SERVICE HANDBOOK

OF THE

MORTAR CARRIAGES

MODEL OF 1896 MI
AND MODEL OF 1896 MII

FOR

12-INCH MORTARS

MODEL OF 1890 MI

ART. TEROSER
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The following publication entitled "Service Handbook of the Mortar Carriages, Model of 1896 MI and Model of 1896 MII, for 12-inch Mortars, Model of 1890 MI," is published for the information and guidance of all concerned.

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BY ORDER OF THE SECRETARY OF WAR:

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SERVICE HANDBOOK OF THE MORTAR CARRIAGES, MODEL OF 1896 MI AND MODEL OF 1896 MII, FOR 12-INCH MORTARS, MODEL OF 1890 MI.

The points in *italics* are of importance and should be specially noted.

GENERAL DESCRIPTION.

NOTE.—The general designs of the two mortar carriages, model of 1896 MI and 1896 MII, are very similar, the changes incorporated in the later model being mainly in the line of greater strength. The instructions following apply to both models of carriages unless otherwise indicated.

THE EMPLACEMENT.—The emplacement is constructed of concrete, the loading platform of which is flush with the top surface of the floor plates of the carriage when it is assembled. It contains a circular well 59.5 inches deep with steps on which the base ring is supported. The edge of the loading platform is not completed until the angle irons which support the azimuth circle and floor plates have been located and their curved ends embedded in the concrete. The anchor bolts are also embedded in the concrete when the emplacement is constructed.

THE CARRIAGE.—This carriage is designed to deliver an all-round high-angle fire of from 45° to 70° elevation.

With a 1,046-pound projectile and full charge, the recoil is approximately 23 inches, measured on the piston rods.

The bore center of the horizontal piece when fully counterrecoiled is 54 inches above the loading platform, and the projectile, in loading, is wheeled directly into the breech recess, the tray of the ammunition trucks forming the loading tray.

ACTION OF THE CARRIAGE.—Upon firing, the piece and top carriage rotate to the rear and downward about the fulcrum pins, compressing the counterrecoil springs and forcing the crossheads and pistons downward, until the combined resistance in the recoil cylinders and the springs stop the motion, after which the compressed counterrecoil springs immediately return the piece to the loading and firing height. The movement of the crank pin through the arc of a circle causes the recoil cylinders and guides to oscillate about their trunnions.

PRINCIPAL PARTS.—The carriage consists of the following principal parts, viz: Base ring and floor plates, traversing roller system, racer, side frames (except on MII carriages which are integral with racer),

top carriage, recoil system, counterrecoil springs and buffer stops, elevating gear, traversing gear, azimuth circle and pointer, elevation quadrant, lanyard attachment, electrical equipment, including firing magneto, shot trucks, shot tongs, tools, accessories, and implements.

BASE RING.—The base ring is of cast iron, in one piece, and is secured in its position by twenty-four 1.75-inch anchor bolts. The outer flange of the base ring, 14 feet in diameter, which contains the bolt holes, rests upon the upper step of the well, whose surface is 24.5 inches below the floor level of the emplacement.

The top surface is turned, forming the lower roller path, and a vertical annular flange forms the male part of the pintle. The traversing rack is attached on the inside below the roller path and its upper and lower surfaces are turned, forming a path for the traversing brake.

Eight brackets, rigidly supporting the azimuth circle castings, are bolted to the outer flange; these brackets and castings, together with radial angle irons whose outer ends are embedded in the concrete, furnish the support for the circle of 16 cast-iron removable floor plates, which are retained in position by countersunk screws.

TRAVERSING ROLLER SYSTEM.—The racer rests and is traversed upon a circle of 24 live, conical, traversing rollers of forged steel No. 3 with a single flange. The rollers are 7.5 inches maximum diameter, and their axes are held in radial position by a distance ring in which their journals have bearings. The following carriages, Nos. 13, 17, 56, 76, 83, 87, 98, 104, 116, 149, 150, 151, 158, 165, 186, 188, 189, 190, 206, 209, 210, 211, 216, 217, 218, 219, 241, 243, 261, 262, 289, 294, 296, 303, 304, 305, and 306, have cast-steel distance rings, each in six sections, having an oil groove finished around the top edges which is reached through an oil tube in the racer.

The remaining carriages in service are equipped with wrought-iron distance rings, consisting of an inner and outer ring, which are held in position by separators bolted to both rings.

RACER AND SIDE FRAMES.—The racer of the model of 1896 MI carriage is cast in one piece, 13 feet 9.5 inches in diameter. Its lower surface is turned, forming the upper roller path, corresponding to the lower roller path on the base ring. The outside annular flange extends downward, fitting over the pintle with 0.063-inch diametral clearance. It is a cellular structure, and upon its front edge are cast two lugs or brackets to which the top carriage is pivoted by means of steel fulcrum pins. On each side of the central opening are side frames running across the racer from front to rear. These side frames form the supporting bearings for the recoil cylinders and also for the fulcrum pins. Three removable oil plugs permit oiling the pintle and traversing rollers.

Cast iron was originally specified as the material for the racer and most of the carriages in service have racers of that material. As a result of the cracking of several of these racers, cast steel No. 2 is now specified, and all racers hereafter manufactured will be of this material.

NOTE.—The cast-iron racers of carriages Nos. 104, 106, 116, 150, 151, 158, 165, 193, 209, 210, 237, 241, 243, 244, 260, 261, 262, 289, 294, and 300 have already been replaced by cast-steel racers.

A few of the cast-iron racers have been strengthened by the addition of reinforcing plates of steel placed along the vertical sides of the central opening.

The racer for the model of 1896 MII carriage is cast with two longitudinal ribs, one on each side of the central opening. These ribs correspond to the side frames of the model of 1896 MI carriage, reinforcing the racer, and forming bearings for the cylinder trunnions. All the racers of this model carriage are of cast steel No. 1.

TOP CARRIAGE.—The top carriage consists of two arms, connected by a heavy web. The upper ends of these arms form the trunnion beds in which the mortar is mounted and secured by means of cast-steel cap squares. The top carriage is inclined to the rear at an angle of about 41°, the lower ends being held by the fulcrum pins. Between the fulcrum and the trunnions are placed openings for the spring guide rods and the seat for the rocking counterrecoil spring cap.

RECOIL SYSTEM.—The recoil is checked by two hydraulic cylinders provided with trunnions which oscillate in their beds on the side frames, their lower ends extending some distance below the racer. They are of cast steel, 7.78 inches interior diameter, and are fitted with 3.5-inch forged-steel piston rods working through stuffing boxes at both ends of the cylinders. About the middle of the rod is screwed and pinned a bronze piston. The stuffing boxes each contain six rings of 0.625-inch square waterproof hydraulic packing. In the walls of each cylinder are cut three grooves, each 4.6892 inches in width and of varying depth, so as to give a constant pressure in the cylinders during the entire length of recoil. The energy of recoil is taken up by the resistance which the fluid offers to being driven through these openings.

NOTE.—The by-pass channels and openings provided in model of 1896 MI mortar carriages are not now used, all holes opening into the by-pass channels being plugged. The cylinders of model 1896 MII carriages are cast without provision for by-pass channel and openings, and some cylinders of this type have been supplied to replace damaged cylinders on model 1896 MI carriages.

The counterrecoil is checked by a counterrecoil buffer. In the model of 1896 MI carriages the upper face of each piston has an annular recess, which at the end of the counterrecoil passes over the

annular projection on buffer on the upper bronze cylinder head. The fluid thus imprisoned is able to escape by the clearances only, its resistance gradually checks the movement, and consequently the mortar returns gently to the firing position. In the model of 1896 MII carriages the male part of the buffer is on the piston and the female part on the cylinder head, the principle being generally similar to that described above.

The filling holes are now located about one-third the length of the cylinders from the top, in order to obtain a void, and the old oil holes on the rear side of the cylinders near the upper ends are permanently closed and can not be opened.

For all charges the cylinders should be filled to the level of the filling holes, removing for this purpose both plugs, so as to permit the air to escape.

A neutral oil, of specific gravity of about 0.85 (such as the "hydroline" at present issued) is used and with this oil the working pressure in the cylinders is about 5,000 pounds per square inch and the piston-rod compression about 190,000 pounds. A more dense oil would cause a higher pressure in the cylinders and therefore shorten the recoil slightly.

If it is desired to measure the recoil, it can be done on one of the piston rods by making several turns around it with fine twine and tying it tightly just where the piston rod enters the stuffing box. The height of the twine above the stuffing box, after firing, will indicate the counterrecoil, which will also be the recoil if the mortar has returned to the firing position. If it does not return to the firing position, the counterrecoil springs should be compressed.

The lower ends of the hydraulic cylinders are connected by an equalizing pipe, in which is made up an emptying coupling so that the resistance and the pressure in both cylinders shall be equal. The coupling is provided for emptying the cylinders at a convenient point.

The emptying coupling was originally made of bronze. These are being replaced by steel couplings as becomes necessary.

Bronze plugs are provided which can be used to replace the equalizing pipes, thus continuing the piece in action in the event of injury to the pipes.

To the top of each cylinder are bolted two guides of cast steel, between which moves a sliding crosshead, into which the upper end of the piston rod is secured by means of a collar and nut. The crossheads are assembled over the crank pins, of forged steel, which are screwed into the trunnions of the mortar and held by spline screws.

COUNTERRECOIL SPRINGS AND BUFFER STOPS.—The top carriage is supported at a point about one-third of its length from the fulcrum shaft by five columns of springs. Each column consists of five double-coil helical springs, threaded on a rod of forged steel. These

five rods, arranged in a row side by side, serve to guide the springs laterally during recoil or counterrecoil. They also are used to sustain the force of the springs when the mortar is dismounted temporarily, the spring compressors assisting.

For the latter purpose the spring-compressor washers are placed over the spring-compressor screws and the latter screwed into the ends of the rods (the plugs having been removed), after which the spring-compressor nuts are screwed down against the washers, until the crossheads are moved a short distance from the buffer plates.

The lower ends of these spring columns rest in a spring box of cast iron, the upper ends bearing against a spring cap. The spring box is hung, by means of trunnions, in two brackets of cast iron bolted to the undersurface of the racer which permits it to oscillate during recoil to the different inclinations of the spring columns. The spring cap, performing essentially the same office above as the spring box does below, is a thin rectangular steel casting fitting over the top of the spring columns, and having upon its upper surface a well-rounded knife-edge bearing. During recoil this bearing rocks in a groove running across the lower surface of the top carriage. Both the spring cap and box are perforated to allow the ends of the spring rods to pass freely through them.

As an additional precaution against shock when returning to the firing position, buffer stops are provided. These are made of alternate layers of balata and steel plates, and are held between the guides under the caps. The crossheads moving between the guides during counterrecoil strike these buffers when the mortar returns to the firing position, and are maintained in pressure contact under the guide caps by the counterrecoil springs.

Elevating System.—A circular rack of cast steel is bolted longitudinally to the mortar on the underside, so that the center from which its pitch line is struck is at the intersection of the axis of the trunnions and bore. This rack engages in a pinion of steel mounted on a heavy shaft on the undersurface of the top carriage. This shaft also carries an elevating gear. Motion is given the gear and shaft through intermediate gears by a second shaft extending across the upper face of the top carriage and bearing a handwheel at each end. The top carriage is cored out to permit the passage of the rack.

The mortar is held in firing position by means of a hand nut on the handwheel shaft, which locks the shaft by pressing a thrust collar against an adjoining bushing, the thrust collar and bushing together forming a conical friction clutch.

To protect the teeth on the elevating gearing from injury which may be caused by inertia effects during the change of elevation in recoil, the elevating shaft carries a friction device. This device consists of alternate bronze and cast-iron disks working in a recess of

the elevating gear. The bronze rings rotate with the elevating gear and the cast-iron rings with the elevating shaft by means of keys, but the keys do not prevent motion in the direction of the axis of the shaft. By means of a nut, plate, and coiled spring on the elevating shaft, the rings are forced together and against the elevating gear, thus forcing the latter against the shoulder of a bushing which is rigidly fastened to the elevating shaft. The elevating gear is not fastened rigidly to the shaft or to the bushing, but by means of nut and spring the pressure on the disks can be made great enough to prevent any slipping during elevating or depressing or an undue amount of slipping during recoil. This pressure will be properly regulated when the united efforts of two men, one at each of the handwheels, is just sufficient to cause slipping of the friction device when an attempt is made to depress below the minimum.

Accurate adjustment should be made by regulating the friction, so that slipping will occur with the mortar depressed against the stop when a force of 156 pounds is applied to the elevation handwheel shaft at a distance of 100 inches from the center of the shaft. The friction may be determined by means of weights or a spring balance.

To hold the mortar in the horizontal position for loading and insure against accidental elevating when the breech is open, an elevation lock is provided. This consists of a lock bar and spring attached to the top carriage and engages a lock stud on the elevation rack, thus automatically locking the mortar when horizontal. To elevate the mortar the lever which serves to withdraw the lock bolt must be operated and held open by hand until the mortar has moved sufficiently in elevation for the stud to clear the lock bar.

On each side of the elevating rack is placed an auxiliary elevation scale graduated in 10-minute intervals. Pointers attached on each side of the opening in the top carriage indicate the elevation of the mortar.

Traversing System.—The circular traversing rack on the inside of the base ring meshes with a pinion on a vertical shaft which passes down through the racer and having at its upper end a worm wheel. Motion is given the latter by means of a handwheel mounted on a worm shaft. The worm shaft, worm wheel, and the part of the vertical shaft above the racer are incased in a standard, which has oil and drain holes so arranged that the worm and the gear rim run in oil.

The standard was originally of cast iron for model of 1896 MI carriages but for replacements cast steel will be provided. Model 1896 MII carriages are all provided with cast-steel standards. The vertical traversing shaft is of forged steel for both models.

In order to maintain the piece without further movement until fired after having been set in azimuth, a traversing brake is supplied.

It consists of a toggle and coiled spring acting to cause a brake shoe to bear on the traversing rack. The brake is operated from the top side of the racer near the azimuth pointer by two pedals, a foot lever, and a catch. Depressing the foot lever sufficiently to engage the catch raises the brake shoe from the brake path on the traversing rack and permits free motion of the racer. Releasing the foot lever by depressing the catch throws the brake on. The brake should be so adjusted that one man working on the handwheel can with difficulty traverse the carriage slightly when the brake is on.

Azimuth Circle and Pointer.—A brass circular strip in eight sections, about 1 inch wide and graduated to degrees, is attached to the top side of the azimuth-circle castings which surround the racer. Attached to the racer is a small brass pointer or subscale. This pointer is subdivided to 0.05° and stamped in hundredths of a degree. An electric light is attached for illuminating the scales, and a cast-iron cover when closed down protects the subscale and the light.

Elevation Quadrant.—To save time in bringing the mortar to the desired elevation and to avoid inaccuracy in placing the gunner's quadrant and holding it against its seat, a special elevation quadrant has been designed. This quadrant is similar to the gunner's quadrant, but permanently attached to the left rim base of the mortar, and consists of a bracket with a toothed arc and an arm hinged at the other end. The arm is telescoped and its front bushing carries a bubble, a micrometer, and a toothed sector which is constantly pressed outward by a spiral spring. The teeth of the sector engage in the teeth of the arc, which are cut in degrees from 45° to 75°. The micrometer, which gives a limited movement to the arm, is graduated to a least reading of one minute. When the quadrant is set to the required angle of elevation and the piece loaded, the mortar is given the proper elevation by bringing the bubble to the center of the tube.

A canvas cover has been provided which should be kept on the quadrant when not in use.

Lanyard Attachment.—A short lanyard is attached to the underside of a stopper in the top of the racer in rear of its central opening and extends below a pulley on the pit ladder, thence upward to the safety lanyard device, and thence to the firing mechanism. The safety lanyard device consists of a bridle clip fastened to the plug set in the face of the breech, and a ring fastened at such a distance from the hook end of the short lanyard that the hook of the lanyard and ring can be fastened to the firing mechanism and the bridle clip. While loading and laying the mortar the ring should be on the clip. A pull on the lanyard is resisted wholly by the bridle clip, which will not permit the ring to slip off and allow a pull on the firing mechanism until the mortar has attained an elevation of about 43°.

The long lanyard is hooked into the eye on the top of the stopper, and the stopper and short lanyard drawn to the rear to fire.

ELECTRICAL ATTACHMENTS.—These consist of the firing circuit, its safety attachments, and the lighting circuits.

FIRING CIRCUIT.—The current for the firing circuit is derived from a hand-operated alternating-current magneto, type MA, located at the mortar pit. The magneto is attached to a bracket (77A) on the wall of the emplacement and connected with the engineer plug box by a flexible cable. One end of the magneto cable is connected to the terminals (T97P and T97Q) of the magneto and the other end is connected to the cable plug (P73D) as furnished with plug box (E20B) by the Engineer Department. The magneto bracket (77A) is furnished by the Ordnance Department and is set up on foundation bolts installed by the Engineer Department. The conduits and wiring to each mortar well are furnished and installed by the Engineer Department. The engineer cable, type 1, terminates in a water-tight receptacle box (E25H2) bolted to the underside of the base ring. When not actually in use this box is kept closed by means of a receptacle cap (E23J) and rendered water-tight by a rubber gasket.

The connection between the fixed base ring and the rotating racer is accomplished by means of slicked reinforced cord, No. 16 (inclosed twisted pair, each approximately 2,583 circular mils) new code type P. W. P. To facilitate connecting up, the inlet end of this cord terminates in a plug (E25Z1) which can be quickly inserted in the receptacle referred to above, the joint being closed by means of a plug cap (E23AC1) which is screwed directly to the receptacle cover and rendered water-tight by means of a rubber gasket. From the inlet-receptacle box on the base ring the flexible cord is led vertically downward to the bottom of the well, thence beneath two hooks which keep it always below the spring box to a double pulley centrally located on a three-legged bracket which straddles the emplacement drain. From the pulley the flexible cord is led to the left-side rib of the racer opening where it terminates in a receptacle box (E25J2). This receptacle box is similar to that previously mentioned, but, instead of a screw cover, is provided with a spring cover which closes automatically whenever the safety firing plug is withdrawn, thereby preventing access of water to the interior of the receptacle.

The plug (E25Z1) is cut away on one side so that it can be inserted in the receptacle box (E25H2) in only one way. This is necessary to prevent possible short-circuiting of the magneto.

The safety firing plug (E25AA1) is similar to that already described, except that it is not provided with a cap and gasket for making a water-tight joint when inserted in the receptacle. This is, however, unnecessary, as the plug is only inserted when ready to

fire, and is immediately and automatically withdrawn when the mortar is depressed after firing. From this plug another length of flexible cord, looped slack in order to let the plug chain take the strain, leads to the face of the breech, where one lead is grounded and the other fastened directly to the spring plunger of the circuit breaker.

The firing plug (E25AA1) is cut away on one side to insure its being inserted in the receptacle box (E25J2) in one way only, as explained in the case of the plug (E25Z1).

Lighting Circuit.—Current for the lighting circuit is supplied by the Engineer Department from the emplacement mains, and is led into each well by engineer cable, type 1, terminating in a water-tight receptacle (E25AB1) as previously described for the firing circuit. The connection between the fixed base ring and rotating racer, is accomplished in a manner similar to that for the firing circuit, except that the outlet end of the lighting circuit terminates in a plug (E25AD) similar to that in which the inlet end terminates. In connecting up the lighting circuits this plug is inserted into a receptacle (E25AF) which is permanently screwed into a junction box (E21T) located at the left side of the racer opening. From this junction box radiate the circuits for the azimuth lamp, elevation quadrant lamp, and portable lamp. The circuit for the portable lamp is led to the rear directly from the junction box to the engineer's plug box (E20B). The plug box and portable lamp are furnished by the Engineer Department.

The circuits for the azimuth and quadrant lamps are led by one cable from the junction box to a 5-ampere water-tight switch (E36A1) on the left-side frame. From this switch a cable is led to the front of the resistance box which is bolted in a horizontal position on the left-side frame. From the rear of this resistance box cables are led to the azimuth pointer and quadrant lamps. The cable for the azimuth pointer lamp is led round the inside of the racer until it reaches the depression for the azimuth pointer where it is connected to a water-tight receptacle box (E22N1) which supports the azimuth lamp and reflector (E12P2). The cable for the quadrant lamp leads to the upper part of the left crosshead guide where it is connected to a quadrant lamp bracket (E22P) which supports the quadrant lamp and reflector.

The circuits which lead from the junction box (E21T) are made of twin conductor, lead covered, steel-armored cable, each conductor of 4,110 circular mils cross section, the ends being secured to their respective terminal points after passing through water-tight stuffing tubes.

The 8-candlepower lamps used at the quadrant and azimuth pointer are of the bayonet-base type operating at approximately

16 volts. A wound tube resistance unit mounted in the lamp resistance box is inserted in series with each lamp which provides the necessary drop in voltage from either 110 or 220 volts, so that the voltage at the lamp terminals is 16 volts. Each lamp with its resistance unit is in parallel on the circuit in order that the failure of any lamp or its resistance unit will not affect any other lamp. After the lamps are in operation for some time the lamp resistance box will become heated, but the box is so designed that a temperature injurious to the unit will not develop. The openings provided for the cables in all plug, receptacle, junction, and resistance boxes and the 5-ampere switch are furnished with water-tight terminal tubes.

Safety Features.—In order to prevent possible accidents due to the crossing of the firing and lighting circuits, the plugs (E25AD) and (E25Z1) are made noninterchangeable, in that the firing plug can not be inserted by mistake in the lighting receptacle on the base ring. The insertion of the lighting plug in the firing receptacle would obviously cause no damage, but in order to prevent mistakes the words "Firing" and "Lighting" are cast in raised letters on the covers of the corresponding receptacles wherever used.

In order to prevent accidents due to firing at too low an elevation, a safety firing plug is suspended from the breech of the mortar by a chain whose length is determined by trial as being only sufficient to permit contact to be made at elevations of 43° and above. Automatic closing of the firing circuit at this point is omitted advisedly.

Care of Electrical Equipment.—The electrical equipment can be divided generally into two distinct classes, the rugged and expensive armored cable and water-tight accessories and the less rugged and correspondingly inexpensive flexible cord. *The flexible cord should be removed from the carriage and stored in a clean and dry place when not actually in use.* In the second class are included cables for the complete firing circuit and that part of the lighting circuit between the inlet on the base ring and the junction box on the racer.

Except in emergencies, *the carriage should not be traversed more than 180° to the right or left of a line perpendicular to the flexible conductors on the floor of the mortar well.*

Shot Trucks and Shot Tongs.—The shot trucks for this carriage are constructed so as to permit passing the shell directly from the truck into the mortar. Each truck consists of a light rectangular framework of steel mounted on four rubber or rope tired wheels and carrying a pan in which the shell lies horizontally and at the proper height for loading. This shell pan projects to the front and is designed to enter the breech of the mortar and to supply the place of the usual loading tray. Two straight wooden bars which slip into sockets on each side of the truck serve as handles and the two rear wheels are of the caster type to facilitate turning. A brake is attached for

holding the truck firmly in position against the breech while loading. Shot tongs are also provided for placing the shot on the shot truck. One pair of tongs is provided for each trolley installed by the Engineer Corps and two pairs are kept in reserve for each battery.

TOOLS, ACCESSORIES, AND IMPLEMENTS.—The carriage is equipped with tools and accessories necessary for its assembling and care. These parts, together with the implements for the mortar, except those which are too large, are stored in an armament chest.

ASSEMBLING THE CARRIAGE.

IMPLEMENTS.—The assembling requires machines and implements for mechanical maneuvers usually found at forts, such as shears, falls, blocking jacks, sling chains, etc.

GENERAL REMARKS.—The size of the carriage is such that it must be dismantled for shipment, so that when it arrives at its destination it has to be entirely assembled.

In assembling the carriage, as in all machinery, no parts should be directly struck with a steel hammer or sledge. Soft-metal drifts or copper or lead hammers should be used.

In unloading or handling the parts, care should be exercised that the edge or finished surfaces do not become upset or burred. When two bearing surfaces are brought together it is especially necessary that both parts should be absolutely clean, smooth, and well lubricated.

In mounting the carriage the top, bottom, and back of the cross-head, the buffer plates, and that part of the top carriage behind the guides will be painted before assembling. These parts are not accessible after being mounted, and if not thus protected would rust badly.

In assembling guides or machined surfaces put on a thin coat of light slushing oil; slush all bolts and threads. No light slushing oil will be applied to the rollers and paths as its use would quickly result in the accumulation of dust and dirt, thus causing the parts to become gummed; simple oiling is all that is required.

The following description gives a statement of the order in which the parts should be put together rather than a complete enumeration of the details of the operation:

BASE RING.—The base ring is moved to its position over the bolts by means of skids and rollers. When the holes in the ring are directly over the corresponding bolts, lower by means of jacks, being careful to lower all at the same time. If it should be necessary to engage under the toothed rack by means of the lugs on the jacks, use three jacks about 120° apart, using a piece of soft wood on top of each shoe. Continue the operation of lowering until the ring is on its bed, having the bolts as nearly central in the holes as possible.

On each side of every platform bolt there should be an iron wedge 6 inches long, 4 inches wide, and approximately three-sixteenth inch thick at the larger end, resting on an iron plate 6 inches long, 4 inches wide, and one-eighth inch thick. These wedges and plates serve to give the base ring proper support, enabling it to be easily leveled by driving in the wedge. This also permits the grouting to become well set without deformation while the remaining parts of the carriage are being assembled.

LEVELING.—A sensitive machinist's level and an accurate steel straightedge should be used in leveling all parts.

The threads of the platform bolts and nuts should be carefully examined to see that they are not burred and are free from rust. After they are put in order thoroughly oil the threads of both bolts and nuts. In screwing down the nuts on the platform bolts take up on each bolt a little at a time, so that no part of the base ring shall be strained. The greatest care must be exercised in using the level and straightedge that the middle of the level is equidistant from the points of contact of the straightedge with the surfaces being leveled and that these points of contact on the straightedge are equidistant from either end.

In using the level it should be reversed after each setting and the mean of the readings in the two positions considered the true reading. The preliminary leveling may be done from the top of the pintle, but for the final leveling the straightedge should be placed on the turned surface of the roller path, following around circumferentially first in one direction and then in the other, leveling and tightening the foundation bolts until no high spots are found. After the base ring is properly leveled and fixed in place, pour under it a grouting of neat Portland cement, being careful that the part below the level of the outside flange is thoroughly embedded. Fill the spaces between the bolts and bolt holes with melted lead.

DISTANCE RINGS AND TRAVERSING ROLLERS.—Clean the lower roller path and rollers very thoroughly with kerosene oil and fine emery cloth and then assemble the rollers and distance ring. After this is done, run the rollers around several times by hand to see that they run freely and do not bind or stick against the distance ring.

Now bolt the eight azimuth-circle brackets to the flange of the base ring, care being taken to see that they are in their proper places as shown by the figures stamped on them.

RACER.—Before assembling the racer the upper roller path should be cleaned in the same manner as prescribed for the lower path. The pintle surfaces on both racer and base ring should also be cleaned with kerosene oil and emery and then thoroughly oiled. Then place the spring box, with its brackets on it, inside the base ring, in about the position it will finally occupy, with the top surface of the feet of the

brackets not higher than the floor level of the emplacement. By means of skids and rollers the racer can now be moved over its proper place, care being exercised that its lowest part is not less than 12 inches above the floor level of the emplacement. While in this position raise the spring-box brackets and spring box, by means of jacks and blocking, to their proper position against the under surface of the racer and secure firmly to the racer by means of the studs which pass through the feet of the brackets. (If means are at hand to turn the racer bottom side up, the spring box and its brackets can be more easily and more securely assembled while in that position, after which the racer is placed in position for lowering.) Lower the racer onto the rollers; this can best be done by means of three jacks placed 120° apart, care being taken to keep blocking under the racer and to remove a little at a time. When in place, rotate the racer several times by hand to see that it runs freely and that the pintle surfaces do not bind. By means of rollers and pinch bars place the side frames in position with keys assembled; locate accurately by means of dowels, and bolt securely to the racer. The side frames being once attached to the carriage should never be removed.

Floor Plate, Ladder, and Dust Guards.—Now put the removable floor plate in place on the racer and secure it with the countersunk screws provided for the purpose. Bolt the ladder to the inner surface of the flange on the front of the floor plate and its brace to the under surface of the floor plate in the rear. After this the dust guards, in four sections, can be bolted on the lower interior flange of the racer inside the roller path.

Recoil Cylinders.—To prepare the cylinders for assembling remove the guides and caps and then the crossheads, take out the top cylinder heads, remove the piston rods, and clean the cylinders thoroughly. Then coat the upper interior parts of the recoil cylinders and that part of the piston rods below the piston head, which will be above the level of the oil, with light slushing oil, to prevent the formation of rust in the space above the level of the oil in the cylinders. After oiling the parts, replace the piston rods and cylinder heads.

Removal of the piston rods will necessitate reassembling and repacking the stuffing boxes. See "Care of the Carriage."

Now clean the trunnions of the cylinders and then lower the cylinders into their respective openings in the racer and side frames and bolt on the cap squares.

Top Carriage.—With the aid of rollers run the top carriage bottom side up to the front of the racer and assemble in bosses by means of the fulcrum pins. Using shears, gin, or jacks, raise the trunnion-bed end of the top carriage until it inclines well to the rear, when it should

be braced preparatory to receiving the mortar. The cap squares should now be removed.

COUNTERRECOIL SPRINGS.—To assemble the springs the center of the mortar trunnions should be about 5 feet 9 inches above the racer. Put five springs in the spring box and lower through them the spring rods, with the locking and adjusting nuts down against the fixed nuts. Now assemble the springs and washers on the rods, four on each rod above washers, and with the aid of a tackle let fall to their approximate position against a scantling which had previously been located. The spring cap should then be placed in position.

TO MOUNT THE MORTAR BY BLOCKING.—The following articles are required: Oak rollers 3 feet long; one cradle 18 feet long and 3 feet wide; two 12-inch timbers 26 feet long, and two of the same length as the cribwork; a quantity of 2-inch, 6-inch, 8-inch, and 12-inch blocking, and three hydraulic jacks of 15-ton capacity. On the emplacement floor in front and rear of the racer make two parallel cribworks of blocking longer than the width of the top carriage. They should be sufficiently high to allow the two long 12-inch timbers, now laid from one crib to the other, to clear the top carriage. The outer faces of these pieces should be within the planes of the inner faces of the trunnion beds.

Build a runway in front of the carriage, so that the mortar on the cradle can be moved on the track just formed, and bring the trunnions of the piece over their beds. Carefully chock the rollers.

TO REMOVE CRADLE AND TRACK.—Insert a heavy block in breech of mortar, allowing it to project 1 foot outside. Place head of hydraulic jack under this block close to breech and its foot on the cradle and raise sufficiently to pass a 12-inch timber between mortar and cradle at right angles to mortar, and block up each end on cribwork outside of cradle. The crosspiece must now clear the cradle. Repeat the operation at muzzle and chock the piece front and rear. Remove cradle, rollers, and track.

TO LOWER THE PIECE.—Jack up the breech as above described, remove sufficient of the crib to allow a 4-inch drop, and lower the breech onto the cross timbers. Do same at muzzle, and continue until trunnions are in their beds. Then bolt on the cap squares.

The clearance between crosshead guides and end of trunnion is small, so great care must be taken in lowering.

Remove the braces supporting the top carriage and lower the mortar and top carriage against the springs, the top carriage rotating about the fulcrum. It will be necessary to guide, with a crowbar, the spring rods through the openings in the spring cap and top carriage. If the weight of the mortar and top carriage is insufficient to compress the springs enough to enter the piston-rod nuts in the cross-

head, the latter having previously been bolted to the crank pins, a tackle should be used to draw the mortar down.

To Connect the Piece with the Recoil System.—Screw the piston-rod nuts with great force into the crossheads, assemble the guides to the cylinders, embracing the crossheads, and bolt on the guide caps with their balata buffers. See that the guides and crossheads are well cleaned and oiled before they are put in place. Connect the equalizing pipe with the recoil cylinders.

Elevating Gear.—Slip the elevating rack through the hole intended for it in the top carriage and bolt it securely to the mortar.

Slide elevating shaft through its bearings, friction device, and elevating pinion, screwing up on the clutch spring, adjusting nut at the same time. Bolt elevating nut-pin bracket to the underside of the top carriage. Slide elevating intermediate pin through its bearings and elevating intermediate gears and fasten with tap bolt. Place in position the idler pin and elevating idler gear, fastening with tap bolt. Bolt in place the elevating handwheel-shaft brackets and assemble in position handwheel shaft with handwheels and collars.

Adjustment of Springs.—After the mortar is in position it may be found that the springs have not been compressed sufficiently to hold the mortar in the firing position, and that there are open spaces between the crossheads and the caps on the crosshead guides. These spaces must be closed by an additional compression of springs. For this purpose the lock nuts on the five spring guide rods are loosened, and the necessary compression given by the adjusting nuts, the spindles being held from turning by means of the fixed nuts immediately over the loose springs. During the adjustment of the springs the mortar should be occasionally jarred against the stop on the top carriage by means of the elevating handwheels. The elevation lock must be held unlocked when the mortar is jarred against the stop in order to prevent the breaking of the lock when the mortar rebounds from the stop. The proper compression is given when the springs will hold the crossheads in pressure contact under the guide caps.

Traversing Mechanism.—Thoroughly clean all the traversing mechanism preparatory to assembling, first detaching the parts which have been shipped assembled. Then put the worm and worm wheel in the pedestal brackets, engage the gears, and insert the worm shaft. Next, put the vertical traversing shaft through the pedestal bracket from the lower end. Key the upper end of the shaft to the worm wheel, put on the washer and nut, and insert the split pin. Bolt the bracket for vertical traversing shaft to its pad on the underside of the racer. Support the traversing pinion in its place, engaging the rack. Lower the assembled pedestal bracket, allowing the vertical shaft to enter its lower bearing and pinion. Bolt the pedestal bracket to its pad on the racer and attach the traversing hand-

wheel. If necessary, turn the handwheel to adjust the keyway for the traversing pinion and secure the pinion with key, washer, and nut. Put on the cover and attach the traversing brake.

AZIMUTH CIRCLE.—The azimuth-circle castings should next be put in place, fitting the ends together as marked, care being taken to see that the inner edge of the circle is central with the racer and 83.5 inches radius, so that the clearance between it and the racer is the same all around. Bolt the angle-iron brackets in position supporting the floor plates and level them with the plates in place, the outer ends of the brackets being supported by blocks. The outer point at which these angle brackets are supported temporarily must not be more than 22 inches from the racer or the supports will interfere with the filling in of the emplacement with concrete, which is to form the sides of the mortar pit and which holds the brackets rigidly in position.

IMPORTANT POINTS.—After the carriage has been completely assembled and the mortar mounted, the following points should be noted, viz:

1. Traverse the carriage each way, elevate and depress the mortar, to see that both work freely.

2. Examine and clean out all oil holes, noting that oil plugs are provided.

3. See that there is not a hard bearing between the rim bases of the mortar and the top carriage, between the crossheads and crank-pin shoulders, and between the cylinder-rim bases and their bearings, as these conditions would indicate parts out of alignment.

4. See that the elevating rack is firmly attached, that the counter-recoil springs maintain the mortar fully "in battery," and that the elevation stop permits the piece to be depressed to horizontal position so that projectiles can be rammed without interference.

5. See that the dust guard does not bind or rub on the traversing rack and that the inner edge of the azimuth-circle castings are concentric with the revolving racer.

6. Attach the elevation quadrant, using a clinometer supported by a rest in the muzzle of the piece while fitting it to test its adjustment. With the piece set horizontal the leveling of the base ring can be tested by traversing to each 90° position and noting the reading of the clinometer.

7. Orient the mortar, add numbers to the degree marks on the azimuth circle, and adjust azimuth pointer to indicate correct azimuth. Muzzle at true south is 0° in azimuth and numbers are placed around clockwise to include 359.

8. See that electrical connections have been properly made by trying the lights and the firing circuits.

To Dismount Carriage for Purpose of Cleaning Trunnions and Springs.—Remove crosshead guides and guide caps and unscrew piston-rod nuts. Then with the aid of jacks, skids, and blocking raise the mortar, the top carriage rotating about the fulcrum, until the center of the trunnions is about 5 feet 9 inches above the racer. The spring cap, spring washers, and rods can then be removed. With the springs out, the trunnion-cap squares can be removed and the top carriage lowered sufficiently to clean the trunnions and their beds. The same operation in the reverse order should be followed when assembling.

CARE OF THE CARRIAGE—GENERAL INSTRUCTIONS.

Carriages should be traversed from time to time through their entire movement and left at a different azimuth each time.

It is especially required that all parts of the carriages be kept free from rust *at all times*. If rust be allowed to accumulate, its removal from all bearing parts, and especially piston rods, requires particular attention in order that clearances shall not be unduly increased. The use of sandpaper for this purpose is forbidden, and emery cloth No. 1, being coarse enough for any ordinary rusting, should be used, the rust being softened, if necessary, by using kerosene oil.

If any leakage occurs from the hydraulic recoil system, it should be immediately remedied, calling, if necessary, upon the corps area ordnance officer for the services of skilled labor.

The repacking of stuffing boxes may be done when necessary by trained enlisted men under the supervision of an officer, but will preferably be done by skilled labor.

Before removing a cylinder head containing a stuffing box, or drawing a piston rod through a stuffing box, the pressure of the packing on the rod should be released by unscrewing the follower several turns.

The vulcanized fiber or copper gaskets between cylinders and their heads should be in good condition and consequently should be replaced whenever necessary in order to prevent leakage.

Recoil cylinders should be emptied at least every three months and thoroughly cleaned every six months.

Cleaning Recoil Cylinders.—For this cleaning a plumber's hand force pump will be supplied to each Coast Artillery post, with about 10 feet of suction hose and 15 feet of discharge tube.

It will be noted that it is unnecessary to remove the packing from the stuffing box to clean the cylinders.

In cleaning, the following order of operations should be followed:

(*a*) Remove oil from cylinders and equalizing pipes.

(*b*) Compress the counterrecoil springs by means of the assembling screws, so as to lower the mortar a few inches, remove the guides and caps, and disconnect and remove the crossheads.

(*c*) Unscrew the cylinder heads and carefully withdraw the piston rods out of the cylinders. Each part dismounted should be marked to insure its being reassembled in its correct place.

(*d*) Thoroughly clean the cylinders with kerosene oil forced from a hand pump into both ends of each cylinder. The plug in the emptying coupling should be removed and both branches of the equalizing pipe flushed out from their cylinder ends. Then wipe the interior of the cylinders dry with clean cotton waste and clean the piston rods and cylinder heads.

(*e*) Replace the emptying coupling plug, assemble the piston rods, cylinder heads, crossheads, caps, and guides, exercising great care that none of the parts are burred or otherwise damaged. The cylinder heads should be firmly screwed into place, care being taken that the packing ring is in good condition and properly placed. Screw the followers tight against the packing in the stuffing boxes.

(*f*) All parts dismounted should be carefully inspected to ascertain that they have been properly assembled.

Removing Packing from Stuffing Boxes (using extractor furnished by the Ordnance Department).—Close the extractor around the piston rod and insert the locking pin. Turn the extractor to the left, with pressure on the packing, until the points are firmly engaged in the packing. Draw the packing out, turning slowly to the left. In the case of a box with interior threads, if the packing is tight it should be unscrewed and not stripped out by the thread, because unless unscrewed, it would catch upon and be injured by the thread.

Extractor bars are provided to be used for starting the packing from its seat and by inserting the toes of the bars in the rack teeth and prying over the edge of the box, being careful not to injure the thread.

To Pack a Stuffing Box.—After drawing the oil from the cylinders, remove the follower and with it the rings and all the packing in the box. Examine the old packing and discard all unfit for use. If any of the old packing is used, it should be put in after the new.

In packing a stuffing box put on the piston rod one ring of 0.625-inch waterproof hydraulic packing, and force it well to the bottom of the stuffing box by a wooden stick and mallet. Treat each layer of packing in a similar manner, being careful to break joints, until the required amount, with the old on top, when any of the latter is used, is inserted.

Put the halves of the ring on the follower, enter them together in the box, and screw up the follower, being careful to note that the halves of the ring do not bind on the screw threads.

No more force should be used on the spanner wrench than that of two men, and generally that of one man is sufficient. The addition of a pipe to the end of the spanner wrench should not be permitted.

When the box is properly filled and the follower tightened there should be for the lower boxes not more than 1 inch of space between the flange of the follower and the piece into which the follower is screwed. For the upper boxes there should be not less than 24 inches between the followers and the piston-rod nuts.

The follower should be tightened from time to time. If the follower is screwed into the stuffing box too tightly, an unnecessary amount of friction will be produced on the piston rod. When the follower is screwed in until the flange strikes the box another ring of packing should be inserted.

It is to be expected that a slight amount of oil will soak through and drip from boxes when carriages are not in use. Also, when tightening the followers, a slight amount of oil will squeeze out of the saturated packing. This oil should be caught and not allowed to render the carriage unsightly.

FILLING RECOIL CYLINDERS.—To fill the cylinders with oil, remove the filling plugs from both cylinders. Pour clean neutral oil of specific gravity about 0.85 (such as the "hydroline" now issued to the service) into the hole of one cylinder until it flows out of the hole of the other. Allow any air that may be present to escape, then pour in more oil until the same is level with the filling holes. About 9.5 gallons are required.

SERVICE CONDITION, LUBRICATION, ETC.—When the carriage is likely to be required for service or is in daily or frequent use, all bearing parts must be kept clean and lubricated. Special attention should be given to the lubrication of trunnion bearings, crossheads and guides, rollers, pintle surfaces, elevating rack and gears and traversing mechanism, including the teeth of all gears.

The above parts should be lubricated at frequent intervals whether the carriage is maneuvered or not. When carriages are in use for daily drills a thorough lubrication twice each week should be sufficient for all but the most severely used parts.

Proper lubricating and cleaning of the traversing rollers and their paths are essential to the free working of the carriage.

When oiling the rollers or the pintle, the carriage must be traversed in order to distribute the oil throughout the whole circumference.

It will occasionally be necessary to examine the rollers, to see that the dust guards are in proper place and that the rollers themselves are clean. If they are found dirty they must be cleaned with kerosene oil, but care must be taken to fill the bearings with synovial oil after the kerosene has been rubbed dry. Experience has shown that recoil cylinders should not remain empty, as in that case the interior walls soon become rusty.

OIL HOLES.—Where provided, oil holes must be cleaned out frequently to keep them free from sand and grit and will habitually be kept closed by the screw plugs provided, except when in the act of oiling.

Before oiling at any hole, wipe off carefully all dirt or grit near the opening that might be carried down into the bearing by the oil.

COMPRESSION GREASE CUPS.—Where compression grease cups are provided similar precautions against dirt or grit must be observed. In filling these cups do not fill the cup completely but fill only to the bottom of the bevel at the top of the cup; if too full, the leather packing will become inverted and will not act effectively. In putting on the cap see that the leather-packed follower enters the cup without being caught, cut, or bent by the edge of the cup, or otherwise. Screw the cap down on the cup, using a wrench, if necessary to secure sufficient power, until the spring rod projects about 0.25 inch above the top of the cap. Later, when the spring has recovered and has moved the follower forward, forcing the grease through the tube into the bearings, which will be indicated by the spring rod being pulled into the cap until its nut touches or nearly touches the cap, it will again be necessary to screw up the cap on the cup until the spring is again compressed. When the cap is screwed nearly home and the spring rod does not project it is an indication that the cup should be refilled.

For further information regarding paints, oils, cleaning material, and methods of using same see Ordnance Department pamphlet, Form No. 1869.

List of articles packed in armament chest—Parts are for four mortars and four carriages.

FOR FOUR MORTARS.

No.	Drawing.	Piece mark.		
x4	76–7–1.....	.....	Box, firing mechanism.	
12	15–5–47.....	U47Z.....	Brush, cleaning (primer seat) in firing mechanism box.	
1	15–5–47.....	U47BC....	Cloth, emery No. 00 (1 quire).	
1	15–5–47.....	U47AB....	Drift, bronze (small).	
1	15–5–47.....	U47AC....	Drift, bronze (large).	
4	15–5–47.....	U47X.....	Drill, gunner's.	
1	15–5–47.....	U47AR....	File, flat, dead smooth, 8-inch.	
1	15–5–47.....	U47AS....	File, round, second-cut, 8-inch.	
1	15–5–47.....	U47AU....	File, half-round, smooth, 8-inch.	
1	15–5–47.....	U47BH....	File, three-cornered, 8-inch.	
3	15–5–47.....	U47AT....	File, round, smooth, 8-inch.	For use on bruised breech block; no other files to be used thereon.
3	15–5–47.....	U47AV....	File, three-cornered, No. 4, 6-inch.	
3	15–5–47.....	U47AU....	File, half-round, smooth, 8-inch.	
3	15–5–47.....	U47AW....	File, pillar, No. 6, 6-inch.	
1	15–5–47.....	U47AG....	Hammer, copper.	
1	15–5–48.....	U48F.....	Hammer, machinist's, ball peen, 2-pound, commercial.	

x Indicates articles carried loose in chest.

List of articles packed in armament chest—Parts are for four mortars and four carriages—Continued.

FOR FOUR MORTARS—Continued.

No.	Drawing.	Piece mark.	
x4	15-5-196....	U196A.....	Lanyards, gunner's.
1	15-5-47.....	U47AN.....	Mallet, hand.
x1	15-5-47.....	U47AP.....	Mallet, long-handled.
1	15-5-47.....	U47AQ.....	Pliers, cutting, 7-inch.
x4	15-5-233....	.....	Pouch, gunner's.
4	15-5-47.....	U47U.....	Do.
1	15-5-47.....	U47AF.....	Punch, pin.
4	15-5-47.....	U47AA.....	Reamer, cleaning (primer seat), in firing mechanism box.
2	15-5-47.....	U47AE.....	Scraper, metal.
x4	20-2-17.....	.....	Sleeve, gunner's.
x6	15-5-47.....	U47AX.....	Sponge, wagon.
2	15-5-45.....	U45N.....	Screw driver, bar, tray bk. ltch. bolt.
2	15-5-45.....	U45R.....	Screw driver, bar, tray bk. ltch. catch nut.
2	15-5-45.....	U45S.....	Screw driver, bar, lower pinion nut.
2	15-5-45.....	U45T.....	Screw driver, bar, crank lock bushing.
2	15-5-45.....	U45V.....	Screw driver, bar, oil hole screws.
2	15-5-45.....	U45W.....	Screw driver, bar, sp. bolt shoe, etc.
x1	15-5-47.....	U47AY.....	Twine, assorted, 4 balls.
x1	15-5-47.....	U47AZ.....	Waste, cotton, 10 pounds.
x1	15-5-47.....	U47BA.....	Wire, copper, No. 12, 2 pounds.
x1	15-5-47.....	U47BB.....	Wire, copper, No. 16, 2 pounds.
1	15-5-45.....	U45G.....	Wrench, monkey, 12-inch.
1	15-5-45.....	U45J1.....	Wrench, monkey, 18-inch, screw driver.
x4	15-5-44.....	U44II.....	Wrench, obturator nut, 3 loose in chest.
4	15-5-44.....	U44P.....	Wrench, obturator nut, clamp screw.
4	15-5-44.....	U44Y.....	Wrench, obturator tit.
4	15-5-44.....	U44M.....	Wrench, pressure, plug.
x1	.....	.....	Card, file, commercial.
1	15-5-46.....	U46F1.....	Funnel, filling.
4	15-5-47.....	U47S.....	Hooks, lifting.
2	15-5-46.....	U46J.....	Oiler, half-pint.
x1	15-5-46.....	U46L1.....	Oiler, locomotive, 1-quart.
*8	.....	.....	Pan, drip for stuffing boxes.
1	.....	.....	Quadrant, gunner's.
1	15-5-45.....	U45AA.....	Screw driver, bar.
1	15-5-45.....	U45M.....	Do.
1	15-5-45.....	U45N.....	Do.
5	15-5-47.....	U47BL.....	Screw, spring compressor.
5	15-5-47.....	U47BM.....	Nut, spring compressor.
x1	15-5-44.....	U44GA.....	Rod for spanner wrench.
1	15-5-43.....	U43C.....	Wrench, double, 0.375 and 0.5 inch.
1	15-5-43.....	U43AN.....	Wrench, double, 1 and 1.125 inch.
1	15-5-43.....	U43F.....	Wrench, double, 0.625 and 0.75 inch.
1	15-5-43.....	U43AK.....	Wrench, double, 1.25 and 1.375 inch.
1	15-5-43.....	U43J.....	Wrench, double, 1.5 and 1.75 inch.
*1	15-5-43.....	U43L.....	Wrench, double, 2 and 2.5 inch.
1	15-5-44.....	U44T.....	Wrench, spanner, 3-inch radius.
1	15-5-44.....	U44W.....	Wrench, spanner, 4.625-inch radius.
x1	15-5-44.....	U44HA.....	Wrench, spanner, for lower followers.
x3	15-5-43.....	U43Q.....	Wrench, single, for filling plugs.
1	15-5-45.....	U45AB.....	Wrench, for screw driver.
1	15-5-44.....	U44AB.....	Wrench, box.
x1	15-5-55.....	U55FA1.....	Wrench, gland.
*2	15-5-43.....	U43AL.....	Wrench, spring-rod.
*1	15-5-43.....	U43AM1.....	Wrench, piston-rod.
x5	15-5-47.....	U47BN.....	Washer, spring-compressor.
*4	15-5-39.....	U39G.....	Water buckets.

x Indicates articles carried loose in chest. * Indicates articles not in chest.

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered.

The parts are grouped and listed alphabetically under the following headings: Base ring, racer, azimuth circle, and side frames; floor plates, dust guards, and ladders; top carriage; recoil mechanism including counterrecoil springs, spring box, and brackets; elevating mechanism; traversing mechanism including distance ring, rollers, pedestal, and brackets; elevation quadrant; traversing brake; electrical equipment; lanyard attachment; grease cup; shot tongs; and ammunition trucks.

When referring to a part, always mention its piece mark where given on the list.

BASE RING, RACER, AZIMUTH CIRCLE, AND SIDE FRAMES.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
	1	12	13	4	Angle	In 4 sections.
	1	15	12K	4	Azimuth circle	In 8 sections.
	8	15	12K	4	Azimuth circle bracket	
	1	12	12	14	Azimuth pointer	
	1	15	12K	4	Base ring	
	12	15	12K	4	Bolts, tap	0.75 by 3 traversing rack.
	24	12	13	8	do	Do.
	16	12	12	17	do	1.25 by 3 azimuth circle brackets.
	16	12	12	17	do	0.75 by 2.25 azimuth circle brackets.
	16	12	13	9	do	0.75 by 2.5 azimuth circle brackets.
	8	12	12	6	do	2 by 4.25, special.
	8	12	13	4	do	2 by 4.75, special.
	28	12	12	6	do	1.5 by 4.5.
	8	12	12	17	Bolts with nuts	1.25 by 4.5 azimuth circle.
	8	12	12	17	do	1.25 by 4.75 azimuth circle.
	8	12	12	17	do	1 by 2.75 azimuth circle.
	8	12	13	9	do	1 by 2.5 azimuth circle.
	4	12	12	6	Bushings	2 right, 2 left, in halves.
	4	12	13	4	do	Do.
	4	12	12	6	Cap squares	2 right, 2 left.
	4	12	13	4	do	Do.
5A	1	12	12	5	Core-hole cover	
	1	12	13	9	do	Carriages manufactured prior to Sept. 30, 1909.
	1	12	13	9	do	Carriages manufactured after Sept. 30, 1909.
	4	12	12	6	Covers	
	4	12	12	6	Dowels	
	2	12	12	14	do	Azimuth pointer.
5C		12	12	5	Filler pieces	As required.
5J		12	12	5	do	Do.
	1	12	12	5	Gasket	
	1	15	12K	4	Graduation strip	
	1	12	12	17	Hinge	
	4	12	12	6	Keys	Side frame.
	1	12	12	17	Lid	
	1	15	12K	5	Oil pipe	For inside of distance ring.
5F	1	12	12	5	do	For outside of distance ring.
5G	1	12	12	5	do	For pintle.
5K	2	12	12	5	Oil-pipe brackets	
	1	15	12K	5	Oil-pipe bushing	
5D	2	12	12	5	Oil-pipe straps	
Q3C	7	12	12	17	Oil plugs	0.375.
Q3C	4	12	13	4	do	0.375.
	4	12	13	4	Oil tubes	Bent.

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

BASE RING, RACER, AZIMUTH CIRCLE, AND SIDE FRAMES—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
Q3C	8	12	13	4	Oil tubes	Straight.
5H	1	12	12	5	Racer	
	1	12	13	4	do	
	80	12	13	4	Screws	Special, 0.625 diameter.
	24	12	12	6	do	Special, 0.5 by 1.125.
	24	12	13	4	do	Do.
	72	12	12	17	do	Countersunk 0.25 by 0.75 azimuth circle.
5B	4	12	12	5	do	Countersunk 0.5 by 1.5.
	2	12	12	14	do	Round head 0.625 by 1 azimuth pointer.
	4	12	13	9	do	Countersunk 0.5 by 1.5 core-hole cover.
	3	12	12	17	do	Countersunk 0.5 by 1.
	12	12	13	4	do	Do.
5E	4	12	12	5	do	Round head, 0.375 by 0.75.
	16	12	12	6	do	Round head, 0.25 by 0.375.
	2	12	12	17	Set screws	1.5 by 3.625 fulcrum pin.
	2	12	12	6	Side frames	1 right, 1 left.
	1	15	12K	4	Traversing rack	MI carriages only.
	1	12	13	8	do	In six sections.

FLOOR PLATES, DUST GUARDS, AND LADDER.

	8	15	12K	4	Angle plates	Riveted to angle irons.
	8	15	12K	4	Angle irons	With plate.
	8	15	12K	4	do	
	15	15	12K	3	Bolts	0.75 by 4, with nuts.
	3	12	12	17	do	0.75 by 2, countersunk with nuts; pit ladder.
	1	12	12	17	do	0.75 by 1.75, countersunk with nuts; pit ladder.
	3	12	13	5	do	0.75 by 2.125, countersunk with nuts.
	1	12	13	5	do	0.75 by 1.875, countersunk with nuts.
	1	15	12K	3	Bolt	0.75 by 3, special.
	36	12	12	17	Bolts, tap	0.5 by 1, dust guard.
	1	15	12K	6	Dust guard	Complete in 4 sections.
	1	15	12K	3	Floor instruction plate	
	16	15	12K	4	Floor plates	
	1	12	12	7	Pit ladder	Complete.
	1	12	13	5	do	Do.
	1	12	12	7	Removable floor plate	
	1	12	13	5	do	
	1	15	12K	3	Reinforce plate	
	2	15	12K	3	Rivets	0.375, reinforce plate.
	4	12	12	7	do	0.5, pit ladder.
	16	15	12K	4	do	0.5, angle-iron plate.
	2	15	12K	3	Screws	Countersunk 0.25 by 0.68.
	11	12	12	17	do	Countersunk 0.5 by 1.25 floor plate.
	11	12	13	5	do	Countersunk 0.75 by 2.
	15	15	12K	3	Split pins	0.156 by 1.

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

TOP CARRIAGE.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
	2	15	12K	7	Bolts, tap	0.75 by 1.5.
	1	15	12K	7	Bushing, elevating shaft.	2.875 bore.
	1	15	12K	7	.....do	3.062 bore.
	1	15	12K	7	.....do	2.552 bore.
	1	15	12K	7	Bushing elevating hand-wheel shaft.	Right.
	1	15	12K	7	.....do	Left.
	2	15	12K	7	Cap squares	1 right, 1 left.
	1	15	12K	7	Elevation stop	
	2	12	12	6	Fulcrum pins	
	2	15	12K	7	.....do	For MII carriages only.
	2	15	12K	7	Fulcrum bushings	For MI carriages only.
	2	15	12K	7	.....do	For MII carriages only.
	2	15	12K	7	Fulcrum-pin washers	Do.
	2	15	12K	7	Fulcrum washers	Do.
	2	12	12	6	Keys	1.25 by 1.062 by 4.
	2	15	12K	7	.....do	1.25 by 1.25 by 6.75, for MII carriages only.
	1	15	OK	3	Name plate	No. 2.
Q3C	5	15	12K	7	Oil plugs	0.375.
Q3K	4	15	12K	7	.....do	0.625.
	8	15	12K	7	Pins	0.25 driven.
	24	15	12K	7	Screws	Countersunk 0.5 by 1.125, for MI carriages.
	32	15	12K	7	.....do	Countersunk 0.5 by 1.125, for MII carriages.
	2	15	12K	7	.....do	Countersunk 0.5 by 1.375, elevating stop.
	2	15	OK	3	.....do	Round head, 0.25 by 0.5, name plate.
	2	15	12K	7	Split pins	0.5 by 6.
	4	15	12K	7	Studs	2.5 by 9.75, with nuts.
	1	15	12K	7	Top carriage	
	2	15	12K	7	Trunnion-cap bushings	1 right, 1 left; in halves.

RECOIL MECHANISM.

	4	12	12	7	Bolts, tap	0.75 by 1.5, special.
13EA	2	12	12	13	.....do	0.5 diameter, special.
	2	12	12	17	.....do	2 by 11.5, special box brackets to racer.
	2	12	12	7	Bolts	0.75 by 2, with nuts.
	8	12	12	17	.....do	1.5 by 5, with nuts, hydraulic cylinder to guides.
	8	12	13	7	.....do	1.5 by 5.125, with nuts.
	8	12	12	17	.....do	1.25 by 6.25; with nuts, crosshead guides to caps.
	8	12	13	7	.....do	1.25 by 6.125, with nuts.
	1	15	12K	12	Box, spring	
13K	2	12	12	13	Bushings, crosshead	
	5	15	12K	12	Bushings, special, guide rod.	In washers.
	2	15	12K	12	Bushings, special, box bracket.	

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

RECOIL MECHANISM—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
13F.....	2	12	12	13	Caps.....	
	1	15	12K	12	Cap, spring.....	
13S.....	4	12	12	13	Collars, pipe-connection.	
13CA....	2	12	12	13	Collars, piston-rod.....	
[illegible]	25	15	12K	6	Counterrecoil springs....	Outer.
	25	15	12K	6	.....do.....	Inner.
13G1.....	1	12	12	13	Crosshead.....	Right.
13H1.....	1	12	12	13	.....do.....	Left.
13Y2.....	1	12	12	13	Cylinder, recoil.....	Right.
13Z2.....	1	12	12	13	.....do.....	Left.
	1	12	13	7	.....do.....	Right.
	1	12	13	7	.....do.....	Left.
13X1.....	2	12	12	13	Cylinder heads.....	
	2	12	13	7	.....do.....	
13V.....	10	12	12	13	Cylinder plugs.....	Small.
13W.....	2	12	12	13	.....do.....	Large.
	1	12	12	13	Drain plug.....	
	2	15	3	2	Drip pans.....	
	1	12	12	13	Emptying coupling.....	
	1	12	12	7	Equalizing pipe.....	In two parts.
	2	12	12	7	Equalizing-pipe brackets.	1 right, 1 left.
	2	12	12	7	Equalizing-pipe straps..	
13N1.....	4	12	12	13	Followers, cylinder head	
13T1.....	4	12	12	13	Followers, pipe-connection.	
	4	12	12	13	Gaskets, for plugs 13P..	
	2	12	12	13	Gaskets, for filling plugs.	
	2	12	12	13	Gaskets, for plugs, large.	
	10	12	12	13	Gaskets, for plugs, small.	
	2	12	12	13	Gaskets, for cylinder heads.	
	4	12	12	13	Gaskets, for equalizing pipes.	
	1	12	12	13	Gaskets, for emptying plug.	
13A.....	1	12	12	13	Guide, front.....	Right.
13B.....	1	12	12	13	.....do.....	Left.
13C.....	1	12	12	13	Guide, rear.....	Right.
13D.....	1	12	12	13	.....do.....	Left.
13Q1.....	1	12	12	13	Liner.....	Right.
13R1.....	1	12	12	13	.....do.....	Left.
13J1.....	2	12	12	13	Liners.....	
	5	15	12K	12	.....do.....	
13L.....	2	12	12	13	Neck rings.....	
13BA1...	2	12	12	13	Nuts, piston-rod.....	
	5	15	12K	12	Nuts.....	2.75 thick.
	5	15	12K	12	.....do.....	1.5 thick.
Q3C.....	4	12	12	13	Oil plugs.....	0.375.
Q3K.....	2	15	12K	12	.....do.....	0.625.
	4	12	12	13	Packings.....	6 rings each.
13M.....	4	12	12	13	Packing rings.....	In halves.
	2	12	12	13	Pins.....	For piston.
	4	12	12	13	.....do.....	Part of buffer.
13DA ...	2	12	12	13	Pistons.....	
	2	12	13	7	Piston bushings.....	
13AA....	2	12	12	13	Piston rods.....	
	2	12	13	7	Pistons and rods.....	
13GA....	2	12	12	13	Plates.....	

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

RECOIL MECHANISM—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
13HA	12	12	12	13	Plates	
13JA	14	12	12	13	do	
13U2	2	12	12	13	Plugs	
13P	4	12	12	13	do	
13E	3	12	12	13	do	1 extra.
13FA	32	12	12	13	Screws	0.375 by 1.25.
	30	15	12K	12	do	0.25 by 0.75.
	15	15	12K	12	Separators	
	2	15	12K	12	Spring box brackets	1 right, 1 left.
	5	15	12K	12	Spring guide rods	
	5	15	12K	12	Spring guide-rod plugs	
	14	12	12	17	Studs	2 by 8.625 with nuts spring-box brackets toe racer.
	5	15	12K	12	Taper pins	
	2	12	12	13	Washers for plugs, large.	
	10	12	12	13	Washers for plugs, small.	
	5	15	12K	12	Washers	3, thick.
	5	15	12K	12	do	Bronze bushed.

ELEVATING MECHANISM.

	2	15	12K	10	Bolts, tap	0.75 by 1.5.
	4	15	12K	8	do	1.375 by 2.625.
	8	15	12K	9	do	0.75 by 2.25.
11E	5	15	12K	11	do	0.875 by 2.25.
11J	2	15	12K	11	do	0.625 by 1.125.
N20G	2	15	12K	20	do	0.375 by 1.75.
	2	15	12K	8	Bolts, fil. head	1.375 by 2.625.
	1	15	12K	9	Bolt	0.625 by 5, with nut.
	4	15	12K	9	Bolts	1 by 5.25, with nuts.
	4	15	12K	9	do	1 by 4.5, with nuts.
N18B	1	15	12K	18	Bolt	Countersunk, 0.5 by 2.
11D	1	15	12K	11	Bracket	For elevating lock.
N18D	1	15	12K	18	do	
N18E	1	15	12K	18	Bracket base	
	1	15	12K	9	Bushing, long	Intermediate gear.
	1	15	12K	9	Bushing, short	Do.
	1	15	12K	9	Bushing	Shaft bracket, right.
	1	15	12K	9	do	Shaft bracket, left.
	1	15	12K	9	Clutch spring	
	1	15	12K	9	Clutch-spring adjusting nut.	
	1	15	12K	9	Clutch-spring plate	
11P	1	15	12K	11	Collar	
	1	15	12K	10	Collar nut	For MI carriages.
	2	15	12K	10	do	For MII carriages.
	1	15	12K	10	Direction plate (clamp)	
	2	15	12K	10	Direction plate (elevate).	1 right, 1 left.
	2	15	12K	10	Direction plate (depress).	Do.
	2	15	12K	20	Dowels	For right scale.
	2	15	12K	20	do	For left scale.
	1	15	12K	9	Elevating gear	
	1	15	12K	9	Elevating-gear bushing	

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

ELEVATING MECHANISM—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
11P.....	1	15	12K	9	Elevating handwheel shaft bracket.	Right, MI carriages.
	1	15	12K	9	.....do.....	Left, MI carriages.
	1	15	12K	9	Elevating handwheel shaft pinion.	
	1	15	12K	10	Elevating handwheel...	Right, complete with handle.
	1	15	12K	10	.....do.....	Left, complete with handle.
	1	15	12K	10	Elevating handwheel shaft.	For MI carriages.
	1	15	12K	10	.....do.....	For MII carriages.
	1	15	12K	9	Elevating idler gear....	
	1	15	12K	9	Elevating intermediate gear.	Pinion and gear together.
	1	15	12K	9	Elevating intermediate-pin bracket.	
	1	15	12K	9	.....do.....	For MI carriages only.
	1	15	12K	10	Elevating intermediate pin.	
	1	15	12K	9	Elevating pinion.	
	1	15	12K	8	Elevating rack.....	
	1	15	12K	10	Elevating shaft.....	
N20E....	1	15	12K	20	Elevating pointer.....	Right.
N20A....	1	15	12K	20	.....do.....	Left.
11B.....	1	15	12K	11	Filler piece.....	
N2OH ..	1	15	12K	20	.....do.....	
N2OJ ...	2	15	12K	20	Filler pieces.....	
	5	15	12K	9	Friction disks.....	Inner.
	5	15	12K	9	.....do.....	Outer.
	1	15	12K	10	Friction filler piece....	
	1	15	12K	10	Hub-elevating handwheel.	For MI carriages only.
	1	15	12K	10	Hand nut.....	
	1	15	12K	10	Idler pin.....	
	3	15	12K	9	Keys.....	Riveted in elevating gear.
	2	15	12K	9	.....do.....	Pinned in intermediate gear.
	4	15	12K	10	.....do.....	5.25 staked in elevating shaft.
	1	15	12K	10	Key.....	0.375 by 0.437 by 3.375 MI carriages.
	1	15	12K	10	.....do.....	0.375 by 0.437 by 3.625 MI carriages.
	1	15	12K	10	.....do.....	0.375 by 0.437 by 3.5 MII carriages.
	1	15	12K	10	.....do.....	0.375 by 0.437 by 4.5 MI carriages.
	1	15	12K	10	.....do.....	0.375 by 0.437 by 3.375 MII carriages.
N20M1..	1	15	12K	20	Left-hand scale.....	
11N.....	1	15	12K	11	Lever.....	
11M.....	1	15	12K	11	Lever pin.....	
11R.....	1	15	12K	11	Lever rest.....	
11L.....	1	15	12K	11	Link.....	
11C.....	1	15	12K	11	Link bolt.....	

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

ELEVATING MECHANISM—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
11F.....	1	15	12K	11	Lock bar.....	
11G.....	1	15	12K	11	Lock stud.....	
	2	15	12K	11	Crown nuts.....	0.625.
Q3C.....	2	15	12K	9	Oil plugs.....	0.375.
Q3C.....	2	15	12K	10	.....do.....	0.375.
Q3C.....	2	15	12K	11	.....do.....	0.375.
	2	15	12K	9	Pins.....	0.312 by 0.812.
	4	15	12K	9	.....do.....	0.25 by 0.75.
	4	15	12K	9	.....do.....	0.25 by 0.625.
	3	15	12K	9	.....do.....	0.25 by 0.875.
	4	15	12K	9	.....do.....	0.25 by 1.25.
11K.....	1	15	12K	11	Pivot stud.....	
N20B1...	1	15	12K	20	Right-hand scale.....	
	3	15	12K	9	Rivets.....	0.187 by 1.25, for keys.
N18C....	2	15	12K	18	Screws.....	Countersunk, 0.5 by 1.437.
N20L....	1	15	12K	20	Screw.....	Countersunk, 0.5 by 2.
N18A....	2	15	12K	18	Screws.....	Fil. head, 0.5 by 1.25.
	2	15	12K	9	.....do.....	Headless, 0.25 by 0.625.
	2	15	12K	10	.....do.....	Round head, 0.125 by 0.3.
	12	15	12K	10	.....do.....	Round head, 0.25 by 0.5.
N20D....	4	15	12K	20	.....do.....	Round head, 0.5 by 1.25.
N20F....	2	15	12K	20	.....do.....	Special, 0.375 diameter.
N18F....	2	15	12K	18	.....do.....	Spline, 0.5 by 1.3.
	4	15	12K	9	Shaft bracket washers...	MI carriages.
	1	15	12K	11	Split pin.....	0.093 by 0.5.
	1	15	12K	11	.....do.....	0.156 diameter.
	1	15	12K	11	.....do.....	0.156 by 1.25.
	2	15	12K	11	Split pins.....	0.156 by 1.
	1	15	12K	9	Split pin.....	0.125 by 0.75.
	1	15	12K	9	.....do.....	0.093 by 0.5.
	1	15	12K	10	.....do.....	0.375 by 3, MI carriages.
	2	15	12K	10	Split pins.....	0.093 by 0.5 MI carriages.
	3	15	12K	10	.....do.....	0.093 by 0.5 MII carriages.
	1	15	12K	11	Split pin.....	0.093 by 0.5.
11A.....	1	15	12K	11	Spring.....	
11H.....	1	15	12K	11	Strap.....	
	1	15	12K	9	Taper pin.....	0.398 by 4.5.
	1	15	12K	9	.....do.....	0.279 by 3.125.
	1	15	12K	10	.....do.....	0.279 by 3.75.
	1	15	12K	10	.....do.....	0.279 by 3.437, MI carriages.
	2	15	12K	10	.....do.....	0.279 by 3.437, MII carriages.
	1	15	12K	11	.....do.....	0.279 by 3.
	1	15	12K	10	Thrust collar.....	MI carriages only.
	1	15	12K	10	Washer.....	Steel, for MI carriages.
	1	15	12K	10	.....do.....	Bronze, for MII carriages.
N20C....	2	15	12K	20	Washers.....	
N20K....	2	15	12K	20	.....do.....	
11Q.....	1	15	12K	11	Washer.....	

TRAVERSING MECHANISM.

	8	12	12	17	Bolts, tap.....	1 by 3, pedestal to racer.
	8	12	12	17	.....do.....	0.375 by 1.25, cover to pedestal.
	36	15	12K	5	Bolts.....	1 by 3.6, with nuts.

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

TRAVERSING MECHANISM—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
	1	12	12	14	Bracket, pedestal shaft..	
	1	12	12	14	Bushing.....	For vertical shaft.
	1	12	12	14	.....do.....	In vertical shaft bracket.
	2	12	12	14	Bushings.....	For handwheel shaft.
	48	15	12K	5	.....do.....	
	1	12	12	14	Collar.....	
	1	12	13	8	.....do.....	
	1	12	12	14	Cover.....	
	1	15	12K	5	Distance ring.....	6 sections.
	2	12	12	14	Drain plugs.....	
	1	12	12	14	Handle, complete.....	Traversing handwheel.
	1	12	12	14	Key.....	0.438 by 0.375.
	2	12	12	14	Keys.....	4.25 long.
	2	12	13	8	.....do.....	0.687 square by 7.125 long.
	2	12	12	14	.....do.....	5.75 long.
	6	15	12K	5	.....do.....	0.75 by 1 by 14.35.
	1	12	12	14	Name plate.....	
	2	12	12	14	Nuts.....	Vertical traversing shaft.
	1	12	12	14	Oil pipe.....	
	1	12	13	8	.....do.....	
	3	12	12	14	Oil plugs.....	0.625.
	2	12	12	14	.....do.....	0.375.
	1	12	12	14	Pedestal brackets.....	
	1	12	12	14	Pinion.....	
	3	12	12	14	Screws.....	Name plate.
	144	15	12K	5	.....do.....	Countersunk, 0.25 by 0.75.
	1	12	12	14	Split pin.....	0.125 by 2.75.
	1	12	12	14	.....do.....	0.203 by 2.75.
	1	12	12	14	.....do.....	0.093 by 0.5.
	1	12	13	8	.....do.....	0.156 by 1.
	1	12	12	14	Taper pin.....	0.398 by 4.375.
	1	12	12	14	.....do.....	0.279 by 3.75.
	1	12	13	8	.....do.....	0.581 by 7.
	1	12	12	14	Traversing handwheel..	MI carriages.
	1	12	13	8	.....do.....	
	1	12	12	14	Traversing handwheel shaft.	MII carriages.
	1	12	13	8	Traversing worm shaft..	
	24	15	12K	5	Traversing rollers.....	
	1	12	12	8	Traversing pinion.....	
	1	12	12	14	Traversing worm.....	
	4	12	12	14	Vertical shaft bracket studs.	Special.
	1	12	12	14	Vertical traversing shaft.	MI carriages.
	1	12	13	8	.....do.....	MII carriages.
	1	12	12	14	Worm wheel.....	
	2	12	12	14	Washers.....	4-diameter.

ELEVATION QUADRANT.

[Details marked * apply to quadrants Nos. 1 to 217, inclusive, only.]

R36B...	1	15	12	36	Arm.....	
R36N....	1	15	12	36	Arm sector.....	
R38H...	1	15	12	38	Arm spring *.....	
R24D....	1	15	12	24	Arm-stop screw.....	
R38A...	1	15	12	38	Bracket.....	
R36A...	1	15	12	36	Bubble cover.....	

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

ELEVATION QUADRANT—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
R36D	1	15	12	36	Bubble housing	
R36G	1	15	12	36	Bubble housing plug	
R36E	1	15	12	36	Bubble housing retaining screw.	
R36W	1	15	12	36	Fulcrum pin	
R36Q	1	15	12	36	Latch spring	
R36X	1	15	12	36	Latch	
R36Z	1	15	12	36	Latch button	
R36F	1	15	12	36	Level vial	
R36S	1	15	12	36	Locking screw	Upper.
R36T	1	15	12	36	....do	Lower.
R36U	1	15	12	36	Micrometer	
R38G	1	15	12	38	Micrometer *	
R38F	2	15	12	38	Micrometer adjusting screws.*	
R38E	1	15	12	38	Micrometer head *	
R36C	1	15	12	36	Micrometer retaining screw.	
R36H	1	15	12	36	Index	
R36K	1	15	12	36	Index retaining screw	
	1	15	12	36	Pin	0.04 by 0.12, driven.
	1	15	12	36	....do	0.05 by 0.3, driven.
R38C	2	15	12	38	Screws	
R38K	1	15	12	38	Screw spring *	
R36P	1	15	12	36	Sector spring	
R36L	1	15	12	36	Washer	
R38L	2	15	12	38	Washers *	
R36R	1	15	12	36	Worm	
R36M	1	15	12	36	Worm nut	
R38M	1	15	12	38	Worm sector	

TRAVERSING BRAKE.

	1	15	12K	13	Adjusting plug	
	1	15	12K	13	Adjusting screw	
	2	15	12K	14	Bolts, tap	1 by 1.75.
	4	15	12K	13	....do	0.625 by 2.25, MI carriages.
	4	15	12K	13	....do	0.625 by 1.75, MII carriages.
	4	15	12K	14	....do	1.25 by 3.75, MI carriages.
	4	15	12K	14	....do	1.25 by 3, MII carriages.
	1	15	12K	13	Brake link	
	1	15	12K	13	Brake link spring	
	1	15	12K	13	Brake link upper pin	
	1	15	12K	13	Brake link lower pin	
	1	15	12K	14	Brake shoe	
	2	15	12K	14	Brake lever pins	
	1	15	12K	14	Bracket	
	1	15	12K	13	Catch	
	1	15	12K	13	Catch pin	
	1	15	12K	13	Catch spring	
	1	15	12K	13	Catch spring plunger	
	1	15	12K	13	Foot lever	
	1	15	12K	13	Foot-lever pin	
	1	15	12K	13	Foot-lever bracket	

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

ELECTRICAL EQUIPMENT.

[On drawings 12-12-21 and 12-13-11 are given the locations of the receptacles, plugs, etc., on the carriages and the lengths of slicked reinforced cord and armored cable required.]

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
E108C...	1	14	4	108	Adaptor, lamp.....	
E106U ..	4	14	4	106	Bars, terminal connecting.	
E25M1...	4	14	4	25	Bases.....	
E22L.....	1	14	4	22	Base.....	
E21F.....	1	14	4	21	.....do.....	
E22V.....	1	14	4	22	.....do.....	
E24F1....	1	14	4	24	.....do.....	
E106B...	1	14	4	106	Base, resistance.....	
T95C1....	1	14	6	95	Base bracket.....	
E110D ..	2	14	4	110	Bayonet lamp sockets...	Commercial.
P57AE...	1	14	5	57	Boat snap hook.....	
P57AF ..	1	14	5	57	Boat snap hook screw...	
T96PA ..	5	14	6	96	Bodies.....	
	4				Bolts, foundation.....	With nuts and washers furnished by Engineer Department.
T95J1...	2	14	6	95	Bolts.....	For MI carriages.
E22R ...	2	14	4	22	Bolts, tap.....	0.75 by 1.625.
T95D....	3	14	6	95	Bolts.....	0.75 by 8, 6-standard nuts.
E20C....	2	14	4	20	Bolts, tap.....	0.25 by 0.875.
E20F.....	2	14	4	20	.....do.....	0.5 by 1.25.
T91R....	21	14	6	91	.....do.....	For MI carriages.
T91R....	19	14	6	91	.....do.....	For MII Carriages.
21B.....	4	12	12	21	.....do.....	For MI carriages.
E106N ..	1	14	4	106	Box, lamp resistance....	
E24Y2 ..	1	14	4	24	Box, 5-ampere watertight switch.	
E36B....	1	14	4	36	Box cover.....	
E22Q....	1	14	4	22	Bracket.....	
V23AM..	1	14	0	23	Bushing.....	0.75 by 0.5.
P65K ...	1	14	5	65	.....do.....	
	1	12	12	21	Cable.....	From inlet to receptacle on beam.
	1	12	13	11		
	1	12	12	21	....do.....	From receptacle on beam to primer.
	1	12	13	11		
	1	12	12	21	....do.....	From inlet to receptacle on racer.
	1	12	13	11		
	1	12	12	21	....do.....	From resistance box to quadrant lamp bracket.
	1	12	13	11		
	1	12	12	21	....do.....	From resistance box to azimuth pointer lamp.
	1	12	13	11		
	1	12	12	21	....do.....	From junction box to portable lamp plug box.
	1	12	13	11		
	1	12	12	21	....do.....	From junction box to switch.
	1	12	13	11		
	1	12	12	21	....do.....	From switch to resistance box.
	1	12	13	11		
E12X....	3	14	4	12	Cable thimbles.....	
E24P1....	1	14	4	24	Cam.....	
E24R ...	1	14	4	24	Cam shaft.....	
E21E....	1	14	4	21	Chain.....	
E23L.....	3	14	4	23	Chains.....	
	2	14	6	95	.....do.....	For MII carriages.

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

ELECTRICAL EQUIPMENT—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
E23L....	1	14	5	65	Chain.....	
E23K....	3	14	4	23	Chain pivots.....	
E22Y ...	2	14	4	22	Connector links.....	
E21K....	2	14	4	21	Connector strips.....	
E25K1...	8	14	4	25	.....do.....	
E21M....	2	14	4	21	.....do.....	
E25S3....	1	14	4	25	Contact housing.....	
E25T3....	3	14	4	25	Contact housings.....	
E25P1....	8	14	4	25	Contact strips.....	
E24J1....	2	14	4	24	.....do.....	
P65M ...	2	14	5	65	Contact terminals.....	
E25AC1 .	2	14	4	25	.....do.....	
E22AB..	2	14	4	22	Couplings.....	
E25G1...	2	14	4	25	Covers.....	
P65H ...	1	14	5	65	Cover.....	
E22S.....	1	14	4	22	.....do.....	
E21D ...	1	14	4	21	.....do.....	
P65A3....	1	14	5	65	.....do.....	
E22C....	1	14	4	22	.....do.....	
E106R ..	1	14	4	106	.....do.....	
	2	15	12K	22	Expansion hooks.....	0.375 by 6, commercial.
	2	15	12K	22	.....do.....	0.375 by 3.5, commercial.
T95E.....	2	14	6	95	Eyebolts.....	
	1	14	4	22	Flexible portable conductor, plain.	8-inches long, for azimuth pointer lamp.
	1	14	4	108	.....do.....	8-inches long, for quadrant lamp.
E22E1...	1	14	4	22	Gasket.....	
E23AD...	3	14	4	23	Gaskets.....	
E25D ...	4	14	4	25	.....do.....	
E23M....	3	14	4	23	.....do.....	
E22U ...	1	14	4	22	Gasket.....	
E106W...	1	14	4	106	Gasket, cover.....	
E21C1...	1	14	4	21	Gasket.....	
E36D.....	1	14	4	36	Gasket, cover.....	
E107F....	1	14	4	107	Gasket, lamp-socket holder.	
E23AB1.	5	14	4	23	Glands.....	
E22J.....	1	14	4	22	Gland.....	
E21Y1..	4	14	4	21	Glands.....	
E25W....	2	14	4	25	.....do.....	
E24U.....	1	14	4	24	Gland.....	
E25V....	2	14	4	25	Gland rings.....	
E21X....	4	14	4	21	.....do.....	
T96QA...	5	14	6	96	.....do.....	
T96RA..	5	14	6	96	Gland nuts.....	
E24S.....	1	14	4	24	Handle.....	
E25U.....	8	14	4	25	Headless screws.....	
E24BA1.	1	14	4	24	Indicator plate.....	Soldered in place.
E25N1..	4	14	4	25	Insulations.....	2 by 2 by 0.062.
E21H....	1	14	4	21	Insulation.....	3.5 diameter by 0.031 thick.
E22BA..	1	14	4	22	.....do.....	1.375 by 1.375 by 0.062 thick.
E22CA..	1	14	4	22	.....do.....	1.625 by 2.375 by 0.062 thick.
E24G....	1	14	4	24	.....do.....	1.812 by 3.125 by 0.062 thick.

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

ELECTRICAL EQUIPMENT—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
E106M...	1	14	4	106	Insulation	5.625 by 10 by 0.062 thick.
E21A2...	1	14	4	21	Junction box	
E110C...	2	14	4	110	Lamp 8 candlepower, 12–16 volts.	Commercial.
21A.....	2	12	12	21	Lamp resistance box brackets.	For MI carriages only.
E22A2...	1	14	4	22	Lamp junction box	Azimuth lamp.
E107L....	1	14	4	107	Lamp socket holder	
E108E...	1	14	4	108	.....do	
E107F....	2	14	4	107	Lamp socket holder gaskets.	
E20E....	1	14	4	20	Lamp hook	
P65C1....	1	14	5	65	Lid	
T95AB...	1	14	6	95	Liner, taper	For MI carriages only.
77A.....	1	14	5	77	Magneto bracket	Attached to wall of emplacement.
T95X1..	1	14	6	95	Nipple	
E25AM..	16	14	4	25	Nuts, hexagonal	0.190 by 0.2 thick, 0.375 flats.
E22G....	8	14	4	22	.....do	0.190 by 0.125 high.
	2	14	5	65	.....do	Do.
E21S.....	16	14	4	21	.....do	Do.
	4	14	4	106	Nuts	0.375.
E106Q...	4	14	4	106	Nuts, round	
E106K...	12	14	4	106	Nuts, clip and terminal	0.242 by 0.2 high.
T95K1..	2	14	6	95	Nuts	For MI carriages only.
	2	14	4	25	Packings	Tube E25AE.
	1	14	4	36	Packing	
	4	14	4	21	Packings	
	6	14	4	25	.....do	
E22K....	1	14	4	22	Packing	
	1	14	4	24	.....do	
	5	14	6	96	Packings	
	2	14	4	108	Pins	0.078 by 0.328 driven.
P65L.....	1	14	5	65	Pin	
	2	14	4	110	Pins	Bayonet.
	1	14	4	24	Pin, handle	0.093 by 0.5.
V23A....	1	14	0	23	Pipe plug	
V23B....	1	14	0	23	.....do	
E106T....	4	14	4	106	Plates, washer	
E20B....	1	14	4	20	Plug box	Furnished by Engineer Department.
E23AC1.	3	14	4	23	Plug caps	
E20A....	1	14	4	20	Portable lamp and cable.	Furnished by Engineer Department.
	2	15	12K	22	Pulley blocks, single	Commercial 0.375 by 1.375 sheave.
E25A1...	2	14	4	25	Receptacle boxes	
E25B1...	1	14	4	25	Receptacle box	
E25AG..	1	14	4	25	.....do	
T95G.....	1	14	6	95	Receptacle bracket	MI carriages only.
E23J.....	3	14	4	23	Receptacle caps	
E12P2....	2	14	4	12	Reflectors	
P65F....	2	14	5	65	Rings	
	4	14	6	95	.....do	For MII carriages only.
E22B....	2	14	4	22	Screws	0.375 by 1, standard.

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

ELECTRICAL EQUIPMENT—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
T95H1	2	14	6	95	Screws	0.5 by 1.75 for MI carriages only.
E25C	4	14	4	25	do	0.375 by 0.875, standard,
E25F	20	14	4	25	do	0.164 by 0.45 A.S.M.E., standard.
E22T	6	14	4	22	do	0.190 by 0.5 A.S.M.E., standard.
E22M	2	14	4	22	do	0.190 by 0.562 A.S.M.E., standard.
E22W	4	14	4	22	do	0.190 by 0.625 A.S.M.E., standard.
E23C	4	14	4	23	do	0.164 by 0.437 A.S.M.E., standard.
E21B	2	14	4	21	do	0.375 by 1, standard.
E22D	6	14	4	22	do	0.164 by 0.437 A.S.M.E., standard.
E21G	2	14	4	21	do	0.190 by 0.45 A.S.M.E. standard.
E24B1	2	14	4	24	do	0.375 by 1, standard.
E36C	6	14	4	36	do	0.164 by 0.42 A.S.M.E., standard.
T91XA	1	14	6	91	Screw	Fil. head, 0.5 by 1.
	2	14	6	95	Screws	Round head, 0.164 by 0.25 for MII carriages only.
E21AA	2	14	4	21	do	0.190 by 0.2 A.S.M.E., standard.
E21P	6	14	4	21	Screws, terminal	0.190 by 0.75 A.S.M.E., standard.
E22Z	4	14	4	22	do	0.190 by 0.687 A.S.M.E., standard.
E21Q	2	14	4	21	do	0.190 by 0.875 A.S.M.E., standard.
E22F	2	14	4	22	do	Do.
E24M2	4	14	4	24	do	0.164 by 0.25 A.S.M.E., standard.
E106H	2	14	4	106	Screws, terminal, long	0.242 by 1.375 A.S.M.E., standard.
E25AL	16	14	4	25	Screws, terminal	0.190 by 0.85 A.S.M.E., standard.
E24Z2	2	14	4	24	Screws, base	0.164 by 0.5 A.S.M.E., standard.
E24L2	8	14	4	24	Screws, contact and terminal strip.	0.138 by 0.375 A.S.M.E., standard, special.
E24T	1	14	4	24	Screws, cam-securing	
E106S	12	14	4	106	Screws, cover	0.312 by 0.625.
E106C	6	14	4	106	Screws, base	0.312 by 0.75.
E106G	8	14	4	106	Screws, clip and terminal, short.	0.242 by 1.125 A.S.M.E., standard.
E25Q	8	14	4	25	Screws, contact	0.138 by 0.125 A.S.M.E., standard.
P65D2	1	14	5	65	Spring	0.040 wire.
T95A	1	14	6	95	do	No. 13 B. & S. gauge.
	2	14	6	95	Split pins	For MII carriages only, 0.156 by 1.
	1	14	5	65	Split pin	0.125 by 1.5.
T91Z	1	14	6	91	Strap	For MII carriages only.
T91F	18	14	6	91	Straps	Do.

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

ELECTRICAL EQUIPMENT—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name of part.	Remarks.
T91F	21	14	6	91	Straps	For MI carriages only.
T91WA	1	14	6	91	Strap	
E106F	1	14	4	106	Strip, connecting, short	
E106E	1	14	4	106	Strip, connecting, long	
T95W	2	14	6	95	Studs	For MII carriages only.
E106P	4	14	4	106	do	With nuts.
E25X	2	14	4	25	Stuffing tubes	
P45AN2	1	14	5	45	Terminal	
T97U	6	14	6	97	Terminals	
E25L2	8	14	4	25	Terminal clips	
E24H1	2	14	4	24	Terminal springs	
E24K1	2	14	4	24	Terminal strips	
	2	14	4	36	Terminal stuffing tubes	To be in accordance with requirements of each carriage.
E21W	4	14	4	21	Terminal tubes	
T95Z	1	14	6	95	Thimble, stirrup	
E21R	8	14	4	21	Washers	0.375 diameter by 0.031 thick by 0.193 hole.
E22H	2	14	4	22	do	0.375 diameter by 0.031 thick by 0.2 hole.
E106D	6	14	4	106	Washers, base	
E106L	14	14	4	106	Washers, clip and terminal	
E24Q	2	14	4	24	Washers, cam	
T95B	2	14	6	95	Wire hooks	
E40H	2	14	4	40	Wound tube resistance units, 110 volts.	Commercial.
E40K	2	14	4	40	Wound tube resistance units, 220 volts.	Do.

LANYARD ATTACHMENT.

N17G	2	15	12K	17	Bolts, with nuts	
N17L	1	15	12K	17	Bridle ring	
N17A1	1	15	12K	17	Button	
N17B1	1	15	12K	17	Hook	
N17D	1	15	12K	17	Lanyard (complete)	
N17H1	1	15	12K	17	Pulley	
N17K1	1	15	12K	17	Pulley bracket	
N17F	4	15	12K	17	Screws, countersunk	0.25 by 0.375.
	1	15	12K	17	Split pin	
N17E	1	15	12K	17	Washer	For pulley.
N17J	1	15	12K	17	do	For button (N17A).

GREASE CUP.

A2A1	1	15	OK	2	Body	
A2B	1	15	OK	2	Cap	
A2D1	1	15	OK	2	Cup leather	
	2	15	OK	2	Gaskets	
	1	15	OK	2	Pin	0.125 by 0.5 driven.
A2E3	1	15	OK	2	Plunger	
A2J	1	15	OK	2	Plunger nut	
A2H	1	15	OK	2	Screw	

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered—Con.

GREASE CUP—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name and part.	Remarks.
A2G.....	1	15	OK	2	Screw.....	Round head 0.190 by 0.375.
	1	15	OK	2	Split pin.....	
A2F.....	1	15	OK	2	Spring.....	
A2C1.....	1	15	OK	2	Washer.....	
A2K1.....	1	15	OK	2	.....do.....	0.190 by 0.5 by 0.05.

SHOT TONGS (GILMARTIN).

NC16B...	2	15	9	16	Cams.....	
NC16D...	2	15	9	16	Cam bolts.....	
NC16N..	1	15	9	16	Clevis.....	
NC16K...	2	15	9	16	Clip blocks.....	
NC16L...	2	15	9	16	Clip washers.....	
NC16M..	2	15	9	16	Clip nuts.....	
NC16A...	1	15	9	16	Frame.....	
NC16F...	2	15	9	16	Links.....	
NC16E...	4	15	9	16	Nuts.....	0.625.
NC16P...	1	15	9	16	Nut.....	0.375.
	2	15	9	16	Pins.....	Driven.
NC16H...	1	15	9	16	Ring.....	
NC16J...	1	15	9	16	Rope.....	
NC16G...	4	15	9	16	Rope guides.....	
NC16C...	4	15	9	16	Stop pins.....	

SHOT TRUCK TYPE 12MB.

[2 per carriage.]

QD1F...	1	15	9Q	1	Adjustable stop.....	
QD2F...	1	15	9Q	2	Axle.....	
	44	15	9Q	2	Balls.....	
QD2B....	1	15	9Q	2	Body.....	
	4	15	9Q	1	Bolts.....	0.5 by 1.35, with nuts.
	2	15	9Q	2	.....do.....	0.625 by 2.5, with nuts.
	2	15	9Q	2	.....do.....	0.625 by 2.75, with nuts.
QD1M...	1	15	9Q	1	Brake lever.....	
QD1N...	1	15	9Q	1	Brake-lever guide.....	
QD1P...	1	15	9Q	1	Brake-lever spring.....	
QD1L...	1	15	9Q	1	Brake shaft.....	
QD1H...	2	15	9Q	1	Brake-shaft bracket.....	
QD1J....	1	15	9Q	1	Brake shoe.....	Right.
QD1K...	1	15	9Q	1	.....do.....	Left.
QD1A....	1	15	9Q	1	Buffer pin.....	
QD1D...	1	15	9Q	1	Buffer spring.....	
QD2V....	2	15	9Q	2	Bushings.....	
QD2X...	2	15	9Q	2	.....do.....	
QD1C....	1	15	9Q	1	Cap.....	
QD1B....	1	15	9Q	1	Cap pin.....	
QD2H...	2	15	9Q	2	Casters.....	
QD2A....	2	15	9Q	2	Caster ball bearings.....	Hardened.
QD2W...	1	15	9Q	2	Caster bracket.....	Right.
QD2E....	1	15	9Q	2	.....do.....	Left.
QD2G....	2	15	9Q	2	Caster pins.....	
QD2K...	2	15	9Q	2	Caster roller pins.....	

Name of parts of 12-inch mortar carriages, models of 1896 MI and 1896 MII, their piece marks, number per carriage, and the drawings on which the parts are ordered.—Con.

SHOT TRUCK TYPE 12MB—Continued.

Piece mark.	No.	Class.	Division.	Drawing.	Name and part.	Remarks.
QD2Q	2	15	9Q	2	Caster wheels	
QD2S	1	15	9Q	2	Crosstie	
QD2M	1	15	9Q	2	Front leg	
QD2U	1	15	9Q	2	Front tie	Right.
QD2T	1	15	9Q	2	do	Left.
QD1G	2	15	9Q	1	Handles	
QD2D	2	15	9Q	2	Handle-bar brackets	Front.
QD2BA	2	15	9Q	2	do	Rear.
QD1Q	2	15	9Q	1	Headless bolts	0.5 by 0.75.
	2	15	9Q	1	Keys	0.25 square.
	1	15	9Q	1	Key	0.3 square.
QD2C	1	15	9Q	2	Loading tray	
A3D	1	15	OK	3	Name plate	For Nos. 1 to 620.
A3C	1	15	OK	3	do	For Nos. 621 and above.
	1	15	9Q	1	Nut	0.875.
Q3J	4	15	9Q	2	Oil plugs	0.375.
	2	15	9Q	2	Pins	0.625 by 6.75.
	2	15	OK	3	Pins, escutcheon	No. 14.
QD2L	1	15	9Q	2	Rear leg	
	2	15	9Q	2	Rings	Ball bearings.
	2	15	9Q	1	Rivets	Brake-lever guide.
	4	15	9Q	1	do	
	100	15	9Q	2	do	
QD2CA	4	15	9Q	2	Screws	No. 16, wood.
	2	15	OK	3	do	Round head, 0.25.
QD1R	1	15	9Q	1	Set screw	
QD1E	1	15	9Q	1	Shot-tray shoe	
QD2P	1	15	9Q	2	Side brace	Right.
QD2Z	1	15	9Q	2	Side brace	Left.
	2	15	9Q	1	Split pins	0.203 by 1.
	2	15	9Q	2	do	0.078 by 0.812.
	2	15	9Q	2	do	0.375 by 2.375.
	4	15	9Q	2	do	0.25 by 1.75.
	1	15	9Q	1	Split pin	0.125 by 1.25.
QD2R	2	15	9Q	2	Transoms	
QD2AA	2	15	9Q	2	Tires	
QD2Y	2	15	9Q	2	do	
QD2DA	2	15	9Q	2	Washers	
QD2N	2	15	9Q	2	Wheels	

Approximate weights of principal parts of 12-inch mortar carriages, model of 1896 MI and model of 1896 MII, as prepared for shipment.

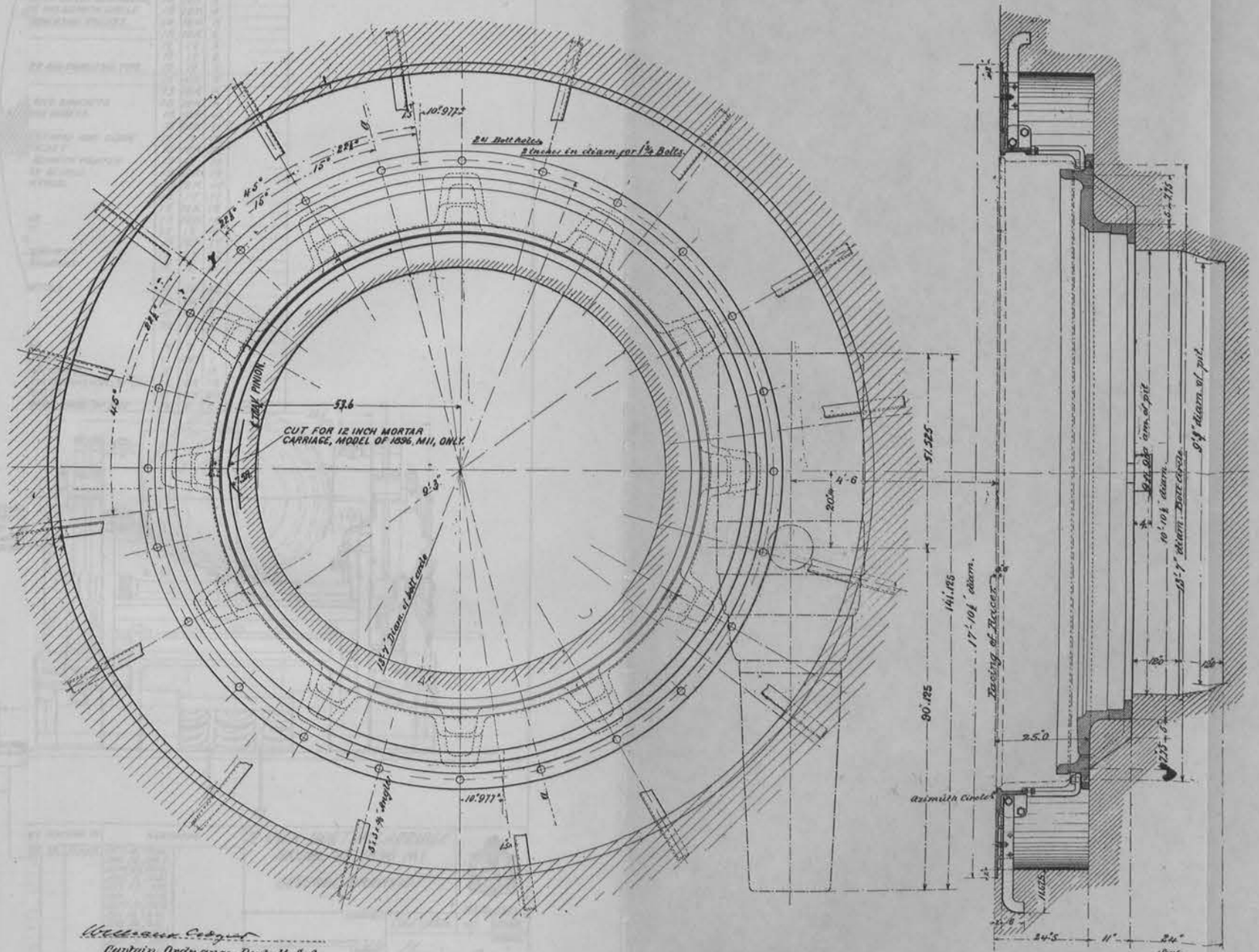
Number of loose pieces, crates, or boxes.		Contents of each package.			Remarks.
		Number of parts.	Name of parts.	Weight (pounds).	
1	Box	8	Azimuth circle brackets.	690	
1	do	4	Azimuth circle sections.	2,210	
1	do	4	Azimuth circle sections, with 16 angles for platform.	2,270	
1	Loose	1	Base ring, traversing rack, and tap bolts.	17,060	12 bolts for 1896 MI, 24 for 1896 MII.
1	Box	40	Counterrecoil springs (20 small, 20 large), with 5 spring guide rods and 10 nuts for spring guide rods.	4,260	
2	Crates	3	Distance ring sections (each crate 1,820 pounds).	3,640	
4	do	4	Floor plates (each crate 685 pounds).	2,740	
1	Loose	1	Racer	[1] 32,430 [2] 38,380 [2] 33,315	For 1896 MI. Do. For 1896 MII.
2	do	2	Side frames, with 2 cap squares (each frame 3,600 pounds).	7,200	For 1896 MI only.
1	Box	2	Spring box brackets	2,730	
1	do	1	Spring box	1,725	
1	Loose	1	Top carriage, complete	5,875	
4	Boxes	6	Traversing rollers (each box 880 pounds).	3,520	
1	Box	1	Traversing shaft pedestal, with cover, 8 cover screws and worm wheel.	915	

[1] Cast iron. [2] Cast steel.

Weight of largest package in which remaining parts of carriages are shipped is 2,500 pounds.

Total weights of carriages prepared for shipment:

	Pounds.
Model of 1896 MI—	
With cast-iron racer	96,775
With cast-steel racer	102,725
Model of 1896 MII	90,718



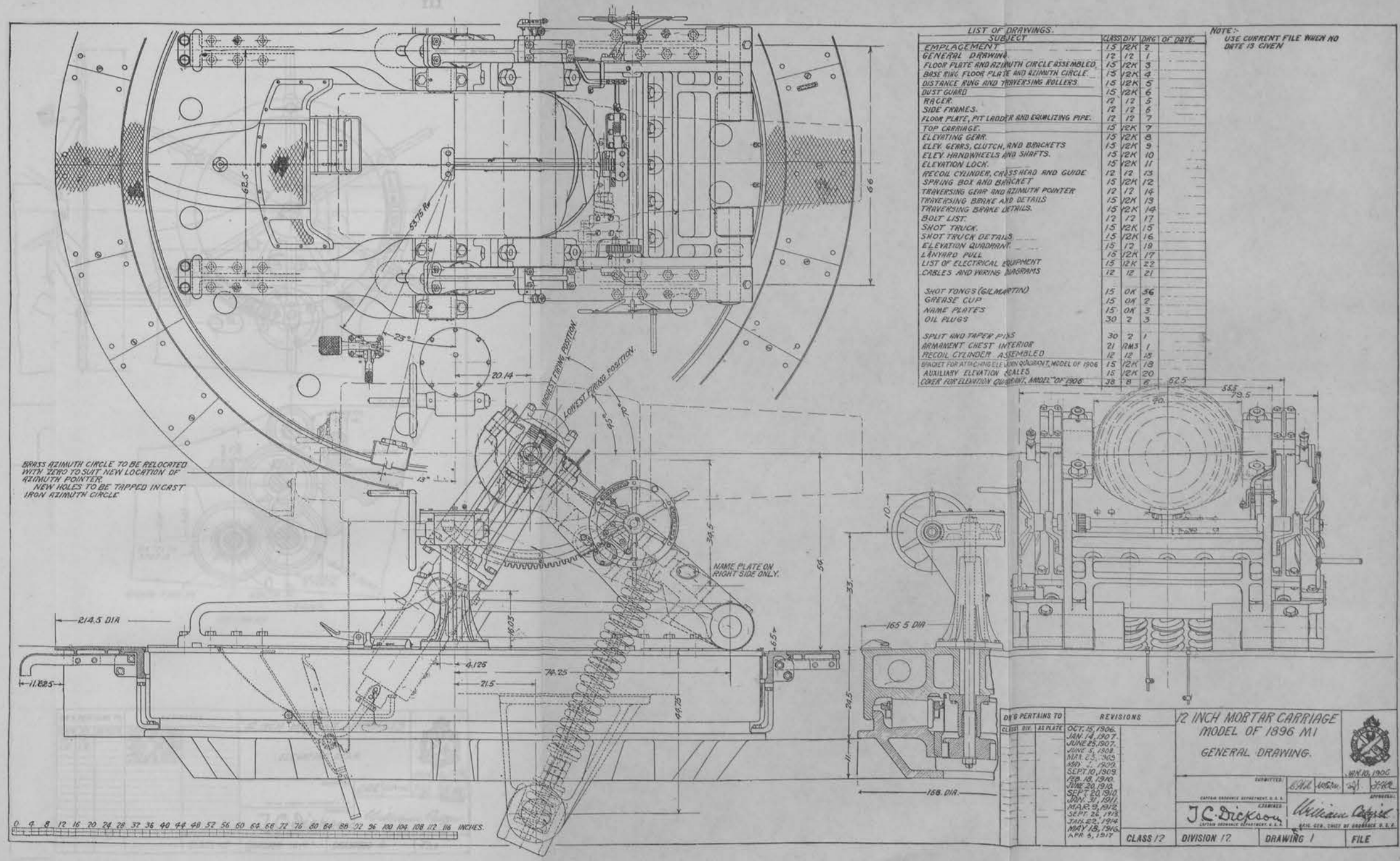
12 INCH MORTAR CARRIAGES
EMPLACEMENT

Approved
D. W. Flagler
Brigadier General
Chief of Ordnance.

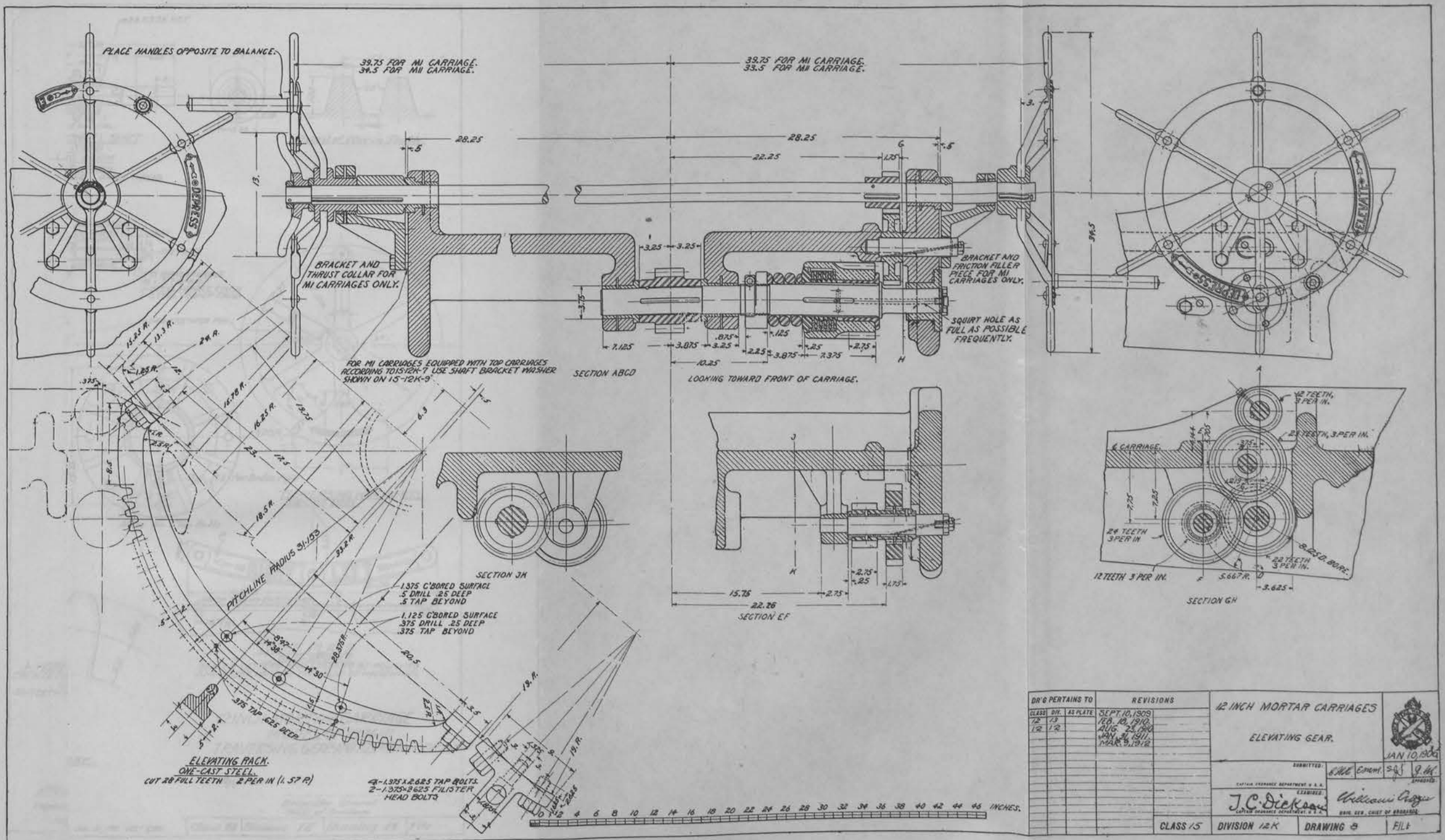
Wilhelm Cotgut
Captain, Ordnance Dept. U.S.A.
Sandy Hook Proving Ground. May 12th 1896 Revised May 19th 1896. May 29th 1896. Dec. 30th 1896. March 9th 97 May 26th 97 Nov. 3rd 97 Jan 10th 1906 DEC. 13 1907. JAN. 25, 1908. JAN. 31, 1911. JUNE 28, 1911. MAR. 9, 1912

Class 15	Division 12K	Drawing 2	File.

Pertains to Class 12 Division 12
Pertains to Class 12 Division 13



62213-22. (To face page 44.) No. 2



DR'G PERTAINS TO			REVISIONS
CLASS	DIV.	AS PLATE	SEPT. 10, 1909
12	13		FEB. 10, 1910.
12	12		AUG. 25, 1910.
			JAN 31, 1911.
			MAR. 9, 1912

12 INCH MORTAR CARRIAGES

ELEVATING GEAR.

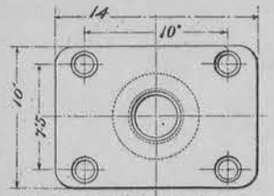
JAN 10, 1906

SUBMITTED: Approved: Sept 9, 1911

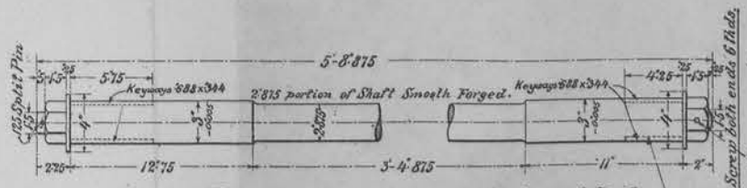
CAPTAIN ORDNANCE DEPARTMENT, U.S.A. EXAMINED: J. C. Dickson, CAPTAIN ORDNANCE DEPARTMENT, U.S.A.

WILLIAM CROZIER, BRIG. GEN., CHIEF OF ORDNANCE

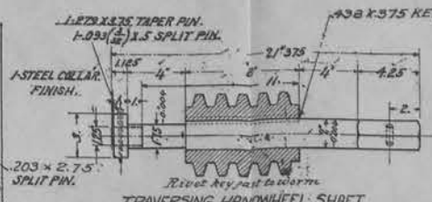
CLASS 15 | DIVISION 12K | DRAWING 8 | FILE



1 Bracket, for Verl. Shaft, Cast Iron, Bushing of Bronze.

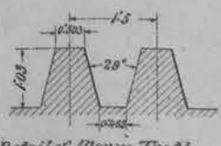


1 Vertical Traversing Shaft 2 Nuts & 2 Washers of Steel.

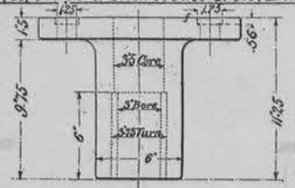


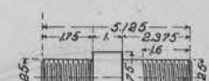
TRAVERSING HANDWHEEL SHAFT
ONE - FORGED STEEL - FINISH
TRAVERSING WORM
ONE - FORGED STEEL - FINISH.
4.5 CIRC. PITCH LEFT HAND DOUBLE THREAD.





Detail of Worm Teeth.



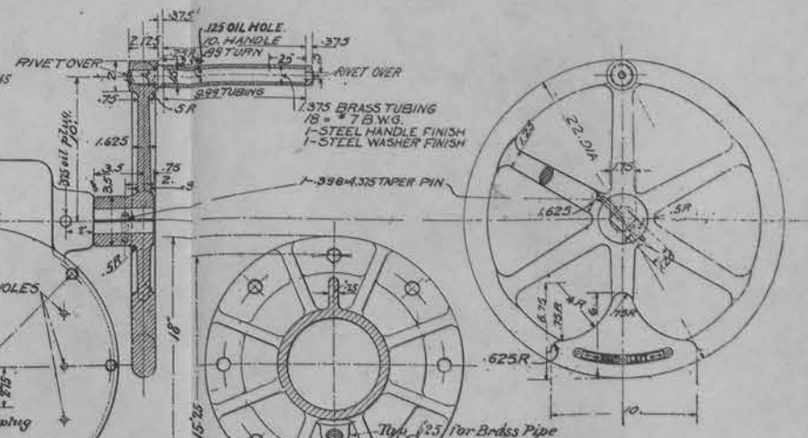


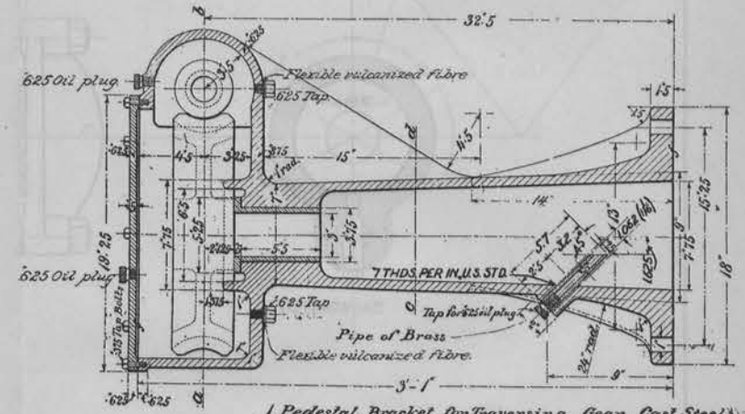
4 Vert Shaft Bracket Studs, Steel.



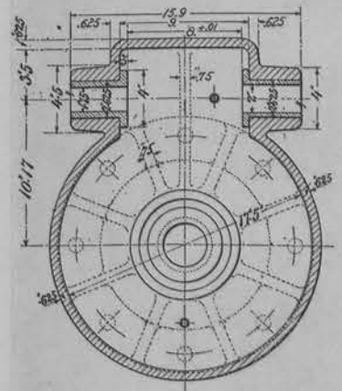
ALTERNATE METHOD OF SECURING CRANK HANDLE TUBING
1 - .5 x .125 C'SUNK STEEL SCREW - THREAD .8 LONG
1 - .391(3/8) x .656(21/32) STEEL PIN - DRIVEN

APPLIES TO CARRIAGES NO'S.- 112,113,114,115,117,119,120,121,122,123,124,126,127,133,134,135,136,137,138,140,141,237,244,245 246,247,248,249,250,251,252,253,254,255,256,257,258,259,269,270,271,272,273,274,275,276 AND 293

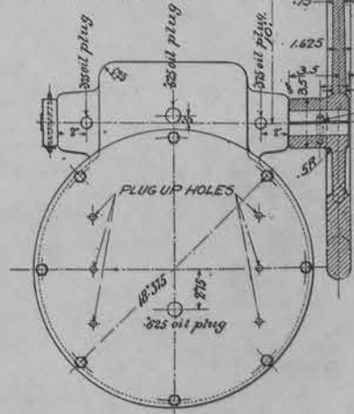




1 Pedestal Bracket for Traversing Gear Cast Steel
Bronze Bushings pressed in



Section on A.B.



Plan of Cover

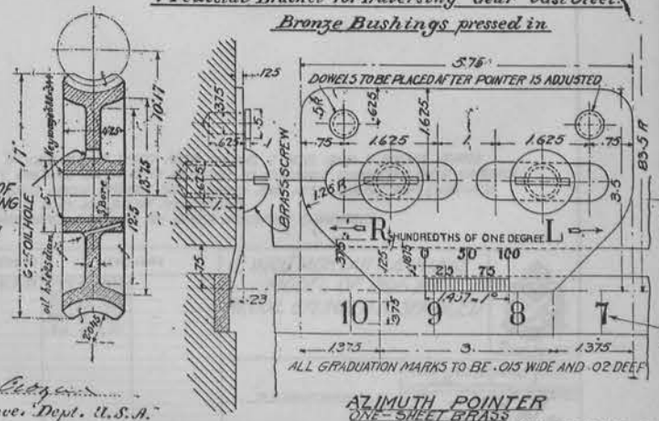
Holes for 1" Tap Bolts

Tap for 1/2" for Brass Pipe

TRAVERSING HAND WHEEL
ONE CAST STEEL

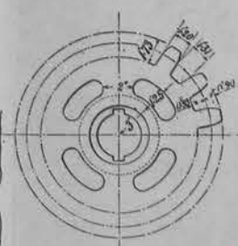


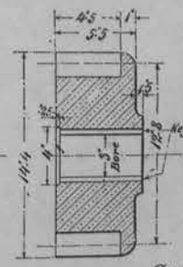
NAME PLATE
ONE - BRONZE
RAISED LETTERS AND EDGES TO BE POLISHED AND BACKS PAINTED THE COLOR OF HANDWHEEL



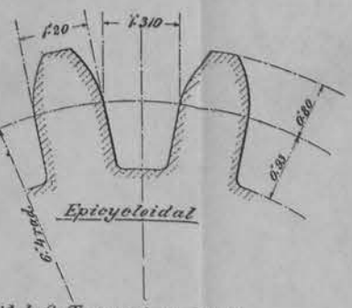
1 - WORM WHEEL OF BRONZE FOR TRAVERSING GEAR
32 TEETH TO SUIT WORM

AZIMUTH POINTER
ONE - SHEET BRASS





1 Pinion, Bronze, 16 teeth f.25 dia. pitch for Traversing Gear
Cast.



Epicycloidal

Captain, Ordnance Dept. U.S.A.
Sandy Hook Proving Ground, June 30th 1896

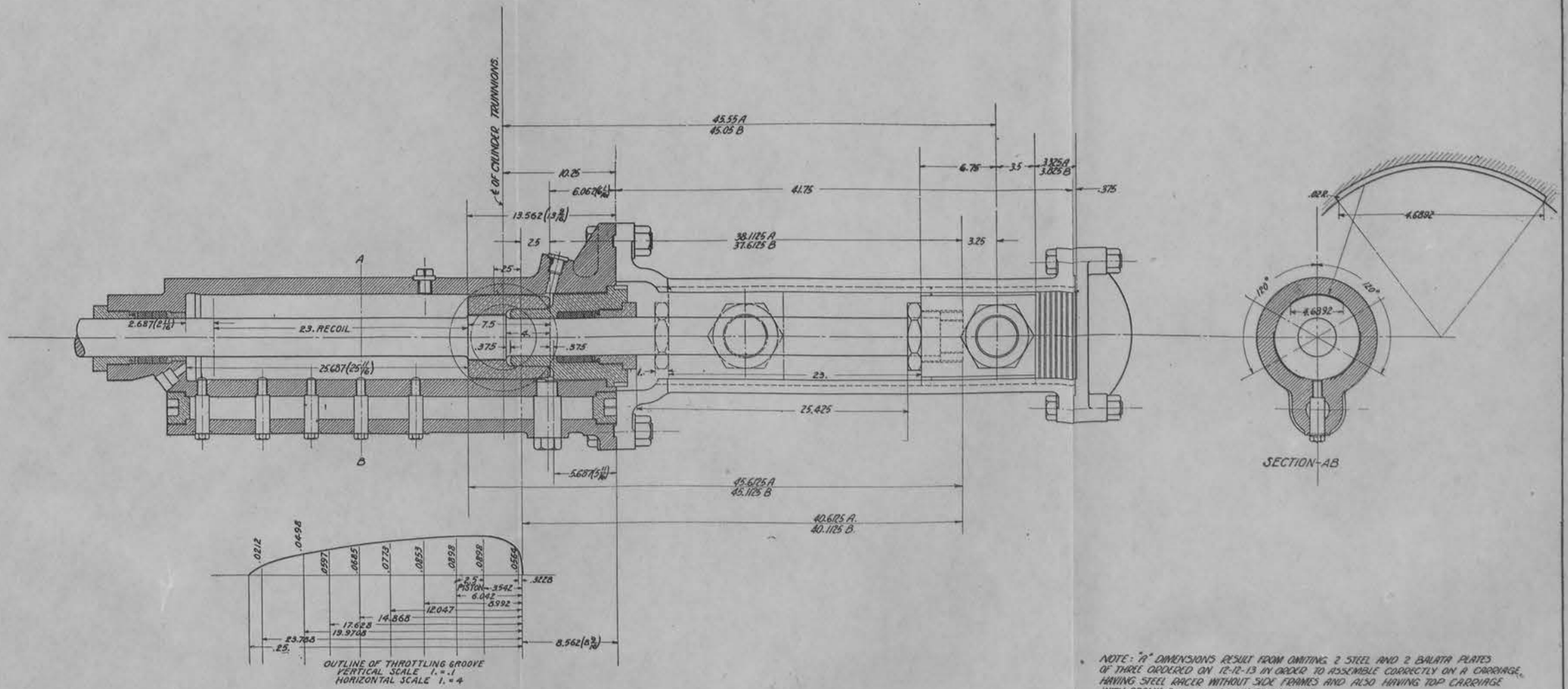
Revised, April 18th 97. May 5th 97. May 26th 97. Feb 23rd 98. June 11th 98. May 25th 99. Dec 9. 1902. Sept 6. 1904. Jan 10th 1905 FEB 18. 1908 SEPT. 8, 1909. JAN. 31, 1911. JULY 5 1911.
JAN. 19, 1912. MAR. 9, 1912 APR. 25, 1916. FEB. 11, 1921.

Approved.

Brigadier General
Chief of Ordnance

12 INCH MORTAR CARRIAGE
MODEL OF 1896 M1
TRAVERSING GEAR AND AZIMUTH POINTER

Class 12	Division 12	Drawing 14	File



NOTE: "A" DIMENSIONS RESULT FROM OMITTING 2 STEEL AND 2 BALATA PLATES OF THOSE ORDERED ON 12-12-13 IN ORDER TO ASSEMBLE CORRECTLY ON A CARRIAGE HAVING STEEL RACER WITHOUT SIDE FRAMES AND ALSO HAVING TOP CARRIAGE WITH CRANK PINS 10.5 BELOW TRUNNIONS.
"B" DIMENSIONS APPLY TO ALL OTHER MODIFIED CARRIAGES.

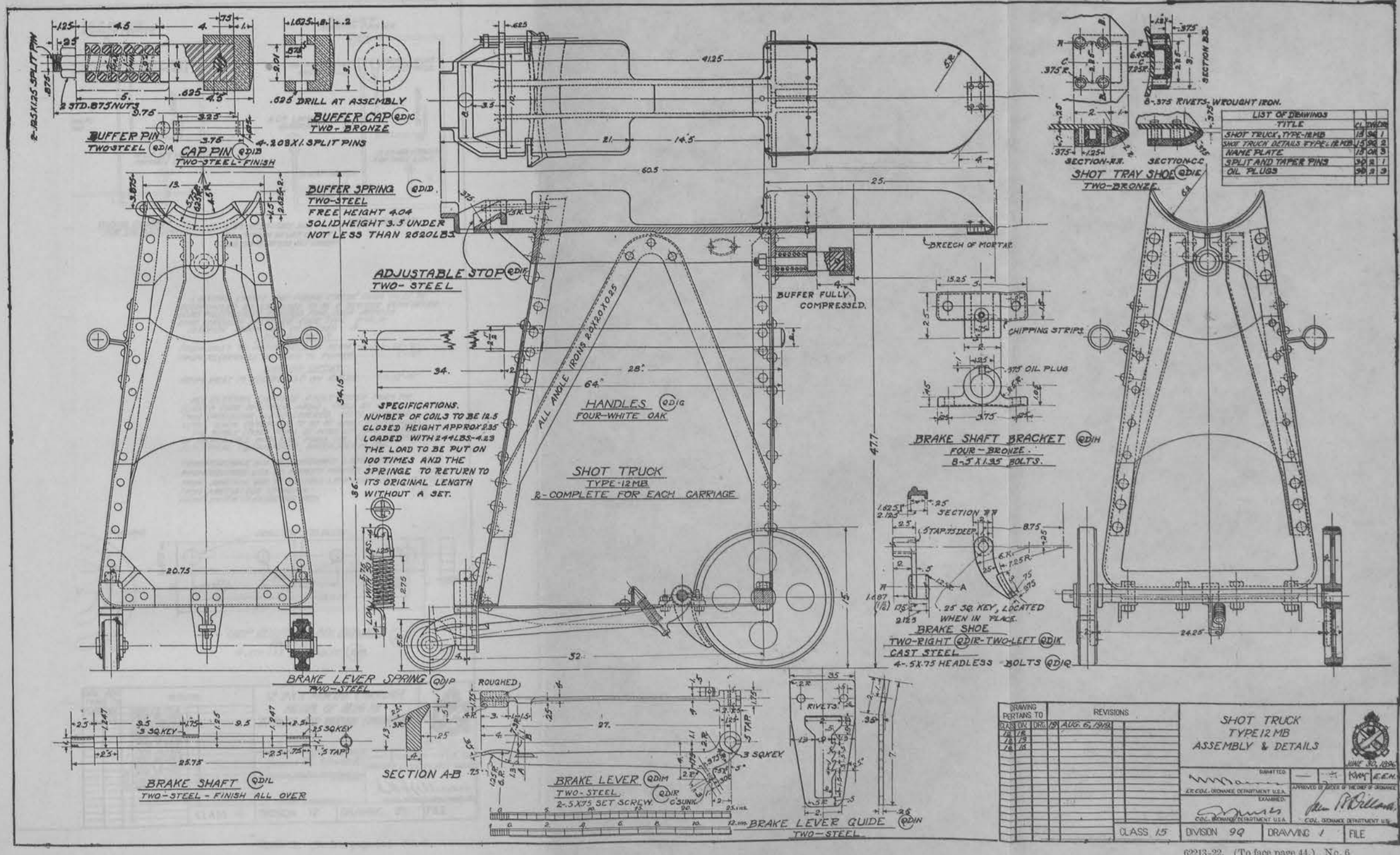
DR'G PERTAINS TO			REVISIONS
CLASS	DIV.	AS PLATE	NOV. 8, 1907. SEPT. 1, 1908. NOV. 24, 1908. MAY 8, 1909. FEB. 10, 1910.

12 INCH MORTAR CARRIAGE
MODEL OF 1896 MI
RECOIL CYLINDER ASSEMBLED

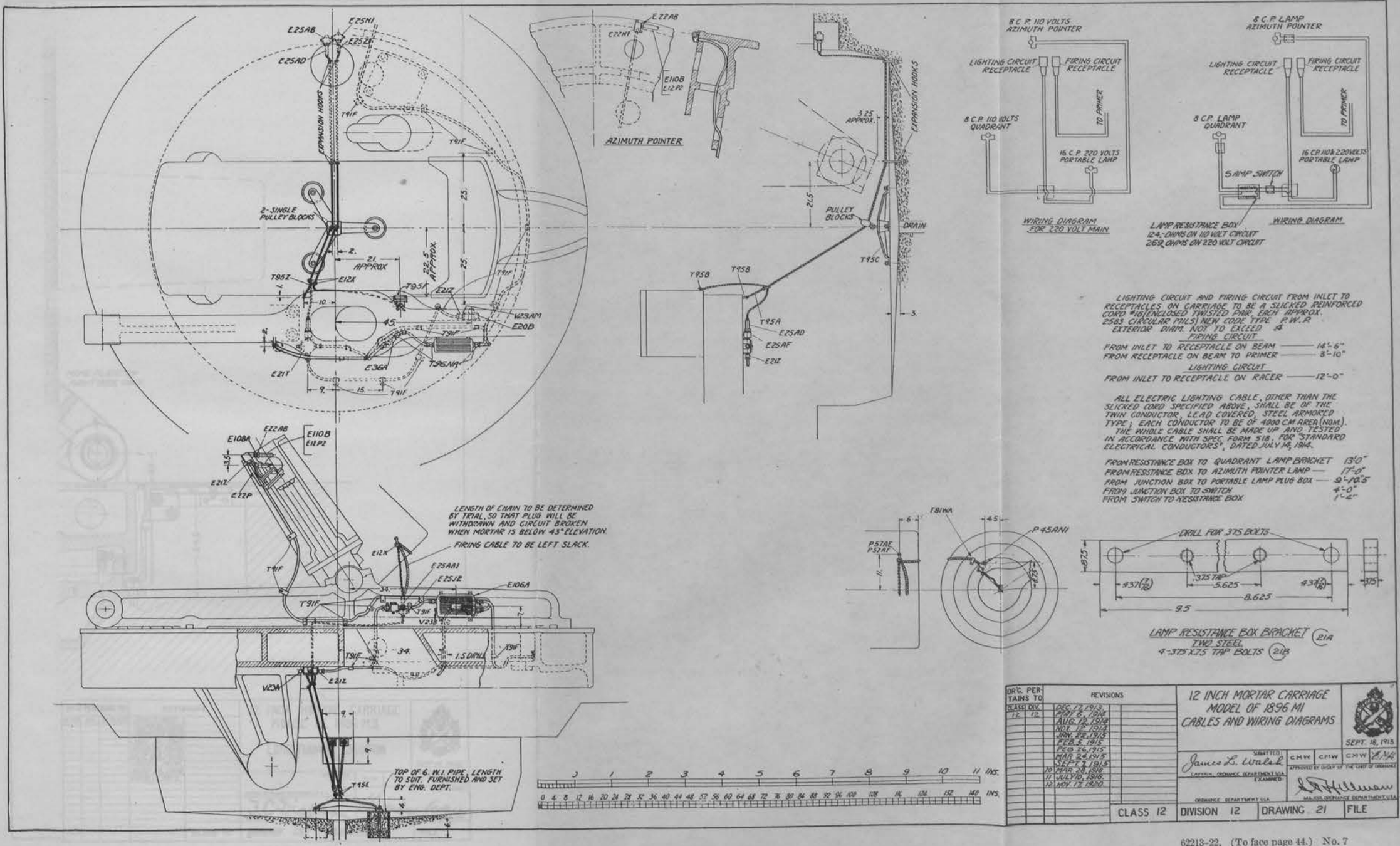
JUNE 25 1907.

SUBMITTED				
MAJOR ORDNANCE DEPARTMENT, U. S. A.	aac	R.S.M.	aac	aac
APPROVED BY ORDER OF COMMANDING GENERAL				
LIEUTENANT MAJOR ORDNANCE DEPARTMENT, U. S. A.	MAJOR ORDNANCE DEPARTMENT U.S.A.			

CLASS 12	DIVISION 12	DRAWING 18	FILE



62213-22. (To face page 44.) No. 6



LIGHTING CIRCUIT AND FIRING CIRCUIT FROM INLET TO RECEPTACLES ON CARRIAGE TO BE A SLICKED REINFORCED CORD #15 ENCLOSED TWISTED PAIR, EACH APPROX. 2583 CIRCULAR MILS) NEW CODE TYPE P.W.R. EXTERIOR DIAM. NOT TO EXCEED .4

FIRING CIRCUIT

FROM INLET TO RECEPTACLE ON BEAM	14'-6"
FROM RECEPTACLE ON BEAM TO PRIMER	3'-10"

LIGHTING CIRCUIT

FROM INLET TO RECEPTACLE ON RACER	12'-0"

ALL ELECTRIC LIGHTING CABLE, OTHER THAN THE SLICKED CORD SPECIFIED ABOVE, SHALL BE OF THE TWIN CONDUCTOR, LEAD COVERED, STEEL ARMORED TYPE; EACH CONDUCTOR TO BE OF 4000 C.M. AREA (NOM.). THE WHOLE CABLE SHALL BE MADE UP AND TESTED IN ACCORDANCE WITH SPEC. FORM 518, FOR "STANDARD ELECTRICAL CONDUCTORS", DATED JULY 14, 1914.

FROM RESISTANCE BOX TO QUADRANT LAMP BRACKET	13'0"
FROM RESISTANCE BOX TO AZIMUTH POINTER LAMP	17'-0"
FROM JUNCTION BOX TO PORTABLE LAMP PLUG BOX	9'-10"5
FROM JUNCTION BOX TO SWITCH	4'-0"
FROM SWITCH TO RESISTANCE BOX	1'-4"

DR'G. PERTAINS TO CLASS	DIV.	REVISIONS	
12.	12.	DEC. 12, 1913.	
		MAY 6, 1914	
		AUG. 12, 1914	
		NOV. 28, 1914	
		JAN. 28, 1915	
		FEB. 5, 1915	
		FEB. 26, 1915	
		MAR. 24, 1915	
		SEPT. 1, 1915	
		10 MAR. 28, 1916	
		11 JULY 10, 1918	
		12 NOV. 12, 1920	

12 INCH MORTAR CARRIAGE
MODEL OF 1896 MI
CABLES AND WIRING DIAGRAMS

SEPT. 18, 1913

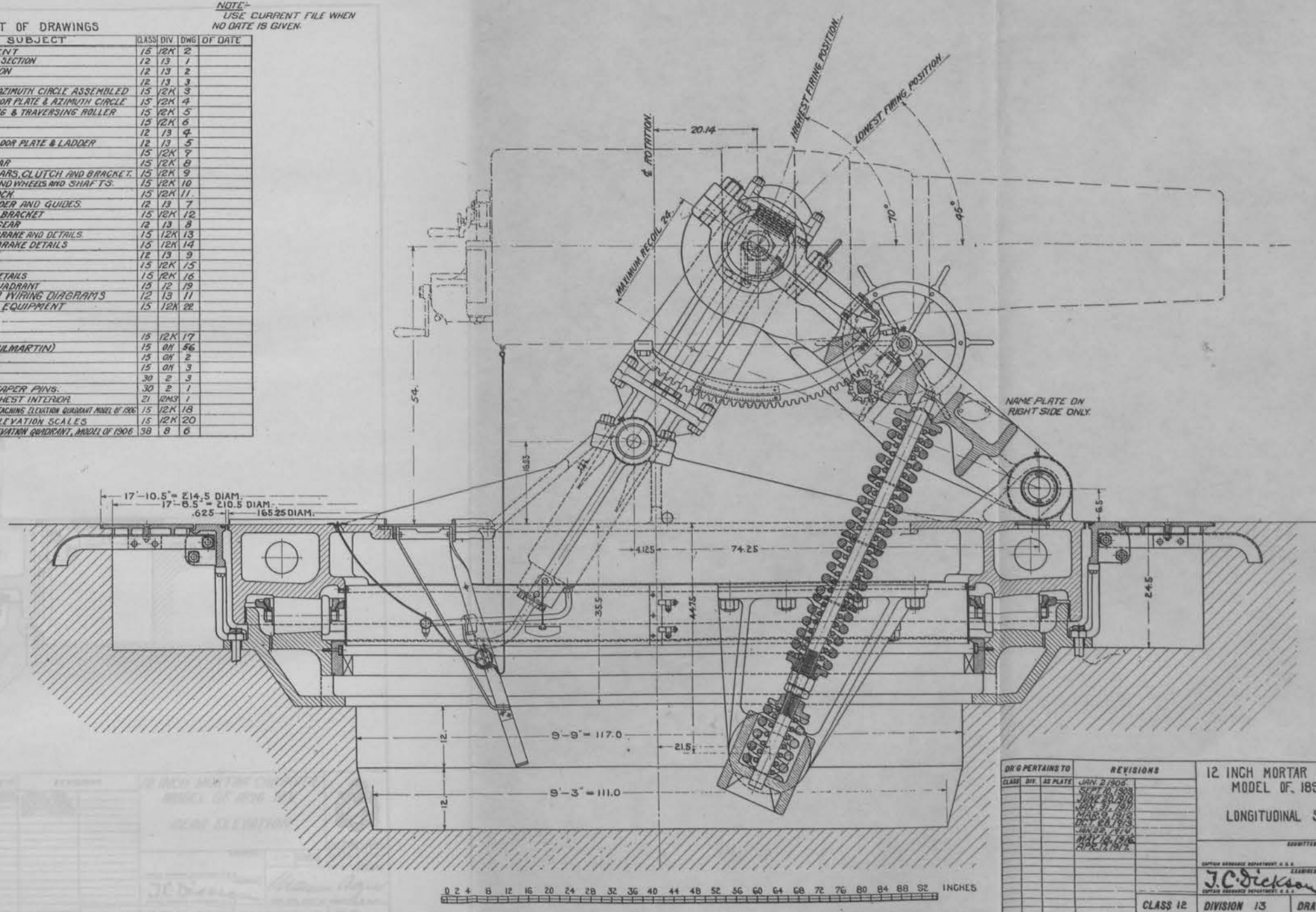
SUBMITTED: James L. Walsh, CAPTAIN, ORDNANCE DEPARTMENT U.S.A. — CMW CMW CMW
EXAMINED: ORDNANCE DEPARTMENT U.S.A.
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE: MAJ.-GEN. ORDNANCE DEPARTMENT U.S.A.

CLASS 12 | DIVISION 12 | DRAWING 21 | FILE

NOTE:- USE CURRENT FILE WHEN NO DATE IS GIVEN.

LIST OF DRAWINGS

SUBJECT	CLASS	DIV.	DWG	OF DATE
EMPLACEMENT	15	12K	2	
LONGITUDINAL SECTION	12	13	1	
REAR ELEVATION	12	13	2	
PLAN	12	13	3	
FLOOR PLATE & AZIMUTH CIRCLE ASSEMBLED	15	12K	3	
BASE RING FLOOR PLATE & AZIMUTH CIRCLE	15	12K	4	
DISTANCE RING & TRAVERSING ROLLER	15	12K	5	
DUST GUARD	15	12K	6	
RACER	12	13	4	
REMOVABLE FLOOR PLATE & LADDER	12	13	5	
TOP CARRIAGE	15	12K	7	
ELEVATING GEAR	15	12K	8	
ELEVATING GEARS, CLUTCH AND BRACKET.	15	12K	9	
ELEVATING HAND WHEELS AND SHAFTS.	15	12K	10	
ELEVATION LOCK	15	12K	11	
RECOIL CYLINDER AND GUIDES.	12	13	7	
SPRING BOX & BRACKET	15	12K	12	
TRAVERSING GEAR	12	13	8	
TRAVERSING BRAKE AND DETAILS.	15	12K	13	
TRAVERSING BRAKE DETAILS	15	12K	14	
BOLT LIST	12	13	9	
SHOT TRUCK	15	12K	15	
SHOT TRUCK DETAILS	15	12K	16	
ELEVATION QUADRANT	15	12	19	
CABLES AND WIRING DIAGRAMS	12	13	11	
ELECTRICAL EQUIPMENT	15	12K	22	
LANYARD PULL	15	12K	17	
SHOT TONGS (GILMARTIN)	15	0H	56	
GREASE CUP	15	0H	2	
NAME PLATES	15	0H	3	
OIL PLUGS	30	2	3	
SPLIT AND TAPER PINS.	30	2	1	
ARMAMENT CHEST INTERIOR	21	12M3	1	
BRACKET FOR ATTACHING ELEVATION QUADRANT MODEL OF 1906	15	12K	18	
AUXILIARY ELEVATION SCALES	15	12K	20	
COVER FOR ELEVATION QUADRANT, MODEL OF 1906	38	8	6	



DR'G PERTAINS TO CLASS	DIV.	AS PLATE

REVISIONS
JAN. 2 1908.
SEPT. 10, 1908.
JUNE 20, 1910.
JAN. 31, 1911.
MAR. 9, 1912.
OCT. 28, 1913.
JAN. 22, 1914.
MAY 16, 1916.
APR. 17, 1917.

12 INCH MORTAR CARRIAGE
MODEL OF 1896 MII

LONGITUDINAL SECTION

OCT. 16, 1905.

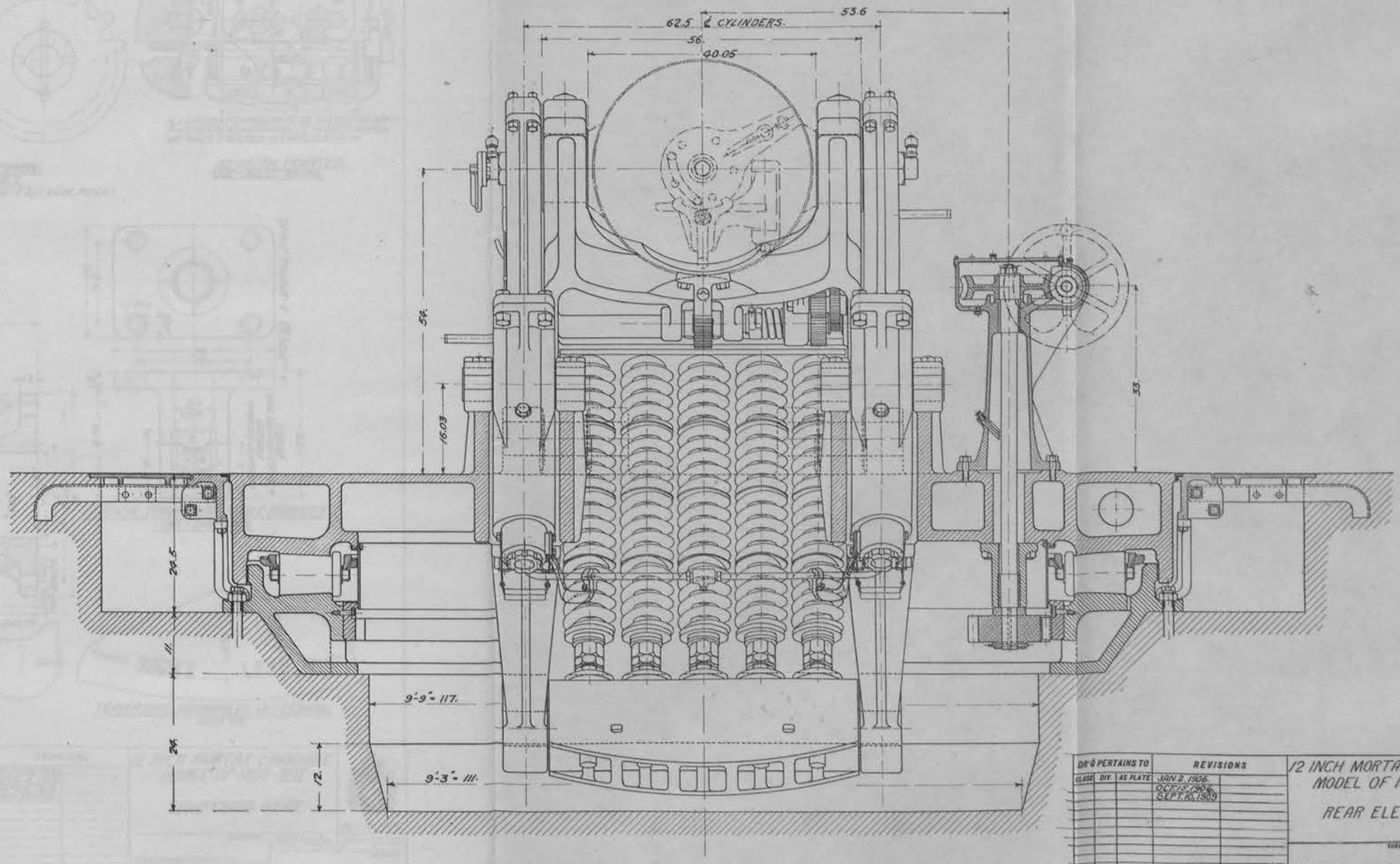
SUBMITTED: Z.M. 1-9 J.S.K. 10-13-K

APPROVED:

CAPTAIN ORDNANCE DEPARTMENT, U. S. A. — ASSEMBLED: J.C. Dickson, CAPTAIN ORDNANCE DEPARTMENT, U. S. A.

BRIG. GEN. CHIEF OF ORDNANCE, U.S.A.

CLASS 12 | DIVISION 13 | DRAWING 1 | FILE



DR'G PERTAINS TO			REVISIONS
CLASS	DIV.	AS PLATE	JAN 2, 1906. OCT. 15, 1908. SEPT. 10, 1909.

12 INCH MORTAR CARRIAGE
MODEL OF 1896 MII

REAR ELEVATION.

OCT. 16, 1905.

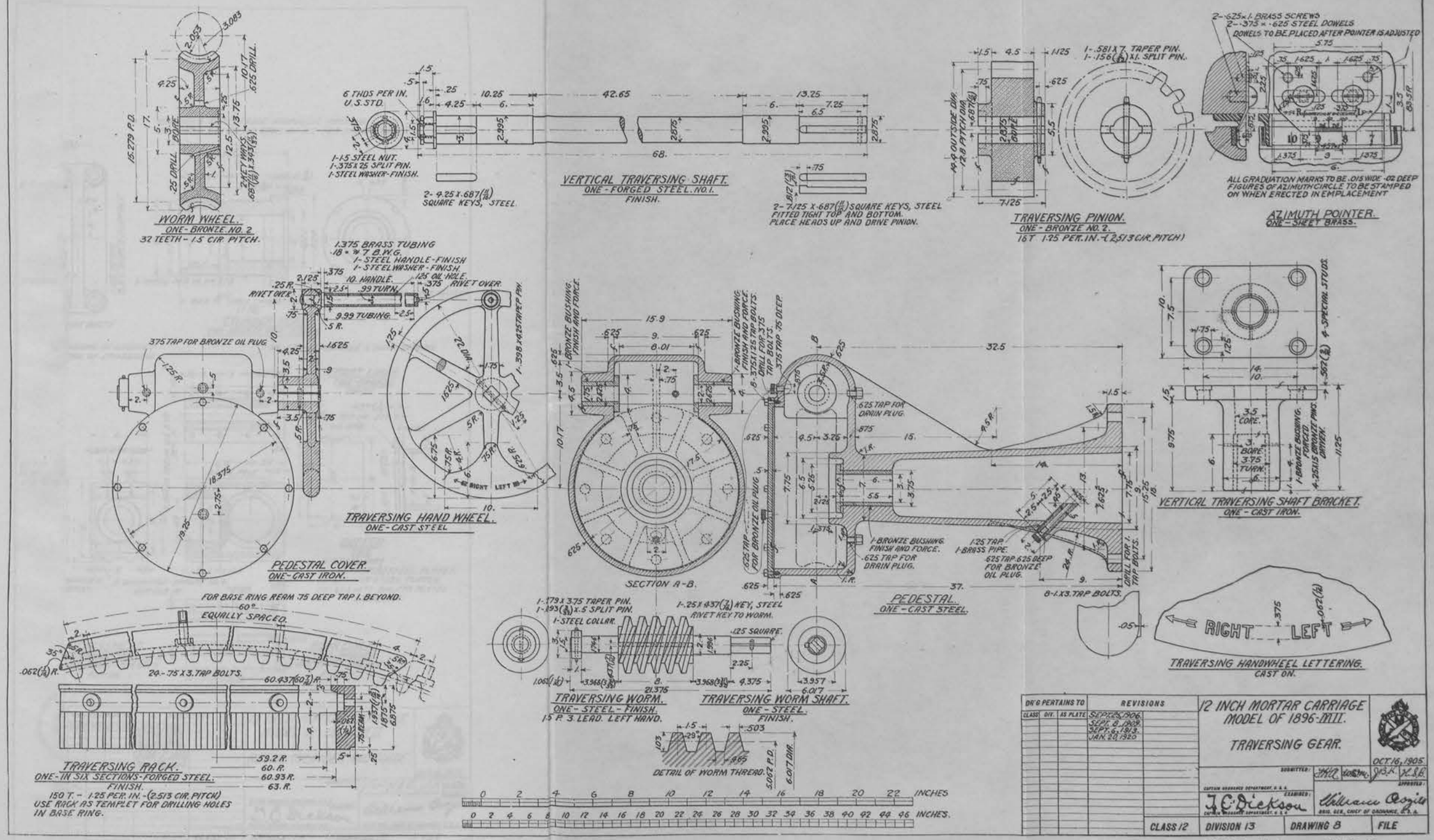
SUBMITTED: C.I.M. 10.6.M. D.F.S.A. W.P.S.M.

APPROVED: William Crozier
BRIG. GEN., CHIEF OF ORDNANCE, U.S.A.

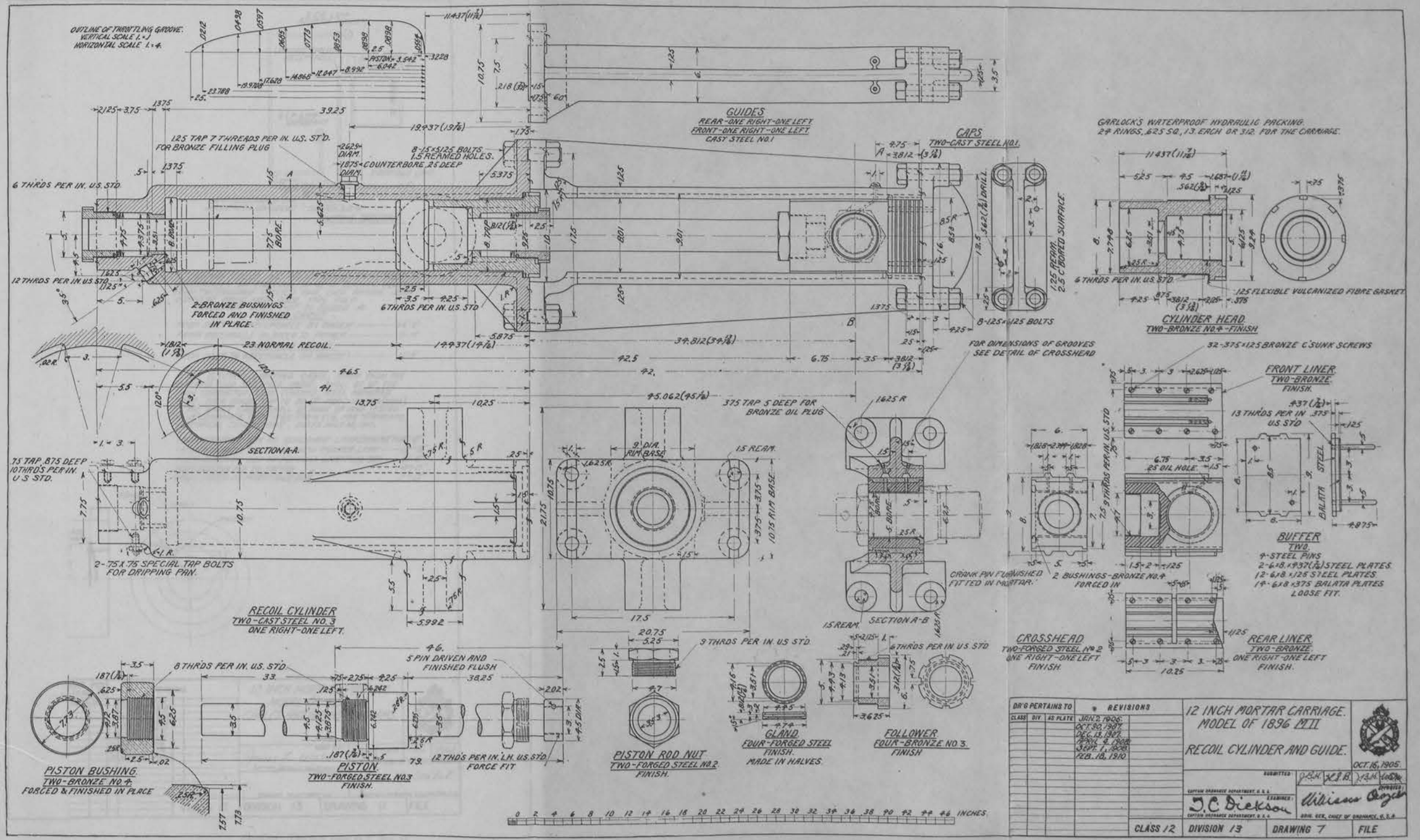
CAPTAIN ORDNANCE DEPARTMENT U.S.A. DRAWN: J.C. Dickson
CAPTAIN ORDNANCE DEPARTMENT U.S.A.

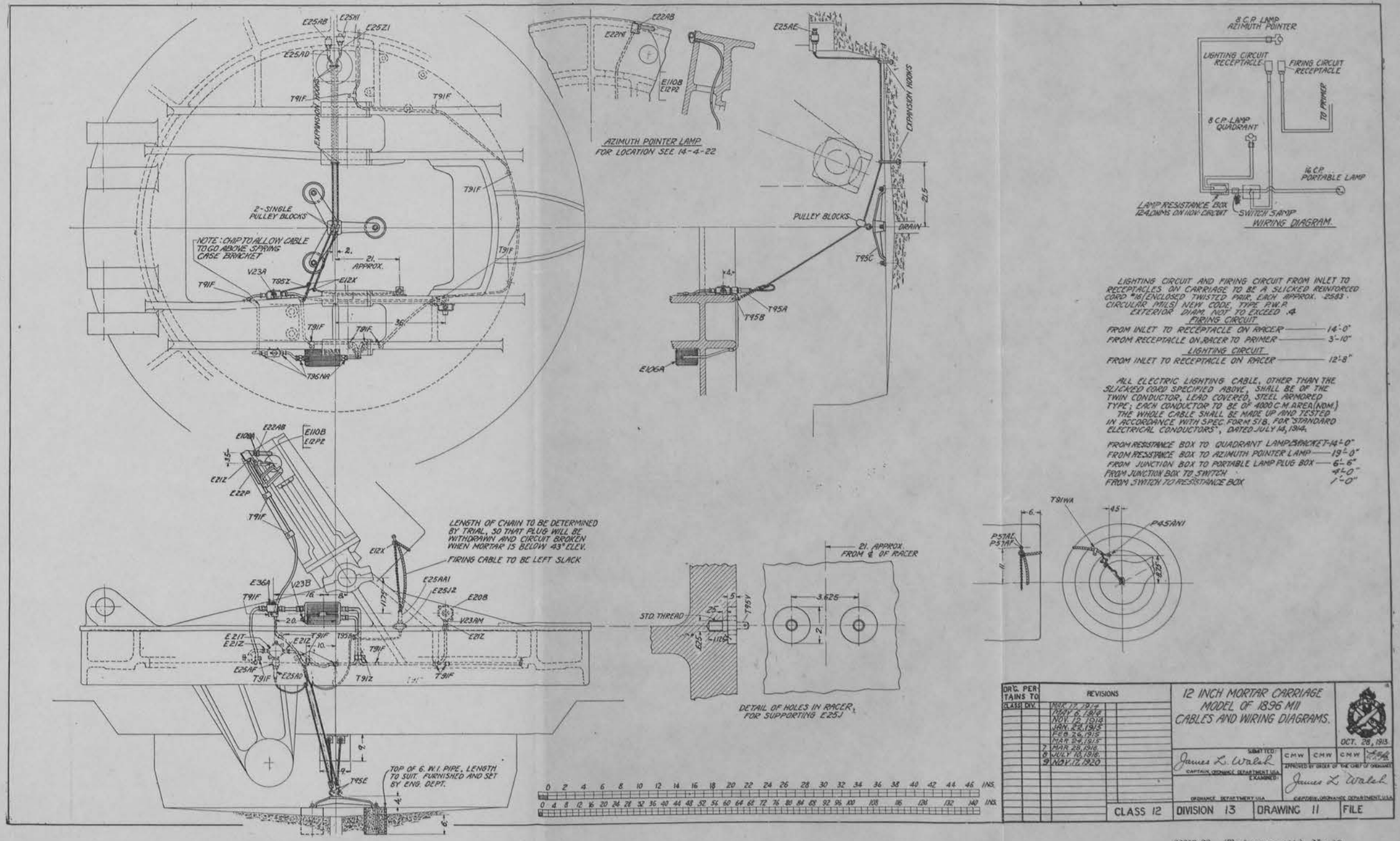
CLASS 12 | DIVISION 13 | DRAWING 2 | FILE

62213-22. (To face page 44.) No. 9



DR'G PERTAINS TO			REVISIONS	12 INCH MORTAR CARRIAGE MODEL OF 1896-MII.	
CLASS	DIV.	AS PLATE	SEPT 25, 1906. SEPT. 8, 1909. SEPT. 6, 1913. JAN. 20, 1920	TRAVERSING GEAR.	OCT. 16, 1905.
				SUBMITTED: J.M.K. 10.8.06 J.M.K. W.S.R.	APPROVED:
				EXAMINED: J. C. Dickson, CAPTAIN ORDNANCE DEPARTMENT, U. S. A.	William Crozier, BRIG. GEN., CHIEF OF ORDNANCE, U. S. A.
CLASS 12			DIVISION 13	DRAWING 8	FILE


OUTLINE OF THROTTLING GROOVE.
VERTICAL SCALE 1:1
HORIZONTAL SCALE 1:4.
GUIDES
REAR-ONE RIGHT-ONE LEFT
FRONT-ONE RIGHT-ONE LEFT
CAST STEEL NO.1
CAPS
TWO-CAST STEEL NO.1.
GARLOCK'S WATERPROOF HYDRAULIC PACKING.
2# RINGS, .625 SQ., 13. EACH OR 3/12. FOR THE CARRIAGE.
125 TAP 7 THREADS PER IN. U.S. ST'D.
FOR BRONZE FILLING PLUG
8-1.5"x1.25 BOLTS
1.5 REAMED HOLES.
2.625 DIAM.
1.875 DIAM. COUNTERBORE .25 DEEP
6 THRDS PER IN. U.S. STD.
12 THRDS PER IN. U.S. STD.
2-BRONZE BUSHINGS
FORCED AND FINISHED
IN PLACE.
6 THRDS PER IN. U.S. STD
8-1.25"x1.25 BOLTS
CYLINDER HEAD
TWO-BRONZE NO.4 - FINISH.
1.25 FLEXIBLE VULCANIZED FIBRE GASKET.
23. NORMAL RECOIL.
SECTION A-A.
.75 TAP .875 DEEP
10 THRDS PER IN.
U.S. STD.
2-.75"x.75 SPECIAL TAP BOLTS
FOR DRIPPING PAN.
RECOIL CYLINDER
TWO-CAST STEEL NO. 3
ONE RIGHT-ONE LEFT.
.375 TAP .5 DEEP FOR
BRONZE OIL PLUG
9" DIA.
RIM BASE
15 REAM.
SECTION A-B
FOR DIMENSIONS OF GROOVES
SEE DETAIL OF CROSSHEAD
32-.375"x1.25 BRONZE C'SUNK SCREWS
FRONT LINER
TWO-BRONZE.
FINISH.
13 THRDS PER IN. .375
U.S. STD
BALATA STEEL
BUFFER
TWO.
4-STEEL PINS
2-6"x8.1"x.937 (15/16) STEEL PLATES.
12-6"x8.1"x.125 STEEL PLATES.
14-6"x8.1"x.375 BALATA PLATES
LOOSE FIT.
2 BUSHINGS-BRONZE NO.4
FORCED IN
CROSSHEAD
TWO-FORGED STEEL No 2
ONE RIGHT-ONE LEFT.
FINISH.
REAR LINER
TWO-BRONZE.
ONE RIGHT-ONE LEFT
FINISH.
CRANK PIN FURNISHED
FITTED IN MORTAR.
5 PIN DRIVEN AND
FINISHED FLUSH
8 THRDS PER IN. U.S. STD.
PISTON BUSHING.
TWO-BRONZE NO.4.
FORCED & FINISHED IN PLACE
PISTON
TWO-FORGED STEEL NO.3
FINISH.
12 THD'S PER IN. L.H. U.S. STD.
FORCE FIT
PISTON ROD NUT
TWO-FORGED STEEL NO.2.
FINISH.
9 THRDS PER IN. U.S. STD.
GLAND
FOUR-FORGED STEEL
FINISH.
MADE IN HALVES.
6 THRDS PER IN. U.S. STD.
FOLLOWER
FOUR-BRONZE NO.3.
FINISH
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 INCHES.
DR'G PERTAINS TO
CLASS DIV. AS PLATE
REVISIONS
JAN. 2, 1906.
OCT. 30, 1907.
DEC. 13, 1907.
JAN. 6, 1908.
MAY 7, 1908.
FEB. 18, 1910.
12 INCH MORTAR CARRIAGE.
MODEL OF 1896 MII
RECOIL CYLINDER AND GUIDE.
OCT. 16, 1905.
SUBMITTED
J. C. Dickson
EXAMINED
APPROVED
CLASS 12
DIVISION 13
DRAWING 7
FILE



LIGHTING CIRCUIT AND FIRING CIRCUIT FROM INLET TO RECEPTACLES ON CARRIAGE TO BE A SLICKED REINFORCED CORD #16 (ENCLOSED TWISTED PAIR, EACH APPROX. .2583 CIRCULAR MILS) NEW CODE, TYPE R.W.P. EXTERIOR DIAM. NOT TO EXCEED .4

FIRING CIRCUIT

FROM INLET TO RECEPTACLE ON RACER	14'-0"
FROM RECEPTACLE ON RACER TO PRIMER	3'-10"

LIGHTING CIRCUIT

FROM INLET TO RECEPTACLE ON RACER	12'-8"

ALL ELECTRIC LIGHTING CABLE, OTHER THAN THE SLICKED CORD SPECIFIED ABOVE, SHALL BE OF THE TWIN CONDUCTOR, LEAD COVERED, STEEL ARMORED TYPE; EACH CONDUCTOR TO BE OF 4000 C.M. AREA (NOM.) THE WHOLE CABLE SHALL BE MADE UP AND TESTED IN ACCORDANCE WITH SPEC. FORM 518, FOR "STANDARD ELECTRICAL CONDUCTORS", DATED JULY 14, 1914.

FROM RESISTANCE BOX TO QUADRANT LAMP BRACKET	14'-0"
FROM RESISTANCE BOX TO AZIMUTH POINTER LAMP	13'-0"
FROM JUNCTION BOX TO PORTABLE LAMP PLUG BOX	6'-6"
FROM JUNCTION BOX TO SWITCH	4'-0"
FROM SWITCH TO RESISTANCE BOX	1'-0"

DRG. PERTAINS TO CLASS DIV.	REVISIONS	
	1 MAR. 17, 1914	
	2 MAY 6, 1914	
	3 NOV. 12, 1914	
	4 JAN. 22, 1915	
	5 FEB. 26, 1915	
	6 MAR. 24, 1915	
	7 MAR. 28, 1916	
	8 JULY 15, 1916	
	9 NOV. 17, 1920	

12 INCH MORTAR CARRIAGE MODEL OF 1896 MII
CABLES AND WIRING DIAGRAMS.

OCT. 28, 1913.

SUBMITTED: James L. Walsh, CAPTAIN, ORDNANCE DEPARTMENT U.S.A. — CMW CMW CMW
EXAMINED: ORDNANCE DEPARTMENT U.S.A.
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE: James L. Walsh, CAPTAIN, ORDNANCE DEPARTMENT U.S.A.

CLASS 12 | DIVISION 13 | DRAWING 11 | FILE