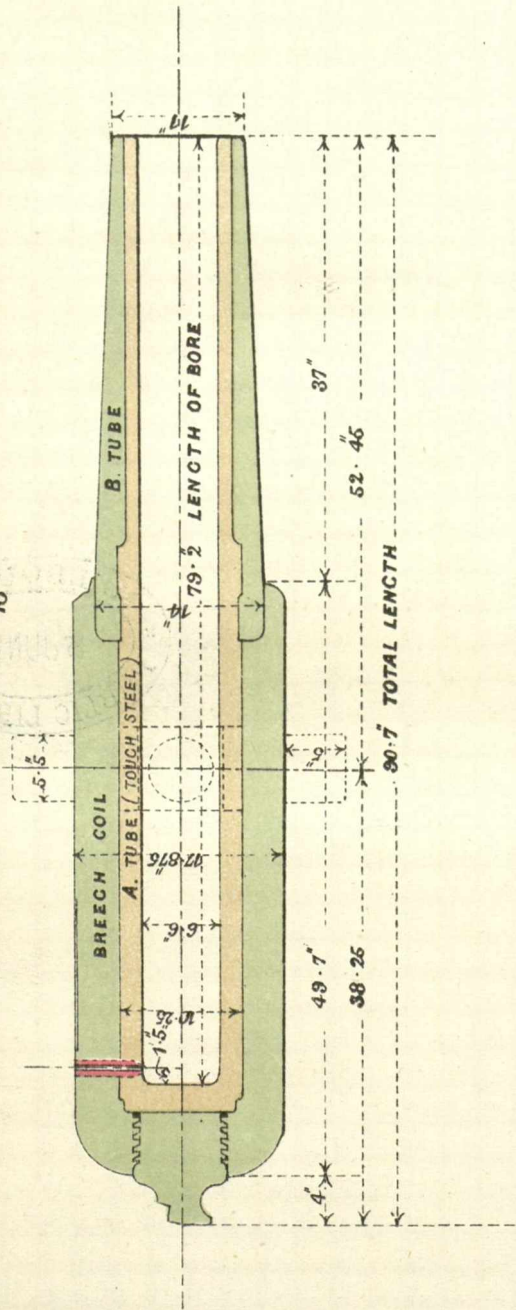


Front-spiece

ORDNANCE, WROUGHT-IRON, R. M. L. HOWITZER, 6.6 INCH, 36 CWT, MARK I.

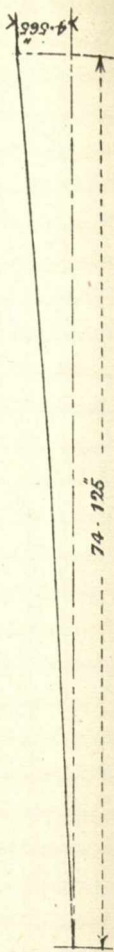
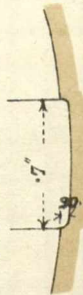
Scale $\frac{1}{16}$.



NUMBER OF GROOVES 20.

RIFLING AN INCREASING TWIST FROM 1 TURN IN 94 CALS AT BREACH TO 1 IN 35 CALS AT MUZZLE

GROOVE FULL SIZE



40185
2457

59 344

9

HANDBOOK

FOR THE

6·6-INCH R.M.L. HOWITZER.

On Bed and Ground Platform or on Siege Travelling
Carriage.

LAND SERVICE.

(PERMANENT WORKS.)



1886.

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1886.

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CONTENTS.

	Page
Howitzer	3
Sights.. .. .	4
Bed, Carriage, Platform, &c.	5
Pivots	12
Instructions for Care and Preservation of Bed and Carriage ..	17
Projectiles	18
Fuzes	20
Instructions for the Preparation of Shells and Fuzes, and the Examination of Filled Shells	20
Charges	23
Directions for making up Cartridges	23
Range Tables	25
Table of Gradients	27
Drill	28
Instructions for using the Clinometer	32
Instructions for the Disablement or Destruction of Guns by means of Guncotton	33

PLATES.

Howitzer	Frontispiece.
Sights.. .. .	Plate I.
Bed	Plate II.
Carriage	Plates III, IV., and V.
Anchoring Apparatus	Plate VI.
Projectiles and Fuzes.. .. .	Plates VI., VII., and VIII.

MEMO.—This book is correct up to 22.12.85

6-6-INCH R.M.L. HOWITZER OF 36 CWT. (MARKS I. & II.)

THE HOWITZER.

(Frontispiece.)

(List of Changes, §§ 4012, 4636.)

Material	{ Mark I. { exterior Wrought iron. { tube Tough steel. { Mark II. (throughout) Steel.	..	..	..	..	..	..	..	..
Length, total		..	..	..	..	..	..	..	..	90.7 inches.	
Weight, nominal	..	..	..	..	..	..	..	..	..	36 cwt.	
Preponderance muzzle (about)	..	..	..	..	..	..	..	..	..	10 lbs.	
Bore	{ calibre 6.6 inches. { length 79.2 inches. { capacity, including unrifled portion 2709.4 cub. in	..	..	..	..	..	..	..	..	..
	
	
Chamber	{ diameter 6.6 in. { length 5.07 in. { capacity 173.4 cub. in.	..	..	..	..	..	..	..	..	..
	
	
Rifling	{ system Polygroove, plain section. { twist Increasing from 1 turn { length in 94 calcs. at breech to { grooves { number 1 turn in 35 calcs. at { depth muzzle. { width 74.125 in. { 20. { 0.05 in. { 0.7 in.	..	..	..	..	..	..	..	..	..
	
	
	
	
Vent	..	..	..	..	..	..	..	..	..	{ Vertical, of hardened { copper, 1.5 in. from end { of bore.	

In order to ensure an exact space in the bore being left for the charge, the grooves terminate abruptly at a distance of 5.075 inches from the end of the bore, so as to prevent the projectile being driven beyond this point; the grooves are slightly splayed at the muzzle to facilitate loading.

Planes for cross-levelling are cut upon the cascable button and front portion of the breech coil, and a plane for quadrant elevation on top of the breech.

Pivot Piece.

The pivot piece for elevating arc is attached to the right side of the breech, and is adapted to fit the piece for the ordinary siege travelling-carriage.

SIGHTS.
(Plate I.)

The piece is sighted upon both sides on a plan proposed by Major French, R.A.

The tangent scales drop into sockets, and are set vertically. The bars of steel are graduated to 15 degrees, adjustment being effected by removable clamps. The scales have bronze heads with clamping screws, and a steel horizontal cross bar, which slides within the head to the extent of 1° to the right and 3° to the left, to compensate for wind and deflection of projectile. The bar is provided with a sliding reversible leaf, having a notch for direct laying; this leaf is provided with a pointed sight for rough laying, and cross wires for fine laying when used reversed. The bar is graduated from 0° to 8° right for the right side, and 0° to 8° left for the left side. The bars are reversible, being graduated upon one edge for the right side, and on the opposite edge for the left side of the piece, and are stamped accordingly.

The trunnion-sights consist of steel stems with horizontal cross bars, forged solid, fitted into gun-metal sockets with bayonet joint. The bars are each fitted with a sliding reversible leaf, having a point for direct laying, and an open notch and eye-hole for rough and fine sighting when used reversed.

The cross bars are graduated from 0° to 8° , to correspond with the tangent sight bars.

These sights can be used for either direct or reverse laying.

For direct laying, the notch of the tangent sight is used in conjunction with the point on the trunnion sight; and for fine laying, the sliding leaves are exchanged, and the eye-hole and cross wires used in conjunction. For direct laying, the method of proceeding is the same as when using service sights of the ordinary pattern; the only special feature being, that both sliding leaves must be clamped at corresponding divisions of the respective cross bars, so as to obtain a line truly parallel to the axis of the gun; any deflection which may be required is given on the part of the bar specially graduated for the purpose.

For reverse laying, the notch of the trunnion sight is used in conjunction with the point on the tangent sight, or the eye-hole of the trunnion sight with the cross wires of the tangent sight.

The mode of proceeding is as follows:—

The line of fire is obtained by any of the recognized methods (see "Instructions for the Service of Siege Artillery," p. 42), after which, the howitzer is laid by clinometer or quadrant for the first round.

Before firing, an "aiming point" is selected to the rear of the platform, in prolongation of the line joining the sights, the leaves of which are for the purpose shifted on the cross bars, and clamped in any required position, without restriction as to keeping to corresponding divisions; the tangent scale being, at the same time, set to any convenient elevation (which need not necessarily be the elevation at which the piece is laid).

If near to the platform, the aiming point must be supplemented by a plumb-line suspended at a fixed point between it and the howitzer to mark the line of fire; but if at a considerable distance in rear, the use of a plumb-line can be dispensed with, especially when battens on the platform, or other means, are used to ensure the gun being in the same position after each round.

After the first round any necessary correction for elevation or deflection is made, and the aiming point, as above described, is used to lay on, the clinometer being no longer necessary.

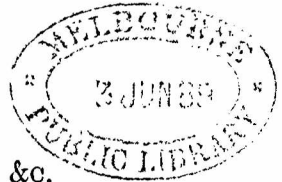
Before firing the sights are securely clamped. After each round any required alteration in the amount of elevation or deflection is given on the tangent sight, and the howitzer, being run up, is laid on the aiming point without altering the position of the sights, except when the plumb-line is used, in which case, to avoid cross-lifting, it may be found necessary to shift both sliding leaves an equal number of divisions to right or left on the cross bars.

For night firing, or when there is much fog, a luminous aiming point is required. This may conveniently be obtained by the use of a bull's eye lantern, with wires crossed in front, fixed to a post; the light being softened by placing paper, or other suitable material, over the glass. In this case a plumb-line will usually be required, and the aiming point will be the point where the plumb-line covers the intersection of the wires on the lantern.

Battens or chalk lines on the platform will generally be found useful.

The following sights and fittings are issued with the piece:—

Clamps, metal, movable, for tangent sight* ..	2	
Pieces, pivot, complete, with plate, metal, elevating, steel pivot† keep pin,‡ and 4 screws, fixing (Mark I)	1	} to suit the ordinary 40-pr. travelling-carriage.
Screws, wrought-iron, preserving plate, metal elevating (Mark I)	4	
Sights, rifled ordnance {	tangent scale, complete, with cross bar and sliding leave (Mark I.)	2
	trunnion, complete, with cross bar and sliding leaf (Mark I.) ..	2



BED, CARRIAGE, PLATFORM, &C.

BED, § R.M.L., 6·6-INCH HOWITZER (MARK I.)

(Plate II.)

(List of Changes, §§ 3506, 4002, 4364.)

The bed consists of two double-plate brackets, with wrought-iron frames and steel plates, connected by a bottom plate of iron and front and rear transoms of steel. It rests upon six metal rollers, with steel axles. It stands over a guide-bar fitted with two compressor bars on either side, the bottom plate being attached sufficiently high up to allow the guide-bar to lie below it. The guide-bar is built up of channel and plate iron, and has a hinged metal flap in front, which fits over a pivot on the wooden ground platform. It has stops in front and rear to check the bed in running up or on recoil, and in rear an eye by which it can be hooked up to an ordinary siege limber.

Elevating Gear.

The elevating gear consists of an endless screw and worm wheel, placed on the outside of the right hand bracket only, and connected

* The clamps are of the pattern distinguished as (b) in Vocabulary, 1879, p. 356.

† The pivots are of the pattern distinguished as (b) in Vocabulary, 1879, p. 456.

‡ Pins wrought-iron, keep, pieces, pivot, rifled M.L. guns, p. 454 Vocabulary, 1879.

§ This bed is an adaptation of that for the 8-inch howitzer, and is the same as that for the 6·3-inch howitzer, except that the elevating gear is arranged differently.

with the elevating arc by a toothed pinion. The worm wheel is fitted with a friction cone, which is adjusted by means of the nuts on the end of the spindle, so as to allow a slight slip at each round.

The parts of the gear are specially numbered for each bed, and are not interchangeable.

Compressor Gear.

The compressor gear consists of a bow or cramp resting on the bottom of the bed, and fitted with a screw and lever at each end for adjustment and compression, by which three hanging plates on each side (projecting through openings in the bottom plate) are forced against the sides of the guide-bar and compressor bars supported on it. The inner hanging plates on each side are formed with a clip or projection on the inward side, to prevent the bed rising above the guide-bar. Two plates are fixed on the bottom plate, to prevent the compressor plates shifting when the bed jumps during recoil. The compressor lever works on an arc on the left side, on which is a projection, under which the lever is held when the compression is on; the adjusting lever works on an arc on the right side, to which it can be keyed as desired.

The front of the guide-bar is slightly tapered to allow the carriage to recoil two feet before the compressor comes fully into action; the sides are grooved for the clips on the inner compressor plates, so as to allow the bed to jump the height of the bar at the commencement of the recoil.

To adjust and work the Compressor.

Before commencing practice, run the bed back about 3 feet from the front stops, and adjust the compressor by means of the adjusting screw and lever,* till one man exerting his whole power on the compressor lever can just force it past the catch; then secure the adjusting lever by the French key, release the compressor lever, and run the howitzer up for firing.

Should the recoil be found to be too violent, the adjusting lever must be moved one or more holes towards the front of the bed, and again secured by the French key.

If the lever is found to be too far to the front to give the required adjustment, remove the nut and collar of the screw, take off the lever, turn it to the rear until it can be replaced on the next position of the hexagon of the screw, and secure it with the nut and collar. Should the recoil be less than required, a similar alteration of the lever, but in the reverse direction, should be carried out.

To run up.

Release the compressor lever on the left side, lifting it past the catch of the arc, and to the front stop.

As the compressor is not self-acting, great care must be taken that the compressor lever is always pressed down past the catch, before each round, as soon as the howitzer is run up.

* For no other purpose than adjustment should the adjusting lever be moved. It is tightened by moving it to the front, and slackened by moving it towards the rear.

Height to axis of trunnions above the ground platform	3 ft. 0.5 in.	
Maximum elevation	45°	
Weight	bed	23½ cwt
	guide-bar	8 "
	limber, with large box	13½ "
	axletree, with wheels	12½ "
Tonnage, with platform	5.889	

PLATFORM, GROUND, HOWITZER BED (MARK I).

(List of Changes, §§ 3137, 3495, 4002.)

The platform used for the 6.6 inch howitzer, when mounted on its bed, is of oak, and consists of two side baulks dovetailed and bolted to two transoms, and two centre baulks housed into the same transoms.

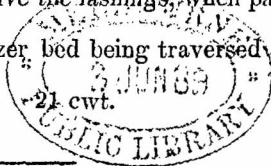
The front transom is fitted with a pivot for the attachment of the guide bar of the howitzer bed; the pivot, and the four bolts which secure it, pass through the transom, and are fastened on the under side by keys.

At the middle of the platform, lengthways, a strap of iron is placed underneath, the ends being turned up and secured to the outer baulks by screw loops.

The portion of the platform occupied by the bed, when in position for firing, is plated with iron, to protect it from the wear of the bed rollers, and a grooved plate is let into the rear transom to facilitate the traversing of the guide bar by a handspike. The outer ends of the transoms and the ends of the side baulks are hooped, to preserve them from splitting. Lashing-rings are secured in the ends of the transoms, and the under side of the baulks, to receive the lashings, when packed for travelling.

The platform will allow of the howitzer bed being traversed 5° to right or left of the centre line.

Weight 21 cwt.



LIMBER SIEGE, TRANSPORTING BED, R.M.L. HOWITZER (MARK I).

(List of Changes, §§ 2969, 3462, 4002.)

The limber is the wrought-iron limber used for all wrought-iron siege carriages. The futchells and splinter bar are of wrought iron, the axletree bed also is of wrought iron, and forms with the axletree a beam of box girder section. The limber is fitted with a limber-hook, steeled with a piece of steel welded in to prevent wear, and fitted with a steel key 1¼ inch diameter.

The shafts are one pair "near" and "off," the former being of the field pattern, and the latter similar to the field pattern, but having a loop for the stay of the outrigger; also another pair framed and attached to the splinter bar. There are outriggers for 4-horse draught.

The wheels are second-class field, Mark III. The washer is a "loop washer," having a shorter loop than the usual drag washer.

BED AND PLATFORM PACKED FOR TRAVELLING.

Bed.

The bed is run up and secured to the directing bar by setting up the compressor, the metal flap is removed from the bar, and the front secured to the bed by chains, with eyes to secure to the flap bolt, and a clip to secure to the top of the transom; a pin is passed through the bottom plate of the bed and the bar, and is secured underneath by a key.

A transporting axletree is passed through the square bushes near the front of the bed, on which is placed a pair of 1st class siege wheels.

The gun-metal rollers are removed and packed in the box on the limber; two brackets with shackles are secured by the axles in the position of the rear rollers; a wood block is placed in the trunnion holes, and the eye on the directing bar is attached to the hook of the siege limber.

Ground Platform.

The ground platform having been taken apart by the removal of the bolts, pivot, and the centre iron strap with screw loops, the parts are removed and packed in the box on the limber; the two transoms are lashed together and laid across the rear of the bed, resting on the directing bar, and the brackets in the rear roller holes.

The two side baulks are lashed together, and with the two centre baulks, also lashed together, are placed on the bed, side by side, resting on the transoms and on the block in the trunnion holes.

The whole ground platform is then securely lashed in position, the lashings being passed through the rings on the transoms and baulks and those on the bed.

						Feet	inches.		
Height over all ..	..	..	..	..	..	6	3½
Length of { bed	{ with wheels	..	..	..	..	11	1
		{ without "	..	..	..	9	9
Length of bed	axletree	..	..	..	..	6	3½
Length of bed	{ without ground platform	..	..	..	..	21	8
		{ with	"	"	..	22	3		
Minimum space through which carriage can turn	..	..	..	..	..	33	5
Wheels	{ track	..	..	..	..	5	2
		{ diameter	..	..	..	5	0
						cwt.	qrs.	lb.	
Weight	{ bed complete	31	1	0	
		limber	13	1	0	
		{ wheels	bed	10	2	0
			limber	4	2	4
total, packed for travelling, with platform						82	3	0	

CARRIAGE, SIEGE R.M.L. 6.6-INCH HOWITZER (MARK I).

(Plate III.)

(List of Changes, §§ 3005, 4432, 4492).

The carriage used for this howitzer is similar to the 40-pr., Mark II, with additional fittings for the hydraulic buffer.

The carriage is formed of two bracket sides, connected by transoms, bolts, and a trail piece with steeled eye, an axletree bed with first-class axletree, and 5 feet siege wheels with metal naves and phosphor bronze pipes.

Each bracket is constructed of plate iron, riveted to the inner side of an angle iron frame, and is provided with firing and travelling trunnion holes.

The axletree bed is of wrought iron, constituting with the axletree a beam of box girder section; it is connected to the brackets by angle stays.

The elevating gear is fitted on the right side only. It consists of an endless screw, with hand wheel, held in bearings on the outside of the carriage bracket, gearing into the teeth of a worm wheel (fitted with friction cone), which gives motion to a pinion on the inside of the bracket gearing with the arc attached to the gun. The arc is kept in gear with its pinion by a metal friction roller on the bracket. The worm wheel and endless screw are covered by a metal guard made in two parts, and hinged together so as to give ready access to the wheel, &c.

A stool bed of wood, strengthened by angle iron along each side, a large coin, a hand coin, and a small hand coin are fitted to and issued with each carriage for use in laying the gun, in case of any damage to the elevating gear; the stool bed also serves as the shifting plank for the gun roller (also supplied) when required to shift the gun from or to the travelling trunnion holes.

A pocket for priming irons is strapped on the rear transom.

The carriage is fitted to carry a hydraulic buffer suspended under it. The fittings consist of two vertical rods suspended from wrought-iron brackets under the axletree bed, and two side rods secured to wrought-iron brackets under the trail, and to the trunnions of the hydraulic buffer. The rods suspended under the axletree bed are each fitted at the lower end with a bearing, with jointed cap-square and French key to support the buffer by its trunnions. For central pivot there are two additional brackets on the trail, to which the buffer is secured by a connecting rod.

For travelling, the cap-squares are opened, the buffer-trunnions released, and the buffer secured close under the axletree bed.

The siege travelling carriage, fitted with hydraulic buffer, is intended to be used on a double-decked wood ground platform, furnished with wheel guides, wheel plates, and trail plank.

Hydraulic Buffer.

The buffer is of special pattern for use with siege carriages; the front and rear caps are of wrought iron, and screwed on the cylinder; a ring with trunnions is secured near the centre of the cylinder, and connected with the front cap by tie bars; the front cap is arranged

for a leather packing ring, and also for cotton instead of the usual hemp packing. The piston rod is 2.75 inches diameter; and the front end is screwed to receive a link, by means of which it is shackled to the anchoring bar.

The buffer being fixed to the carriage by its trunnions, and the piston rod shackled to the anchoring arrangement, when the carriage is run up, the piston rod is pushed into the cylinder, and the piston pushed by the rod to the rear of the cylinder, the oil passing to the front of the piston. As the carriage recoils, the piston and rod are drawn down the cylinder, the resistance to its passage by the oil which can only pass from the front to the rear of the piston through the holes in it, checking the recoil.

In the hydraulic buffers for siege carriages the size and number of holes in the piston do not vary. There are four holes of 0.35 inch diameter.

The buffer is 5 feet $1\frac{1}{2}$ inches long internally, the piston is 2 inches thick, thus the buffer allows of a possible recoil of 4 feet $11\frac{1}{2}$ inches; practically 4 feet 9 inches should never be exceeded.

	Charge.	Working quantity.	Quantity to be drawn off.
	lbs.	quarts.	quarts.
Working contents of buffer to allow about 4 feet recoil.	5	13	$7\frac{1}{2}$
	3	17	$3\frac{1}{2}$
	2	16	$4\frac{1}{2}$

Before action, see that the cylinder contains the requisite quantity of oil; that there is no leakage at the gland; that the buffer is properly attached to the carriage with the tie bars secured by the split keys, and that the piston rod is properly shackled to the anchoring apparatus.

To fill the cylinder with oil—Run the carriage up, take out the screw plug, and rest the gallon measure in the hole, turn off the cock, and fill the measure with mineral oil to the gallon mark, then turn the cock and allow the oil to flow into the cylinder. Repeat the operation until the buffer is full ($5\frac{1}{2}$ gallons); then draw off sufficient to reduce the contents to the required quantity.

Oil is withdrawn by means of the front screw valve, air being let into the cylinder at the same time by the removal of the rear plug.

If leakage occurs at the gland and tightening up the latter does not remedy it, the packing must be renewed.

To renew the packing: Remove the shackle on the piston rod unscrew the metal gland with the spanner provided (spanner hydraulic buffer No. 1), and with the tang of a file extract the cotton packing then by drawing out the rod, the remaining portion of the packing, *i.e.* the metal ring and leather collar will come out with it. Place the new leather on the rod so as not to damage its thin edge, follow it with the metal ring, and press them both home to the bottom of the stuffing box, then after inserting the cotton packing, tighten up the whole with the metal gland. The cotton rings must be a quarter of an inch less in length than the circumference of the piston rod, and have the ends bound with cotton yarn. When required for use the rings must be well greased with tallow, and placed in the stuffing box, so that the ends do not coincide. If necessary to withdraw the piston and rod from the cylinder, the buffer must be removed from the carriage, and rigidly lashed to skidding to prevent it turning while removing the rear cap.

After warming the cap with a piece of hot iron (which by softening the red lead and expanding the iron facilitates removal), unscrew it by tapping the spanner with a hammer, the shackle should be detached, and the gland slackened before removing the piston rod. During this operation great care must be taken to prevent damage to the component parts.

To replace the piston and rod—Slide the latter up the cylinder to the front cap, then with the tang of a half-round file inserted through the stuffing box, prise it into its bearing, while it is being forced forward from the rear. Before replacing the cap, coat its thread and that of the cylinder with red lead.

To connect the buffer to the carriage.—Lay the buffer with the filling hole uppermost beneath the carriage in a line with the axis of the gun, lift the tie bars and attach them by the connecting bolt to the brackets on the trail, then raise the front of the buffer with a handspike, and secure its trunnions in their bearings by the cap squares and French keys provided for the purpose.

For travelling, the piston and rod are pushed home in the cylinder and secured by a strap, the thick end of the shackle pin being uppermost; the buffer is then lifted by handspikes and secured by the chains on the carriage. The vertical rods are folded backwards, and rest on the top of the cylinder.

Dimensions of Carriage.

Height to centre of gun	..	..	..	..	..	..	ft.	in.
Length of	{ carriage	{ with wheels	..	..	..	..	4	5
		{ without „	..	..	..	..	11	7
	{ axletree	..	..	..	..	..	10	9½
Angle of trail..	..	..	..	..	..	..	6	3
Elevation maximum	..	..	..	..	..	..	20°	
Depression	..	..	..	..	..	..	35°	
								5°		
								ft.	in.	
Wheels	{ track	..	..	..	..	..	5	2
	{ diameter	..	..	..	..	..	5	0
								cwt.	qrs.	lbs.
Weight	{ carriage, with wheels, drag, shoe, and	33	3	5	
	{ elevating gear	10	2	0	
	{ wheels (2)	4	0	23	
	{ hydraulic buffer, empty				

List of stores that can be carried on the carriage—

							No.
Arc, elevating..	..	..	..	..	..	..	1
Coins, wood, hand	..	..	..	..	..	..	3
Hammer	..	..	..	..	..	..	1
Handspikes	..	..	..	..	..	..	5
Pincers (pair)	..	..	..	..	..	..	1
Roller, shifting	..	..	..	..	..	..	1
Spanner, McMahon's	..	..	..	..	..	..	1
Socket priming irons..	..	..	..	..	..	..	1
Stool bed	..	..	..	..	..	..	1
Waterbrush	..	..	..	..	..	..	1
Tube pocket	..	..	..	..	..	..	1
Wadhook	..	..	..	..	..	..	1

Fixed Pivots.

If the carriage should be employed in permanent fortifications, it can be used with a front pivot without alteration, but special fittings will be required on the carriage if it is to be attached to a central pivot. The same pattern block is used for both pivots.

*Central Pivot.**(Plate IV.)*

For this the buffer is reversed, and secured by special fittings to the carriage and pivot.

A guide in the form of a wheel, which revolves around the top of the pivot block is used to ensure the carriage being "run up" with its centre over the axis of the buffer, to prevent strain on the piston rod.

The pivot consists of a cast iron pivot block and a steel pivot plug; the latter is forged with a crutch head, which has suitable bearings for the buffer trunnion.

The guide is a wheel with wood spokes and felloes, bound with a 3-inch ring tire, and fitted with a special cast iron nave, which is bored to suit the top of the pivot block.

When in position the buffer trunnions are secured to the pivot plug by caps, and the piston rod is attached by a connecting rod to the trail. The connecting rod is steadied and held in line by two steel bolts inserted in brackets on the trail.

NOTE.—These brackets are additional to those used when the carriage is attached to the anchoring apparatus.

*Front Pivot.**(Plate V.)*

The fittings on the carriage for this pivot are the same as for a front anchorage.

With this pivot the carriage is mounted on a ground traversing platform, which consists of two sides of teak connected by transverse pieces, and a trail plank also of wood.

At the front of the platform on either side is a metal roller on an eccentric axle, with a socket for an iron pointed lever to facilitate traversing.

Handspikes are used under the trail plank.

APPARATUS, ANCHORING, CARRIAGES WITH HYDRAULIC BUFFERS

(MARK I).

*(Plate VI.)**(List of Changes, § 4430.)*

This apparatus is for use with siege carriages fitted with hydraulic buffers to control recoil.

It consists of an iron tie rod, $1\frac{1}{2}$ -inch in diameter and 12 feet $5\frac{1}{4}$ inches long, having at one end a shackle and bolt to connect it with the eye of the piston rod of the buffer, and at the other end a "plus thread" screw, fitted with a nut, and iron plate, 1 inch by 9 inches by

9 inches, to secure it to the beam. This iron plate has a circular hole $1\frac{3}{4}$ -inch in diameter in centre, through which the tie-rod passes. Two iron links are attached to the tie-rod to allow, if necessary, of greater lateral training.

There is a beam of oak, 9 inches by 9 inches by 10 feet long, with a circular hole $1\frac{3}{4}$ inch in diameter, in the centre; another also of oak, 4 inches by 9 inches by 3 feet long, without any hole, this latter beam is to prevent the tie-rod being forced through the large beam when running up the howitzer.

In laying the anchorage, which would necessarily have to be done in constructing the battery, the 10 feet oak beam should be laid at such a depth that the tie-rod, when shackled up, will be parallel to the upper surface of the platform (generally laid at a slope of 1 in 24), and at such distance from the interior slope of the parapet that the eye of the tie-rod will just be clear inside the revetment, and so be in a convenient position for shackling up. It is essential that the position of the shackle should be such that its bolt will be vertical, so as to admit of lateral play when traversing in the process of laying the gun. The height of the shackle from the level of the platform will depend upon the height of the axis of hydraulic buffer. It should be about 1 inch less than the height of this axis.

Estimated weight .. ..	..	..	..	cwt.	qr.	lb.
				3	1	21
Estimated tonnage					tons.	
						0.223

PLATFORM, GROUND, DOUBLE-DECKED (MARK I).

(*List of Changes*, § 4224.)

The platform consists of two layers of 3-inch fir planks, those of the bottom layer parallel to the line of fire, those of the upper layer at right angles to it; under the bottom layer are placed four transverse planks, similarly to those in the top layer, one at the front, another at the rear of the platform; the other two dividing the distance between them. The layers are connected by 5-inch coach screws through both ends of all the transverse planks. Two short hurters, each 3 feet by 6 inches by 6 inches, are also provided to prevent the gun carriage running up too far. These hurters, which are each secured by four 9-inch coach screws, are laid down with an interval of about two feet in the clear between them, so that the buffer with which the carriage is anchored may not foul them.

They should not be secured until the howitzer is placed in the firing position with the piston rod home in the buffer; they should then be screwed down in contact with the front of the wheels.

One platform consists of:—

Bottom layer, 16 planks—18 ft. by 9 in. by 3 in.	
Top layer, 24 "	}
Transverse planks, 4 "	
} 12 ft. by 9 in. by 3 in.	
48—5-in. coach screws, $\frac{5}{8}$ -in. diameter	
8—9-in. coach screws, $\frac{5}{8}$ -in. diameter.	
2 hurters, 3 ft. by 6 in. by 6 in.	

Almost any scantling may be used for hurters.

These platforms should be laid at a slope of 1 in 24 ($2^{\circ} 23'$) to the front, with a clear space of 1 foot between the front of the platform and the foot of the interior slope.

The object of this arrangement is—

1. To leave a sufficient gangway between the front of the wheels and the interior slope, so as to enable the Officer, or No. 1, who lays the gun, to pass round to the front of the trunnions, when the gun is in the firing position, to lay "reverse."

2. For convenience of drainage.

3. To prevent the earth and stones shaken down by the shock of firing falling on the platform.

The average weight of double-decked platforms is about 35 cwt.

PLATFORM, HOWITZER, WOOD, SIEGE.

(Plate V.)

This platform, still in experimental stage, is one likely to be adopted for use with all howitzer carriages. The plate explains the nature of the platform, a full description of which will be given when the details are finally settled, and a pattern sealed.

NOTE.—These platforms, as well as the pivots and anchoring apparatus, will be carried and laid by the Royal Engineers.

GUIDES, WHEEL, PLATFORM, SIEGE (MARK I).

(List of Changes, § 4435.)

The wheel guide is of elm, plated with iron on the curved edge. Two such guides are issued with each platform. They should be screwed down on the platform after the carriage has been run up into the firing position, and the buffer shackled to the anchoring arrangements, care being taken that the piston rod is in exact prolongation with the tie rod. Their object is to restore the gun each time it is run up, to a correct position with regard to the anchorage, and to simplify the process of laying reverse.

Weight of each	qr.	lb.
	1	15

The screw is of iron and galvanized.

Four of these screws are used to secure each wheel guide.

Weight of each	lb.	oz.
	1	6

PLATE, STEEL, WHEEL, PLATFORM, SIEGE (MARK I).

(List of Changes, § 4435.)

The wheel plates are of steel, 18 inches by $\frac{1}{2}$ inch by 6 feet. One of these plates is to be placed under each wheel of the carriage to protect the upper layer of the platforms.

Weight of each	cwt.	qrs.	lbs.
	1	2	10

PLANK, TRAIL, SIEGE (MARK II).

(List of Changes, § 4435.)

The trail plank is of oak, 12 inches by 3 inches by 6 feet, shod on both sides for the whole of its length with channel steel, and fitted with four rope handles. It is to be placed under the trail of the carriage to preserve the ground platform from injury.

LIMBER, SIEGE, R.M.L. (MARK I).

(List of Changes, §§ 2969, 3462, 4002, 4629, 4631.)

The limber is the wrought-iron siege limber, common to the beds and carriages of all pieces in the siege train; the futchels and splinter-bar are of wrought iron; the axletree bed is also of wrought iron; and, with the axletree, constitutes a beam of box-girder section.

The wheels are 2nd class field (Mark III). The washer is a "loop washer," having a shorter loop than the usual drag washer.

The limber is fitted with a limber-hook steeled, with a piece of steel welded in, to prevent wear, and fitted with a steel key $1\frac{1}{4}$ inch diameter.

The shafts are, one pair "near" and "off," the former being of the field pattern, and the latter similar to the field pattern, but having a loop on the iron for the stay of the outrigger; also another pair "framed" and attached to the splinter-bar. There are outriggers for four-horse draught.

When used with the bed the limber carries a "box, limber, transporting bed," fitted to contain the loose parts and tools for the bed and ground platform. When used with the siege carriage it is fitted to take the "box limber R.M.L. howitzer," which contains the following stores:—

	No.
Bit, vent, 17-inch	1
Can, oil, lubricating (a long can)	1
Can, tin, oil, feeding, 1 pint	1
Chalk, white, ozs.	4
Cock, metal, draw off.. .. .	1
Cloths, sponge	6
Couples, trace.. .. .	2
Clinometer (in case)	1
Cylinder, with 6 bits	1
Driver, screw, shrapnel, large	1
Driver, screw, steel, 6-inch	1
Drift, wood	1
Extractor, fuze	1
File, half round, handled	1
Hemp, undressed, lbs.	2
Hook, borer	1
Key, for metal lined cases	1
Key, iron, fuze and plug	1
Knife, clasp	1
Leathers, gland	1
Line, hambro	1
Lanyards, friction tube	3
Line, chalk	1

	No.
Marline, lbs.	3
Match, slow, lb.	1
Measure filling buffer.. .. .	1
Portfire, common	2
Pocket, tube	1
Pocket, fuze	1
Pin, linch, 1st class	1
Pin, linch, 2nd class	1
Plummet, lead.. .. .	1
Plug, screw, filling with chain	1
Pricker, 12-inch	1
Reel, wood	1
Rope, cotton, white, lbs.	4
Stick, portfire	1
Sight, tangent, with cross bar	2
Sight, trunnion, with cross bar	2
Spike, spring	1
Spikes, common	2
Scissors, laboratory	1
Spanner, cap and gland	1
Spanner, plug and cock	1
Tape, measuring	1
Tubes, friction	25
Twine, whipping, lb.. .. .	1
Vent, servers, with lanyards	2
Wax, bees', ozs.	4
Washer, drag, 1st class	1
Washer, loop, siege, limber	1

The box is also fitted to carry an elevating arc, and a 2-gallon oil can, if required.

There is also a smaller store box called "Box Limber Store Siege R.M.L. 8-inch 70-cwt. and 6.6 inch Howitzer," issued with the limber when the howitzer is used otherwise than with the siege train. It carries the following stores—

	No.
Bit, vent, 17-inch	1
Can, oil lubricating (short can)	1
Chalk, white, ozs.	4
Cloths, sponge	6
Couples, trace	2
Clinometer (in case)	1
Clippers, portfire	1
Cylinders, with 6 bits	1
Drift, wood	1
Driver, screw	1
Extractor, fuze	1
Hemp, undressed, lbs.	2
Hook borer	1
Instructions, printed	1
Key plug, G.S.	1
Knife, clasp	1
Line, hambro.. .. .	1
Lanyards, friction tube	3
Line, chalk	1

	No.
Marline, lbs.	3
Match, slow, lb.	1
Portfires, common	4
Pocket, tube	1
Pocket fuze	1
Pin, linch, 1st class	1
Pin, linch, 2nd class	1
Reel, wood	1
Stick, portfire	1
Sight, tangent, with cross bar	2
Sight, trunnion, with cross bar	2
Spike, spring	1
Spikes, common	2
Scissors, laboratory	1
Tube, friction	25
Twine, whipping, lb.	1
Vent, servers, with lanyards.. .. .	2
Washer, drag, 1st class	1
Washer, loop, siege, limber	1

The following list of stores can be carried on the limber— No.

Axe, felling	1
Box tin grease, 3 lbs.	1
Bucket, cavalry	2
Bill hook	1
Drag washer, 1st class	1
Drag washer, 2nd class	1
Drag ropes (pair)	1
Lifting jack, Clerk's	1
Maul	1
Pick axe	1
Swingletrees	3
Shovel	1
Spade	1
Spanner, cap, and gland	1

GENERAL INSTRUCTIONS FOR CARE AND PRESERVATION OF THE BED AND CARRIAGE.

Care should be taken that all nuts and screws are properly tightened up, on no account should a hammer be used in doing this.

A nut, screw, or bolt if removed, should be slightly oiled before being replaced, and a few turns should be given by hand before employing the spanner, to prevent damage by the threads crossing.

All bright parts should be kept clean, and when not in use slightly greased. All bearings should be kept clean, and lubricated through holes provided for the purpose. All working parts, viz., axles, spindles, pinions, compressor and adjusting nuts and screws, rocking levers, pivots, and arcs, must be kept free from clotted oil, dirt, and rust.

The axletrees and grease chambers of the wheels should be frequently cleared from clotted grease, and all dirt and grt removed before lubricating. To insure thorough lubrication, the chambers must be kept filled with grease.

The compressor plates and bars are on no account to be greased but the rust must be removed by scraping to obtain regularity in working.

Store boxes should be removed occasionally and examined underneath. Care must be taken to prevent the lodgment of water on any part of the mounting.

When carriages are parked, or placed in a shed with the shafts exposed, the latter should be raised on the props to keep the shafts dry.

Defects or damage should be made good without delay, and if the paint becomes rubbed off at any part, it should be patched over as soon as possible.

PROJECTILES.

(List of Changes, §§ 4030, 4339, 3915, 4337.)

		Weight.		
		lbs.	oz.	
Shell	common	empty	91 1½	
		gas check	3 1	
		bursting charge P and R.F.G	7 9¾	
	Total weight filled		100	0 ± 1.5%
	shrapnel	filled with 318 mixed metal balls, 14 per lb.		96 3½
		gas check	3 1	
		bursting charge	0 11½	
		Total weight filled		100	0 ± 1.5%
	Star spherical, weight		12	0
	Shot case filled with 224 sand shot, 4-oz... .. .		100	0
Method of rotation		Copper gas-check.		

The common shrapnel and case are the same as for the 6-6-inch gun. They are of the ordinary description.

The shells are without studs; the bodies are unturned, being cast to the figured dimensions, leaving 0.15" windage, and bands are left at the base and head turned down to 0.05" windage.

Star Shells.

These shells have 21 stars* filled with magnesium light composition, each star having a small hole through the centre of composition, which after being threaded with quickmatch, is filled and driven with fuze composition to ensure its ignition.

The shell is made of two hemispheres of Bessemer metal 0.22 inch thick, tinned all over and fitted together with a lap joint and further secured by six iron screws and six twisting pins.

The inside of each hemisphere is strengthened by a ring of wrought iron, the upper hemisphere being fitted with a gunmetal socket for a wood time fuze.

	diam.	length.
* 16 stars ..	1.15	2.5
5 " ..	1.15	2.05

In order to keep the fuze-hole of the shell in an axial position when loading, a ring of yellow pine is fastened to the lower hemisphere. This shell will be fired with a 2 lb. charge, and 15 seconds' wood time fuze. As a rule it should be burst about 100 feet about the plane, so as to ensure sufficient dispersion of the stars before reaching the ground.

15 degrees elevation and fuze bored to 10, gives about 900 yards' range.

35 degrees elevation and fuze full length gives about 1800 yards' range.

Average time of burning about $1\frac{1}{2}$ or two minutes, the brighter stars burning out more quickly.

Average total weight 12 lbs.

Incendiary Stars.

Incendiary stars are intended for filling common shells which are to be used for incendiary purposes. Each star consists of a hollow paper cylinder about 2 inches in length, 0.7 inch in external diameter, and 0.5 inch in internal diameter, soaked in paraffin wax, and filled with the following composition, viz. :—

India-rubber solution	..	..	2 oz.
Powder, mealed	..	..	5 "
Saltpetre, ground	..	..	1 "
Paraffin wax ..	..	..	$0\frac{1}{4}$ "
Naphthaline ..	..	..	$0\frac{1}{4}$ "
Coal tar ..	..	..	1 "

with half the weight of the mass, of mealed L.G. powder, added.

Each end of the star is primed with quickmatch.

The shell will hold about 97 stars with 2 lb. 9 oz. of L.G. powder.

The stars are packed in tin-lined deal boxes holding 200 stars; they are not wrapped in bundles, but over the stars a sheet of brown paper and paper shavings are placed before the closing plate is soldered down.

Gas Check.

The rotation is effected by means of the gas-check, the curved portion of the base of the shell being cast with radial grooves, into which the inner surface of the gas check is compressed by the pressure on firing; the gas check is also at the same time firmly attached to the base of the shell by being compressed into the groove or neck round the projecting part at the rear end of the shell.

The gas check is made with projections round the circumference corresponding with the rifling grooves of the howitzer. It is suitable for either common shrapnel shell; it can be slightly attached to the shell before loading by striking it with a pointed hammer or chisel at two or three points round the neck at the base, or it may be inserted loose in the bore (taking care to insert it in the proper direction for fitting on the shell), when it will become attached to the shell in ramming home.

FUZES.

(Plate VIII.)

(List of Changes, §§ 4496, 4685, 4686, 4824.)

PERCUSSION DIRECT ACTION.

The question of a time fuze for howitzers is still under consideration. Should necessity arise before it is settled, there would be issued the

TIME, WOOD, 15" WITH DETONATOR AND 0.012" SUSPENDING WIRE;
and the TIME, WOOD, 15" SPECIAL PRIMING for Star Shell.

INSTRUCTIONS FOR THE PREPARATION OF SHELLS AND
FUZES, AND THE EXAMINATION OF FILLED SHELLS.*(See Clause 175 Army Circulars, 1884.)*

PERCUSSION, DIRECT ACTION, FOR COMMON SHELL.

These fuzes require no preparation, except the removal of the metal cap; they are screwed firmly into the fuze-hole by means of the "Key, iron, plug, G.S.," which fits into the square hole in the cap. This cap is fastened on to the head of the fuze by two double bayonet joints, which enable the cap to be used either in fixing or unfixing the fuze. The cap can be removed by bringing the centre of the bayonet joints in line with the studs on the side of the head of the fuze.

The cap will not be removed until after entering the shell into the muzzle.

TIME, WOOD, 15" WITH DETONATOR, 0.012 WIRE.

These fuzes should be screwed into the fuze-hole by hand; when they cannot be screwed any further they are properly secured. They must not be fixed by striking them with a mallet or any other instrument, neither must they be struck against anything.

The fuzes are prepared for any desired time of flight by boring through the side-hole corresponding to the required time, into the composition.

When using the hook-borer place the fuse in the hook of the hook-borer in the proper position for boring the required hole; enter the bit into the side-hole, screwing up until the bit has entered as far as the borer will allow, taking care to press the fuze with the fingers so as to ensure its bedding fairly in the hook.

Unscrew, and, when the bit is quite clear, remove the fuze from the hook. The length of the bit is so regulated that, when placed in the handle, it will enter sufficiently far into the composition when screwed down to the shoulder. If the bit should become unserviceable, the handle must be detached from the shank and the tightening screw unscrewed, the square hole in the hook being made for that purpose. Care must be taken when substituting another bit that it is properly placed in the handle, and that the tightening screw firmly presses upon it, for if any space be left between the handle and the head of the bit,

the end will not enter a sufficient depth into the composition. The borer should be occasionally examined and cleaned. The operation of preparing the fuze and fixing it in the shell takes, on an average, about 15 seconds; with a little practice these operations may be performed in a shorter time.

The safety-pin is not to be withdrawn until after entering the shell into the muzzle.

Extracting Wood Fuzes.

Apply the fuze extractor to head of fuze and unscrew.

FILLING AND SECURING SHELLS.*

Common Shells.

Remove the plug from the fuze-hole, insert the leather funnel and pour in the bursting charge, in quantities of about 2 lb. P., and then 5 oz. F.G. alternately, each set of powders being well mixed up; the shell should be tapped with a mallet or a piece of wood to ensure its being completely filled, just leaving room for the fuze if it is to be fuzed with a time-fuze; this can be done by inserting a piece of wood the same size as the fuze; after filling the shell carefully, wipe every portion of powder from the fuze-hole, then fix the fuze or plug as may be required.

In shells that are liable to be moved, or that are not required for immediate use, and in shells for use in the field, insert the wad, papier mâché, G.S., with the side on which the shalloon is cemented downwards, *i.e.*, next the powder; drive it in with the "drift, wood, G.S.," as far as the shoulder on the drift will allow, and then screw in the fuze or plug, as may be required.

Shrapnel Shells.

Remove the plug from the fuze-hole, and after seeing that the fuze-hole is clear of any dirt, &c., insert the leather funnel and pour in the bursting charge, which has been previously weighed out or measured. This must be done gradually, for if the whole of the powder is put in at once the tube will probably become choked. This shell should be tapped on the side with a wooden mallet, until the whole of the bursting-charge has passed down the tube, taking care that none of the powder is left at the bottom of the socket. Drop in the metal primer † and, by means of the large Shrapnel screwdriver, ‡ screw it tightly into the tube, and then screw in the fuze or plug as may be required.

Common Shells for Incendiary Purposes.

The shell to be prepared for incendiary purposes, if already filled with the bursting charge, will be emptied, and then filled up as far as possible with incendiary stars. The shell should be tilted to one side, and the stars put in gradually and occasionally "set" or shaken down, so as to bed themselves evenly together. (A small wooden stick will be found of assistance in getting the stars well in.) When no more

* Shells for siege purposes are issued filled.

† *Vide* L. of C. 4538.

‡ *Vide* L. of C. 4790.

stars can be inserted, L.G. powder is introduced, the shell being tapped with a mallet or piece of wood in order to have the shell completely filled. The fuze or plug will be then inserted, as may be required.

Before using a shell, it should be ascertained that there is powder close to the fuze hole. These shells are fuzed with percussion fuzes.

FIXING PLUGS AND FUZES.

When plugs or metal fuzes are screwed into shells, they will be lubricated with Field's grease, No. 3 if for use at home stations or in British North America. Price's composite grease is to be employed in all other stations.

Projectiles fitted with plugs, and kept in exposed situations where the plugs are liable to become set fast by corrosion from the action of salt water or otherwise, should have their plugs unscrewed once at least every six months, and the screws cleaned and re-lubricated as above.

Instances have occurred in which fuze-hole plugs of common shells have been so jammed in as to be immovable, in consequence of using the "Wrench, removing base plugs of Palliser shells." The "Key, iron, fuze and plug, G.S.," and the "Key, iron, plug, G.S." are the only implements which should be used for screwing in the G.S. plug.

DISTINGUISHING MARKS.

All filled shells must be marked with the word "Filled" and date. The colour of the paint will be red on a black ground, or black on a red ground. At stations where means are available, the monogram is to be painted on the shell. Shrapnel have their heads painted red.

Shells which have been emptied will be marked on the head with the letter E in red paint.

EXAMINATION OF FILLED SHELLS.

Common Shell.

Remove the fuze-hole plug, pass the "metal hook for removing wads" through the hole in the centre of the wad, and draw the wad out of the fuze-hole; if the powder charge is in a serviceable condition, insert a new papier mâché wad, and replug the shell as directed in instructions for filling. If the powder charge is found to be caked from the effects of damp, empty the shell and clean it out. If the powder is so caked that it will not run out of the shell, or if any powder remains adhering to the interior of the shell, fill the shell with boiling water and allow it to stand for about five minutes, then pour out the water and fill up again with boiling water. After standing for fifteen minutes more, the shell may be emptied, using the copper scraper for shells to facilitate the removal of the wetted powder. The scraper must not be applied until after fifteen minutes have elapsed after the second quantity of boiling water has been poured in. When the shell is perfectly dry, refill with serviceable powder.

Shrapnel Shells.

Remove the fuze-hole plug, unscrew the primer with the "large screw-driver," and lift out the primer with the "metal pincers for removing primers"; turn the shell nose downwards, and if the powder charge flows out and is serviceable, refill and replace primer and plug;

the shell should be well shaken if the powder does not come out quite freely, as a portion of the powder may possibly be jammed in the tube; if the powder cannot be extracted as above, being caked from the effects of damp, &c., the primer and plug will be replaced, and steps taken for the exchange of the shell.

NOTE.—If means are available, a wooden horse placed over the open mouth of an empty powder-barrel, should be used when emptying shells by up-ending them, and for shells filled with powder in bags, a piece of metal tubing, or a piece of sheet copper rolled up into a tube as large in diameter as can be inserted through the neck of the bag, will greatly facilitate the extraction of the powder.

CHARGES.

(List of Charges, § 4462.)

Silk cloth 5, 3 and 2 lb. R.L.G.²

DIRECTIONS FOR MAKING UP CARTRIDGES.

(See Clause 155, Army Circulars, 1883).

Filling.

Care will be taken to see that the cartridge bags are properly dry before being filled, and the proper charge will be carefully weighed out, and inserted in the bag by means of the "Funnel, copper, cartridge." Cartridges will be choked by drawing together the mouth of the cartridge into several pleats with a brass needle, threaded with silk twist, the silk twist being doubled; after drawing together the mouth of the cartridge, three turns will be taken round the pleats, and the choke thus formed will be further secured by passing the needle three times through it, alternately above and below the turns, thereby stitching down the turns round the choke at two points equidistant from each other.

Hooping.

1st. With braid hoops.—Draw the braid through the serge or silk cloth until the knot of the loop comes home to the serge or silk cloth, the single end being already passed through the loop from underneath, pass the single end to one side of and under the loop, then draw the loop tight and keep it so by placing the forefinger of the left hand firmly on the loop; bring the running end between itself and the loop, and draw tight the single bend thus formed, *taking care that the bend bites on the loop and not on the single end*, otherwise the knot will slip. The maintenance of the proper form of the cartridge depends on the hooping being thus secured.

2nd.—With worsted or silk twist.—After making the last stitch in choking, the needle will be turned downwards and carried through the powder and out of the seam in the line for the front hoop, the worsted or silk twist will then be carried tightly round the cartridge so as to form a hoop, and will be stitched to the cartridge at two or three points in the same way as the turns at the choke were secured and the remainder of the hoops will then be similarly formed.

Marking filled Cartridges.

There is only one pattern of empty cartridge, which is marked for 5lb., 3lb., or 2lb. The cartridge, when filled with any charge, will have the other charges, which are marked on them, crossed out. They will be properly choked as usual, but the end of the choke will not be cut off.

All cartridges issued from store filled will have the initial or monogram of the station at which they are filled stamped on the bottom end. Cartridges filled with powder will be marked with the letters "R.L.G." in *black* printer's ink, 1 inch long. About $\frac{1}{4}$ oz. of ink will be sufficient for 100 cartridges.

The cartridges filled by the Royal Artillery will be distinguished by having no initial letter stamped on them. This order does not apply to cartridges filled by working parties of Royal Artillery for the Ordnance Store Department (see § 3564, "List of Changes in War Material," &c).

The following initials and monograms will be used at the several stations mentioned:—

Home Stations.

Alderney	A	Dublin	DN	Pembroke	P
Aldershot	A	Edinburgh	E	Sheerness	S
Chatham	C	Fort George	G	Tynemouth	T
Chester	RC	Gosport	G	Upnor	U
Cork	RC	Guernsey	G	Woolwich	W
Devonport	D	Harwich	H		
Dover	DR	Jersey	J		

Foreign Stations.

Barbadoes	B	Hong Kong	HK
Bermuda	B	Jamaica	JA
Cape Town	C	Kingston, Canada	K
Ceylon	C	Malta	M
Gibraltar	GIB	Mauritius	M
Halifax, N.S.	H	Quebec and Montreal	Q

Finished Cartridges.

All cartridges will be very carefully examined and gauged as to length and diameter previous to packing.

Drill Cartridges.

Drill cartridges are a special manufacture and issued complete; are of wood, covered with raw hide, and made to the shape of the cartridge they represent.

RANGE TABLES.

(Based on Practice of December 1879, March, April, and May 1880.)

Projectiles, common and shrapnel shells, fitted with rotating gas-checks: weight, 100 lb.

Charge, 5 lb. R.L.G.² powder. Muzzle velocity, 839 f.s.

Range.	Drift, right.	Elevation.		Deflection, left.		Angle of descent.		Remaining velocity.	Five minutes' elevation increases or decreases the range by	Five minutes will alter point of impact vertically or laterally at each range.	50 per cent. of rounds should fall within			Time of flight.
											Length.	Breadth.	Height.	
yds.	yds.	°	'	°	'	°	'	f.s.	yds.	yds.	yds.	yds.	yds.	secs.
400	0:05	0	58	0	0	4	1	40	811	0:58	6:1	0:08	0:18	1:4
500	0:2	1	26	0	1	2	2	8	805	0:72	7:6	0:10	0:28	1:7
600	0:4	1	54	0	2	2	3	36	799	0:87	9:1	0:12	0:41	2:0
700	0:6	2	22	0	3	3	4	793	17:9	1:01	10:5	0:15	0:56	2:4
800	0:8	2	50	0	3	3	3	32	787	1:16	11:9	0:20	0:74	2:8
900	1:0	3	18	0	4	4	4	1	781	1:19	1:31	0:25	0:93	3:2
1,000	1:2	3	46	0	4	4	4	30	775	1:19	1:45	0:30	1:15	3:6
1,100	1:5	4	14	0	5	5	5	0	769	1:19	1:60	0:35	1:39	4:0
1,200	1:8	4	42	0	5	5	5	30	763	1:19	1:74	0:40	1:66	4:4
1,300	2:1	5	10	0	6	6	6	3	757	1:19	1:89	0:50	1:97	4:8
1,400	2:4	5	38	0	6	6	6	36	751	1:19	2:03	0:60	2:30	5:2
1,500	2:8	6	6	0	6	7	7	12	745	1:19	2:18	0:70	2:70	5:6
1,600	3:2	6	34	0	7	7	7	48	739	1:19	2:32	0:80	3:10	6:0
1,700	3:6	7	2	0	7	8	8	24	734	1:19	2:47	0:90	3:50	6:4
1,800	4:0	7	30	0	8	9	9	0	729	1:19	2:61	1:00	4:00	6:8
1,900	4:4	7	58	0	8	9	9	36	724	1:19	2:76	1:20	4:50	7:2
2,000	4:8	8	26	0	8	10	10	18	719	1:19	2:91	1:40	5:05	7:6
2,100	5:3	8	54	0	9	11	11	0	714	1:19	3:05	1:60	5:55	8:0
2,200	5:8	9	24	0	9	11	11	42	709	1:19	3:20	1:80	6:30	8:4
2,300	6:3	9	54	0	9	12	12	24	704	1:19	3:34	2:00	6:98	8:8
2,400	6:8	10	24	0	10	13	13	12	700	1:19	3:49	2:30	7:75	9:2
2,500	7:3	10	54	0	10	14	14	0	696	1:19	3:63	2:41	8:60	9:6
2,600	7:9	11	24	0	10	14	14	48	692	1:19	3:78	2:90	9:50	10:0
2,700	8:5	11	54	0	11	15	15	36	688	1:19	3:92	3:25	10:40	10:4
2,800	9:2	12	24	0	11	16	16	24	684	1:19	4:07	3:60	11:30	10:8
2,900	10:0	12	54	0	12	17	17	18	680	1:19	4:21	3:95	12:30	11:3
3,000	10:8	13	24	0	12	18	18	12	676	1:19	4:36	4:30	13:40	11:8
3,100	11:8	14	0	0	13	19	19	6	672	1:19	4:51	4:70	14:50	12:3
3,200	12:8	14	36	0	14	20	20	0	668	1:19	4:65	5:20	15:70	12:8
3,300	14:0	15	12	0	15	20	20	54	664	1:19	4:80	5:70	16:90	13:3
3,400	15:5	15	48	0	16	21	21	48	660	1:19	4:94	6:20	18:20	13:8
3,500	17:2	16	24	0	17	22	22	48	656	1:19	5:09	6:80	19:60	14:3
3,600	19:2	17	0	0	18	23	23	48	653	1:19	5:23	7:40	...	14:8
3,700	21:5	17	36	0	20	24	24	48	650	1:19	5:38	8:00	...	15:3
3,800	24:0	18	16	0	22	25	25	48	647	1:19	5:52	8:70	...	15:8
3,900	26:8	18	58	0	24	26	26	54	644	1:19	5:67	9:40	...	16:4
4,000	29:9	19	40	0	26	28	28	0	642	1:19	5:81	10:20	...	17:0
4,100	33:3	20	24	0	28	29	29	12	640	1:19	5:96	11:10	...	17:6
4,200	37:0	21	12	0	30	30	30	24	638	1:19	6:11	12:00	...	18:2
4,300	41:2	22	0	0	33	31	31	42	636	1:19	6:25	13:00	...	18:8
4,400	45:8	22	48	0	36	33	33	6	635	1:19	6:40	14:00	...	19:5
4,500	50:8	23	42	0	39	34	34	30	634	1:19	6:54	15:30	...	20:2
4,600	56:2	24	36	0	42	35	35	54	635	1:19	6:69	16:60	...	20:9
4,700	62:0	25	36	0	45	37	37	24	637	1:19	6:84	18:10	...	21:6
4,800	68:5	26	36	0	49	39	39	0	640	1:19	6:98	19:16	...	22:4
4,900	75:5	27	42	0	53	40	40	36	643	1:19	7:13	21:20	...	23:2
5,000	83:5	28	54	0	57	42	42	24	646	1:19	7:27	23:20	...	24:1
5,100	93:0	30	12	1	3	44	44	18	649	1:19	7:42	25:40	...	25:1
5,200	104:0	31	42	1	7	46	46	24	652	1:19	7:56	27:90	...	26:1
5,300	116:5	33	24	1	16	48	48	54	655	1:19	7:71	31:00	...	27:3
5,400	130:0	35	30	1	23	52	52	3	658	1:19	7:85	35:40	...	28:6

Charge, 3lb. R.L.G.² powder. Muzzle velocity, 619 f.s.

Range.	Drift, right.	Elevation.	Deflection, left.	Angle of descent.	Remaining velocity.	Five minutes' elevation increases or decreases the range by	Five minutes will alter point of impact vertically or laterally at each range.	50 per cent. of rounds should fall within			Time of flight.
								Length.	Breadth.	Height.	
yds.	yds.	° /	° /	° /	f.s.	yds.	yds.	yds.	yds.	yds.	secs.
400	1 0	2 36	0 8	3 0	599	10 9	0 58	3 1	0 10	0 16	1 3
500	1 2	3 22	0 8	3 48	594	10 9	0 72	3 0	0 16	0 26	2 4
600	1 5	4 8	0 9	4 36	589	10 9	0 87	4 7	0 22	0 38	3 9
700	1 9	4 54	0 9	5 24	584	10 6	1 01	5 5	0 28	0 52	3 4
800	2 4	5 41	0 10	6 18	579	10 6	1 16	6 3	0 40	0 70	3 9
900	3 0	6 23	0 11	7 12	574	10 4	1 31	7 1	0 55	0 90	4 4
1,000	3 7	7 16	0 13	8 6	569	10 2	1 45	7 9	0 70	1 15	4 9
1,100	4 5	8 5	0 14	9 0	564	10 2	1 60	8 6	0 85	1 37	5 4
1,200	5 4	8 54	0 16	10 0	560	10 0	1 74	9 3	1 00	1 64	5 9
1,300	6 3	9 44	0 17	11 0	556	9 6	1 89	10 0	1 20	1 96	6 5
1,400	7 3	10 35	0 18	12 0	553	9 3	2 03	10 7	1 40	2 23	7 1
1,500	8 5	11 30	0 20	13 6	550	9 3	2 18	11 4	1 60	2 65	7 7
1,600	10 0	12 24	0 22	14 12	547	9 3	2 32	12 1	1 90	3 06	8 3
1,700	11 7	13 18	0 24	15 24	544	9 3	2 47	12 8	2 20	3 50	8 9
1,800	13 5	14 12	0 26	16 36	541	8 3	2 61	13 5	2 50	4 02	9 5
1,900	15 5	15 12	0 28	17 54	538	8 3	2 76	14 2	2 85	4 58	10 1
2,000	17 8	16 12	0 31	19 12	535	7 6	2 91	14 9	3 20	5 20	10 7
2,100	20 0	17 18	0 33	20 36	532	7 6	3 05	15 6	3 60	5 85	11 4
2,200	22 8	18 24	0 36	22 6	529	7 0	3 20	16 3	4 00	6 65	12 1
2,300	25 5	19 36	0 38	23 36	526	7 0	3 34	17 0	4 40	7 45	12 8
2,400	28 5	20 48	0 41	25 12	523	7 0	3 49	17 7	4 90	8 35	13 5
2,500	32 0	22 0	0 44	26 54	521	6 4	3 63	18 4	5 40	9 35	14 3
2,600	35 8	23 13	0 47	28 42	519	6 4	3 78	19 1	6 00	10 50	15 1
2,700	39 8	24 36	0 51	30 42	518	5 6	3 92	19 8	6 60	11 80	16 0
2,800	44 0	25 6	0 54	32 48	519	5 6	4 07	20 5	7 20	13 20	16 9
2,900	49 0	27 36	0 58	35 0	521	4 9	4 21	21 2	7 90	15 00	17 8
3,000	55 0	29 18	1 3	37 24	524	4 5	4 36	21 9	8 60	16 80	18 7
3,100	61 0	31 8	1 8	40 6	527	3 8	4 51	22 5	9 30	19 00	19 7
3,200	69 0	33 18	1 14	43 12	531	3 3	4 65	23 1	10 10	...	20 7
3,300	77 5	35 48	1 21	47 0	536	2 8	4 80	23 7	10 90	...	21 8

Charge, 2 lb. R.L.G.² powder. Muzzle velocity, 482 f.s.

Range.	Drift, right.	Elevation.	Deflection, left.	Angle of descent.	Remaining velocity.	Five minutes' elevation increases or decreases the range by	Five minutes will alter point of impact vertically or laterally at each range.	50 per cent. of rounds should fall within			Time of flight.
								Length.	Breadth.	Height.	
yds.	yds.	° /	° /	° /	f.s.	yds.	yds.	yds.	yds.	yds.	secs.
400	1 8	4 30	0 16	5 0	466	6 4	0 58	2 4	0 10	0 21	2 6
500	2 4	5 48	0 17	6 24	463	6 4	0 72	3 0	0 16	0 34	3 2
600	3 2	7 6	0 18	7 48	460	6 4	0 87	3 6	0 22	0 49	3 8
700	4 0	8 24	0 20	9 12	457	6 4	1 01	4 2	0 28	0 68	4 5
800	5 0	9 42	0 22	10 36	454	6 3	1 16	4 8	0 40	0 90	5 2
900	6 0	11 2	0 23	12 12	451	6 0	1 31	5 4	0 55	1 17	5 9
1,000	7 4	12 26	0 26	13 48	448	5 7	1 45	6 0	0 70	1 48	6 6
1,100	9 0	13 54	0 28	15 30	445	5 6	1 60	6 6	0 85	1 84	7 3
1,200	10 8	15 24	0 31	17 12	442	5 6	1 74	7 2	1 00	2 24	8 0
1,300	12 8	16 54	0 34	19 0	439	5 2	1 89	7 8	1 20	2 60	8 8
1,400	15 0	18 30	0 37	21 0	436	4 9	2 03	8 4	1 40	3 20	9 6
1,500	17 5	20 12	0 40	23 0	434	4 6	2 18	9 0	1 60	3 80	10 5
1,600	20 7	22 0	0 45	25 12	432	4 6	2 32	9 6	1 90	4 50	11 4
1,700	25 0	23 48	0 51	27 30	430	4 2	2 47	10 1	2 20	5 25	12 4
1,800	30 0	25 48	0 57	30 6	429	3 6	2 61	10 6	2 50	6 10	13 4
1,900	36 5	28 6	1 6	33 0	428	3 2	2 76	11 1	2 85	7 20	14 5
2,000	45 2	30 42	1 18	36 24	427	2 7	2 91	11 6	3 29	8 50	15 7
2,100	55 5	33 48	1 36	41 12	427	1 6	3 05	12 1	3 60	10 70	17 0

Table showing Gradients corresponding to Angles of Descent.

Angle of Descent.		Slope of Descent.	Angle of Descent.		Slope of Descent.
degs.	mins.		degs.	mins.	
1	9	1 in 50	27	10	1 in 1.95
1	55	1 " 30	27	47	1 " 1.90
2	13	1 " 26	28	24	1 " 1.85
2	18	1 " 25	29	3	1 " 1.80
2	23	1 " 24	29	45	1 " 1.75
2	52	1 " 20	30	28	1 " 1.70
3	1	1 " 19	31	13	1 " 1.65
3	11	1 " 18	32	2	1 " 1.60
3	23	1 " 17	32	50	1 " 1.55
3	35	1 " 16	33	42	1 " 1.50
3	49	1 " 15	34	36	1 " 1.45
4	5	1 " 14	35	32	1 " 1.40
4	24	1 " 13	36	32	1 " 1.35
4	46	1 " 12	37	34	1 " 1.30
5	13	1 " 11	38	41	1 " 1.25
5	43	1 " 10	39	50	1 " 1.20
6	19	1 " 9	41	2	1 " 1.15
7	11	1 " 8	42	16	1 " 1.10
8	8	1 " 7	43	38	1 " 1.05
9	28	1 " 6	45	0	1 " 1.0
10	18	1 " 5.5	46	28	1 " .95
11	19	1 " 5.0	48	1	1 " .96
11	46	1 " 4.8	48	39	1 " .88
12	16	1 " 4.6	49	18	1 " .86
12	48	1 " 4.4	49	58	1 " .84
13	23	1 " 4.2	50	39	1 " .82
14	2	1 " 4.0	51	20	1 " .80
14	45	1 " 3.8	52	3	1 " .78
16	32	1 " 3.6	52	46	1 " .76
16	23	1 " 3.4	53	30	1 " .74
17	22	1 " 3.2	54	15	1 " .72
18	26	1 " 3.0	55	0	1 " .70
19	2	1 " 2.9	55	46	1 " .68
19	40	1 " 2.8	56	34	1 " .66
20	20	1 " 2.7	57	23	1 " .64
21	3	1 " 2.6	58	13	1 " .62
21	48	1 " 2.5	59	3	1 " .60
22	38	1 " 2.4	59	53	1 " .58
23	31	1 " 2.3	60	45	1 " .56
24	26	1 " 2.2	61	38	1 " .54
25	28	1 " 2.1	62	35	1 " .52
26	34	1 " 2.0	63	26	1 " .50

DRILL.

(See Manual of Siege and Garrison Exercises, Part III. Section VI.)

TRAVELLING CARRIAGE FITTED WITH HYDRAULIC BUFFER.

The detachment consists of 10 Nos., and falls in two deep. It is told off, marched into the battery, and halted in line, facing the parapet and to the left rear of the platform. It is now in the position of "detachment rear."

TO TAKE POST UNDER COVER.*

<u>Officer.</u> <i>Take post under cover.</i>		<u>No. 1.</u> <i>Right turn. Double March.</i>
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The detachment wheels to its left, the front rank filing to the left of the howitzer, the rear rank to the right; 2 and 3 halt close to the parapet on the right and left of the platform; 4 and 5 form up on their right and left, and the whole turn to the right about together. No. 1 follows in rear of the detachment, keeping under cover as much as possible; 6 and 8 going to the cartridge store; 7, 9, and 10 to the shell store.

GENERAL DUTIES.

No. 1 commands, directs or superintends boring and fixing fuzes, assists to run up, and lays.

No. 2 searches, sponges, assists to load, rams home, runs up, and traverses.

No. 3 loads, uncaps or removes safety pin from fuze when in bore, rams home, runs up, and traverses.

No. 4 attends to side arms and supplies them to 2, runs up, and elevates.

No. 5 attends to vent, supplies 3 with automatic gas-checks, runs up, makes ready, and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes and brings up projectiles in bearer, and assists to lift them to the muzzle.

No. 8 attends to cartridge store, and serves out cartridges to 6.

No. 9 assists 7.

No. 10 attends to shell store, issues shells, tubes, and fuzes.

TO PREPARE FOR ACTION.

<u>Officer.</u> <i>Prepare for action.</i>		<u>No. 1.</u> <i>Prepare for action. Examine gun.</i>
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"Prepare for action."—The stores are brought up as follows:

No. 1, handspike and sights.

No. 2, handspike, and assists 4 with side arms.

No. 3, handspike, removes the tampeon from the muzzle.

No. 4, handspike, side arms, and support for head of side arms.

No. 5, handspike, tubes in pocket, lanyard, pricker and vent server,

No. 6, two cartridge cases, which he leaves at the cartridge store, bucket filled, and brush. For drill purposes two drill cartridges.

* If the howitzer is not behind a parapet and the word of command is "Take post at the howitzer," the detachment wheels to its left as before, 2 and 3 halt in line with the front of the wheels; 4 and 5 with the rear of the wheels, No. 1 in rear of the gun, 6, 7, 8, 9, and 10 at the limber.

No. 7, fuzes and fuze and shell implements. He obtains the fuze boxes from 10, having ascertained from No. 1 the fuzes required; and satisfies himself as to the correctness of fuzes and fuze implements. He places the fuze boxes on the shell benches in the covered way on left of gun portion where the shells are fuzed.

No. 8 prepares to issue cartridges.

No. 9 brings up a shell bearer and brush; also gas-checks in bar, with lid unscrewed.

No. 10 prepares to issue shells, friction tubes, and fuzes. He examines the shells carefully, cleaning them if necessary, and loosens the fuze-hole plugs of shells that will be first issued, and also provides a hammer.

The stores having been brought up, No. 1 will satisfy himself that the fore sights fit properly on the howitzer and the horizontal bars of the sights work easily; he receives the reports from the Nos. responsible of any irregularity or deficiency in connection with the howitzer, ammunition, or stores; he will ascertain that the buffer contains the correct amount of oil by bringing the buffer horizontal and measuring the depth at the filling hole.*

The sponge, rammer, and wadhook are laid on the ground clear of the platform, to the right of the howitzer, and parallel to it, heads to the rear, resting on the support supplied by 4, sponge nearest the howitzer.

The sponge bucket near the sponge head.

The handspikes are laid down, two on each side of the howitzer close to the carriage, points to the front, bevelled side uppermost, those of 2 and 3 outside, and about two feet advance of those of 4 and 5. No. 1's handspike in rear of the platform.

No. 3 examines the bore to see the grooves are free from grit, &c.

No. 4 ascertains that the elevating gear is in working order (should the elevating arc have been detached from the carriage he brings it up and adjusts it).

No. 5 straps the tube pocket round his waist on the right side, coils up the lanyard and passes the bight of it through the tube pocket strap; examines the vent server, and places it in the vent, the loop of the vent server lanyard over one of the sights; he fills his tube pocket with friction tubes which he procures from 10, and places the pricker in the loop on the carriage and sees that the automatic gas-checks are placed in a convenient position.

N.B.—Should the stores be on the howitzer, they are unstrapped and laid down as above detailed.

"*Examine gun.*"—No. 5 drifts the vent, replaces the pricker in the loop and the vent server. 2 supplies himself with the wadhook, searches the howitzer after the pricker has been withdrawn, and replaces wadhook. 4 attends to the elevating wheel to bring the howitzer into a convenient position for loading.

	To Load.	
Officer.		No. 1.
Range		With
With		load.
yards.		
load.		

"*Load.*"—No. 1 gives 7 the nature of shell and fuze required, and during the loading fixes his tangent scale at the required elevation, He places himself in a convenient position, near the muzzle, whence he

* The depth should be

can watch the loading and observe, by the mark on the rammer, if the shell is home.

No. 2 places himself in a convenient position for sponging. He places his left foot in line with and about 12 inches from the muzzle, steps to his right with his right foot, and looks to his left rear, takes the sponge in a horizontal position from 4, left hand back down, right hand back up; brings it in a line with the axis of the gun, enters the head into the bore, being careful to observe that the vent server is in the vent, slides his hands along the stave to his right as far as he can reach, sends the sponge up the bore, slides his hands out again and forces the sponge hard home, gives it two half turns, pressing it against the bottom of the bore, withdraws the sponge, hand over hand, turning it from him, cleaning the bore well. When the sponge arrives near the muzzle, he jerks it out, his hands then should be in the position they were in when he introduced the sponge into the bore. He then hands the sponge to 4, and assists 3, 7, and 9 to lift the projectile, and place it in the bore, receives the rammer, right hand about the centre back down, left as near the head as possible back up; as soon as the cartridge and shell are put in, he enters the head into the bore and forces them home hand over hand. He then springs the rammer, steps out, hands it to 4 and goes under cover.

No. 3, as soon as the sponge is withdrawn, takes the cartridge from the cartridge case with his left hand, moves up and places it in the bore, receives a gas-check from 5, and places it in the bore immediately in front of the cartridge, painted side to the rear; he then assists 2, 7, and 9 to lift the projectile and place it in the bore, withdraws the safety pin, or uncaps the fuze, places himself in a corresponding position to 2 and assists him to ram home; when the cartridge and projectile are home he quits the stave and goes under cover. Special care should be taken in ramming home star shell.

No. 4 doubles out, halts in line with the sponge head, turns to his left, picks up the stave with his right hand back under, 6 inches from the head, turns three quarters left about, and in doing so lifts the sponge over his head, allowing the end of the stave to rest on the ground. His left hand meets the stave close to the sponge, his right hand is slipped up the stave about two feet. He then moves towards the muzzle, and places the sponge in a convenient position for 2 to lay hold of, waiting for its return at the left rear of 2; facing the howitzer. When he receives the sponge from 2 he allows the end of the stave to fall on the platform, steps to his left, turns three-quarters right about, passing the sponge over his head, lays it down, takes up the rammer as before detailed for the sponge and hands it to 2. He then remains in position to receive the rammer as soon as 2 has sprung it. He lays it down as he did the sponge and goes under cover.

No. 5 hands a gas-check to 3.

No. 6 brings up a cartridge in a case and places it on the ground on 3's right front; after the sponge is withdrawn he uncovers it, and, as soon as 3 has withdrawn the cartridge, 6 takes the case back to the cartridge store.

Nos. 7 and 9 bring up projectile in bearer, having fixed the fuze according to No. 1's directions, and assisted by 2 and 3 place it in the bore. No. 9 removes the empty bearer.

No. 8 issues a cartridge to 6.

No. 10 issues a shell to 7 and 9.

TO RUN UP.

Directly the howitzer is loaded No. 1 gives "Run up," and applies his handspike at the trail eye to guide the howitzer.

Nos. 2, 3, 4, 5 take up their handspikes; 2 and 3 apply theirs horizontally over the spokes of the wheels in front, and under the bracket, close to the breast, and bear down; 4 and 5 use theirs as levers of the second order under the rear part of the wheels. All four numbers face to the rear.*

When the howitzer is run up, No. 1 gives "*Halt*," slides his handspike to the rear clear of the recoil, and looks over the sights, steadying himself by leaning on the cascable. 2 and 3 go to the end of the trail facing to the rear ready to traverse, 4 and 5 lay down their handspikes, 4 goes to the elevating wheel; 5 prepares a tube.

TO LAY THE HOWITZER.

Officer.

No. 1

Elevate.
Depress.
Halt.
Trail right.
Trail left.
Halt.

At "*Elevate*" or "*Depress*," 4 turns the wheel in the required direction till the word "*Halt*."

At "*Trail right*," 3 heaves over the trail, at "*Trail left*" 2 till the word "*Halt*."

At "*Extreme right or left*," 2 and 3 apply their handspikes and with 4 and 5 heave over the trail; when it is necessary to shift the trail plank, 2 and 3, place the points of their handspikes under the trail and raise it; 4 double mans 2's handspike, 1 and 5 shift the plank.

If it is necessary to run the howitzer back, at "*Run back*" 2 and 3 apply their handspikes in front of the wheels, using them as levers of the second order; 4 and 5 take a purchase with theirs over the most horizontal spokes in rear and under the brackets; the whole facing to the rear.

Should no order to fire be given, when the howitzer is laid, No. 1 gives the order "*Under cover*."

TO MAKE READY AND FIRE.

Officer.

No. 1.

Fire— —*rounds*

No.— —*Ready.*
No.— —*Fire.*

No. 1 lowers his tangent scale, and gives "*Ready*;" 5 presses the tube into the vent with his right thumb, steps clear of the recoil, shifts the lanyard to his right hand and extends it, keeping his hand level with the vent, facing the howitzer.

As soon as "*Ready*" is given, 2 and 3 lay down their handspikes and with 4 go under cover.

At "*Fire*" 5 draws the lanyard strongly towards his body, without a jerk; he then drifts the vent, replaces the vent server and goes under cover.]

No. 1 does not again give "*Load*" until 5 has replaced the vent server.

* Running back at Drill is the converse of the preceding.

BED.

The drill is the same as for howitzers on travelling carriages, with the following exceptions:—

The recoil is checked by means of an iron plate compressor. No. 1 sets the adjusting lever, with a view to obtaining as much recoil as possible and thus taking the strain off the pivot bolt. He must take care that the directing bar is central so that the compression on each side is equal when the compressor handle is put down.

5 attends to the compressor lever. He throws it up after recoil, and puts it down below the catch as soon as the howitzer is run up and before it is laid. It is liable to throw the howitzer out of line if put down after the latter is laid.

To run up.—4 hooks a drag-rope to the eye bolt in the breast transom. It is manned by the whole of the available numbers. It will be found advantageous to use tackle instead of a drag-rope when possible.

To load.—The howitzers are loaded in the firing position.

To Traverse.—2 and 3 are supplied with iron shod levers instead of handspikes. They apply them under the eye of the directing bar.

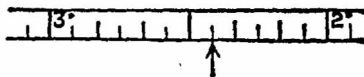
To lay.—The howitzer being mounted in rear of a high parapet the object fired at cannot be seen over the sights. One of the methods of laying hereafter described must therefore be adopted.

Howitzers on beds not to be fired at less than 20° elevation on account of the strain on the pivot.

INSTRUCTIONS FOR USING THE CLINOMETER.

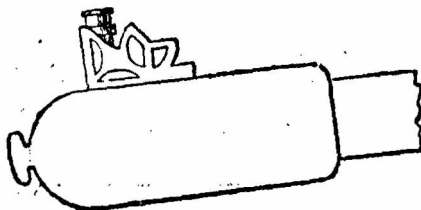
To read the angles marked on the drum.—The brass drum is marked in degrees, commencing at 0° on the top to 45° at the bottom. Each degree is sub-divided into 12 parts, each small division, therefore represents angles of 5 minutes.

The scale is read from right to left, thus—

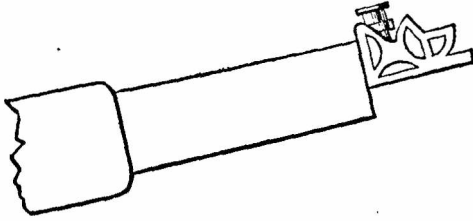


the reading opposite the arrow would indicate an angle of $2^\circ 25'$.

To lay the howitzer at any angle up to 45° .—Unscrew the drum until the \uparrow points to the elevation required, place the clinometer, thus—

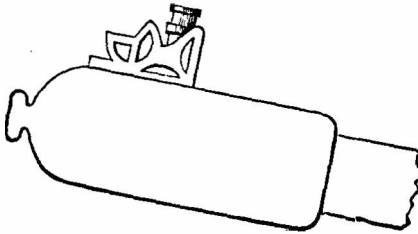


on the plane surface cut on the breech, or against the muzzle, thus—



and elevate the piece until the bubble of the spirit-level is in the centre of the tube.

For angles of depression.— Proceed as above, but reverse the direction of the instrument, placing it thus on the breech of the gun—



and thus on the muzzle—



INSTRUCTIONS FOR THE DISABLEMENT OR DESTRUCTION OF GUNS BY MEANS OF GUNCOTTON.

(See Clause 200, Army Circulars, 1882.)

THE HASTY DISABLEMENT OF SIEGE GUNS.

The hasty disablement of siege guns will be carried out by the Royal Artillery.

(4346)

c

STORES REQUIRED.

The necessary supplies of guncotton for the disablement of siege guns will be obtained from the Royal Engineer Siege Park.

The following stores will be carried with each unit of the Siege Train:—

Two "wallets, leather," each capable of containing eight 1 lb. slabs of guncotton.

These slabs are issued wet, and are so kept in store; but it is immaterial whether they are wet or dry when required for use.

One "cylinder, tin, for guncotton primers, 1 oz., 1¼-inch, dry (to hold 8)."

Two "cases, leather, brown, cylindrical, for detonators," each containing a cylinder, tin, for detonators (No. 8), with 2 feet of safety fuze attached (to hold 8), and one rectifier.

One "pouch, leather, brown," with strap, containing apparatus, flint and steel, slow match, and a small reel of twine.

INSTRUCTIONS FOR CARRYING OUT THE OPERATIONS.

In the case of guns of 64-pr. and larger calibres two slabs must be employed.

Insert a detonator into a dry primer, first using the rectifier to ensure the hole in the primer being of a proper size to admit the detonator.

On no account should a detonator be twisted or roughly forced into a primer.

Insert the dry primer fitted with detonator into the perforation in one of the 1 lb. slabs, pushing it gently in until the hole in the slab is quite filled by it.

Tie a piece of twine round the detonator, pass the ends round the slab, and then tie them together; the object being to prevent the primer slipping out of the slab.

Place the slabs lengthways on the chase, their long sides touching about a foot from the muzzle. Tie them on tightly with twine to prevent them slipping from wind or other disturbing cause.

The exact position must depend on the form of the gun. The great thing is to have as much of the surface of the cotton *in actual contact* with the gun, as possible. Hence the slabs should not ride on an astragal or moulding, but should always be placed on a plain part of the chase.

Observe the direction of the wind, and arrange the slab containing the detonator so that the tail of the safety fuze is away from the slab and to leeward of it. This is to lessen the chance of a spark igniting the cotton before the detonator is fired, in which case, in all probability, no effect whatever would be produced on the gun.

If projectiles belonging to the gun are available, and time allows, it is advisable to ram one up the bore; so that when the gun is dented by the explosion it may be imprisoned there, and prevent the gun from being used, even to fire a bag of bullets.

Tear or cut the little calico cap off the end of the safety fuze, and ignite the fuze by the apparatus provided, or other convenient means. An ordinary flame does not readily ignite it. The fuze ignites most easily when cut obliquely with a sharp knife.

Retire to a safe distance (say 50 yards) and await the explosion. The length of safety fuze will burn about 45 seconds.

Should circumstances permit, the effect of the detonation will be increased by placing a filled sand bag or a sod of turf on the guncotton, when lashed in position on the chase. Great care should be taken in this operation not to strike or bend the detonator.

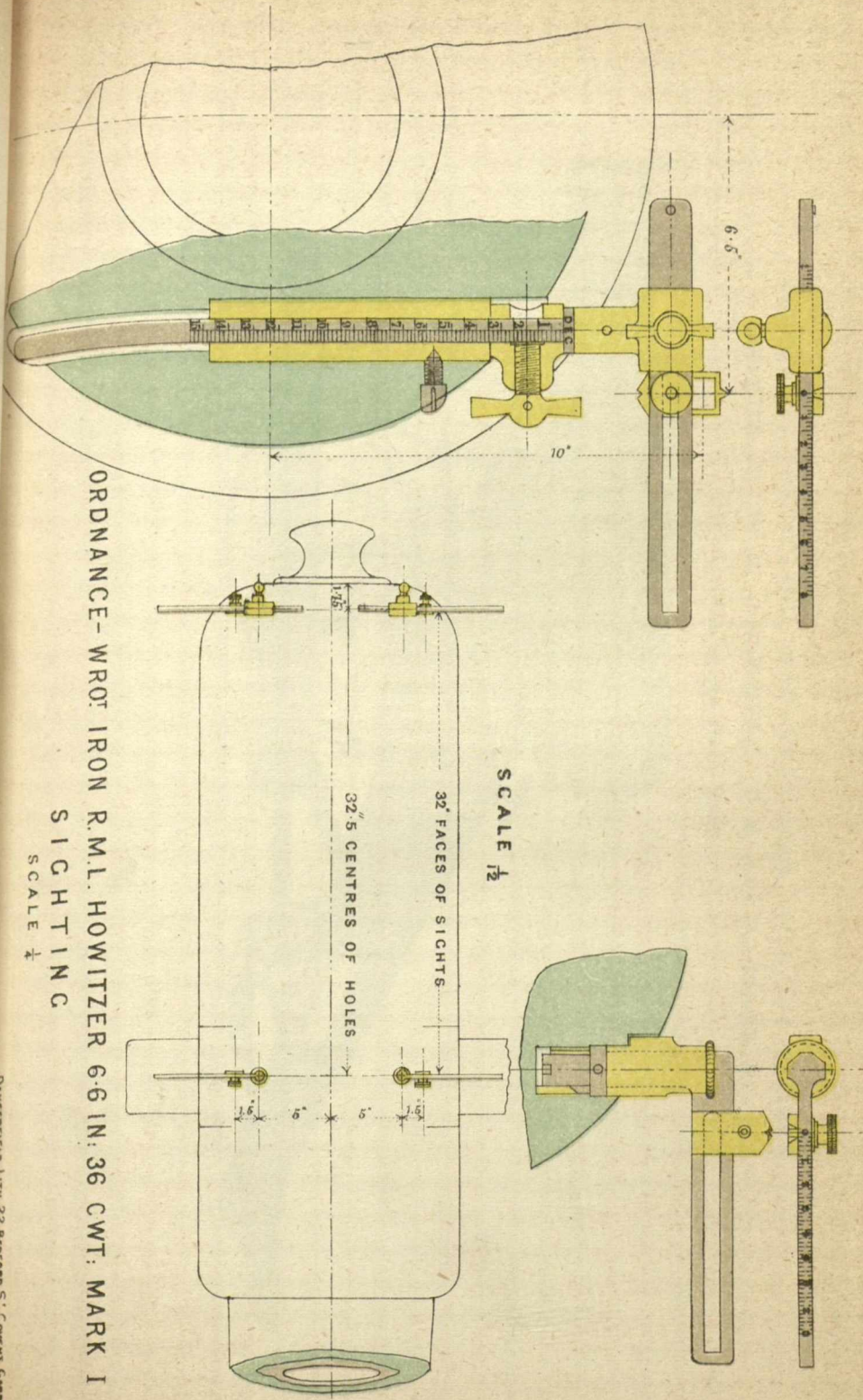
It is also advisable, after the explosion, to try if the gun is so dented as to prevent loading. If the dent is not sufficient, the operation should be repeated, putting the fresh slabs in the same place as the first.

CAUTION.

Never roughly bend or kink the safety fuze. If it has apparently gone out without firing the detonator, allow at least half an hour to elapse before meddling with it.



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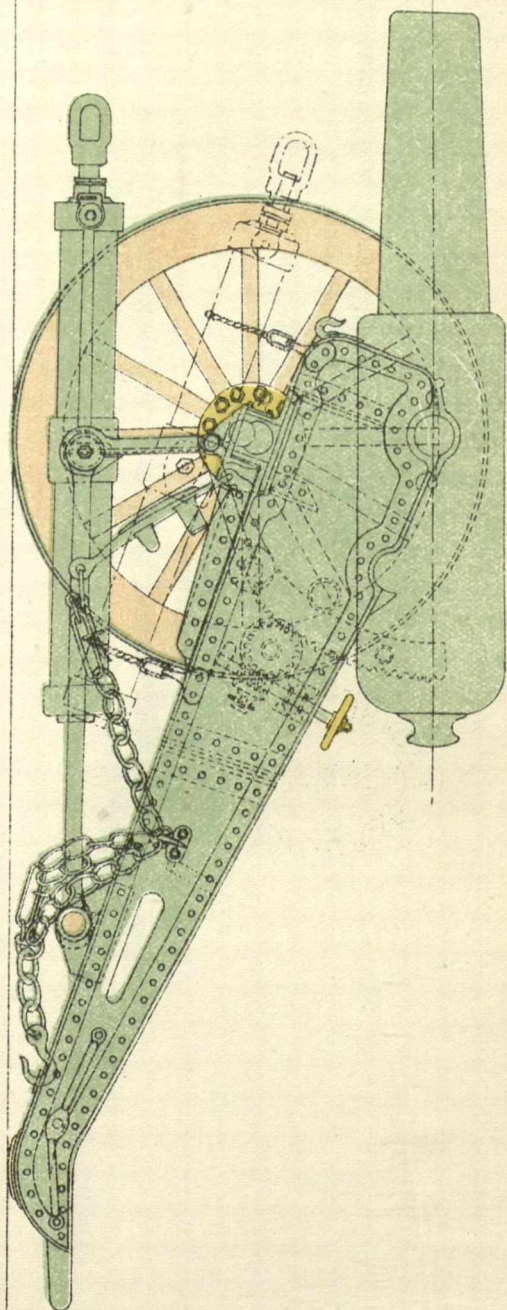
ORDNANCE-WROUGHT IRON R.M.L. HOWITZER 6.6 IN. 36 CWT. MARK I

SIGHTING

SCALE $\frac{1}{4}$ "

CARRIAGE, TRAVELLING, WROUGHT-IRON, WITHOUT LIMBER.
SIEGE, R. M. L. HOWITZER, 6.6 INCH, MARK I.

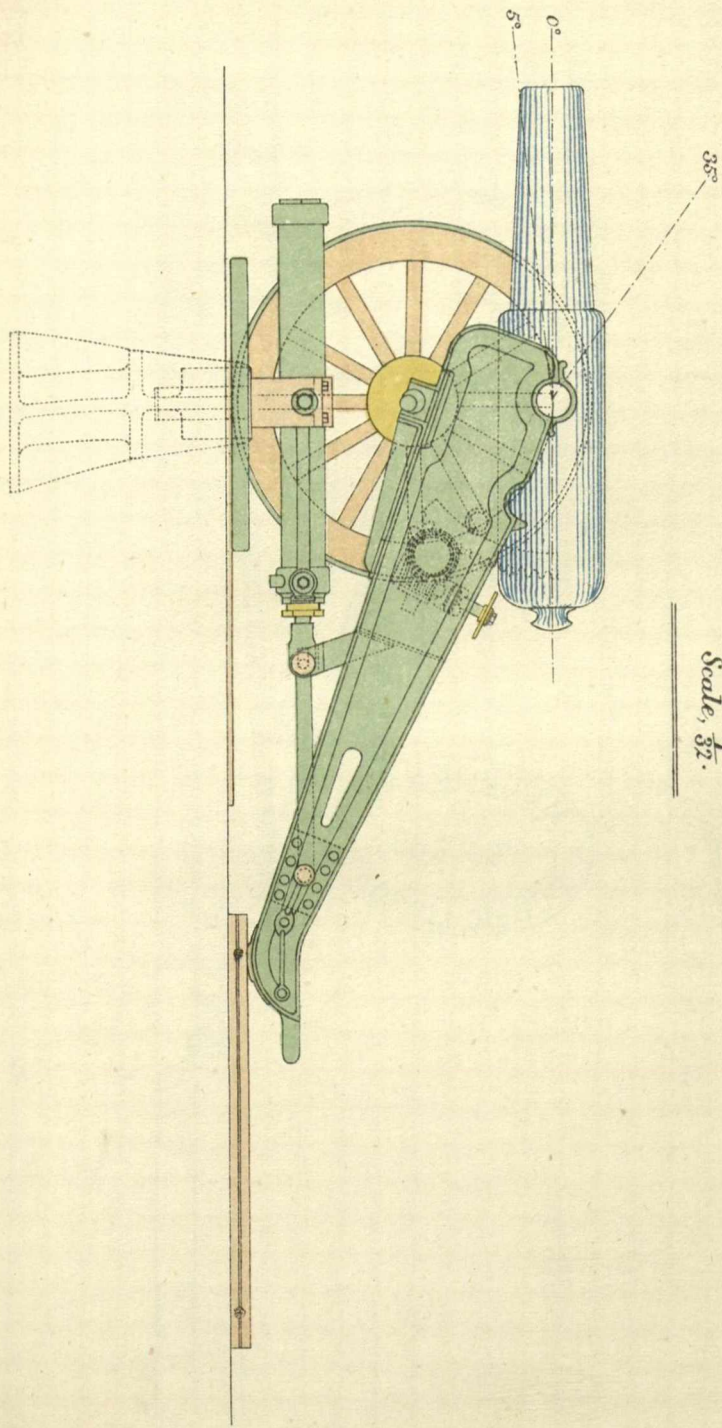
Scale, $\frac{1}{24}$ full size.



CARRIAGE, SIEGE, R. M. L. 6.6 INCH HOWITZER FOR CENTRAL PIVOT.

Iron without timber.

Scale, $\frac{1}{32}$.



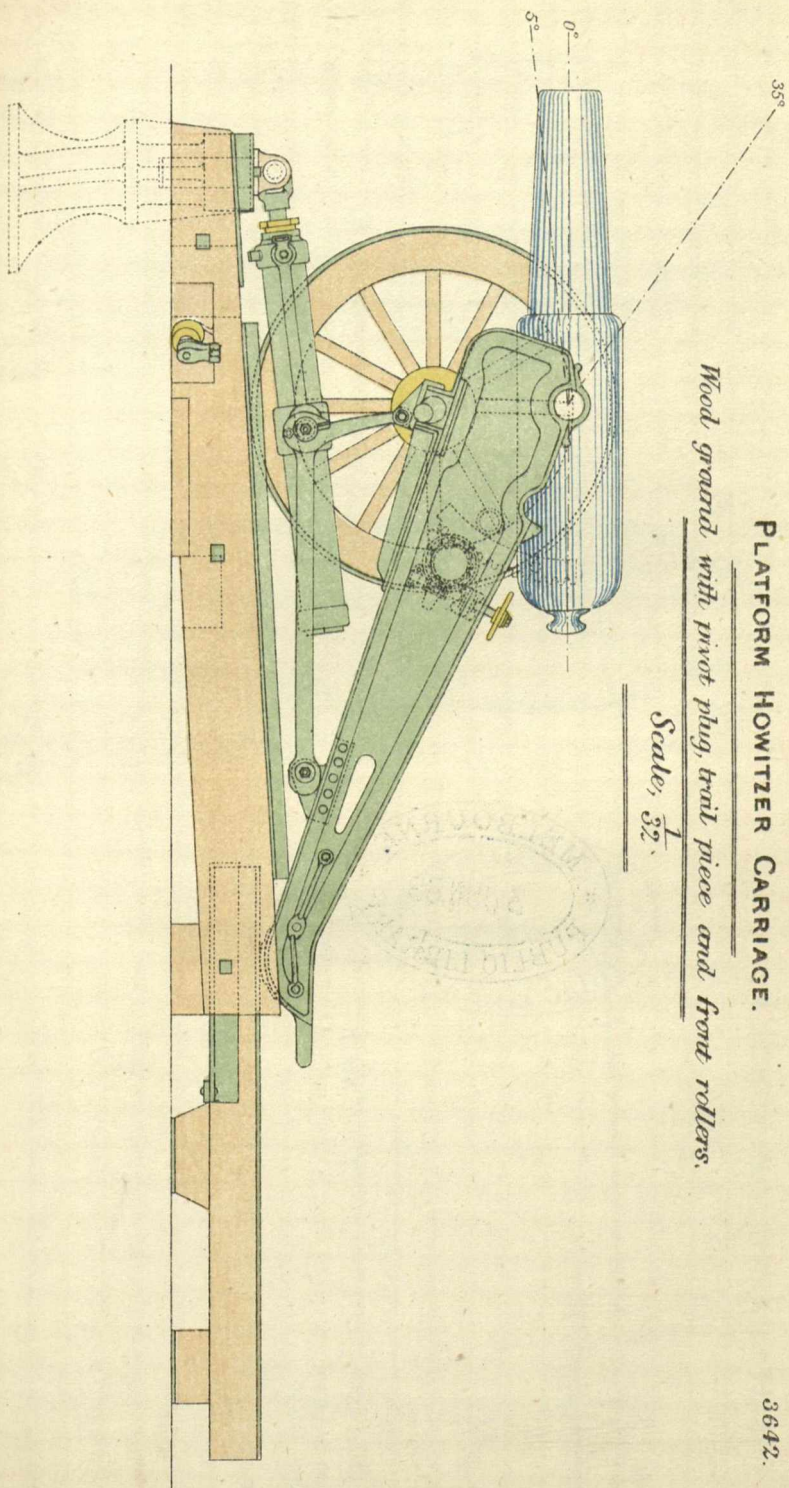
R. C. D.
3641.

CARRIAGE, SEIGE. R. M. L. 6.6 INCH HOWITZER FOR A PIVOT.

Iron without timber.
PLATFORM HOWITZER CARRIAGE.

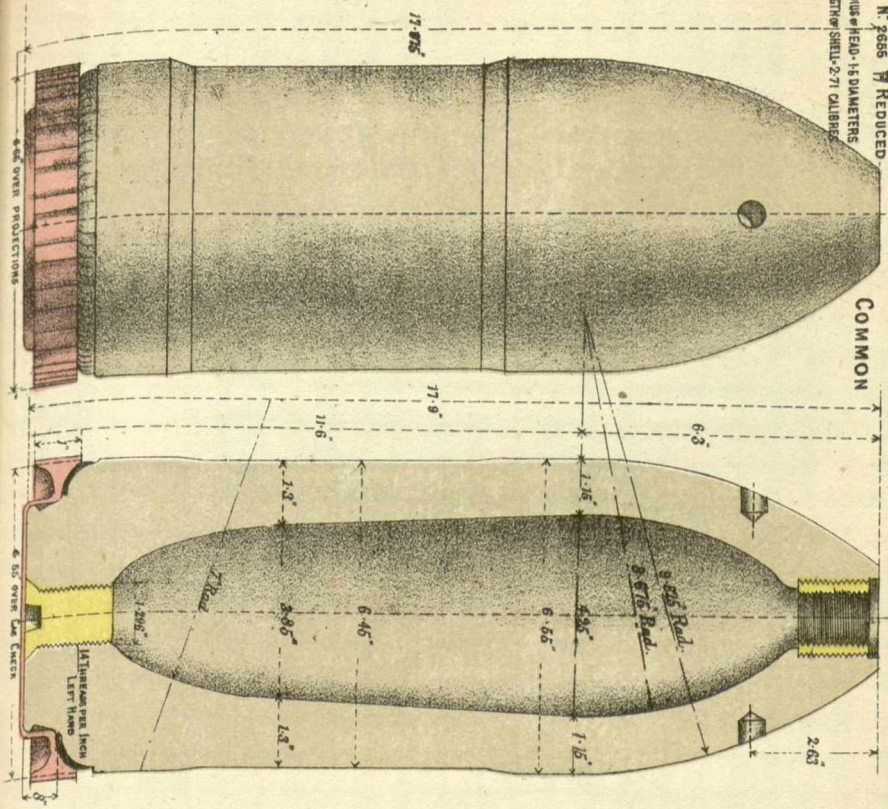
Wood ground with pivot plug, trail piece and front rollers.

Scales, $\frac{1}{32}$.



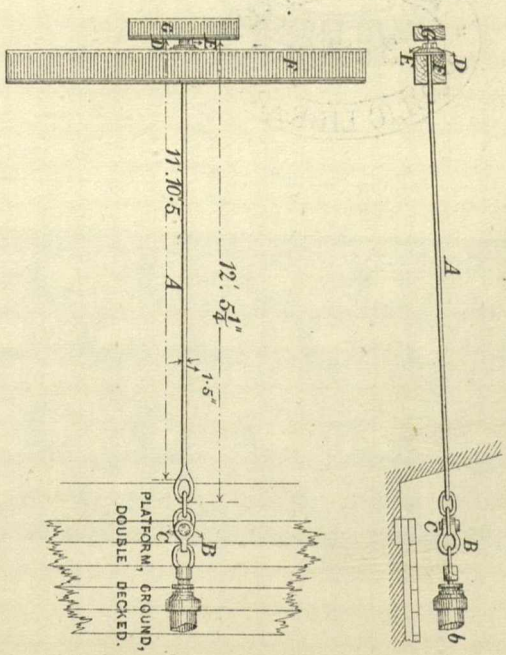
R. C. D.
3642.

N^o 2856 $\frac{1}{2}$ Reduced
 RADIUS OF HEAD, 1.5 DIAMETERS
 LENGTH OF SHANK, 2.71 CALIBRES



ANCHORING APPARATUS

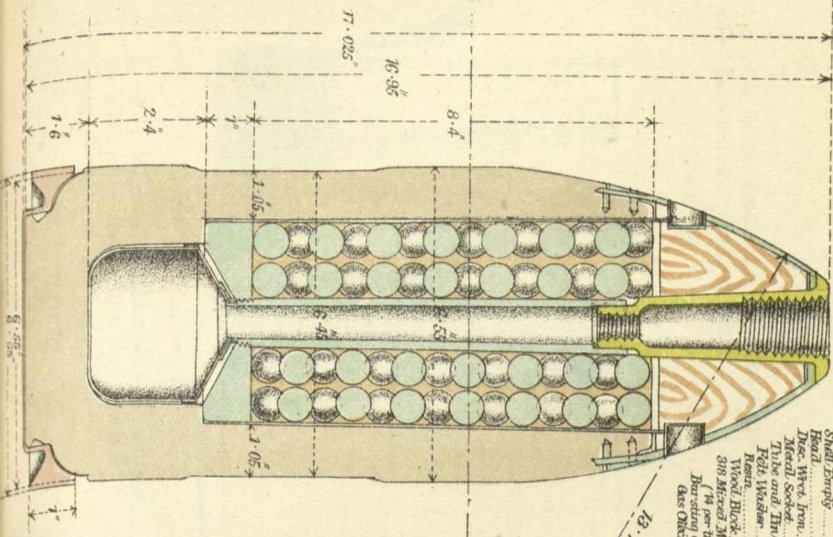
Scale $\frac{1}{64}$ th full size.



SHRAPNEL (MARK I)

No 3582 6.5 (Reduced.)

Radius of Head = 2 Diameters
Length of Shell = 2.56 Calibres



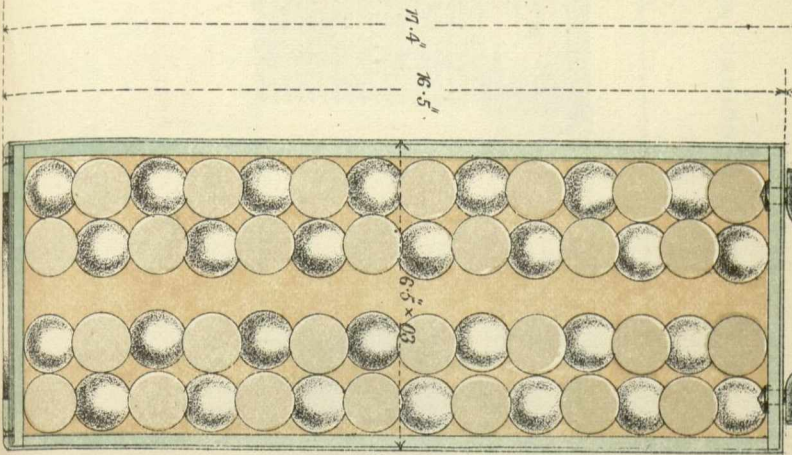
Average Total Weight 100 lbs.

Shell Empty	2.62
Lead	3.2
Steel Wad Iron	3.2
Metal Saker	18.5
Tube and Tin Cap	11.4
Exp. Wad	2.0
Red Wax	10
Wood Block	22.12
308 Mixed Metal Bull.	(19 per lb.)
Bursting Charge	11.5
Gas Case	3.1

PROJECTILES.

Scale $\frac{1}{4}$.

Length of Shot = 2.5 Calibres



GUN CASE (MARK I)

No 3623 6.5 A (Reduced.)

Average Total Weight 100 lbs.

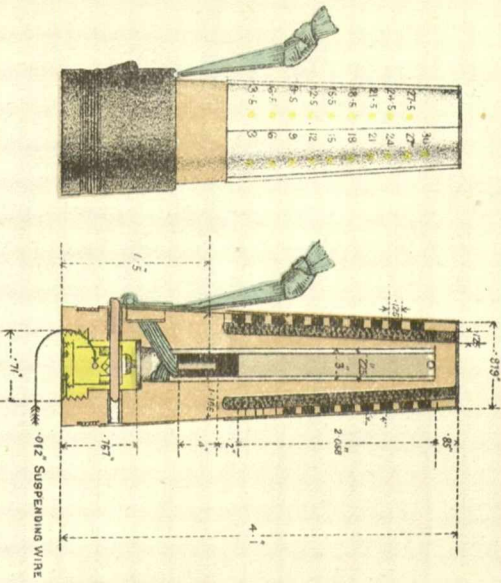
Case Empty	35.5
Case and Sand	37.0
274 Small Shot Avg	55.1

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— FUZES. —

FUZE TIME WOOD IS SECONDS WITH DETONATOR AND
 .012 SUSPENDING WIRE MARK III.

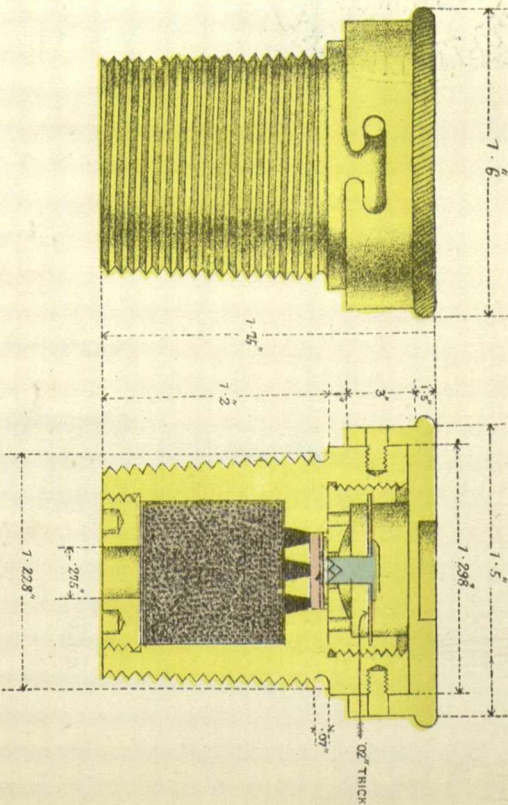
SCALE $\frac{1}{2}$



In future the powder charnards will be bored parallel to the axis of the fuze instead of being parallel to the side. 1885.

FUZE PERCUSSION DIRECT ACTION MARK I.

FULL SIZE.

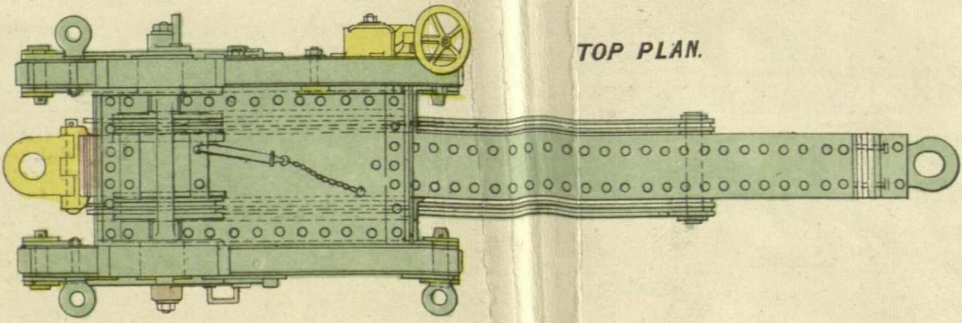
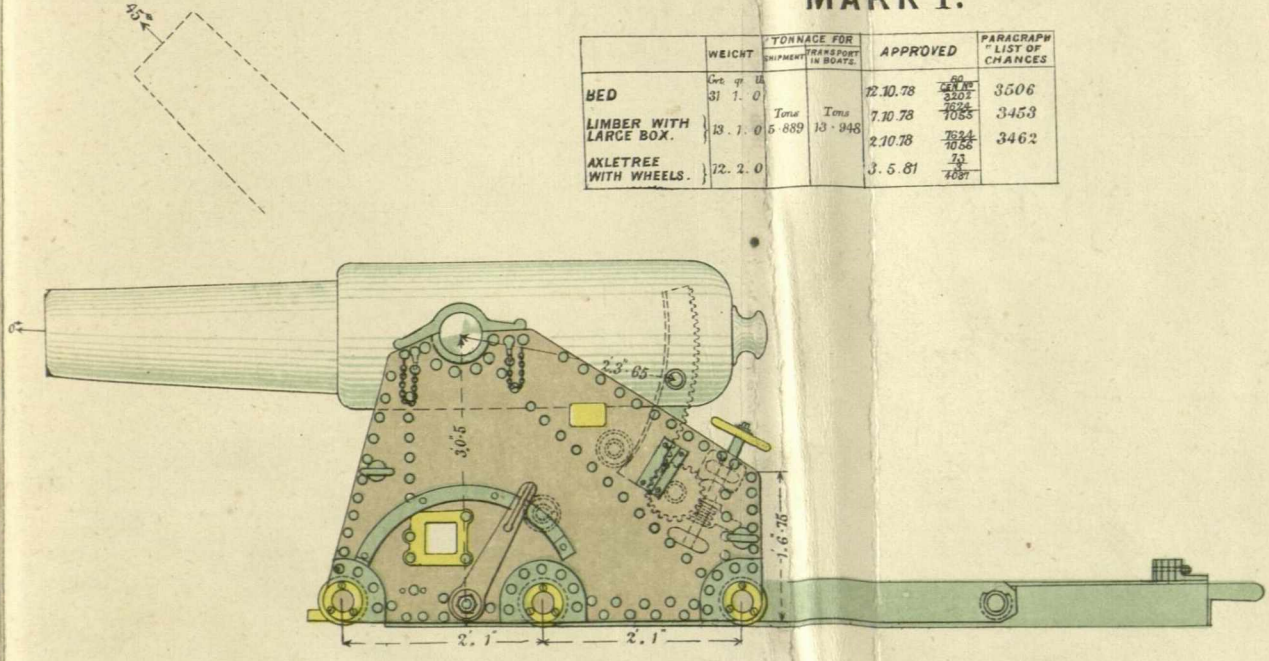


58
9
+

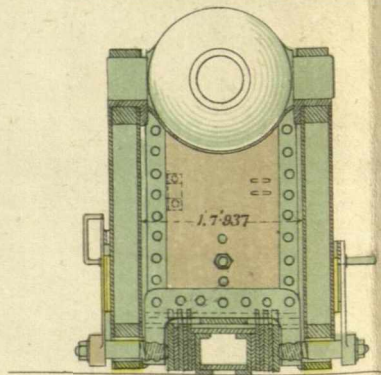
BED, STEEL, R.M.L. 6.6 HOWITZER.

MARK I.

	WEIGHT	TONNAGE FOR SHIPMENT		APPROVED	PARAGRAPH "LIST OF CHANCES"
		IN BOATS	IN BOATS		
BED	31 1. 0			72.10.78	3506
LIMBER WITH LARGE BOX.	13 1. 0	5 889	13 948	7.10.78	3453
AXLE TREE WITH WHEELS.	12. 2. 0			2.10.78	3462
				3. 5. 81	

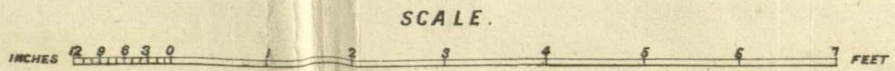


TOP PLAN.



WROUGHT IRON
STEEL
GUN METAL
INDIA-RUBBER

SECTION AT COMPRESSORS.



SCALE.