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HANDBOOK

FOR

9-PR. R.M.L. GUNS OF 6 CWT. & 8 CWT.

(MOVABLE ARMAMENT.)



1901.



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N.B.—This Handbook has been corrected up to December, 1901. Any alterations which may be suggested should be forwarded to Chief Inspector, Woolwich Arsenal.

H A N D B O O K

FOR THE

9-pr. R.M.L. Guns of 6 cwt., Mark II, and 8 cwt., Mark I.

(MOVABLE ARMAMENT.)

THE GUNS.

(*Plates I and II.*)

			6-cwt. Gun.		8-cwt. Gun.
Length	{ nominal	.. ..	71 inches	.. ..	68·5 inches.
	{ total	.. ..	74·5 inches	.. ..	72 inches.
Weight, nominal	.. ..	.. ..	6 cwt. ..	.. ..	8 cwt.
Preponderance	.. ..	.. ..	10 lbs. ..	.. ..	7 lbs.
Bore	{ calibre	.. ..	3 inches	.. ..	3 inches.
	{ length	.. ..	66 inches	.. ..	63·5 inches.
	{ capacity of unrifled portion of bore.	.. ..	24·86 cubic inches	.. ..	24·86 cubic inches.
Rifling..	{ system	.. ..	French, modified	.. ..	French, modified.
	{ twist	.. ..	uniform, 1 in 30 cal.	.. ..	uniform, 1 in 30 cal.
	{ length	.. ..	62·3 inches	.. ..	59·8 inches.
	{ grooves { number	.. ..	3	.. ..	3.
	{ grooves { depth	.. ..	0·11 inch	.. ..	0·11 inch.
Vent, hardened copper..	{ width	.. ..	0·8 inch	.. ..	0·8 inch.
		.. ..	.. ..	.. ..	0·6 inch from end of bore.
Muzzle velocity in f.s. ..	.. ..	.. ..	.. ..	.. ..	1330.

The two natures of this gun differ from each other chiefly in weight and dimensions; they both fit the same carriage, are vented alike, have the same rifling, and take the same ammunition.

As regards their construction, they each consist of an "A" tube of steel, over which is shrunk a wrought-iron jacket.

The cascade is in one piece with the "A" tube in the 8-cwt. gun, and was originally so in the case of the 6-cwt. gun also, but in the latter was too weak to stand the jar of the elevating gear on firing, and so has been removed, a cascade of wrought iron, of strengthened pattern, being screwed in to replace it.

A plane for the clinometer is prepared immediately in front of the vent.

APPURTENANCES, &c.

SIGHTS.

Both guns are centre-sighted, and each is provided with two tangent sights of different lengths, only the shorter of which can be carried in the gun. The longer one is only for use when firing at higher angles of elevation than those given on the short sight.

In each gun the tangent sight is set at an angle of $1^{\circ} 30'$ to correct for drift.

The sights are graduated in degrees, yards, and length of fuze, and are each provided with a deflection leaf, capable of giving $30'$ right or left.

The graduations are:—

			Degrees.		Yards.
6-cwt. gun	{ short sight	..	0 to 5	..	2,100
	{ long	..	0 to 12	..	2,500
8-cwt. gun	{ short	..	0 to 6	..	2,400
	{ long	..	0 to 12	..	3,500

The tangent sights are not interchangeable between the two guns, as they are graduated to a different radius.

The fore-sight is a small hog-backed sight, screwed into a recess in the dispar patch at the muzzle. A wrench is provided for removing the sight when necessary.

SIDE ARMS, &c.

Prickers, vent, $7\frac{1}{2}$ inches.—This is of steel with point, the opposite end is formed into a ring; it is used for clearing the vent.

Punch, vent, 8 inches.—The punch is of steel with a flat point, the head is in the direction of length, rounded with a small hole, and sufficiently strong to bear hammering; it is for clearing the vent when this service cannot be done efficiently by the pricker.

Brush, piassaba, R.M.L., 9-pr., Mark II.—The head of the brush is of elm, with piassaba grass arranged spirally and secured in the head by marine glue. The stave (No. 10) is of ash, parallel in shape, 6 feet 2 inches long, and is secured in the head by a copper rivet. It is used for cleaning the bore of the gun, and in conjunction with a sponge cloth, or piece of canvas, tied on the head.

Total length of brush, 6 feet $3\frac{1}{2}$ inches.

Sponge, R.M.L., 9-pr., Mark II.—This is of wood, the sponge head is on one end of the stave and the rammer head on the other, each being secured by a copper rivet. The sponge head is covered with fleecy hosiery secured by marine glue. The rammer head is not recessed for the fuze; it has a copper band to prevent splitting and an iron nut is let into the centre to receive the wadhook worm.

Worm, wadhook, No. 5.—For use, this article screws into the rammer head. It is made of iron.

Tampon, R.M.L., 9-pr.—This is of wood. It is now being replaced by a canvas cover.

CLINOMETERS { WATKIN (MARK I). FIELD (MARK II).

When the stock of the Watkin clinometer is used up, the Mark II field clinometer will be issued for the lighter kinds of R.M.L. guns in the movable armament.

These instruments are each fitted with a metal drum, that of the former is graduated to 45° and the latter to 26° . For method of using the clinometers, which is similar, *see* p. 35, also for their care.

When not in use the clinometers are kept in their leather cases, which are separate stores to the clinometers.

CARE AND PRESERVATION OF GUN AND FITTINGS AND AIMING RIFLE.

See "Regulations for Magazines and the Preservation of Artillery Matériel."

RIFLE, AIMING, M.-H. CHAMBER, EWART.

This apparatus is for use with the gun in imparting instruction in laying, and consists of the following parts:—

Rifle, aiming, M.-H. chamber,

Ewart—

Bands	..	..	..	Bronze.
Front	..	..	..	With securing bolt, nut, and washer, and for 6-cwt. gun hinge bolt, collar, and keep pin.
Rear	..	..	..	With securing bolt, nut, and washer, buffer, and key, and for 8-cwt. gun hinge bolt, collar, and keep pin.
Barrel, rifle	..	..	..	M.-H. rifle barrel, with breech action and metal boss.
Cord, firing	..	..	..	White line, tarred, 2 yards long (with two hooks).
Lever, vent	..	..	..	Steel.
Link, trigger	..	..	..	Bronze, with fixing screw.
Tube, 0.23-inch "J"	..	..	..	Including breech-piece, bushes (movable and fixed), set nut, and leather washer.
Lanyard, friction tube, siege,				With toggle, 5 feet 5 inches.
No. 1.				
Tube, friction, drill	..	..	..	Dummy, iron, with spring clip.
Tube, 0.23-inch—				
Brush, cleaning.				
Key, M.-H.				
Rod, cleaning.				

Method of Fitting, Adjusting, and Using the Apparatus.

The aiming rifle is fitted to the left side of the gun in the following manner:—

The two bands are placed over the chase of the gun, the distance between the inner faces of the bands being 27 inches.

The bands are secured round the gun by fixing bolts. The muzzle of the rifle is passed through the hole in the arm projecting from the front band, and the breech is placed in the socket on the rear band, and fastened with a key. A buffer spring, to lessen the strain on recoil, fits into the socket in rear of the rifle. A hole is made at the rear end of the socket to facilitate the extraction of the buffer spring.

To adjust the rifle on the gun, the latter is laid horizontally; the

0.23-inch tube "J" is then inserted in the bore of the rifle, sufficient length being allowed to project from the bore to admit of the application of a spirit level to the 0.23-inch tube, by which means the rifle is levelled, so that the axis of rifle and gun are in parallel horizontal planes. The bands are then firmly screwed up, care being taken to see that they do not shift during the operation, in the event of which they must be slackened and readjusted.

Elevation is obtained by means of the gun sights, and any error in line is corrected by use of the deflection scale.

The rifle is fired by means of the firing cord. One end is hooked to the loop of the "Link, trigger," and the other end to an arm of the "Lever, vent," the service "Lanyard, friction tube, siege, No. 1" is then hooked to the other arm of the "Lever, vent," the latter being kept in position by the service dummy tube.

Ammunition.—See p. 10.

CARRIAGES, FIELD, R.M.L., 9-PR.

Mark I carriage is formed of two bracket sides, connected by transoms, bolts, and a trail plate; an axletree bed with axletree and two field wheels.

Each bracket side is constructed of plate iron, riveted to the outer side of an angle-iron frame.

The trail plate eye is steeled to prevent wear.

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

The wheels are of the 2nd class, with metal nave.

The elevating screw is attached to the cascable by a bolt, and worked by a metal nut, bevel wheel, spindle, and hand-wheel on the right.

The axletree boxes are fitted with guard-irons and sliding foot rests, in order that they may serve as seats. Each carries two rounds of case shot, or two shells, and small stores. A leather guard is fitted to the lid of the near box to protect the gunners' overalls from contact with the sponge head.

A deflector, which is fitted with a pendulum to indicate on a degree scale the differences in the height of the wheels, is suspended by loops from the axletree bed.

Fittings are provided for the stores, shown in the diagram of packing, p. 37.

"Handspike, traversing, No. 4," is used with this carriage.

Mark II carriage (Plate III) differs from the Mark I, in having the plate of each bracket placed on the inner instead of the outer side of the frame, and in the trail piece, which lies between the brackets, instead of overlapping them.

The wheels and elevating screw are the same as in the Mark I carriage; the axletree boxes are similar, but not interchangeable with those of Mark I.

LIMBERS, FIELD, R.M.L., 9-PR.

Mark I limber has a wooden axle bed, with a block at the rear, and limber hook which is secured by three bolts, two of which are nipped at the front of the bed, while the third screws into the end of the centre futchell which is bent down between the bed and block.

The futchells are of iron, and are housed across the bed and secured by bolts passing vertically through the latter and nutted beneath; they do not extend beyond the bed to the rear, but knees of T-iron are secured to the back of the bed to support the ammunition boxes, and an angle stay is riveted to the futchells along the front of the bed, to give rigidity to the frame of the limber. The splinter bar is of iron.

The limber hook is steeled to prevent wear, and has a steel key.

The axletree is the "light field" axle (2nd class), and the wheels are the same as those for the gun carriage. It is secured in the axle bed by yoke bands with coupling plates, and V-irons with a clip plate.

The footboard is 11 inches wide, the platform 13 inches; there is no slat.

The shafts are No. 1 "near" and Nos. 3 and 19 "off," the latter known as the "Brandling" pattern; they are fitted for farmers' draught, and the limber is fitted for single, double, treble, and bullock draught.

The limber boxes are "near," "off," and "centre"; the "near" and "off" carry each 18 projectiles in trays, and as many cartridges in a canvas cartouche.

Four extra projectiles can be carried under the trays, and as many more cartridges in the cartouche when necessary. In this case, however, the cylinder for bits and hook borer will have to be removed from the lids of the "off" limber boxes, and carried where convenient.

Suitable fittings are provided for the carriage of stores shown in the diagram of packing.

Mark II limber (Plate IV) differs from Mark I in having an iron (box girder) axletree bed instead of wood, and in the form of the limber hook, which is made to stand out from the bed, and so obviates the necessity of a block between them.

The wheels and boxes are the same as in Mark I limber.

Weights, &c., of Carriages and Limbers.

		Mark I.	Mark II.
Height, centre of gun		3' 6½"	3' 0½"
Length of {	carriage { with wheels	10' 3"	10' 4"
	{ without wheels	9' 0"	8' 10½"
	axletree	6' 4½"	6' 4½"
	carriage and limber { without gun	21' 0½"	21' 3½"
	{ with gun	22' 4½"	22' 6"
Minimum space through which carriage can turn ..		32' 3"	32' 0"
Angle of trail		22°	23°
Angle of lock		52°	56½°
Elevation, maximum {	with screw	21°	22°
	without screw	24°	22°
Depression, maximum		4°	6°
Wheels {	track	5' 2"	5' 2"
	diameter	5' 0"	5' 0"
Weight of {	carriage, empty, with wheels, drag shoe, and elevating screw	cwts. qrs. lbs. 12 3 8	cwts. qrs. lbs. 11 3 8
	limber, empty, with boxes, shafts, and wheels	11 1 19	11 1 10
	wheels	4 2 0	4 2 0
	elevating screw	0 0 11	0 0 11
	carriage and limber, packed	34 3 20	33 3 17
		tons. 4·079	tons. 3·818
Tonnage of carriage and limber			

WAGON, AMMUNITION, R.M.L., 9-PR.

Mark I.—The frame of the wagon consists of a perch of girder iron, with steeled eye, and two sides of angle iron, connected together by iron plates, over which the boards are secured, namely, two footboards and three platforms. The axletree, which is the "light field" axle, is secured in a bed of wood bolted beneath the perch and sides.

The wheels of the wagon are the same as for the gun carriage.

The wagon is fitted with a sabieu block, with 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," except lid fittings. Beneath the wagon are two under boxes.

Fittings for the carriage of stores shown in the diagram of packing are also provided.

The wagon limber is identical with the gun limber.

The Mark II wagon (Plate V) differs from Mark I in having an iron axletree bed, similar to that of the gun carriage, instead of a wooden one; in the perch being formed of channel iron in two parts, with strengthening plates, instead of solid girder iron, and in the block for the spare wheel being of iron instead of wood. The perch resembles the trail of gun carriage in its general form, and is riveted to the axletree bed. The wheels, ammunition boxes, &c., are the same as in Mark I wagon.

The wagon limber is identical with the gun limber.

Weights, &c., of Wagons and Limbers.

	Mark I.	Mark II.
Length of wagon and limber	20' 5½"	20' 7¼"
Minimum space through which wagon can turn ..	29' 8½"	29' 6"
	cwt. qrs. lbs.	cwt. qrs. lbs.
Weight of wagon and limber, empty	25 3 13	25 0 22
" " " packed.. .. .	41 1 25	40 0 2
	tons.	tons.
Tonnage of	4.193	4.373

CARE AND PRESERVATION OF CARRIAGES.

(See also "Regulations for Magazines, &c.")

All bearings should be kept clean and slightly oiled, and all nuts tightly screwed up. Linch pins, washers, the end of the wheel iron of the off shaft, and axletree arms should be kept perfectly clean, care being taken in cleaning them not to rub them away too much, and so reduce them in size; they can be kept slightly oiled, but if so the old oil must be frequently rubbed off and fresh put on. Carriages kept in store should have the bright parts of the ironwork coated with grease. Water should not be allowed to lodge in any of their recesses.

Defects or damages 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. Opportunity should be taken of the annual painting to give the carriages a thorough overhauling and repair.

Elevating Screws.

Elevating screws should be kept clean and oiled; if they do not run up and down freely, they should be removed and examined; if the threads are indented on the edges, they must be neatly filed down. If the bevel pinions in the box have become indented or choked up with clotted oil and dirt, the box should be opened, the necessary adjustments made, and the inside of the box painted with red lead.

Cap-squares.

The inside of the cap-squares and the trunnion bearings must be kept clean and oiled.

The lugs and the crown of the cap-square are liable to be "drawn," giving too much play to the trunnions of the gun. The cap-square should be repaired as soon as possible, as the deformation otherwise will rapidly increase in firing, and the lugs will be broken.

Bolts.

All bolts should be kept tightly nutted up. Sometimes a particular nut will work loose continually; in such cases, after tightening it up, cut the thread of the bolt across close up to the nut, and caulk it under a little.

Care must be taken in painting that no working parts are painted, and intelligence must be exercised in keeping the working surfaces free from paint. Such parts must, on the other hand, *on no account be polished*, but kept clean by greasing or oiling. If they are not in constant action, a coating of oil will preserve them from rust and not collect dust.

AMMUNITION.

CARTRIDGES.

(Plate VI.)

Nature.	When filled		Number of hoops.
	Diameter not to exceed	Length not to exceed	
Cartridges, R.M.L., 9-pr.—	Inches.	Inches.	
1½ lb. R.L.G.²	2·6	9·5	5
1 lb. blank L.G.	2·6	6·25	3
Cartridge, aiming tube ..	0·355	0·87	—

The gun cartridges are of No. 1 class silk cloth, hooped with silk braid, and choked with silk twist.

DRILL CARTRIDGE.

This cartridge is issued for drill, it is made of wood, covered with raw-hide, and fitted with rope grummets at the choke end. It is of about the same weight and dimensions as the service cartridge.

AIMING TUBE CARTRIDGE.

Mark I case is of solid drawn brass with a cap chamber and anvil in the base; two fire holes in the anvil allow the flash to pass from the cap to the charge, which is $3\frac{1}{4}$ grains "Curtis and Harvey's Diamond No. 2" powder; over it are wads and a bullet of pure lead.

Mark II differs in the arrangement of the wads.

Packed 100 in a cardboard box and issued, usually, 10,000 in a tin-lined box.

PACKING.

The powder cartridges are usually issued in metal-lined cases, packed as follows:—

60 $1\frac{3}{4}$ lb. cartridges } in a whole metal-lined
or 101 1 lb. blank cartridges } powder case.

PROJECTILES.

(Plate VII.)

Nature.	Mark.	Bursting charge.		Weight filled and fuze ^d in the case of shell.
		Weight.	Powder.	
Shell { common	V	$7\frac{1}{2}$ ozs.	P. and F.G.	lbs. ozs. 9 7 $\frac{1}{2}$
	VIII	12 dms.	F.G.	10 9 $\frac{3}{4}$
Shot, case	IV and V	—	—	9 10 $\frac{1}{4}$

Projectiles will be painted black, except the studs and distinguishing marks.

Common Shell.

The common shell is of iron, cast to finished dimensions, and furnished with two rings of studs. The head is struck with a radius of $1\frac{1}{2}$ cals. The interior of the shell is lacquered, and the fuze-hole is tapped to G.S. gauge.

The bursting charge is in the proportion of 6 ozs. of P. and $2\frac{3}{4}$ ozs. of F.G.

*Shrapnel Shell.**

The body of the shell is cast to finished dimensions, and has two rings of copper studs. The walls of the shell are thickened near the base so as to form a shoulder, on which rests a wrought-iron diaphragm, a lining of brown paper, and mixed metal bullets, 28 at 18 per lb. and 35 at 34 per lb., run in with melted resin. The head is of Bessemer metal lined with wood, and contains a composite fuze socket of tin and gunmetal, screwed to G.S. gauge. The bursting charge is contained in a tin cup in the base of the shell, connected with the fuze socket by a gunmetal tube screwed into the diaphragm.

* Shrapnel shell can be utilised as case shot, for distances up to 100 yards, by loading the reverse way, and firing them without fuze or plug.

*Case Shot.**

The body of Mark IV is of tin, in three parts, soldered together longitudinally. The base is strengthened by having a disc of sheet iron laid loose in the interior, and a ring of the same riveted to the tin case outside. The sides are lined with three longitudinal segments of sheet iron laid in loose. The top consists of a disc of sheet iron secured to the case by turning over and soldering the ends of the latter. It is filled with 108 mixed metal balls at $16\frac{1}{2}$ per lb., packed in clay and sand.

Mark V differs from Mark IV in being fitted with a wrought-iron handle on the top to facilitate the removal of the shot from the limber boxes. Earlier patterns are not issued.

WAD, FUZE-HOLE.

Mark II wad is made of papier-mâché, and has a hole in the centre covered by thin black shalloon cemented on one side. It is forced into the fuze-hole by the "Drift, G.S., short," the side covered with shalloon being placed downwards in the shell. The diameter is 1.06 inches and thickness 0.26 inch.

Mark III wad differs from the previous pattern in being but half the thickness.

The use of the wad is to prevent the powder working up in the fuze-hole of common shell not to be fired immediately after filling. It is not necessary to remove it before screwing in the fuze, as the explosion of the latter is sufficient to force the wad into the shell.

INSTRUCTIONS FOR PREPARATION OF SHELLS,
DISTINGUISHING MARKS, &c.

See "Regulations for Magazines and Preservation of Artillery Matériel."

FUZES.

(*Plates VIII to XI.*)

Percussion { R.L., No. 7, Marks II*, III*, IV.
 { small, No. 8, Mark IV.
Time, 15-seconds, M.L., No. 41, Mark II.
Time and percussion, No. 56, Mark IV.
Drill, T. and P., No. 56, Mark I.

The actual equipment allowed of the above for movable armaments will be found in the "Equipment Regulations."

The following is a description of the fuzes:—

PERCUSSION, R.L., No. 7.

(*Plate VIII.*)

The body is of gunmetal, screwed to fit the G.S. gauge, and with a square hole in the head to fit the key by which the fuze is screwed into the shell. The bottom is closed by a screw plug.

* The shot, when placed in axletree boxes, should be packed with oakum to prevent their being damaged in travelling.

The safety pin (of double twisted wire) passes through the head of the fuze, and is kept in its place by the two ends being opened out slightly in the conical cap, as shown in Plate VIII. A thin disc of brass is then fitted over the ends, and soldered to keep the fuze water-tight. The head of the safety pin is fitted with a loop of tarred twine, by which it is withdrawn. The pin is not to be withdrawn until the shell is placed in the gun.

When the safety pin is withdrawn, the hole through which it passed, if left open, would probably admit of the passage of the flash from the discharge of the gun into the interior of the fuze, and so cause a premature burst. To guard against this, a small lead pellet slides freely in a recess cut in the head above the safety pin hole. When the shell is rammed home, the pellet sets back, and so closes the safety pin hole.

The percussion arrangement of Mark IV fuze consists of a steel needle, fixed in the centre of the top on the inside, and a lead pellet containing a detonator covered by a brass disc 0.005 inch thick in its head. A tinfoil disc (subsequent to 27th June, 1894) is placed under the detonator to prevent the composition working through the fire holes. The pellet is kept in position by a gunmetal guard, which rests on two feathers on the outside of the pellet. The guard is furnished with a feather on the outside which fits a groove in the body of the fuze, so that body and guard must rotate together.

A shield of copper is placed over the top of the lead pellet to prevent the brass safety pin from indenting it, and thereby allowing the detonator to approach too close to the needle. Mark III has the brass disc over the detonator only 0.001 inch thick, and the guard has no feather. This pattern when converted to Mark IV pattern is called Mark III*. Mark II had not the copper shield.

This fuze requires no preparation, except the removal of the safety pin; it is screwed firmly into the fuze hole by means of the fuze key. The safety pin is not to be withdrawn until after entering the shell into the muzzle of the gun.

Action.—On the shock of discharge, the guard sets back on the pellet, shearing off the feathers, and on graze or impact the guard and pellet fly forward together, bringing the detonator in contact with the needle, and thereby firing the fuze.

Weight of fuze, $6\frac{1}{2}$ ozs.

When the stock is used up, this fuze will be replaced by "Small, No. 8."

PERCUSSION, SMALL, NO 8.

(Plate IX.)

The fuze (Mark IV) consists of the following parts:—

Body, detonator pellet, with two retaining bolts, spiral spring, safety pin, closing pellet, needle plug, and magazine.

The body is of gunmetal, screwed on the outside to the G.S. gauge. It is bored out from the top to receive the detonator pellet, and is closed by means of the needle plug. Two holes, closed on the outside by brass discs, are bored in the body to receive the retaining bolts of the pellet. Two fire holes are bored in the bottom to communicate the flash from the pellet to the magazine, which consists of a pierced pellet of pressed powder, secured in the lower end of the fuze by a brass disc spun in.

A detonator, covered by a brass washer 0.03 inch thick, is secured in a recess in the top of the gunmetal pellet, and two fire holes filled

with F.G. powder lead from it to the bottom, where they are closed with paper discs. The top of the pellet is reduced to fit inside a spiral spring, which prevents the pellet rebounding or working forward during flight. A tinfoil disc (subsequent to 27th June, 1894) is placed under the detonator to prevent the composition working through the fire holes.

The two retaining bolts, with brass spiral springs, pass transversely through the pellet (as shown in the drawing), the springs keeping them locked in the holes in the body until spun out by the rotation of the shell. A screw in the body projects into a groove down the side of the pellet, and prevents it from turning.

The needle plug has a steel needle fixed in the centre, and screws into the top of the body. A hole through the side of the fuze into the needle plug contains a brass pellet, with spiral spring behind it, for closing the safety pin hole.

The safety pin, of twisted copper wire, passes through the needle plug, down the body, behind the head of one of the retaining bolts, and is bent over at the top into a groove in the needle plug.

The fuze is now rendered waterproof as much as possible by the safety pin hole and closing plug for the same being closed with Pettman cement, and all openings in the body finally painted with the same material.

Mark III differed from the above in having the detonator pellet held in position by a small screw plug, and in having no protecting washer over the detonator. In Mark II the spiral spring in front of the detonator pellet was found stronger, and was replaced by the same spring as in Mark III, the fuze being then Mark II*, which was identical with Mark III. Marks II* and III will be exchanged for Mark III* or IV.

Mark III fuzes are converted to practically the same as Mark IV, and are then Mark III*.

This fuze requires no preparation, except the removal of the safety pin; it is screwed firmly into the fuze hole by means of the fuze key. The safety pin is not to be withdrawn until after entering the shell into the muzzle of the gun.

Action of the Fuze.—The safety pin being withdrawn at the moment of loading, the hole is closed by the closing pellet. On discharge the centrifugal motion of the shell causes the retaining bolts to fly outwards, leaving the detonator pellet free to move forward. On impact the pellet compresses the spring in front of it, and moves forward on to the needle, which ignites the detonator, and so fires the fuze.

Weight of fuze, 6½ ozs.

TIME, 15-SECONDS, M.L., No. 41.

(Plate X.)

This is made of beech wood, with a composition channel bored almost the whole length of the centre of the fuze. This channel is lined with paper, and driven with 2 inches of slow-burning composition. Above this is a 0.6-inch pellet of incased powder, having a hole bored down its centre to a depth of 0.4 inch. There are six powder channels bored parallel to the composition channel, connected at the bottom by quickmatch placed in an annular groove and pressed into the bottom of each channel. The last hole is bored through and threaded with quickmatch. The numbers on the paper scale are

reversed, so that they read correctly when the fuze is being bored. Each side hole is marked on the index paper with a dot of yellow paint. The head of the fuze is closed by a gunmetal plug, round the pin of which quickmatch is looped and let through two fire holes to a groove round the head. This groove is covered by a copper and tape band which must be removed before firing.

Preparing.—It is prepared for any desired time of flight by boring through the "side hole," corresponding to the required time, into the composition.

Fixing.—It is fixed in the fuze hole by screwing it round by hand until it is held firmly in the fuze hole; it must not be fixed by tapping with a mallet or striking the fuze, previously inserted loosely in the shell, against any hard object. Such action would tend to crack the fuze and cause a premature explosion.

The fuze must not be uncapped until the shell is placed in the muzzle of the gun. This is done by taking hold of the exposed end of the copper band, and unwinding from *right* to *left* smartly, so as to thoroughly detach the band from the head of the fuze, and so leave the priming fully exposed.

Action.—On discharge of the gun, the quickmatch in the fire holes is ignited, and in turn the powder pellet and fuze composition, till the bored side hole is reached, when the shell is fired.

Time of burning at rest, 14.6 to 16.5 seconds.

Weight, $2\frac{1}{2}$ ozs.

Extracting.—Apply the "Extractor, fuze, small, rifled (I.F. and shell)," to the head of the fuze and unscrew.

FUZE, TIME AND PERCUSSION, No. 56.

(Plate XI.)

The fuze consists of the following parts, made of gunmetal, except when otherwise stated, viz.:—Body, detonator plug with detonator, percussion pellet, brass spiral spring, base plug, brass safety pellet, brass ball, composition ring, cap, brass washer, dome, and two safety pins, and two leather washers.

The *body* is screwed at the lower end to G.S. fuze hole gauge, and is bored from the bottom to receive a percussion pellet and base plug. Two holes are bored beyond the recess for percussion pellet, one for the detonator plug, the other for the safety pellet. An arrow head is engraved on the body (a black triangular setting mark has been substituted for the arrow, commencing with the 449th thousand).

The *detonator plug* is screwed on the outside and fitted with a detonator covered with a brass disc.

The hole bored for the detonator plug is continued above it to form a small magazine filled with F.G. powder. In the top of the body is bored a recess to contain a perforated pellet of pressed pistol powder, which communicates with the magazine by a hole bored at right angles to the axis of the fuze. The stem on the body is screwed on top to take the cap, two grooves being cut in the top end of stem to receive the feathers on the brass washer. A groove is cut in the top face of body, close to the stem, and half way round it, and a gas escape hole bored obliquely through the body into the groove. A small tablet of fine white paper is secured with shellac to the body of the fuze over the perforated powder pellet, and over it two washers of fine white paper and calf-skin are secured with shellac, a

hole being cut through the washers and tablet immediately over the powder pellet.

The *percussion pellet* has a cut in the side for the safety pellet and ball to fall into when set in action. A hole is made transversely through the pellet and fitted with a brass retaining bolt, held in position by a brass spiral spring. The pellet contains a powder charge of F.G. powder. A small set screw, in the wall of the body, fits into a slot in the percussion pellet to prevent it from turning in flight. A spiral spring of brass wire is placed between the percussion pellet and detonator plug.

The *base plug* has a conical hole bored in it, and closed at the bottom by a shallow disc and brass washer spun in; it contains a perforated pellet of pressed powder, secured by a brass washer spun over on top.

The *safety pellet* has a slot cut in the side to clear the brass ball, and is suspended in the body by a thin copper wire passing through it. A hole is also bored in the upper part of the pellet and body of fuze for the safety pin to pass through.

The *composition ring* has a chamber on one side, and three projections on the inside to keep it concentric with the stem of the body. The chamber has a hammer with a steel needle suspended in it by a copper wire over a patch of detonating composition. A safety pin also passes through the hammer and chamber. The ring has a groove on the underside filled with composition, and connected with the chamber by a lighting hole. The outside of the ring is graduated from 0 to 18, each division being subdivided into halves and quarters, with a broad arrow at the point, where the groove is interrupted by a bridge soldered in.

The *dome* is made of sheet brass.

The *washer* is made of sheet brass, with two feathers, which fit into featherways cut in the top of the stem. When screwing up the cap the washer remains stationary, thus preventing the dome from turning and altering the setting of the fuze.

The *cap* is hexagonal in form, and screws on the stem of the body.

The fuze is stamped **T** on the composition ring close to the time safety pin, which now has a scarlet cord loop, and **P** on the body close to the percussion pin.

The fuze should be set *before* the safety pins are withdrawn.

To set the time arrangement, the cap is loosened with the "Key, fuze, universal," and the ring moved round until the graduation ordered is exactly in line with the arrow or triangular mark on the body; the fuze is then clamped by screwing down the cap as tightly as possible, care being taken that the ring and dome have even bearings.

If the fuze is required to act as a percussion fuze only, the **P** pin should be withdrawn and the **T** pin left in position; otherwise both pins should be withdrawn, but this should not be done till the moment of loading.

Action.—On discharge, if the time safety pin has been withdrawn, the hammer sets back, shearing the suspending wire, and igniting the detonator and the time ring, which burns until it comes over the pellet, and so flashes down through the radial magazine, detonator pellet, and base plug, and into the shell.

If the percussion pin has been withdrawn, the safety pellet sets back, shearing the suspending wire, and the brass ball falls down into the space over the safety pellet. The centrifugal bolt, owing to the rotation of the shell, is withdrawn, the percussion pellet is free to

move forward on impact and ignite the detonator, which flashes through the percussion pellet and base plug into the shell.

At rest it burns about 13 seconds.

Weight of fuze, 13 ozs.

FUZE, DRILL, TIME AND PERCUSSION, NO. 56, MARK I.

This fuze is of service pattern, but is issued empty, and is provided with special safety pins which can be withdrawn and replaced as required. The dome of the fuze is bronzed to facilitate identification. Fuzes of this description now made have a steel washer (with the feathers bent up at right angles) under the cap, instead of a brass washer as hitherto.

WAD, FUZE-HOLE.

When fixing fuzes in shells having a wad in the fuze-hole (*see* p. 11), it is not necessary to remove the wad, as the explosion of the fuze is sufficient to force it into the shell.

FIXING PLUGS, FUZES, &c.

See "Regulations for Magazines, &c."

TUBES, FRICTION, COPPER, SOLID DRAWN, WITH BALL, MARK II.

(*Plate XII.*)

The tube is made of solid-drawn copper, and has a solid head; it is filled with pistol powder, and the bottom is closed by a brass ball, over which is a cork plug, secured by shellac. The length is 2.1 inches. The nib-piece is solid drawn, and projects right through the tube, and has a small hole bored in it to allow the flash from the friction composition to reach the powder in the tube.

The nib-piece contains a copper friction bar roughened on both sides; the roughened portion of the bar has a detonating composition, composed of chlorate of potash, sulphur, and sulphide of antimony, smeared on both sides of it. The composition is damped with shellac varnish while it is being smeared on. The nib-piece is pinched down so as to press on the sides of the friction bar, the projecting part of which has a vertical eye, into which the hook of the lanyard fits. The exterior of the tube is varnished black after the tube has been thoroughly dried.

On pulling the lanyard the friction bar is drawn out, igniting the composition and firing the tube. The gas from the exploded cartridge drives the tube out of the vent.

RANGE TABLE.

Based on Practice 5.7.88 and 6.2.89.

Charge { weight, 1½ lb.
nature, R.L.G.²
Projectile, common shell.

Muzzle velocity, 1330 f.s.
Jump, 9 minutes.

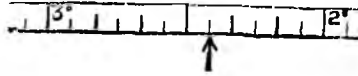
Remaining velocity. f.s.	5' elevation or deflection alters point of impact		Slope of descent. 1 in	ELEVATION. ° ' "	RANGE. yards.	Fuze scale for time and percussion fuze, Mark IV.	50 per cent. of rounds should fall in			Time of flight. secs.
	Range. yards.	Laterally or vertically. yards.					Length. yards.	Breadth. yards.	Height. yards.	
1275	45	0.14	312	0 1	100	1	7	0.1	0.1	0.27
1224	44	0.29	149	0 12	200	2	9	0.1	0.1	0.54
1177	43	0.43	98	0 23	300	3	10	0.1	0.1	0.81
1133	42	0.58	72	0 34	400	4	12	0.1	0.2	1.09
1093	41	0.72	56	0 46	500	5	13	0.1	0.2	1.36
1058	40	0.87	46	0 58	600	6	15	0.1	0.4	1.64
1031	39	1.01	38	1 10	700	7	16	0.2	0.6	1.92
1007	38	1.16	33	1 23	800	8	18	0.2	0.7	2.20
985	38	1.31	24	1 36	900	9	19	0.2	0.9	2.49
964	7	1.45	25	1 50	1000	10	21	0.3	1.1	2.78
944	36	1.60	22	2 4	1100	11	23	0.4	1.3	3.08
924	35	1.74	20	2 18	1200	12	25	0.5	1.5	3.38
905	34	1.89	18	2 32	1300	13	28	0.7	1.8	3.69
887	33	2.03	16	2 47	1400	14	28	0.9	2.0	4.01
870	33	2.18	15	3 2	1500	15	30	1.1	2.3	4.34
853	32	2.32	14	3 18	1600	16	32	1.4	2.6	4.67
837	31	2.47	12	3 34	1700	17	34	1.8	2.9	5.00
821	30	2.61	11	3 50	1800	18	36	2.2	3.2	5.34
806	30	2.76	10	4 7	1900	19	37	2.5	3.6	5.68
792	29	2.91	9.8	4 21	2000	20	39	2.9	4.1	6.03
778	28	3.05	9.1	4 42	2100	21	41	3.3	4.6	6.39
764	27	3.20	8.4	5 0	2200	22	43	3.6	5.1	6.75
750	27	3.34	7.8	5 19	2300	23	45	3.9	5.7	7.13
737	26	3.49	7.3	5 38	2400	24	47	4.1	6.4	7.51
724	25	3.63	6.8	5 58	2500	25	49	4.3	7.2	7.90
711	24	3.78	6.3	6 18	2600	26	52	4.4	8.1	8.30
698	23	3.92	5.9	6 39	2700	27	54	4.5	9.1	8.71
686	22	4.07	5.5	7 1	2800	28	56	4.6	10.2	9.12
674	22	4.21	5.1	7 21	2900	29	58	4.6	11.5	9.54
662	21	4.36	4.7	7 47	3000	30	61	4.7	13.0	9.93
650	20	4.51	4.4	8 12	3100	31	63	4.7	14.5	10.43
638	19	4.65	4.1	8 37	3200	32	65	4.8	16.1	10.89
627	18	4.80	3.8	9 3	3300	33	67	4.8	17.8	11.36
616	17	4.94	3.5	9 31	3400	34	70	4.8	19.7	11.85
605	17	5.09	3.3	10 0	3500	35	72	4.9	21.8	12.35
594	16	5.23	3.0	10 31	3600	36	75	5.2	23.9	12.85
583	15	5.38	2.8	11 3	3700	37	78	5.5	26.5	13.36
572	14	5.52	2.6	11 35	3800	38	81	6.2	29.8	13.89
562	14	5.67	2.4	12 9	3900	39	83	7.3	33.9	14.43
552	13	5.81	2.2	12 44	4000	40	86	8.6	39.1	14.98

January 27th, 1897.

INSTRUCTIONS FOR USING THE CLINOMETERS.

To read the angle marked on the drum.—The brass drum is marked in degrees, commencing at 0° on the top to 45° at the bottom, in the case of the Watkin, Mark I, Clinometer, and to 26° in the Mark II Field Clinometer. Each degree is subdivided into 12 parts; each small division, therefore, represents angles of 5 minutes.

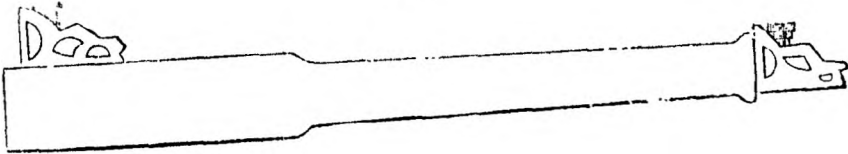
The scale is read from right to left, thus—



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

To lay a gun for elevation.—Unscrew the gun until $\uparrow$ points to the elevation required, place the clinometer on the planed portion of the breech, or against the muzzle, thus—

FIG.



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, thus—

FIG. 2.



“To measure the angle of sight.”—Lay the gun, with tangent or telescopic sight set at zero, on the object, then measure the angle at which the gun stands by clinometer.

Preservation and adjustment of the instrument.—In order to preserve the clinometer in efficient working order it is necessary to keep the working parts free from grit and dust as far as possible. As excess of oil is apt to cause the adhesion of grit, only sufficient is to be applied to make the screw work smoothly, and to keep the steel parts from rusting.

On no account should the instrument be taken to pieces, as requires special tools to put it together again.

Instruments are issued in correct adjustment, and with due care will remain correct for many years.

To ascertain if the instrument is in adjustment:—

- (a) Carefully clean the plane surface cut on a gun for use with the clinometer.
- (b) Turn the drum to zero.
- (c) Place the instrument on the plane surface (drum towards breech), and elevate or depress the gun till the bubble is in the centre of its run.
- (d) Turn the clinometer end for end.
- (e) Should the bubble not return to the centre, the instrument is out of adjustment.
- (f) As the amount of the error will generally be small it is advisable to add or subtract the error, as the case may be, rather than correct the adjustment.
- (g) To ascertain the error after complying with (d) (drum towards muzzle), turn the drum until the bubble is again in the centre of its run; *one-half* the reading on the drum is the index error.
- (h) If the reading falls on the *black* markings on the drum, add *half* the amount when setting the clinometer for any required *elevation*.
- (i) If the reading falls on the *red* markings on the drum, subtract *half* for any required *elevation*.

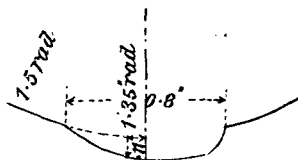
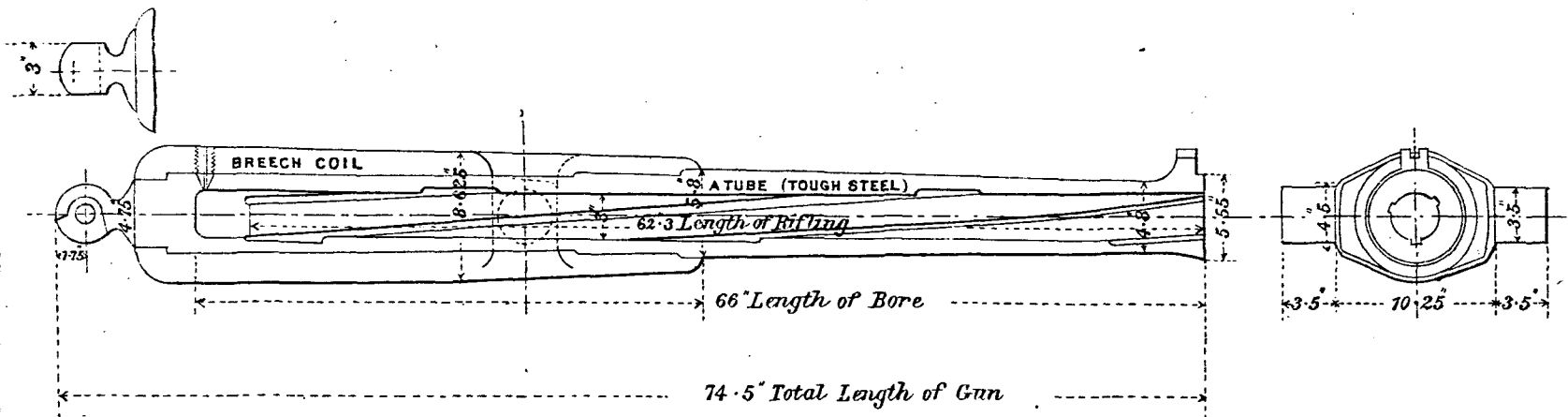
If it is required to adjust the clinometer to have *no* index error, set the drum to the ascertained index error (keeping the drum end towards muzzle), and bring the bubble to the centre of its run by manipulating the capstan-headed nuts) using a tempered steel wire just fitting the holes in the nuts). Then placing the drum at zero, elevate or depress the gun till the bubble is in the centre.

Reversing the instrument end for end should not alter the central position of the bubble; should it do so, proceed as before until there is no change.

RANGE-FINDING INSTRUMENTS.

Full particulars as to description and method of use are contained in a separate handbook.

ORDNANCE, R.M.L., 9 P^r, 6-CWT, MARK II.



E. Weller & Grahams, Ltd. Litho. London.

Technical drawing of a 12-inch gun, showing side and end views with dimensions.

Side View Dimensions:

- Overall length: 72" Total Length of Gun
- Bore length: 63.5" Length of Bore
- Preponderance: 7.00
- Labels: BREECH COIL, A TUBE TOUGH
- Dimensions along the barrel (from breech to muzzle): 2.6, 3.75, 1.3, 5.3, 6.65
- Dimensions at the breech: 4.3, 1.5

End View Dimensions:

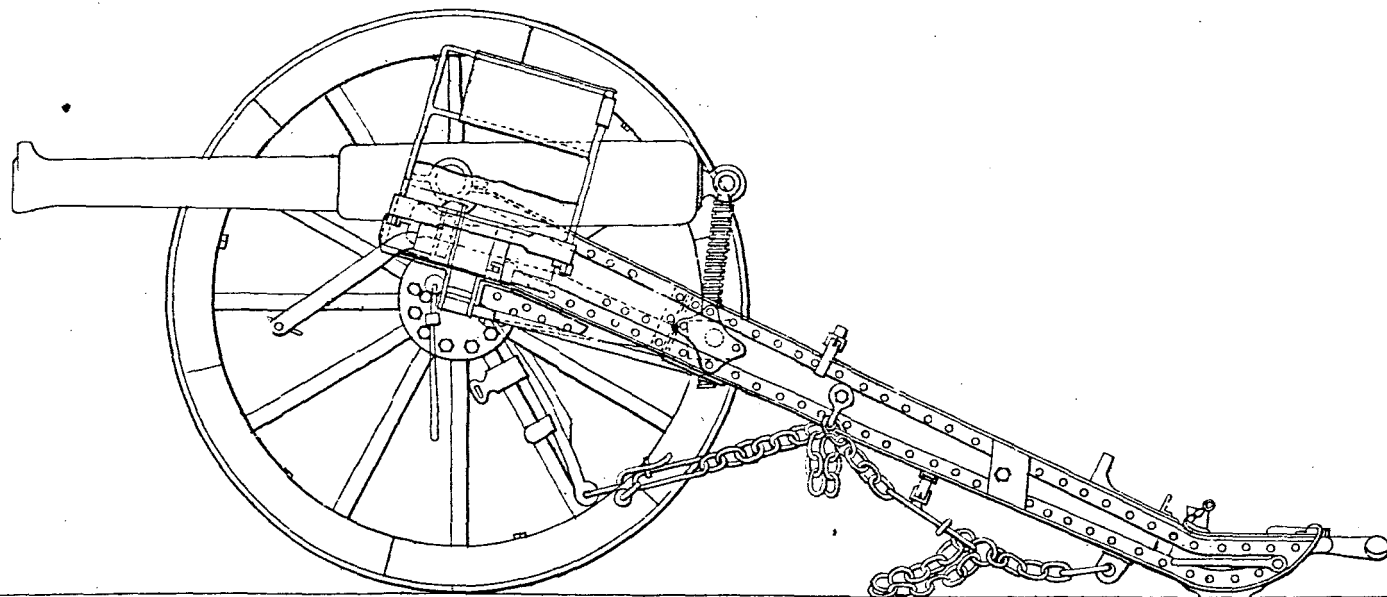
- Overall diameter: 10.25"
- Dimensions at the breech: 4.5, 3.5

Full size.

1321, H. 01.

CARRIAGE, FIELD, R.M.L., 9 P^{ts}, MARK II.

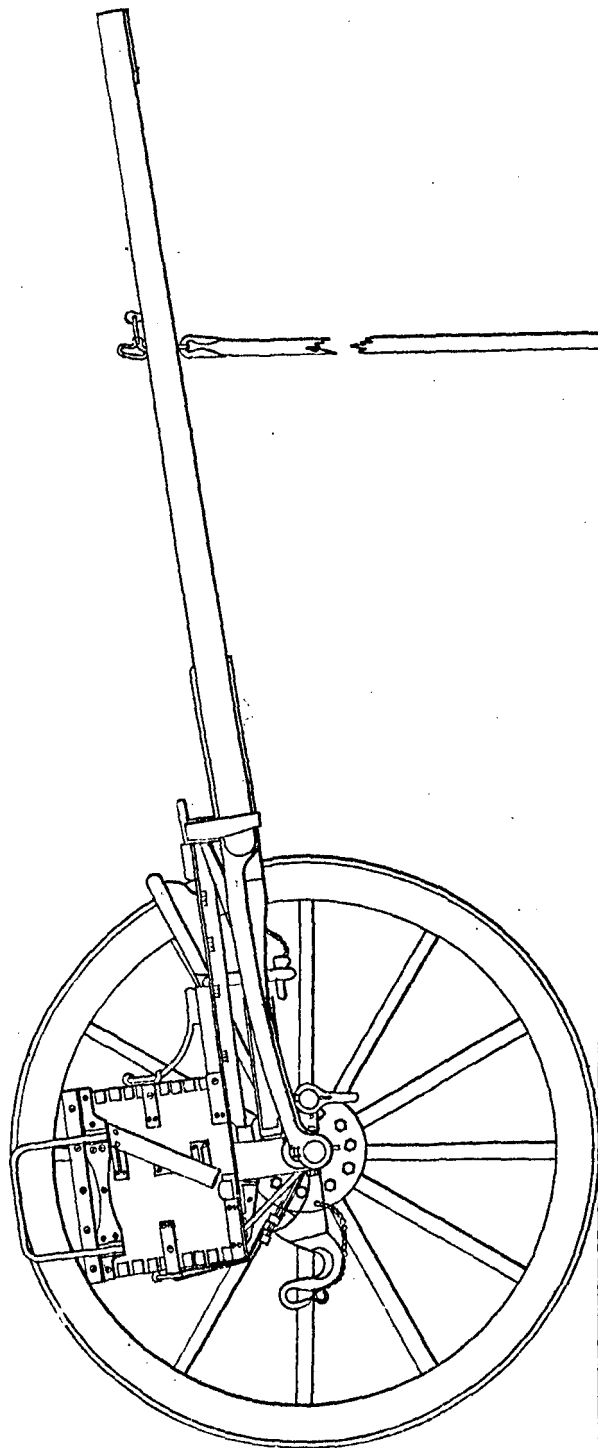
NOTE; SUITABLE FOR 8 OR 6 CWT GUN.



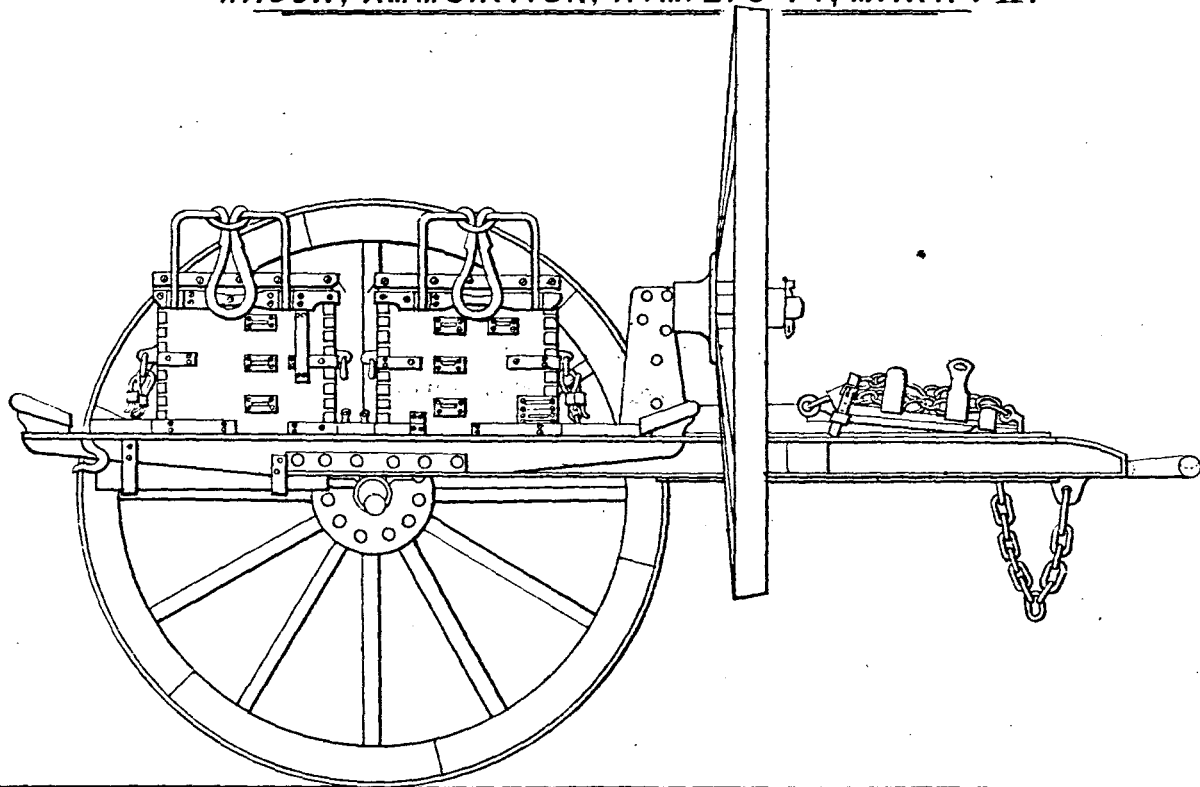
SCALE.



LIMBER, FIELD; R.M.L., 9-P^R, MARK II.



WAGON, AMMUNITION, R.M.L. 9-P^a, MARK . II.

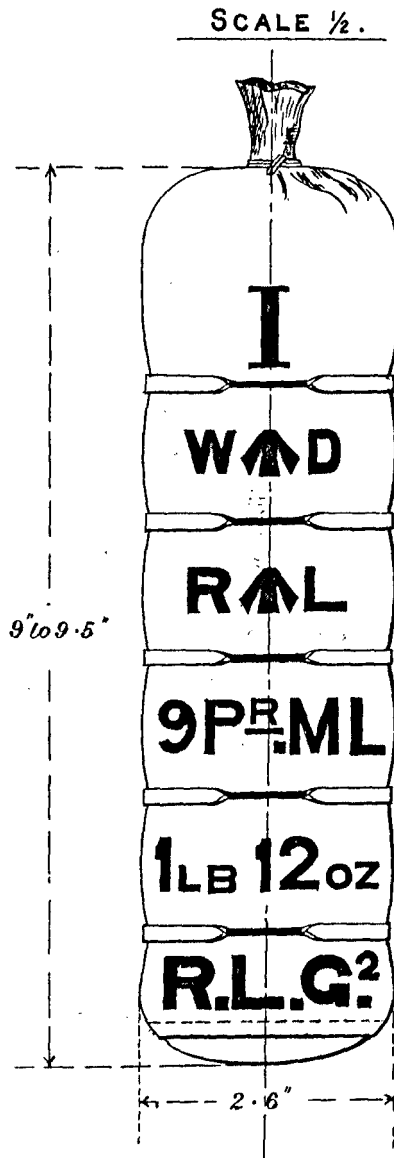


SCALE.

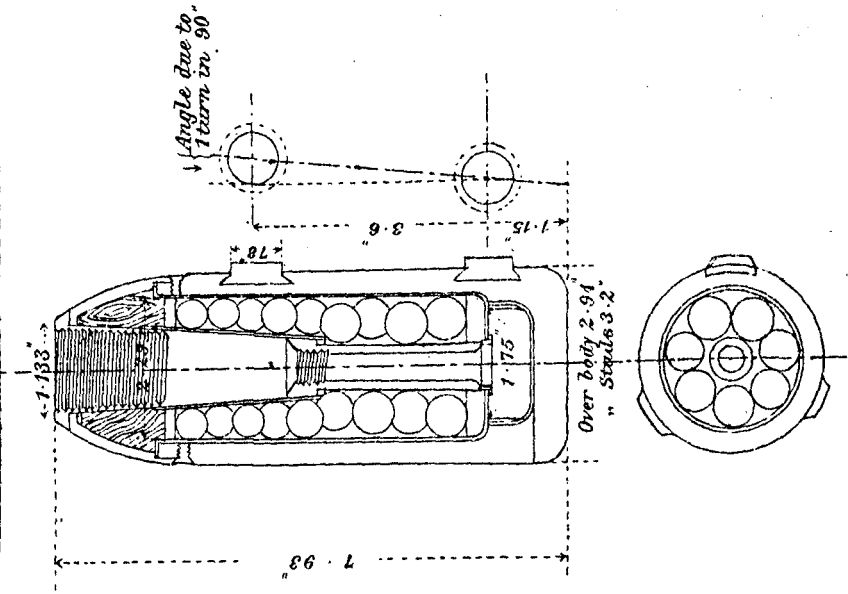


CARTRIDGE, R.M.L. FILLED, SILK CLOTH, 9 P^R

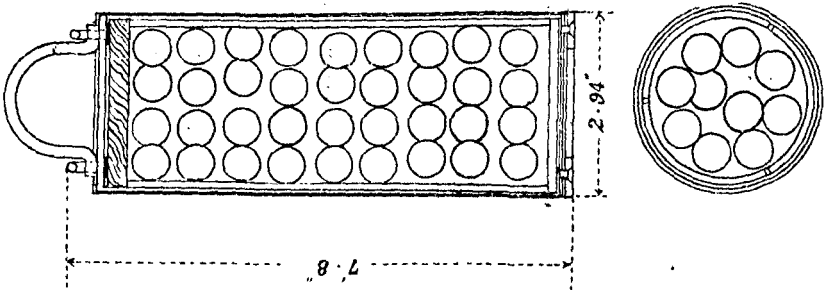
1 LB. 12 OZ. R.L.G.² (MARK I).



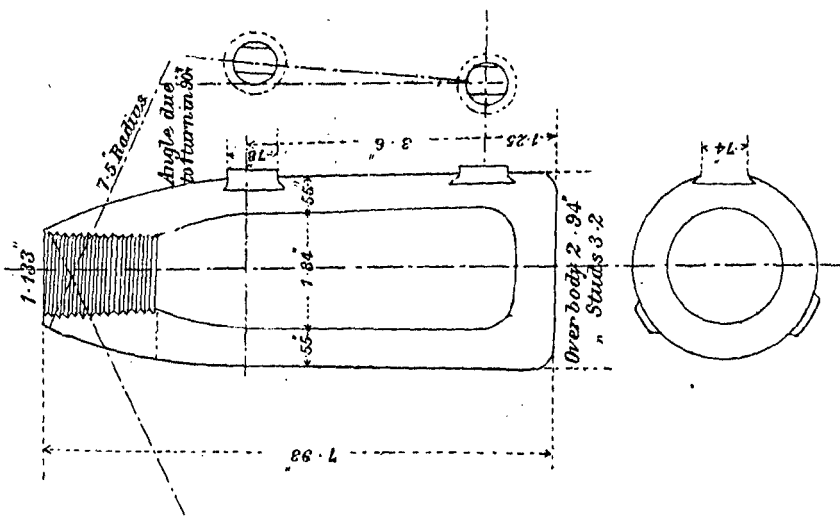
SHELL, R. M. L. SHRAPNEL, 9 P^r, VIII.



SHOT, R. M. L., CASE, 9 P^r, V.

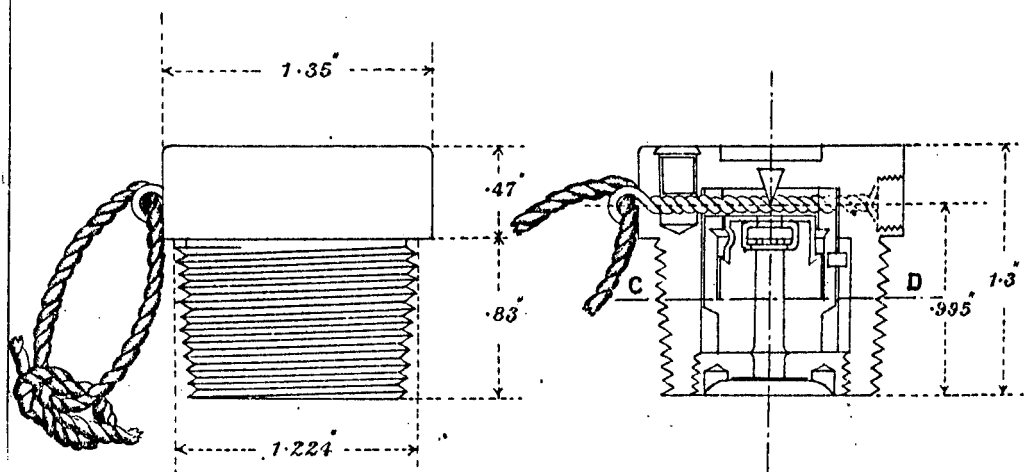


SHELL, R. M. L. COMMON, 9 P^r, V.



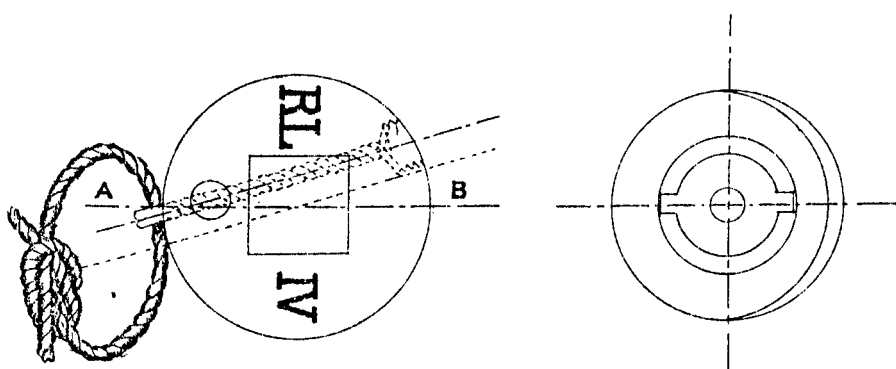
FUZE, PERCUSSION, R.L, N° 7., MARK IV.

FULL SIZE.



ELEVATION.

SECTION AT A.B.

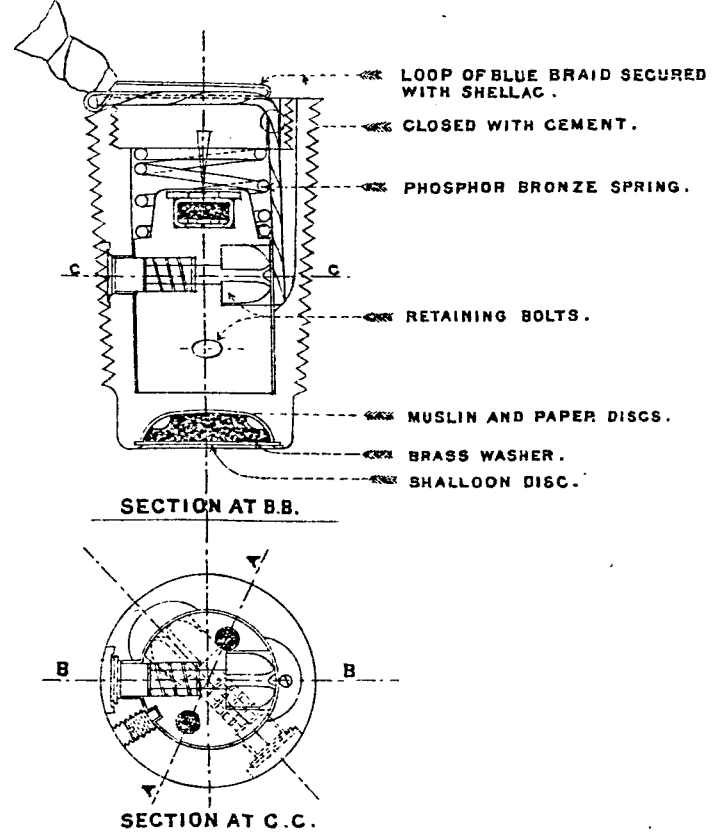
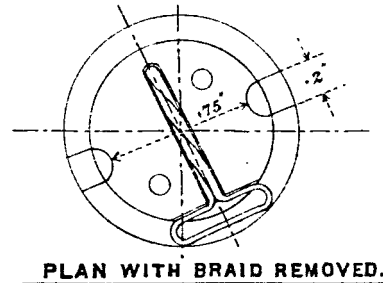
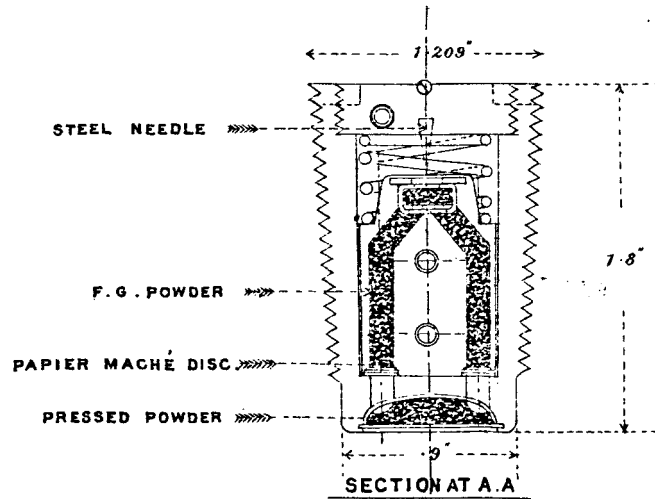


PLAN.

SECTION AT C.D.

FUZE, PERCUSSION, SMALL, N° 8., MARK IV.

FULL SIZE.

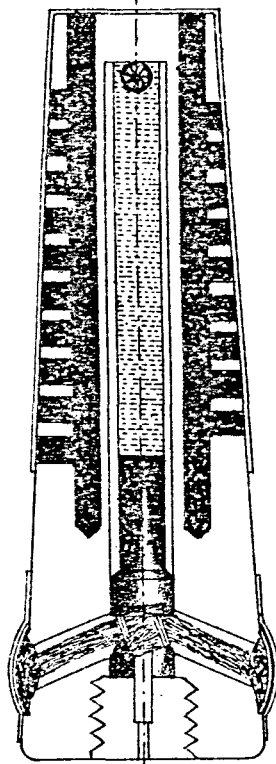


FUZE, TIME, M.L., 15 SECONDS, N° 41, MARK II.

FULL SIZE.

DEVELOPMENT OF PAPER SHOWING

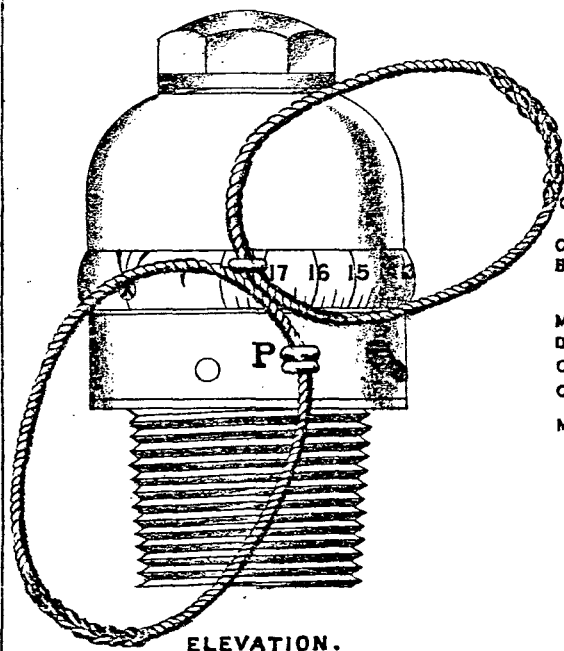
MARKING OF FUZE.



27.5	30	29.5	29	28.5	28
24.5	27	26.5	26	25.5	25
21.5	24	23.5	23	22.5	22
18.5	21	20.5	20	19.5	19
15.5	18	17.5	17	16.5	16
12.5	15	14.5	14	13.5	13
9.5	12	11.5	11	10.5	10
6.5	9	8.5	8	7.5	7
3.5	6	5.5	5	4.5	4
	3	2.5	2	1.5	1

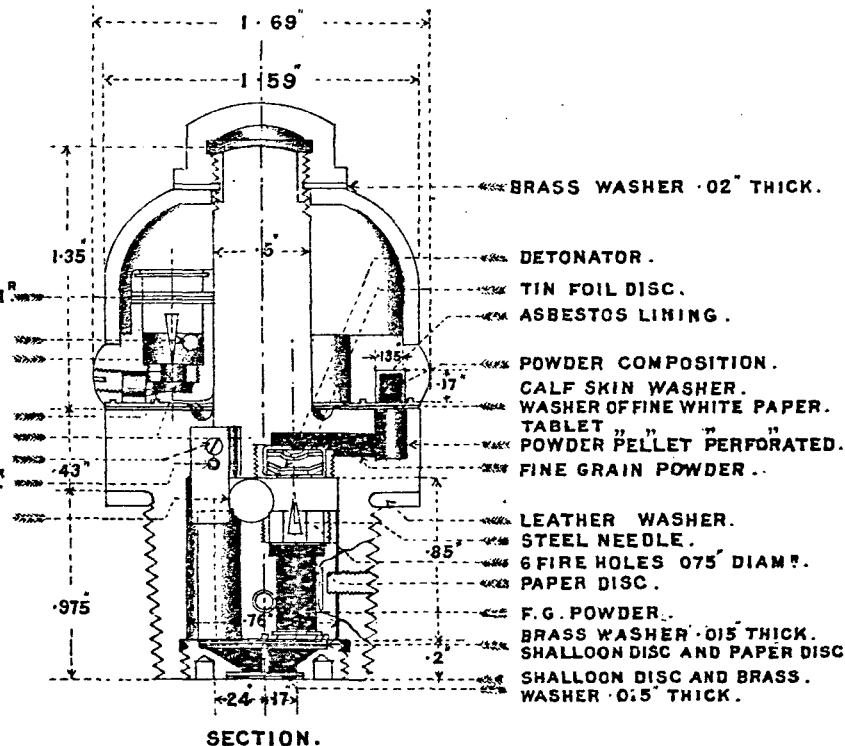
FUZE, TIME AND PERCUSSION, N° 56 (MARK IV.)

FULL SIZE.



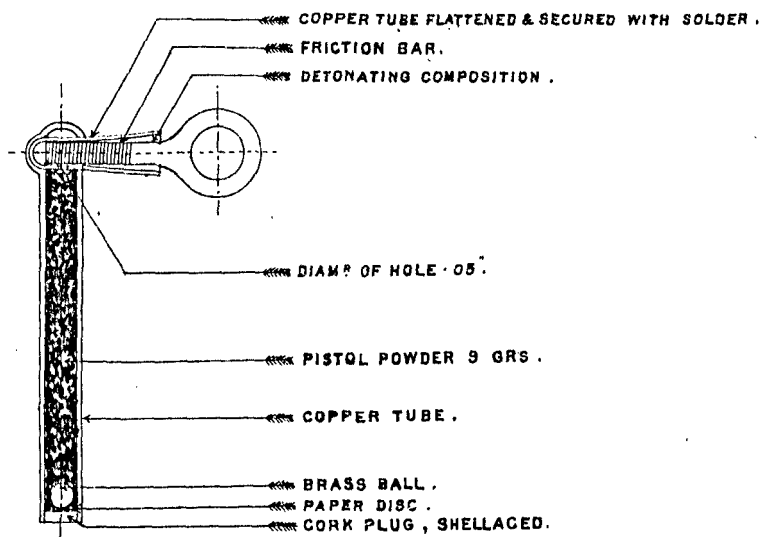
ELEVATION.

COPPER SHEARING WIRE .022 DIAM.
 COPPER SAFETY PIN .065 DIAM.
 BRASS DISC .001 THICK.
 MEALED POWDER.
 DETONATING COMPOSITION.
 COPPER SAFETY PIN .065 DIAM.
 COPPER SHEARING WIRE .022 DIAM.
 METAL BALL.



SECTION.

TUBE, FRICTION, COPPER, SOLID DRAWN, WITH BALL,
(MARK II.)
Full Size.



SECTION AT A.B.

