HANDBOOK

FOR THE

40-PR. R.M.L. GUN OF 35 CWT.

1889.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY HARRISON AND SONS, ST. MARTIN'S LANE,
PRINTERS IN ORDINARY TO HER MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE & SPOTTISWOODE, East Harding Street, Fleet Street, E. C.; or
ADAM and CHARLES BLACK, 6, North Bridge, Edinburgh; or
HODGES, FIGGIS, & Co., 104, Grafton Street, Dublin.

1889.

Price One Shilling.

CONTENTS.

PLATES.

MEMO.

This Handbook is corrected up to April, 1889. Any alterations which may be suggested, should be forwarded to Assistant-Director of Artillery, Woolwich.

40-PR. RIFLED MUZZLE-LOADING GUN OF 35 CWT. MARK II.*

GUN.

FRONTISPIECE.

Material			Steel tube and W. I. jacket
Length	nominal		114·75 inches.
	total		120 inches.
Weight			35 cwt.
Bore	calibre		4·75 inches.
	length		104·5 inches.
Rifling	system		Woolwich.
	twist		Uniform 1 in 35 calibres.
	length		90·5 inches.
	grooves	depth	0·1 inch.
		number	3.
		width	0·8 inch.
Vent, of hardened copper			Vertical. 7 inches from end of bore.
Preponderance			26 lbs.
Means of rotation			Studs.

SIGHTS.

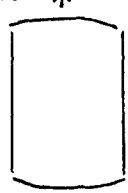
The gun is side sighted only, and the sights used are:—

1. The ordinary tangent and fore sights.
2. The crossbar sights.

Tangent Sights.—Two tangent sights are set at an angle of 1° 20′ to the left to correct drift; the crosshead is graduated to 30 minutes right and left for deflection, in order to allow for wind or other irregularity, and is provided with a gun-metal sliding leaf; there is also a slow motion elevating nut under the crosshead graduated round its circumference from 1 to 10 minutes for finer adjustment in elevating. The tangent bar is four-sided and is marked thus:—

Muzzle.

Degrees ⅄ 0° to 12°.



Fuze (†).

Yards (4,500) (†).

* The Mark I guns are shorter, but take the same charge and projectiles; these will be used for batteries of position.

† These graduations are correct for shells fitted with gas checks.

The tangent sights are not interchangeable with those for Mark I guns.

Fore Sights, B.—There are two fore sights of the ordinary service drop sight pattern, which are interchangeable with those for 25-pr. rifled M.L. guns.

A clinometer is supplied for elevations above 12°.

Crossbar Sights.—There are two scales, the rear one fitting into the tangent scale socket and the front one into the foresight socket of the gun.

The rear scale consists of a steel bar graduated with a yard scale up to 4,500 yards, and is fitted with a moveable socket and clamp. The head of the scale is rectangular and has a slot cut in it, in which a horizontal steel bar is free to slide.

The top of the horizontal bar is graduated from 0 to 8 degrees and smaller divisions.

On the left of the bar is a deflection scale by which a deflection of 1° right and 3° left can be given.

If no deflection is required, the left zero mark is made to coincide with the left face of the head.

A reversible sliding leaf, with a triangular apex for rough laying and cross wires below, is free to move along the bar. Both horizontal bar and sliding leaf are provided with clamping screws.

The front scale has a fixed horizontal bar similar to that of the rear scale, and graduated from 0 to 8. It has also a sliding leaf with a sighting notch on the top and a clamping screw in front.

CARRIAGE AND LIMBER, MARK II.*

(*Plates I. and II.*)

The carriage is formed of two bracket sides, connected by transoms, bolts, and a trail piece with steeled eye, an axletree bed with 1st class axletree, and 5-feet siege wheels with metal naves.

Each bracket side 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 stays.

The elevating gear is of the worm wheel pattern; the gear is placed on the right side only, and consists of a "worm shaft" or "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 a friction clutch, giving motion to a pinion gearing into the teeth of the arc attached to the gun. The arc with its pinion is kept in position by a metal friction roller on the bracket. The wheel and 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 an iron plate along each side, large coin, hand coin, and scotch, are fitted to and issued with the carriage, for use in laying the gun, in case of any damage to the elevating gear; the stool bed also serves as "shifting plank" for the gun roller.

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

---

* The Mark II Carriage is suitable for either Mark I or II guns, but existing stores of Mark I Carriages will be issued for use with Mark I Guns. The Mark I differs from the Mark II Carriage in being of weaker construction. It has but two transoms.

The limber is formed on the same plan as the wood siege limber, but has the futchels and splinter bar of iron with the axletree bed of wrought iron instead of wood, and which, with the axletree, constitutes a beam of box-girder section. The wheels are the 2nd class field, with tire 3 inches wide.

Instead of a pintail it is fitted with a limber hook, steeled to prevent wear, with a steel key.

The shafts are one pair "near" and "off," the former, being the "field" pattern, and the latter known as the Brandling pattern, fitted with loop, for stay of outrigger, and another pair framed. There are outriggers for 4-horse draught.

The limber boxes are "near," "off," and "centre;" the "near" and "off" carry each 6 projectiles and as many cartridges in a canvas cartouche, each shell is fitted with a lifting strap.

		Feet.	Inches.
Height, centre of gun		4	5
Length of carriage with wheels		11	8
Length of carriage without wheels		10	8
Length of axletree		6	3½
Length of carriage and limber without gun		21	2
Length of carriage and limber with gun		25	0
Minimum space through which carriage can turn		36	
Angle of trail		20°	
Elevation, maximum		35°	
Depression, maximum		5°	
		Feet.	Inches.
Wheels track		5	2
Wheels diameter		5	0
		cwts.	qrs.	lb.
Weight of carriage, empty, with wheels, drag-shoe, and arc, elevating		32	3	20
Weight of limber, empty, with boxes, shafts, and wheels		13	1	0
Weight of wheels		10	2	0
Weight of arc, elevating		0	0	26

OVERBANK CARRIAGE.

When this gun is used as a siege gun it is mounted on an overbank carriage constructed to fire over a 5 ft. 8 in. parapet.

The "overbank" is the service pattern carriage fitted with a top of wrought iron, a special elevating gear, arranged to depress 20° for loading, and a step for laying the gun.

The top is formed of two bracket sides connected by cross bolts and secured to the carriage at the front by a strap bolt on each side of each bracket and at the rear by clips and bolts. The elevating arrangement consists of a worm shaft and wheel, working an elevating pinion and arc by means of a friction cone. This gear is fixed at the front of the carriage between the brackets and is driven by a handwheel, the elevating arc being secured at each end to the underside of the gun.

The following is the method of removing the top:—

Depress the gun. Detach the elevating arc, turn the handwheel of the elevating gear until the teeth of the arc are clear of the pinion. The arc can then be removed from the rear and the gun dismounted.

Take off the nuts and clip plates of the strap bolts and remove the rear clips and bolts, which will allow of the top being lifted off.

Weight of top (approximate)	10 cwt. 2 qrs.
Height to centre of gun at trunnions ..	6 ft. 3 in.
Elevation	35°.

A breech loop and a roller are supplied with these tops; they are required for shifting the gun from firing to travelling trunnion holes.

Notes on fixing a top carriage.

Top carriages and fittings are not interchangeable, and will only fit the travelling siege carriage the No. of which is marked on them.

The following tools are required:—

Knock-up wrench, large	1
McMahon's spanner	1
Spanner for check nuts	1
Small half-round file for removing burrs ..	1

The following articles should first be removed from the lower carriage:—

Side-arms and straps.
Cap-squares.
Coins.
Worm wheel, shaft, and hand wheel.
Stool bed.
Side-arm straps.
Elevating gear.
Drag-shoe hook.
Temporary bolts removed from front of brackets.
Loop lashing screws.
Staple plate for roller.

The fittings for the top carriage elevating gear are now carefully adjusted between the front part of the brackets of the lower carriage, care being taken that the holes in the fittings correspond with those in the carriage, or difficulty will be experienced in inserting the screw bolts.

The fittings are then nutted up to the carriage, the drag-shoe hook is replaced, and the worm-screw shaft fixed in its bearings, front and rear.

The carriage step is put on and secured by a $\frac{1}{2}$-inch split key.

The top carriage *may*, in case of necessity, be mounted up the trail by "man-handling" it; but it is awkward work, and to be avoided, if possible, by using a gyn to raise the top carriage, which may be slung by means of a heavy drag-rope put on close in rear of the trunnion holes. When high enough the lower carriage is run under it, the four vertical tensile bolts are allowed to hang down, and guided into position as the top carriage is lowered, the plate with staple and straps for side-arms is put on the left front tension bolt just before the top carriage is lowered.

The four vertical tension bolts are secured to the lower carriage by two plates, through which their lower ends pass, a washer having first been put on each, the bolts are nutted up.

The cross-stay nuts are now tightened up *as much as possible on both sides*, by using the powerful "knock-up" wrench.

The after part of the top carriage is secured to the trail by screw nuts and clip plates, which latter are marked.

To adjust the elevating arc the gun should be depressed about 5°, when the ends of the arc (which are marked "muzzle" and "breech") are placed in the patches, the arc being worked into position by means of the worm-wheel. The arcs are kept in position by large pins, which are secured with washer and pin.

AMMUNITION WAGON.

The body of the wagon (which is the same as 9- and 16-prs., Mark II, or 25-pr.) consists of a perch of iron, with steeled eye and strengthening plates, two sides of angle iron, connected together by iron plates, over which the boards are secured, namely, two footboards and three platforms.

The axletree bed is of wrought iron, and with the axletree constitutes a beam of box-girder section. The wheels are of the 2nd class, with metal naves, and tire 3 inches wide.

The wagon is fitted with an iron bracket and arm, for carrying a spare wheel, and has also fittings for carrying a drag shoe and stores.

The ammunition boxes (four) stand between the platform boards secured by nib irons and straps; two are the same as the "near" gun limber box, and two the same as the "off," excepting leather fittings. Beneath the wagon are two under boxes.

The limber is similar to the gun limber, but not fitted with outriggers and framed shafts for 4-horse draught.

The boxes are identical with those of the gun limber.

	Feet.	Inches.
Length of wagon and limber	20	7½
Minimum space through which wagon can turn	29	6½
	cwts.	qrs. lb.
Weight of wagon and limber, empty	25	3 10

AMMUNITION WAGON, WITH MARK I WAGON AND LIMBER BODIES.

The wagon body differs mainly from the above in having the perch framed of girder iron in one piece with cast-iron strengthening plates, in the axletree bed being of wood, and in the block with arm for spare wheel being of wood strengthened by iron.

The limber body also differs in the axletree bed being of wood, and in the form of the limber hook, which is made to stand out from the bed by means of a block.

The wheels also differ in having the tire 2½ inches wide.

	Feet.	Inches.
Length of wagon and limber	20	5½
Minimum space in which wagon can turn ..	29	8½
	cwts.	qrs. lb.
Weight of wagon and limber, empty	25	0 26

40-PR. RIFLED M.L. EQUIPMENT.

War Establishment.

LIMBER.

On Footboard.
1 lifting jack (Clerk's).
1 pair drag ropes, heavy.
Under Footboard.
2 swingletrees.
1 washer drag, 1st Class.
1 washer loop, 2nd Class.

1 half-round tin grease pot, 3 lb., under.

1 billhook, under.

Near Box.

1 vent server.

1 stick portfire.

3 Shrapnel shells.

6 filled cartridges in cartouch.

Fuze pocket, with hookborer.

2 common shells.

1 case shot.

On top of lid of Box.
1 blanket.
1 waterproof cover.
1 corn sack.

Centre Box.

1 oil can.

16 percn. fuzes.

15 15-secs. wood time fuzes with detonators.
4 sponge cloths.

25 friction tubes.
2 lanyards.

2 linch pins.
2 couples trace.
2 spikes, common.
Vent-bit, chalk line and reel.

Off Box.

2 common shells.

1 case shot.

6 filled cartridges in cartouch.

3 Shrapnel shells.

On top of lid of Box.
1 blanket.
1 waterproof cover.
1 corn sack.

2 cases leather cartridge, under,
1 swingletree, "
1 felling axe, "
1 shovel, "

On inside of Lid.
1 clinometer.*
1 knife with marline-spike.
1 funnel leather.
1 fuze extractor.
1 portfire clipper.
1 key plug, G.S.
1 holdall.

1 pickaxe, under.
1 maul, "

2 leather buckets, under.
1 spade, "

On inside of Lid.
2 portfires.
1 spring spike.
1 screwdriver, large.
1 hook borer with cylinder and 6 bits.
1 tangent sight } spare, per division.
1 trunnion "
1 pair scissors, laboratory.
1 spanner for gas check.

GUN CARRIAGE, MARK II.

Coin.

1 handspike.

1 handspike.

1 bracing elevating rack.
1 case leather with tube.
pocket and strap and lanyard.

Coin. 1 spanner.

Coin. 1 pr. pincers.

3 handspikes.

under, 2 prickers, priming.

1 water brush.
1 claw hammer.

1 wadhook.
1 rammer.
2 sponges with cap.
1 wood lever.
†1 piassaba brush.

Arc (when not in use).
Drag shoe and chain.

1 tampeon, with lanyard.
1 gun roller.
Weight about 89 cwt.

---

* Per Battery.
† No. 1 gun only.

Note—Each shell is supplied with a lifting strap.
N.B.—Oakum should be used to prevent the movement of the cylinders in the centre boxes.

40-PR. RIFLED M.L. EQUIPMENT.

War Establishment.

LIMBER.*

On Footboard.

1 pair drag ropes, heavy.
1 picket rope.
1 lifting jack, G.S.

Under Footboard.

1 felling axe.

1 half-round tin grease box, 3 lb., under.

NEAR BOX.

CENTRE BOX.

1 swingletree.
1 bill hook, under.

OFF BOX.

vent server.

On top of lid of Box. 1 blanket. 1 cover, water-proof. corn sack.

1 shovel.

3 Shrapnel shells.

6 filled cartridges in cartouch.

3 common shells.

1 oil can.

16 percn. fuzes.

15 15-secs. wood time fuzes, with detonators. 4 sponge cloths.

50 friction tubes.

2 lanyards.

3 common shells.

6 filled cartridges in cartouch.

3 Shrapnel shells.

1 spade.

On top of lid of Box. 1 blanket. 1 cover, water-proof. 1 corn sack.

1 camp kettle, under.
On inside of Lid.
1 portfire clipper.
1 key plug, G.S.

1 pickaxe, under.

2 leather buckets, under.
On inside of Lid.
1 screwdriver, large.
1 drift wood.
1 hook borer with cylinder and 6 bits.

Drag shoe.

WAGON BODY.

†1 spare wheel.

1 spanner for gas check.

On inside of Lid.
Nil.

On inside of Lid.
Nil.

1 water brush, under.

On top of lid of Box. 2 blankets. 2 water-proof covers.

3 picket posts.

3 Shrapnel shells.

6 filled cartridges in cartouch.

3 common shells.

3 common shells.

6 filled cartridges in cartouch.

3 Shrapnel shells.

On top of lid of Box. 2 blankets. 2 water-proof covers.

3 picket posts.

1 camp kettle, under.

4 reaping-hooks.

1 camp kettle, under.

On top of lid of Box. 2 blankets. 2 water-proof covers.

1 portfire stick.

1 handsaw, in case.

3 Shrapnel shells.

6 filled cartridges in cartouch.

3 common shells.

3 common shells.

6 filled cartridges in cartouch.

3 Shrapnel shells.

On top of lid of Box. 2 blankets. 2 water-proof covers.

28 lb. grease in two tin magazine boxes, under.
1 maul, under.

Under box, containing,—
Slow match. Marline.
Hambro' line. Twine, whipping.
1 washer drag, 2nd class.
1 linch pin.

On inside of Lid.
2 portfires.

On inside of Lid.
2 portfires.
2 couples, trace.

Weight, with Mark I. bodies, about 42 cwt. 3 qrs. 8 lb.
" " II. " " 43 cwt. 2 qrs. 0 lb.

* Not interchangeable with gun limber, which is a siege limber. † Per two wagons.

Note.—Each shell is supplied with a lifting strap.

INSTRUCTIONS FOR CARE AND PRESERVATION.

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

All bright parts should be kept clean but not polished, and when not in use slightly greased.

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

The elevating gear must be kept clear of clotted oil, dirt, and corrosion, and well lubricated. When not in use the removable parts should be greased and placed in store.

The axletrees and grease-chambers of the wheels should be frequently cleaned, and all dirt and grit removed before lubricating. To ensure thorough lubrication the chambers must be kept filled with grease.

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

When carriages are parked the shafts should be raised on the props to keep the points dry.

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

CLERK'S PLATFORM, MARK II.

List of Changes, §§ 3513, 4138, 4506.

This platform consists of two inclined planes of fir (having a slope of 3°), 4 transoms, and 1 oak trail plank plated with iron, two front stops and two rear stops.

The inclined planes are each fitted on their inner sides with a riband plated with iron along its inner edge; a moveable iron stop in front and rear to keep the wheels from running off; a plate round the thin end with a hole for the pivot pin; at the rear a traversing bolt. Three of the transoms are 7 feet long and the fourth 10 feet.

The first transom has four holes for the pivot pins of which the two inner are used when the platform is laid for use with the 40-pr.

Weight of platform, 17 cwt.; tonnage, 1·6 tons.

To Lay the Platform.

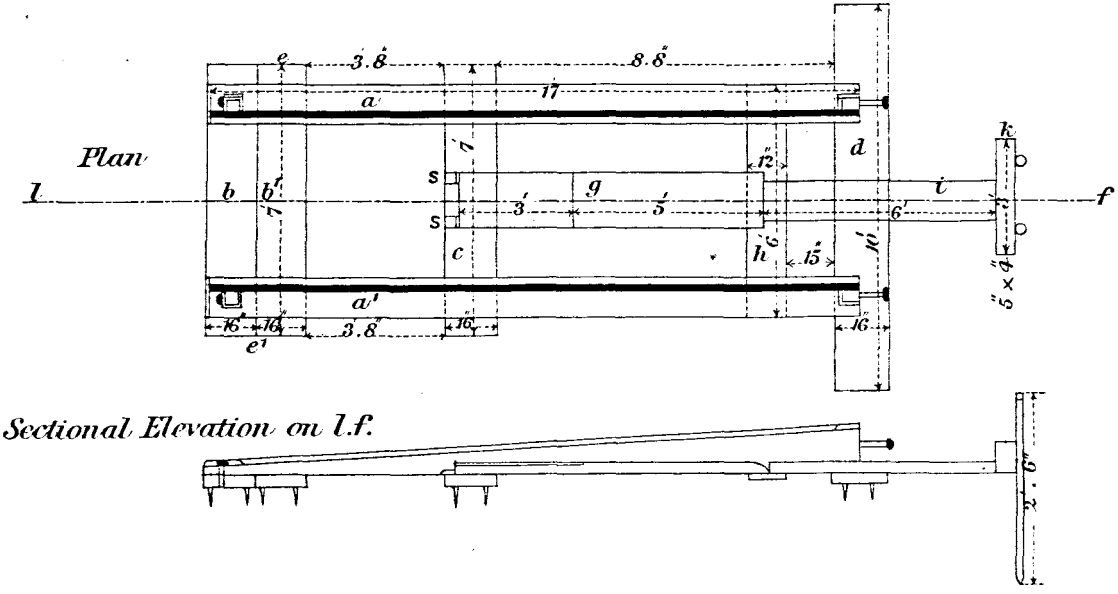
In addition to the platform itself two service oak planks 6′ × 12″ × 3″, one piece of oak skidding 3′ × 5″ × 4″, and two field pickets 2′ 6″ are required.

Entrenching Tools, &c., required:—4 picks, 4 shovels, 2 rammers, 6 banderols or pickets, 1 maul, 1 field level or quadrant, 1 measuring tape or rod.

The line of fire (*l f*) having been ascertained, and marked by pickets or banderols, the front transom (*b*), with the holes in it, is laid at right angles to it, in the centre of the gun portion 6 inches from foot of the interior slope of the parapet; this is done by making the distances *e f*,

CLERK'S PLATFORM.

METHOD OF LAYING.



e' f, from ends of the transom to any point f in the line of fire equal. The transom should be flush with the ground, and laid horizontal by aid of a field level.

A second front transom (b') is laid in rear of and close to the first. At a clear interval of 3 ft. 8 in. is laid the third transom.

The rear transom is laid at such distance from the front, that the ends of the inclined planes will rest on them so as to allow a bearing for the handspikes under the traversing bolts.

The ground between the transoms having been well rammed, the side pieces are laid, ribands *inside*, and pivoted to the *inner* holes in the front transom by means of two iron pins.

Iron stops are then fitted on the front ends of the side pieces to prevent the gun being run up too far.

Similar stops on the rear ends to check recoil.

The trail plank is then placed between the side pieces, the iron shod portion of it to the front, and resting on the centre transom and plank.

The rear of the trail plank is supported on a plank placed 15 inches in front of the rear transom, the trail plank being lengthened by a 6-feet oak plank butted against a piece of skidding supported by two pickets. Two small scotches (s s), should be screwed down to the centre transom for the front of the trail plank to butt against.

To place the Gun on the Platform.

This may be done by removing the rear stops and moving the gun up from the rear on inclines of coins or skidding with planks on them.

It may also be done by placing the gun in position before the inclined planes have been placed and pivoted; the wheels are then raised in succession, and the inclined planes run under them and pivoted to the front transom.

PROJECTILES.

List of Changes, §§ 5370, 3383, 4083.

Plate III.

			Weight without gas check. lb.	oz.	
Shell	Common, Mark III	Bursting charge 3 lb. 6oz. P. and F. G. powder.	38	14¼	±1·5%
	Shrapnel, Mark III	Filled with 180 mixed metal bullets at 18 per lb., and bursting charge 4½ oz.	41	12	±1·5%
Shot	Case, Mark II, filled with 405 mixed metal bullets at 16½ per lb., clay and sand.		38	6	

The Common and Shrapnel shells are fitted with a gas check and plug weighing about 20 oz. The gas check has three projections to fit the grooves, and six fire holes 0·2 inch diameter. It is attached to the shell by a hexagonal-headed plug, care being taken before tightening the plug to align the projections with the studs on the projectile.

INSTRUCTIONS FOR FILLING SHELLS.

Common Shells.

Remove the plug from the fuze-hole; place the filling rod in the bag; insert it through the fuze-hole, taking care not to force the end of the rod through the bottom of the bag; carefully push in the bag until the neck only is in the fuze-hole, a portion being kept outside, as the whole bag must not be allowed to slip into the shell during the operation of filling; then withdraw the rod, and insert the funnel in the neck of the bag, pressing the funnel well down into the fuze-hole. Weigh out the proportions of P. and fine-grained powders (2 lb. 10 oz. P., and 12 oz. F.G.). Drop in the former, pebble by pebble, and then fill up the interstices with F.G. The neck of the bag is then tied up and cut off, one or more "bags, primer, filled, 7 drams," dropped in, and the plug or fuze, as required, inserted.

Shrapnel Shells.

Remove the plug from the fuze-hole, and after seeing that the latter is clear of any dirt, &c., insert the leather funnel and pour in the bursting-charge (pistol, F.G., R.F.G., or R.F.G.^{2}, powder), which has been previously weighed 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. The 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 "Primer, shrapnel shell, Mark III," and by means of the "Driver, screw, shrapnel, large, Mark III," screw it tightly into the tube, and then screw in the fuze or plug, as may be required.

DISTINGUISHING MARKS.

All shrapnel shell will be painted with a red tip 1 inch deep.

All filled shell will be marked with the date of filling, with P if filled with P mixture, and with a red band $\frac{1}{2}$ inch wide, painted round the head $1\frac{1}{2}$ inches from the top; in the case of shrapnel, the red band will be $\frac{1}{2}$ inch below the red tip. Filled common shell must be marked with the word "Bag" if a bag is used, and a red disc 1 inch diameter if shalloon primers have been inserted. The colour of the paint will be red on a black ground, or black on a red ground. The monogram of the station is to be painted on the shell, except when filled by the Royal Artillery.

Shells which have been emptied will be marked on the head with the letter E in red paint, and also the monogram of the station.

Projectiles for practice only will be marked with a yellow band round the head, to distinguish them from service projectiles.

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 at all other stations.

EXAMINATION OF FILLED SHELLS.

Shells, Common.

Remove the plug, and the "bags, primer," with the "hook, G.S. wads." Draw out the neck of the "bag, burster" by means of the above hook, and untie the twine round the neck of the bag. If the powder is in a serviceable condition tie up the neck of the bag again, and proceed as directed in the instructions for filling. If the powder is caked from the effects of damp, empty the shell (this requires careful manipulation); up-end the shell as required; insert the filling rod or any suitable-sized piece of brass wire so as to facilitate the exit of the powder, and to prevent the bag from doubling up, &c., until the whole of the powder is extracted. Take out the bag, and, if it is in a serviceable condition, replace it in the shell; if not, insert a new bag, and refill with serviceable powder, the "bags, primer, filled, 7 drms.," if serviceable, being also replaced. 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 15 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 15 minutes have elapsed after the second quantity of boiling water has been poured in. When the shell is perfectly dry, refill with serviceable powder.

Shells, Shrapnel.

Remove the fuze-hole plug, unscrew the primer with the "driver, screw, Shrapnel, large, Mark III," and lift out the primer with the "pincers, Shrapnel, primer"; 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.

FUZES.

(*List of Changes*, §§ 4496, 4685, 5270, 2621.)

Fuze, time, 15 secs. M.L. with detonator, No. 43, Mark III.
Fuze, percussion, R.L. No. 7, Mark II, or Mark III.

15 *secs. M.L. Time Fuze with Detonator.* (*Plate IV.*)

This fuze is made of beech. It is bored with a central composition hole and six powder channels. The powder channels communicate one with another by means of a strand of quickmatch pressed into a groove on the base. The fuze composition is pressed into the central hole. The fuze is ignited on discharge by the setting back of the hammer on to a detonating pellet. The hammer is retained by a suspending wire 0·03 inch thick, and by a safety pin which is

withdrawn before ramming home. The fuze is marked spirally from 1 to 30, the figures and dots being arranged in six columns corresponding to the powder channels.

When reference is made to the divisions of the fuze in teaching, it is far simpler to call them merely divisions, without any reference to either tenths of inch of length or seconds of burning. Both are only nominal, and simply confuse the learner. To say that for a certain number of yards of range a certain number of divisions of the fuze are required, is all that can be necessary.

R.L. Percussion Fuze, Mark II or III. (Plate V.)*

This fuze consists of a body, needle, guard, pellet with cap, base plug, and safety pin.

The body is of gun-metal, it is tapped on the exterior to the G.S. pitch and taper, and on the interior at the bottom to receive a screw-plug also of gun-metal. On the top is a square keyhole recess of proper size to take the "Key, plug, G.S." or "Key, fuze, Universal."

From the lower surface of the head projects a steel needle.

Inside the body is a gun-metal guard recessed as shown in the plate, and supported in position by two feathers on the exterior circumference of pellet.

The pellet is made of lead and tin in equal proportions, and has a bevelled edge above the feathers corresponding to a similar recess in the interior surface of the guard.

The pellet is hollow and is cupped out to receive a copper cap containing about 3½ grains of cap composition, pressed and varnished in the same way as ordinary percussion caps. The upper part of the pellet is covered by a copper cap, attached by three indentations, to protect it from being damaged by the safety pin when jolted in the limbers, thereby allowing the detonating composition to approach dangerously near to the point of the needle.

The safety of the fuze in transit, &c., is ensured by a safety pin made of twisted brass wire, which has a tarred twine becket wherewith to pull it out at the moment of loading.

When the safety pin is withdrawn, the hole through which it passed, is closed by a small lead pellet which sets back across it.

The bottom plug screws in the bottom of fuze. It has a fire-hole drilled through its centre which is closed by a thin brass disc secured by spinning over.

Mark II* is exactly similar to the above, having been converted from Mark II by the addition of the copper cap.

Action.

On discharge, the guard sets back, shearing the feathers, the pellet is then free to move forward on to the needle on impact.

PREPARING FUZES.

Fuzes, Time, Wood, with detonator.

These 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 fuze 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.

FIXING FUZES.

Fuzes, Percussion, R.L.

These fuzes require no preparation except the removal of the safety-pin; they are screwed firmly into the fuze-hole by means of the "Key-plug, G.S." or Key-fuze, universal.

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

Fuzes, Time, Wood, with Detonator.

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

The safety pin will not be withdrawn until after entering the shell into the muzzle.

TUBE.

Tube, friction, copper, short, or tube, friction, copper, solid drawn.

EXTRACTING WOOD FUZES.

Apply the fuze-extractor to the head of the fuze and unscrew.

CARTRIDGE.

(*List of Changes*, 5361.)

* Cartridge, silk cloth, 6¾ lb., R.L.G.[4] These are issued filled.

* This charge gives the same muzzle velocity as the 7 lb. R.L.G.[2], and has been sealed to govern future supplies, and the conversion of the empty Silk Cloth Cartridges.

RANGE TABLE FOR 40-PR. R.M.L. GUN.

*Charge, 6¾ lb. R.L.G.[4] Powder.

Projectile, Common Shell, or Shrapnel, fitted with gas check.

Range.	Elevation.	Angle of Descent.	Remaining Velocity.	5 minutes elevation increases or decreases the range by	5 minutes will alter point of impact vertically or laterally at each range	50 per cent. of rounds should fall within*			Time of Flight.	Dangerous zone for a height of 6 feet.	Fuze scale, 15 secs. Time Fuze with Detonator.	
						Length.	Breadth.	Height.			Range.	Length of Fuze.
yards.	° ′	° ′	f.s.	yards.	yards.	yards	yards.	yards.	seconds.	yards.	yards.	
0	—	—	1,425	—	—	—	—	—	—	—	120	0·5
100	—	—	1,392	—	—	6·5	0·08	—	0·20	—	220	1·0
200	0 6	0 18	1,359	56	0·29	3·0	0·16	0·02	0·40	—	320	1·5
300	0 15	0 27	1,326	53	0·43	4·3	0·24	0·03	0·65	whole	420	2·0
400	0 24	0 39	1,294	51	0·58	5·6	0·32	0·06	0·90	174	520	2·5
500	0 34	0 48	1,262	50	0·72	6·8	0·40	0·10	1·15	142	620	3·0
											720	3·5
600	0 44	1 0	1,235	49	0·87	8·0	0·48	0·14	1·40	115	820	4·0
700	0 54	1 12	1,208	48	1·01	9·1	0·56	0·19	1·65	95·2	920	4·5
800	1 4	1 24	1,182	47	1·16	10·2	0·63	0·25	1·90	81·9	1,020	5·0
900	1 14	1 38	1,156	46	1·31	11·3	0·71	0·32	2·15	70·1	1,120	5·5
1,000	1 25	1 50	1,130	45	1·45	12·4	0·79	0·40	2·40	62·5	1,220	6·0
											1,315	6·5
1,100	1 36	2 4	1,110	44	1·60	13·4	0·87	0·48	2·65	55·0	1,410	7·0
1,200	1 47	2 19	1,091	43	1·74	14·4	0·94	0·58	2·90	49·0	1,505	7·5
1,300	1 58	2 34	1,072	42	1·89	15·6	1·02	0·69	3·15	44·2	1,600	8·0
1,400	2 9	2 50	1,053	41	2·03	16·3	1·10	0·81	3·40	40·2	1,695	8·5
1,500	2 20	3 6	1,034	40	2·18	17·2	1·17	0·93	3·70	36·8	1,790	9·0
											1,885	9·5
1,600	2 32	3 20	1,021	40	2·32	18·1	1·24	1·06	4·00	34·1	1,980	10·0
1,700	2 44	3 35	1,008	39	2·47	19·0	1·32	1·20	4·30	31·5	2,070	10·5
1,800	2 56	3 55	995	38	2·61	19·9	1·39	1·37	4·60	29·1	2,160	11·0
1,900	3 9	4 15	982	37	2·76	20·7	1·46	1·54	4·90	26·8	2,250	11·5
2,000	3 22	4 36	970	36	2·91	21·5	1·53	1·72	5·20	24·8	2,340	12·0
											2,425	12·5
2,100	3 35	4 50	958	36	3·05	22·3	1·60	1·90	5·50	23·1	2,510	13·0
2,200	3 49	5 12	947	35	3·20	23·1	1·69	2·11	5·80	21·5	2,595	13·5
2,300	4 3	5 38	936	34	3·34	23·9	1·76	2·34	6·10	20·1	2,680	14·0
2,400	4 17	6 1	925	33	3·49	24·7	1·84	2·60	6·40	18·8	2,765	14·5
2,500	4 32	6 27	914	32	3·63	25·5	1·91	2·89	6·70	17·5	2,850	15·0
											2,930	15·5
2,600	4 47	6 54	904	31	3·78	26·2	1·99	3·20	7·00	16·3	3,010	16·0
2,700	5 3	7 25	894	30	3·92	26·9	2·06	3·52	7·30	15·2	3,090	16·5
2,800	5 19	7 56	884	29	4·07	27·6	2·13	3·84	7·60	14·2	3,165	17·0
2,900	5 35	8 12	874	29	4·21	28·3	2·21	4·17	7·95	13·4	3,240	17·5
3,000	5 52	8 46	864	28	4·36	29·0	2·28	4·50	8·30	12·8	3,315	18·0
											3,390	18·5
3,100	6 9	9 10	855	28	4·51	29·7	2·36	4·85	8·65	12·2	3,460	19·0
3,200	6 27	9 48	846	27	4·65	30·4	2·44	5·21	9·00	11·7	3,530	19·5
3,300	6 45	10 5	837	27	4·80	31·0	2·51	5·60	9·35	11·2	3,600	20·0
3,400	7 3	10 42	828	26	4·94	31·6	2·59	6·00	9·70	10·7	3,665	20·5
3,500	7 22	11 0	819	26	5·09	32·2	2·66	6·40	10·05	10·2	3,730	21·0
											3,790	21·5
3,600	7 41	11 20	810	26	5·23	32·8	2·74	6·80	10·40	9·8	3,850	22·0
3,700	8 0	12 5	802	25	5·38	33·4	2·82	7·23	10·75	9·4	3,910	22·5
3,800	8 20	12 25	794	25	5·52	34·0	2·90	7·67	11·10	9·0	3,965	23·0
3,900	8 40	13 15	786	24	5·67	34·6	2·97	8·11	11·50	8·6	4,020	23·5
4,000	9 0	13 40	778	24	5·81	35·2	3·05	8·55	11·90	8·2	4,070	24·0
											4,120	24·5
4,100	9 21	14 30	770	23	5·96	35·8	3·13	9·00	12·30	7·8	4,165	25·0
4,200	9 42	14 50	762	23	6·11	36·4	3·21	9·45	12·70	7·5	4,210	25·5
4,300	10 3	15 5	754	23	6·25	37·0	3·28	9·90	13·10	7·4	4,250	26·0
4,400	10 24	15 28	746	23	6·40	37·5	3·36	10·35	13·50	7·2	4,290	26·5
4,500	10 46	15 45	739	23	6·54	38·0	3·44	10·80	13·95	7·1	4,325	27·0
—	—	—	—	—	—	—	—	—	—	—	4,360	27·5
—	—	—	—	—	—	—	—	—	—	—	4,390	28·0
—	—	—	—	—	—	—	—	—	—	—	4,420	28·5
—	—	—	—	—	—	—	—	—	—	—	4,450	29·0
—	—	—	—	—	—	—	—	—	—	—	4,475	29·5
—	—	—	—	—	—	—	—	—	—	—	4,500	30·0

* This Range Table is applicable to the 7 lb. R.L.G.[4] charge which gives the same muzzle velocity.

Drill with 40-pr. Rifled M.L. Gun.

The detachment consists of nine numbers, and falls in two deep in rear of the gun, which is limbered up.

To tell Off.

Officer.	*No.* 1.
Tell off.	

At "*Tell off.*"—No. 1 (who is on the left of the detachment) takes a pace to his front, turns to his right, and numbers himself 1; the right-hand man of the rear rank numbers 2; the right-hand man front rank 3; the second man from the right of the rear rank 4; the man in his front 5; and so on; after the detachment is told off No. 1 falls in again on the left of the front rank.

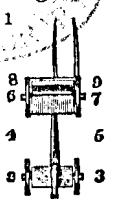
No. 1 then straps on the fuze pocket on his right side, and 5 the tube pocket.

The front is that direction in which the gun is pointed when unlimbered, or to which, when limbered up, the horses' heads are turned.

Position of Detachment when Limbered up.

In Order of March.

Fig. 1.



No. 1 in line with the point of the near shaft and two yards on the left of it.

Nos. 2 and 3 in line with the axletree of the gun carriage.

Nos. 4 and 5 in line with the centre of the trail.

Nos. 6 and 7 in line with the axletree of the limber.

Nos. 8 and 9 in line with the splinter bar.

The Nos. stand covering, one yard from the wheels. (Fig. 1.)

In Front.

Two deep, two yards in front of the shafts or leaders' heads.

In Rear.

Two deep, two yards in rear of the muzzle of the gun.

Right or Left.

Two deep, in line with the gun axletree, one yard to the right or left of the wheel.

Change of Position of Detachment.

To form the Order of March from Detachment Front.

Officer.	*No.* 1.
Form the order of march.	*Right turn, Double march.*

"*Right turn, Double march.*"—No. 1 turns with the detachment; 2 and 3 wheel to their right and open out. Each number halts when at his post; they turn to the front together, looking to No. 2, who turns about immediately he arrives at his post.

To form the Order of March from Detachment Rear, Right or Left.

Officer.	*No.* 1.
Form the order of march.	*Left turn, Double march.*

When the detachments are in rear, or on the right, they proceed direct; but when on the left they countermarch to the left. No. 1 heads the rear rank. Each number halts when at his post.

To Change from Front to Rear.

Officer.	*No.* 1.
Detachment rear.	*Right turn, Double march.* *Rear turn.* *Right turn, Halt, Front.*

When the detachment is clear of the gun it turns to the rear; when in line with the position of "*Detachment rear*" it turns to the right, and when in rear of the muzzle it halts and fronts.

To Change from Rear to Front.

Officer.	*No.* 1.
Detachment front.	*Right turn, Double march.* *Front turn.* *Left turn, Halt, Front.*

When the detachment is clear of the gun it turns to its front, when in line with the position of "*Detachment front*" it turns to its left, and when in front of the leading horses it halts and fronts.

To Change from Rear to Right or Left.

Officer.	*No.* 1.
Detachment, right (left).	*Right (left) turn, Double march.* *Front Turn, Halt.*

The detachment turns to its front when one yard clear of the gun wheel and halts when in line with the axletree.

To form Detachment Rear from the Order of March.

Officer.	*No.* 1.
Detachment rear.	*Right about turn, Double march. Halt, Front.*

Nos. 2 and 3 close to the centre, and wheel to their left, marking time when opposite the off wheel and two yards from it; as soon as the detachment has closed up it is halted and turned to the front.

To form Detachment Front from the Order of March.

Officer.	*No.* 1.
Detachment front.	*Double march. Halt, Front.*

No. 1 doubles out two yards in front of the near shaft, turns to his right, and gives the order "*Double march.*" Nos. 8 and 9, followed by the other Nos., double out. As soon as 8 is clear of the shafts he inclines towards 9. When 8 and 9 arrive in line with No. 1 they wheel to their left, and mark time; when the detachment is closed up, No. 1 gives "*Halt, Front,*" turning himself to the front at the same time.

To Change Rounds when the Gun is Limbered up.

The detachment being at the "order of march" in changing rounds No. 2 becomes No. 4; 4, 6; 6, 8; 8, 1; 1, 9; 9, 7; 7, 5; 5, 3; 3, 2.

To Unlimber.

This must be done when the gun is in the firing trunnion holes.

Officer.	*No.* 1.
Unlimber.	*Prepare to unlimber.* *Lift.* *Limber drive on.* *Lower.*

"*Prepare to unlimber.*"—No. 1 unkeys the keep chain and with 2, 3, 4, 5, 6, and 7 stands to the trail, 2 and 3 nearest the gun. If there are no horses 9 goes to the shafts, and 8 to the splinter bar on the near side.

At "*Lift*" the trail is lifted clear of the pintail, at "*Limber drive on*" the limber moves on, and at "*Lower*" the trail is lowered to the ground.

To Limber up.

Officer.	*No.* 1.
Limber up.	*Prepare to limber up.* *Lift.*

The several numbers place themselves as for unlimbering, and at "*Lift*" lift the trail on to the pintail, No. 1 keys up.

When unlimbering or limbering up guns mounted on overbank carriages, great care should be taken *not to raise the trail too high*, as it is apt to fly up and escape from the control of the men lifting it, in which case the gun pitches violently over on to its muzzle, and may become dismounted.

To Shift a 40-pr. R.M.L. Gun, on Travelling Siege Carriage, from Travelling to Firing Trunnion Holes.

This must be done while the gun is limbered up.

Strength of Detachment.—One gun detachment.

Officer.	*No.* 1.
Shift from travelling to firing trunnion holes.	*Prepare to shift the gun.* *Prepare to bear down.* *Bear down.* *Come up.* *Prepare to lift.* *Lift and heave.* *Prepare to bear down.* *Bear down.* *Come up.*

"*Prepare to shift the gun.*"—2, 3, 4, and 5 cast loose side-arms and handspikes and unbuckle straps should the gun be so secured; 2 and 3 take off cap-squares; 4 and 5 scotch the gun wheels with handspikes, 4 in front, 5 in rear.

"*Prepare to bear down.*"—2 places his handspike in the bore; 4 passes a handspike across 2's to 5; 8 and 9 make fast two drag-ropes to the breech, and pass the ends towards the muzzle; 3, 8 and 9 then double man 2's handspike. A check rope should be made fast to the cascable and axletree bed of limber by No. 9.

"*Bear down.*"—2, 3, 4, 5, 8, and 9 bear down; 6 hands the roller to No. 1, who places it as near as possible under the centre of gravity and gives

"*Come up.*"

"*Prepare to lift.*"—4 crosses his handspike under that in the bore to 5; 1, 6, and 7 man the ropes.

"*Lift and heave.*"—The bends of the arms are placed under the handspikes; the gun is raised out of the travelling holes and hauled forward until the trunnions fall into the firing holes. The handspike men should keep their eyes fixed on the gun so as to be prepared for its descent. As soon as the gun is in the trunnion holes the drag-ropes are cast off by 8 and 9.

"*Prepare to bear down.*"—4 reverses his handspike and places it over that of 2.

"*Bear down.*"—6 withdraws the roller, and straps it on the carriage; 1 and 7 put on the elevating gear.

"*Come up.*"—The handspikes are withdrawn and laid down.

To Shift from Firing to Travelling Trunnion Holes.

The operation of shifting from firing to travelling trunnion holes is the converse of the above, but the roller should be placed with its centre opposite the rear of the horns of the travelling trunnion holes. The breech can be raised with handspikes to enable the roller to be withdrawn. The gun is secured by straps to the carriage for travelling.

To Shift a 40-pr. R.M.L. Gun on Overbank Carriage from Firing to Travelling Trunnion Holes.

This must de done while the gun is limbered up.

Strength of Detachment.—About 19 Nos.; or, say, two gun detachments.

Stores required.—The stores required, in addition to those on the gun, are as follows, viz.:—

Drag-ropes, heavy	2
Luff tackles, complete	3
Selvagees	2
Wrench pivot No. 4	1

The special gun roller, when in use, rests on two gudgeon plates fitted to the cheeks of the overbank to top carriage; when not in use the brackets fold down.

The wrench pivot No. 4 is used for removing the keep pins of the bolts which secure the elevating arc in the patches.

Officer.	*No. 1.*
Shift from firing to travelling trunnion holes.	*Prepare to shift the gun.* *Hook tackles.* *Prepare to bear down.* *Bear down.* *Come up.* *Prepare to lift.* *Lift and heave.* *Halt. Lower.* *Prepare to bear down.* *Bear down.* *Heave and ease off.* *Cast off tackles.*

Prepare to shift the gun.—2, 3, 4 and 5 cast loose side-arms, handspikes, remove elevating arc, fittings, &c.; 2 and 3 remove cap-squares; 4 scotches the wheels in front; 5 in rear; 8 and 9 lash trail eye to axletree bed of limber with a drag rope.

Hook tackles.—No. 1 places breech loop on cascable; 4 and 5 hook the double blocks to it; 6 and 7 the single blocks to the eye bolts on breast of carriage; they take in the slack, and stand ready for easing off, assisted by 4 and 5; 9 hooks the double block of tackle to cascable; 8 the single to trail plate eye, using selvagees for this purpose, they take in the slack, and pass the fall to the front.

Prepare to bear down.—2 places a handspike in the bore, and makes fast a drag-rope to end of it; double manned by 3, 8, and 9; 6 hands roller to 1.

Bear down.—2, 3, 8 and 9 bear down. No. 1 places roller and gives. *Come up.*

Prepare to lift.—All the numbers above 9 man the breech tackle.

Lift and heave.—2, 3, 8 and 9 lift; 4, 5, 6 and 7 ease off a little, the remainder haul on breech tackle until the trunnions are over the flat part of the brackets; when No. 1 gives *Halt, Lower*, 2, 3, 8 and 9 lower the trunnions on to the brackets, the breech-tackle Nos. easing off at the same time.

Prepare to bear down.

Bear down.—No. 1 removes roller, and throws back catches.

Heave and ease off.—4, 5, 6 and 7 ease off; 2, 3, 8 and 9 steady the muzzle; remainder haul on breech tackle.

Cast off Tackles.—The tackles are cast off by the same numbers that hooked them; the gun is secured by straps to the carriage for travelling.

To Shift from Travelling to Firing Trunnion Holes.

Officer.	*No.* 1.
Shift from travelling to firing trunnion holes.	*Prepare to shift the gun.* *Hook tackles.* *Arrange muzzle handspike.* *Taut. Heave.* *Cast off tackles.*

Prepare to shift the gun.—As before, 8 and 9 lash trail eye to axle-tree bed of limber with a drag rope.

Hook tackles.—As before.

Arrange muzzle handspike.—As before.

Taut. Heave.—2, 3, 8 and 9 steady the muzzle; 19 eases off check tackle, the remainder man the falls of the hauling tackles on their own sides; as soon as the trunnions rest on the flat part of the carriage brackets, 6 and 7 place points of handspikes in the trunnion holes to receive the gun.

Cast off tackles.—As before.

To Take Post Under Cover.*

Officer.	*No.* 1.
Take post under cover.	*Right turn.* *Double march.*

The detachment wheels to its left, the front rank filing to the left of the gun, 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 go to the cartridge store; 7 and 9 to the shell store

* If the gun is not behind a parapet and the word of command is "*Take post at the gun*," 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 at the limber.

General Duties.

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

No. 2 searches, sponges, 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, runs up, makes ready, and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes and brings up projectiles.

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

No. 9 attends to shell store, issues shells, tubes, and fuzes.

The instructor should ascertain that each number is at his post by proving. This he does by calling out No. 1 "*Prove*," No. 2 "*Prove*," &c. The man called upon raises his right arm and extends it smartly to the front, hand open, thumb upwards, hand as high as the shoulders. When the next number is called he drops his hand. The last number lowers his hand at the word "*Down*."

On all occasions before giving a word of command, No. 1 should repeat the number of his gun.

At the sound or order "*Stand fast*," when a gun is loaded it will remain so, if in the act of being loaded, the loading will be finished and the gun not fired until the order to recommence firing is given.

Loading should be performed as rapidly as is consistent with the proper performance of all the duties, avoiding confusion.

The cartridge should be kept covered until the sponge is out of the bore.

A sponge for rifled guns should be high, it should be allowed to take the twist of the rifling, and forced to the bottom of the bore.

To Prepare for Action.

Officer.	*No. 1.*
Prepare for action.	*Prepare for action.* *Examine guns.*

"*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.

No. 7, fuzes and fuze and shell implements. He obtains the fuze boxes from 9, 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 provides a brush, prepares to issue shells, friction tubes, and fuzes. He examines the shells carefully, cleaning them if necessary

and removing burrs from studs; he loosens the fuze hole plugs of shells that will be first issued and sees that the gas-checks are properly fitted and the projections aligned with the studs on the shell.

The stores having been brought up, No. 1 will satisfy himself that the fore sights fit properly on the gun and the deflection leaves of the hind sights work easily; he receives the reports from the Nos. responsible of any irregularity or deficiency in connection with the gun, ammunition, or stores.

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

The sponge bucket near the sponge head.

The handspikes are laid down, two on each side of the gun close to the carriage, points to the front, bevelled side uppermost, those of 2 and 3 outside, and about two feet in 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 9, and places the pricker in the loop on the carriage.

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

"*Examine gun.*"—No. 1 drifts the vent, replaces the pricker in the loop and the vent server. 2 supplies himself with the wadhook, searches the gun after the pricker has been withdrawn, and replaces wadhook. 4 attends to the elevating wheel to bring the gun into a convenient position for loading.

To Load.*

Officer.	*No. 1.*
Range—Yards. *With—load.*	*With—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 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 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 hand along the stave to his right as far as he can reach, sends the sponge up the bore, slides his hands out again and

* Unconsumed cartridge is liable to be retained at the end of the bore of these guns. This renders frequent searching necessary.

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 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, hand 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; he then slews his body to his right and receives a shell from 7, and puts 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.

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, six 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 2 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 gun. 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. 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 he goes back to the cartridge store.

No. 7 brings up a shell, point to his right, having fixed the fuze according to No. 1's directions, and hands it to 3.

No. 8 issues a cartridge to 6.

No. 9 issues a shell to 7.

To Run up.

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

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 gun 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.

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

To Lay the Gun.

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 inclined planes, drawing out the iron bolts in the rear for the purpose; when it is necessary to shift the trail plank, 2 and 3, using the side pieces as fulcrums, place the points of their handspikes under the trail handles and then raise the trail; 4 double mans 2's handspike, 1 and 5 shift the plank.

If it is necessary to run the gun 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 gun 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, except when firing at a moving object, 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 gun.

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.

Guns on Overbank Carriages.

The service of the guns is the same as that just detailed, with the following exceptions:

The gun is run up till the muzzle is three or four feet from the parapet to load: 3 then depresses the muzzle (by means of the elevating wheel which is in front of the carriage) till it is about a foot below the interior crest.

A sponge with wire rope stave and jointed rammer are used. The sponging is performed in the ordinary manner. The rammer is handed to 2 folded up. It is passed into the bore one length at a time, the second length being straightened out and the collar slipped over the joint when the end of the first length reaches the muzzle, and so on. Withdrawing it is the converse of the above.

The rammer should be turned in entering and withdrawing it, so as to allow the portion of it outside the bore to hang downwards.

Before finally withdrawing the rammer, 2 must ascertain if the shell shows any tendency to slip forward, and if it does so, he keeps a steady pressure on the rammer while 3 elevates till the muzzle of the gun is nearly in line with the interior crest. The rammer is then withdrawn, and 3 elevates till the axis of the gun is about 3° elevation.

The gun is then run up.

In laying No. 1 stands on the trail. He must carefully note that the trail plank under the point of the trail is well supported. If it is not, the removal of his weight from the trail after he has finished laying will cause the trail to rise and the muzzle to be depressed. The shooting would therefore be inaccurate.

To Mount or Dismount a 40-pr. R.M.L. Gun of 35-cwt., on or from a Travelling Siege Carriage by Long Skids, up or down the Rear.

Strength of Detachment, about 19 Nos. (two gun detachments will suffice).

Stores Required.

Drag ropes, heavy	2
Handspikes, common, 6 ft.	5
Lashings, white or tarred, 1½-inch, 3 fms. each ..	4
Luff tackles, complete	2
Roller, ground, elm, 3′ × 6″	1
Scotches, of sorts	12
Selvagees	2
Skids,* oak, 14′ × 5½″ × 5½″	2
Skids,† oak, 3′ × 9″ × 6″	1
Water bucket, filled, and brush	1

* Weight 160 lbs., or, if strengthened with iron plates at the sides, 203 lbs.

† Two 3-inch planks, one on top of the other, may be used to support the lower ends of the long skids instead of a 6″ × 9″.

To Mount the Gun.

The ground roller should be placed under the gun, a little in front of the centre of gravity, the carriage at such a distance in front, that when the long skids are in position, their lower ends may be under the muzzle. The cap-squares are removed by 2 and 3, and the wheels scotched by 4 and 5, for which purpose large scotches are to be preferred, though handspikes can be used for the purpose.

Place skids, hook tackles.
Taut. Heave.
Remove skids, unhook tackles.

"*Place skids*," "*hook tackles.*"—8, 9, 10 and 11 place the skids, the lower ends bevel down resting on a 6″ × 9″ on its flat; the upper bevel up on the medium and small coins which are placed on the stool-bed, between the front part of the carriage brackets; the thick ends of the coins outwards, the points overlapping inwards.

The skids are cradled at their upper ends by the coins, at their lower ends by two large scotches on the 6″ × 9″, and at an intermediate point by two medium scotches on the trail transom; they are hooked together with the hooks back up and lashed back to the trail handles.

The tackles are then hooked; 12 and 13 hooking the double blocks to a strap round the cascable, 10 and 11 the single to a strap round the breast of the carriage. The skids are then watered.

"*Taut.*" "*Heave.*"—The Nos. man the tackles on their own sides and haul the gun up the skids until the trunnions rest on the points of handspikes placed in the firing trunnion holes by 6 and 7.

"*Remove skids*," "*unhook tackles.*"—The muzzle is borne down and the skids and tackles cleared away by the Nos. who placed them; 6 and 7 working out their handspikes, 2 and 3 replacing the cap-squares; care should be taken to avoid fouling the worm-wheel shaft of the elevating gear with the moveable block of the right luff tackle; the shaft may be removed without much difficulty by taking off the whole of the upper and the outer half of the lower gun-metal bearings of the shaft by means of a spanner.

To Dismount the Gun.

To effect this the gun must first be raised out of the trunnion holes.

Raise the gun out of the trunnion holes.
Prepare to bear down.
Bear down.
Come up.
Prepare to lift.
Lift.
Lower.

"*Raise the gun out of the trunnion holes.*"—2 and 3 take off cap-squares and elevating arc, 4 and 5 scotch the wheels with large scotches or handspikes, 4 in front, 5 in rear.

"*Prepare to bear down.*"—2 places a handspike in the bore, double-manned by 3, 8 and 9; 4 passes a handspike to 5 over that in the bore just in front of the face of the piece, double-manned by 10 and 11, all facing the rear.

"*Bear down.*"—The muzzle is borne down and the gun roller placed by 7 under the breech, about 18 inches in rear of the centre of gravity and scotched up.

"*Come up.*"—The breech is allowed to rest on the roller.

"*Prepare to lift*"—4 shifts his handspike to 5 under that in the bore.

"*Lift.*"—The gun is lifted high enough for 6 and 7 to insert a handspike in each trunnion hole.

"*Lower.*"—The gun is lowered till the trunnions rest on the handspikes.

Prepare to bear down.
Bear down.
Place skids.
Come up.
Make fast breech drag-rope.
Prepare to lift.
Taut. Lift and heave.
Remove skids.

"*Prepare to bear down.*"—As before.

"*Bear down.*"—As before, the gun roller is removed by 7.

"*Place skids.*"—10, 11, 18 and 19 (or any of the higher Nos.) hook the skids together, hook back up, and place supports and cradle them, as in mounting; they then lash them to prevent their moving towards the trail, passing the lashing ropes out to the front round the carriage brackets, and back to any convenient part of the wheels or axletree, or make fast to the felloes of the wheels in front and frap.

"*Come up.*"—The breech is lowered on to the long skids.

"*Make fast breech drag-rope.*"—11 makes fast a drag-rope (not with the hook end) to the cascable.

"*Prepare to lift.*"—The same Nos. as before prepare to lift the muzzle, the other Nos. man the breech drag-rope.

"*Taut. Lift and heave.*"—The Nos. at the muzzle lift, those on the drag-rope heave, and the gun is hauled down the long skids, which should have been previously watered, on to the ground roller placed to receive the breech.

Methods of Laying.

A.—When the object fired at is visible over the sights.

1. *The tangent scale is used.*

No. 1 removes the tangent scale from the gun, and sets it by bringing the top of the moveable socket to the required division on the yard or degree scale and clamping it. (Any odd number of minutes is given on the slow-motion screw at the head of the scale.) If any deflection is wanted, he sets the arrow on the sliding leaf to the required division and clamps it.

No. 1 having set his scale replaces it in the gun, taking care that the socket is home.

He then lays with a full sight, *i.e.*, he brings the top of the notch, the apex of the foresight and the point aimed at in line.

To ensure good laying the following rules must be observed:—

The eye not to be less than one foot in rear of the tangent scale notch, if possible more, and the distance between eye and notch not to be varied from round to round.

The head to be upright and the body in an easy position, supported if possible by holding on to or resting on the cascable.

The most conspicuous point in the object to be chosen to lay at.

The operation of laying to be completed as rapidly as possible so as not to fatigue the eye.

The gun to be laid a little above the object and then depressed on to it. This ensures the teeth of the elevating arc being in bearing with the driving pinion.

If the elevating gear is unserviceable and the gun has to be elevated by handspikes, the elevation should first be roughly obtained, 2 and 3 applying their handspikes under the breech and 4 attending to the coin, the gun being laid a little above the mark.

It is then traversed into line and the final adjustment for elevation obtained by 2 tapping the small coin with his handspike.

B.—When the object is visible from the battery, but the line of sight obscured by the parapet.

2. *Laying by plumb line.*

If No. 1 can see the object from some spot immediately in rear of the gun (by standing on an empty shell box, &c.), he can obtain the direction by plumb line.

He first sets the tangent scales to the required deflection. Then standing in rear of the gun he holds the plumb line so that it cuts both the sights. If the object is on the right of his line he gives "*Trail left*" and *vice versâ*. When the plumb line cuts both the sights and the object, the direction has been obtained.

The elevation is given by quadrant or clinometer applied on the surface cut on the gun.

Note.—The quadrant angle is the same as the angle of elevation when the object fired at is in the same horizontal plane as the gun or howitzer. If the object is below this horizontal plane, the quadrant angle is less, if it is above, the quadrant angle is greater than the angle of elevation. If therefore, there is a great difference of level between the firing point and the object, the angle which a straight line joining the object and firing point made with the horizon (the angle of sight) must be ascertained, and added to or deducted from the angle of elevation (as given in the range tables), in order to obtain the quadrant angle, *i.e.*, the number of degrees and minutes at which the quadrant should be set.

3. *Laying by an auxiliary mark in front.*

If there is a conspicuous object near the line of fire (such as a church spire) which is visible over the sights, No. 1 can, after laying the gun by the method described in § 2, put up his tangent scale and move his deflection leaf until his line of sight passes through the new object.

With the elevation and deflection thus obtained, he may lay on this auxiliary mark for the succeeding rounds.

This plan is more applicable to the howitzers than the guns, as their long deflection bars give them a larger field of view over the sights.

4. *Laying on an auxiliary mark in rear.*

This method, also called the reverse system of laying, is the converse of the last.

A conspicuous object some distance (the farther off the better) in rear of the gun is selected, and No. 1 places himself in front of the fore-sight and looks over this sight at the object. 4 by his directions moves the tangent scale and deflection leaf until the line is obtained.

5. *Laying by the Cross-bar sights.*

By this system the reverse method of laying is made applicable under all circumstances.

The gun having been laid as described in § 2, No. 1 sets the rear scale to a convenient height (so that his line of sight will be approximately horizontal). He adjusts the horizontal bar without deflection, and slides the leaf to one of the divisions near the centre of the bar. He then tightens all the clamping screws and goes to the front of the front scale. He clamps the sliding leaf of this scale to the same division at which the rear one is set, and looks over his sights.

Under his direction a plumb line is suspended about 4 yards in rear of the gun and another line suspended or a mark made about 10 yards in rear of the first (or farther back if possible). The plumb line and rear mark are so placed that they are accurately in the prolongation of the line of sight and they are adjusted at such a height that No. 1 can see them both when looking over his sights. By raising or lowering his rear scale, No. 1 can adjust his line of sight for the most convenient position of the plumb line and rear mark.

He has thus four points in line, and, by noting the height of his rear scale when he has laid on the mark, he has a means of obtaining the elevation in succeeding rounds independent of the quadrant. He removes the rear scale from the gun before it is fired.

After the first round he lays as follows :—

a. He gives any necessary correction in elevation and deflection on the rear scale (by the same rules as with the service sights), clamps it and inserts it in the tangent scale socket. He then unclamps the leaf and slides it to the end of the horizontal bar.

b. He goes to the front of the foresight, unclamps the leaf and slides it along the horizontal bar until the notch is in the same line as the plumb line and mark. He then clamps it.

c. Under his direction, 4 sets the sliding leaf of the rear scale so that it reads the same as the front one.

d. He lays the gun (2 and 3 traversing and 4 elevating) by giving *trail right* or *left* and *elevate* or *depress* until the line of sight cuts both plumb line and mark.

6. *Laying on plumb line in rear with service sights.*

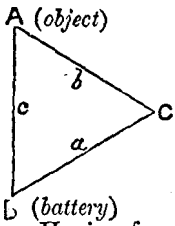
This method of laying (by plumb line and mark in rear) is applicable to the service sights. It would, however, entail a loss of time from the gun having to be cross-lifted into the original line nearly every round, but it is a useful method for howitzers mounted on beds.

7. *Obtaining the line of fire.*

If the object is visible from any elevated spot of ground in rear of the battery the line may be obtained by plumb line as in § 2.

If it is visible from some point in front of the battery, two men (*A* and *B*, provided with pointing rods) can obtain the line as follows :—*A* lines *B*'s rod on the battery, *B* lines *A*'s rod on the object. They move about until the rods are correctly laid and then plant them. The line thus obtained can then be projected to the rear by running a line of rods or banderols up to the battery.

If there is no spot either in rear or in front whence the object can be seen, some spot on the flank must be found whence both the battery and the object are visible. The distance of this spot from the battery and the object is measured (by range-finder) and the included angle taken by pocket sextant.



The sides AC and CB and the included angle ACB of the triangle ABC are then known and the remaining side BA (the required range) and remaining angles can be calculated.

The angle by the formula $\frac{a+b}{a-b} = \frac{\tan \frac{1}{2}(A+B)}{\tan \frac{1}{2}(A-B)}$ and the side by that $c = \frac{a \sin C}{\sin A}$.

Having found the angle ABC, the sextant is set at this angle, and the officer using it places himself at the point B, which should be in rear of the gun. He sees the point C by direct vision, and has a picket or pointing rod moved along the parapet until its reflection cuts C. The rod is then in the line of fire BA.

The line of fire may also be obtained roughly from a good map or plan.

8. *Laying the gun.*

Having obtained the line of fire by any of the preceding methods, the gun may be laid by any one of the methods described in §§ 3 to 7 found most convenient or applicable to the case in point.

In firing either guns or howitzers at elevations of 10° and upwards it is important to ascertain if the trunnions are level. The difference of level should not be great if the platform has been properly laid, but after continued firing (especially from a howitzer on its bed at high angles of elevation, if the howitzer is not in the centre of the platform) even the best laid platform is liable to give slightly. If the difference of level exceeds 1° the platform should be levelled at the first opportunity or pieces of plank placed under the lower wheel—one inch of plank for each degree difference of level. If the difference is within 1° it may be corrected by giving deflection on the scale on the higher side according to the formula—

minutes deflection $= \frac{n \times \theta^\circ}{60}$ where n = the number of minutes of difference of level
θ = angle of elevation in degrees.

There is a plane surface cut on the guns on which to apply the clinometer.

9. *Firing by night.*

If the enemy's works are illuminated.

If this is done by means of the electric light the firing may be carried out as in the day time.

If by star shells, which only give a momentary illumination, the guns in the battery would be loaded, and the elevation and direction roughly given before the star shells are fired. As soon as the enemy become visible, the laying is completed and the gun fired.

The object of lighting up an enemy's works is to ascertain if he is repairing his batteries or throwing up new ones, and to guard against sorties, &c.

Night firing under normal conditions.

When firing by night, the bull's-eye lantern in box (see List of Changes, § 5,223) should be arranged as an aiming point. Probably two or more guns might use the same point.

Other aiming points should be prepared in case the first is shot away, but should not be lighted up until required. The width of the slit in the lantern-box may have to be reduced or increased according to its distance from the gun. The $\frac{1}{4}''$ slit shows a good aiming point at about 70 yards distance on a clear night.

When two near back marks are used, a light will probably have to be thrown on the sights as well as the plumb line.

Observation on the Effects of Fire.

Good results cannot be expected unless the effect of each round is carefully watched and noted. If it is impossible, from the immediate neighbourhood of the battery or from the battery itself, to observe the impact and burst of the shells, an observing station should be established in front and not too much on the flanks of the battery,* from which the result of each round or series of rounds can be communicated by signal to the Officer Commanding the Battery.

If the fire is directed against guns, &c., behind earthworks, hits in the parapet can frequently be recognised, the smoke from the short bursts obscures the enemy's works, that from the bursts over forms a background on which the works will be more distinctly seen.

In breaching fire the sound of the bursts is sharp when the shells explode on masonry, smothered when they explode in earth. The *débris* from the wall is often thrown up to some height in the air by the explosion. Before the wall is penetrated, the smoke will be observed almost immediately on the explosion; when it has been penetrated the smoke is longer in appearing, and the sound of the bursts is duller than before.

In making corrections in elevation, it must be remembered that half the number of rounds fired may be expected to be short of and half beyond the mean point of impact (or mean range).

For instance, if the object is to dismount an enemy's guns, &c., by frontal fire, the mean point of impact should be as nearly as possible the interior crest of his parapet. If, therefore, half the rounds are observed to strike the parapet or fall short, and the other half burst in rear of the parapet, we know that the elevation is correct. If in the course of the practice more than the proper proportion of rounds are observed to fall short or over, the elevation should be corrected accordingly.

The lateral deviation must be observed and corrected from the battery itself.

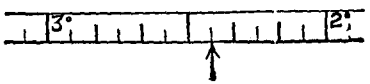
---

* If the station is too much on one of the flanks, the observer is liable to confuse shells falling right or left of the line of fire with those falling short or over. For instance, if he is on the right a shot falling to the left of the object would appear to him short, and *vice versâ*.

INSTRUCTIONS FOR USING WATKIN'S CLINOMETER.

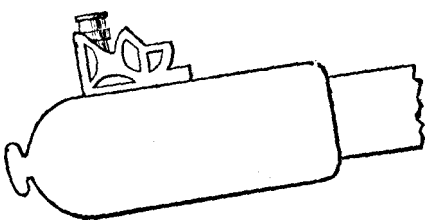
To read the angles marked on the drum.—The brass drum is marked in degrees, commencing at 0° on the top to 45° at the bottom. Each degree is subdivided into twelve parts; each small division therefore represents angles of 5 minutes.

The scale is read from right to left, thus—

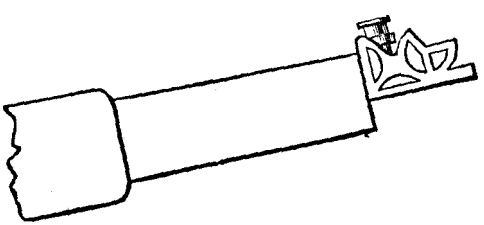


the reading opposite the arrow would indicate an angle of 2° 25′.

To lay a gun or howitzer at any angle up to 45°.—Unscrew the drum until the ⅄ points to the elevation required, place the clinometer, thus—

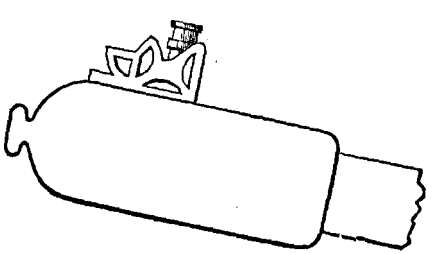


on the plane surface cut on the breech, or against the muzzle, thus—

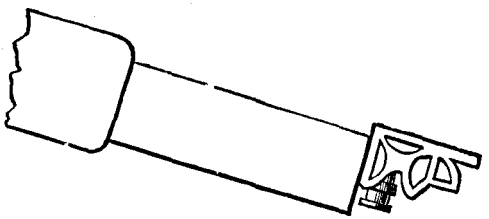


and elevate the piece until the bubble of the spirit-level is in the centre of the tube.

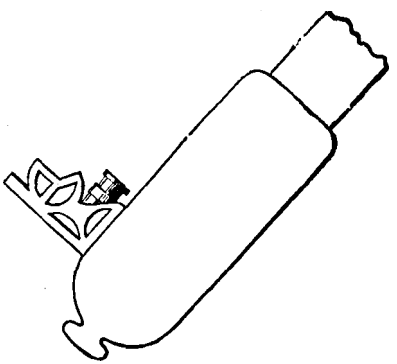
For angles of depression.—Proceed as above, but reverse the direction of the instrument, placing it thus on the breech of the gun—



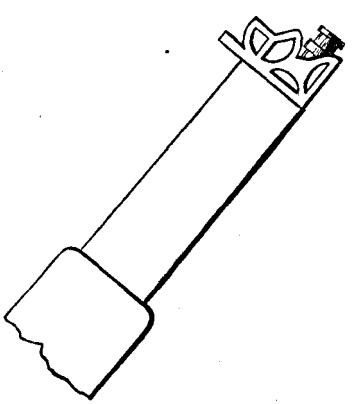
and thus on the muzzle—



For angles of elevation greater than 45°.—Subtract the angle of elevation required from 90°, unscrew the drum to this reading; thus, for 60°, unscrew the drum to 30°, and place the instrument on the breech of the gun, thus—



or on the muzzle, thus—



and elevate until the bubble is in the centre of its run.

The Hasty Disablement of Siege Guns and Field Guns.

1. The hasty disablement of siege guns will be carried out by the Royal Artillery, and of field guns by the Royal Horse Artillery.

Stores Required.

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

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

Boxes	guncotton, slabs*	1—½ slab	8
		8—¼ slabs	1
	stores, disabling, ordnance, siege		1
	vesuvian matches		1
Cases	detonator, for 8†		2
	guncotton primers†		2
	guncotton slabs†		4
Cylinders	detonator, No. 8, for 8		2
	guncotton primer, dry, 1¼ in. × 1¼ in., for 8		2
Detonators, No. 8			16
Guncotton	dry primers, 1 perforation, 1¼ in. × 1¼ in.		16
	wet slabs, 2 perforations, 6⅛ in. × 6⅛ in. × 1⅜ in.		‡8
Pouches, match-box†			1
Rectifiers, guncotton primers			2
Twine, choking, 3-thread		pieces	1

* Copper, tinned. † Leather.

‡ In half slabs, 1 perforation in each.

4. These stores will only be issued in time of war. The guncotton and detonators will be carried by the Ammunition Reserve Column till active operations are impending; and, when required in the field, the supply of guncotton (both slabs and primers) will be replenished from the Royal Engineer Field Park.

*Instructions for Carrying out the Operations.**

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

6. Insert a detonator into a dry primer.

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

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

9. 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.

* *See* note at end.

10. 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.

11. 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.

12. 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 guncotton before the detonator is fired, in which case, in all probability, no effect whatever would be produced on the gun.

13. 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.

14. Tear or cut the little calico cap off the end of the safety fuze and ignite the fuze by the vesuvian matches 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.

15. Retire under cover, and await the explosion. The length of safety fuze will burn about 45 seconds.

16. Should circumstances permit, the effect of the detonation will be increased by placing a filled sandbag 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.

17. 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.

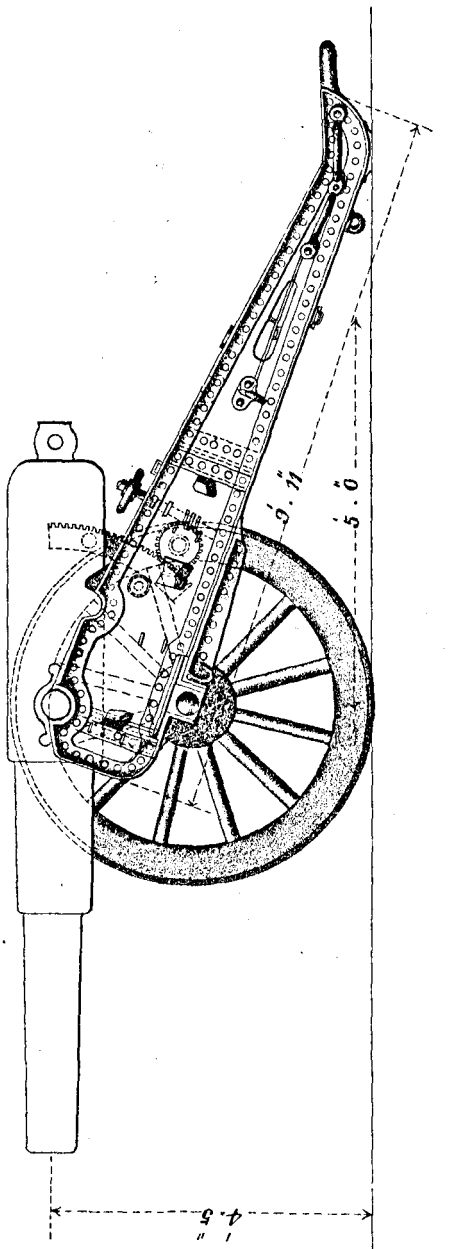
18. Never roughly bend or kink the safety fuze. If it has apparently gone out without firing the detonator, allow at least half an hour to elapse before meddling with it, if time will admit, but if not, the greatest care must be taken in touching it, to avoid accident by a "hang-fire."

19. The above instructions apply equally to the hasty disablement of field guns, but with them only one slab of guncotton need be used.

NOTE.—The above instructions have been prepared with special reference to the disablement or destruction of muzzle-loading guns. Breech-loading guns can generally be temporarily disabled by the removal or destruction of portions of the breech apparatus. In destroying such guns, or rendering them permanently disabled, Officers will, while being guided generally by these instructions, use their discretion as to the application of the charges in such positions as may appear most suitable, according to the particular construction of the gun to be operated upon.

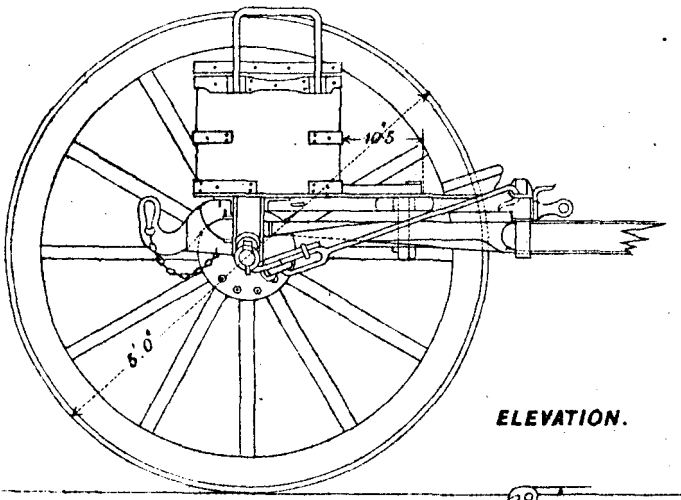
LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY HARRISON AND SONS,
PRINTERS IN ORDINARY TO HER MAJESTY.
(Wt. 1402 875 4 | 89 | 2724)

Carriage Siege R.M.L. 40 Pr. Gun. Mark II.

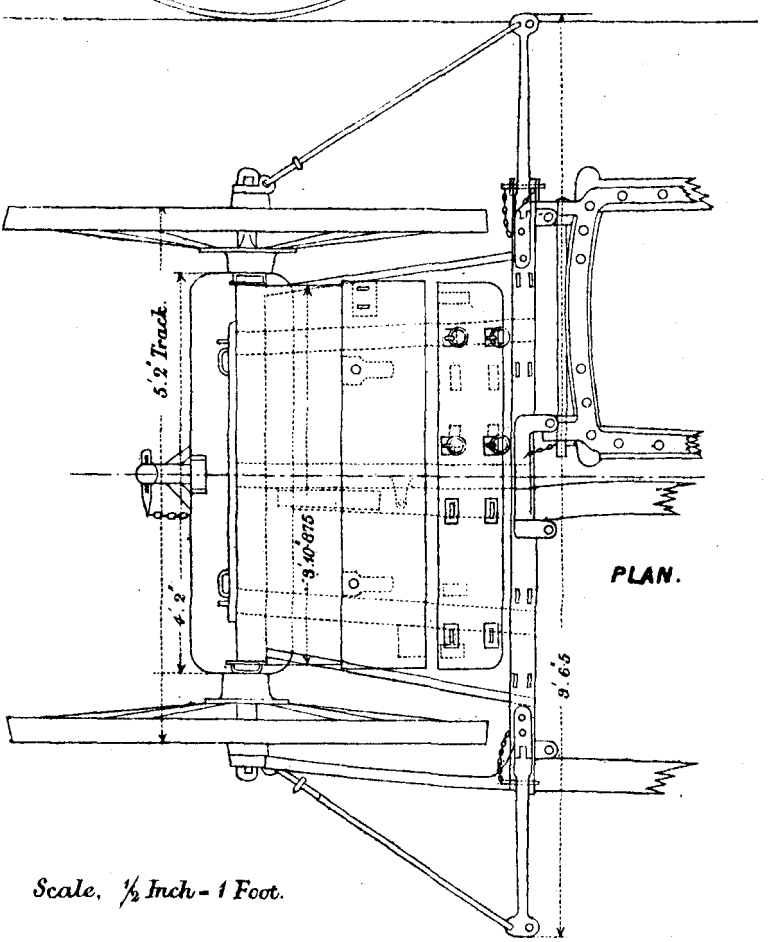


Dangerfield, Lith 22, Bedford St Covent Garden. 17872. 2/89.

LIMBER, SIEGE, R.M.L. 40 PR GUN. MARK II.



ELEVATION.



PLAN.

Scale, ½ Inch = 1 Foot.

12447.

DANGERFIELD. LITH. 22. BEDFORD ST. COVENT GARDEN.

40 Pr Rifled M.L. Projectiles.

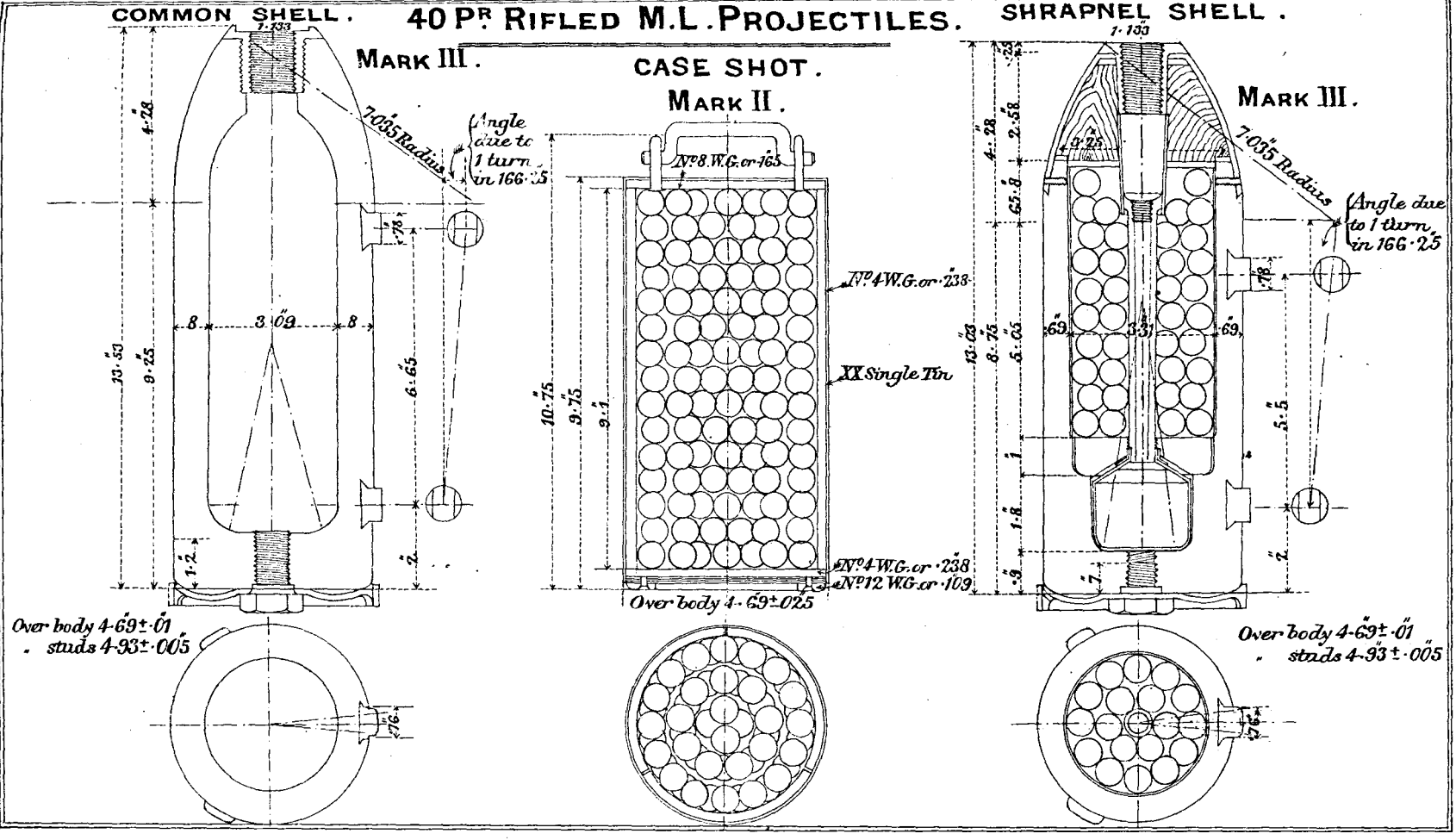
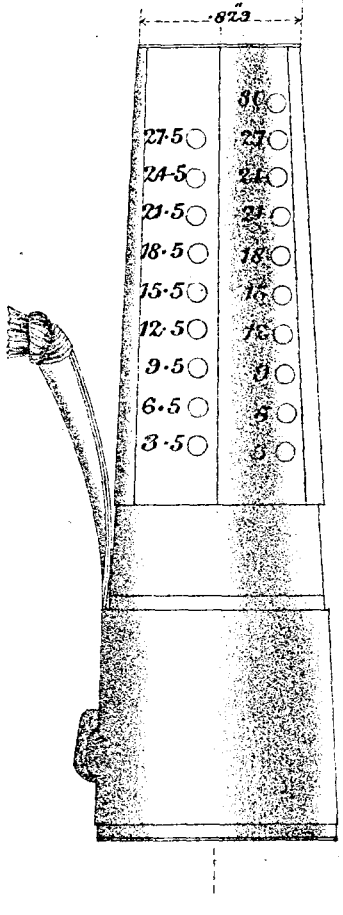


Plate III.

DANCERFIELD LITH 22 BEDFORD ST COVENT GARDEN 77872.2/69.

Fuze Time 15 Seconds with Detonator No. 43 Mark III.
Wood 5 in a Tin Cylinder.

Full Size.



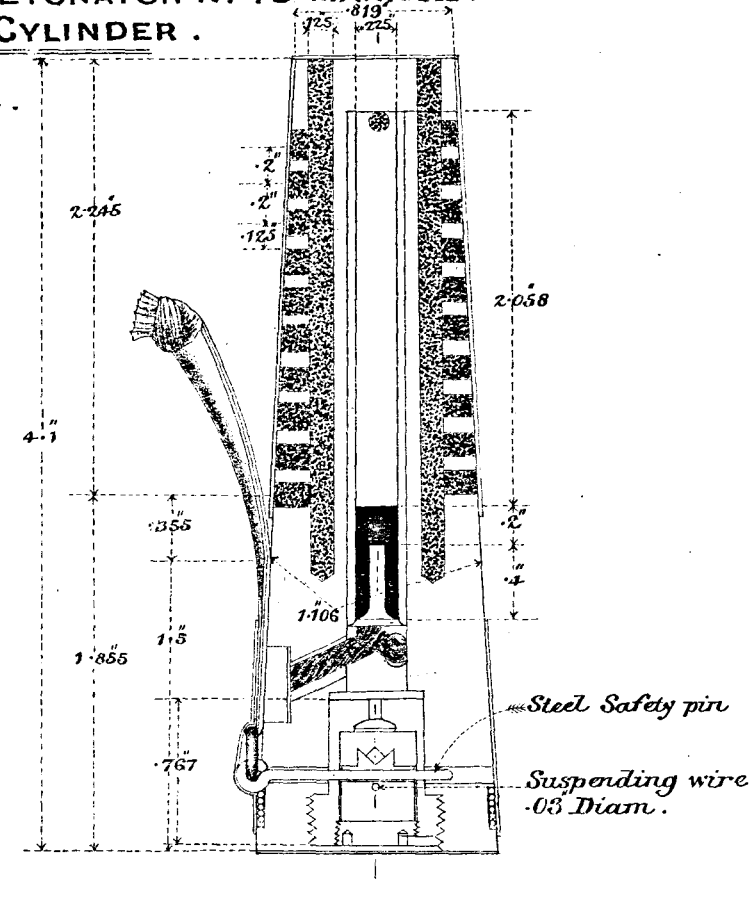
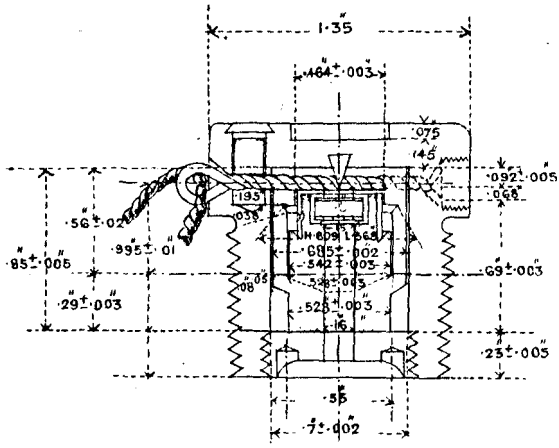


Plate IV.

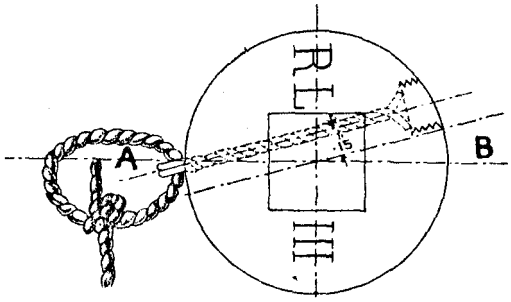
Dangerfield Lith. 22, Bedford St. Covent Garden. 75.72.2.94

FUZE PERCUSSION R.L. Nº 7 MARK III.

FULL SIZE.



SECTION AT A.B.



PLAN.

DANGERFIELD LITH. 22, BEDFORD ST. COVENT GARDEN. 15262. 11/87.