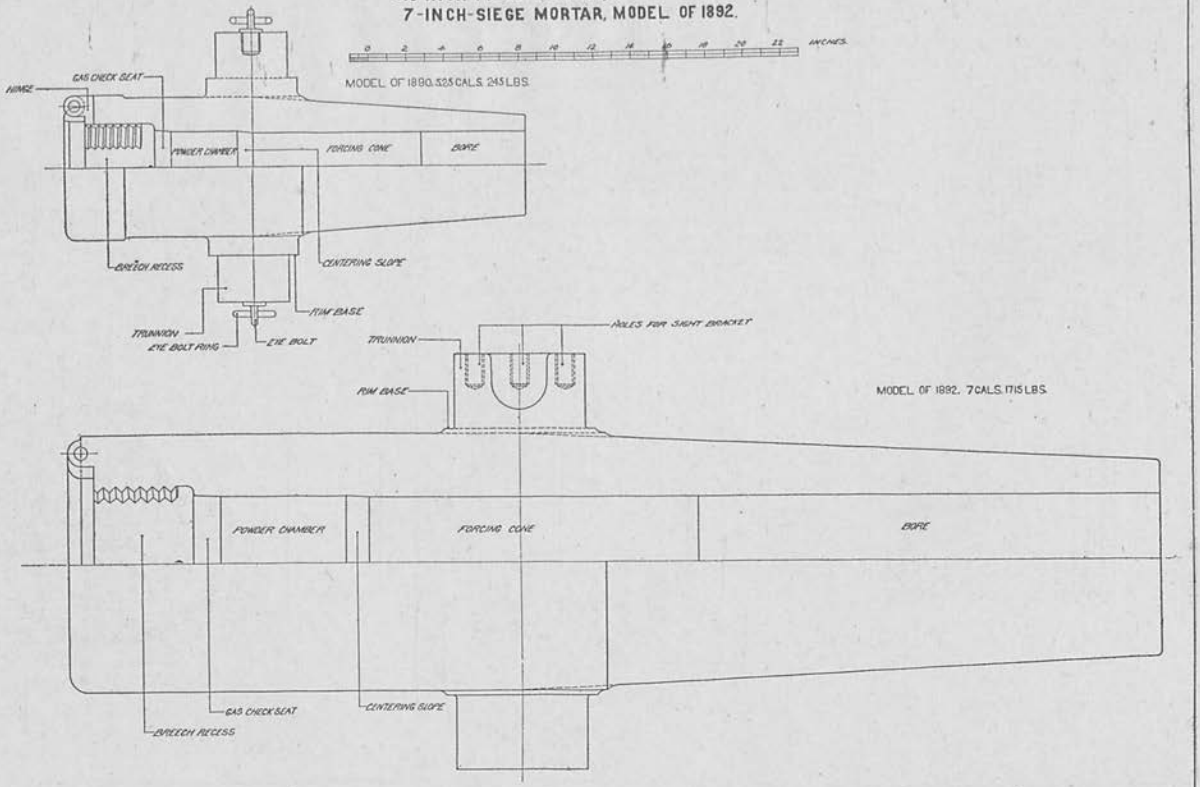
On the sides of the box similar markings are found accompanied by a pictorial stenciled symbol indicating the type of projectile, the tracers, and the fact that the ammunition is separate loading.

The shell and shrapnel for these mortars will be found packed in ordinary pine shipping boxes, eight rounds per box, together with propelling charges and friction primers. The charges and primers are packed in separate tin containers and are placed in the wooden boxes with the projectiles.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, January 4, 1915.

31943-978.
38025-2127.
Form No. 1714.
Ed. Aug. 25-17—700.

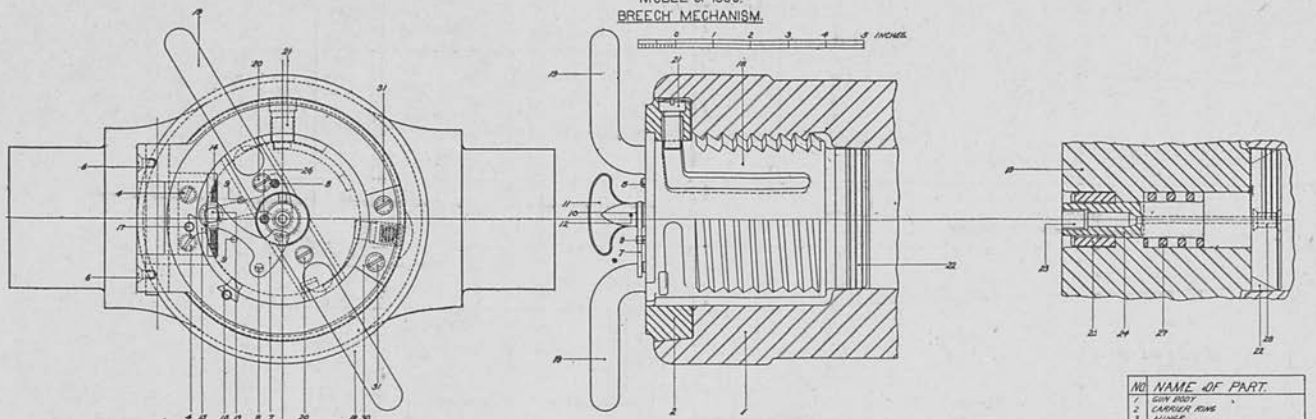
3.6-INCH-FIELD MORTAR, MODEL OF 1890.
7-INCH-SIEGE MORTAR, MODEL OF 1892.

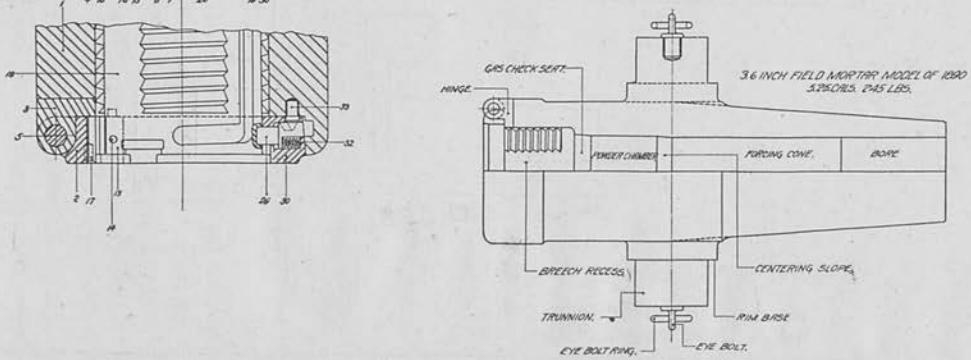


3.6-INCH-FIELD MORTAR.

MODEL OF 1890.

BREECH MECHANISM.





3.6 INCH FIELD MORTAR, MODEL OF 1890.
3.25 CALS. 245 LBS.

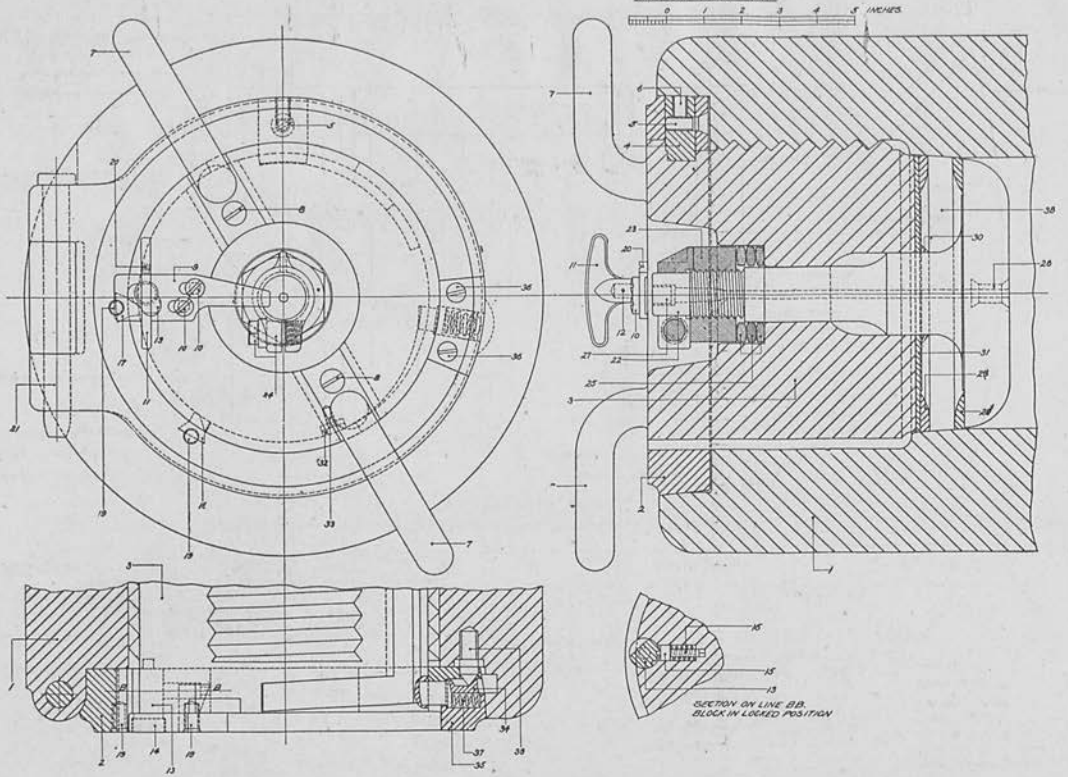
NO.	NAME OF PART.
1	GUN BODY
2	CARRIER RING
3	HINGE
4	HINGE SCREWS
5	HINGE PIN
6	HINGE PIN SCREWS
7	VENT COVER
8	VENT COVER SCREWS
9	VENT COVER STOPS
10	VENT COVER WASHER
11	VENT COVER HANDLE
12	TAPER PIN
13	LOCK BOLT
14	LOCK BOLT SET SCREWS
15	PALLET
16	PALLET
17	PALLET RIVETS
18	BREECH BLOCK
19	BLOCK HANDLES
20	BLOCK HANDLE SCREWS
21	STOP
22	GAS CHECK RING
23	PRIMER SEAT
24	OBTURATOR SPINDLE
25	OBTURATOR SPINDLE NUT
26	OBTURATOR SPINDLE SPLINE SCREW
27	OBTURATOR SPINDLE SPRING
28	VENT BUSHING
29	LATCH
30	LATCH COVER
31	LATCH COVER SCREWS
32	LATCH SPRING
33	RETRACTING STUD

CLASS 36 DIVISION 2 DRAWING 58

7-INCH-MORTAR.

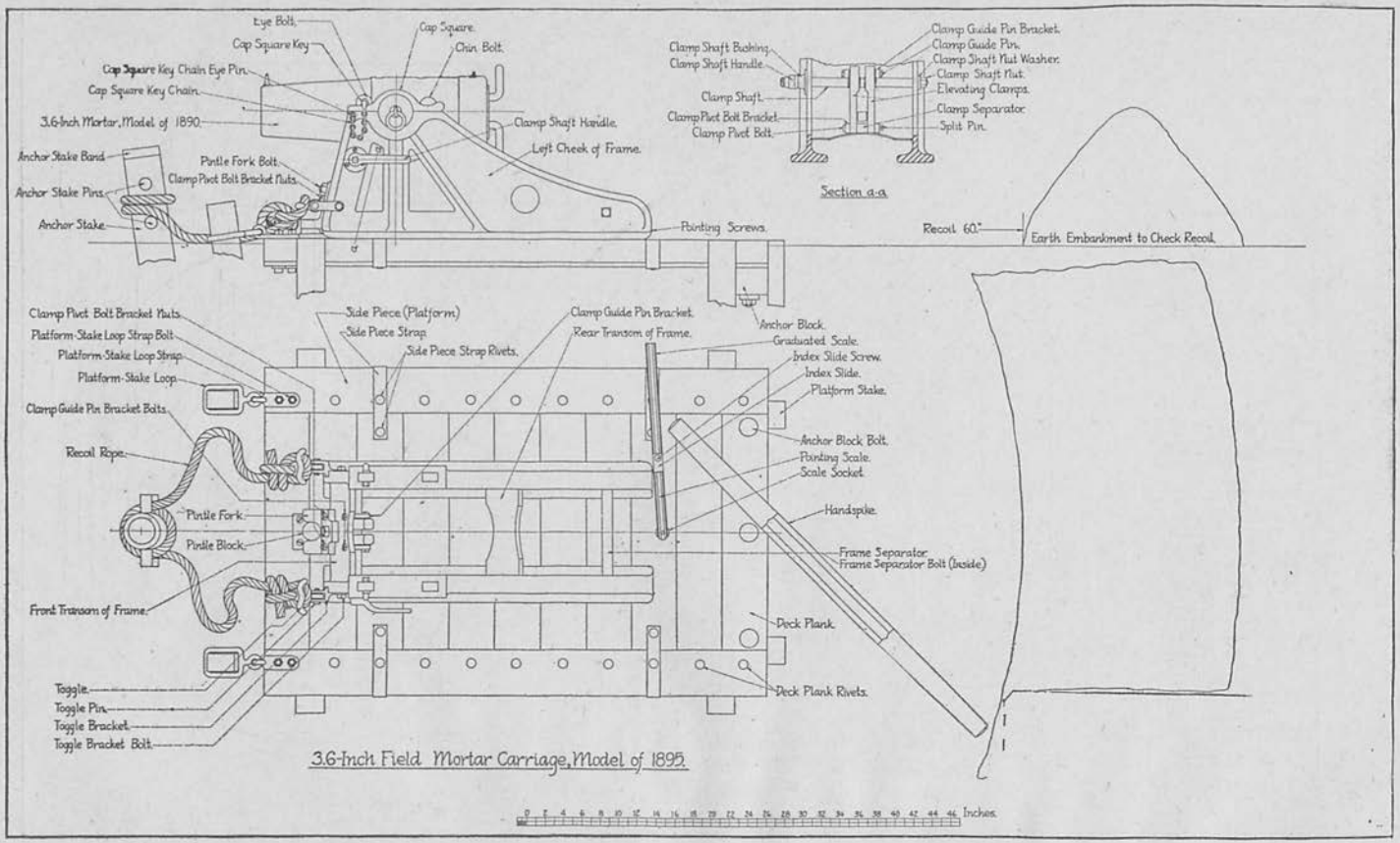
MODEL OF 1892.

BREECH MECHANISM.

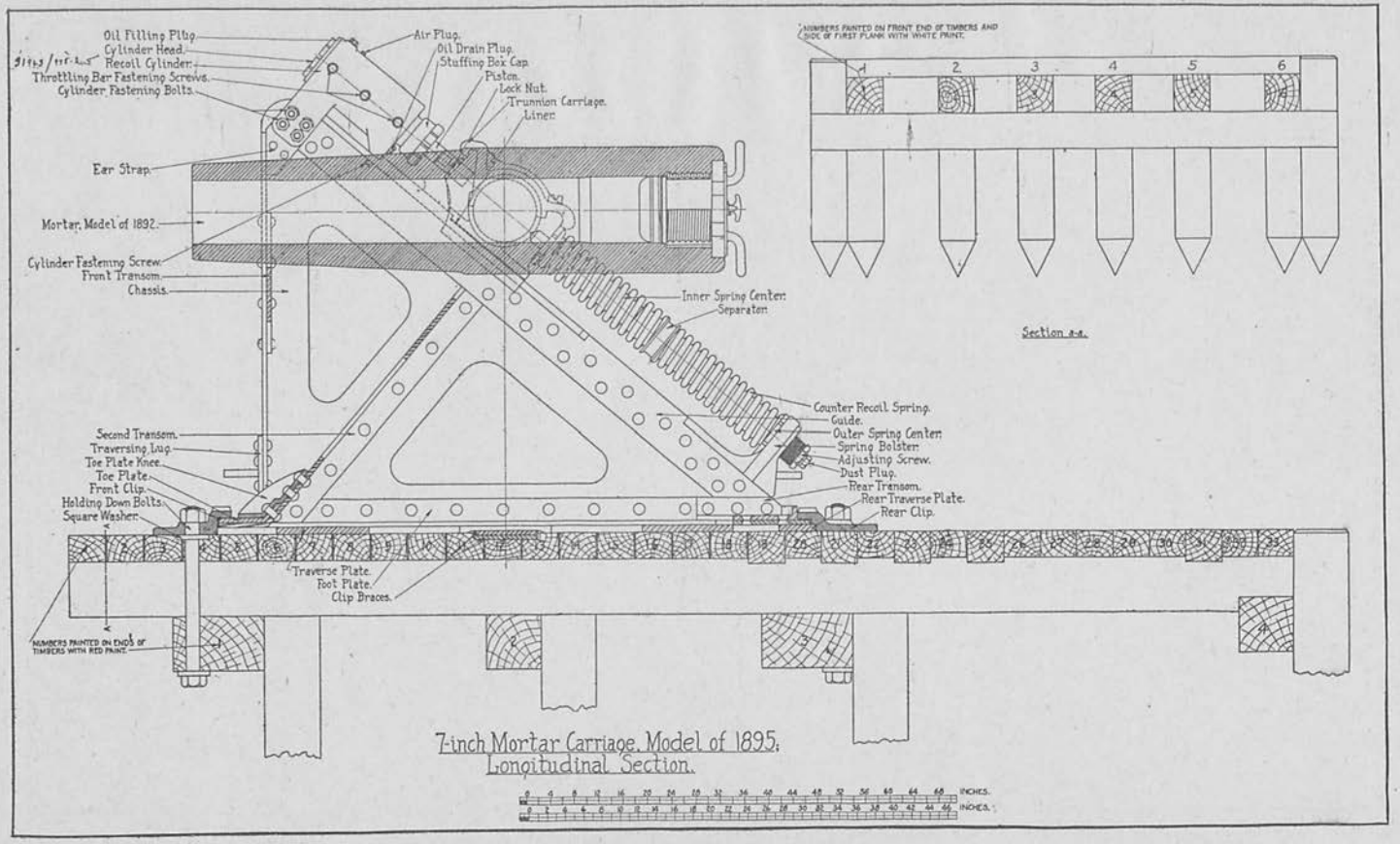


NO	NAME OF PART
1	GUN BODY
2	CARRIER RING
3	BREECH BLOCK
4	STOP
5	STOP SCREW
6	THREADED HALF PIN OBTURATOR SCREW BOLT
7	BLOCK HANDLES
8	BLOCK HANDLE SCREWS
9	VENT COVER
10	VENT COVER SCREWS
11	VENT COVER HANGLE
12	TAPER PIN
13	LOCK BOLT
14	BUSHING
15	PLUNGER
16	PLUNGER SPRING
17	PALLET
18	PALLET
19	PALLET RIVETS
20	GUIDE SCREW
21	HINGE PIN
22	OBTURATOR SPINDLE
23	OBTURATOR SPINDLE NUT & SCREW
24	OBTURATOR SPINDLE NUT CLAMPING COLLAR
25	OBTURATOR SPINDLE ADJ. FRICTION WASHER
26	VENT BUSHING
27	PRIMER SEAT
28	FRONT SPLIT RING
29	REAR SPLIT RING
30	SMALL SPLIT RING
31	FILLING IN PIECE
32	PALLET PIVOT LOCKING RECESS
33	PALLET SCREWS
34	LATCH
35	LATCH COVER
36	LATCH COVER SCREWS
37	LATCH SPRING
38	GAS CHECK PAD
39	RETRACTING STUD

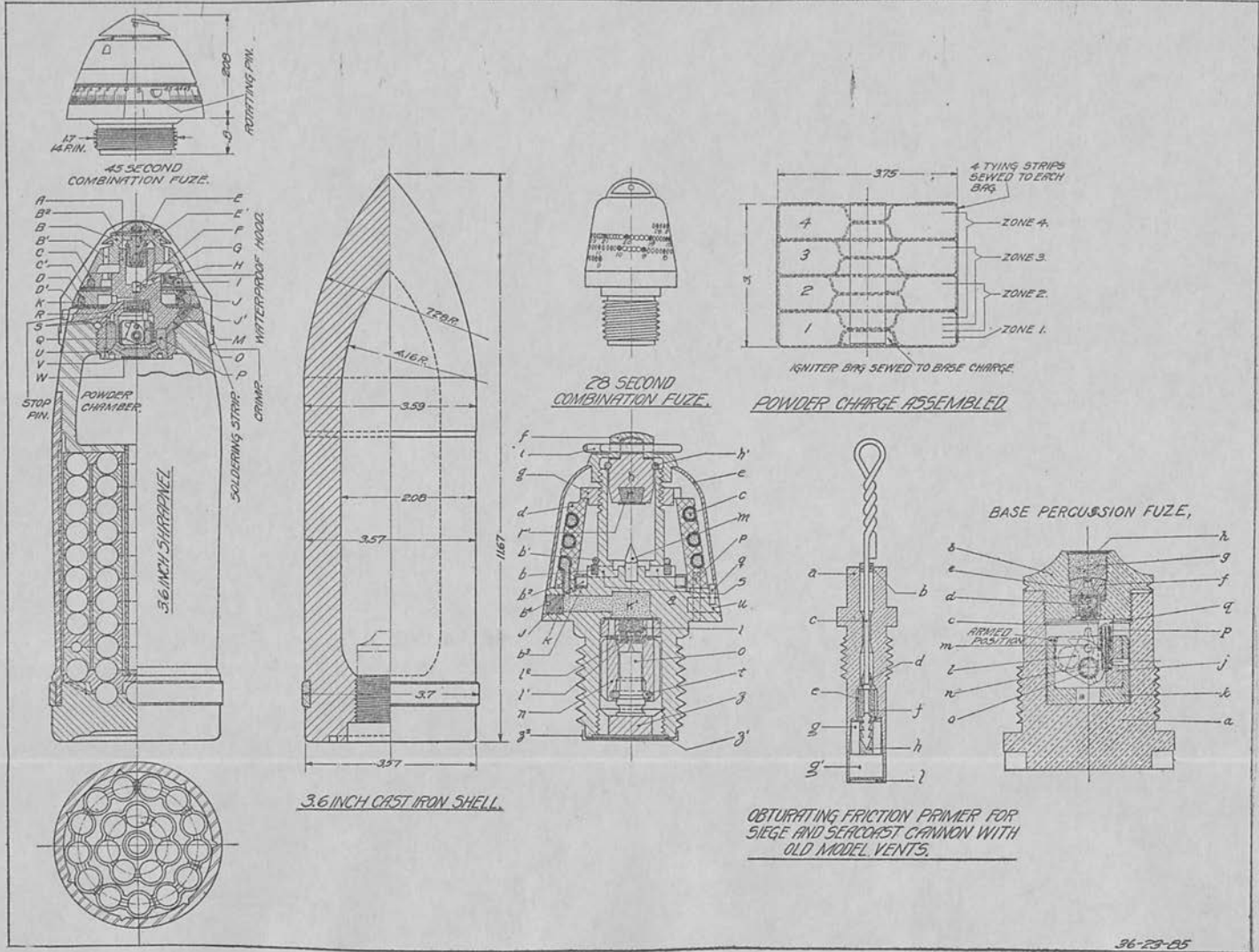
96.3-ICR

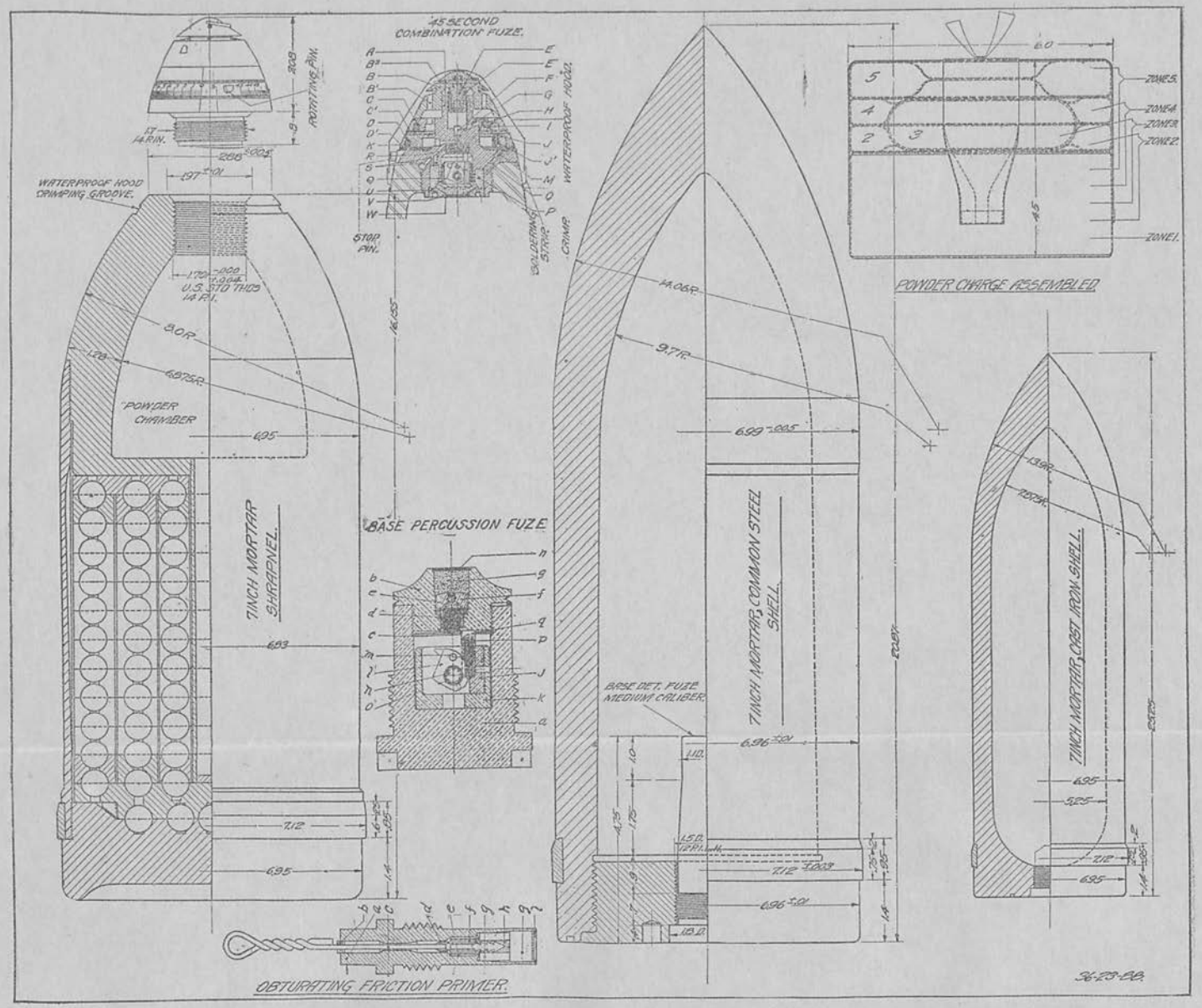


3.6-Inch Field Mortar Carriage, Model of 1895.

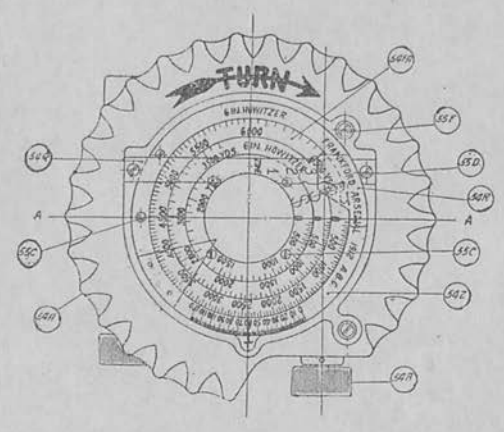


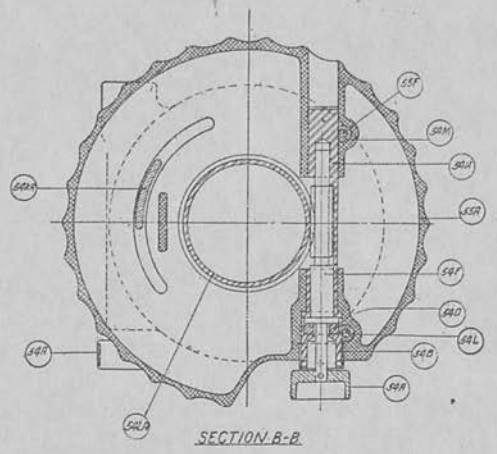
7-inch Mortar Carriage, Model of 1895.
Longitudinal Section.

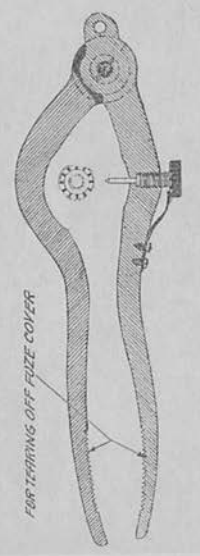

45 SECOND COMBINATION FUZE.
RADIAL PIN.
.17 & RIN.
A
B²
B
B'
C
C'
D
D'
K
R
S
Q
U
V
W
E
E'
F
G
H
I
J
J'
M
O
P
WATERPROOF HOOD.
CRIMP.
SOLDERING RING.
STOP PIN.
POWDER CHAMBER.
36 INCH SHRAPNEL
7.2 R.
4.16 R.
3.59
2.08
3.57
3.7
11.67
3.57
3.6 INCH CAST IRON SHELL.
28 SECOND COMBINATION FUZE.
375
4 TYING STRIPS SEWED TO EACH BAG.
4
3
2
1
ZONE 4.
ZONE 3.
ZONE 2.
ZONE 1.
IGNITER BAG SEWED TO BASE CHARGE.
POWDER CHARGE ASSEMBLED.
BASE PERCUSSION FUZE.
ARMED POSITION.
OBTURATING FRICTION PRIMER FOR SIEGE AND SEACOAST CANNON WITH OLD MODEL VENTS.
36-23-85

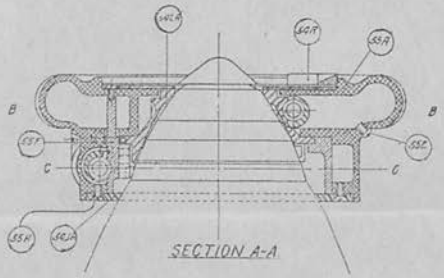


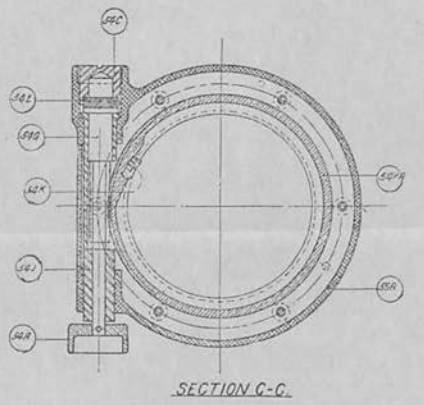
10075—17. (Face p. 54.)











FUZE PUNCH FOR 2.8 SEC. COMB. FUZE FOR 3.6 IN. MORTAR.

HAND FUZE SETTER
MODEL OF 1913
FOR USE WITH 3.6 IN. & 7 IN. MORTARS.

36-23-87