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I.—DEFINITION OF GUNNERY TERMS.

**Calibre.*—The diameter of the bore in inches. In rifled guns it is measured across the lands. See fig. 1, Pl. I.

**Axis of the Piece.*—A line passing down the centre of the bore. See AB, fig. 2, Pl. I.

**Axis of the Trunnions.*—A line passing through the centre of the trunnions. See CD, fig. 3, Pl. I.

**Windage.*—The difference between the sectional area of the bore through the grooves and that of the projectile through the studs, gas checks, or the driving bands. See unshaded portion, fig. 4, Pl. II. NOTE.—With B.L. guns there is practically no windage.

**Trajectory.*—The curve described by the projectile in passing from the muzzle to the first point of impact. See fig. 5, Pl. III.

Range.—The distance from the piece to the second intersection of the trajectory with the line of sight. *NOTE.—In plain terms this is the distance between the gun and the object fired at.

**Line of Sight.*—A line passing through the sights of the piece and the point aimed at. See EF, fig. 6, Pl. III.

**Line of Fire.*—A line joining the muzzle of the piece and the point aimed at. This term would be used instead of the preceding one if firing from behind cover or in any case when the sights of the piece are not used.

Plane of Sight.—The vertical plane passing through the line of sight.

Angle of Sight.—The angle which the line of sight makes with the horizontal plane. See GHI, fig. 7, Pl. III.

* Every recruit should be taught those definitions marked with an

Section I.—Definition.

**Angle of Elevation.*—The angle which the line of sight makes with the axis of the piece. See fig. 8, Pl. IV.

Quadrant Angle.—The angle which the axis of the piece, makes with the horizontal plane. It is termed *quadrant elevation* or *depression* according as the piece is laid above or below the horizontal plane. See fig. 8, Pl. IV. NOTE.—The angle of elevation and the quadrant angle are the same when the line of sight is horizontal.

Line of Departure.—The direction of the projectile on leaving the muzzle, in other words, a tangent to the trajectory at the muzzle. See fig. 9, Pl. IV.

Plane of Departure.—The vertical plane passing through the line of departure.

Angle of Departure.—The angle between the line of departure and the horizontal plane. See fig. 9, Pl. IV.

Jump.—The angle between the line of departure and the axis of the piece before firing. See fig. 9, Pl. IV. NOTE.—Jump arises from the gun and carriage revolving in a vertical plane on their points of support in rear when the gun is fired, and takes effect before the projectile leaves the bore. With no jump the line of departure and the axis of the piece before firing would be identical.

Angle of Descent.—The angle which a tangent to the trajectory at the first point of impact makes with the horizontal plane. See fig. 11, Pl. V.

Angle of Incidence.—The angle which a tangent to the trajectory at the point of impact makes with the surface struck. It may be considered either vertically or horizontally. See figs. 12, 13 and 14, Pl. VI.

Lateral Deviation.—The perpendicular distance of the point of impact of the projectile right or left of the plane of sight.

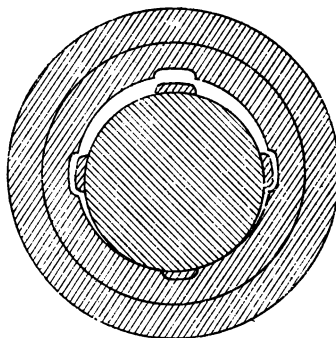
Drift.—The constant deflection of the projectile from the plane

* Every recruit should understand the definitions with an asterisk. 4556)

II.

To face p.1.

FIG. 4.



WINDAGE.



DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 6.86.12095.

EXAMPLES OF ANGLES OF INCIDENCE.

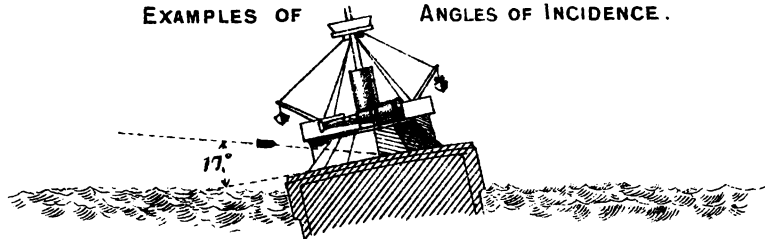


FIG. 12. SHIPS DECK.

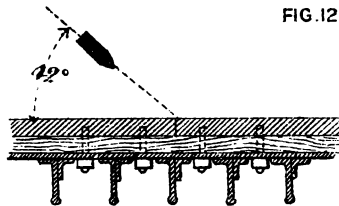


FIG. 14. HORIZONTAL SECTION THROUGH SHIPS SIDE.

FIGS. 12 & 13. VERTICAL ANGLES.

FIG. 14. HORIZONTAL ANGLE.

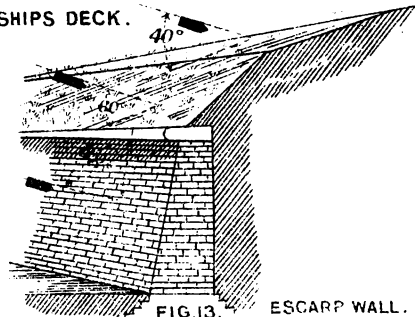


FIG. 13. ESCARP WALL.

of departure due to the rotation imparted by the rifling of the piece. See fig. 10, Pl. V.

**Point Blank.*—A gun is laid point blank when the line of sight is parallel to its axis. Point blank range is the range due to the jump of the gun.

Muzzle Velocity.—The velocity in feet per second with which a projectile leaves the muzzle.

Remaining Velocity.—The velocity of a projectile at any given point of its trajectory.

Striking Velocity.—The velocity of a projectile at the point of impact.

The following are the natures of artillery fire :

I. WITH REFERENCE TO THE VERTICAL PLANE.

Direct Fire.—Fire from guns with service charges at all angles of elevation not exceeding 15° .

Indirect or Curved Fire.—Fire from guns with reduced charges and from howitzers and mortars at all angles of elevation not exceeding 15° .

High-Angle Fire.—Fire from guns, howitzers and mortars at all angles of elevation exceeding 15° .

2. WITH REFERENCE TO THE HORIZONTAL PLANE.

Frontal Fire.—The line of fire perpendicular to the front of the object fired at.

Oblique Fire.—The line of fire inclined to the front of the object fired at.

Enfilade Fire.—The line of fire parallel (or nearly so) to the front of the object fired at.

Reverse Fire.—When the rear instead of the front of the object is fired at.

* Every recruit should be taught those definitions marked with an asterisk.

(a.m.¹)

Section II.—The Gun.

II. THE GUN.

1. RIFLING.

The object of rifling a gun is :—

1. To increase its accuracy.
2. To enable an elongated projectile to be used.

1. Accuracy. A shot from a smooth bore leaves the gun rotating round an axis dependent upon the position of the centre of gravity of the shot, or the portion of the bore last touched.

This rotation is uncertain in its direction and the deviation due to it cannot therefore be corrected. In a rifled gun as the rifling gives a definite rotation to the projectile its lateral deviation is constant and can be allowed for, thus increasing the accuracy of the gun.

2. The advantages of using an elongated projectile may be briefly summarised :—

1. A diminished surface for the same weight is offered to the resistance of the air, and thus greater range and greater power at a given range are obtained.
2. The trajectory being flatter, the probability of hitting an object is increased.
3. The head may be of any required form or weight ; *e.g.*, Palliser shot or Shrapnel shell.
4. By varying the length, different kinds of projectiles for the same gun can be brought to the same weight ; and thus complications in range tables &c., are avoided.
5. On the other hand, if desirable, a specially heavy projectile may be fired ; *e.g.*, the 7" and 7-pr. double shell.

Section II.—The Gun.

6. The capacity of the shell for powder or bullets is increased.
7. A shell of the same weight as that of the S.B. Gun can be fired from a much lighter gun ; or a heavier shell from a gun of the same weight.

2. SYSTEMS OF RIFLING.

The object of any system of rifling is to give the necessary amount of rotation or spin to the projectile with a minimum pressure on it and on the bore of the piece ; this result should be obtained by the most simple means and with the least possible loss of power.

The term “system of rifling” consists essentially in the means of giving rotation to the projectile, but the twist of the grooves, the length, diameter, or form of the projectile must depend upon the purpose for which the gun is required, no matter upon what system the gun may be rifled.

The conditions especially desirable in a system of rifling for ordnance are :—

1. Accuracy of fire.
2. Simplicity and durability of both projectile and gun.
3. Non-liability of the projectile to jam in the bore either in loading or firing.

The systems of rifling now in the service may be classified as follows :—

a. The R.B.L. Polygroove (original Armstrong) Rotation given to the projectile by its soft metal coating being forced into a large number of grooves with sharp corners.

b. The R.M.L. old Woolwich system, having a few broad deep grooves, rotation imparted by means of soft metal studs fitted to correspond with the grooves, or in studless projectiles by gas-checks which take the rifling.

c. The R.M.L. and B.L. modern poly-groove. Rotation given in the former by gas-checks, in the latter by driving bands,
(a.m.¹)

B 2

Section II.—The Gun.

which are forced into a large number of shallow and rounded grooves.

The disadvantages of the first system are :—

The shape of the grooves and the thickness of the lead coating on projectiles cause considerable pressures and loss of velocity.

Lead coatings are liable to damage in transport, deterioration in store, and to be detached in flight. They foul the bore and therefore necessitate a lubricant.

The disadvantages of the second are :—

The gun is weakened by the deep grooves, and as windage is not entirely sealed by the gas-check, the rush of gas past the projectile scores the gun, injuring it and causing a waste of power. With a studded projectile, an excessive strain is thrown on the gun and projectile, the latter is not perfectly centred, the studs are liable to injury in transport or store, and weaken the shell. The advantages of the last are :—

Absence of windage, the projectile is well centred, the grooves being numerous and shallow and the projectile an easy fit in the bore, the strain on the gun and projectile is lessened.

3. TWIST OF RIFLING.

Rotation is always effected by fitting or forcing projections (lead coat, studs, gas-check or copper driving ring) on the projectile into spiral grooves, which are cut in the bore of the gun.

The spiral grooving or twist is either :—

1. Uniform or,
2. Increasing.

With the uniform twist the inclination of the grooves to the axis of the piece is the same throughout the bore. With an increasing twist the inclination increases.

The uniform twist imparts rotation to the projectile very rapidly at first, but adds little to it during the latter part of its passage down the bore.

Section II.—The Gun.

The increasing twist gives rotation gradually, and therefore brings lower pressure at the breech end of the bore than the uniform twist but it necessitates only one driving ring on the shells.

The muzzle velocity is a little greater with the uniform twist.

Twist is measured by the number of calibres in which the projectile makes one complete revolution.

In the later guns the first part of the groove is an increasing twist, the latter part towards the muzzle is uniform, this is done to give steadiness to the projectile on leaving the muzzle.

4. CENTRING.

The projectile on leaving the bore should be centred, *i.e.* it should be rotating round its longer axis, which should be coincident with the line of departure.

Should it be imperfectly centred, a higher velocity of rotation is necessary to keep the axis of the projectile in the required direction, for if this velocity is insufficient the projectile becomes unsteady and noisy in flight.

5. DRIFT.

The direction of the rotation given to all service projectiles being right-handed, causes the shell to be deflected towards the right.

This constant deflection is called "drift." The amount of it is determined for each nature of piece by actual experiment, and is compensated for in all guns by inclining the tangent sights to the left. This cannot be done with howitzers as owing to their varying charges, no permanent angle of drift can be found for them applicable to all circumstances.

Their tangent sights are accordingly put in perpendicularly, they are provided with long deflection bars, and the amount of deflection to be given at each range with each charge, is noted in the range tables.

Section II.—The Gun.

6. MUZZLE OR BREECH-LOADING.

Whether a gun is loaded at the breech or muzzle, the accuracy of the shooting depends (supposing the rifling and length of bore to be the same) on the absence of windage, on the projectile being of the same weight and properly centred, the uniformity of the powder and on the space occupied by it being the same for each round.

It is very generally admitted that it is easier to carry these conditions out with B.L. than with M.L. guns.

The B.L. question may be summed up thus :—

1. It is now possible to construct B.L. guns of large size, of which the breech-loading apparatus will withstand the stress of firing heavy charges of a suitable powder. 2. The loading Nos. are generally less exposed. 3. The bore can be more easily examined. 4. The gun can be of any length. 5. The difficulties of chambering are reduced.

On the other hand, so far as the gun alone is concerned; the M.L. is undoubtedly simpler than the B.L., as considerable care is required to keep the breech-closing arrangement in order.

7. PROPORTION OF WEIGHT TO CALIBRE.

There are three natures of ordnance in the service, viz. :—guns, howitzers, and mortars.

The first being principally used for direct fire, the heaviest charges should be employed compatible with the strength of the gun.

The second being chiefly required for curved and high angle fire with small charges, a much lighter piece compared with the weight of projectile suffices.

Section III.—Muzzle Energy and Charge.

COMPARE.

Nature.	Weight.	Cartridge.	Projectile.	M. V.
6·6" R.M.L. gun ...	70 cwt.	25 lbs. P.	100 lbs.	1,468 f s.
6·6" R.M.L. howitzer...	36 cwt	1 to 5 lbs. R.L.G. ²	100 lbs.	839 f.s.

The last are used wholly for high-angle fire. They are short and light compared with weight of shell, and fire a heavy shell of large calibre and capacity. They are still retained in the service, notwithstanding their great inaccuracy and other defects, but practically for siege purposes they have been superseded by rifled howitzers.

COMPARE.

Nature.	Weight.	Length.	Elevation.	Weight of		Bursting charge.	Range.
				Cartridge.	Shell.		
8" howitzer	70 cwt.	113"	30½°	9½ lbs. R.L.G. ²	180 lbs.	13½ lbs.	5,600 yds.
13" mortar .	36 cwt.	53"	45°	9½ lbs. L.G.	206 lbs.	11 lbs.	2,870 yds.

III.—MUZZLE ENERGY AND CHARGE.

For a given calibre and weight of projectile there are, speaking generally, three ways in which the energy actually realised can be varied. These are :—

1. By varying the powder.
2. By modifying the gun.
3. By altering the weight of the charge ; or by altering its gravimetric density, which is called "air-spacing."

Section III.—Muzzle Energy and Charge.

1. EFFECT OF VARYING POWDER.

The nature of the powder exercises great influence on the muzzle energy realised per pound of powder.

The important points are the maximum pressure and the rate at which the pressure changes, which again depend upon the point of ignition and rate of combustion of the powder.

With the same gravimetric density these vary with :—

1. The size and shape of the grain.
2. The density and hardness of the powder.
3. The amount of glazing.
4. The quantity of moisture.

These are treated of in "Treatise on Ammunition."

2. EFFECT OF MODIFYING THE GUN.

As regards the gun, the points which affect the muzzle energy realised are :—

1. Length of bore.
2. Windage.
3. Rifling.
4. Position of vent.
5. Chamber.

Length of Bore.

The work done depends, in a measure, upon the length of the bore, but after a certain point is reached, the work done corresponding to each additional space passed over becomes less and less, and as the length of the bore increases, the energy absorbed in friction, &c., continually gets larger.

Hence lengthening the bore up to a certain point is advantageous, but there is in each particular case a limit of length which cannot profitably be exceeded.

Windage.

Windage causes loss of energy from the escape of a certain portion of gas.

Rifling.

The effect of rifling is generally to reduce the muzzle velocity, a small proportion of the total work being absorbed in giving rotation to the projectile.

Position of Vent.

In the case of grain powders, with which the gas could with difficulty penetrate the charges, the best position for the vent was found by experiment to be at 4-10ths the length of the cartridge from the rear.

Rear axial vents have, however, for some years been used with marked success, for with prismatic powders built up symmetrically with channels from end to end of the cartridge, the gas first developed can readily penetrate to the front of the charge, and thus insure sufficiently uniform ignition.

Chambering.

All the newer guns have the place where the cartridge rests of larger diameter than the bore, this is called Chambering and can be more easily developed in B.L. guns.

It enables the comparatively large charges to be made up into fairly compact form, and reduces the disadvantages of very long cartridges.

The increased diameter of the chamber is a source of weakness, but this is of less consequence, as the maximum pressures may be kept tolerably low with the slow burning powders now used especially when "air-spacing" is employed.

Effect of Altering the Weight of the Charge, or its Gravimetric Density, which is called "Air-spacing."

The gravimetric density of a charge of powder is the ratio between the weight of powder and the weight of water which would completely fill the space in rear of the projectile. It is usually expressed in terms of the number of cubic inches allowed to each pound of powder in the chamber.

Section IV.—The Projectile.

It has been found that when the gravimetric density of a charge is decreased, the pressures and the velocity of the projectile both fall off. When a certain additional quantity of powder is added (keeping to the same gravimetric density of the charge), the velocity of the projectile becomes as great or greater than before, but the maximum pressure in the bore is less than with the smaller charge of greater gravimetric density.

Great use has been made of this method, which is called "air-spacing."

EXAMPLE.

38-ton gun, with 800 lbs. projectile and gas-check.

Charge.	Cubic inches to lb. of powder.	Length of Cartridge.	Mean pressure on chamber per square inch.	M.V.
130 lbs. P ²	24·6	23"	24·5 tons	1,451 f.s.
130 " 	30·0	33"·22	19·3 "	1,391 "
180 " 	30·0	45"·37	22·4 "	1,541 "

IV.—THE PROJECTILE.

1. FORCES ACTING ON A PROJECTILE IN THE BORE OF A GUN.

These may be briefly summed up as follows :—

a. The Force of Projection of the Powder-Gas.

The forward velocity, or velocity of translation, attained by a projectile at the muzzle of a gun, is due to the sum of the pressures of the powder-gas during its passage through the bore. The more gradually this velocity is imparted to the projectile the less will be the strain upon it and the gun. The object sought after is to distribute, as far as possible, the pressure over the whole length of the bore and to obtain the maximum work from a given charge of powder without undue strain on either gun or projectile. Theoretically the last atom of powder should be converted into gas as the projectile leaves the muzzle.

b. The Rotation imparted to the Projectile by the Grooves.
See chapter on Rifling, p. 6.

2. FORCES ACTING ON A PROJECTILE DURING FLIGHT.

The chief forces acting on a projectile during its flight are—

- a.* The force of projection.
- b.* The force of gravity.
- c.* The resistance of the air.
- d.* The rotation due to rifling.

With regard to *a*, *b*, and *c*—

If a projectile were acted on by the force of projection alone, it would proceed in a straight line, and pass over equal spaces in equal times. The force of gravity, however, causes the projectile to fall with a constantly accelerating velocity, so that, were it moving in vacuo, it would describe a curve instead of a straight line. This curve would be a parabola.

But the resistance of the air, which, according to Professor Bashforth's experiments, varies approximately as the cube of the velocity,* the square of the diameter and inversely as the weight, further varies the form and renders the calculation of the elements of the trajectory a complicated mathematical problem. Most practical questions can however be comparatively easily worked out by means of Professor Bashforth's tables.

It is evident that (the resistance of the air varying as $\frac{d^3}{W}$ †) if two projectiles are of equal diameter and start with the same muzzle velocity, the heavier will lose its velocity more slowly and range the further. Or if the two projectiles are of the same weight but of different diameters, the one with the smaller diameter will have the advantage.

* For velocities between 1100 and 1490 f. s., for higher velocities the resistance varies nearly as the square of the velocity, and for lower velocities at a higher power than the cube.

† D = diameter; W = weight.

Section IV.—The Projectile.

This is well shown in the following range table, which gives a comparison between the shooting of a 12-pr. S.B. and a 13-pr. R.M.L. gun.

Gun.	Muzzle Velocity.	Range and Elevation.		
		1°	3°	5°
12-pr. S.B.	1,769	700	1,200	1,600
13-pr. R.M.L....	1,700	1,200	2,140	2,917

The remaining velocity of the two projectiles at 2,000 yards would be

12-pr. S.B. 506 f. s.

13-pr. R.M.L. 977 f. s.

The velocity of the elongated projectile is thus nearly double that of the spherical one at 2,000 yards, though it started at a slightly lower velocity.

The resistance of the air is also affected by the shape of the head of the projectile.

The weight of a projectile can be increased,

1. By increasing its length.
2. By increasing its density.

The power of a projectile to maintain its velocity varies directly as its weight, and inversely as the square of its diameter, but with similarly shaped elongated projectiles the weight varies nearly as the square of the diameter multiplied by the length, hence it may be said that the power of a projectile varies as its length.

Thus the longer the projectile (other things being equal), the harder will it hit at any given range, and the greater will be its absolute range for any given muzzle velocity; but other considerations limit its length, such as the strength of its walls, for the pressure of the powder-gas being directed on the base of the shell, if the pressure is high and the shell long, there will be a

Section IV.—The Projectile.

tendency in the walls to set up, and prematures may occur, or again if too long it is liable to turn over in flight.

The density of a projectile may be increased by making it of heavier material.

d. The rotation due to rifling has already been treated of in Section II.

3. VARIABLE FORCES ACTING ON A PROJECTILE.

The forces and causes of deviation already mentioned will have been ascertained and their effects considered before a gun is issued for service: they will not therefore come under the cognizance of the practical gunner. There are, however, other causes of deviation which must be observed and corrected to ensure accurate shooting. These are—

- a.* Varying effect of the charge due to,
 - 1. Incorrect weighing.
 - 2. Variation in the strength of the powder.
 - 3. State of the atmosphere, especially as regards moisture.
 - 4. Difference of space occupied by the cartridge in the bore.
- b.* Difference of level of trunnions.
- c.* Force and direction of wind.

a. The only way to correct variations in the strength of powder, which are sometimes very great, is carefully to mix the powder before the cartridge is made up. This is not a very difficult matter with small charges and the better practice that will be obtained amply compensates for the time and trouble involved in the operation: extreme care in weighing out the charges (especially for howitzers) cannot be too strictly enforced.

A long continuance of damp weather will cause the cartridges to absorb moisture, which will entail a reduction in muzzle velocity and consequently in range. The contrary effect will take place in dry weather, especially in hot climates.

If the shell is not rammed home exactly to the same spot

Section V.—Natures of Fire and Use of Projectiles.

each round, the shooting will be irregular. The greater the space occupied by the cartridge the less will be the range.

Rammer staves are marked to show when the charge is properly home.

b. For difference of level of trunnions or wheels, see chapter on LAYING, p. 28.

c. Wind has considerable effect on the range and direction of the projectile. According to its direction it may increase or reduce the range, or deviate the projectiles to right or left. If gusty, and of great force, the shooting will be bad, especially at long ranges or with low charges.

If, however, the wind is fairly constant in direction and force the necessary corrections can be made on the tangent or deflection scale. A little practice should enable a No. 1 to obtain a very close approximation to the proper correction.

V. NATURES OF FIRE AND USE OF PROJECTILES.

A. COMMON SHELL.

Common shells may be used :—

1. To destroy the *personnel* and *materiel* of the enemy.
2. To destroy ships, earthworks, buildings, &c.

1. To obtain the maximum effect from common shell against troops in the open, they should be burst close up to or, if the troops are in column or other deep formation, in the head of the column. Against troops behind cover (field entrenchments, &c.) common shell must be used to destroy the parapet or other cover. If used against guns, limbers, &c., an endeavour should be made to obtain direct hits.

Percussion fuzes should be used in all but very exceptional cases.

2. When employed for the destruction of earthworks, magazines, buildings, &c., the common shell depends for its effect on its penetration combined with the explosive force of its bursting

Section V.—Natures of Fire and Use of Projectiles.

charge. There is little doubt that common shell will for the future be made of steel for two reasons :—

1st. Because the cast iron shell from a high velocity gun breaks up on striking an earthen parapet. 2ndly, as the walls can be made thinner the bursting charge may be greater.

Several kinds of fire may be employed with common shell.

a. Direct fire against :—

1. Earthworks, and to dismount guns behind them.
2. Masonry.
3. Ships.

b. Curved fire from howitzers against :—

1. Earthworks.
2. Masonry.
- c. High-angle fire from howitzers and mortars to destroy :—
 1. Earthworks, magazines, or any overhead cover.
 2. Ships' decks.

1. *Direct Fire Against Earthworks.*

a. To breach an earthen parapet by direct fire, the angle of incidence must be such that the shell will bury itself. It is desirable that the action of the fuze be delayed before bursting.

The parapet should be attacked low down on the exterior slope. The depth down depending upon the power of the shell to blow away the earth above it. If the slope is a very gentle one the shell will glance upwards before bursting, and the effect will be trifling until a steeper face is formed. The parapet once breached any ordnance mounted behind it will soon be dismounted.

2. *Direct Fire against Masonry.*

Common shell fired against masonry will often explode on impact even when not fuzed.

3. *Direct Fire Against Ships.*

Common shell with percussion fuzes would be fired at un-armoured ships.

Section V.—Natures of Fire and Use of Projectiles.

Also for the secondary attack of armoured ships. By this is meant the attack of the unarmoured or slightly armoured portion of a turret or central-citadel ship. This attack would be resorted to when the armour covering the vitals of the ship so over-matches the gun that an attack on that part with Palliser shot would be hopeless.

1. *Curved Fire against Earthworks.*

b. This would be resorted to when the target was inaccessible by direct fire, due to some covering mass being between the gun and target; or when the angle of incidence was too small to admit of good effect by direct fire. It is generally less accurate than direct fire, one ill-placed shell may repair all the damage done by the previous round, but as an earthen parapet can only be breached by the continued action of several shells at the same place every endeavour should be taken to make the fire as accurate as possible.

The shell should be placed low down on the exterior slope of the work, and when practicable fuzed so as to burst after penetration.

2. *Curved Fire against Masonry.*

For the attack of masonry escarps by curved fire, see “Manual of Siege Artillery.”

c. *High angle Fire from Howitzers and Mortars.*

c. 1. Common shell would be used with high angle fire for the destruction of any overhead cover or to break through ships' decks.

Great accuracy can be obtained with heavy shell. The penetration depends on the angle of incidence and the striking velocity. Angles of elevation greater than 45° have hitherto not been used in our service, the penetration would certainly be increased but at the cost of accuracy. At short ranges the penetration must therefore be insignificant.

Section V.—Natures of Fire and Use of Projectiles.

Experiments at Lydd have shewn that at a range of 2,400 yards, angle of elevation 30° , one well-placed 8 in. common shell with delay action fuze will break into a field magazine roofed with deal baulks 10 in. \times 10 in. \times 12 ft., and with 5 ft. to 6 ft. of earth on the top.

An 8-in. steel shell with a six-diameter head fired under the same conditions, will break in a field magazine protected by a roof of oak baulks 12 in. \times 12 in. \times 12 ft., and two layers of 36 lbs. rails, over this 1 ft. 9 in. of earth, then fir baulks 10 in. \times 10 in. \times 12 ft., with two more layers of 36 lbs. iron rails, with about 2 ft. of earth over all.

We have had no conclusive experiments as to the effect of high angle fire against a ship's deck, but the following are the calculated effects of a 9 in. R. M. L. shell, weight 256 lbs., falling on well supported wrought iron plates: these would probably be exceeded in practice.

Muzzle Velocity.	Striking Velocity.	Angle of Elevation.	Range.	Penetration into wrought-iron plates.
460 f.s.	422 f.s.	45°	2,000 yds.	1·8 inches
550 "	529 "	65°	2,000 "	3·0 "
640 "	593 "	45°	4,000 "	2·5 "
880 "	781 "	45°	6,000 "	3·3 "
1030 "	862 "	40°	8,000 "	4·0 "
1400 "	1025 "	20°	8,000 "	2·7 "

B. SHRAPNEL SHELL.

Shrapnel shells are used exclusively against the *personnel* of the enemy, beyond the effective range of case shot, *i.e.* on land fronts, against troops in the open and sometimes to search them out behind cover; on sea fronts, against men in boats, on or between decks, or in the rigging of ships.

(a.m.¹)

c

Section V.—Natures of Fire and Use of Projectiles.

Time fuzes are nearly always used with shrapnel.

With percussion fuzes, not only is the velocity of the shell reduced by the graze, but as it rises from the graze before bursting, the balls are thrown upwards and pass over the heads of troops &c. aimed at.

As, however, the flatter the trajectory the more effective a percussion shell, it may be possible with the new high velocity guns to use percussion shrapnel with considerable effect.

With shrapnel the object to be attained is :—

1. Against an extended front to burst the shell so that its bullets cover as much space laterally as possible consistent with their having sufficient velocity for penetration.

2. Against a deep formation to open the shell so that the depth as well as the breadth is covered by the balls.

Shrapnel shells depend for their effect on the striking velocity of the balls and splinters disengaged from the shell on bursting: the higher the velocity the more effective the shell, because not only is the angle of descent for a given range less, and the space covered by the balls therefore greater, but the penetrative power of the balls is also increased.

When the shell opens, the bullets at first travel forward with the velocity the shell had at burst and they would move in the original trajectory of the shell, were it not for :—

1. The disturbing effect of the bursting charge.

2. The centrifugal force imparted by the rotation of the shell.

3. Loss of velocity greater than that which the shell in its original condition would have experienced, due to the difference in form and weight of the fragments.

The trajectory of the centre line of the cone (especially with the new B.L. guns) falls very little below what would have been the trajectory of the shell had it not burst.

Hence the destructive effect of shrapnel may be said to depend upon :—

Section V.—Natures of Fire and Use of Projectiles.

1. Its velocity at burst.
2. The timing of burst.
3. The angle of descent.

1. *Velocity at Burst.*

As on its velocity at burst depends the velocity of the balls, the higher the velocity of the shell the greater depth will balls of the same weight and form cover with effective fire. A heavy ball will retain its velocity longer than a light one.

The least velocity which a heavy shrapnel ball should have on striking to be effective may be taken at from 350 to 400 ft. per second.

The remaining velocity at 4,000 yards of a 64-pr. R.M.L. Mark III. Shrapnel shell is about 745 ft. per second, and that of the heavy R.M.L. and new type B.L. guns varies from 1,000 to 1,300 ft. per second.

As far then as the penetrative power of the balls is concerned the shells will be effective beyond these ranges.

2. THE TIMING OF BURST.

The distance at which a shrapnel should be burst in front of troops so as to disable the largest number depends on their formation, and is influenced by the following considerations:—

(a) That the balls when released proceed in a conical shower, the angle of the cone being from 8° to 16° increasing with the range.

(b) That the axis of the cone falls very little below what would have been the trajectory of the shell.

(c) That the diameter of the cone for medium ranges is from $\cdot 14$ to $\cdot 15$ of its length from point of burst for old guns and about $\cdot 20$ to $\cdot 30$ for new B.L. Shrapnel with bursters in the head.

(a.m.¹)

c 2

Section V.—Natures of Fire and Use of Projectiles.

(d) That the longer the range the greater becomes the angle of descent and the less the velocity of the shell.

(e) That the striking velocity of the bullets should not be less than 350 ft. per second.

Taking for example the angle of the cone of dispersion of a shrapnel to be 8° then (fig. 1.) if it burst 50 yards short of object, the spread of the bullets extends over about $7\frac{1}{2}$ yards; at 100 yards short, 15 yards; at 150 yards short, $22\frac{1}{2}$ yards; at 200 yards short, 30 yards.

It is therefore evident that the shell should be burst close to a target having great depth with very narrow front, further off against a formation having breadth and depth, and still further off against an extended front with no depth.

In firing at an extended front, an oblique is more effective than a frontal fire.

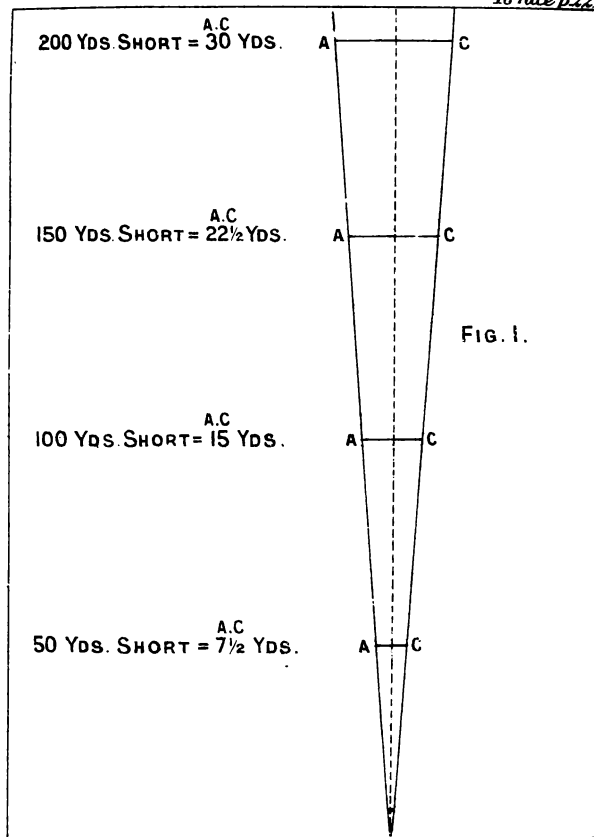
In firing at a column shrapnel should be burst close up to the head of it.

It should further be noted that as the range increases so does the cone of dispersion of the balls because the velocity of the shell through the air decreases more rapidly than the velocity of rotation due to rifling.

The angles of the cone of dispersion at various ranges of the following guns are found to average from 8° to 13° when the bursters are in the base and from 12° to 16° when the bursters are in the head.

Effective distances of burst when the object has breadth, and time fuses are used, would be according to the power of the gun,

Yards.	R.M.L. Yards.	Front covered. Yards.	B.L. Yards.
Up to 1,000 ...	100 to 250	20 to 50	200 to 500
1,000 to 2,000 ...	75 to 200	40 to 80	150 to 250
2,000 to 3,000 ...	50 to 150	} 60 to 150	100 to 200
3,000 to 4,000 ...	25 to 75		50 to 100

To face p. 22

DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN.

11.86.12096

Section V.—Natures of Fire and Use of Projectiles.

A considerable percentage of bullets must always strike between the gun and the object.

Table representing the front covered laterally by various cones various lengths from the point of burst.

Cone of dispersion.	20	40	60	80	100	120	140	160	180	Yards.
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	
8°	8·4	16·8	25·2	33·6	42·	50·4	58·8	67·2	75·6	
9°	9·3	18·6	27·9	37·2	46·5	55·8	65·1	74·4	83·7	
10°	10·5	21·0	31·5	42·0	52·5	63·0	73·5	84·0	94·5	
15°	15·0	30·0	45·0	60·0	75·0	90·0	105·0	120·0	135·0	

3. THE ANGLE OF DESCENT.

The angle of descent has considerable influence on the effect of shrapnel.

If it is great the lower part of the cone strikes at such an obtuse angle that there is little ricochet, and the upper part of the cone covers but little space before grazing.

Supposing the angle of descent to be 6°, the lower part of the cone with an 8° opening, would graze at 10°, and the velocity of the balls would be greatly reduced after ricochet. As the angle of descent increases considerably at very long ranges, the balls of the lower half of the cone would hardly ricochet at all.

C. BATTERING PROJECTILES.

Battering projectiles are used for the attack of iron armour, and to a limited extent for breaching purposes.

Those hitherto in our service (Palliser) are made of cast-iron, the heads being chilled, and the bodies cast in sand.

Section V.—Natures of Fire and Use of Projectiles.

On striking an iron plate the body of a Palliser projectile breaks up, unless the gun quite overmatches the armour. Until recently Palliser shells were filled with powder and plugged in the base, but bursting charges have now been given up.

... Steel shell are being introduced for modern guns.

* ATTACK OF ARMOUR.

Armour may be divided into two classes, "soft" and "hard" armour. Under the head of soft armour may be included all that is made of wrought iron. Hard armour is of steel or is steel faced. The latter sort is called compound armour and has come into general use in England since about the year 1876.

Soft armour must be overcome by being perforated. If it is beyond the power of the gun, little harm is done, the projectile on the head of it, remaining usually in the hole and plugging it up. If the plate is perforated, the hole is a comparatively clean one, and is easily stopped. (Figs. I and II.)

Compound armour must be destroyed by fracture, the point of the shot entering the plate and splitting it. (Figs. III and IV.)

If the plate overmatches the gun, it may still be destroyed by repeated blows about the same spot.

It is roughly estimated that a compound plate may be from 25% to 30% thinner than a wrought-iron plate for resistance to direct impact.

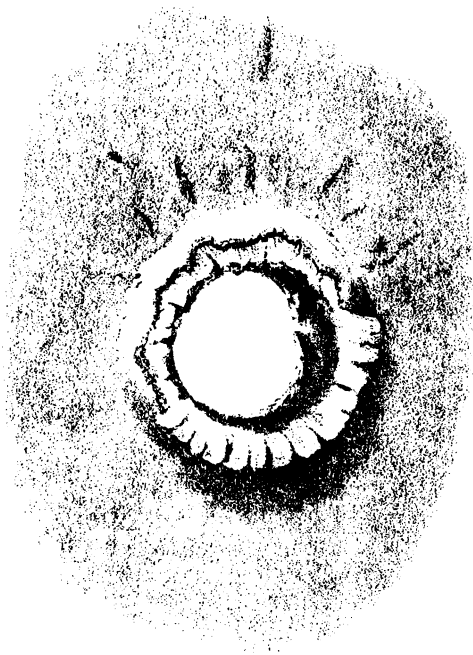
Against oblique fire the superiority of the hard armour is very marked: a wrought-iron plate would probably not deflect a shell striking at an angle of 60° to the plate, whereas a compound plate must be struck nearly at right angles to obtain any result.

Practical Directions.

To estimate quickly the power of a gun to perforate wrought-iron armour, consult †Inglis' or †Maitland's diagram

* *Vide* Capt. Orde-Browne's paper on "Armour," R.A.I. Proceedings, vol. xiv.
 † See "Text Book of Gunnery."

FIG. 1.



WROUGHT IRON PLATE.
FRONT AFTER PERFORATION.

DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN S. 86. 12094.

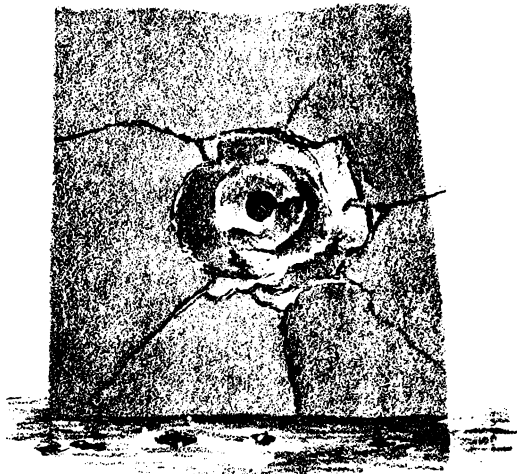
FIG. 2.



WROUGHT IRON PLATE.
BULGE IN REAR AFTER PARTIAL PENETRATION.

DANGERFIELD. LITH. 22, BEDFORD ST. COVENT GARDEN. 6.56.1205.

FIG. 3.



11" COMPOUND PLATE * FACE AFTER ROUND OF
PALLISER SHELL FROM 12.5 M.L.GUN. CHARGE
160 LB. P^r RANGE 65 YDS.
* THICKNESS OF STEEL FACE 3.66".

DANGERFIELD, LITH. 22 BEDFORD ST COVENT GARDEN G. 88.12034

FIG. 4.



11" COMPOUND PLATE * WROT. IRON BACK AFTER
ROUND OF PALLISER SHELL FROM 12.5 M.L. GUN.
CHARGE 160 LB. P? 65 YDS.

* THICKNESS OF STEEL FACE 3.66.

ANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 6.86.12034.

Section V.—Natures of Fire and Use of Projectiles.

If neither are available, take the calibre of the gun as a measure and reckon that at least 1,000 feet striking velocity is required for each calibre in the thickness of the armour to be perforated.

Thus a 6-inch gun would require a striking velocity of 1,000 f.s. to perforate 6" of wrought-iron armour, or a velocity of 1,500 f.s. for 9" of armour.

In old type guns, which have comparatively lighter shot, considerably more velocity would be required.

Artillerists can give no such simple rule as the above for matching a shot against compound armour.

The method generally adopted has been to give the shot sufficient energy to perforate a wrought-iron plate 25% thicker than the compound plate attacked. This is a high test for the plate.

It is important not to waste shot in firing at wrought-iron which is beyond the power of the gun. In such a case the secondary attack* should be resorted to.

Ships' decks can be best attacked by high angle fire, or by direct fire from very high batteries. There are so many objects on a ship's deck offering a better angle of incidence than the deck itself, that no opportunity of this mode of attack should be neglected.

D. CASE SHOT.

Case shot from heavy guns would generally be used against boats or bodies of troops.

It is effective from 600 to 1,000 yards, when using full charges and single rounds. The elevation should not exceed $\frac{1}{2}^{\circ}$ or 1° , in order to obtain full benefit of the ricochet.

* See page 18.

VI.—LAYING ORDNANCE.

Explanation of Terms.

Before proceeding to instruct in laying, it will be necessary to explain everything connected with the sights, the manner in which they are fitted to the gun, and the reading of the scales for elevation and deflection.

Definitions in Gunnery (which will be found at page 1) should be thoroughly explained by means of diagrams. To reduce as much as possible the theoretical instruction only those most necessary should be gone into. The meaning and use of the most necessary parts of the range table should be clearly explained as the instruction proceeds.

To adjust the Scale for Elevation.

The hind sight is raised until the mark on it for the required number of yards or degrees is in line with the top of the socket in which it slides, and then clamped.

To adjust the Scale for Deflection.

The sliding leaf is moved to the right or left until the arrow points to the required number of minutes. The deflection being given on that side to which the shot is to be thrown.

As a practical rule, each minute of deflection on the sight gives a difference of one inch in every hundred yards of range. Thus, supposing at a range of 2,400 yards a projectile has struck 12 feet to the right, it will be necessary to move the deflection leaf 6 minutes to the left, or give "6 minutes left deflection" to correct the error, because 12 feet or 144 inches divided by 24 (the number of hundreds of yards in the range) gives 6.

The above practical rule for deflection holds equally good for corrections in elevation to raise or lower the point of impact on a vertical target. Thus if at a range of 1200 yards the point of impact is 6 feet too high, the necessary correction would be

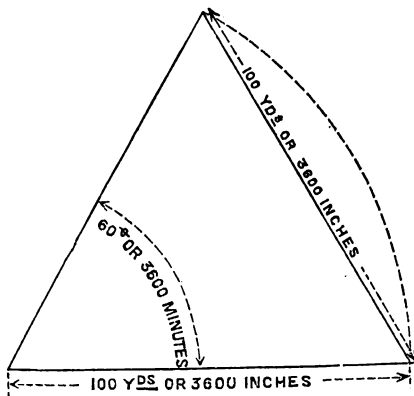
Section VI.—Laying Ordnance.

"6 minutes less elevation," because 6 feet or 72 inches divided by 12 gives 6.

This rule, that one minute of elevation or deflection on the tangent scale gives an inch at every hundred yards, is saying in other words that the chord of an arc of one minute with a radius of 100 yards is one inch in length, and that the proportion holds good for any angle and any radius.

Although true enough for all practical purposes, it is only mathematically correct for an angle of 60° .

See fig.



For instance, by the rule 10 minutes left deflection on the scale should at a range of 1000 yards throw a shot 100 inches to the left, but if the gun shot true it would make a difference of 104.4 inches to the left, that being the length of the chord of 10 minutes to a radius of 1000 yards.

Section VI.—Laying Ordnance.

If the trunnions of a gun are not level the projectile will deflect towards the side of the lowest trunnion.

The practical rule for correcting this error is as follows :—

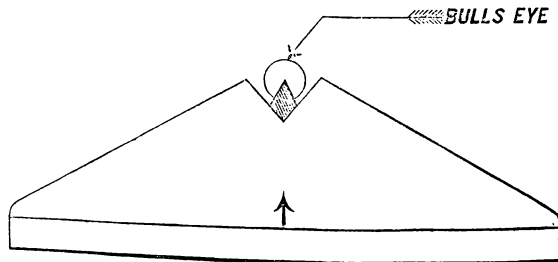
$$\frac{\text{No. of minutes difference of level} \times \text{Degrees of elevation}}{60} =$$

Minutes of Deflection to be given on the side of the highest trunnion.

With gun carriages having a wheel track of 60 inches, or thereabouts, this rule may be thus stated : number of inches difference in level of wheels \times number of degrees of elevation on tangent scale = number of minutes deflection to be given on the side of highest wheel.

To lay a Gun.

To obtain uniform results in laying one method should be strictly adhered to. The service method of laying a gun is to direct it so that the centre of the line joining the two highest points of the notch in the hind sight, the apex of the foresight and the point aimed at are in line as in Fig.



The scales having been adjusted at the required elevation and deflection, No. 1 proceeds to lay the gun.

He should put himself in an easy position, his feet being placed so that his body is well balanced, and if possible steady

himself by leaning on the gun with his arm, and bring his eye on a level with the top of the hind sight, and about one foot from it.

When the sights are fitted with window and cross wires, and it is required to use them for fine laying, the gun should first be laid as above, then the eye should be brought close up to the eye-hole. He should then give the necessary orders for elevating and traversing until the gun is laid.

During instruction in laying, the targets likely to be met with on service should be selected, such as houses, enclosures, batteries, &c., and on sea fronts, ships.

The Instructional Target will be found most valuable in teaching men to lay a gun correctly, as with it personal errors can be shown, both in elevation and direction, and the practical rule for correcting errors can be proved.

INSTRUCTIONAL TARGET.

Description.

The target is made of half-inch deal, and is 4 feet square, an iron rod about $\frac{5}{16}$ of an inch thick, and $3\frac{1}{2}$ feet long, with a ring on it, is fixed over the top; it is painted half light red and half light green (black and white are found to be too dazzling), so that there is a sharp cut line between the two colours down the centre of the target (fig. 1). The colours should be bright.

Fig. 1.

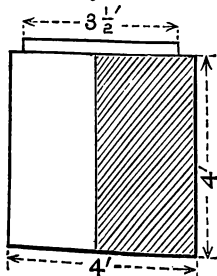
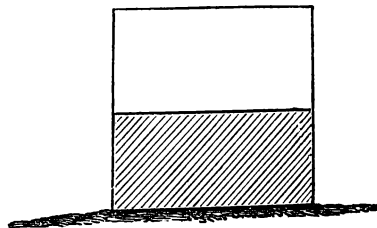


Fig. 2.



Section VI.—Laying Ordnance.

Elementary Instruction in Laying.

This instruction is divided into three stages :—

1st, for direction only.

2nd, for elevation only.

3rd, direction and elevation combined.

For Direction only.

The gunner should be made to raise the tangent scale to the required elevation, and traverse the gun so that the line of sight is directed on the line down the centre of the target.

For Elevation only.

The target should now be turned so as to have the centre line horizontal (fig. 2), the gunner should adjust the scale and elevate or depress the gun (the last motion of the screw always being one of depression) until the line of sight is directed on the line across the target.

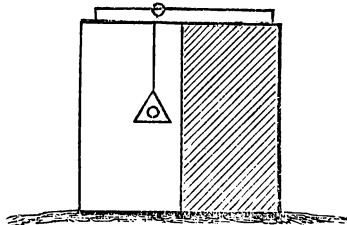
In both these exercises it is immaterial what point on the line is selected to lay on.

Direction and Elevation combined.

When the gunner is able to lay accurately for elevation and direction separately, he must then be exercised at laying a gun with elevation and direction combined.

For this purpose a small equilateral triangle made of sheet lead, 6 inches to the side, is used as a bull's-eye ; it is painted white, there is a small hole in the centre of the triangle. This triangle is suspended to the ring travelling on the rod, and its position can be shifted as required.

Fig. 3.



The bull's-eye having been placed in a given position, the gunner lays on it (attention being paid to the instructions in laying contained in the Garrison or Field Artillery Manual). At this stage it is desirable that quickness in laying, as well as accuracy, should be insisted upon.

Corrections in Deflection and Elevation.

When the gunner is able to lay accurately and quickly, he should be taught the use of the deflection and elevation scales, and the practical proof of the rule for using either thus : Put up the target at a *measured* distance of 100 yards from the gun, with the centre line vertical.

Deflection.

With the deflection leaf at zero, the gunner now lays on the vertical line down the centre.

The shot is supposed to strike 2 feet to the right, that is on the right edge. It should now be explained to the gunner that at 100 yards range, for every minute that the deflection scale is pushed over to the left, the point of impact on the target is moved one inch to the left ; and that therefore, as he wishes to shift his point of impact 24 inches to the left, he must shift the

Section VI.—Laying Ordnance.

deflection scale 24 minutes to the left. This is done ; he again looks over the sight and sees that the gun is now laid on the right edge, he gives the word "trail right," and the trail should then be moved to the right very slowly until the line of sight again cuts the centre line. He now replaces the deflection leaf at zero, and on looking over the sights he sees that the gun is laid 24 inches to the left of the centre line, that is, on the left edge. This practice should be repeated at other measured ranges, 200, 400, or 600 yards, until the gunner not only knows, but understands the reason of, the rule for giving deflection, viz. : Reduce the error to inches, and divide by the number of hundreds of yards of range for the number of minutes of deflection.

Elevation.

To instruct in making correction in elevation, turn the target over and repeat the process, using the degree side of the tangent scale. It must be explained, however, that the correction in elevation applies only to a vertical target, and not to errors in range.

Object of Hole in the Triangle.

This is for the instructor to test the accuracy of the laying. He should first lay the gun on one angle of the triangle, a mark is made through the hole, and the bull's-eye is then moved away ; the gunner looks over the gun and directs the bull's-eye to be replaced in the line of sight. A mark through the centre will show the amount of his error. This is a most useful practice, as those men that lay well or ill can be at once found out by measuring the sum of their errors, and thus considerable emulation aroused among the men of the squad.

Laying on Natural Objects.

After the gunner has attained a thorough knowledge of the tangent scale, and can adjust it quickly to any named elevation and deflection, and can lay accurately and rapidly at a target, he

Section VI.—Laying Ordnance.

should be taught to lay on natural objects, preferring first those objects which are more or less well defined, at medium ranges, and then passing on to small or ill-defined objects at short, medium, or long ranges.

To test accuracy at longer ranges, and when laying on natural objects, the following method may be used. The instructor lays the gun with a certain elevation, and puts the tangent scale down. Then he directs the gunner to raise the tangent scale till the gun is correctly laid without altering the elevating screw. The difference on the tangent scale will show the amount of error.

Both these practices for accuracy may be varied by making the gunner himself lay and re-lay the gun, and thus see for himself the amount of his own error, if any.

Where there is no target, or no room to place it at 100 yards off, Figs. 1 and 2, reduced to size can be painted on a wall or drawn on a board at a measured distance in front of the gun, and the same instruction carried out. For instance, if 20 yards off, 10 minutes on the deflection or elevation scale would give 2 inches on the target.

General rules to be observed.

1. See that the tangent and deflection scales are set and clamped at the elevation and deflection required.

2. To avoid wearying the eye, get the gun laid approximately for elevation and direction before carefully looking over the sights, then lay quickly.

3. Lay over the object and then depress on to it, thereby avoiding error due to the play of the elevating gear.

4. Choose a clearly defined part of the target to lay on, and always lay on the same point from round to round. All corrections and allowances should be made by using tangent or deflection scales and not by laying off the target.

5. The distance of the eye from the hind sight should on no account be varied, but be the same from round to round.

Section VI.—Laying Ordnance.

6. Let the words of command be a guide to the numbers elevating and traversing, giving them loud or low, as the gun requires to be moved much or little.

When the emplacement is fitted with a graduated arc, the platform with a pointer, and the gun with index plate and reader, the latter can, when firing at a fixed object, be laid by the elevating and traversing numbers.

They should be instructed to assist the No. 1 by noting the marks on the arcs, so that in succeeding rounds they may be able to get the gun laid approximately without word of command.

As constant practice is necessary to ensure quick and accurate laying, it should be the rule to devote a short time at every drill to laying.

Laying Mortars.

The range of a mortar is regulated by the amount of the charge.

Mortars are marked with a notch on the muzzle ring and one on the base ring. A line joining these notches should be marked in chalk to facilitate laying.

A mortar is correctly laid when the axis of the mortar, as shown by the line joining the two notches and the object are in the same vertical plane.

To Lay a Mortar.

1st. When the object can be seen from the rear of the mortar.

No. 1 stands in rear of the mortar, holding a plummet line in his hand in front of his eye, and causes the mortar to be moved until the chalk line on it coincides with the line which passes through the object and the plummet line.

2nd. When the object cannot be seen from the mortar.

In this case two pointing rods must be placed on the parapet

Section VI.—Range Finders.

or intervening obstacle in front, correctly lined between the object and the centre of the mortar platform.

No. 1 then lays the mortar as above on the pointing rods.

Night Firing.

See "Manual of Siege Artillery," page 83.

"To obtain the line of fire from guns mounted on lands fronts, the object being invisible from the battery."

See "Manual of Siege Artillery," page 76.

RANGE-FINDERS.

NOLAN RANGE-FINDER.

See Handbook issued with the Instrument and Siege Manual.

WATKIN DEPRESSION RANGE-FINDER.

See Handbook issued with the Instrument.

RANGE-FINDER FOR ELEVATED BATTERIES.

See printed instructions inside the lid of the box containing the instrument. This has been generally superseded by the Watkin Depression Range-Finder.

From high batteries where no range-finder is available, the range can be found by the formula :—

$$\text{Range in yards} = \frac{\text{height of gun in feet} \times 1146.}{\text{number of minutes in angle of depression.}}$$

The angle of depression can be obtained by the quadrant.
(a.m.¹) D

Section VI.—Watkin Clinometers.

INSTRUCTIONS FOR THE CARE, PRESERVATION,
AND ADJUSTMENT OF THE WATKIN FIELD,
SIEGE, AND GARRISON CLINOMETERS.

(1). Para. 3973, List of Changes in War Matériel, details the method of using the Clinometer.

(2). In order to preserve the Clinometer in efficient working order, it is necessary to keep the working parts 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.

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

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

(5). 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 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.

Section VII.—Practice.

- (g) To ascertain the error after complying with (d), 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 graduated part of the scale, *add half* the amount when setting the Clinometer for any required *elevation*.
 - (i) If the reading falls on the ungraduated portion of the drum, *subtract half* for any required *elevation*.
- (6). If it is required to adjust the Clinometer to have *no* index error, set the drum to *half* the ascertained index error, 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.

SECTION VII.—PRACTICE.

GENERAL INSTRUCTIONS.

1. *Preparing for action*.—Before practice all parts of the guns, carriages, and platforms should be most carefully examined, to see that the clip plates are on, the sights are correct, a plug of paper in the gas escape hole, the elevating and traversing gear in working order, the racers well swept, and the trucks running true, the hydraulic buffers filled with the proper amount of oil, or the compressors properly adjusted and in working order ; that the rope mantlets work easily, the buckets are supplied with water, the hoisting gear at the cartridge and shell lifts in good order, the lamps in the ammunition stores and their passages burning properly, and that a supply of spare stores such as side arms, &c., is at hand.

2. *Removing bulkheads*.—When practice is to be carried on
(a.m.¹) D 2

Section VII.—Practice.

from a casemate battery the officer in charge is responsible that all bulkheads, including boarding, framework and sashes, that are in danger of injury shall be removed.

3. *Nos. to stand to their guns.*—Unless specially ordered to do so for instructional purposes, no man when at service practice will fall out in order to observe the effect of the round ; all will stand to their gun and reload as quickly as possible. One group, at least, should be fired against time, and the time expended should be recorded in the practice report.

Time to fire one round.—The time for loading, laying, and firing one round, with a well-drilled detachment, from the under-mentioned guns should be as follows, viz. :—

7"	R.M.L.	1 minute	" en barbette,"	Elswick compressor.
9"	"	1 $\frac{1}{2}$	"	behind shield, with hoisting tackle.
10"	"	1 $\frac{3}{4}$	"	do. do.
12"	"	3 minutes	" en barbette,"	on "C" emplacement.
12·5"	"	2 $\frac{1}{2}$	"	(hand loading) in casemate.

4. *Observation of fire.*—At service practice the officer in charge should receive no assistance in judging the results of the fire from the range party ; he must depend entirely on his own observation assisted by the report of the look-out party. This is difficult under the most favourable circumstances, but especially so when firing over broken ground with an uncertain light, or with the object partially obscured by smoke, &c.

Height of burst.—As a rule, shrapnel shells are burst too high ; it is better to burst low than high ; the number of feet in height above the plane should never exceed the number of hundreds of yards in the range. Further, the height of burst is generally under-estimated.

5. *Ammunition for recruits.*—The ammunition allowed for recruits may be expended, at the discretion of the Commanding Officer, either in elementary or in service practice, in either case the recruits will profit by its use.

Section VII.—Practice.

6. *Silent Drill.*—The drill should be silent in order to decrease the noise.

7. *Control of recoil.*—With M.L. guns the recoil should be watched attentively for the first round or two. If not sufficient to reload, some oil on the slide before running up will probably remedy this; if too violent some fine sand must be similarly applied, or else the gun may run violently back to the stops, rebound, and run up again with such force as to bend and at last tear off the clip plates. This is particularly the case with the 11" M.L. guns, which are always very violent; their slides should be well sanded before and after running up. Any gun that had to be run back by tackle through mismanagement of the above might never be able to renew the action. There should always be an oil can and some fine sand brought up to the battery.*

Where the case shot is only about half the weight of the shell as in many M.L. guns, two must be used with each round, otherwise the recoil will not be sufficient to reload. The full charge should always be used with case.

8. *Evils of using different charges.*—The effect of any change of ammunition such as from full to reduced charges in the course of an action will cause confusion in the supply, may entail a different fuze, may cause mistakes in the elevation, and will alter the recoils.

9. *Nos. to stand to the handles.*—In cases where the gun has to be traversed back to a central position or when firing at a moving target, or when the weight of the handles is likely to alter the training, one or both numbers should man the handles while the gun is being laid and fired.

10. *Cylinder to be kept closed.*—In loading the cartridge cylinder should be kept closed until the sponge is out of the bore, then no time is to be lost in introducing the cartridge.

* Some mountings are more lively or more sluggish under recoil than others of the same pattern. The fact should be noted conspicuously in the artillery store. In very marked cases some modification may be necessary in the amount of oil in the buffer.

Section VII.—Practice.

11. *Cartridge to be well home.*—It is the duty of No. 1 to ascertain that the charge is rammed home. This can be easily discovered if the rammer is marked. The present service mark is a brass screw which shows when the full charge and common shell are home.

12. *Fuzes, tubes, and projectiles.*—The projectiles for immediate service should be brushed, gauged, and all burrs removed from the studs or driving bands and gas-checks. Palliser projectiles will generally be in the battery close to the gun. In fixing the clip for raising the projectile up the lift, the screw is to be tightened up before hoisting. Shells are to be fuzeed on the gun floor, and as much under cover as possible. Fuze and tube cylinders are not to be opened in any shell store.

13. *Percussion fuzes for segment shell.*—Segment shell, to be effective, must be burst close up to the target; a percussion fuze should therefore be used.

14. A time fuze should never be used with a common shell, unless it be for some special instructional purpose.

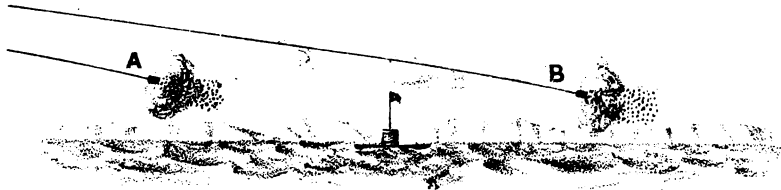
15. *Metal plugs.*—Shells filled with water should not be plugged with wooden plugs, as this renders them liable to break up on graze. The metal plugs should be used.

16. *Bursting charge.*—Live shells are not to be fired with less than the authorised bursting charge.

17. *Fuzes, rate of burning.*—The rate of burning of a fuze is influenced by its age, the climate in which it has been kept, and the pressure of the atmosphere. An old fuze burns longer than a new one, those over three years old being liable to an increase of 10 per cent. in their rate of burning. A fuze will burn longer as the height above the sea level increases, that is as the height of the barometer decreases. For each fall on one inch in the barometer corresponding to about 1,000 feet in height, the time of burning increases by $\frac{1}{30}$, the fuze should therefore be bored that much shorter.

To face p. 46

PLATE XII



Shell may burst at A or B 30' up. In either case it would appear from the battery as a puff of smoke 30' up, which might be anywhere as to range. If, however, the trajectory has been determined, the burst can be moved up or down in that trajectory only, by regulating the fuse.

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Section VII.—Practice, Moving target.

N.B.—1 mile per hour is $\frac{1}{2}$ yard per second.

3. The vessel may move as follows :—

- i. It may advance directly on the battery.
- ii. It may retire directly from the battery.
- iii. It may advance obliquely.
- iv. It may retire obliquely.
- v. It may cross the front of the battery.

N.B.—Cases i, ii, and iv, though they certainly will occur in action, cannot be permitted at practice on account of the risk to the tug.

i. Should an enemy's ship advance directly on the battery, the tangent scale should be set to some range which the enemy is approaching, say, for instance, 1,975 yards, No. 1 will then without shifting his tangent scale keep his sights on the enemy, until the latter is reported by the range finder to be within, say 25 yards of the anticipated range, in this case 2,000 yards. He will then fire.

The allowance of 25 yards is for the ship's travel* during the time taken to fire the gun and the time of flight.

The latter of these allowances will depend on the range, nature of gun, &c.; the former may for each pattern of mounting be made by good and careful drill, almost a constant quantity.

ii. Where the enemy is retiring it is necessary to reverse the above process; in other respects the mode of procedure is the same as in i. If, however, the depression range finder is laid on the water line astern, the length of the ship must be added to the 25 yards.

iii. and iv. In these cases the same process will suffice, as the length of the ship will render deflection unnecessary.

v. In this case deflection only will be given, as the range remains practically the same.

* As the gun is laid on the ship's stem the time allowed is really for a travel of 25 yards + half the ship's length.

PART I.—Gunnery.

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Section VII.—Practice, Moving Target.

- As a rough guide, with a 10" R.M.L. gun firing from a low site battery, it may be said that for i., ii., iii., and iv., an allowance of 25 yards + or - will suffice, while for case v. one degree of deflection should be given for ranges between 1,000 and 3,000 yards. This presumes the ship to be 200 feet long, and to travel 12 miles an hour, and 5 seconds to have been allowed for No. 1 to get clear.

N.B.—Some such rough rule should be worked out for each battery, according to its armament and its height above the sea, in order that any calculations when in action may be avoided.

4. This system of laying should be frequently rehearsed at drill before any practice be permitted.

5. At practice, if both tangent scales can be used, the laying should be checked by an officer or experienced N.C. officer, who should look over the sight which is not being used by No. 1.

6. From coast batteries, laying at steamers under weigh should be constantly practiced, and the elevating and traversing Nos. be trained to work intelligently with the No. 1.

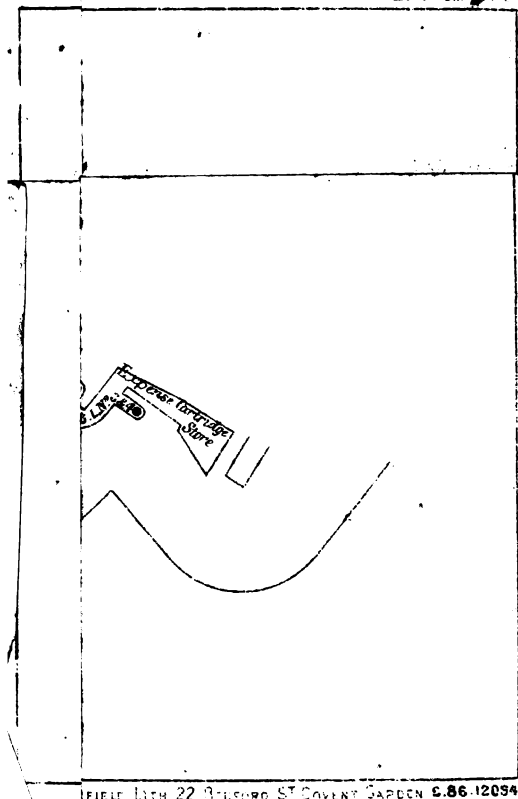
7. On land fronts the problem is much easier as every range should be well known, and, as the pace would be comparatively moderate, the following rule will suffice :—Multiply the rate in miles per hour the target is moving across the range by 5 for the number of minutes' deflection to give at any range on the side towards which it is moving.

8. With guns on travelling carriages, even on ordinary level ground, moving the trail may affect the elevation. No. 1, as soon as he has adjusted his scale, must place himself in prolongation of the line of sight, stepping clear of the recoil as he gives the order, "Fire."

With guns on traversing platforms he steps or jumps down from the platform at the word "Ready," or if there is room he may remain on the footboard in rear giving the word, "Ready," and "Fire." This, however must depend on the pattern of the mounting.

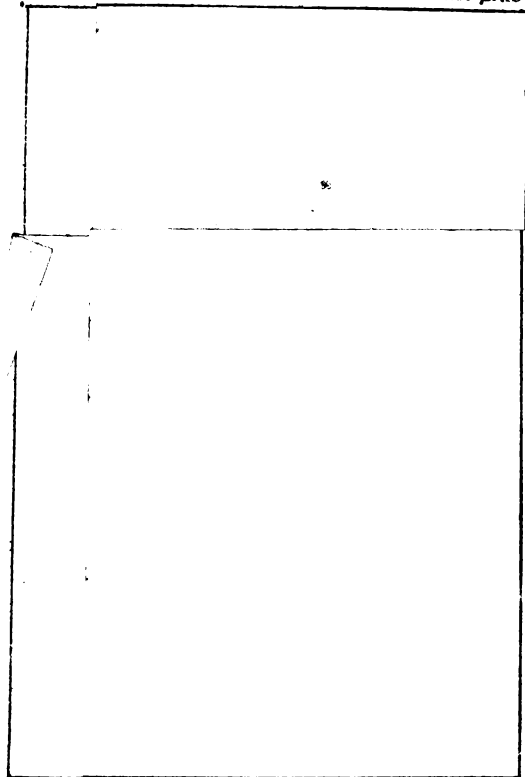
Plate

To face p. 50

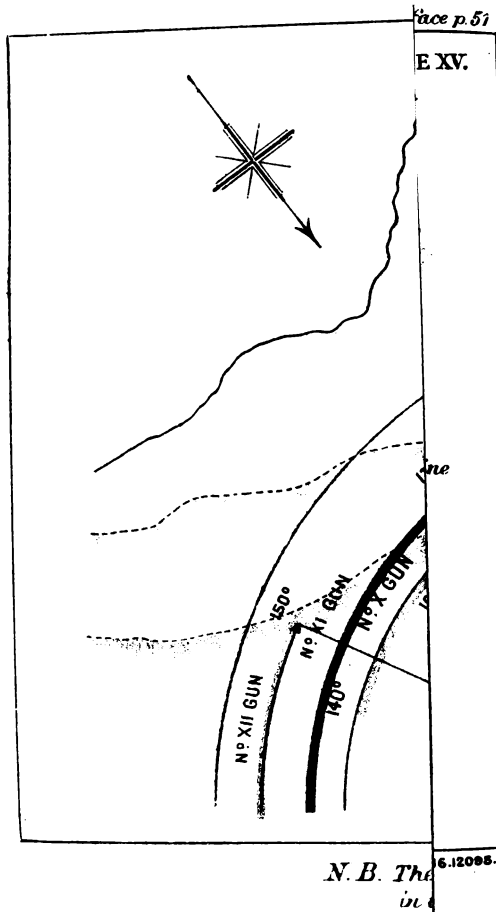


Plate

To face p. 50



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Arrangement of Stores.

In all new works the guns are numbered from right to left (when facing the direction in which the guns are pointing) and the several ammunition stores and lifts are lettered so as to show the guns they are intended to serve, but in practice it will be found necessary to have the ammunition sent up to the gun floor as fast as it can be distributed among the guns. Speaking tubes, or other means, are also provided at the several lifts, and are lettered according to the guns or batteries for which they are intended.

Rate of Fire.

Circumstances alone can determine the rate of firing. Against ships in motion, or in the defence of a channel attempted to be forced by steamships, it cannot be too rapid, provided the gun is carefully laid.

Map.

On land fronts the character of the country, its woods, hollows, ravines, hills, fences, &c., and all sheltered positions where an enemy would be likely to establish a battery, or mass troops, should be well known and a large scale map should be provided by which all ranges can be measured.

Transmission of Orders.

The transmission of orders by the commanding officer from his station in action to the divisional officers at the guns is another matter of the first importance.

The means provided to convey these orders may be the telegraph, the telephone, or speaking tubes. If no means are provided the officer must devise a simple code of signals, even a piece of chalk and a blackboard would serve to show the range and bearing, but whatever the means are, whether the best or worst, they must be constantly rehearsed to be of any use.

(a.m.¹)

E.

Section VIII.—General Instructions.

The Commanding Officer must select the best positions for the range or position finder and look-out parties. If the depression range finder is in use, he must see that the necessary preliminaries have been carried out as laid down in the Handbook for the instrument and must test their accuracy. When the Nolan instrument is in use, bases on convenient fronts should be measured and permanently marked out.

Tables (*see* § 2,847, Changes in War Stores) showing the bearings and measured distances to certain fixed objects should be conspicuously placed in each battery.

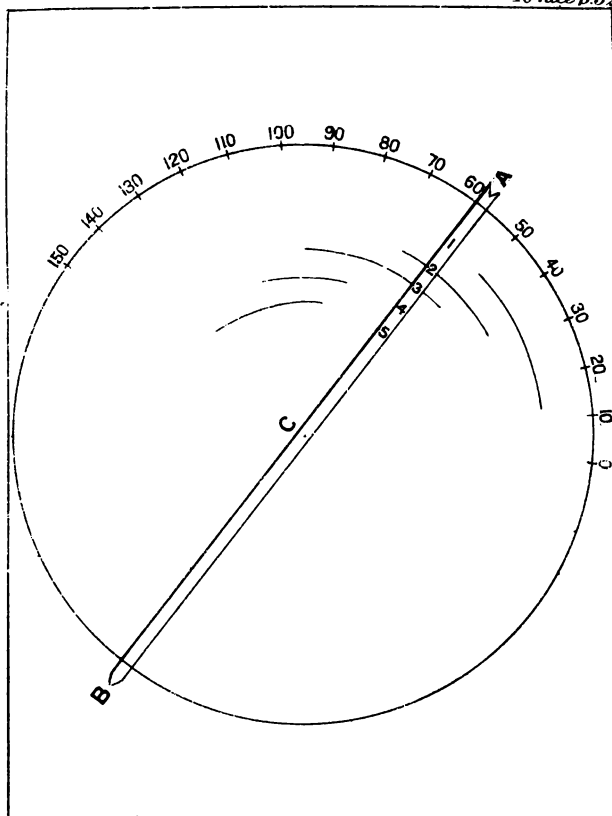
Chart Showing Arcs of Fire.

A chart (example given Plate XV.) must be prepared, showing the arcs of fire of each gun, marked to correspond with the bearings on the graduated arc on the gun floor, so that on the Watkin range finder giving the range and bearing of any vessel it is at once evident to the commanding officer what guns can bear on it. This chart may be on a table close to the commanding officer's station. It should give all useful information, such as soundings, position of mine fields, rate of currents, channels, time a ship must take to thread them, &c. Admiralty charts are issued on demand, from which the above can be compiled by the officer in charge of the fort.

*Other Means of Showing the Bearings of the Guns.**

When there is no Watkin range-finder a pointer on a plane table can be made to tell the Commanding Officer which of his guns are in bearing, thus;—Any smooth board, about 18 inches in diameter, will serve for the plane table. Let A B be a wooden pointer pivoting on C with an eye piece at A, and a

* The introduction of the position finder will modify some of the measures prescribed below, but many batteries must be without them, and in any case provision must be made for the possibility of these instruments being disabled.



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Section VIII.—General Instructions.

resight, like that of a prismatic compass, at B. Mark the graduated arcs of the guns on the board, and the numbers of the guns on the pointer, where the arcs cut it. Fix the board so that when A is over any graduation on the circumference and the gun pointers are on the same graduation on the arcs, the pointer and axis of the guns may be parallel. Now, the pointer be laid on a target in the position in the figure, it appears at once that Nos. 2 and 3 guns can bear. There will be small error for drift and another for the lateral distance of the observer from the guns.

Correction for Difference of Range and Deflection.

Whatever range-finder is in use the Officers at the guns must have the means of knowing what target the Commanding Officer is referring to when he signals the bearing and range. This is especially necessary in a casemated work when the view is so limited that it is difficult to indicate the target without aiming the gun on to it.

The bearing and range may be notified from the Commanding Officer to the guns, but a correction will be necessary on the main arc due to the relative position of observer, gun, and target. There may also be a correction of range necessary from the same cause.

Every gun should therefore have a card, or some device to show these corrections, for every probable bearing and range. The figure opposite shows a simple device which can be made with very little trouble, and which records these corrections automatically.

To Lay the Guns without the Sights.

In order to be able to lay the guns by index plate and graduated arc, when from smoke, darkness, or any other cause, the sights cannot be used, the quadrant elevation or depression (a.m.)

E 2

Section VIII.—General Instructions.

at half tide for every 100 yards, together with the allowance due for drift, should be posted up between the guns.

This quadrant angle is found by subtracting the range table elevation from the angle of depression of the gun to the target.

To find the allowance made for drift by the set of the tangent scale of any gun, multiply the angle of the set in degrees by the angle of elevation in degrees, the product will be the amount of drift allowed for in minutes.

PROTECTION OF MINE FIELDS.

An attack on a mine field would probably be by night, and its mode would be by steam pinnaces and row-boats of all sizes creeping for cables, sweeping for or exploding mines and generally doing all possible mischief to the defence. Also by countermining a passage through the field. This is done by gunboats or steam pinnaces towing barges containing heavy charges of guncotton which are dropped overboard in two parallel lines about 90 feet and fired simultaneously. The object being so to wreck the mines of the defence that a buoyed passage 180 feet wide may be cleared for the advance of the leading ship of the attack. Each run of countermines in our service is about 700 yards long and takes 5 or 6 minutes to lay and fire.

The electric light may light up the mine field to a certain extent but cannot be relied upon ; it is obscured by either smoke, mist, or rain and by very little of either.

If the light is in use it is essential that it should be under the control of the Artillery, as its purpose is to light up objects for the artillery to fire at.

The artillery must be prepared either to find the mine field in absolute darkness, or that the gunners are dazzled by the electric light of the attack directed full into the embrasures.

Section VIII.—General Instructions.

In either case the sights would be useless and guns would have to be laid by elevating and traversing arcs ; among other preparations the mine field must therefore be so quartered off beforehand among the guns that any part of it could be swept by fire at discretion.

Machine and quick firing guns will be largely used in the defence.

PART I.

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Section VIII.—Staff and General Duties.

	Lieut.-Col.	Adjutant.	Master Gunner	Dist. Gunners.	Majors.	Captains.	Lieutenants.	S. Sergeants.	N.C.O.	Gunners.	Trumpeters.
Commandant and Staff	1	1	1	—	—	—	—	—	—	—	—
Communicating Orders	—	—	—	—	—	—	—	—	2	—	2
Attending Lamps	—	—	—	2	—	—	—	—	—	—	—
Range Finders	—	—	—	—	—	—	1	—	2	1	—
Look-out on Shore	—	—	—	—	—	—	—	—	1	1	—
Signalman and Look-out in Forts	—	—	—	—	—	—	—	—	1	2	—
In charge of Artillery Store	—	—	—	1	—	—	—	—	—	—	—
In charge of Lamp room	—	—	—	1	—	—	—	—	—	—	—
Guides	—	—	—	4	—	—	—	—	—	—	—
	1	1	1	8	—	—	1	—	6	4	2
Magazine Floor. { Staff	—	—	—	—	—	1	—	1	4	—	—
In 10 S. Stores to issue Shell	—	—	—	—	—	—	—	—	—	20	—
Taking Shell from S. Stores to 8 lifts	—	—	—	—	—	—	—	—	—	4	—
At Winches 1 and 8 for upper gun floor	—	—	—	—	—	—	—	—	—	6	—
Issuing Cartridges to door on hatch of 8 C. Stores	—	—	—	—	—	—	—	—	—	4	—
Outside door or hatch to take C. to lift	—	—	—	—	—	—	—	—	—	8	—
At foot of 11 C. lifts	—	—	—	—	—	—	—	—	—	8	—
	—	—	—	—	—	1	—	1	4	61	—

Lower Gun Floor.	Gun Ammunition Service.	Staff	—	—	—	—	1	—	1	2	—	—	
		At head of lifts to work winches 2, 3, 4, 5, 6, & (if necessary) 7	—	—	—	—	—	—	—	—	12	—	
		At head of S. lifts, 1 & 8 Distributing projectiles	—	—	—	—	—	—	—	—	2	—	
		At head of 11 C. lifts	—	—	—	—	—	—	—	—	16	—	
		Stacking empty cylinders	—	—	—	—	—	—	—	1	11	—	
		16-10" R.M.L. guns	—	—	—	—	2	1	3	—	4	—	
		3-9" " "	—	—	—	—	—	1	—	—	160	2	
		Reserves " "	—	—	—	—	—	—	—	1	24	—	
			—	—	—	—	—	—	—	1	12	—	
			—	—	—	—	2	2	4	1	4	241	2
Upper Gun Floor.	Gun Ammunition Service.	At head of S. lifts 1 and 8 Distributing projectiles... ..	—	—	—	—	—	—	—	—	2	—	
		Issuing C. from C. stores	—	—	—	—	—	—	—	—	2	—	
		Stacking empty cylinders	—	—	—	—	—	—	—	—	2	—	
			—	—	—	—	—	—	—	—	1	—	
		4-9" R.M.L. guns	—	—	—	—	1	—	1	—	32	1	
		Staff	—	—	—	—	—	—	1	1	—	—	
			—	—	—	—	1	—	1	1	1	39	1
Total without Officers, 368			1	1	1	8	3	3	6	3	15	345	5

Figures in *italics* denote that those numbers should be in magazine clothing.

The men taking shift from S. stores 1, 8, 9, and 10, and working lifts 1 and 8 should be in magazine clothing as they work in C. passages.

No of shell stores 10.

No. of shell lifts 8.

The winches of 1 and 8 S. lifts are worked in the ammunition passages, these two lifts supply both upper and lower gun floor; the winches of the remaining six are worked on lower gun floor.

No. of cartridge stores 10 ; eight in basement and two on upper gun floor.

No. of cartridge lifts 11. Two of these, Nos. 1 and 10, supply upper gun floor.

STAFF AND GENERAL DUTIES.

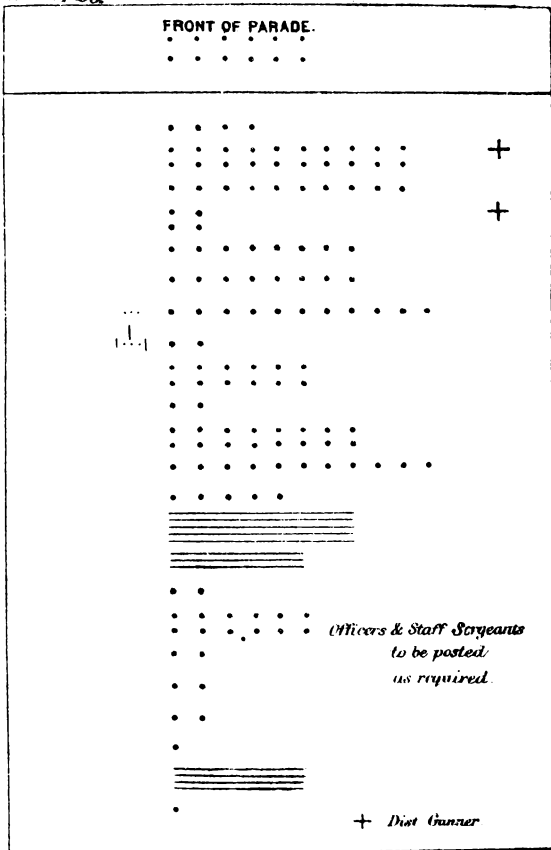
1 Lieutenant, 6 N.C. Officers or Gunners, 2 Trumpeters, and
4 Gunners.

4 Gunners.

								No. of Parties.	Strength of Parties.
Magazine Floor.									
{	Staff							—	5
	Shell Issuers from S. Stores							10	20
	,, Carriers to Lifts							10	10
	At Winches 1 and 8							2	4
	Issuing Cartridges							8	8
	Outside C.S. to take C. to Lifts							8	8
{	At Foot of 11 C. Lifts							11	11
	Staff							—	3
	{	Winch Party						6	12
		At Shell Lifts 1 and 8						2	2
		Distributing Projectiles						8	16
		At Head of 11 C. Lifts						11	11
Stacking Empty Cylinders						—	5		
{	16-10" Detachments						16	160	
	3-9" ,,						3	24	
	Trumpeters						—	2	
	Reserves						1	13	
Lower Gun Floor.									
{	{	At Head of S. Lifts, 1 and 8						2	2
		Distributing Projectiles						2	2
		Issuing Cartridges						2	2
		Stacking Empty Cylinders						1	1
		4-9" Detachments						4	32
{	{	Staff						—	2
Upper Gun Floor.									

DIAGRAM OF PARADE.

To face p. 58. Staff & General duties.



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Ammunition.

PART II.—AMMUNITION.

A most necessary part of instruction is a thorough explanation of all ammunition used in the service, its distinguishing marks, preparation and various uses.

Little time need be occupied in describing manufacturing details.

Specimens of the ammunition should be placed before the squad during the explanation.

Gunpowder.

Gunpowder used in the service of ordnance is classified as follows :

[It is to be noted that the term “service” is to be applied only to powder used for firing projectiles. But classes I, II, III, are “serviceable.”]

CLASSES OF GUNPOWDER, 1885.

Class.	Designation.	Description.
I.	Service 	<ol style="list-style-type: none"> 1. All new powder. 2. All new gunpowder, the packages of which have been opened for inspection, and found serviceable. This is to stand first in order for practice purposes. 3. Gunpowder returned into store, including the contents of cannon cartridges, which on examination may be found uninjured.

PART II.

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Ammunition.

CLASSES OF GUNPOWDER, 1885—*continued*.

Class.	Description.	Description.
II.	Blank ...	4. Gunpowder which has been repaired at Waltham Abbey. 1. Gunpowder from broken-up cannon cartridges, not fit for Class I., and which cannot be repaired.
III.	Shell ...	2. Service powder found dusty and soft in grain, which could not be repaired for Class I. 1.* Gunpowder specially selected for making P mixture for the shells specified below.
IV.	Doubtful ...	2. Service gunpowder which is dry but dusty, or soft or broken in the grain.
V.	Condemned for sale	All gunpowder awaiting examination.
VI.	Condemned for ex- traction ...	Gunpowder found unfit for any of the above classes, but available for mining purposes and sale. Gunpowder obtained from shells and from S.A. ammunition, having its own means of ignition, both of which are to be immediately wetted.

* The bursting charges of common and double shells for—

1st, Rifled Ordnance S.S. generally,

2nd, " for siege train,

3rd, " B.L. for L.S.,

will consist of a mixture of "P" powder and powder of "fine grain."

For proportions see page 104.

The following natures of gunpowder are at present in use in the service :

Prism¹ black, full and reduced charges for 8-inch B.L. ; 10·4-inch and 17·72-inch R.M.L. Also as priming for *Prism¹ brown* charges.

Prism¹ brown, full and reduced charges for B.L. guns 9·2-inch and upwards and the 16-inch R.M.L.

Prism² full and reduced charges for 17·72-inch and 12·5-inch Mark II, R.M.L.

P² full and reduced charges for 6-inch B.L. Mark II, III, and

Ammunition.

IV, 12.5-inch Mark I, and 12-inch R.M.L. 35 tons, and full charge guns of R.M.L. 12-inch 25 tons.

P. full and reduced charges for R.M.L. guns, 80-pr. to 12-inch, 25 tons reduced only.

S.P. full and reduced charges for 80-pr. B.L. full charges for 5-inch ; 4-inch (22 cwt.) 20 pr. and 12-pr. B.L.

*R.L.G.*² full charge for 4-inch (13 cwt.) B.L. ; all R.B.L. and R.M.L. 64-pr. and under, except the 7-pr. and all S.B. guns.

8-inch Howitzer (70 cwt.) 6.6-inch and 6.3-inch Howitzers.

R.L.G., may still be used alternately for all R.B.L. guns, and for R.M.L. guns, from the 9-pr. up to the full charge of the 11-inch gun, except in the case of the 13-pr. gun, and it will not be used in cartridges of future manufacture for the 7-in. R.B.L. guns.

L.G. As given for R.L.G. and S.B. mortars, also for bursting charges of Shrapnel E.O.C. type having the bursting charge in the head.

*M.G.*¹ for 1-inch Nordenfeldt.

*R.F.G.*² for Martini-Henry ammunition and machine guns except the 1-inch Nordenfeldt, and bursting charges of shrapnel shell.

R.F.G. for rifle small arms except Martini-Henry and pistols, the bursting charges of shrapnel shell, also full and reduced charges 7-pr. R.M.L. guns.

F.G. for S.B. small arms, bursting charges of shrapnel shell, full and reduced charges 7-pr. R.M.L. guns.

Rifled Pistol. For Enfield pistols, bursting charges of shrapnel shell.

Blank R.L.G., or *L.G.* for saluting charges. Rifled and S.B. guns.

Blank R.F.G., *R.F.G.*² and *F.G.* for blank S.A. cartridges, and may be used for saluting charges for rifle and S.B. Ordnance.

Shell *F.G.* for bursting charges of 6, 9, 12 and 20-pr. segment shell.

ISSUE.

Prismatic powder is issued in cases powder 100lb. made of wood lined with zinc.

Ammunition.

Cubical and grained powders in barrels enclosed in waterproof bags holding 125lbs. of P and P², 110 lbs. R.L.G.², and 100 lbs. all other.*

Service powder will never be issued for *blank* or saluting cartridges when any powder classed under the latter head is available. This rule is intended to apply strictly to the non-issue of Service R.L.G., R.F.G., and R.F.G.² powders for blank charges. *Blank* powder will not be issued for filling shells when shell powder is available.

DIRECTIONS FOR MAKING UP CARTRIDGES FOR RIFLED ORDNANCE.

I. MAKING, EMPTY.

1. The patterns will be strictly adhered to in cutting out.
2. The cartridges will cut so that the width of the material runs in the width of the cartridge.

Silk Cloth will be used for all cartridges for R.M.L. ordnance, except the 7-pr. 4 oz., 8 oz., and 2.5-inch 6 oz. for all cartridges for B.L. guns, and all R.B.L. cartridges.

Serge cartridges for R.M.L. or R.B.L. guns, which may be in store, will be used up according to orders issued from time to time on the subject.

Shalloon will be used for the 7-pr. R.M.L. cartridge, 4 oz. and 8 oz. and for 2.5-inch R.M.L. cartridge 6 oz.

3. The cartridges, before being sewn, will be printed in black with the nature of gun, charge, &c., and with lines for the hoops and seams. The B.L. 80-pr. 34 lb. and the R.B.L. 7-inch and 40-pr. will also be printed with lines for the choke. All marking

* When waterproof bags are used, these weights will be reduced by about 10 lbs.

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on cartridges will be done with printers' ink. About $\frac{1}{4}$ oz. of ink is sufficient for 100 cartridges of each nature, except the R.M.L. 12.5-inch, and the 17.72 or 16-inch, for which about $\frac{3}{8}$ oz. and $\frac{3}{4}$ oz. respectively will be required per 100.

4. Braid of double width will be used for all charges of 40 lb. and upwards. Cartridges which are not to be hooped with braid will be hooped with silk or worsted after being filled. Beckets for lifting will be attached to all cartridges of 30 lb.

5. Kitted pack thread will be run into the empty R.B.L. 7-in. and 40-pr. cartridges for choking on to the wood sockets, and into the B.L. 80-pr., 34-lb. cartridges for choking on to the zinc end of the wood tubes.

II. FILLING.*Cartridges Filled with Loose Powder.*

6. Care will be taken to see that cartridges are not made up in damp weather, that they are properly dry before being filled, and the proper charge is carefully weighed out, and inserted in the bag by means of the "Funnel, copper, cartridge."

7. Cartridges which are made up without sticks will be choked by drawing together the mouth of the cartridge into several plaits with a brass needle, threaded with three strands of worsted for serge cartridges, or with two strands of silk twist for silk cloth cartridges, up to 14 lb. inclusive; after drawing together the mouth of the cartridge, three turns will be taken round the plaits, and the choke thus formed will be further secured by passing the needle three times through it alternately above and below the turns, thereby stitching down the turns round the choke at two points equidistant from each other. Charges above 14 lb. up to 85 lb. inclusive, without beckets attached, require three strands of silk twist passed round the plaits, three times, and the needle passed through the choke four times, making three securing stitches. Charges from above 14 lb. and upwards, with beckets, will have the choke first formed, and

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temporarily secured by taking two turns round the choke, the becket drawn tightly in on both sides, then three turns will be taken round the choke, the needle passed through the choke and becket five times, making four securing stitches. The becket should form a loop about $3\frac{1}{2}$ inches in length over the choke.

8. Cartridges which are made up with sticks will have the sticks secured to them just before filling, by choking the bottom end internally round one end of the stick with broad braid ; the cartridge will be turned inside out, and a needle threaded with broad braid, will be run through the bottom end, in the part marked by a printed line, so as to bring it into plaits, then draw up loosely and arrange the plaits so as to lay uniformly in the groove on the end of the stick ; draw the braid tight, bring both ends half round the stick and tie with a half reef knot, then half round again and tie with a half reef knot, and once more and finish with a reef knot. This braid will be found already threaded through the bottom end for the choke in all empty cartridges issued from Woolwich. The cartridge will then be turned back (ready for filling) and, the stick being set upright, an apparatus for use in filling cartridges (*see* § 3738, "List of Changes") will be placed on the top thereof, and the cartridge will be drawn round the ring of the apparatus. The powder charge will then be inserted, care being taken that it is filled in uniformly round the stick so as to preserve the proper shape of the cartridge. The cartridge being filled, the apparatus will be withdrawn, the stick being kept steadily in the centre and the cartridge choked at the front end, with becket attached, round the head of the stick, with broad braid ; the braid is first run through and drawn tight into the groove (as described above), and passed round once and tied ; the becket is then placed in its position, and the ends of the braid brought round over the becket and tied with a half reef knot ; this will be repeated three times, each turn being tied with a half reef knot, the last being a complete reef knot, and the ends of the braid cut off. The loop of the becket when laid

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down must not reach within half an inch of the outside of the cartridge.

9. The B.L. 80-pr. cartridge, 34 lb., will be made up with a wood tube containing one shalloon puff. The cartridge will be filled in the usual way for pebble powder, and the tube inserted into the powder, care being taken to keep it in the centre of the cartridge, and the kitted string will be drawn into the recess in the funnel-shaped part of the tube, giving it three turns round, each turn being tied with a half reef knot, the last turn being tied with a complete reef knot.

10. The cartridges will be made up to their proper lengths and diameters by means of the hoops, which should be drawn tight so as to make a firm cartridge.

11. Hooping—

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

2nd. With worsted or silk twist.—After making the last stitch in choking (*see* para. 7), the needle will be turned downwards and carried through the powder and out at the seam in the line for the front hoop, the worsted or silk twist will then be carried tightly round the cartridge so as to form a hoop, and will be stitched to the cartridge at two or three points in the same way as the turns at the choke were secured, and the remainder of the hoops will then be similarly formed.

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12. Cartridges which are intended for either P. or R.L.G. powder will, when filled with the R.L.G., be brought to their proper length by having the hoops drawn in very tightly; the ribs formed in those parts where the hoops are in the interior of the cartridge will, however, be found to project to about the regulated diameter. The braid hoops will be thus drawn in, with all cartridges, whenever the powder is of a denser description than usual.

13. The R.B.L. cartridges which have paper cylinders inside, viz., 7-in., 40-pr. and 20-pr., will have half the charge inserted, the paper cylinder will then be placed on the powder *in the centre of the cartridge*, the flat side uppermost, and the remainder of the charge then filled in.

14. The R.B.L. cartridges which have the lubricators outside, viz., 7-in. and 40-pr., when filled will be choked *tightly* round the groove of the wood socket, into which the lubricator is screwed, the greatest care being taken to fix the socket in the centre of the cartridge.

15. The R.B.L. cartridges which have the lubricators inside, viz., 20-pr., 12-pr., 9-pr., and 6-pr., when filled with the proper charge, will have the lubricator placed inside with the papier-mâché disc next the powder, and the cartridge then choked tightly over the top. The line which is printed on the cartridge for the top hoop should be close under the papier mâché disc, and the hoop drawn very tight, so as to prevent any grains of powder getting round or over the lubricator.

16. The R.B.L. 12-pr. or 9-pr. and 6-pr. exercising and saluting cartridges have attached to the upper part another bag containing sawdust, which forms a wad. The upper bag will be turned down, and the lower bag or cartridge proper will be filled with the powder charge, well shaken down, and then choked as prescribed in para. 7. The upper bag will then be brought up, and a portion of sawdust put in and pressed down with a stick, a portion more of sawdust will then be put in pressed down, and

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so on, proceeding as before until the wad is of the proper size ; they will then be choked and finished, tying the braids tight so as to make a firm cartridge.

Cartridges filled with Prismatic Powder.

17. CARTRIDGES, PRISM.¹—These cartridges are made up in the Royal Laboratory, Woolwich, as follows, viz. :—The prisms are built up by hand in a zinc envelope open at both ends, having as many sides, and being of the same length as the finished cartridge, fitted with a movable wooden bottom, secured by three screws ; the envelope is placed on a pedestal less in diameter than itself and filled with the required number of layers of prisms ; the cartridge is then placed downwards over the cylinder, and the screws holding the wood bottom taken out and the envelope drawn down from between the prisms and cartridge ; the cartridge is then held down tightly over the prisms while the braids are being secured, commencing with the bottom braid. The cartridge is then reversed, and after the wood bottom is taken out, it is placed on the scales, and the necessary prisms removed from the top layer, or added to it, until the weight is correct.* The top is then placed on and secured at each side, and then sewn round with two strands of silk twist. The top and bottom of the cartridge have each a hole in the centre fitted with network, which is covered over with shalloon patches, stuck on with shellac to prevent the powder dust from falling into the package.

These cartridges, if necessary, may be made up, by careful manipulation, without using a zinc cylinder, by building up the prisms on a wooden bottom cut to the same shape as the cartridge.

18. CARTRIDGES, PRISM.²—The required number of prisms will be built up in layers on a wooden bottom the same shape as the

* In making up cartridges with prism¹ powder, the top layer should not be less than 75 per cent. of the number of prisms in a complete layer, one or more prisms being taken from each complete layer to make up the requisite number in the top layer.

(a.m.¹)

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cartridge, the bag drawn over the whole, and the remaining operations proceeded with the same as with prism.¹ with the exception of the zinc envelope which is not required for prism.²

III. MARKING FILLED CARTRIDGES.

19. All cartridges when filled will have the initial or monogram of the station at which they are filled, stamped on the bottom end, and the nature and weight of powder which they contain marked on the side in *black* printers' ink, the letters being one inch long. About $\frac{1}{4}$ oz. of ink will be sufficient for 100 cartridges.

20. The cartridges filled by the Royal Artillery will be distinguished by having no initial letter stamped on them. This order does not apply to cartridges filled by working parties of Royal Artillery for the Ordnance Store Department (*see* § 3,564, "List of Changes in War Material, &c.")

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

Home Stations.

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

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Foreign Stations.

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

IV. FINISHED CARTRIDGES.

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

V. ISSUE OF FILLED CARTRIDGES.

23. Cartridges for the 7-in. and 40-pr. R.B.L., the 8-in. howitzer, 64 pr. and 80 pr. R.M.L. guns are issued in metal-lined cases.

These are of three sizes, whole, half, and quarter, and weigh 48 lbs., 30 lbs., and 18 lbs. respectively.

Cartridges for R.M.L. guns, 7-in. and upwards, are packed in zinc cylinders, each containing one cartridge with the exception of that for the 7-in. which will hold one full or two reduced charges.

They serve as cases to carry the cartridge from the magazine to the gun. The cylinder for 17·72-in. or 16-in. cartridges is intended only for transport or storage in Ordnance Store Department magazines.

Securing Lids of Cartridge Cylinders.

See A.C., Clause 11, January 1884, Equipment Regulations.
(a.m.¹)

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Stacking.

24. When cartridge cylinders containing cartridges are stored lying on their sides, the number of tiers in each stack will be limited as follows :—

12·5-in.	not to exceed	3	in depth.
12 or 11-in.	„	3	„ „
9 and 10-in.	„	4	„ „
7-in.	„	5	„ „

When stacked on their ends, thin battens of wood will be placed on them to prevent the handles injuring the bottoms of those packed over them. These battens are not absolutely necessary for cylinders with screwed lids. Stacking on their ends is preferable because if stacked on their sides, unless the points of support are under each end where the cylinders are strongest, or along their length, they become so dented that the cartridges are difficult to extract.

VI. DRILL CARTRIDGES.

25. Drill cartridges are issued for almost all guns. They are of about the same size and weight as the service cartridge.

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TABLE OF FILLED CARTRIDGES FOR RIFLED ORDNANCE.

Gun.	Filled Cartridges.						No. of cartridges to form a charge.			Remarks.
	Weight and Powder.	Length.		Diameter.		Full.	Reduced.	Saluting.		
		From	To	From	To					
B.L.										
16·25-in.										
13·5-in.										
12-in. I. and II. ...	73½ lb. Prism ¹ brown ...	10·75	11·25	13·5	14·0	4	3	Nil		
9·2-in. I. and II. ...	80 lb. " " ...	17·5	18·25	11·1	11·6	2	1	"		
" III., IV., V.	87½ lb. " " ...	18·5	19·25	11·0	11·5	2	1	"		
8-in. ...	50 lb. Prism ¹ black ...	15·75	16·25	9·45	9·75	2	1	"		
6-in. II. ...	17 lb. P ² ...	11·75	12·25	7·3	—	2	1	—		
" III. and IV. ...	21 lb. " ...	12·9	13·5	7·5	—	2	1	—		
" IV. ...	25 Prism ¹ brown ...	11·75	12·25	7·5	7·9	2	1	—		
" ...	7 lb. blank ...	7·3	7·8	6·0	—	—	—	1	Also 80-pr.	
80-pr. ...	34 lb. S.P. ...	27·7	—	6·3	—	1	—	—		
" ...	25 lb. " ...	27·2	—	5·4	—	—	1	—		
R.B.L.										
7-in 82 cwt. ...	11 lb. R.L.G. ² ...	10·0	11·0	7·03	—	1	—	—		
" 72 " ...	10 lb. " ...	—	—	"	—	1	1	—		
" 82 or 72 cwt. ...	7 lb. blank " ...	6·0	6·5	"	—	—	—	1		
40-pr. ...	5 lb. R.L.G. ² ...	10·0	10·75	4·77	—	1	—	—		
" ...	3 lb. blank ...	5·75	6·25	"	—	—	—	1		
R.M.L.										
17·72-in. ...	112½ lb. Prism ¹ black ...	13·75	14·25	14·5	15·0	4	3	Nil		

R.M.L.													
16 in. ...	...	112½ lb. Prism ² ...	...	14.0	14.5	15.2	15.7	4	3	..			
12-5-in. I. ...	...	112½ lb. Prism ¹ brown ...	...	13.75	14.25	14.0	14.5	4	3	..			
12-5-in. I. ...	...	80 lb. P. ² ...	...	20.05	—	10.4	12.0	2	1	..			
.. II. ...	...	52½ lb. Prism ² ...	...	10.3	10.7	11.95	12.25	4	3	..			
12-in. 35 tons ...	...	110 lb. P. ...	...	27.5	28.5	9.9	11.5	1	—	Nil			
.. 25 tons ...	...	85 lb. P. ² ...	...	21.5	22.5	..	..	—	1	—			
.. ..	...	.. ..	...	..	..	..	..	1	—	..			
11-in. ..	...	55 lb. P. ...	...	14.25	15.25	..	..	—	1	..			
.. ..	...	85 lb. P. ...	...	25.0	26.0	9.3	10.5	1	—	..			
.. ..	...	60 lb. P. ...	...	18.0	19.0	..	..	—	1	..			
10-4-in. ...	...	95 lb. Prism ¹ black... ..	...	26.2	27.2	9.5	10.0	2	1	..			
10-in. ...	...	70 lb. P. ...	...	25.0	26.0	8.25	9.5	1	—	..			
.. ..	...	44 lb. P. ...	...	16.3	17.3	..	..	—	1	..			
9-in. ...	...	50 lb. P. ...	...	22.5	23.5	7.3	8.5	1	—	..			
.. ..	...	33 lb. P. ...	...	17.0	18.0	8.2	..	—	1	..			
8-in. ...	...	35 lb. P. ...	...	21.0	22.0	6.43	7.5	1	—	..			
.. ..	...	21 lb. P. ...	...	15.0	15.7	7.3	..	—	1	..			
7-in. 7 and 6½ tons...	...	30 lb. P. ...	...	22.5	23.5	5.57	6.5	1	—	..			
.. 90 cwt. ...	...	22 lb. P. ...	...	17.2	18.2	..	..	1	—	..			
.. both ...	...	17 lb. P. ...	...	14.3	15.0	6.4	..	—	1	..			
6-6-in. ...	...	12½ lb. P. ...	...	11.25	11.75	5.1	6.2	2	1	..			
80-pr. ...	...	12 lb. P. ...	...	11.25	12.25	6.0	..	1	—	..			
.. ..	...	20 lb. P. ...	...	18.5	19.5	..	..	1	—	..			
64-pr. I. and II. ...	...	6 lb. R.L.G. ² , R.L.G. or L.G. ...	...	7.5	8.5	6.0	..	1	—	..			
.. III. ...	...	8 lb. .. ..	...	9.2	9.7	6.0	..	1	—	..			
80-pr., 64-pr., or } 32-pr. S.B. }	...	5 lb. blank ... ..	...	6.5	—	5.8	..	—	—	1			
Howitzer													
8-in. 46 cwt. ...	...	10 lb. R.L.G. or L.G. ...	...	8.75	9.25	6.8	..	1	—	..			
.. ..	...	5 lb. .. ..	...	5.75	6.25	6.3	..	—	1	..			
.. ..	...	2½ lb. .. ..	...	4.0	—	6.0	..	—	1	..			
8-in. How. 70 cwt. I. ...	...	11½ lbs. R.L.G. ² ..	...	8.5	9.0	7.3	..	1	—	..			
.. .. I. ...	...	7 lbs. .. ..	...	6.0	6.5	6.7	..	—	1	..			
.. .. I. ...	...	3½ lbs. .. ..	...	4.2	4.5	6.1	..	—	1	..			
6-6-in. Service I. ...	...	5 lbs. .. ..	...	5.75	6.25	6.1	..	1	—	..			
.. .. I. ...	...	3 lbs. .. ..	...	4.75	5.1	5.2	..	—	1	..			
.. .. I. ...	...	2 lbs. .. ..	...	4.25	4.75	4.75	..	—	1	..			
6-3-in. .. I. ...	...	4 lbs. R.L.G. ...	...	5.75	5.6	6.25	..	1	—	..			
.. .. I. ...	...	2 lbs. .. ..	...	4.25	4.75	4.75	..	—	1	..			

Studded shell
Studless ..

Ammunition.

TABLE OF PACKAGES OF FILLED CARTRIDGES.

Gun.	Weight and Powder.				Metal-lined Case.				No. of Cartridges in Cylinder.	No. of Cylinders Zinc, in Skeleton Wood Case.	Total Weight.	Remarks.
					Whole.		Half.					
					No.	Wgt.	No.	Wgt.				
B.L.						lbs.		lbs.			lbs.	
12-in....	73½ lb. Prism ¹	...	...	...	...	...	1	1	111	} No Pack- ages.
9-2-in.	80 lb. "	...	...	...	...	...	2	...	...
"	87½ lb. "	...	...	...	...	...	2	...	...
8-in.	50 lb. "	...	...	...	...	...	2	...	...	} No Pack- ages.
6-in.	17 lb. P ²	...	6	152	—	—	—	—	—	
"	21 lb. P ²	...	4	134	—	—	—	—	—	
"	25 lb. Prism. ¹}	...	...	...	...	...	...	...	...	} No Pack- ages.
80-pr.	34 lb. S.P.	...	...	...	...	...	...	...	...
"	25 lb. S.P.	...	...	...	...	...	...	...	...
6-in. or 80-pr.	7 lb. Blank	...	15	156	6	73	—	—	—	
B.B.L.												
7-in.	10 lb. R.L.G. ²	...	8	133	3	62	—	—	—	
"	11 lb. "	...	8	141	3	65	—	—	—	
"	7 lb. Blank	...	15	156	6	73	—	—	—	
40-pr.	5 lb. R.L.G. ²	...	15	131	5	57	—	—	—	
"	3 lb. Blank	...	37	163	17	82	—	—	—	
B.M.L.												
17-72 in.	112½ lb. Prism ¹	...	...	...	...	...	*1	1	162	
"	" Prism ²	...	...	...	...	...	*1	1	162	
16 in.	" Prism ¹	...	...	...	...	...	*1	1	162	
12-5 in.	80 lb. P ²	...	...	...	...	...	1	1	120	

12 in.	...	...	52½ lb. Prism ²	...	...	...	...	...	1	1	153	
"	...	...	110 lb. P.	...	...	...	...	...	1	1	123	
"	...	...	85 lb. P ²	...	...	...	...	...	1	1	84	
11 in.	...	...	55 lb. P.	...	...	...	...	...	1	1	119	
"	...	...	85 lb. P.	...	...	...	...	...	1	1	89	
"	...	...	60 lb. P.	...	...	...	...	...	1	1	103	No Package.
10¼ in.	...	...	95 lb. Prism ¹	...	...	...	...	...	...	...	66	
10 in.	...	...	70 lb. P.	...	...	...	...	...	1	1	77	
1 in.	...	...	44 lb. P.	...	...	...	...	...	1	1	110	
9 in.	...	...	50 lb. P.	...	...	...	...	...	1	2	102	No Package.
"	...	...	33 lb. P.	...	...	...	...	...	...	...	...
8 in.	...	...	35 lb. P.	...	...	...	...	...	...	...	...
"	...	...	21 lb. P.	...	...	...	...	...	...	...	...
7 in.	...	...	30 lb. P.	...	...	...	...	...	1	2	110	No Package.
"	...	...	22 lb. P.	...	...	...	...	...	...	...	...
"	...	...	17 lb. P.	...	...	...	...	...	2	2	154	No Package.
6½ in.	...	...	12½ lb. P.	...	8	151	4	82	—	—	—	
80-pr.	...	...	12 lb. P.	...	9	158	4	79	—	—	—	
"	...	...	20 lb. P.	...	...	...	...	...	1	4	—	
64-pr.	...	...	6 lb. R.L.G. ²...	...	19	164	8	79	—	—	—	
"	...	...	R.L.G. or L.G.	...	...	...	...	...	...	...	...
"	...	...	8 lb. R.L.G. ²...	...	13	155	6	80	—	—	—	
"	...	...	R.L.G. or L.G.	...	...	...	...	...	...	...	...
80-pr., 64-pr. or 32-pr. S.B.	...	...	5 lb. Blank ...	...	22	160	10	81	—	—	—	
Howitzer	...	...		...	...	...	...	...	...	...	...
8 in., 46 cwt.	...	...	10 lb. R.L.G. or L.G.	...	11	161	4	71	—	—	—	
"	...	...	5 lb. "	...	21	157	9	77	—	—	—	
"	...	...	2½ lb. "	...	47	159	18	77	—	—	—	
" 70 cwt. I.	...	...	1½ lb. R L.G. ²	...	8	142	3	65	—	—	—	
"	...	...	7 "	...	12	135	6	74	—	—	—	
"	...	...	3½ "	...	32	165	14	81	—	—	—	
6½ in. Service I.	...	...	5 "	...	22	162	10	82	—	—	—	
"	...	...	3 "	...	35	158	16	81	—	—	—	
"	...	...	2 "	...	50	155	21	75	—	—	—	
6½ in.	...	...	4 " R.L.G.	...	27	161	12	80	—	—	—	
"	...	...	2 "	...	50	155	21	75	—	—	—	

* For Transport and Storage in Ordnance Store charge only. In R.A. charge they are stored, 3 in "Y" and 2 in "Z" Cases, brass, powder, cylindrical.

Projectiles for S.B. Ordnance.

Projectiles for smooth-bored ordnance may be classed as follows :—

Shot...	....	{ Solid. Case. Grape. Sand. Common.
Shells	....	{ Mortar. Shrapnel. Hand grenade.
Miscellaneous	....	{ Carcasses. Parachute light balls.

SHOT.

Solid.

Wooden bottoms are riveted to solid shot when intended for use with guns of position or bronze guns. All S.B. solid shot are painted black.

Case.

There are three classes :—1. Iron case with iron ends and iron handles. 2. Tin case with iron bottom and rope handles. 3. Tin case with wooden bottom. They consist of metal cylinders filled with sand shot of different sizes, according to the calibre. Case shot are fired from all natures of guns, carronades, and howitzers, and are used against troops or boats. The effective range is not much more than 350 yards.

Grape.

Caffin's pattern consists of four circular iron plates, between which three tiers of sand shot are arranged, a wrought iron spindle passing through the centre of the plates, and a nut which screws

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on to the head of the spindle binding the shot and plates together.

Grape shot for carronades and for 10-inch S.B. gun are made up like case shot.

Grape shot are only fired from cast iron guns and carronades. They are used under the same circumstances as case shot, but owing to the greater weight of their balls, they have a longer effective range.

Sand

Are cast iron shot of various sizes from $1\frac{1}{2}$ oz. to 4 lbs., chiefly used for making up case and grape, and shrapnel shells 7-inch R.M.L. and upwards.

SHELLS.*

Common

Are fitted with wooden bottoms. Their fuze holes are of the common gauge, and tapped throughout to take Pettman's L.S. percussion fuze and common wood time fuze.

Common shells are used against matériel, troops behind cover, wooden ships, buildings, &c.

Mortar.

Mortar shells have no wooden bottom attached. The 10-inch and 13-inch are fitted with *lewis holes* (formerly *lugs*), by which they may be lifted. The fuze hole is not countersunk, and is larger than that of common shells, so as to take the long fuze necessary on account of their time of flight. The fuze hole of the 8-inch mortar shell is somewhat smaller than that of the 10-inch and 13-inch, to admit of the fuze being set home.

For the $5\frac{1}{2}$ -inch and $4\frac{2}{5}$ -inch mortars, 24-pr. and 12-pr. common shell without wooden bottoms are used.

Shrapnel.

The diaphragm pattern is the only one that need be noticed. It consists of a thin cast iron shell, weakened internally by four

* For directions for filling shells *vide* page 99.

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grooves, and filled with lead bullets. The bursting charge, which is just sufficient to open the shell and release the bullets, is separated from them by a wrought iron diaphragm.

Shrapnel shells are used against troops in the open at distances beyond case shot range. It should burst from 50 to 20 yards in front of the object.

Hand Grenades

Are used chiefly for the defence of places against assault, being thrown among the storming parties in the ditch. They are useful in the defence of houses. They can be thrown by hand about 20 or 30 yards. They are of two sizes, 6-p^r and 3-p^r.

MISCELLANEOUS.*Carcasses*

Are cast iron spherical shells with three vents or fire holes in their upper hemisphere. They are filled with a highly combustible composition which is lighted by the flash of discharge, and burns from 3 to 12 minutes, according to the calibre.

They can be fired from S.B. guns from 12-pr. upwards (in which case they should have wooden bottoms attached), and from mortars, from 13-inch S.S. mortars and 10-inch gun, charges not to exceed 16 lbs. and 8 lbs.

The vents are plugged with brown paper, and covered with kit plaster, which must be removed before loading.

Carcasses are used for incendiary purposes.

Parachute

Are shells formed of two outer and two inner hemispheres of tinned iron soldered and riveted together. The lower inner hemisphere contains bright burning composition and a large calico parachute is packed inside the upper hemisphere. A small bursting charge is contained between the inner and outer hemispheres.

Parachute light balls are fired from mortars only. Special time fuzes are used with them. They should be bored to such a

Ammunition.

length as to open the shell either at the highest point of its trajectory or soon afterwards. The bursting of the shell lights the composition and releases the parachute, which expands and floats in the air, descending gradually. The composition burns from one to three minutes, according to the calibre—10 inches, 3 minutes ; 8 inches, $1\frac{1}{2}$ minutes ; $5\frac{1}{2}$ inches, 1 minute.

The parachute light possesses many advantages over the ground light, but is much affected by the wind.

Projectiles for Rifled Ordnance.*For B.L. guns.*

The projectiles fired from these guns are fitted with copper "driving bands" near the base, they are somewhat larger in diameter than the bore of the gun, and when the charge is fired they are forced into the rifling and thus impart rotation. The front edge of the driving band has a slope of 7° , a similar slope being in the shot chamber of the gun, when the projectile is rammed home, it is gripped and the windage is sealed.

The projectiles fired from these guns are common,* double, and shrapnel shell, case and palliser shot, those for 8-inch and upwards have a hole in the side of the centre of gravity to receive the "*bolt eye lifting*."

For R.B.L. guns.

The projectiles fired from these guns are lead coated, and somewhat larger in diameter than the bore across the lands. When the gun is fired, the lead is forced into the grooves and rotation thus given to the projectile.

The projectiles fired from these guns are, common, segment, and shrapnel shell, case shot, and solid shot for practice only.

For R.M.L. guns and howitzer.

The earlier patterns of projectiles for R.M.L. guns were

* A light common shell was made for the 6-in. B.L. gun, no more will be made, those on charge to be used up with reduced charges W.O.A. 6 | 83.

Ammunition.

studded, and rotation was imparted to them by the studs fitting into the grooves of the gun, their number varied from 3 in the 80-pr to 9 in the 12.5-inch.

For guns having the increasing twist of rifling it is necessary to reduce the size of the front studs to admit of loading. The 8-inch howitzer of 46 cwt. shell differs from that for the 8-inch gun only, in the studs being all of the same size, and being set at a greater angle to suit the twist of rifling. The studless R.M.L. projectiles are rotated by copper gas-checks. See p. 86.

These gas checks impart rotation to the projectiles by the projections on their circumference fitting into the grooves of the gun. They attach themselves to the projectile automatically, but if there is any likelihood of the gun having to be unloaded it will be necessary to attach the gas check to the projectile by striking it inside the crown with a blunt pointed hammer at two or three points, and thus lightly fixing it to the shell. They are as a rule loaded separately from the projectile.

There is a projecting rim on the base of these projectiles over which the gas check fits easily, and on the rounded part of the base are a number of undercut flutings intersected by two undercut rings.

The projectiles for 12.5-in. and upwards are fitted with a hole a little in rear of the centre of gravity to receive the "*bolt eye lifting*," the 12.5-in. and 16-in. have also a pawl hole.

SHELLS.

Common

Are used with all garrison guns, and have the general service fuze hole.

They are painted black except the driving bands of B.L., the lead coating of R.B.L., and the studs of R.M.L. They are

Ammunition.

lacquered inside with red lacquer. Sarge bags are used for the bursting charges in all except the 7-in. R.B.L.; 80-pr. and 64-pr. R.M.L. and howitzers.

Double

Resemble common shell but are longer. The 7-in. has 3 strengthening ribs cast inside, is lacquered and uses a sarge bag for the bursting charge.

Shrapnel.

These shells are made for all calibres of garrison guns. The body is of cast iron with a chamber inside the base into which fits a tin cup to contain the bursting charge, over this is a wrought-iron disc with a hole in the centre threaded to receive a wrought iron pipe, the walls of the shells are lined with brown paper and filled with sand shot except the 6-in. B.L., 40-pr., and 7-in. R.B.L., 64-pr., 80-pr., and 6'6-in. R.M.L. which have mixed metal balls, the interstices between the balls filled in with resin, the head is made of Bessemer metal lined with wood, let into the head is a gun-metal socket, the lower part of which fits into the wrought iron pipe, the interior is tapped to receive the primer, the top threaded to the G.S. gauge.

Segment.

For 7-in. and 40-pr. R.B.L. only. They differ from common shell in having a lining of cast iron segments, are lacquered but do not use bags. It is not easy to distinguish them from common; they are shorter, and the lead coating extends somewhat farther over the base.

Star.

For 8-in., 6'6-in., and 6'3-in. howitzers. They are spherical in form, made of two hemispheres of Bessemer metal tinned all over and fitted together with a lap joint. In the centre of the top hemisphere is a hole to receive a gun-metal socket of the G.S. gauge. It

Ammunition.

contains 21 stars of three different sizes driven with magnesium composition. Round the lower part of the exterior is a ring of yellow pine in two thicknesses fastened together by eight iron screws. The ring is fastened to the bottom hemisphere by marine glue and drops of solder and it serves the same purpose as a wood bottom in S.B. guns.

Steel Shells.

These are now being manufactured experimentally of the following descriptions—common and shrapnel. These shells are made of “cast steel” and “forged steel;” they are distinguished from iron shells by having a white band painted round the head, shrapnel will have it below the red tip; those of cast steel are stamped C.S. and those of forged steel F.S. on the base.

*SHOT.**Palliser*

Are made for all guns in the garrison service, except R.B.L. 7-in and 40-pr. and R.M.L. 64-pr.

They are ogival pointed projectiles, the head being made very dense, by being cast in an iron mould, called a chill, the body in sand, which makes it less brittle; they are cast hollow and lacquered, and the hole in the base is closed, either by a gun-metal or cast-iron plug. Projectiles, similar to the above have been issued, as shell with bursting charges contained in bags, but by § 4,839, the bursting charge has been discontinued, and they are to be filled with an equivalent weight of sand, see § 5,033. Projectiles of this nature with the bursting charge have their points painted white to distinguish them from those without, which are painted black all over, except “driving bands,” and “studs” which are unpainted.

Case.

Case shot are used with all guns, and are made up as a rule from one or more pieces of sheet iron, riveted together to form

Ammunition.

a cylinder, having the ends fringed and turned in, to one of which is attached the bottom, inside the bottom is placed a loose disc, the case is lined with wrought-iron segments, and filled with sand, shot packed in clay and sand, the top is of wrought iron, having one handle up to the 8-in. inclusive, above that two handles.

Those for B.L. and R.B.L., have studs of soft metal, soldered round the base, to prevent them being rammed too far up the bore in loading.

The case for the 7-in. R.B.L. is used in the 7-in. R.M.L., that for the 8-in. gun serves for the 8-in. howitzer, and the 64-pr., 6.3-in. howitzer, and 80-pr. R.M.L. case are identical.

The 32-pr. S.B.B.L. has a special case shot, and is the only projectile fired from that gun.


It is made from three pieces of sheet iron soldered together, the bottom end is turned in, and a wrought-iron disc laid inside, outside is fastened a wooden ring ; it contains 80 sand shot, and 80 mixed metal balls, packed in clay and sand ; the top is closed by a wooden disc fastened to the case by wrought-iron nails.

(a. m.¹)

G

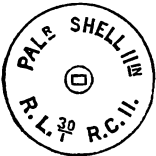
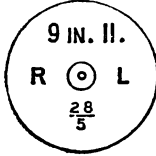
Ammunition.

MARKINGS ON PROJECTILES.

Marks.	Explanations.
<p>Base.</p>  <p>On rear stud. IV $\frac{9}{71}$ X</p> <p>On rear stud. E.</p> <p>Indentations on base.</p>	<p><i>R.M.L. Palliser Shot—"Studded."</i></p> <p>Palliser Chill.—Mode of manufacture. R.—Workman's mark.</p> <p>IV.—Roman numeral. Mark or pattern.</p> <p>9/71.—Date of casting.</p> <p>R.L.—Royal Laboratory. Place of manufacture.</p> <p>Roman numeral.—Mark or pattern. X.—Denotes the studs are planed. Date.—Date of final gauging and examination.</p> <p>Examined at out station, hammer and water test.</p> <p>Shows the shot was tested with pointed hammer.</p>

Ammunition.

MARKINGS ON PROJECTILES—*contd.*

Marks.	Explanations.
<p>Base.</p> 	<p><i>R.M.L. Palliser Shell</i>—"Studded."</p> <p>The word "chill" is not cast on base.</p> <p>R.C.—Ridsdale and Cwmbran iron.</p>
Other markings, identical with shot.	
<p>Base.</p>  <p>On lower band. I. R. L. 2/82 1/2</p> <p>(a.m.¹)</p>	<p><i>R.M.L. Palliser Shot</i>—"Studless."</p> <p>Nature.—Mark or pattern.</p> <p>Rl. Laby.—Place of Manufacture.</p> <p>Date of casting.</p> <p>Roman numeral, mark, or pattern.</p> <p>Royal Laboratory.—Place of manufacture.</p> <p>Date of final gauging and examination.</p>

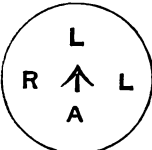
Ammunition.

MARKINGS ON PROJECTILES—*contd.*

Marks.	Explanations.
	<i>R.M.L. Common Shell—"Studded."</i>
On, base, body, and studs. U.C.	Same as Palliser projectiles. Under cut stud holes.
	<i>R.M.L. Shrapnel Shell—"Studded."</i>
On stud, 35 ton II*	Same as common studded. 12" 35 ton projectiles have this marking on the stud to distinguish them from 12" 25 ton projectiles. Asterisk in addition to Roman numeral denotes that the shell has been altered to take a gas-check. R.M.L. studless projectiles have the same markings as studded, except those having reference to studs.
On top. IV R. ↑ L. 9 in. M.L. V R. ↑ L. 64-pr. or 80-pr. or 6-3" How.	<i>R.M.L. Case Shot.</i> Roman numeral, mark or pattern. Ryl. Laby., place of manufacture. Calibre of gun. Nature of gun. Same as above. Case shot for two or more pieces of ordnance have markings similar to this.

Ammunition.

MARKINGS ON R.B.L. PROJECTILES.

Marks.	Signification.
I. \uparrow A. E. O. C. R.L. Z. U.	Passed by Inspector of Artillery.* Elswick Ordnance Company.† ‡ Royal Laboratory.|| Zinc attachment. Under cut method of attachment.
	Lead and antimony coating, made in Royle Laby., stamped in cannellure.
D.	Permanent lead disc in segment shell, L.S. only.

* Some shells of very early manufacture have \uparrow only.

† Some E. O. C. shells re-loaded in Royal Laboratory, carry Laboratory marks on their coats.

‡ E. O. C. projectiles have the marks on apex.

|| R.L. do. do. do. on base.

Projectiles for Practice.

Projectiles for practice will be marked with a yellow band round the body to distinguish them from those for service.

GAS-CHECKS.

Gas-checks for Studded Projectiles.

For 9-in. to 12.5-in. there have been two patterns. Mark I. has been declared obsolete. Mark II is used with common

Ammunition.

shell and Palliser shot, 9-in. to 12·5-in., and shrapnel shell, 12·5-in. only. They differ from Mark I in having projections on their circumference to fit into the grooves of the gun, and are fixed to the base of the projectile by means of a gun-metal plug and wrought-iron nut, arranged so that the gas-check is free to revolve, and thus facilitate loading. The gas-checks for the 8-in. howitzer of 46 cwt. are Mark I, but have projections to fit into the grooves, and are fixed by means of a gun-metal plug with hexagonal head, therefore it is necessary to be careful that the projections are aligned with the studs on the projectile.

The gas-check for the 6·3-in. howitzer consists of a saucer-shaped piece of copper with projections to fit into the grooves, and perforated at the rim with a few holes. They have the concave surface to the rear, rotation being imparted to the shell by means of radial projections, which fit into corresponding grooves in the base. It is fixed by means of an hexagonal headed gun-metal plug.

Gas-checks Automatic.

These gas-checks are used with studless, R.M.L. projectiles of the following calibres: 17·72-in. to 9-in., 6·6-in. and 80-pr., also 6·6-in. and 8-in. of 70 cwt. howitzers. They extend completely over the base of the shell, and somewhat resemble soup plates, with rims or flanges, on which are projections to fit into the grooves of the gun.

A Mark II. has been approved, differing in having the projections to fit the grooves of the same thickness as the flange, by forming a recess behind each, thus ensuring equal expansion.

Ammunition.

§ 4,081 RIFLED M.L. PROJECTILES.

Use of "full" charges with.

The following particulars with regard to projectiles for R.M.L. guns, which are capable, or otherwise, of withstanding "full" charges, are published for general information.

Palliser projectiles for all natures of rifled M.L. guns may be fired with "full" charges.

The undermentioned shells may also be fired with "full" charges.

Gun.	Nature of Shell.	Studded or Studless.	Mark.	With or without Gas-check.	Remarks.
16-inch ... {	Common Shrapnel {	Studless	I.	With	
		"	I.	"	
		Studded	I.	"	
12·5-inch ... {	Common {	Studless	I.	"	
		Studded	I.	"	
	Shrapnel {	Studless	I.	"	
12-inch 35 ton {	Common {	"	I.	"	
	Shrapnel {	"	I.	"	
12-inch 25 ton {	Common {	"	I.	"	
	Shrapnel {	"	I.	"	
11-inch ... {	Common {	"	I.	"	
	Shrapnel {	"	I.	"	
10-inch ... {	Common {	"	I.	"	
	Shrapnel {	"	I.	"	
9-inch ... {	Common {	Studded	VI.	"	
		Studless	I.	"	
	Shrapnel {	"	I.	"	
8-inch ... {	Common {	Studded	I. to III.	Without	
	Common {	"	I. to V.	"	
7-inch ... {	Double {	"	I. to III.	"	

In addition to these, all studless shell, common and shrapnel, and all studded common shell, except those for the 12-inch 35 tons, Marks I. & II., may be fired with full charges if they have not been altered to take gas-checks. Shells so altered may be known by being marked with a (*) after the numeral.

Ammunition.

The "reduced" charge is the highest which may be used with any R.M.L. shells not specified above.

Case shot may be fired with either "full" or "reduced" charges.

Hence in action when firing shell not named above an officer would have to decide between changing from full to reduced charges with its certain evils or risking a shell breaking up in the bore.

Fuzes.

There are two descriptions of fuzes in the service, *Time* and *Percussion*.

FUZE-HOLE GAUGES OF SHELL, AND FUZES OF EACH GAUGE.

Gauge.	Shell.	Fuze.	
		Time.	Percussion.
Mortar	Large mortar, 13", 10", 8"	Large mortar ...	Pettman L.S.
Common	S.B. common (L.S.) and diaphragm shrapnel	Common, diaphragm small mortar ...	
General service	All rifled shells, except R.B.L. 6, 9 and 12 prs., segment and common	5, 9, 15, 20, 30 secs. M.L. 5, 9 secs. B.L. and 15 secs. with detonator, Armstrong's time and concussion, time and percussion short E time	R.L.; Pettman G.S.; Direct Action; Bolt; Small.
Armstrong field service	R.B.L. 6, 9, 12, & 20 prs., segment and common		B.L. Plain.

TIME OF BURNING.

The time of burning of the composition of the fuzes given in the following pages is correct when the fuze is burned at rest, and the barometric pressure is 30 inches.

TIME FUZES FOR R.M.L. ORDNANCE.

15-Seconds *M.L.*

This fuze has the composition channel in the centre, and is driven with a slow burning composition ($7\frac{1}{2}$ seconds per inch).

Ammunition.

There are six powder channels bored near to and parallel to the axis of the fuze, they are connected at the bottom by quick-match laid in a groove and pressed into the bottom of each channel. It is marked in half seconds and graduated to quarter seconds, the figures 2, 2.5 &c., are printed so that they may be read when the head of the fuze is towards the body of the person holding it, the figures are at one side of the side holes; and the side holes are accurately stamped and coloured yellow. This fuze is used with R.M.L. guns 10 inch and upwards with or without gas checks and R.M.L. guns under that calibre without gas checks.

15-Seconds M.L. Special priming.

This fuze differs only from the above in having an additional priming of gun-cotton passed twice round the head of the fuze over the ordinary quick-match priming and fastened with silk twist, leaving about $1\frac{1}{2}$ inch of each end of the gun-cotton loose; a patch of waterproof paper is pressed down over the priming, and a band of thin copper and tape wrapped round the whole and secured by shellac varnish.

The head of the fuze is painted red, and the loose end or tip of the copper band white.

This fuze is used with star shell.

15-Seconds with detonator (Mark III).

This fuze differs from the M.L. in having a detonating arrangement in the head; this is necessary in B.L. guns where there is no windage and also with R.M.L. guns 9-inch and under when using gas checks.

The safety pin should not be removed until the moment of loading.

N.B.—Mark I. and II. with detonator may be used up with 9-inch R.M.L., and the 5 and 9-secs. may be used up for ranges with which they would be suitable.

Ammunition.

FOR R.B.L. ORDNANCE.

These fuzes can be used for all shells having fuze holes of general service gauge, except that the 20 secs. cannot be used with shrapnel shell.

FOR S.B. ORDNANCE.

Diaphragm.

Are used for diaphragm shrapnel shells.

The length of fuze composition is one inch ; and it burns 5 seconds.

They are marked on two sides in half seconds, one side having the even, the other the odd numbers.

They are painted black and drab.

Common.

They are used with S.B. common shell, also with 12 and 24-pr. shell, fired at short ranges from the $4\frac{2}{5}$ and $5\frac{1}{2}$ -inch mortars.

They contain two inches of composition, and burn for 10 seconds.

They are marked similarly to the *diaphragm*.

They are painted black and drab.

Mortar, Large,

Are used with 8, 10, and 13-inch mortar shells.

The length of the composition is six inches, and it burns 30 seconds.

The fuzes are marked with five divisions to the inch in a spiral direction round the outside, the figures referring to the length of composition, but by the addition of a cipher will refer to the general half-second unit ; the marking commences at two inches.

No hole is bored at the marks, they being merely indentations.

They are painted drab colour.

Mortar, Small.

Are used with the $5\frac{1}{2}$ and $4\frac{2}{5}$ -inch mortars at long ranges.

Ammunition.

They contain three inches of fuze composition, and burn 15 seconds.

They are marked and constructed similarly to the large mortar fuze, therefore the intervals between the holes correspond to one second of time in burning; the marking commences at one inch.

They are also painted drab.

10-inch Parachute Light Fuze

Has 3 inches of fuze composition, burning 15 seconds. Its marking is different to the service fuzes, thus 6 on it means 6 seconds.

8-inch Parachute Light Fuze

Has 2 inches of slow-burning composition, and burns 13 seconds. These two fuzes on emergency might be used with S.B. common shell.

5½-inch Parachute Light Fuze

Has 1½-inch slow composition, burns 10 seconds. Too small for use with S.B. common shell.

The parachute fuzes are painted blue, and have been up to the present time issued 50 in a cylinder.

Hand Grenade.

Used with a 3 or 6-pr. hand grenade; burns 7½ seconds: they are placed in the grenade, uncapped, and lighted by a portfire. 1,200 in a half metal lined case.

PERCUSSION FUZES.

A percussion fuze is one that depends upon impact or graze for its action.

Pettman L.S.

Can be used with all S.B. common shells tapped to receive it: such shell will be known by a cross engraved on the plug. It is

Ammunition.

made of gun metal, is conical in form, and has a screw turned on its body. Above the screwed part is a plain projecting shoulder, upon which the fuze rests when screwed home.

It will not act on graze, but only on striking some resisting substance, such as the parapet of an earthwork, or the side of a ship.

FOR RIFLED ORDNANCE.

Pettman, G.S.

Is made of gun-metal and threaded on the exterior to the G.S. gauge.

This fuze will not act on graze, neither will it act when fired with reduced charges.

It is at present used in 12-in. 35-ton and upwards with full charges, or when the gun is loaded by hydraulic rammer.

DIRECT ACTION.*

For use with the following guns :—

B.L.

10-in. ; 9·2-in. ; 8-in. and 6-in. (of all marks).

R.B.L.

7-in.

R.M.L.

12-in. of 25 tons ; 11-in. ; 10·4-in. ; 10-in. ; 9-in. ; 8-in. ; 7-in. ; 80-pr. ; 64-pr. ; 6·6-in. ; and with 8-in. ; 6·6-in. ; and 6·3-in. Howitzers.

It acts equally well with high and low charges.

It is prepared by the removal of the metal cap ; this should not be removed until the shell in the bore of an M.L. gun, or is about to be entered into a B.L. gun.

The fuze acts on direct impact, and on graze only when the angle of descent is not less than 10°.

* When practice is carried out over land ranges or sands where any blind shells are liable to be left exposed by the tide, R.L. fuzes are to be used with 80-pr., 6·6-inch and 64-pr. guns instead of direct action fuze.

Ammunition.

Great care must be taken to see that nothing shall press on the diaphragm in the head of the fuze after it has been uncapped. Especially in the case of the 6·6-in. gun and howitzer, and the 6·3-in. howitzer, of which the rammer heads are not recessed.

Not to be used in guns loaded by the hydraulic rammer.

Bolt Percussion.

This fuze is made of gun-metal and was introduced for use with B.L. and R.M.L. guns. It will act on graze or impact.

R.L. Percussion II.

This fuze is used with the 40-pr. R.B.L.

FUZE TIME AND CONCUSSION.*Medium.*

The body of the fuze is made of soft metal and the other parts are of gun-metal. In the upper part of the fuze is the time arrangement, and a ring of fuze composition in the body covered by a movable metal collar and clamping nut. Round the exterior it is graduated in inches and tenths of inches up to five inches.

The concussion arrangement is contained in the lower part of the fuze, and is similar to what is generally known as percussion.

It is used with all B.L. guns.

FUZE TIME AND PERCUSSION.*Short.*

Is made of gun-metal. The lower part is screwed to G.S. gauge and contains the percussion arrangement; the upper part contains the time arrangement and consists of a collar of phosphor bronze, in which is placed a ring of burning composition and to the upper part of this collar is attached the igniting

arrangement ; over the collar is a dome of metal held in place by a cap which screws on to the top of a spindle ; in the top of this cap are four fire holes for the escape of gas.

The collar of phosphor bronze is marked on the exterior to show the time of burning in half seconds, and there are intermediate graduations corresponding to quarter seconds. The fuze is provided with two safety pins ; the upper pin, which passes through the dome, restrains the action of the time arrangement ; the lower pin, which passes through the cylindrical portion of the body, restrains the action of the percussion arrangement.

Means of Firing Ordnance.

COPPER FRICTION TUBES.

There are three natures, .2 inch diameter :—

The special friction tube (about 2 inches long) for the 7-pr.

The long friction tube (about 5 inches long) for 7-inch R.M.L. guns and upwards.

The short friction tube (about 3 inches long) for all other ordnance.

Tubes Vent Sealing.

For guns having axial vents, vent sealing tubes are employed. They may be divided into four classes each of two kinds.

Tubes vent sealing.	{ Electric P. Percussion.	{ For guns with percussion locks.
	{ Electric M. Friction M.	
	{ Electric V. Friction V.	{ For guns with vent heads.
	{ Electrical. Mechanical.	
Primers vent sealing	{	{ For 80-pr. B.L. only.

The percussion tubes and mechanical primers are fired by means of a percussion hammer attached to the gun ; the friction

Ammunition.

tubes by lanyards with hook to fit into the eye on the end of the wire; electrical tubes by means of any battery suitable for low tension.

PORTFIRES.*Common*

Burn at the rate of about one inch in 5 seconds.

The readiest way to extinguish a portfire is by a sharp, sudden jerk. When put out in this way, the burnt end should be cut off, otherwise difficulty will be experienced in re-lighting it.

MATCH.*Quick*

Is made of cotton wick boiled with a solution of meal powder and gum in about the following proportions:—2 lbs. wick, 20 lbs. meal powder,* 9 oz. gum arabic, 9 pints of water.

Unenclosed it burns at the rate of about 1 yard in 13 seconds; when enclosed in a tube of any kind, it burns much more rapidly, being as instantaneous as a train of gunpowder, the pressure causing the gas to rush forward and fire the mass explosively. Quick-match is made up in paper or calico tubes when this rapid action is required, and when so made up is termed a "leader."

The proportions of powder, &c., will vary with the number of threads in the wick; those given above are for six-thread wick. Quick match is demanded by weight; 1 lb. of six-thread match would be about 360 feet long. Quick-match is largely used for priming fuzes, &c.

Issue. Either in long packing or in metal-lined cases, and should be demanded by weight.

Slow.

Is made of pure hemp, slightly twisted and boiled in a ley of water and wood ashes in the proportion of water 50 gallons, wood, ashes one bushel; this serves for 100 lbs. of yarn. It burns at the rate of one yard in eight hours; it is used for lighting port-

* A portion of the powder is kept dry, and dusted over the quick-match.

Ammunition.

fires, &c. Slow match may be equally well made by boiling in a solution of 8 oz. saltpetre to one gallon of water.

PRIMERS FOR VENT PIECES OF R.B.L. GUNS

Are used with the 7-inch and 40-pr. R.B.L. guns, and consist of a cylinder of leather paper, driven like a tube, with three strips of red worsted attached to the exterior.

To prime, the primer is pressed into the vent, worsted end first.

TIN CUPS.

To prevent, as far as possible, the escape of gas on discharge in R.B.L. guns, tin cups are issued as under :—

For the 7-inch and	{	With service, practice, and exercise ammunition.
40-pr. side closing		
" 40-pr.	{	With practice ammunition.
" 12-pr.		
" 9-pr.		
" 6-pr.		

Each cup may be used until it loses its shape.

They are placed against the cartridge with the edge to the front. A small extractor hook is provided, by which to withdraw them after firing.

WADS.*Grummet.*

Grummet wads are used with all S.B. guns when firing at angles of depression, or at angles of elevation less than 3°. They are placed over the shot, and thus prevent it from running out. The cross pieces should be towards the muzzle when rammed home.

Grummet wads are supplied on special demand for use when firing rifled projectiles at angles of depression.

Ammunition.

Wedge.

Wedge wads. Two sizes of wedge wads are issued. They both consist of two wooden wedges connected by a piece of cane.

In the larger wad the length of cane is 7·5 inches, and length of wedge 7 inches. It is for use with 9-inch guns and upwards.

In the smaller wad the length of cane is 6·5 inches, and the wedge 5·5 inches long. It is for use for 64-pr., 80-pr., and 7-inch guns.

These wads are to be rammed home separately after the projectiles. Their use is to prevent the projectile from shifting when running the gun up.

NOMENCLATURE OF ARTILLERY MAGAZINES, STORES, &c.

"Magazine."—Building or buildings with passages leading thereto, in which powder in bulk, filled cartridges, or shells are stored.

"Shifting Room" or "Shifting Lobby."—The chamber or portion of the entrance passage devoted to putting on or taking off magazine or laboratory clothing.

"Ammunition Entrance."—The entrance to the magazine for ammunition only.

"Magazine Store."—A chamber within a magazine (if provided) in which the hides, wadmiltits, and spare magazine clothing may be kept.

"Cartridge" or "Shell Store."—A chamber in which filled cartridges or filled shell are stored.

"Powder" or "Shell Passage."—A passage along which powder in cartridges or in bulk or shell are transported.

"Ammunition Passage."—A passage along which both natures of ammunition are transported.

"Lamp Passage."—A passage by which access is gained to the lamp recesses.

(a.m.¹)

H

Ammunition.

"Cartridge" or "Shell Serving Room."—A chamber on the same level as the gun into which the cartridge or shell lifts lead, and from which the service of cartridges or shell is conducted.

"Cartridge or Shell Recess."—A small receptacle for the storage of a few cartridges or shell for the immediate service of a gun.

"Receiving Hatch."—An opening in the door or wall of a cartridge or shell-filling room, through which empty shell or powder in bulk is passed.

"Cartridge" or "Shell Issuer."—A hatch in a door, or opening in a wall, through which cartridges or shell are passed.

"Cartridge" or "Shell Lift."—The lift up which cartridges or shell are hoisted.

"Artillery General Store."—A store for the reception of the spare gun stores of all natures.

"Artillery Store."—A store in a battery for the reception of the sights, elevating arcs, and other stores belonging to the guns and required for their immediate service.

"Laboratory."—A building or buildings with passages leading thereto in which ammunition is examined, cartridges made up, and shells filled.

"Cartridge" or "Shell Filling Room."—A chamber in a laboratory in which cartridges are made up and shells filled.

Regulations to be observed in Making Up Cartridges, Filling Shells, and Examining Ammunition in Laboratories in Artillery Charge are to be found hung up in the entrance of every Laboratory or Magazine, and in Equipment Regulations.

Instructions for reclosing Tin Cylinders containing Explosives. (See A.C., Clause 102, 1885.)

Ammunition.

Instructions for the Preparation of Shells and Fuzes.**I. FILLING AND SECURING SHELLS.**

All shells should be scraped clean, both internally and externally, before filling.

SMOOTH BORE ORDNANCE.*Shells, Spherical, S.B., Common.*

Remove the plug from the fuze-hole by means of the key; insert the funnel and pour in the bursting-charge; carefully wipe every portion of powder from the fuze-hole, and drive in a papier-mâché wad with the drift as far as the shoulder on the drift will allow; then screw in the fuze-hole plug, or fuze, as required.

Shells, Spherical, S.B. Diaphragm Shrapnel, Boxer.

Remove the plug from the loading-hole by means of a screw-driver; hold the shell in a position with the loading-hole uppermost; insert the funnel and pour in the bursting-charge; turn the shell from side to side to facilitate the filling; carefully wipe every portion of powder from the loading-hole, and drive in a papier mâché wad with the drift as far as the shoulder on the drift will allow, and screw in a plug; unscrew the fuze-hole plug, to which is attached a wood plug covered with serge (to prevent the bursting powder from passing into the socket in sufficient quantity to cause inconvenience in fixing the fuze); and in order to insure the small hole communicating with the powder-chamber being clear, shake a few grains of powder from the powder-chamber into the socket; then replace the fuze-hole plug.

Shells, Spherical, S.B., Mortar.

Mortar shells are only filled when required for firing. Remove the cork from the fuze-hole, ~~except in the case of the 10 and 13-~~
(a.m.)

H 2

Ammunition.

inch, when it may be driven in; insert the funnel and pour in the bursting charge, and insert the fuze as described under head of "Preparing Fuzes."

III. FIXING GAS-CHECKS.

1. *Projectiles fitted with plug and nut.*

Unscrew the nut and remove then apply the "Wrench removing base plugs" to the gas-check plug, and screw it well up in the direction of the arrow,* to ensure its being well home.

If, when unscrewing the nut, there is any tendency for the plug to unscrew also, the "Wrench, removing, plug," should be at once applied to the head of the plug and turned in the direction of the arrow, at the same time as the nut is being turned in the opposite direction.

Place the gas-check on the base of the projectile, with the concave or unpainted side next the base, then screw the nut on to the end of the plug with the "Spanner, gas-check nut." With Mark II., gas-check, plug and nut, the nut will be screwed down to the shoulder on the plug.

2. *Projectiles fitted with plug with hexagonal head.*

Unscrew the plug and remove it.

Place the gas-check on the base of the projectile with the concave or unpainted side next the base (the saucer-shaped gas-checks for 6.3-inch howitzer with the concave surface to the rear), insert the plug and screw it well home with the spanner until it binds against the gas-check.

With gas-checks having projections for studded projec-

* The heads of the gas-check plugs, and the wrought-iron nuts, will each be stamped with an arrow to show the direction in which to turn, either when screwing in the gas-check plug, or when screwing on the wrought-iron nut.

Ammunition.

tiles, see that the projections are in the line of the studs before screwing the plug home ; with the 6.3-inch howitzer shells see that the radial projections on the gas-checks fit into the corresponding grooves in the base before screwing the plug home.

3. Projectiles fitted for "Gas-checks, automatic."

These gas checks become fixed to the projectile when the gun is fired ; when it is required to attach the gas-check before loading, place it on the base, and strike it with a pointed hammer or chisel so as to make an indent at two or three points in that part which surrounds the neck of the projecting base of the projectile. They are however as a rule loaded separately.

III.—FILLING SHELLS.*

1. *Shells, Common and Double, R.M.L., Studded, 7-inch and upwards, and B.L. 6-inch 80-pr.*

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 ; pass the filling-rod down through the funnel and gradually pour in two or three pounds of powder ; take out the funnel and rod, lift up the bag and jerk it, so as to "set" the powder well down to the bottom and to open the bag. Then re-insert the funnel and rod as before and continue the filling.

The filling-rod should be moved up and down to facilitate

* All shells before being filled should have the fuze-holes and interior thoroughly examined to ascertain that they are dry and clean.

Ammunition.

the passage of the powder through the funnel ; the powder should be firmly pressed upon all over, and the rod should not be forced against the bag ; a steady pressure is necessary to fill the shell, and this should be frequently applied ; no great amount of force should be used.

When the shell is quite full, withdraw the funnel and filling-rod and tie the neck of the bag with twine close to the top of the fuze-hole. A piece of twine is attached to the neck of the bag for this purpose, it must be shifted to its proper position if necessary. Cut off the superfluous choke and push the neck of the bag well down, and to one side of the fuze-hole ; insert in every shell one "Bag, shalloon primer, seven drams F.G.," or more if there is room, then screw in the fuze or plug as required, taking care that the fuze-hole is clean and the fuze or plug lubricated.

2. *Shells, Common R.M.L. Studless 6-6-inch gun and upwards, and Common and Double B.L. 6-inch and upwards.*

These shell are filled from the base. Place the shell upon its point which may be inserted in a block of wood hollowed out for the purpose, or in any other convenient place. If the shell, immediately after filling, is to be used with a wood time-fuze, insert an unserviceable M.L. wood time-fuze, or a piece of wood of the same size in the fuze-hole before filling ; if not, the fuze-hole plug will be sufficient.

After standing the shell upon its point pass the holder, shell, "B.L." or "studless" of the size required over the base, and screw up the bolt, then hold the handles firmly while another man unscrews the base plug with the "Wrench, removing base plugs." Now drop in three "Bags, shalloon primer, seven drams F.G." (The 17-72-inch shells take one "Bag, shalloon primer, 10 oz."). Place the brass filling rod inside the bag and insert it in the shell, taking care not to push the rod through the bag,

Ammunition.

withdraw the rod, insert the copper funnel, and complete the filling, see p. 101.

The B.L. 80-pr. common and double shells are filled through the fuze-hole in the same manner as the heavy studded shell. B.L. shells, fitted with copper rotating rings extending round the base, must on no account be violently rocked about on their bases so as to injure the ring.

3. *Shells, Common and Double, R.M.L., 80-pr. and under,
B.L. 5-inch and under, and all Howitzers.*

Remove the plug from the fuze-hole, insert the leather funnel and pour in the bursting charge; the shell should be tapped with a mallet or a piece of wood to ensure its being completely filled, just leaving room for the fuze if it is to be fuzed with a time-fuze; this can be done by inserting a piece of wood the same size as the fuze; after filling the shell carefully wipe every portion of powder from the fuze-hole, then fix the fuze or plug, as may be required.

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

4. *Filling shells, common and double, with P. powder,
and powder of fine grain.*

Bursting charges of common and double shells for

1. Rifled ordnance for sea service generally,
2. " " for siege train,
3. " " B.L. (interrupted screw type) for land service,

will consist of P. powder, with so much of a fine grain powder as will fill up the interstices between the pebbles. F.G. pistol,

Ammunition.

R.F.G., R.F.G.² or service L.G. powders will be employed for this latter purpose according to convenience of store, but the last-mentioned nature only in cases of emergency.

Shells without bags are filled as follows :—

Weigh out the proportions of P. and fine grained powder as laid down below, and drop the P. powder into the shell pebble by pebble, then insert the funnel and pour in the quantity of fine-grained powder laid down. The shell should be tapped on the exterior with a wooden mallet to assist the latter powder in filling up the interstices between the pebbles. The operation must be repeated until the shell is completely filled, when the G.S. wad will be inserted shalloon side downward and the fuze-hole plug screwed in.

Shells with bags are filled as follows :—

These shells are sometimes filled through the base and sometimes through the fuze hole ; in the former case the shalloon primers are dropped in before the bag is inserted ; in the latter, one or more shalloon primers are inserted in the shell after the bag is filled and tied up. The bag having been inserted in the shell, and the proportions of P. and fine-grained powders as laid down below weighed out, one portion of the former is dropped into the shell pebble by pebble, after which the copper funnel is inserted, and the proportion of fine-grained powder poured in. The whole is then lightly stirred and pressed with the filling rod, and the operation repeated until the shell is filled. The neck of the bag is then tied up and cut off, and the plug inserted.

NATURES.

PROPORTIONS.

17·72-inch and 16-inch R.M.L.	about 8 lb. P. then 20 oz. F.G.
12·5-inch to 11-inch R.M.L.	
and B.L.	” 5 lb. P. ” 12 oz. F.G.
10-inch to 8-inch R.M.L. and B.L.	” 4 lb. P. ” 10 oz. F.G.
6-inch B.L.	” 2 lb. P. ” 8 oz. F.G.

Ammunition.

7-in to 6·3-inch R.M.L.

and R.B.L., and 80-pr. B.L....	about 2 lb. P. then 5 oz. F.G.
40-pr. R.B.L.	1 lb. P. " 4 oz. F.G.
5-inch B.L., 40-pr. R.M.L. and	} Fill with P. and then fill up the interstices with F.G.
smaller natures, and 20-pr. R.B.L.	

All shells filled with bursting charges of this description will have the letter P. stencilled on them in addition to any other markings.

5. *Shells, Shrapnel.*

Remove the plug from the fuze-hole, and after seeing that the fuze-hole is clear of any dirt, &c., insert the leather funnel and pour in the bursting-charge, which has been previously weighed out or measured. This must be done gradually, for if the whole of the powder is put in at once the tube will probably become choked. 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 metal primer and, by means of the large diaphragm Shrapnel screwdriver, screw it tightly into the tube, and then screw in the fuze or plug as may be required.

The B.L. 80-pr. and the 2·5-in R.M.L. have the E.O.C. type of shrapnel, having the bursting charge in the head.

For the 80-pr. B.L. an empty shalloon bag is issued. To fill the shell, unscrew the plug, clean it and the thread in the fuze hole, and having ascertained that the interior of the shell is clean, and that both it and the shalloon bag are quite dry, insert the latter flat side downwards with the neck protruding from the fuze hole, and by means of the "funnel, leather, large" pour in the bursting charge (which is always to consist of service L.G. powder). Withdraw the funnel and tie up the neck of the bag as close to the shell as possible. Cut off the superfluous end, push the choke to one side of the fuze hole, and return the plug.

Ammunition.

6. *Shells, Star.*

These shells do not require to be filled—they are ready for the insertion of the fuze when the plug is removed.

7. *Shells, Common, and Segment, R.B.L.*

The R.B.L. 7-inch common and segment, the 40-pr. segment will be filled as directed for the smaller natures of common shells. The 40-pr. common will be filled as described at p. 101.

IV.—FIXING PLUGS AND FUZES, AND SECURING SHELLS.

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.

Filled B.L. common and Palliser shell loaded through the base have the projection on the "disc lead small" (except the 80-pr., which take the "disc, lead, large"), inserted in the hole in the base plug, and the disc hammered flat in the recess provided for it, and painted over with black paint.

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

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

Ammunition.

V.—DISTINGUISHING MARKS.

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

All steel shot or shell will have a white band painted round the head, in the case of shrapnel this band will be immediately below the red tip. C.S. will be stamped on the base of cast steel and F.S. on the base of forged steel projectiles.

All filled shell will have a red band painted round the head, in the case of steel shell this band will be below the white band; they will also be marked with the date of filling, and at stations where means are available the monogram is to be painted on the shell. Filled common or double shell will be marked with the word "Bag," if a bag is used, and with a red disc 1-inch diameter if shalloon primers have been inserted, and with the letter P if filled with P and fine grain mixture.

The colour of the paint will be red on a black ground or black on a red ground.

Palliser shot (formerly shell) which have been weighed up with sand (§5,033) will have the letter W stencilled in white on the head, and also stamped on the base plug.

Projectiles which are to be used for practice only will be marked with a yellow band.

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

VI.—STORAGE OF FILLED SHELLS IN CHARGE OF THE ROYAL ARTILLERY.*1. When fitted for gas-checks.*

Filled shells will have the gas-checks, if attached by plug, fitted before being placed in the shell store. The automatic gas-check is not attached to the shell.

Ammunition.

In storing filled shell (7-inch R.M.L. and upwards), they are to be placed on their bases, resting on the gas-check plugs and prevented from falling over by two pieces of wood, 9" x 1 1/2" square placed one on each side of the nut.

2. *When not fitted for gas-checks.*

Filled shells for 7-inch guns and upwards (except 7-inch R.B.L.) will be placed upright on their bases in the shell store.

Filled shells 7-inch R.B.L. will be piled, except those having flat bases, which may be placed upright where store room is available.

Filled shell of less than 7-inch calibre will be piled.

VII.—PREPARING FUZES.

1. *Fuzes, Time, Wood, Boxer.*

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

Ammunition.

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. With the 30-seconds fuze, a gimlet borer must be used.

2. *Land Service Only.*

When using the gimlet borer, hold the fuze in the hollow of the hand, insert the borer into the side hole, pressing it in perpendicular to the axis of the fuze ; when it has reached the bottom of the hole, use it as a gimlet to complete the communication with the composition, boring up to the handle ; then pull the borer straight out.

3. *Fuzes, Time and Concussion, Armstrong.*

These fuzes consist externally of two parts—which are packed separately—the fuze proper, and the thimble by which it is ignited.

Each fuze is provided with a metal nut which clamps a metal collar on to the cylindrical portion (the body) of the fuze, which is of white metal ; round this latter is marked the scale in inches and tenths, and in it is a hole for the key used to screw the fuze into the shell, or remove it.

The shell is fuzed as follows :—

- (a) The fuze, without the thimble, is tightly screwed into the fuze-hole by means of the “key, fuze, Armstrong’s, time and concussion” before the shell is brought to the gun.
- (b) The metal nut is unscrewed a little by hand or key, to loosen the metal collar, which is turned until the arrow-head on it is opposite the desired mark on the scale.

Ammunition.

- (c) The nut is now tightened to keep the collar in this position..
- (d) The thimble *must not* be screwed into the top of the fuze until the moment of loading.

All the screws above mentioned are right-handed.

4. *Fuze, Time, and Percussion, Short.*

The "Key fuze, Armstrong, time and concussion," Mark IIL, or "key, fuze, universal," is used with this fuze, which is set after it is fixed in the shell.

To Fix the Fuze.

Insert the point on the hemispherical arm of the key in the small hole in the circumference of the body of the fuze, and screw the latter tightly into the G.S. fuze hole.

To Prepare it as a Time Fuze.

Loosen the hexagonal cap on the top of the time fuze by means of the slot in one of the arms of the key, which will fit over it, and then turn the dome and collar of the fuze together until the required graduation on the collar coincides with the arrow-head on the body, and tighten the cap. This should be done *before the removal of the upper safety pin.*

Withdrawing Safety Pins.

If required to act as a time and percussion fuze, withdraw both safety pins just before inserting the shell in a B.L. gun; if the percussion arrangement is not required to act, the lower safety pin should be left in; if the fuze is required to act as a *percussion one only*, the upper safety pin should *not* be removed, and the arrow-head should be set midway between the zero and the 18 on the ungraduated part of the collar. If the fuze is not fired the safety pins must be replaced.

Ammunition.

5. Fuze, Percussion, Bolt.

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, universal.

6. Fuzes, Percussion, Pettman, G.S.

The fuzes require no preparation ; they are simply screwed firmly into the fuze-hole by means of the "Key, iron, fuze and plug, G.S." In the case of shells filled for the navy, and fitted with this fuze, the wad with loop, *see* § 2370, C in W.S., will be placed over the fuze.

7. 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, iron, plug, G.S."

With breech-loading guns the safety-pin will not be withdrawn until just before entering the shell into the breech.

With muzzle-loading guns the safety-pin will not be withdrawn until after entering the shell into the muzzle.

8. Fuzes, Percussion, Direct-Action.

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

With B.L. and R.B.L. guns the cap will not be removed until just before entering the shell into the breech.

Ammunition.

With R.M.L. guns the cap will not be removed until after entering the shell into the muzzle.

9. *Fuzes, Time, Wood ; with Detonator, and Boxer, Breech-Loading.*

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.

With B.L. and R.B.L. guns the safety-pin will not be withdrawn until just before entering the shell into the breech.

With R.M.L. guns the safety-pins will not be withdrawn until after entering the shell into the muzzle.

10. *Fuzes, Time, Wood, Boxer, Muzzle-Loading.*

These fuzes are fixed in the fuze hole by screwing the fuze round by hand until it is firmly held in the fuze-hole, or by giving the head of the fuze two or three smart taps with a mallet, or suitable piece of wood, or (with the smaller natures of shell) by striking them against the gun-carriage or boat's thwart, if more convenient ; this operation should be performed fairly, and not so as to split or injure the top of the fuze ; the fuze must not be uncapped until the shell is placed in the muzzle of the gun. These fuzes are "uncapped" by taking hold of the small end of the copper band, which is left exposed, and unwinding from left to right smartly so as to thoroughly detach the band from the head of the fuze and to leave the priming fully exposed.

11. *Wad, Papier-mâché, in Fuze Hole.*

When fixing fuzes in shells having a wad in the fuze-hole, or in the bottom of the socket of R.B.L. common shells, 20-pr. land service, 12-pr. and 9-pr., it is not necessary to remove the wad, as the explosion of the fuze is sufficient to force it into the

Ammunition.

shell, if using percussion fuzes ; and if using wood time fuzes, the wad is driven into the shell in the operation of fixing the fuze.

VIII.—EXTRACTING WOOD FUZES.*Fuzes, for Rifled Ordnance.*

Apply the fuze extractor to the head of the fuze and unscrew ; if the adapter which is in the fuze-hole of some R.B.L. shells should also be unscrewed, do not remove the fuze from it by striking it on the end, as a blow in that direction may weaken or break the wire that suspends the hammer.

Section I. Mountings for Garrison Service.

PART III.—MOUNTINGS FOR GARRISON SERVICE.

SECTION I.—WOOD STANDING CARRIAGES.

The following wood standing carriages are in the service for rifled guns :—

Nature.	Weight.	§ List of Changes.
	cwts. qrs.	
40-pr. R.B.L. 	13 3	
" " (converted naval non-recoil)	23 1	{ 1092
64-pr. 71 cwt. B.M.L. 	8 3	{ 1248
" 58 " " 	14 3	3092
" " " " (depression) ..	16 0	3113
		2706

A standing carriage consists of two brackets and a transom of oak or teak, two axletrees of oak and four trucks of cast-iron. (The trucks of the carriage for the 64-pr. 71 cwt. are of elm).

Elevating Gear.

A vertical elevating screw works in a metal nut bolted to the rear axletree. The rear end of a wrought-iron stoolbed, the front end of which is pivoted between the carriage brackets, rests on the head of the screw. The breech of the gun is sup-

Mountings for Garrison Service.

Section II.

ported on coins of sabicu, which rest on the stoolbed. The elevating screw is distinguished as the "ratchet head and lever," it has a ratchet head, above which a ratchet collar is attached by a bolt to a ring placed round the screw, and secured to it by a pin working in a groove. The ratchet collar underneath, at the side opposite to that at which it is attached to the ring, has four teeth, and projecting from it at the same side an arm, on which a lever handle fits. When the lever handle is raised the teeth of the collar clear the ratchet head, and the lever can be turned so as to obtain a fresh purchase.

Allen's Brake.

Allen's brake is fitted to the carriage for the 64-pr. 58 cwt. R.M.L. It consists on each side of a wood wedge iron shod, which is suspended from the side of the carriage by jointed bars, in rear of the front truck, in such a manner that in recoil it jams itself under the truck.

Depression Carriages.

Depression carriages are used with guns mounted at great elevation. The front part of the brackets is sloped away, they are fitted with capsquares, and with a moveable block across the rear steps in which the elevating screw is held.

The converted non-recoil carriage for the R.B.L. 40-pr. differ from the ordinary standing carriage in the shape of the brackets.

SECTION II.—WROUGHT-IRON STANDING CARRIAGES.

The following two wrought-iron standing carriages are in the service :—

(a.m.¹)

I 2—

PART III.**Section III, Mountings for Garrison Service.**

No.	Nature.	Weight.	§ in List of Changes.
		cwts. qrs.	
No. 1	R.M.L., 64 pr., 64 cwt.	17 1	1474
		17 1	1474
No. 2	R.B.L., 40-pr.	17 1	1474
		17 1	1474

The carriage consists of two skeleton brackets connected by axletrees and transom bolts. The trucks are of elm metal bushed and shod with iron.

Cast iron trucks are issued to replace the wood trucks, when not in use, to protect the latter from the effects of climate.

The carriage is fitted with an elevating screw of the ratchet head and lever pattern.

SECTION III.—HOWITZER AND MORTAR BEDS.

The following howitzer and mortar beds are in the service :—

Nature.	Weight.	§ List of Changes.
	cwts. qrs.	
R.M.L., 6'3" and 6'6" { bed	23 1	} 3506
howitzer { guide bar	8 0	
R.M.L., 8" howitzer, { bed	24 3	} 3130
46 cwt. { guide bar	8 1	
Mortar Beds—		
13" cast iron bed	32 3	—
10" "	17 3	—
8" "	8 3	—
5½" wood bed.. ..	1 0	—
4½" "	0 3	—

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The howitzer beds are generally similar in form, each consists of two double plate brackets, connected by a bottom plate and two transoms, and supported on six metal rollers. For use the bed is placed on a platform of oak, over a long directing bar, which is pivoted to the front of the platform.

The bed is fitted with a friction compressor to check the recoil. Two compressor bars are suspended on pins on each side of the directing bar, so that they are able to move slightly either towards the bar or away from it. Three compressor plates are suspended on each side from the bed, and hang on each side of the bars. Over the compressor plates in the bed lies a wrought-iron cramp, through holes in the arms of which pass two screw shafts. The inner ends of these shafts abut against the outer plates, and their outer ends pass through the brackets of the bed, and have lever handles fitted on them. By turning these handles the screw can be made to press against the plates, and the plates made to grip the bars.

Elevating Gear.

The elevating gear is the worm wheel with friction cone, see page 124, fitted on the right side. The same bed will suit either the 6'3-inch or 6'6-inch howitzer; but the elevating gear is slightly different in each case. For the 6'3-inch howitzer there are three pinions and one friction roller, and in the 6'6-inch one pinion and two friction rollers. The arcs of the two howitzers are also different.

Mortar Beds.

Mortar beds are either made of cast-iron, with wrought-iron capsquares, or in the case of wood beds, of blocks of African oak, teak or sabicu bolted together.

The naval beds traverse on a central pivot over an octagon deck of wood, which is supported on buffers of india-rubber. For L.S. these beds are mounted with their octagon decks on wooden ground platforms.

SECTION IV.—MEDIUM SLIDING CARRIAGES AND PLATFORMS.

Certain carriages and platforms have been for purposes of nomenclature, placed in the priced vocabulary of stores in a numbered series under the heading of "Medium."

These carriages and platforms are as follows:—

All wood sliding carriages and platforms for rifled guns.

Iron carriages for wood platforms.

The following iron carriages and platforms.

7" R.B.L.

40-pr. "

64-pr. R.M.L. for 5 feet 6 inches and 6 feet parapet.

7" 6½ tons for 6 feet parapet.

32-pr. S.B., B.L.

SUB-SECTION I.—WOOD SLIDING CARRIAGES AND PLATFORMS.

Nature.	Weight.		\$ List of Changes.
	Casemate.	Dwarf.	
	cwts. qrs.	cwts. qrs.	\$
7' R.B.L., 82 cwt. { carriage ...	15 0	15 2	416
{ platform ...	27 0	37 0	346
7" R.B.L., 72 cwt. { carriage ...	14 2	15 0	1202
{ platform ...	18 3	37 0	613
40-pr. R.B.L. { carriage ...	10 2	11 2	and
{ platform ...	27 0	34 0	4484
80-pr. R.M.L. { carriage ...	15 1	15 3	4632
{ platform ...	27 0	37 0	and
{ platform 6 ft. parapet ...	—	53 0	4485
64-pr. R.M.L., 71 cwt. { carriage ...	—	14 3	3576
{ platform ...	—	37 0	and
{ ditto for 6 ft. parapet ...	—	53 0	4486
64-pr. R.M.L., 58 cwt. { carriage ...	11 0	14 0	4722
{ platform ...	27 0	37 0	3576
{ ditto for 6 ft. parapet ...	—	53 0	4485

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Sliding carriages, both casemate and dwarf, which only differ in the height of the brackets, are similar to standing carriages, but have the axletrees replaced by sliding blocks of sabicu which take the bearing on the platform.

A metal roller is fitted at the front of each bracket, and there are fittings to take a roller handspike in running up at the rear.

The elevating gear is similar to that on the standing carriage but the screw works in an oscillating nut.

The casemate carriage for the R.B.L. of 72 cwt. is converted from a naval carriage and is fitted with the side plate compressor.

There are four natures of platforms for wood sliding carriages, viz., casemate, dwarf fitted with pivot plate, dwarf without pivot plate and blocked up.

The casemate platform, medium, No. 14, will take all nature of casemate carriages.

It consists of two sides connected by three transoms and a head block of teak and is supported on four trucks of wrought-iron.

The trucks run on axles resting in flanged feet secured each by one vertical bolt to the side. The front rollers are made each in one piece with its axle, and the front flanges are fitted with two small plates of iron, under the axle bearings which pivot on studs.

The dwarf platform without pivot plate, medium, No. 17, is suitable for the R.B.L. 40-pr., and for other rifled guns, in emplacements with A or B pivots. The upper part or frame of the platform is the same as that of the casemate platform, which can be converted to it, by removing the front trucks with their flanged feet, placing the rear trucks and flanged feet in front, and fresh trucks and flanges with longer vertical bolts in rear; a rear block being placed between the new trucks and the sides.

The dwarf platform with pivot plate, medium, No. 16, is

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suitable for the R.B.L., 7" and R.M.L. 80-pr. and 64-pr. It is similar to the preceding, but is fitted with a plate with four holes for C, D, E, or F. pivots.

The blocked up platform, medium, No. 18, is at present approved for the R.M.L. 80-pr. and 64-pr. 71 and 58 cwt. It is similar to the preceding but is fitted with teak blocks between the trucks and side, so as to be suitable for a parapet 6 feet high.

SUB-SECTION II.—IRON CARRIAGES FOR WOOD PLATFORMS.

Nature.			Med. No.	Weight.	\$ List of Changes.
			No.	cwts. qrs.	\$
7" R.B.L.	{ 82 cwt. carriage 13' 2" platforms	{ ... 4' 3" parapet... 3' 6" "	2	23 3	} 4210
			11	44 0	
			12	34 3	
7" R.B.L.	{ carriage ... 11' platform	{ ... 3' 6" "	3	—	} 4209
			13	30 3	
64-pr. R.M.L.	{ 71 cwt. carriage 13' 2" platform	{ ... 4' 3" 3' 6" "	10	23 0	4615
			11	44 0	4212
			12	34 3	4210
64-pr. R.M.L.	{ 71 cwt. carriage 11' platform	{ ... 3' 6" "	11	24 2	4216
			13	30 3	4209
64-pr. R.M.L.	{ 71 cwt. carriage 13' 2" platform	{ ... 2' 7" "	12	23 0	} 4617
			19	—	
64-pr. R.M.L.	{ 58 cwt. carriage 13' 2" platform	{ ... 4' 3" 3' 6" "	13	22 1	} 4212
			11	44 0	
			12	34 3	

These carriages are all constructed similarly, and are intended to be used with wood platforms which have been shortened from their original length of 16 feet to either 13 feet 2 inches or 11 feet.

Each carriage consists of two single plate brackets connected by a transom and a bottom plate. It is fitted with four metal rollers, two in front and two in rear, the axles of the rear rollers

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being eccentric, and formed on a shaft, which has bent sockets outside the brackets.

Elevating Gear.

The elevating gear, except for carriage No. 12, consists of a wrought-iron stoolbed, an elevating screw and a wood coin. The elevating gear of No. 12 carriage, consists on each side of a spur pinion and wheel transmitting motion from a handwheel to an arc. The handwheels are connected to a cross shaft, to which the pinions are keyed, and the arcs by a cradle, on which the breech of the gun rests. The gear is clamped by a small clamp with screw acting on each spur wheel.

The carriage, if for the 11 feet platform, is fitted with the E.O.C. compressor, if for the 13 feet 2 inches platform, with a bracket for the attachment of a piston rod of a hydraulic buffer.

The platforms for these iron carriages are of two lengths ; 13 feet 2 inches and 11 feet.

The platforms 13 feet 2 inches long, are made of three different heights, to suit parapets 4 feet 3 inches, 3 feet 6 inches, and 2 feet 7 inches in height respectively.

The platforms 11 feet long are intended for a parapet of 3 feet 6 inches.

These platforms are converted from Nos. 14 and 17, by reducing their length, and if intended for a 4 feet 3 inch parapet, fitting them with pivot plates and strengthening them with stays.

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SUB-SECTION III.—IRON CARRIAGES AND PLATFORMS.

Nature.		Weight.	\$ List of Changes
		cwts. qrs.	\$
	{ Carriage No. 1	31 1	4003 and 4614
	{ Platform No. 1	—	
7' R.B.L., 82 cwt.	{ Platform No. 2	50 0	
	{ Platform No. 3	—	
	{ Carriage No. 4	21 0	4235
40-pr. R.B.L.	{ Platform No. 4	22 0	
	{ Carriage No. 8	84 3	3861
64-pr. R.M.L., 64 cwt., 6' parapet ...	{ Platform No. 8	65 3	
	{ Carriage No. 9	27 0	3884
64-pr. R.M.L., 64 cwt., 5' 6" parapet...	{ Platform No. 9	58 0	
	{ Carriage No. 7	54 1	3986
7' R.M.L., 6½ tons, 6' parapet ...	{ Platform No. 7	75 1	
	{ Carriage No. 6	14 1	4059
32-pr. S.B., B.L. ...	{ Platform No. 6	13 0	

R.B.L. 7" 82 cwt.

CARRIAGE NO. 1. PLATFORMS NOS. 1, 2, 3.

This carriage and the platforms for which it is intended have been converted from the naval carriage and slide for the R.M.L. 7-inch gun of 6½ tons.

The carriage is similar to the L.S. carriage for the 7-inch gun of 7 tons, page 128, with double plate brackets, rear rollers with eccentric axles, capstan head elevating gear and the E.O.C. compressor.

The platforms are of three different heights intended for parapets 4 feet 3 inches, 3 feet 6 inches, and 2 feet 7 inches in height respectively. The trucks and flanged feet are similar to those for the 7-inch R.M.L. and upwards. The platform is not fitted with a pivot plate.

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R.B.L. 40-pr.

CARRIAGE No. 4. PLATFORM No. 4.

This is a double plate carriage mounted on live rollers of steel 5 each side, and fitted with a tension buffer. The elevating gear consists of an arc attached to the gun on the right side, worked through a train of spur gearing by a handwheel.

The platform is of girder iron and is fitted with a pivot bar, by which it is secured to a pivot in the work.

The girders are supported on wrought-iron stays and blocks, to which are secured the wrought-iron flanges for four hollow soled steel trucks. The trucks are coned to suit the radii of the racers.

The piston rod is secured to the front of the platform.

S.B., B.L. 32-pr.

CARRIAGE No. 6. PLATFORM No. 6.

This is a single plate carriage, without rollers, fitted with a tension hydraulic buffer. The elevating gear consists of an elevating screw, stoolbed and coin.

The platform is of girder iron and is fitted with wrought-iron trucks. It is also fitted with a pivot plate for a pivot plug, which is secured by a key. The rear stops are made to fold down inside the platform, when the carriage is run back for housing.

The mounting is arranged for firing over a 2 feet 3 inch parapet with a depression of 15 degrees.

R.M.L. 64-pr. 64 cwt.

CARRIAGE No. 8, FOR PLATFORM No. 8.

" 9, " 9.

These carriages and platforms are similar in general form ; No. 8 is intended for a 6 feet parapet, it is formed of deep single plate brackets, supported on live rollers, and fitted with elevating gear, consisting of a train of spur and bevel gearing communi-

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cating motion to an arc attached to the gun and worked by a handwheel at the front.

The gear is clamped by a jamming arrangement consisting of one thread of a screw on the outside of the right bracket, and a corresponding thread on the back of the jamming lever, so that by pressing the latter down the gear is clamped.

The platform is of girder iron. It has wrought-iron trucks running in flanges each of which is secured by a central vertical bolt, so that the setting of the trucks can be altered to suit the particular position of pivot required.

The platform is fitted with a circular buffer, § 3860, to check recoil. This consists of a short metal cylinder on a cross shaft, fixed centrally between the sides of the platform. The cylinder is free to revolve round the shaft and is formed with teeth on its rim, which gear with a rack under the bottom plate of the carriage. For use the cylinder is filled with oil, which during the recoil of the carriage is forced through a channel in a block in the interior. The amount of the opening for the oil can be varied by a screw valve. A differential brake to prevent the carriage running up after recoil, is fitted to the buffer cylinder.

Running in and out gear is fitted on the left side only. It consists of spur gearing, with a clutch which engages a pinion geared into teeth formed on the rim of the buffer.

A loading derrick is fitted at the front on the left side, a sponge tank and side arm brackets on the right side, and brackets for the rammer on the pivot plate near the front. A step is fitted on each side in rear.

But few of these carriages and platforms have been manufactured, and it is improbable that any more will be made.

The carriage and platform No. 9, are intended for a 5 feet 6 inch parapet, and are generally similar in form to the preceding. The carriage, however, has rear rollers with eccentric axles, the elevating gear is worked by a hand wheel at the right side; and the platform is fitted with an ordinary hydraulic buffer in compression.

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7" R.M.L. of 6½ Tons.

CARRIAGE No 7 FOR PLATFORM No. 7.

The carriage and platform are similar in general form to the preceding. The brackets of the carriage are double plate, and supported on live rollers of steel. The elevating gear is similar to that of No. 8 carriage but is fitted to both sides. The carriage is fitted with a hydraulic buffer, the cylinder of which rests on the bottom plate, the piston rod being secured to a bracket on the front of the platform.

The platform is fitted with running in and out gear, similar to that on No. 8 platform, with the exception that the cylinder of the circular buffer is replaced by a cast-iron spur wheel.

SECTION V.—CARRIAGES AND PLATFORMS FOR R.M.L. GUNS FROM 7-INCH TO 12-INCH OF 25 TONS.

SUB-SECTION I.—SINGLE PLATE CARRIAGES AND PLATFORMS.

Nature.				Weight.		\$ L. of C.
				cwts.	qrs.	\$
7" R.M.L.	casemate carriage	23	3	1584
	dwarf carriage	..	..	29	0
	casemate platforms	..	..	55	2
	dwarf platforms	Δ ..	..	69	2
	"	"	D ..	69	2	1584
9" R.M.L.	casemate carriage	..	..	37	0
	dwarf	"	..	39	0	
	casemate platforms	..	..	57	3
	dwarf	"	Δ ..	74	0	1584
	"	"	D ..	74	0	
12" R.M.L.	25 tons casemate, carriage	60	3	
	" platform	102	0	1584

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Single Plate Carriages.

The first wrought-iron carriages for any of the above natures of ordnance were manufactured on what is known as the "single plate" construction. These carriages were made for the 7-inch of 7 tons, 9-inch and 12-inch guns. They were made of two different patterns, known as Pattern I and Pattern II.

Pattern I carriage consisted of two single plate brackets connected by front and rear blocks and a transom. The blocks were formed of angle iron frames, over which plate iron was riveted.

They were fitted with the American compressor, which was a modification of the E.O.C. compressor, with wood baulks on the platform instead of iron bars.

In some of the earlier carriages, the elevating arc was rigidly attached to the gun, and was worked through a train of wheels by a handwheel.

The later carriages of this pattern, known as "Pattern I strengthened," were fitted with capstan head elevating gear.

In Pattern II carriages the brackets were connected by a bottom plate instead of by the blocks. They were fitted with the E.O.C. compressor for single plate carriages. This compressor is generally similar to that for double plate carriages, page 130. The nuts of the rocking levers, however, are worked by independent screw shafts, one passing through the left, and the other through the right bracket of the carriage, and each having a lever handle on its extremity. The screw on the right, or compressor shaft is of quicker pitch than that on the left or adjusting shaft.

Platforms for Single Plate Carriages.

The platforms for these carriages were either casemate or dwarf, the latter being intended either for an A or a D pivot.

The general construction of these platforms is similar to that of those for double plate carriages.

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SUB-SECTION 2.—DOUBLE PLATE CARRIAGES AND PLATFORMS.

Nature.	Weight.		List of Changes.
	cwts.	qrs.	\$
7" R.M.L. 7 tons carriage	27	3	1635
platform, casemate ..	53	0	
" dwarf A ..	77	3	
" " C ..	80	3	
" " D ..	80	3	1635
9" " 12 tons carriage	42	1	
platforms casemate ..	74	3	
" dwarf A ..	97	0	
" " C ..	101	2	1635
" " D ..	107	6	
10" " 18 tons carriage casemate,			
Mark I ..	51	1	1937
carriage casemate,			
Mark II.. ..	67	0	2513
platforms casemate			
Mark I	95	2	1937
platforms casemate,			
Mark II. ..	104	0	2513
platforms casemate,			
special, Mark II.	125	0	3011
platform dwarf A	134	1	1937
" " C	140	2	
" " D	141	0	
11" or 12" 25 tons, carriage	67	3	1685
platforms casemate..	115	0	
" dwarf A..	139	1	
" " C..	142	1	
" " D..			

Double Plate Carriages.

Double plate carriages, similar in construction and gear, have been made for the 7-inch, 9-inch, 10-inch, 11-inch, and 12-inch R.M.L. guns.

A double plate carriage consists of two brackets, connected by a bottom plate and transom, and strengthened by two stays. The carriage for the 11-inch or 12-inch of 25 tons has also an angle stay across the bottom plate.

Each bracket is made of a frame of bar iron, to each side of which a plate of iron is riveted. The brackets stand upon the bottom plate and are secured to it by screws the heads of which are countersunk. The carriage is fitted with four metal rollers running upon iron axles. The axles of the front rollers rest in metal bearings, each attached to the brackets by two screws; these bearings are eccentric, and may be adjusted, so as to alter the position of the axles, if necessary, on account of wear of the rollers.

Eccentric Axle.

The axles of the rear rollers are eccentric, and are secured in the brackets by drop plates in such a manner that they can be readily removed. These axles are formed in one forging with a cross shaft, called an eccentric shaft, except in some of the earlier carriages in which the axles are formed by independent pieces united by a connecting bar. The ends of the eccentric shaft are made hexagonal for the reception of sockets to take iron-pointed levers, while in the shaft itself there are holes for the same levers in case of the sockets being damaged. A pawl with a handle is fitted to each socket. When the levers have been brought down and the carriage raised on its rollers, the pawls can be lifted by the handles so as to engage the stop

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plates, and thus prevent the carriage coming down off its rollers.

Elevating Gear, Capstan Head.

The carriages first issued were fitted with capstan head elevating gear. Later made carriages, except for the 7-inch, have worm wheel elevating gear.

The capstan head gear consists, on each side, of an elevating arc pivoted to the gun ; a friction roller, against which the arc works ; a pinion gearing with the arc on a spindle which passes through the bracket of the carriage ; a capstan head fitting on the outer end of the spindle, and a clamp which screws upon the spindle outside the capstan head, so that when tightened upon the latter it clamps the pinion. Both clamps are tightened by turning to the rear.

The capstan heads are interchangeable for either side of the carriage ; the pinions with their spindles are not, nor are the elevating arcs. The arcs and pinions are marked with the nature of the gun to which they belong, and the word "top" stamped upon the upper end of each of the former.

Worm Wheel.

The worm wheel elevating gear consists, on each side, of an arc attached to the gun as before ; either a friction roller or a fixed guide against which the arc works ; a pinion gearing with the arc ; an intermediate pinion in certain cases, a pinion and worm-wheel on the same spindle, the worm-wheel being connected to the spindle in future, for 10-inch carriage and upwards, by a friction cone ; a worm shaft, working in metal brackets, attached generally to the inside of the carriage brackets, but some times either at the top or at the outside ; a handwheel is fitted on the rear end of the worm shaft. The shaft on one side may be thrown out of gear with the worm wheel by

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throwing back a hinged clutch, secured by a steel pin and retained by a turnbuckle; the shaft is then turned and either drawn to the rear or allowed to slip to the front clear of the wheel. The clutch is then replaced and holds the shaft as desired.

In the carriages first issued the recoil was checked by the Elswick Compressor, but all carriages of present manufacture are fitted for a hydraulic buffer, and those passing through the R.C.D., which are fitted with the compressor, generally have the fittings removed and are converted to receive the hydraulic buffer.

Compressor.

The Elswick Compressor consists of a series of long iron bars suspended on pins in the front and rear of the platform, and capable of side motion. A series of iron plates hang through an opening in the bottom plate of the carriage, the plates alternating with the bars. The plates and bars are pressed together by rocking levers, one on each side, which are pivoted underneath the bottom plate of the carriage. The upper ends of the levers pass through the bottom plate. These ends are forked, and in the forks rest metal nuts. A cross horizontal shaft, called the compressor shaft, passes through the right bracket of the carriage through the right-hand nut, which is called the compressor nut, and enters the left-hand nut, which is longer than the other and is called the adjusting nut. The screw-threads on the shaft for these nuts are left and right handed. On the end of the shaft outside the right bracket there is a lever handle, called the compressing lever. When the lever is thrown down to the rear and the shaft turned the nuts are caused to move away from each other, the lower ends of the rocking levers forced in, and the plates and bars pressed together. When the compressing lever is thrown up the nuts travel towards each other and compression is taken off.

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A short shaft called the adjusting shaft passes through the left bracket of the carriage, and enters the adjusting nut, feathers in the nut fitting in long keyways in the shaft. On the outer end of this shaft there is a lever handle called the adjusting lever. When the adjusting lever is turned the nut is placed in a new position on the compressing shaft; but the nut is free to move out or in along the adjusting shaft, when the compressing lever is turned. Moving the adjusting lever up increases the compression, moving it down diminishes it.

The levers work each along an arc riveted to the bracket of the carriage, the adjusting lever can be keyed in any required position on its arc, and the compressing lever, when forced down, is caught under a projection on its arc. The compressor is made self-acting, by a tripper hinged to the side of the platform, which on recoil catches against the lower end of the compressing lever and forces it down its arc.

A carriage, casemate Mark II, for the R.M.L. 10" gun differs from the preceding in having long low brackets, connected by box-shaped transoms, beneath which a bottom plate is riveted. The transoms and bottom plate form a well which fits between the sides of the platform when the carriage is mounted.

The arrangement of the rollers and gear is similar to that in Mark I carriage.

Platforms and Pivots for Double Plate Carriages.

Each nature of the preceding carriage has its own platform. In each nature the platforms are made casemate and dwarf, the former being low for use in casemates, and the latter high for open batteries.

Casemate platforms are always A pivot, the pivot being imaginary. Dwarf are made for A, C, and D pivots, the first-mentioned being imaginary, the last two actual.

A platform consists of two girder iron sides, having planed upper surfaces, upon which the brackets of the carriage rest.

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The sides of 7-inch and 9-inch platforms are bent round to meet in front ; those of 10-inch and upwards are fish-bellied in form and are not bent round in front. The sides are connected by cross-pieces of angle and plate called transoms and bottom plates.

The platform is supported upon four trucks of wrought iron or steel. The earlier platforms had trucks of wrought iron, those of later manufacture for 10-inch and upwards have trucks of steel. The axles of the trucks are of steel ; they rest in wrought iron flanged feet, which are bolted to horizontal cross-plates called truck plates.

The upper part or frame of the platform is the same for both dwarf and casemate, for the same nature of gun ; the platform differing in the size of the trucks, and the manner in which the sides are supported over the truck plates.

The Mark II casemate platform for the 10-inch has larger trucks than Mark I.

Dwarf platforms for C and D pivots have a cross stay, in which there is a pivot hole for pivot plug, bolted beneath the front bottom plate. A longitudinal pivot plate extends from one truck plate to the other, and is bolted to those plates and to the cross stay ; it has a pivot hole in it corresponding to the hole in the latter. The platform is connected by a steel pivot plug passing through the holes in the plates, with a cast-iron gun sunk vertically in the work.

The pivot plugs are of three natures, to correspond in diameter with the bores of the 9, 18, and 24-pr. S.B. guns respectively. The body of the 24-pr. plug, and the head of the 18 or 9-pr. fits the pivot hole in the platforms. For 11-inch and 12-inch a clip plate is attached to the pivot plate in front of the pivot plug to prevent the latter being displaced by the concussion on firing.

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Fittings.

The platform is fitted with footplanks (except in the 10-inch Mark II) and a platform board for standing upon, and, if a dwarf platform, with side steps.

A bollard for the preventor rope is fitted to the rear transom of the 7-inch platform.

To form a stop for the carriage when run up, a piece of angle iron is bolted over the front of the platform, and a piece of elm or sabicu to the rear of this ; upon these are fitted small buffers, each consisting of an indiarubber ring upon an iron spindle with a flat head. In some cases layers of felt and wrought iron or spiral springs of steel have been substituted for the rings of indiarubber.

Similar buffers are fitted at each side in rear to form stops for the carriage in recoil.

Eyebolts for tackle are bolted one in front and one in rear at each side.

Staples are bolted to the right side in front and rear to receive brackets on which the side arms rest. Metal brackets are bolted to each side to carry an iron pointed lever. There are staples upon the right side of the platform, for attaching a sponge tank.

Pointers.

For 9-inch and upwards a folding pointer for use with a graduated arc on the floor of the work is attached to the right rear of the platform, it is of iron with a steel point.

For 10-inch and upwards two snatch blocks for loading tackle are attached to the front of the platform, except those mounted en barbette in emplacements having sunken ways for loading stages.

A staple plate to secure a grease box is fitted on the left side near the front for 11-inch and upwards.

The earlier platforms for the 7-inch, 9-inch, and 12-inch, were

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fitted for the Elswick compressor, the later issues with the hydraulic buffer. Some of the former also have been altered and fitted with the buffer.

Hydraulic Buffer.

The hydraulic buffer consists of a cylinder of wrought-iron (for future manufacture of steel) which is fixed to the rear of the platform. In the cylinder works a piston at the end of a piston rod, the front end of which is connected by two nuts to a bracket underneath the bottom plate of the carriage at the front. The cylinder is partly filled with oil; on recoil, the piston is driven along the cylinder, the resistance of the oil to its passage checking the recoil. The oil passes from the back of the piston, as it moves, to the front through small holes drilled in it. The size of these holes varies with the nature of gun for which the buffer is intended.

The rear end of the cylinder is closed by a cap screwed on, and the front end by a cover and flange. These are of cast iron, for the 7-inch and 9-inch, and of wrought iron for the 10-inch and upwards. There is a hole in the cover through which the piston rod passes, and a recess in which packing is placed and the joint made tight by a metal packing gland.

There is a filling hole closed by a screw plug at the rear of the cylinder, and a metal draw-off cock in the cover.

The greatest quantity of oil used should not exceed 12 gallons, which, with the carriage run out, will be $4\frac{1}{2}$ inches at the filling hole, this depth may be easily tested by a slip of wood.

Traversing and Running Back Gear.

The 9-inch and higher natures of platforms are fitted with gear for traversing and running back.

The traversing gear consists of a combination of common tooth gearing which acts directly on two of the four trucks of the platform, causing them to revolve, and traverse the platform

Mountings for Garrison Service.

Section A.

right or left as desired. The gear is set in motion by one or two winch handles.

The running back gear consists of part of the traversing gear combined with a revolving bollard, and special block tackle. A clutch pinion is provided, which by means of a lever is connected or disconnected with the truck pinions, by which means the part of the gear intended for running back may be set in motion without acting on the trucks of the platform. The same winch handles work both the traversing and running back gear.

The particular trucks, which are placed in gear depend on the nature of the pivot. For A pivot the gear is applied to the two rear trucks for D pivot to the front trucks, and for C to one front and one rear one.

The position of the winch handles are either side, rear, side within length, or C central.

"Side;" the handles are at the ends of a horizontal cross shaft at the rear of the platform.

"Rear;" there is only one winch handle and it is at the end of the spindle of the bollard.

"Side within length;" the handles are at the ends of a cross horizontal shaft near the rear of the platform, but sufficiently far from it, to prevent the handles projecting beyond the rear of the platform in working.

"C central;" the handles are at the ends of a cross horizontal shaft at the centre of the platform.

Platform for 7 feet Parapet.

Some 9-inch and 10-inch dwarf platforms have been adapted for use behind a parapet 7 feet high. The platform is fitted with a fixed loading stage at the front, with steps; a hinged loading derrick is fitted on each side at the front, and the traversing gear, which has one winch handle at the rear is arranged so as to be worked from the sunken way.

PART III.**Section V. Mountings for Garrison Service.**

Nature.				Weight.		\$ List of C.
				cwts.	qrs.	\$
10" Small port carriage	..	..	..	120	0	} 3182
„ platform	..	..	..	106	0	

10-inch Small Port Carriage.

The carriage is arranged to allow of the gun being raised vertically through a height of 12 inches by means of a hydraulic lift or ram, acting under the trunnion coil ; so as to enable an elevation of 9 degrees and a depression of 4 degrees to be obtained through a small port.

The gun rests in moveable trunnion blocks, which are free to move vertically in recesses formed in the carriage brackets. The trunnion blocks are supported by vertical screws, to which motion is imparted, through toothed wheels and shafting, by means of winch handles at the rear. The screws are worked so as to follow up the trunnion blocks when the gun is lifted by hydraulic power ; as it is intended that they, and not the hydraulic ram, should support the gun when being fired. They also serve as an alternative means of lifting in the event of the hydraulic gear being deranged.

The hydraulic ram for raising or lowering the gun is placed centrally in the carriage, and in the vertical plane of the trunnion blocks.

The ram, with its cistern and pump in one, is supported on the bottom plate of the carriage by moveable plates, which admit of its being removed when necessary. The pump is worked by a lever on each side of the carriage and the ram is lowered when required by raising the rear ends of the pump levers above a folding stop on the bracket.

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Section V.

The elevating gear is similar to that of 10-inch (Mark I) carriages (§ 2376) but is attached on the outside of the carriage. The worm wheels are each fitted with a cone friction clutch. A straight rack is used instead of an elevating arc, and is connected to the gun by a link. An index and pointer are fitted on the left bracket of the carriage, and show the elevation and depression that can be given to the gun at any point of the vertical lift.

The platform is of the same 'description as the 10-inch casemate, Mark I (§§1937, 2646,) but is raised 6 inches by the introduction of packing pieces.

Two hydraulic buffers at the sides are used instead of one at the centre, so as to clear the hydraulic ram during recoil.

SUB-SECTION III.—CARRIAGES AND PLATFORMS CONVERTED FROM NAVAL CARRIAGES AND SLIDES.

Nature.					Weight.*	§ List of* Changes.
					cwt. qrs.	§
7" R.M.L. 6½ tons	{	Carriage ..	..	32	0 }	5103
		Platform..	..	39	0 }	
8" " " "	{	Carriage ..	..	39	1 }	5102
		Platform..	..	55	1 }	
8" " Elevation		..	..	..
8" " Depression		..	..	..
9" " " "	{	Carriage ..	..	44	0 }	5101
		Platform..	..	60	0 }	

Double and Single Plate Carriages S.S. Converted, for L.S.

Certain naval carriages and slides have been converted for use as land service carriages and traversing platforms, for the † 7-inch 6½ tons, the ‡ 8-inch and ‡ 9-inch R.M.L. guns.

* To be filled in when notified.

† Double plate.

‡ Single plate.

PART III.**Section V.****Mountings for Garrison Service.**

The carriage is similar to the L.S. carriage, pages 126, 128; it is fitted with a tension hydraulic buffer, the cylinder of which is fixed underneath the bottom plate. The elevating gear is the capstan head. The carriages for the 8-inch and 9-inch guns are fitted with nipping gear, which is similar in action, though not in arrangement, with the same gear on the 38-ton carriage and is used to connect the carriage with the running back chains of the platform.

The platform (converted slide), is lower than the ordinary service platform.

It is supported on flat-soled trucks of cast-iron for the 7-inch, and of wrought-iron for the higher natures.

The 7-inch platform is fitted with winch gear for running in. This gear consists of a cast-iron spur wheel and serpentine wheel in one, on a gudgeon, bolted to the side of the slide in rear, the spur wheel is driven by a pinion worked by a winch handle. This gear is used in conjunction with a sheave on the carriage bracket. The standing end of a rope is hooked to the eyebolt at the rear of the platform, a turn is taken round the sheave on the carriage, and then round the serpentine wheel.

The 8-inch and 9-inch platforms are fitted with running-in and traversing gear.

The running-in gear consists of one endless chain on the 8-inch platform, and two on the 9-inch, worked by winch handles at the rear, as for 38-ton platforms.

The traversing gear consists of a pinion underneath the platform, which gears with a rack on the floor of the work, and is put in motion by one winch handle at the rear.

All the platforms are fitted with front pivoting bars to connect them to real pivots.

In addition to the above certain carriages and platforms have been converted from naval carriages and slides for the 8-inch gun, and have been specially arranged to permit of either great elevation or great depression being given to the gun.

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The elevation carriage is similar to the preceding. It is fitted with a tension hydraulic buffer, capstan head elevating gear, and nipping gear, but the gear is arranged so as to admit of 16 degrees of elevation.

The platform is also similar to the preceding, but is fitted with gun-metal rollers, the rear rollers having eccentric axles.

Depression Mounting.

The depression carriage is similar to the preceding, but is fitted with two hydraulic tension buffers underneath the bottom plate, one on each side. The carriage is arranged to admit of 27 degrees depression.

The platform with its gear is generally similar to the preceding, but the sides are very much deeper. The chain for the running-in gear lies centrally between the sides.

SECTION VI.—CARRIAGES AND PLATFORMS FOR THE R.M.L. 12-INCH GUN OF 35 TONS, AND 12·5-INCH GUN OF 38 TONS.

The following natures of carriages and platforms are in the service for these guns :—

Nature.	Weight.	§ List of Changes.
	cwts. qrs.	§
12' R.M.L. 35 tons carriage	115 1	3085
12" " " platform	186 3	3102
12·5" " carriage, 6' recoil, Mark II., casemate or dwarf ...	123 2	4098
12·5" " " 7' recoil, Mark II., casemate ...	123 2	4167
12·5" " platform, 6' recoil, Mark III., casemate ...	162 1	4112
12·5" " " Mark III., special casemate ...	162 3	4197
12·5" " " 7' recoil, Mark III. ...	163 2	4167
12·5" " " Mark III., dwarf C ...	188 1	3098
12·5" " " Mark II., " D ...	184 1	2099

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Section VI.	Mountings for Garrison Service.	12" and 12.5"
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The carriages and platforms for both guns are generally similar in construction and gear; Mark I carriage and platform was constructed with a compression buffer on the platform; the alteration of the buffer in the 38-ton mountings, to one in tension on the carriage, constitutes the Mark II carriage.

The Mark I platforms for the 38-ton gun had a cone clutch on the traversing gear; the substitution of a disc clutch for the cone clutch constitutes the Mark II platform.

A Mark III platform has a larger disc clutch, but in other respects is identical with Mark II. The Mark III Special, 6 feet recoil platform, has trucks and racers similar to the 7 feet recoil platform. A Mark II carriage is mounted either on a Mark II or Mark III platform.

Carriage (except Small Port).

The carriage, both 6 feet and 7 feet recoil, is similar in general form to the Mark II carriage for the R.M.L. 10-inch gun.

Rollers.

The carriage is raised on its rollers by a hydraulic jack attached to the left side of the carriage, the ram of the jack being attached to a crank fitted to the eccentric shaft of the rear rollers.

The release valve of the jack is internal, and is brought into action by pressing the lever handle to the rear beyond the ordinary stroke.

A pointer is attached to the end of the eccentric shaft on the left side to indicate the extreme limit to which the jack should be pumped up.

Hydraulic Buffer.

A tension buffer is used to reduce the recoil in the Mark II carriage. The cylinder is fixed underneath the bottom plate of the carriage, and the piston rod attached to the front of the platform. On recoil, the cylinder moving with the

12" and 12'5"

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carriage and the piston remaining stationary, the resistance of the oil in the cylinder to the motion checks the recoil. The buffer is constructed to allow of a nominal 6 feet or 7 feet recoil, and the carriage, when so fitted, is only suitable for a corresponding platform. The size of the holes in the piston varies with the length of the recoil, and the charge which it is intended the gun should fire. Thus the hole in the pistons of the buffers of 6 feet recoil carriages for axial-vented guns which fire larger charges, are smaller than the others.* The front cap of the buffer is formed by a metal bracket, by which the cylinder is secured to the carriage. This bracket is fitted with a packing gland, which, in addition to the packing of white cotton rope, has a cup leather kept in position by a metal ring.

Elevating Gear.

The elevating gear consists of a train of wrought iron spur wheels and steel pinions on the right bracket of the carriage, worked by a handwheel on the outside of the bracket. The elevating arc is of steel, and is rigidly attached to the gun. The outside of the arc is graduated by alternate black and white spaces each of which represents an angle of ten minutes. The spaces are subdivided across the arc, so that by means of a pointer readings of two minutes can be obtained. The gear is clamped by a bow cramp worked by a screw lever handle which on being tightened presses two friction pieces against the sides of the arc.

Preventor Gear.

The carriage is fitted with preventor gear to keep it under control in running up, and prevent injury to the elevating gear. This gear consists of a rocking lever, pivoted to the second transom, and passing through the bottom plate. A small com-

* The working quantity of oil should not exceed—6 feet recoil, 10 gallons; 7 feet recoil, 11½ gallons. To ensure this amount being in the buffer, fill it when the gun is run out and draw off 1 quart.

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pressor plate is hinged to the lower end of the lever. When the gear is in action, a compressor bar on the platform is gripped between this plate and a fixed piece underneath the carriage bottom plate. The upper arm of the rocking lever is forked and carries a nut on a short screw shaft worked by a handle on the outside of the right bracket. To adjust the amount of compression when necessary the screw shaft has a collar with teeth cut on its outer face, which fit corresponding teeth on the boss of the handle. The lever handle may be worked by hand, but, to ensure its acting automatically, there is a projection on it, which engages with a tripper on the platform, when the carriage runs up.

Nipping Gear.

The carriage is fitted with nipping gear to connect it with two running back chains on the platform. The gear consists of a sprocket plate (or plate with projecting teeth) on each side, sliding through a slot in the bottom plate of the carriage. The two sprocket plates are joined by links to rocking levers, which are keyed on a short cross shaft, supported in bearings on the bottom plate. A counterweight on the right rocking lever raises the plates from the chains and disconnects the gear. The lever on the left side is connected by a link with an eccentric worked by a lever handle outside the left bracket of the carriage. A stud on this handle catching in a pawl on the carriage, keeps the gear disconnected. The running back chains pass through brackets beneath the carriage which hold them up to the sprocket plates, when the latter are forced down.

Compressor Stop Plates.

Two compressor stop plates are suspended under the carriage. These plates on recoil jam between the plates of the compressor stop on the platform, and tend to prevent the carriage running up again.

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Platforms (except Small Port.)

The platforms are similar in construction to those for 10-inch and 11-inch R.M.L. guns.

Traversing and Running-back Gear.

The platform is fitted with traversing and running back gear, worked by the same horizontal shaft under the rear of platform, which is set in motion by two winch handles working within the length of the platform. This shaft has two pinions riding loosely upon it, a bevel pinion for traversing gear, and a spur pinion for the running back gear. By means of a double clutch, either pinion is made to revolve with the shaft. For traversing the bevel pinion is connected with a longitudinal shaft having on it a pinion of metal or cast-iron, which gears in a cast-iron rack let in the floor of the work. For running back the spur pinion gears into a spur-wheel on another cross shaft. This shaft has two sprocket wheels, with teeth that fit into endless chains, one at each side of the platform. The chains, to which the carriage can be attached when necessary, at the front pass over plain wheels in adjusting forks, the latter being held in brackets, secured under the front truck plates of the platform.

Clutch.

The double clutch consists of a series of discs or plates on the shaft, alternately of steel and gunmetal. The former, circular in shape, revolve with the shaft loosely inside recesses in the pinions; the latter are octagonal or of some similar form, so as to fit the recesses in the pinions, but ride loosely on the shaft.

By means of the clutch lever, the plates in either pinion are forced together, when the friction between them gives motion to the pinion required.

The clutch lever, pivoted at the rear, is moved by a hand-

PART III.**Section VI.****Mountings for Garrison Service.**

wheel on the left side of the platform, by means of a screw shaft, with a nut in the forked end of the front of the lever.

The clutches are similar for all platforms varying chiefly in the diameter and number of plates.

Indicator.

On the screw shaft behind the handwheel is an indicator. This consists of a disc with a spiral groove on its face, in which travels a pointer, sliding in a bracket on the side of the platform. The bracket is marked with the letters R. O. T. respectively for "running back," "out of gear," and "traversing." When the handwheel is turned to the left (or towards the front of the platform) the spiral groove in the disc, as it revolves with handwheel, lowers the pointer towards the position marked T, which shows that the gear is in readiness for traversing.

Compressor Stop and Preventor Bar.

The compressor stop which is over the rear truck plate consists of two plates, between which the rear end of the preventor bar lies, acting as a third plate; the front end of the bar is secured over the front truck plate. The stop is brought into action by an adjusting screw and a compressor screw, with a lever and catch on the right side of the platform. There is a tripper attached to the outside of the platform on the right side to bring the lever handle of the preventor gear into action.

The platform is fitted with front and rear buffer stops, pointer for traversing arc, fittings for grease box, &c., similarly to those for 10-inch and 11-inch guns.

The 35-ton gun platform is similar to that for the 38-ton gun, but is fitted with a compression hydraulic buffer. The traversing and running back gear is not fitted with a friction disc clutch, but the bevel and spur pinions on the cross shaft, which puts

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the gear into action for traversing and running back respectively are moved themselves by two forked levers pivoted under the rear of the platform. These levers are worked together by one lever handle at the rear.

The platform is not fitted with compressor stop or preventor gear.

Three 12·5-inch 38-ton guns at Malta are mounted on platforms of the above description, which were constructed for 12-inch R.M.L. 35-ton guns.

Three 12-inch R.M.L. 35-ton guns at Fort Westmoreland, Cork Harbour, are mounted on platforms which were constructed for 12·5-inch R.M.L. 38-ton guns, and which are of the service pattern for those guns.

SMALL PORT MOUNTINGS.

These mountings are designed to enable the gun to be fired through a small port, with greater elevation and depression than would be obtainable by the ordinary method of mounting.

To obtain 7° elevation and 4° depression with the small port, a fall or rise of 14 inches can be given to the trunnions of the gun, which are supported in blocks, moveable vertically in slots in the carriage.

The 6 feet recoil carriages and platforms have been mounted at Plymouth Breakwater Fort, and at Fort Cunningham, Bermuda.

The 7 feet recoil carriages and platforms have been mounted at Fort Delimara, Malta.

The former are fitted with two compression buffers; the carriages in other respects are the same.

Carriage.

The brackets of the carriage are high, and the bottom plate is arched downwards.

The carriage is raised on its rollers by a hydraulic jack, acting
(a.m.¹) L

PART III.**Section VI.****Mountings for Garrison Service.**

on the eccentric shaft, as in the ordinary casemate or dwarf carriage.

In each bracket there is a recess for a moveable trunnion block, which serves as a bearing for the gun, and is arranged to slide vertically when the gun is raised or lowered.

Hydraulic Lift.

To raise or lower the gun, a hydraulic lift is supported over the bottom plate of the carriage directly beneath the centre of gravity of the gun. The top of the ram of the lift has a cradle jointed to it, which, when the lift is in action, adjusts itself to the gun, and lifts it with the trunnion blocks of the carriage. The lift can be removed from the carriage when required without dismounting the gun.

The pump of the lift is worked on each side by a double ended lever outside the carriage bracket, connected to the pump spindle by a short horizontal shaft, with a socket end to fit on the spindle and prolong it through the carriage bracket.

The release valve of the lift is internal and is brought into action by a long stroke of the lever. In raising, the length of stroke is regulated by a jointed stop on the carriage, which must be folded back to clear the lever, when it is required to lower the ram.

To show the height of the gun above its lowest position, and the elevation or depression then obtainable, an index plate is fixed outside each carriage bracket at the sides of the slot for the trunnion stud of the gun, which is read by a pointer or reader fixed on the trunnion stud; on one side of the index is shown the height of the gun in inches, and on the other side the corresponding amount of elevation or depression the port will allow.

Following-up Gear.

A strong vertical screw works under each trunnion block, being raised or lowered by winch handles at the rear of the carriage

through suitable gear. This gear is not of sufficient power for raising the gun, but the screws are intended for the support of the gun when it is fired.

To show the position of the screws an index plate is fixed on the left bracket of the carriage, and a pointer is connected to and moved by the following up screws.

Elevating Gear.

The elevating gear is fitted to the right side of the carriage. A straight rack works between vertical guides inside the bracket. The rack is slotted lengthwise and in the rack slides a nut which is attached to the gun by a link.

For giving elevation the rack is moved by a handwheel on the outside the right bracket through a train of spur wheels and pinions. The gear is clamped by a jamming lever also on the outside the right bracket.

The elevation given can be read on a metal scale plate in rear of the rack, graduated in degrees with intervals of 10 minutes. By means of a vernier on a metal plate attached to the nut, which is linked to the gun, the scale can be read to one minute.

To suit the varying position of the trunnions, when the gun is raised or lowered by the hydraulic lift, the nut linked to the gun can be made to shift its position up or down the slot in the rack. This movement is given to the nut by turning a second handwheel at the top of the right hand bracket, the gear connected with which is so arranged, that both the nut with its vernier and the scale plate are moved together and at exactly the same rate. In rear of the scale plate there is a fixed vertical inch scale reading 14 inches. This scale is read by an arrow head on the rear edge of the scale plate. When this arrow points to the same height on the inch scale as the trunnion arrow head does on its index plate, the quadrant elevation or depression the gun can be read by the vernier.

(a.m.')

L. 2

PART III.**Section VII.****Mountings for Garrison Service.***Nipping Gear and Preventor Gear.*

The carriage is fitted with nipping gear and preventor gear, both of which are similar in action to the gear on the ordinary carriages, but which differ slightly in arrangement to suit the arched bottom plate of the small port mounting.

Platform.

The platforms for small port carriages are generally similar in construction and gear to the ordinary casemate platform.

SECTION VII.—MONCRIEFF MOUNTINGS.

The following are the Moncrieff mountings in the service :—

Nature.		Weight.	§ List of Changes.
		tons. cwt. qrs.	§
7" R.M.L. 7 tons, Mark I.	{ carriage	1 15 0	} 2434
	{ elevator	14 17 0	
	{ platform	5 13 0	
" " Mark II.	{ elevator	14 9 2	} 2915
	{ platform	9 9 2	
7" R.B.L. 82 cwt., Mark II.	{ elevator	8 19 2	
	{ platform	4 3 1	
64-pr. R.M.L. 58 cwt. Mark II.	{ elevator	7 14 2	} 3633
	{ platform	3 14 2	
9" R.M.L. 12 tons, Mark II.	{ elevator	26 13 0	} 3115
	{ platform	13 12 2	

These mountings have been designed with the following objects :—

Mountings for Garrison Service.

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First, to afford cover to the gun detachment by enabling the gun, when run up to fire over a solid parapet, though when run back to be in a low and convenient position for loading and entirely protected from view and from direct fire.

Second, to store up the force of recoil and utilise it for bringing the gun from the loading to the firing position.

To carry out these objects, the gun is carried by a structure called an elevator, which rolls upon the upper surface of a traversing platform, and in so doing from its form places the gun in the required position for either loading or firing. A counterweight is attached to the opposite end of the elevator to that in which the gun lies, so that as the force of recoil causes the elevator to roll to the rear and the gun to descend, it at the same time raises a weight. On completing the loading, by moving a brake lever this weight is permitted to fall and so causes the elevator to roll to the front bringing the gun into the firing position.

There are two patterns of the Moncrieff system ; in the first the gun is placed in a carriage distinct from the elevator ; in the second the elevator itself carries the gun. The first pattern exists for the 7-inch R.M.L. gun only ; the other guns have the 2nd pattern only, and the system on which they are mounted is called Mark II, although none of the earlier type exists for these guns.

MARK I MOUNTING.

Carriage.

The carriage consists of two triangular double plate brackets connected by two transoms.

The elevating gear is worm wheel with friction cone ; it is carried on the rear transom.

The brackets are connected in rear by an axle with a truck at each end.

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Elevator.

The elevator consists of two sides formed in the same manner as the brackets of carriage, and are connected at one end by the counterweight. The other end of the elevator is connected with the front of the carriage by a shaft, which passes through holes in both.

A cycloidal rack is bolted to each side of the elevator for pinions on the platform to gear into by which the elevator can be moved to any position by hand.

Platform.

The platform consists of two sides connected by transoms and stays, and supported over four flat-soled trucks. Fixed upon the sides of the frame are guides for the truck of the carriage to run on, and also walls to support brake gear, &c.

Brake gear for holding the elevator down after recoil and for controlling its rise is fitted on each side of the platform. It consists, on each side, of a pinion gearing with the cycloidal rack of the elevator, on the same shaft as a brake drum, which with its gear, is similar to that on the Mark II mounting.

A sliding locking plate is bolted on the front of each wall to secure the gun when left standing in the loading position; to use this bolt its retaining screw is withdrawn, and it is allowed to drop on the short arm of the bent lever in which position it is secured by its screw; it acts by preventing the friction band of the drum becoming slackened.

The platform is fitted with traversing gear which acts on one front and one rear truck.

MARK II MOUNTINGS.

In this pattern of mounting the gun is carried directly by the elevator without the intervention of a carriage.

There are no cycloidal racks for pinions on the elevator, but

instead there are what are called "retaining racks" on the platforms, to which the elevator is connected by connecting bars. One end of each of the latter is metal bouched and pivots on a spindle passing through part of the counterweight and the side of the elevator.

Elevating Gear.

To carry the breech of the gun and also give the required elevation in laying a long elevating bar is attached to a metal patch under the breech by a bolt, which also supports a laying stage. The lower extremity of this bar is pivoted between two radius bars, one end of each of which is bent outwards and attached to a spindle in the side of the elevator, while their other extremities hold a metal roller between them. This roller runs in an elevating guide on the platform, to which the required degrees of elevation is given, and communicated by the elevating bar to the gun. On recoil the roller of the radius bars travels to the rear along its guide, while the elevating bar changes from a vertical to a nearly horizontal position.

Platform.

The platform is similar to that of the Mark I mounting, but is not fitted with guides or walls.

A rack for the elevator to roll along is fitted on each side, and as already mentioned a sliding retaining rack to which the elevator is attached, and by means of which its motion in rising is controlled. The upper surface of this rack is formed with teeth to receive a pawl by which it and consequently the elevator can be retained when left in the loading position. The under surface has teeth for a pinion to gear into by which it can be moved and consequently the elevator. The pinions by which the racks are worked are placed upon a cross shaft passing through the sides of the platform and fitted with brake drums, by means of which the elevator is held down after the

PART III.**Section VII.****Mountings for Garrison Service.**

force of recoil has ceased, and by which the rise of the gun again to the firing position is kept under control. A brake drum consists of a rim containing a ratchet wheel, which can move independently of the rim, but must move with the cross shaft. Four pawls to act on the ratchet wheel are pivoted to the rim. The wheel and pawls are enclosed between two plates let into and bolted one on each side of the rim.

Round the brake drum passes a friction band, one end of which is fixed to the side of the platform, and the other to a bent lever. The lever is weighted so as to tighten the friction band sufficiently to hold the brake drum, so that the pawls of the latter may prevent the ratchet wheel turning back, and the elevator rising after recoil. When the weighted arm of the lever is raised, the friction band is slackened, the whole of the brake drum is allowed to revolve, and the elevator consequently to rise. Both levers are arranged to be worked together by lever handles at the rear of the platform.

For the R.B.L. 7-inch and the R.M.L. 64-pr. the platform is only fitted with one brake drum. Connected with the brake drums there is gear arranged for moving the elevator into any desired position by means of iron-pointed levers.

Elevating Gear.

The elevating guides to receive the roller of the radius bars lies along the centre of the platform to the rear. An elevating arc is attached beneath the front of the guide, and is worked by a handwheel through worm wheel gear, fitted with a double friction cone.

SECTION VIII.—MOUNTINGS FOR B.L. GUNS.

Nature.	Weight.*	\$ List of Changes.
	cwt. qrs. lbs.	\$
Yoke mounting 12" { carriage platform, upper tier .. " lower " .. yoke	162 3 0	} 4866
	185 3 0	
	191 0 0	
	93 3 0	
6" Mark V., HP carriage, with platform	295 3 10	
10" E.O.C. { carriage platform		
9-2" E.O.C. { carriage platform		
10" R.C.D. experimental ..		
9-2" " " " " ..		
10" disappearing experimental ..		
9-2" " " " " ..		

YOKE MOUNTING, 12-INCH.

This mounting is for the Spithead Forts.

Carriage.

The carriage is formed by two cast steel brackets connected by wrought-iron transoms and bottom plate. It runs upon fourteen steel rollers, which are always in action.

Hydraulic Buffers.

Each bracket is cast with a bore running through it longitudinally, which forms the cylinder of a tension hydraulic buffer.

* To be filled in when notified.

The front end of the piston rod of each buffer is secured to a cast-steel framework at the front of the platform called a yoke. The pressure in the buffer during recoil is rendered approximately uniform by taper bars, which pass through slots in the edge of the piston. By turning the pistons, the size for the openings for the oil can be altered, and so the action of the buffer regulated to suit varying charges.

A short lever is attached to the end of each piston rod at the front of the yoke, for the purpose of turning it, when adjustment is required. These levers are united by a connecting bar, so that they must always move together. The connecting bar works along a fixed plate, with a scale on it, showing the relative size of opening for the oil. When adjusted each lever is secured by a bolt and nut, and there is also a bolt and nut for securing the connecting bar.

Platform.

The platform for the lower tier is supported on trucks similar to those for the 38-ton casemate platforms.

The trucks for the upper tier platform have not yet been finally approved.

The platform is fitted with elevating, traversing, loading, withdrawing and brake gears. It is not fitted with running-back gear.

Elevating Gear.

A long steel bar, called an elevating guide, is pivoted near the rear of the platform between the sides; a steel elevating arc is riveted to the front end of this guide, and is worked by handwheels at the outside of each side of the platform through a train of spur wheels and pinions. The guide is of girder section, and metal blocks attached to the breech of the gun slide along each side of it between the flanges. When the handwheels are turned the guide pivots about its rear end, and the blocks, which, when the gun is in the firing position, are run out, are close to

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the front end, are moved up or down with it, thus raising or lowering the breech of the gun. The gear is clamped by a bow cramp, worked by handwheels, which acts on a wheel on the left side of the platform on the same shaft as a pinion, which gears with the elevating arc. This pinion is connected with its shaft by a double friction cone, adjusted by a nut acting on a long spiral spring coiled round the shaft, between the sides of the platform.

Traversing Gear.

The traversing gear is in principle similar to that of the 38-ton platform, a pinion attached to the platform gearing with a fixed rack on the floor of the work; it is put in motion by winch handles working within length of the platform.

Brake Gear.

To hold the carriage back after recoil, and to keep it under control in running up, there is a sprocket wheel, on a short axle between the sides of the platform, the teeth of which gear with a rack underneath the bottom plate of the carriage. A drum round which passes the band of a differential brake is attached to each side of the wheel. The brake is arranged so as to oppose no resistance to the motion of the carriage during recoil, but to prevent running up after recoil, until it is released by raising a lever handle on either side of the platform towards the front.

Loading Gear.

The loading gear is fitted to the side of the platform near the rear, and consists of a derrick with three sheaves, and fall with hook, a windlass with spur wheel, and a pinion with spindle for a winch handle.

Withdrawing Gear.

The gear for withdrawing the breech screw is attached to the right of the platform, and consists of an arm carrying a

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cradle, fitted with a screw and nut, working between guide bars with two small catches, one for the gun, the other for the breech piece. When the arm is swung into position, the catches drop into their recesses, and the breech screw is withdrawn by means of the screw worked by the handle.

Yoke.

The yoke consists of two vertical cast-steel brackets reaching from floor to roof of the casemate in which the gun is mounted, and connected at top and bottom by distance pieces. The brackets are fitted at each end with rollers, which run in curved troughs of wrought-iron, let into the floor and roof of the work. The weight of the yoke is supported on brackets at the front of the platform.

HP. CARRIAGE 6-IN. MARK V GUN.

This mounting is constructed to raise the gun by means of compressed air so as to admit of it being fired from a 9-foot pit, or over a 9-foot parapet, with 15 degrees elevation and 5 degrees depression ; and to absorb the force of recoil as the gun descends under cover for loading.

It consists of an elevator or carriage, a platform, a hydro-pneumatic cylinder, and a central pivot.

Carriage.

The carriage consists of steel brackets connected by steel transoms. It is pivoted to the platform, and is raised to the firing position by the ram of the hydro-pneumatic cylinder, to which it is connected by a cross head.

Platform.

The platform is fitted with elevating and traversing gear, and works on a circular racer round the pivot ; the cylinder is

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secured to it ; it is prevented from jumping by steel clips, which engage a clip racer fixed to the work by bolts.

Elevating Gear.

Elevating gear is fixed to both sides of the platform, and is worked by a handwheel on the right side. It consists of spur-gearing acting on arcs attached to the breech of the gun by elevating rods. One of the wheels of the gear is recessed out to fit a friction cone, adjusted by means of a spring and two nuts, so as to admit of the gear slipping a little when firing and thus reduce its liability to damage.

An automatic regulating brake is also fitted to the gear. This consists of a cone and wheel with a friction strap and pawl. The friction strap acts on the wheel, which is free to move in it when the gun is being elevated, but is gripped by the strap and pawl when the gun is being depressed. The cones should be tightened up until the power required on the handwheel for depressing is the same as that required for elevating.

Traversing Gear.

Traversing is effected by turning a handwheel at each corner of the platform, which actuates a pinion gearing with a spur wheel fixed to the truck.

HP. Cylinder.

The HP. cylinder is formed by a steel casting, it has two chambers, one of which is a recoil chamber, in which the ram moves, the other being an air chamber containing the fluid and compressed air.

These chambers are connected by two recoil valves and a bye-pass valve.

On opening the bye-pass valve by a lever with which it is fitted, the fluid is forced by the compressed air against the ram,

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which is gradually pushed out, thus raising the gun to the firing position.

When the gun is fired the elevator presses back the ram, which forces the fluid through the recoil valves into the air chamber and again compresses the air.

The bye-pass valve is automatically closed when the gun has reached the firing position, by means of a cord attached to the carriage and to a crank lever on the valve pin. The cylinder is charged by an air pump.

9-2-INCH AND 10-INCH BARBETTE MOUNTINGS, E.O.C.

These mountings are special, and are generally similar in construction. Each consists of a carriage, platform, and pivot block, the latter forming also a racer plate.

Carriage.

The carriage is of the double plate construction, and runs upon rollers, which are permanently in action. It is fitted in front with a curved shield which has a port, through which the chase of the gun projects. It is fitted with a tension hydraulic buffer, which rests on the bottom plate. The buffer is fitted with suitable valves, which check the motion of the carriage in running up. Spur wheel elevating gear is fitted on the right side, it is worked by handwheel and clamped by a bow cramp.

Platform.

The platform is supported over four coned trucks on the racer plate; the latter has a central boss, to which the platform is connected by a pivot plug.

Steps and a loading derrick, with bollard and winch handle are fitted to the rear.

The flanged feet of the front trucks are fitted with clip plates, which clip under the flange of the pivot plate, and prevent the platform jumping. Gear is fitted to the right side of the plat-

form, to hold the carriage back automatically after recoil. The gear consists of a pawl, pivoted to the outside of the girder of the platform, which engages the front of the carriage after recoil, being kept in action by a spring, also pivoted to the girder. When it is desired to let the carriage run up, the pawl is released by a lever handle to which it is linked.

Pivot Plate.

The pivot plate is of cast steel formed in two pieces connected by a ring, which is shrunk on the plate when finally laid in position.

9'2-INCH AND 10-INCH BARBETTE MOUNTINGS, R.C.D.

These mountings are at present (1886) experimental. They are similar in construction.

The mounting consists of a carriage and platform constructed to fire over an 8 feet parapet, with 17 degrees elevation and 5 degrees depression.

Carriage.

The carriage consists of two cast steel brackets, connected by a transom, it is supported on rollers which are permanently in action. The lower part of each bracket is bored out to receive the cylinder of a tension hydraulic buffer, the piston rod of which is attached to the platform at the front. The buffers are arranged to give an approximately uniform pressure, and can be regulated to suit varying charges.

Platform.

The platform consists of two girders built up of wrought-iron and steel, and connected by steel transoms. The front end of the girders is supported on a steel casting, which forms a transom, with brackets for the front trucks.

The rear end rests on a supporting frame which is hinged to

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the rear transom and to a steel casting, which is formed with brackets for the rear trucks. This casting is kept on the racer by two long horizontal bars, fixed to a band, which works in a groove round the pivot block. A stop bracket is fixed to the front casting, and projects downwards in front of the racer to prevent the trucks leaving the track. A clip bracket is connected by a small vertical hydraulic buffer to the front of the platform, to minimise the effect of the jump, should any occur.

Elevating Gear.

The platform is fitted with elevating gear, consisting of a long bar, pivoted to the fourth transom, with arc at the front end, which is moved through a train of spur gear, by handwheels at the outside of the sides at the centre. A sliding block attached to the breech of the gun works along the bar.

A certain amount of slip is allowed to the gear, by means of a cone on one of the spur wheels, which fits into a corresponding recess or socket, keyed on the elevating spindle. The cone is forced into the socket by a steel spiral spring coiled round the spindle, and contained in a metal sleeve. This sleeve is fitted with a nut for adjusting the pressure of the spring, the reaction of which is taken by another nut on the end of the spindle. The bar is automatically released after each round, by means of a tripper on the carriage engaging a projecting lever on the platform, which acts on two levers pivoted so as to nip the spring together, and reduce the pressure on the cone. The grip of the cone being thus relieved, the bar falls by its own weight, and guides the gun to an elevation of 17 degrees, for under cover loading when run up.

The traversing gear is arranged to act directly on the front trucks; it is worked by winch handles, near the front of the platform.

The pivot block is in one casting of iron; the top is fitted with

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a metal block, which slides in a rectangular hole in the centre transom, where it is secured by a wrought-iron pivot plug.

The racer is of steel, cast in eight segments, with a hook on its outer edge for the clip bracket.

9·2-INCH AND 10-INCH DISAPPEARING MOUNTINGS.

(EXPERIMENTAL.)

Disappearing mountings for the above-mentioned natures of guns are in course of manufacture, but they are at present only in the experimental stages.

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**PART IV.—CARE OF ARMAMENT AND STORE
ACCOUNTS.**

Every Artillery Officer should know how to account for, to take care of, and to detect any deterioration in the armament and in all stores in his charge.

As regards store accounts ; short instructions on the manner of keeping those of a Sub-District will be found below based on the instructions laid down in Equip. Regs. App. IV.

Instruction in the other subjects such as Examination of Ordnance, Care of Ammunition, &c., &c., are too voluminous to find a place here and reference must be made to the following circulars and handbooks, viz. :—

Care and ventilation of Magazines, Ammunition Stores, &c., see Regulations for Magazines, Ammunition Stores, &c.

Examination of Ordnance, see Army Equip. Regs. App. 5.

Care and preservation of Carriages and Platforms, &c., see handbooks of the various guns. Equip. Regs. A.C. 1885, Cl. 208.

Securing lids, stacking and painting of cartridge cylinders, see Equip. Regs. A.C. 50, 1884.

Testing winches and chains in shell lift, see Equip. Regs. A.C. 1882, Cl. 179.

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All ordnance will as far as possible be examined after the following number of rounds. Practice should be discontinued until such examination takes place.

R.M.L.			B.L.		
		No. of rounds.			No. of rounds.
16-inch	....	32	12-inch	....	32
12.5 "	....	32	8 "	and under 12-inch	50
12 "	....	32	4 "	22 cwt. and under	
11 "	....	50	8-inch	....	100
10 "	....	50	Below the 4-inch, 22 cwt.		150
9 "	....	50	12-pr.	....	150
8 "	....	100			
7 "	....	100			
80-pr.	....	150			
64 "	....	150			
40-pr. and under	}	150			
and all R.B.L.					
7" R.B.L.	....	100			

STORE ACCOUNTS OF A SUB-DISTRICT.

The following instructions for Sub-accountants and others have been prepared by First Class Master Gunner D. G. Smith, R.A., Senior Armament Clerk, Western District :—

The books and records kept by a Master Gunner under the Officer in charge of the Sub-District are as follows :—

1. Store Ledger.
2. Distribution Book.
3. Receipt and Issue Journal.
4. Copies of Requisitions.

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 Care of Armament and Store Accounts.

5. Expenditure Journal.
6. Army Form G 908.
7. Memorandum of Examination, Rifled Ordnance
8. Cartridge and Shell Store Records.
9. Joint Armament Return.
10. Joint Inspection Record.

For his guidance, he is furnished with a copy of the Equipment Regulations, the Vocabulary of Stores, the monthly changes in war *matériel*, army circulars, and a handbook for each nature of gun on charge.

1. *Store Ledger* (para. 2, *Appx. IV*, page 544, *Equip. Regs.* 1881).

The Store Ledger (Army Book 118 or 118A, the latter intended for small sub-districts) as its name implies, is an account of the number or quantity of every article of equipment on charge in a sub-district, and a record of all changes that occur, such as receipt from or issue to ordnance store, &c.

It is a large folio volume with printed headings corresponding to the names of stores in the vocabulary. The headings of two opposite pages are exactly alike except that one column of left hand page is headed "Receipts" and the corresponding column of right hand page "Issues." The first line contains the state or number of each article on charge at the time of commencing the book carried forward from the previous ledger. Subsequent transactions are entered on their proper side as they occur, that is all receipts on the left and all issues on the right hand page. It is important that the book should always be kept posted to date. The ledger is balanced yearly to 31st March, by adding up both sides and subtracting the issues from the receipts, thus leaving a new "Remain and State" for 1st April. Specimen pages showing the method of posting and closing the ledger will be found at pages 549 to 557 Equipment Regulations 1881.

The ledger is sent to the District Office annually, under directions from the Officer commanding Royal Artillery, to be

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audited ; and when this has been done a minute to that effect signed by the Brigade Major is added at the end of the volume, which is then returned to the sub-district.

2. *Distribution Book* (para. 2, *Appx. IV*, page 544, *Equip. Regs.* 1881).

The Distribution Book (Army Book 211, 211A, or 211B) is next in importance to the Ledger. Its use is to show in what part of the sub-district the articles charged in the ledger are to be found. Each double page of the book is divided into a number of columns, the first on the left, headed "Ledger Folio," the second "Section of Vocabulary" the third "Description of articles," and the remainder (except two) to the right are left blank for the names of the batteries, stores, and magazines, which should be inserted as far as possible in the order in which they are met with in walking round the sub-district. The last column but one is intended for the "totals" and the last column "for remarks."

This book may be kept entirely in pencil, but there is no reason against the first three columns being filled in in ink. Printed instructions will be found on the first page as to method of using. The Ledger headings are copied into the third column under the heading "Description of Articles" and the number or quantity of each article kept in each of the separate stores, &c., is inserted in the proper column. The total of each line should agree with the number of the particular item shown as on charge by Ledger. Supposing 2,000 64-pr. cartridges to be on charge in a sub-district, one glance along the line in which that item is written shows the main or expense magazines in which they are to be found, and the number contained in each.

3. *Receipt and Issue Journal* (para. 10, *Cl.* 136, *A.C.* 1885).

The Receipt and Issue Journal (A. B. 127 or 129) is a plain Army Book ruled as required in the same manner as the Army

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Form G 1033, Receipt and Delivery Voucher, one half of the book being used for receipts and the other half for issues, working from the covers inwards. Into this book are copied as received the vouchers supporting the transactions shown in the Ledger, each voucher bearing a distinguishing number placed on it in the District Office.

Receipt and Issue Journals (A. B. 195 and 196) may be found in use in sub-districts, but these Army Books are now reserved for use in district offices only.

4. *Copies of Demands* (para. 12, Cl. 136, A.C. 1885).

A guard book is used to hold copies of all requisitions put forward from a sub-district. Army forms G 997, 1027, and 1029, are the usual forms of requisition, the first for equipment, and the other two for materials for repair, paint, and cleaning stores. When the articles demanded are received from store a note should be made against each item showing the voucher on which it will be found, thus enabling the sub-accountant to tell at any time the items that have been fulfilled and the number still outstanding.

Demand Book (A. B. 37) may be found in use in sub-districts but it will in future be reserved for use in district offices only.

5. *Expenditure Journal* (para. 11, Cl. 136, A.C. 1885).

The Expenditure Journal (A. B. 127 or 129) is a plain Army Book ruled as required to show the expenditure of cleaning materials, paint, practice and time, gun ammunition, &c. As no article of this description is now taken up in the Ledger (Cl. 136 A.C. 1885) it is convenient to rule a portion of the Expenditure Journal in such a manner as to make it suitable for a record of Receipts, Issues, and Remains of these consumable stores. Such an account will be found almost indispensable on a change of sub-accountants.

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Expenditure Journal (A. B. 36) may be found in use in sub-districts ; no more will be issued.

6. *Army Form G 908 (para. 133, Equip. Regs. 1881).*

The Equipment Regulations is the authority for the numbers and quantities of stores to be held as the equipment of works. Tables of details for the different natures of ordnance will be found embodied in the Regulations commencing at page 147, or, with the abridged editions, in a separate form specially issued to Master Gunners.

A statement of equipment, Army Form G 908, founded on these details, is prepared for each work in a district, showing the total number of each article allowed, and the proportion of such to be held by the Royal Artillery and the Ordnance Store Department respectively. A copy of this statement is furnished to the sub-district, and it is the duty of the officer in charge to maintain the proportion allotted to the R.A.; consequently the remains of stores, as shown by ledger, should always agree with the numbers in the middle column of the statement. If the ledger totals are less than these, requisitions to complete equipment should be put forward, and if more, the surplus articles should be returned to store.

Articles required in a sub-district for drill only are not shown in the statement, but stores for saluting and time guns are included though, in these instances, no more are allowed than are essential to the particular service of the guns. All empty cases, baskets, paint tins, &c., or any surplus stores that are not to be brought on charge should be returned to store without delay.

7. *Memorandum of Examination of Ordnance (para. 56, Appx. V, Equip. Regs. 1881).*

Each piece of rifled ordnance issued from Royal Arsenal is accompanied by a memorandum of examination. This docu-

ment is really a history of the gun or howitzer, giving the particulars of its construction and of all subsequent alterations or repairs, together with a record of the number of rounds fired from it. It corresponds to the medical history sheet and record of service of a soldier. The memorandum is to be in the possession of the officer in charge of the piece, and all entries of rounds fired should be made in his handwriting at the close of each day's practice. Note should also be made of the examination of the piece by the examiner or the officer in charge, whenever such is carried out. A certificate that this memorandum is in possession and complete to date, is to be included in the Annual Returns of Rifled Ordnance, A.F. G 872 and 925.

There is no memorandum of examination for S.B. ordnance, but a book containing somewhat similar particulars will generally be found in sub-districts having S.B. guns, and an Annual Return is rendered on A.F. G 869.

Instructions as to the number of rounds after which each piece is to be examined and the method of getting such examination carried out, will be found at paragraphs 36 to 44 Appendix V, Equipment Regulations, 1881.

8. *Cartridge and Shell Store Records (Appx. VIIIA, Equip. Regs. 1881, amended by Cl. 101, A.C. 1884).*

A Cartridge or Shell Store Record (A.B. 132 and 133) is kept for each ammunition store in Royal Artillery charge. The object of these books is to keep up a history of the gunpowder, cartridges, projectiles, fuzes, and tubes on charge, a record of their periodical examination by the officer in charge and the Inspector of Warlike Stores, their present condition, and a reference by which that of oldest manufacture can be selected for practice if required.

Instructions regarding these books and as to the dates of examination will be found in Appendix VIII(a), Equipment

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Regulations, 1881, and specimen pages are inserted in each book.

Joint Armament Return and Joint Inspection Record.

For each work in a district there is a Joint Armament Return, and for all works containing guns, 7-inch R.M.L. and upwards, a Joint Inspection Record. These documents are confidential and kept in the district office, but are sent out annually in the months of September and March respectively, for correction to date by an artillery and engineer officer. It is very convenient if the Master Gunner keeps a note book to record changes affecting these returns as they occur, otherwise such changes are apt to be overlooked at the joint inspections, and the returns consequently to become inaccurate.

Taking over charge of a Sub-District.

An officer detailed to take over charge of a sub-district, should ascertain that the books and records enumerated are present, and satisfy himself that they are correctly kept, he can then proceed to take over the stores.

To do this he would call for the Distribution Book, and proceed to the first store shown therein.

Every store room should contain a board with an exact inventory of its contents. The articles should be entered in these inventories in the order, and by the names they bear in the vocabulary, for instance, what is commonly known as a "six by nine" would be entered as, Skids, 3' x 9" x 6".

The Distribution Book contains a copy of every Inventory Board. Stores of the same nature appear in the same line, stores in the same store room in the same column. The total column is a total of all the inventories, and the numbers there shown should agree with the Remain in Ledger.

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In order to verify his stores, the officer should check each Inventory Board with the articles in the store room, compare the board with the Distribution Book, and when all the stores have been thus gone over, ascertain that the "totals" have been carried on correctly.

The Distribution Book is then compared with the Ledger, and if the totals of the one agree with the Remains shown by the other, the officer is in a position to render the certificate required by Regimental Order No. 26 of April, 1883, as amended by corrigenda published with Regimental Orders for April, 1884.

The following are specimens of the entries in the several books of account regarding a few skids. The Receipt and Issue Journals referred to are of the old pattern but no difficulty will be experienced on that account.

Distribution Book.

Ledger Folio.	Section of Vocabulary.	Description of Articles.	Citadel Plymouth.						Remarks.
			Artillery Store No. 1.	Drill Shed.	Side arm shed.	Cumberland Battery.	On temporary loan.	Total.	
169	V.	Skids. { 3' x 9" x 6" 3' x 6" square	7	4	5	4 3	* 9 5	25 12	

* A temporary receipt voucher should be produced for these stores.

On reference to folio 169 of the ledger the above stores appear as follows :

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 Care of Armament and Store Accounts.

Ledger.

169. (SEC. V.) ORDNANCE. Ordnance Stores.

Date.		No. of Voucher.	Receipts.	Skids.			
						3' x 9" x 6"	3' x 6" square
1886							
April	1		State			49	4
May	17	371	O.S.O. gun wharf				8
			Total receipts			49	12
			Issued ..			24	
1887			} = Remain and state			25	12
Mar.	31						
April	1						

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Ledger.

ORDNANCE. Ordnance Stores.

169.

Date.		No. of Voucher.	Issues.	Skids.			
						3' x 9" x 6"	3' x 6" square
1886 July	14	52	O.S.O. gun wharf			24	
			Total issues ..			24	

Care of Armament and Store Accounts.

The transactions of May 17th and July 4th are supported by copies of vouchers in Receipt and Issue Journal.

Receipt Journal.

Date of Receipt.		No. of Voucher.	Ledger Folio.	Receipts.	Quantity.		
					S.	R.	U.
1886				Station, Citadel, Plymouth ...			
				Service, R.A.			
				Order, S.O.S.O., W.D. 19.4.86 ...			
May	17	371	169	From H.M. gun wharf, Devonport			
				Skids, 3' x 6" sq.	8		

Issue Journal.

Date of Issue.		No. of Voucher.	Ledger Folio.	Issues.	Quantity.		
					S.	R.	U.
1886				Station, citadel, Plymouth ...			
				Service, R.A.			
				Order			
July	14	52	169	To H.M. gun wharf, Devonport ...			
				Skids, 3' x 9" x 6"	24		

Index to Equip. Regs. 1881.

The following is an index to the Equipment Regulations, 1881, on subjects of importance to Garrison Artillery.

Accounts of Equipment para. 103 and Appendix IV amended by Cl. 136, A. C. 1885.

Cafe of Armament and Store Accounts.

Ammunition—

Cartridges and projectiles for equipment, paras. 141 to 142j.
Fuzes and tubes, paras. 143 to 155A. For Station and
Annual Practice, paras. 256 to 282H. Making up, paras.
286A to 286F. Silk-cloth cartridges for salutes, &c., para.
286.

Arrangement of stores in works, Appendix VIII.

Barrack Inventory. Stores held on paras. 117 and 119.

Boards of Survey and Courts of Enquiry, paras. 87 and 88, 90
to 97.

Care and preservation of equipment, paras. 499 to 518 and
Appendix V.

Candles, colza oil, and wick, para. 120 amended, by Cl. 160
A.C. 1885.

Depôts, Drill and Laboratory Instruction, Stores for, page 188,
amended by Cl. 18 and 81, A.C. 1885, and Cl. 42, A.C. 1886.

Equipment—

General Instructions, paras. 124 to 140, and 156 to 181.

Details, page 147 to 181.

Estimates, paras. 24 to 34.

Magazines, Laboratories, &c. Appendix VII.

Maps and Text Books, paras. 401 and 402.

Receipt of equipment, paras. 53 to 56.

Requisitions for equipment, paras. 35 to 39, 49, 51, and 52.

Return of equipment into store, paras. 61 to 63, 74 to 84.

Siege Train (for instruction), Appendix IXA.

Signalling equipment, paras. 379 to 381, and page 187.

Care of Armament and Store Accounts.

Special stores for mounting, &c., Lists of, Appendix X.
Targets, paras. 383 to 394c.

Tools—

Artificers, paras. 373 and Appendix XXII
Military tradesmen, para. 376.

PART V.—DRILL.**SECTION 1.—GENERAL INSTRUCTIONS FOR DRILL.**

The instructor should avoid long explanations or details of manufacture, he should either place each man in the position he is to occupy at any given stage of the drill, or himself show how every operation in detail should be performed.

A portion of the lesson should be devoted to theoretical instruction, and the instructor should be careful not to dwell too long on any point of the drill.

A detachment should on no account be permitted to pretend to load or lay a gun ; drill stores are provided, and are to be used.

It is to be understood that it is unnecessary to impart the drill (especially to recruits) in the exact order in which it is written, but that advantage should be taken of a system such as is shown on page 195, whereby the detail of drill may be more easily taught.

This system may with trifling modification be applied to all natures of ordnance.

To ascertain that each No. is correctly placed, the instructor should occasionally prove the detachment as follows :—

At “No. 1 prove,” “No. 2 prove,” &c., the No. called on should raise his right arm and extend it smartly to the front, hand open and as high as the shoulder, thumb upwards ; when the next number is called, he drops his arm ; at “Down” the No. last called drops his arm.

On all occasions before giving a word of command, No. 1 should repeat the number of his gun if there be more than one, the detachments having been numbered off for that purpose before taking post.

(a.m.¹)

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Section I.

General Instructions for Drill.

At the word "under cover" at any time during drill or practice the whole of the numbers at the gun will lay down their stores and double under cover.

At the word "stand fast," or on the "halt" being sounded, the Nos. will remain steady in the position they are then in until "go on" is given, or the "march" sounded.

When one No. does wrong, the word "Stand fast" should be given and the error pointed out. When it can be avoided the word "As you were" should not be given to the whole squad but only to the No. or Nos. concerned.

The term "Load" in the detail of general duties means the service of cartridge, projectile, and wedge wad.

"Side arms" means sponge, rammer, wad hook, shell extractor, shell and cartridge trays. "Attending to vent," means with M.L. guns, drifting and placing the vent server in the vent, and with B.L. guns, taking out the tube, and riming out the vent.

To "Make ready" means, with R.M.L. guns, to insert the tube with lanyard attached; with R.M.L. guns having removeable vents, to hook the lanyard to the tube wire; with B.L. guns to cock and hook the lanyard.

With guns of either nature having removeable vent heads the term also includes removing and replacing the vent head and closing the safety shutter.

Words of command should be quick and clear, but not louder than required.

All drill should lead up to the service of the guns by signal or "Silent drill." This is the only drill allowed at practice or at General or Commanding Officer's inspection, unless otherwise ordered.

When a battery is to be manned or guns used for drill, the detachments and the various ammunition parties should be told off on parade, numbered for their respective guns, &c., and marched direct to their posts or to where the gun stores are kept.

General Instructions for Drill.

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Having obtained the stores the gun detachments will be marched to the battery.

Guns when being run up at either drill or practice must be brought up without a jerk, otherwise the clip plates may be injured and eventually broken off. If the guns are too lively fine sand must be used on the slide.

When a gun on traversing platform is being run back No. 1 follows close up with one of the wedges of a wedge wad, holding the other in his hand.

Any target engaged by coast batteries would probably be a moving one, and the drill should be carried out on that supposition. It is therefore important that the time that elapses from the moment that No. 1 has finished laying until the gun is fired should be as near as possible the same. Five seconds will be found to be enough for No. 1 to descend from the platform and for the gun to be fired. Men should be carefully drilled to take this time.

At drill the gas check is attached to the drill shell ; otherwise it could not be extracted.

Wedge wads are brought up but not rammed home.

The drill is based upon the appliances available, and upon the supposition that the carriages and platforms are of the latest pattern. At stations where such is not the case, it may be found necessary to modify to a certain extent the details laid down, but the general principle should, as far as possible, be adhered to.

The drills for those guns, of which very few exist in the service, such as the 10·4-inch, M.L., the 80-ton or the 100-ton guns, the 32-pr. B.L. have not been included in this book as it is felt that while their insertion would add very materially to the bulk of the volume, they would be of use to very few. Hand-books for these guns will be issued to the districts in which they are mounted.

For full detail of stores issued for the service of guns, *vide* "Equipment Regulations."

(a.m.)

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Section I.

R.M.L. Ordnance (64-pr.).

64-PR. R.M.L. CONVERTED GUN.

DESCRIPTION.

		58-cwt. guns.	71-cwt. guns.
Calibre ....	....	6'3 in.	6'3 in.
Nominal weight	....	58 cwt.	71 cwt.
Preponderance....	....	6 cwt.	6'375 cwt.
Length {	of bore	9 ft. 0'45 in.	8 ft. 7'27 in.
	of rifling	8 ft. 5'45 in.	8 ft. 0'27 in.
	nominal	9 ft. 6 in.	9 ft.
Grooves	....	3	3
Twist of rifling, uniform		1 in 40 calibres	1 in 40.

PATTERNS.

Two patterns of this gun, converted on the Palliser principle, are met with for land service, mounted on garrison standing carriages or on sliding carriages and traversing platforms, viz. :-

64-pr. of 71 cwt., converted from 8-in. S.B. of 65 cwt.
 64-pr. of 58 cwt. ,, ,, 32-pr. S.B. of 58 cwt.

MODE OF CONVERSION.

The mode of conversion consists in boring out the old gun and making a wrought iron tube to fit the casing thus prepared ; this tube is slightly smaller than the bore of the casing. When fitted into its place it is secured there by means of a cast iron collar, screwed into the muzzle end of the casing, over a shoulder on the end of the tube ; a wrought iron plug is also screwed through the casing underneath the chase and into the barrel, preventing any chance of the latter shifting round.

RIFLING.

The rifling is termed "the plain groove system." The bottom of the groove is concentric with the bottom of the bore.

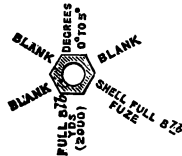
VENTING.

In the 71-cwt. gun the old vent patch is removed and the old vent closed with a wrought iron screw plug, a new vent being drilled a little from the breech end ; it is bushed with a "through" vent. The 58-cwt. gun is vented in the original position.

SIGHTING.

The 58-cwt. gun is provided with centre sights only, viz. :—

One centre hind sight. This is a short scale for use up to 2,000 yards or 5°. It works in a gun-metal socket fixed in the gun, and is provided with a set screw ; is six-sided, and marked as follows .—



Marks III. or V. centre hind sights can be issued with this gun. The 64-pr. 58-cwt. of future issue will be provided with new pattern sights, the centre hind sight (Mark VI. §3,205) has a deflection leaf, giving 1° 30' on either side, and a longer hexagonal bar than the foregoing, being graduated in degrees (up to 12°) on the front face, and in yards (to 4,000) on the rear face with a fuze scale on the right rear face. The muzzle sight is recessed into the dispart patch on the muzzle.

One centre foresight. Consists of a pillar, collar, and socket of gun-metal, a steel leaf, and screw for fixing the leaf. The socket is permanently fixed in a bracket attached to the gun ; the pillar and collar each lock into it with a bayonet joint—so that when once the sight is in its true position it cannot be

Section I.


R.M.L. Ordnance (64-pr.).

removed without first raising the collar and turning the pillar round a quarter of a circle.

The 71-cwt. gun is provided with side sights only, viz. :—

The tangent scales (one on each side) graduated up to 15°, have deflection leaves giving 50 minutes on either side, and marked as follows :

DEGREES,
0° TO 15.

BLANK.  SHELL, FULL.
8 LB., FUZE.

FULL, 8 LB.
YARDS (3,600).

Marks II. (iv.) III. (iv.) or IV. tangent sights with deepened notch can be issued with this gun.

Two trunnion sights (one on each side), similar to the centre foresight of the 58-cwt. gun, fitting into gun-metal brackets attached to the gun over the trunnions by two screws.

PROJECTILES.

Nature.	Weight Empty.		Burst.		Mean Total Weight.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Common Shell	57	6	7	2	64	8
Shrapnel Shell	66	0	...	9	66	9
Case Shot ... ..	...	...	...	...	49	14½

CHARGES.*

Full 6 lbs. R.L.G.², or R.L.G. or L.G.,
8 lbs. L.G. or R.L.G.
Saluting 5 lbs. L.G.

* The tangent scale is graduated for the 8 lb. charge. This charge must not, however, at present be used. A range table is issued for the 6 lb. charge.

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FUZES.

Percussion Direct action for common shell only.

Time { 15 secs. M.L. 5 secs. and 9 secs. M.L., may be
 used if sufficient for time of flight of shell.

64-PR. R.M.L. GUN. MARK III.

DESCRIPTION.

Calibre	....	....	....	....	....	6.3 inches.
Nominal weight	....	....	....	....	....	64 cwt.
Preponderance	....	....	....	....	....	3.75 cwt.
Length	{ of bore	....	....	....	....	8 ft., 1½ inch.
	{ of rifling	....	....	....	....	7 ft., 6½ inch.
	{ nominal	....	....	....	....	9 ft., 6¾ inch.
Grooves	....	....	....	....	....	3
Twist of rifling, uniform	....	....	....	....	....	1 in 40 cal.

PATTERNS.

There are three patterns of this gun. Mark III. differs from Mark I. in general construction, and in being built in fewer parts. There are a few 64-pr. Mark II., stamped "B" on the left trunnion, which differ from Mark III., in having a forged W.I. breech-piece. Those of Mark III., made since April, 1871, have solid ended steel tubes.

RIFLING.

As for 64-pr., converted.

VENTING.

Similar to 7-inch R.M.L. gun.

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Section I.**. R.M.L. Ordnance (64-pr.).****SIGHTING.**

Similar to the 7-inch R.M.L. gun, also having a deflection leaf, giving 50 minutes on either side.

NOTE.—The sights are graduated for the 10 lb. charge R.L.G.

PROJECTILES.

Are the same as the 64-pr. of 58 cwt.

CHARGES.

Full 8 lbs. R.L.G², R.L.G., or L.G.

**DRILL FOR 64-PR. R.M.L. GUNS, ON COMMON
STANDING CARRIAGES.**

The detachment consists of 9 Nos. and falls in two deep.

To TELL OFF.

<i>Officer.</i>	|	<i>No. 1.</i>
<u> </u>		<u> </u>
<i>Tell Off.</i>		

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 of the 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.

The detachment is marched into the battery and halted in line facing the parapet, and to the left rear of the platform. The detachment is now in position of "detachment rear."

TO TAKE POST UNDER COVER.

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

The detachment stepping off wheels to its left at the left corner of the platform ; the front rank filing to the left of the gun, the rear rank to the right, 2 and 3 halting close to the parapet and near the embrasure ; 4 and 5 forming upon their right and left, and the whole turning to the right about together. No. 1 follows in rear of the detachment, and at drill forms up on the right of No. 5 ; 6 and 8 go to the cartridge store (6 outside) and 7 and 9 to the shell store (7 outside).

GENERAL DUTIES.

No. 1 commands, directs or superintends boring and fixing fuzes, directs the gun into the line of fire in running up, and lays.

No. 2 searches, sponges, rams home, runs up, elevates and traverses.

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

No. 4 attends to side arms and supplies them to 2, runs up and attends to the elevating screw and coin in laying.

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.

TO PREPARE FOR ACTION.

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

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R.M.L. Ordnance (64-pr.).

“ Prepare for action.”

The stores are brought up as follows :—

No. 1, handspike, sights,* and a piece of chalk.

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

No. 3, handspike and elevating screw, removes the tampeon from the muzzle.

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

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

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

No. 7, fuzes, fuze and shell implements. He obtains the fuze boxes from 9, having ascertained from No. 1 the nature of fuzes required ; he sees that fuzes and fuze implements are correct.

No. 8 prepares to issue cartridges.

No. 9 provides a brush for cleaning shell, prepares to issue shells, friction tubes and fuzes, after which 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.

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

The sponge and rammer 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

* 6-foot handspikes are used with this gun.

R.M.L. Ordnance (64-pr.).

Section I.

gun : the shell extractor and wad hook so as not to interfere with the working of any of the guns in the battery, and convenient for the guns for which intended. The sponge bucket near the sponge head.

The handspikes are laid down, two on each side of the platform, close to the carriage, points to the front, bevelled side uppermost ; those of 2 and 3 outside and about 2 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 sees that the elevating screw is properly oiled.

No. 5 straps the tube box round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube box strap, places the pricker in the loop on the side of the carriage, 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 box with friction tubes, which he procures from 9.

If the gun is to be prepared for drill only, 8 and 9 provide and hook a tackle to the rear axletree and to a holdfast in rear of the gun.

The gun is supposed to be at the rear of the platform.

"Examine gun."

No. 5 drifts the vent, replaces the pricker in the loop and the vent server.

No. 2 supplies himself with the wadhook, searches the gun after the pricker is withdrawn, and replaces the wadhook.

Nos. 4 and 5 take a purchase with handspikes over the cheeks and under the breech, the coin is withdrawn and the elevating screw put in by 3, No. 1 holding up the stool bed with a handspike applied over the bottom step of the carriage. No. 1 gives the order "*Lower*," 4 and 5 withdraw their handspikes, and lay them down.

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R.M.L. Ordnance (64-pr.).

To LOAD.

<i>Officer.</i> <hr style="width: 50px; margin: 0 auto;"/> <i>Range</i> —yards. <i>With</i> —load.	<div style="border-left: 1px solid black; height: 100px; margin: 0 auto; width: 2px;"></div>	<i>No. 1.</i> <hr style="width: 50px; margin: 0 auto;"/> <i>With</i> —load.
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"Load."—No. 1 gives 7 the nature of shell and fuze required, and during the loading fixes his tangent scale at the required elevation, and places himself where he can best superintend the service of the gun.

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 hands along the stave to his right as far as he can reach, sends the sponge up the bore, slides his hands out again and forces the sponge hard home, gives it two half turns, pressing it against the bottom of the bore, withdraws the sponge hand over hand, turning it from him, cleaning the bore well. When the sponge arrives near the muzzle he jerks it out, his hands then should be in the position they were in when he introduced the sponge into the bore. He then hands the sponge to 4 and receives the rammer, right hand about the centre back down, left as near the head as possible back up; as soon as the cartridge and shell are put in, he enters the head into the bore and forces them home hand over hand. He then springs the rammer, steps out, hands it to 4, and goes under cover.

No. 3, as soon as the sponge is withdrawn, takes the cartridge from the cartridge case with his left hand, moves up and places it in the bore, 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

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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. Should it appear by the mark on the rammer that the charge is not home, 2 and 3 ram home again.

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 about two feet. He then moves toward the muzzle and passes the stave into the embrasure in such a manner that 2 can conveniently lay hold of it, waiting at the left rear of 2, facing the gun, to receive the sponge. 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, which he does 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.

<i>Officer.</i> <hr style="width: 20%; margin: 5px auto;"/>	To RUN UP. <div style="border-left: 1px solid black; height: 80px; margin: 0 auto; width: 10px;"></div>	<i>No. 1.</i> <hr style="width: 20%; margin: 5px auto;"/> <i>Run up.</i> <i>Halt.</i>
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Section I.

R.M.L. Ordnance (64-pr.).

Directly the gun is loaded, No. 1 gives "*Run up*," and applies his handspike under the rear axletree to guide the gun.

Nos. 2, 3, 4, and 5, take up their handspikes at the centre, with the hands next the parapet back up, the other hands at the small ends back down; stepping up to their respective axletree arms, they apply their handspikes under and in rear of them, and stand ready to heave, taking the time from 2, and using short quick purchases they heave together until the front trucks nearly touch the hurter, when 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.

Nos. 2, 3, 4, and 5 withdraw their handspikes, drop the points to the ground; 4 and 5 lay theirs down; 2 and 3 turn to the rear and step outwards, holding their handspikes diagonally across the body, outward hands at the small ends as high as the ear, inward hands resting on the handspike at the full extent of the arm, bevelled side of the handspikes uppermost; 4, kneeling on his left knee in rear of the right cheek, takes hold of the large coin with both hands, or the small coin with his left hand, or works the screw as may be directed by No. 1; the screw should be used only for final adjustment; 5 goes under cover and prepares a tube.

TO LAY, MAKE READY, AND FIRE.

*Officer.**No. 1.**Commence firing**Elevate.**or**Lower.**Fire—Rounds.**Coin.**With screw, Elevate. Halt.**Depress, Halt.**Trail (right). Halt.**Trail (left). Halt.**No. — Ready.**No. — Fire.*

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No. 1, looking over his sights, gives "*Elevate*," then "*Lower*," and when the gun is at the required elevation, "*Coin*." If a slight amount of elevation or depression is required, he gives "*With Screw*," "*Elevate*," or "*Depress*."

"*Elevate*," 2 and 3 step forward in line with the breech, place their handspikes, bevels down, over the steps and under the breech, and bear down ; at "*Lower*," they allow the small ends to rise gently ; at "*Coin*" they withdraw their handspikes and step outwards ; 4 withdraws the coin as soon as 2 and 3 elevate, and at "*Coin*" forces it sharply home. If the order is "*With Screw*," "*Elevate*," or "*Depress*," 4 works the screw until "*Halt*" is given. The other numbers stand fast.

If the muzzle is to go to the left No. 1 gives "*Trail right*," and when the muzzle is sufficiently to the left, "*Halt*." At "*Trail right*" 2 moves round on his right foot to the rear of the axletree arm and applies his handspike under it to row ; 3, stepping to his left, takes a purchase under the rear of the cheek and stands ready to heave over the trail. They heave together until the order "*Halt*," and remain there steady till the next order is given.

"*Trail left*" is the converse of the above. If much traversing is required the order is "*Extreme right*" or "*Extreme left*." In this case 4 or 5, according to the side, takes a purchase in front of the rear truck in addition to the other numbers.

Should no order to fire be given when the gun is laid, No. 1 will give the word "*Under cover*."

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, facing the gun.

As soon as "*Ready*" is given, 2 and 3 lay down their handspikes and with 4 go under cover, except when firing at a moving target.

At the word "*No*" (naming his gun) from No. 1, 5 stretches the lanyard looking towards No. 1.

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

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

TO RUN BACK AND UNLOAD.

Officer.No. 1.*Run back.**Halt.**Unload.*

When the vent has been drifted and the vent server placed in the vent, at "*Run back*" the detachment double out and man the fall of the tackle arranged by 8 and 9 for the purpose, and heave the gun back into the position for loading, No. 1 giving "*Halt*," "*Unload*," when the gun is sufficiently run back. On this order the gun is unloaded, 2 and 3 withdrawing the charge, 4 supplying the necessary side arms.

TO CEASE FIRING AND REPLACE STORES.

Officer.No. 1.*Cease firing.**Replace stores.**Elevate.**Lower.**Coin.**Replace stores.*

"*Cease firing*," "*Replace stores*," No. 1 gives "*Elevate*," and the gun is laid under metal by 4 and 5, he then gives "*Replace stores*," and the stores are replaced by the numbers who brought them up.

R.M.L. Ordnance (64-pr.).

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TO FORM DETACHMENT REAR.

Officer.No. 1.*Detachment rear.*

Outwards turn.
Double March.
Halt.
Front.

"*Detachment rear*," No. 1 doubles to the left rear of the platform, faces to the left, and gives the order "*Outwards turn*," 2 and 4 turn to their left, 3 and 5 to their right.

"*Double march*," 4 and 5 followed by 2 and 3 wheel to the right and left, and when clear of the platform to the right, and round No. 1's left shoulder, 6, 7, 8, and 9 coming up into their places; when 2 and 3 have passed him, No. 1 gives "*Halt*," "*Front*," and changes his flank by the rear.

TO CHANGE ROUNDS.

Officer.No. 1:*Change Rounds.**Change Rounds.*

In changing rounds No. 2 becomes 4; 4, 1; 1, 9; 9, 8; 8, 7; 7, 6; 6, 5; 5, 3; 3, 2.

SYSTEM OF DRILLING RECRUITS.

(See page 186).

DRILL FOR 64 PR. R.M.L. GUN.

TO LOAD.

Detail.

No. 1, as at page 190; then give "No. 1 only"—"*Load*."
 (a.m.) o.

Section I. R.M.L. Ordnance (64-pr.). Drilling Recruits.

Next Detail.

"No. 2 places himself in a convenient position for sponging, *i.e.*, his left foot in line with and about 12" from the muzzle, steps to his right with his right foot, and looks to his left rear," and says "No. 2"—"Load."

Next.

"No. 6 brings up a cartridge in a case, and places it on the ground on No. 3's right front."

"No. 6"—"Load,"

and so on throughout :—

No. 7 brings up a shell, point to his right, having fixed the fuze according to No. 1's directions and places himself on the right rear of No. 6.

Nos. 8 and 9 as at page 191, Nos. 7, 8, and 9 "Load."

No. 4 doubles out, &c., &c., lines 6 *et seq.* to "sponge" line 15, page 191, No. 4 "Load."

No. 2 takes the sponge, &c., &c., from line 12 as far as hands the sponge to 4," line 23, page 190.

Go on 2.

No. 4 when he receives, &c., &c., and complete 4's detail p. 191.

Go on 4.

No. 6 complete 6's detail on page 191.

Go on 6.

No. 3 give No. 3's details as on pages 190 and 191.

No. 2 complete No. 2's detail.

Go on Nos. 2, 3, and 7.

R.M.L. ORDNANCE ON REAR CHOCK CARRIAGES.

Guns mounted on rear chock carriages require the same detachment and stores as those on common standing carriages, with the exception of one roller handspike provided by No. 1 and two 7-foot handspikes by 2 and 3, instead of five common handspikes.

The drill is also the same, with the following exceptions :—

In running up, No. 1, holding his roller handspike vertically, takes a purchase under the socket in rear of the chock, bears down and raises it off the platform, keeping a firm hold of the handspike to prevent its flying up, which gives him a perfect control over the carriage and enables him to guide it. When the platform is in good order the gun runs up very fast. No. 1 in that case allows the small end of his handspike to “come up” just before the trucks reach the hurter. As soon as the gun is run up, No. 1 releases his roller handspike, takes it by the centre with his right hand, and slides it well to the rear clear of the recoil.

In running up, 2 and 3 apply their handspikes at the axletree arms, assisted by 4 and 5. As soon as the gun is up the handspike men turn to the rear in line with the vent.

“*Elevate*,” 2 and 3 apply their handspikes, 5 double-manning 3’s, 4 attending to the coins.

“*Trail Left*,” 2 applies his handspike under the right cheek behind the chock.

“*Trail Right*,” 3 applies his handspike in a similar manner under the left cheek.

“*Extreme Right*,” or “*Extreme Left*,” the numbers all go to one side and heave over, applying their handspikes behind the cheek.

The running back is performed by means of tackle, No. 1 applying his roller handspike as in running up, and the rest of the Nos. running away with the fall.

(a.m.)

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Section I. R.M.L. Ordnance (64-pr.) on Moncrieff Carriage.

DRILL WITH 64-PR. R.M.L. (CONVERTED GUN) OF 58 CWT. ON MONCRIEFF CARRIAGE. MARK II.

The detachment, consisting of 9 Nos., is told off and takes post under cover, as with the same gun mounted on a traversing platform.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, attends to the brake in running up, and lays.

No. 2 searches, sponges, places projectile in bore, rams home (attends to lever if required), and elevates.

No. 3 loads, uncaps, or removes safety pin from fuze when in the bore, rams home (attends to lever if required).

No. 4 attends to side arms, supplies them to 2 (attends to lever if required).

No. 5 attends to vent, supplies wedgewads, traverses (attends to lever if required), makes ready, and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes, and brings up the projectile.

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

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

TO PREPARE FOR ACTION.

As with the gun on a traversing platform, except no preventor rope, handspikes, truck levers, or iron-shod levers, are required. No. 5 provides a long lanyard 7 and 9 a selvagee each.

A sponge, with wire rope stave, and a rammer with jointed stave are used.

2 and 3 bring up an iron-pointed lever each, which they lay down on each side of the gun.

Tackle will be necessary to run the gun back. Two sets of light gun tackle are brought up by 7 and 9.

The sponge and rammer are laid down on the right of the gun,

R.M.L. Ordnance (64-pr.) on Moncrieff Carriage. Section I.

close to the parapet, heads towards the muzzle, the shell extractor and wadhook outside the pit.

At "*Examine Gun*," same as at 64-pr. R.M.L. on a traversing platform, except 4 supplies 2 with the wadhook, and replaces it, and 2 attends to the elevating wheel and depresses, after the gun has been searched, until the muzzle is in a convenient position for loading.

TO LOAD.

As with the gun on a traversing platform, except as follows :—

No. 1 at "*Load*" gets the gun into a convenient position, *i.e.*, the upper edge of counterweight nearly horizontal ; 2 depresses the gun, if necessary.

After the loading is completed, 2 gives 1° or more of elevation, as shown on the arc.

TO RUN UP.

Before running up, No. 1 will give the caution "*Stand Clear*," then, holding the brake, he allows the gun to run up.

He must be very careful not to let it escape from his control, and on the other hand he must not check it too soon. Should the latter be the case, No. 1 gives "*Work Levers*," 2 and 3 work their levers, small ends to the rear ; 2 and 4 man the right, 3 and 5 the left lever ; No. 1 will give "*Down*," "*Fresh Purchase*," "*Halt*," as required.

When the gun is up, No. 1 will mount up the ladder to lay it, 2 and 3 unshipping the levers ; 5 mans the traversing handle.

TO LAY THE GUN.

5 traverses.

2 elevates or depresses.

The gun may be laid without exposing any number, No. 1 using a reflecting sight or elevating in accordance with the graduations on the elevating arc or trunnion pointer, and traversing to marks previously made on the racers.

Section I. R.M.L. Ordnance (64-pr.) on Moncrieff Carriage.

TO MAKE READY AND FIRE.

When No. 1 has laid the gun, at "*Ready*," he drops the tube into the vent, throws the lanyard clear of the carriage, and comes down.

As soon as No. 5 has fired he drifts the vent, replacing the vent server and pricker, and coils up the lanyard.

TO UNLOAD AND RUN BACK.

(For drill purposes extra men will be required.)

To run back, 2 and 3 work their levers, small ends to the front, and bear down, double-manned by 4 and 5, No. 1 giving "*Down*," "*Fresh Purchase*," "*Halt*," as required.

Tackles to be hooked by 4 and 5, assisted by 6 and 7, and manned by all available Nos.

Unloading should be effected from the firing position before the gun is run back.

TO CEASE FIRING AND REPLACE STORES.

TO FORM DETACHMENT REAR.

TO CHANGE ROUNDS.

As with 64-pr. R.M.L. on traversing platform.

80-PR. R.M.L. CONVERTED GUN.

DESCRIPTION.

Calibre	....	6·3 in.
Nominal weight	....	5 tons.
Preponderance	....	9 cwt. 3 qrs. 4 lbs.
Length	{ of bore	.... 9 ft. 5·25 in.
	{ of rifling	.... 8 ft. 10·25 in.
	{ nominal	.... 10 ft.
Grooves	....	3
Twist of rifling	....	Uniform, 1 in 40 cal.

GENERAL OBSERVATIONS.

The 80-pr. R.M.L. converted gun for land service is met with for defence of land fronts, and for coast defence against wooden shipping.

MODE OF CONVERSION.

Its mode of conversion from the 68-pr. S.B. of 95 cwt. is identical with that of the 64-pr. of 58 cwt.

RIFLING.

The rifling, however, is on "the Woolwich system," the width of the groove being 1·3 inches, and depth 0·145 inch. Case shot is, therefore, the *only* projectile interchangeable with the 64-pr. gun.

VENTING.

The 80-pr. is vented in the same manner as the 64-pr. 58-cwt gun.

SIGHTING.

The 80-pr. is side-sighted, and has drop trunnion sights; the tangent scales are fitted with deflection leaves, giving 50 minutes right and left, and are graduated and marked in a similar manner to the sights for the 64-pr. of 71 cwt.

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R.M.L. Ordnance (64-pr. and 80-pr.).

PROJECTILES.

Nature.	Weight empty.		Burst.		Gas-check.		Mean total weight.	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
Common shell	71	1	8	10	...	...	79	11
" " studless...	77	2½	9	5	3	8½	90	0
Palliser shot "	86	7½	...	...	3	8½	90	0
Shrapnel shell "	85	13½	...	10	3	8½	90	0
" " studded ...	78	10	...	9	...	...	79	3
Case shot " ... ..	...	...	...	...	...	...	49	14½

CHARGES.

Full	....	....	20 lbs. P. muzzle velocity, 1,553
Full	....	....	12 lbs. P. " " 1,251
Saluting	....	....	5 lbs. Blank

FUZES.

Percussion. Direct action for common shell only.
Time { 15 secs. M.L. 5 secs. and 9 secs. M.L. may be
 { used if sufficient for time of flight of shell.

DRILL FOR 64-PR. AND 80-PR. R.M.L. GUNS ON TRAVERSING PLATFORMS.

The drill is the same as for 64-prs. on common standing carriages, except in the details hereafter specified.

The detachment consists of nine numbers. The additional stores required are two sets of tackle, one preventor rope, two truck levers, two iron shod levers; two handspikes only are required. With the 64-pr., luff tackles; with the 80-pr., light

R.M.L. Ordnance (64-pr. and 80-pr.).

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gun tackles, 7-foot handspikes, and one shell-bearer should be provided.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, holds on to the preventor rope and lays.

No. 2 searches, sponges, rams home, runs up, elevates, and traverses.

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

No. 4 attends to side arms, and supplies them to 2, runs up, attends to the elevating screw and coin in laying.

No. 5 attends to vent, supplies wedge wads, runs up, holds on to preventor rope, makes ready, and fires.

No. 6 supplies 3 with cartridges (and with 80-pr. brings up projectiles).

No. 7 attends to fuzes and brings up projectile.

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

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

TO PREPARE FOR ACTION.

"To prepare for action."—No. 1 provides and fixes sights, a piece of chalk, and preventor rope, which he attaches to the carriage, assisted by 3 (if necessary), takes two turns with it round the bollard, the running end coming off to the left at the top.

No. 2, handspike, truck lever, iron shod lever, and assists 4 with side arms.

No. 3, handspike, truck lever, iron shod lever, and elevating screw. Removes muzzle tampeon.

No. 4, side arms and support.

No. 5, wedge wads, tubes in box, lanyard, pricker, and vent server.

No. 6, two cartridge cases (which he takes to the cartridge store), bucket filled and brush, two drill cartridges for drill purposes.

PART V.**Section I.****R.M.L. Ordnance (64-pr. and 80-pr.).**

No. 7, fuzes, fuze and shell implements, one set of tackle (and with 80-pr. a shell bearer).

No. 8 prepares to issue cartridges.

No. 9, one set of tackle and a brush for cleaning projectiles. Prepares to issue shell, tubes, and fuzes.

The handspikes and iron shod levers are laid down bevelled sides uppermost; the handspikes next the gun, the truck levers between them, the whole with their points to the front.

The standing blocks are hooked by 7 and 9 to the rear eye-bolts of the platform, the tackles over-hauled, and the ends of the falls coiled down.

"Examine gun."—No. 5 drifts the vent, replacing the pricker and vent server, 4 and 5 take a purchase with their handspikes over the cheeks and under the breech, and bear down.

With the 80-pr. 2 double man's 4's handspike; the coin is withdrawn and the elevating screw put in by 3, No. 1 holding up the stool bed with an iron shod lever applied over the bottom step of the carriage. No. 1 gives *"Lower,"* when 4 and 5 withdraw their handspikes and lay them down; 2 supplies himself with the wad hook, searches the gun, after the pricker is withdrawn, and replaces the wad hook.

TO LOAD.

No. 2 mounts on the side piece, and places himself in position for sponging.

No. 3 mounts on the step to put in the cartridge, and on the platform to put in the projectile, and a wedge wad after they have been rammed home, 2 and 3 pressing it steadily home, jamming it under the head of the projectile by two smart taps.

With 80-prs. 6 and 7 bring up projectiles in bearer, 6 carrying the cartridge case in his right hand. The bearer is placed on the front of the platform, and 7 removes it when the shell has been placed in the bore by 2 and 3.

TO RUN UP.

"*Run up.*"—No. 1 takes in the slack, and holds on the preventor rope ; 2, 3, 4, and 5 take up the truck levers ; 2 and 3 raising the small ends to enable 4 and 5 to hook the points to the eye-bolts. When this is done 2 and 3 haul down the small ends by means of the ropes ; 4 and 5 place the pawls ; 4 goes under cover ; 5 holds on to the preventor rope behind 1 ; 2 and 3 guide the levers whilst the carriage is in motion.

Nos. 1 and 5 ease off, hand-over-hand, and hold on when the mark on the preventor rope comes over the bollard.

When the gun is in its proper position No. 1 gives "*Halt.*" when 2 and 3 heave down the small ends of the levers ; 4 and 5 throw back the pawls ; 2 and 3 allow the small ends of the levers to rise gently, manning the ropes when the levers are above their reach.

When the rear of the carriage rests upon the platform the levers are unhooked, withdrawn, and laid down outside the handspikes by 2, 3, 4 and 5, 4 tightening the compressor if the carriage is fitted with one ; 2 and 3 pick up their handspikes, and stand ready to elevate (at the 80-pr. 5 double manning 3's handspike) ; 4 attending to the coins and elevating screw.

5 unhooks and takes in the slack of preventor rope.

TO LAY, MAKE READY, AND FIRE.

The gun is elevated in the same manner as when mounted on a standing carriage ; on No. 1 giving the word "*Coin.*" 2 and 3 lay down their handspikes, and take up the iron shod levers to traverse ; 5 prepares a tube.

As these platforms are pivoted in front, in rear, or in the centre, the position taken up by 2 and 3 differs according to the manner in which the platform is pivoted.

PART V.**Section I.****R.M.L. Ordnance (64-pr. and 80-pr.).**

<i>Nature of pivot.</i>	<i>Position of Nos. 2 and 3.</i> <i>"Trail right."</i>
Pivot "A" (under the muzzle of the gun when run up).	2 stands facing to the rear with the point of his lever resting on the rear racer ; at " <i>Halt</i> ," he scotches the rear truck his own side with the lever.
Pivot "B" (under the front part of the platform).	3 stands facing to the rear and applies the point of his lever under the left rear truck of the platform, both hands back up, and heaves the platform over to the right, taking short quick purchases. <i>"Trail left."</i> The numbers work in the opposite directions.
Pivot "C" (in the centre of the platform).	As with "A" Pivot. <i>Position of Nos. 2 and 3</i> <i>"Trail right."</i> 3 works as with pivot "A ;" 2 takes up his position at the front truck on his own side, and works over the front of the platform to the left. At " <i>Halt</i> ," 2 withdraws his lever and with it scotches the rear truck. <i>"Trail left."</i> 3 works the front truck, and 2 the rear, 3 scotches the rear truck at " <i>Halt</i> ."

Nature of Pivot.

Pivot "D" (at an intermediate point between the centre of the platform and the rear truck).

Trail right or left.

2 and 3 work the front truck, 2 heaving the front of the platform over to the left in the first case, 3 the front to the right in the second.

Pivot "E" (in front of the rear block).

As with "D" Pivot.

Pivot "F" (in the rear of the rear block).

As with "D" Pivot.

With platforms pivoted at "A" or "B;" at "*Extreme right*" (or *Left*) 2, 3, 4 and 5 push over the rear of the platform in the direction ordered.

When traversing tackle is used; at "*Hook traversing tackle*" 4 and 5 hook the double blocks to the rings or holdfasts prepared for them; 2, 4, and 3, 5, haul on the tackle, or ease off at "*Trail right*" (or *Left*), so as to move the platform in the direction required.

If the tackle when hooked hinders the service of the gun the double blocks are removed by 4 and 5, or the single ones by 2 and 3, as may be directed by No. 1.

At "*Ready*," 2 and 3 withdraw their levers and place them, bevels up, as scotches under the trucks, 2, 3, and 4 then go under cover. No. 5 hands the tube with lanyard attached to 1, the other end of the lanyard hanging down the side of the carriage, or if long, being coiled up and hung on the rear eyebolt. No. 1 puts in the tube when he has laid the gun, giving the word "*Ready*," he jumps off the platform and gives the word No. (naming his gun). No. 5 seizes the lanyard and stretches it out, looking towards No. 1. At "*Fire*" from the No. 1 he draws the lanyard strongly towards him without a jerk, replaces it under his belt, hooks the preventer rope (except at drill) and goes under cover.

64-pr. R.M.L. Gun, with Circular Buffer.

Should no order to "Fire" have been given by the officer, No. 1 will not receive a tube from 5, but will give the word "Under cover" as soon as the gun is laid.*

RUN BACK.

"*Run back*," 4 slackens the compressor if the carriage is fitted with one.

Nos. 4 and 5 assisted by 2 and 3, first hook the front blocks to the front eye-bolts of the carriage, and take in the slack. The truck levers are then applied as in running up; No. 1, standing between the cheeks, holds the small ends of the truck levers and guides them. All the numbers except No. 1, man the falls on their respective sides, and at "Heave," haul the gun back.

When the gun is run far enough back, No. 1 hauls down the levers by the ropes till the pawls fall; the levers are then allowed to come up, No. 1 rising with them; 2, 3, 4 and 5 unhook the truck levers, and lay them down; 5 hooks the preventor rope. The front blocks are unhooked by 4 and 5, who carry them to the rear, overhaul them, assisted by 2 and 3, lay them down clear of the racers, and coil down the ends of the falls.

64 - PR. R. M. L. GUN, WITH CIRCULAR BUFFER.
MOUNTED ON TRAVERSING PLATFORM, "C"
PIVOT. TO FIRE OVER A 6-FOOT PARAPET.

The drill is the same as for 64-pr. R.M.L. gun, on the ordinary traversing platform, with the following exceptions:—

GENERAL DUTIES.

No. 1 commands, directs or superintends boring and fixing fuzes, adjusts the buffer to the charge used, ascertains that the buffer contains the proper amount of oil, and lays.

* "In the service of guns when the firing number cannot put the tube into the vent without mounting on the platform, this duty should be performed for him by No. 1."

64-pr. R.M.L. Gun, with Circular Buffer.

No. 2 searches, sponges, rams home, runs back when necessary, elevates and traverses.

No. 3 loads, uncaps or removes safety pin from fuze when in the bore, rams home, attends to the brake in running up, runs back when necessary, places the clutch in or out of gear, and traverses.

No. 4 attends to side-arms, supplies them to No. 2, and runs back when necessary.

No. 5 attends to the vent, supplies wedge-wads, makes ready, fires, and runs back when necessary.

TO PREPARE FOR ACTION.

No. 1 provides a piece of chalk and fixes sights.

No. 2 iron-shod lever, elevating wheel, and assists No. 4 with side arms.

No. 3 iron-shod lever, 4 fathoms of $1\frac{1}{2}$ -inch lashing for jointed rammer when necessary, removes the muzzle tampeon.

No. 4 a jointed rammer, sponge with wire rope stave, and running back handle.

No. 5 wedge-wads, tubes in box, lanyard, pricker, vent server, and running back handle.

TO LOAD.

The gun is run up or back to the most convenient position for loading (the white paint mark on the carriage and platform should then coincide).

No. 2 will depress the gun, to bring the muzzle in line with the carrier, which is swung round with the shell on it, after the cartridge has been placed in the bore.

No. 7 brings up projectile and places it on the carrier.

Nos. 2 and 3 then place the head of the rammer against the nose of the shell, and ram home. Should any difficulty be experienced in ramming home, these Nos. may be assisted by a bight of a rope being passed behind each joint of the rammer

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in succession, and hauled on by the remainder of the detachment.

TO RUN UP.

No. 3 sees that the running-back clutch is out of gear, and, carefully releasing the brake lever, allows the gun to run up gently to the front stops.

TO LAY THE GUN.

No. 1 looks over his sights, gives elevate, &c., as required, then places a tube in the vent for No. 5.

No. 2 works the elevating wheel.

No. 4 works the clamping lever.

TO RUN BACK.

No. 3 places the clutch in gear, and Nos. 2, 3, 4, and 5 man the running back handles, and run back, 3 then puts the clutch out of gear.

TO UNLOAD.

The gun should be unloaded when horizontal.

NOTE.—In mounting the carriage on the platform, care should be taken that the rear tooth of the carriage rack is just in front of the starting tooth of the buffer.

7-INCH R.M.L. GUN OF 7 TONS (L.S. ONLY).

					Mark I.	Mark III.
Calibre	7 inches	.. .. .	7 inches	.. .. .	7 inches	.. .. .
Nominal weight.. .. .	7 tons	.. .. .	7 tons	.. .. .	7 tons	.. .. .
Preponderance .. .. .	.. .. .	.. .. .	2 cwt. 3 qrs. 2 lbs.	.. .. .	.. .. .	.. .. .
Length {	of bore .. .. .	.. .. .	10 feet 6 inches	.. .. .	.. .. .	.. .. .
	of rifling .. .. .	.. .. .	9 feet 2.5 inches	.. .. .	.. .. .	.. .. .
	total .. .. .	.. .. .	12 feet 4 inches	.. .. .	.. .. .	.. .. .
Rifling {	grooves	Number	12 feet 6 inches	.. .. .	.. .. .	.. .. .
	spiral, uniform	3	3 .. .. .	.. .. .	.. .. .	.. .. .
Chamber	1 in 35 calibres	.. .. .	Uniform, 1 in 35 calibres	.. .. .	.. .. .	.. .. .
"A" tube	Cylindrical .. .. .	.. .. .	Conical	.. .. .	.. .. .	.. .. .
"B" tube	Toughened steel	.. .. .	Coiled iron	.. .. .	.. .. .	.. .. .

DIFFERENT PATTERNS.

There are actually 4 patterns of this gun. Of Mark II., how- (which are marked FI. on the left trunnion), only two were made.

RIFLING.

The rifling is on the "Woolwich system," adopted for all R.M.L. guns from 25-pr. upwards, excepting the 64-pr.

The 7-inch, however, differs from other guns in having a uniform twist.

VENTING.

The 7-inch gun is vented with a cone or through vent bush of hardened copper, the position of which is so regulated that the bush strikes the surface of the bore $\frac{1}{10}$ ths of the length of the cartridge from the bottom.

SIGHTING.

The gun is provided with six sights, viz., two tangent sights, one on each side, graduated up to 15°. The scale is four-sided, and is marked as follows :—

7-INCH MARK III., § 2198.

DEGREES.

COMMON SHELL FULL FUZE

FUZE,
YARDS

} COMMON SHELL, REDUCED.

PALUISER SHOT, AND COMMON SHELL, FULL YARDS.

The tangent sights are provided with deflection leaves, the scale of which allows of 50' deflection being given right or left.

One centre hind sight. This is a scale for use at close quarters, and for double shell. It works in a gun metal socket fixed in the gun, and is provided with a set screw, is hexagonal and marked as follows :—

(a.m.¹)

P

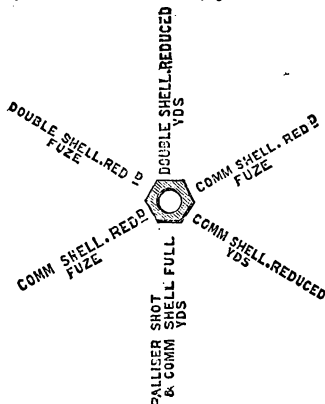
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7-INCH MARK III., § 198.



Two trunnion sights. Similar to centre foresight, 64-pr. of 58 cwt.
 One centre foresight. Similar to the trunnion sight.

PROJECTILES.

Nature.	Weight Empty.		Burster.		Gas-check.		Mean Total Weight.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Common Shell, V, studded ...	106	14	9	4	...	...	116	2
Double " III, " ...	145	6	12	12	...	...	158	2
Shrapnel " III, " ...	115	10	...	12	...	...	116	6
Palliser Shot " ...	...	...	...	...	...	...	112	0
" (Shell), IV ...	112	1	2	*10	...	...	114	11
Case Shot, Mark VI ...	...	...	...	...	...	...	68	2½

* § 5033—Shot Palliser, formerly termed shell. To be weightd with sand.

R.M.L. Ordnance (7-inch).

Section I.

CHARGES.

Full ....	....	....	30lbs. P.
Reduced	....	....	17lbs. P.

FUZES.

Percussion, direct action, for common shell only.
Time, 15-seconds M.L.O. for use with shrapnel shell.

DRILL WITH 7-INCH R.M.L. GUN ON TRAVERSING PLATFORM.

The detachment consists of 10 Nos., and falls in two deep.

To TELL OFF.

As detailed at page 186.

To TAKE POST UNDER COVER.

As detailed at page 187, except that 7, 9, and 10 go to the shell store (7 and 9 outside).

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, and lays.

No. 2 searches, sponges, rams home, runs up and elevates.

No. 3 sponges, loads, uncaps the fuze when in the bore, rams home, runs up and elevates.

No. 4 attends to side arms, supplies them to 2, and traverses.

No. 5 attends to vent, supplies wedge wads, traverses, makes ready, and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes, brings up projectile.

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

No. 9 assists 7.

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

With Elswick compressor 4 attends to compressor lever.

If there are mantlets, 2 and 3 attend to them.

(a.m.¹)

P 2

TO PREPARE FOR ACTION.

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

No. 1 provides a piece of chalk and fixes sights.

No. 2, iron pointed lever, and assists 4 with side arms.

No. 3, iron pointed lever, elevating wheels, and removes the tampeon from the muzzle.

No. 4, side arms.

No. 5, wedge wads, two iron shod levers, tubes in box, lanyard, pricker, and vent server.

No. 6, bucket, filled, and brush (one zinc cartridge cylinder and one dummy cartridge for drill purposes only).

No. 7, running back tackle, fuzes, fuze and shell implements, he obtains the fuze boxes from 10, he sees that fuzes and fuze implements are correct.

No. 8 goes to cartridge store and prepares to issue cartridges.

No. 9, running back tackle, a shell bearer and a brush.

No. 10 goes to shell store and prepares to issue shells, 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.

The stores having been brought up or found correct, No. 1 will satisfy himself that the foresights fit properly on the gun, the deflection leaves of the hind sights work easily, and that the clip plates are secured to the carriage; he ascertains that the hydraulic buffer is filled with the proper amount of oil, or the compressors properly adjusted and in working order. He sees that the racers are swept; he receives reports from the Nos. responsible of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform, stores, ammunition, &c.

2 and 4 place the sponge and rammer in the supports on the

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right side of the platform, the shell extractor and wadhook in rear, so as not to interfere with the working of any of the guns in the battery, and convenient for those for which intended; 2 sees that the elevating gear, 4 that the traversing gear is oiled, and in good working order.

2 and 3 place the iron pointed levers in their supports.

3 examines the bore to see the grooves are free from grit, &c.

5 straps the tube box round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube box strap, fills his box with friction tubes, which he procures from 10, places the iron shod levers on the ground parallel to and either side of the gun, places the pricker in the loop on the side of the carriage; examines the vent server and places it in the vent, the loop of the vent server lanyard over one of the sights.

6 supplies the tank (for reception of the sponge head) with water from the bucket, and places the latter clear of the working of the gun.

7 and 9 hook the double blocks to the rear eyebolt of the platform, overhaul the tackle, and coil down the fall.

"*Examine gun*," No. 5 drifts the vent, replaces the pricker in the loop and the vent server; 2 searches the gun after the pricker is withdrawn, supplying himself with the wadhook and replacing it.

4 and 5 elevate until No. 1 gives "*Halt*," which he does when the gun is in a convenient position for sponging and loading; the whole of the numbers take post under cover.

When levers are used for elevating, 4 and 5 will clamp at "*Halt*."

TO LOAD.

<i>Officer.</i>		<i>No. 1.</i>
<i>Range</i> —yards.		<i>With</i> —load.
<i>With</i> —load.		

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"Load."

No. 1 gives 7 the nature of shell and length of fuze required, adjusts the tangent sight, and places himself where he can best superintend the service of the gun.

No. 2 moves into position for sponging, receives the sponge from 4, and, assisted by 3, sponges as soon as the vent server is in the vent; he then returns the sponge to 4 and receives the rammer; as soon as the cartridge and projectile are in the bore he rams home assisted by 3; he springs the rammer, assisted by 3, and retains it in his hand while the wedge wad is being put in; 2 and 3 press it steadily home, jamming it under the head of the projectile with two smart taps, the rammer is sprung as before, and 2 returns it to 4; should it appear by the mark on the rammer that the charge is not home, 2 and 3 ram home again, before the wedge wad is introduced.

No. 3 moves into position and, having assisted 2 to sponge, slews to his right, draws the cartridge from the cylinder with his left hand, choke to his left, and places it in the bore. When the projectile is in the bore he pushes it well in (uncaps the fuze, if required), and assists 2 to ram home and spring the rammer; he receives a wedge wad from 5, places it in the bore, and assists 2 to press it home and spring the rammer.

No. 4 hands the sponge to 2 and replaces it. He supplies the rammer as soon as the projectile is in the bore and replaces it. He cleans and damps the sponge.

No. 5 provides 3 with a wedge wad.

No. 6 supplies a cartridge to 3, bringing it up on his shoulder, standing at his right rear and keeping the cylinder closed till the sponge is out of the bore; 7 and 9 bring up the projectile, place it in the bore; 9 removes the empty bearer; 8 issues a cartridge to 6; 10 issues a shell to 9.

The projectiles are to be placed in the bearer so that the rear studs are in line with the end of it; the handles of the bearer being turned down whilst the projectile is placed in it.

R.M.L. Ordnance (7-inch).

Section I.

To RUN UP.

Officer.No. 1.*Run up.**Halt.*

"*Run up*," 2 and 3 put the iron pointed levers into the sockets and bear down ; should it be observed that the gun is running up too rapidly 2 and 3 raise their levers and check it.

When the gun is in position No. 1 gives the word "*Halt*," 2 and 3 raise their levers till the sockets are touching the stop plates. They then replace them. No. 5 hooks a tube to the lanyard ; 2 and 3 close the mantlets.

To LAY, MAKE READY, AND FIRE.

Officer.No. 1.*Commence firing**or**Fire — rounds.**Elevate. Halt.**Depress. Halt.**Trail right. Halt.**Trail left. Halt.**No. — ready.**No. — fire.*

2 and 3 work the elevating, 4 and 5 the traversing gear.* As soon as the gun is roughly in the line of fire 5 quits the traversing handle, and hands the tube, with lanyard attached, to 1, the other end of the lanyard hanging down the side of the carriage, or, if too long, coiled up and hung on the rear eyebolt. No. 1 puts in the tube when he has laid the gun, giving the word "*Ready*," he jumps off the platform and gives the word "*No.*" (naming his

* If the rear trucks are fitted to receive the iron pointed levers 4 and 5 apply them ; if not so fitted iron shod levers or tackles must be used, 6 and 7 assisting, if necessary.

PART V.**Section I.****R.M.L. Ordnance (7-inch).**

gun). No. 5 seizes the lanyard and stretches it out, looking towards No. 1. At "*Fire*" from the No. 1, he draws the lanyard strongly towards him without a jerk, he drifts the vent, replaces the vent server and pricker, and coils up the lanyard, placing it under his belt.

Should no order to fire have been given by the officer, No. 1 will not receive a tube from 5, but will give the word "*Under Cover*" as soon as the gun is laid.

The elevating numbers stand clear when No. 1 jumps down. No. 4 remains on the traversing handle.

When platforms are fitted with traversing gear, 4 and 5 will, after the gun has been fired, traverse it back to a position convenient for loading, without any word of command.

TO RUN BACK AND UNLOAD.*Officer.**No. 1.*

Run back. Halt.
Unload.

At "*Run back*" No. 1 follows up the right front roller with a wedge; 2 and 3 apply their levers and bear down; 4 and 5 attend to pawls and hook the treble blocks to the front eye-bolts of the carriage. The tackles are manned by all the available numbers on their own sides. At "*Halt*" 2 and 3 raise their levers and replace them.

When the gun is back, 4 and 5 unhook the front blocks and lay them down after overhauling the tackle. The gun is unloaded by the numbers who loaded it.

TO CEASE FIRING AND REPLACE STORES.*Officer.**No. 1.*

Cease firing.
Replace stores.

Depress. Halt.
Replace stores.

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The gun is depressed, and the stores are replaced by the numbers who brought them up.

TO FORM DETACHMENT REAR (AS AT PAGE 195).

TO CHANGE ROUNDS.*

Officer.

No. 1.

Change rounds.

Change rounds.

No. 2 becomes 4; 4, 1; 1, 10; 10, 9; 9, 8; 8, 7; 7, 6; 6, 5; 5, 3; 3, 2.

See § 3,986.

**DRILL WITH 7-IN. R.M.L. GUN ON SLIDING CARRIAGE
ON TRAVERSING PLATFORM, MOUNTED TO FIRE
OVER A 6-FT. PARAPET.**

The detachment consists of 10 numbers and falls in two deep.

TO TELL OFF.

As detailed at page 186.

TO TAKE POST UNDER COVER.

As detailed at page 187, except that 7, 9, and 10 go to the shell store (7 and 9 outside).

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, attends to indicator and brake in running up, lays and makes ready.

No. 2 searches, sponges, rams home, and elevates.

No. 3 sponges, loads, uncaps the fuze when in the bore, rams home, and elevates.

* See foot note on page 237.

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No. 4 attends to side arms, supplies them to 2, rams home, attends to clamping of elevating gear, and traverses.

No. 5 attends to vent, supplies wedge wads, rams home, attends to clamping of elevating gear, traverses, and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes, brings up projectile, and places it on loading derrick.

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

No. 9 assists 7.

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

TO PREPARE FOR ACTION.

Officer.

Prepare for Action.

No. 1.

*Prepare for Action.
Examine gun.*

No. 1 provides a piece of chalk and fixes sights.

No. 2, elevating wheel, running back handle, and assists 4 with side arms.

No. 3, elevating wheel, running back handle, and removes the tampeon from the muzzle.

No. 4, side arms.

No. 5, wedge wads, two iron shod levers, tubes in box, lanyard, pricker and vent server.

No. 6, bucket, filled, and brush (one zinc cartridge cylinder and one dummy cartridge for drill purposes only).

No. 7, fuzes, fuze and shell implements, he obtains the fuze boxes from 10, and sees that fuzes and fuze implements are correct.

No. 8 goes to cartridge store and prepares to issue cartridges.

No. 9, a shell bearer and a brush.

No. 10 goes to shell store and prepares to issue shells, tubes, and fuzes, he examines the shells carefully, cleaning them if

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necessary, and removing burrs from studs, he loosens the fuze-shell plugs of shells that will be first issued.

The stores having been brought up or found correct, No. 1 will satisfy himself that the foresights fit properly on the gun, the deflection leaves of the hind sights work easily. He ascertains that the hydraulic buffer is filled with the proper amount of oil. He sees that the racers are swept. He receives reports from the Nos. responsible of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform, stores, ammunition, &c.

2 and 4 place the sponge and rammer in the supports prepared for them, the shell extractor and wadhook in rear, so as not to interfere with the working of any of the guns in the battery, and convenient for those for which intended; 2 and 3 see that the elevating gear is in good working order.

3 examines the bore to see the grooves are free from grit, &c.

5 straps the tube box round his waist, on the right side, coils up the lanyard, and passes the bight of it under the tube box strap, fills his box with friction tubes, which he procures from 10, places the iron shod levers on the ground parallel to and on either side of the gun, places the pricker in the loop on the side of the carriage; examines the vent server and places it in the vent, the loop of the vent server lanyard over one of the sights.

6 supplies the tank (for reception of sponge head) with water from the bucket, and places the latter clear of the working of the gun.

"*Examine gun,*" No. 5 drifts the vent, replaces the pricker in the loop and the vent server; 2 searches the gun after the pricker is withdrawn, supplying himself with the wadhook and replacing it.

The gun having been run back to a convenient position for loading, No. 1 gives the word "*Unclamp,*" Nos. 4 and 5 unclamp elevating gear, No. 1 then gives the word, "*Depress,*" 2 and 3 depress until No. 1 gives "*Halt,*" which he does when

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R.M.L. Ordnance (7-inch).

the gun is in a convenient position for sponging and loading ; 4 and 5 will clamp at "*Halt*" ; the whole of the numbers take post under cover.

To LOAD.

<i>Officer.</i>	<i>No. 1.</i>
<u> </u>	<u> </u>
<i>Range—yards.</i>	<i>With—load.</i>
<i>With—load.</i>	

" Load."

No. 1 gives 7 the nature of shell and length of fuze required, adjusts the tangent sight, and places himself where he can best superintend the service of the gun.

No. 2 moves into position for sponging, receives the sponge from 4, and, assisted by 3, sponges as soon as the vent server is in the vent ; he then returns the sponge to 4 and receives the jointed rammer ; as soon as the cartridge and projectile are in the bore, he rams home, assisted by 3 ; he withdraws the rammer, assisted by 3, and retains it in his hand while the wedge wad is being put in ; 2 and 3 press it steadily home ; jamming it under the head of the projectile with two smart taps, the rammer is withdrawn as before, and 2 returns it to 4 ; should it appear by the mark on the rammer that the charge is not home, 2 and 3 ram home again before the wedge wad is introduced.

No. 3 moves into position, and, having assisted 2 to sponge, slews to his right, draws the cartridge from the cylinder with his left hand, choke to his left, and places it in the bore. When the projectile on the loading derrick is swung round opposite the bore by 7 and 9, he pushes it well in (uncaps the fuze, if required), and assists 2 to ram home and withdraw the rammer ; he receives a wedge wad from 5, places it in the bore, and assists 2 to press it home and withdraw the rammer.

No. 4 hands the sponge to 2 and replaces it. He supplies the

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rammer as soon as the projectile is in the bore, rams home, and replaces it. He cleans and damps the sponge.

No. 5 rams home, provides 3 with a wedge wad.

No. 6 supplies a cartridge to 3, bringing it up on his shoulder, standing at his right rear and keeping the cylinder closed till the sponge is out of the bore ; 7 and 9 bring up the projectile, place it on the loading derrick ; 9 removes the empty bearer ; 8 issues a cartridge to 6 : 10 issues a shell to 9.

The projectiles are to be placed in the bearer so that the rear studs are in line with the end of it ; the handles of the bearer being turned down whilst the projectile is placed in it.

To RUN UP.

Officer.

No. 1.

Run up.
Halt.

“Run up.” No. 1 stands to the running up lever, placing the “indicator” out of gear, and takes care that the gun runs up without violence as far as the front stops.

To LAY, MAKE READY, AND FIRE.

Officer.

No. 1.

Commence firing
or
Fire — rounds

Elevate. Halt.
Depress. Halt.
Trail right. Halt.
Trail left. Halt.
No. — ready.
No. — fire.

2 and 3 work the elevating wheels, 6 and 7 the clamping levers and traverse with iron shod levers, 5 hands the tube with lanyard attached to 1, the other end of the lanyard hanging down

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the side of the carriage, or if long, being coiled up and hung on the rear eyebolt. No. 1 puts in the tube when he has laid the gun, giving the word "*Ready*;" he jumps off the platform and gives the word "*No.*" (naming his gun). No. 5 seizes the lanyard and stretches it out, looking towards No. 1. At "*Fire*" from the No. 1, he draws the lanyard strongly towards him without a jerk, he drifts the vent, replaces the vent server and pricker, and coils up the lanyard, placing it under his belt.

Should no order to fire have been given by the officer, No. 1 will not receive a tube from 5, but will give the word "*Under cover*" as soon as the gun is laid.

The elevating numbers stand clear when No. 1 jumps down.

TO RUN BACK AND UNLOAD.

*Officer.**No. 1.*

Run back. Halt.
Unload.

At "*Run back*" No. 1 puts the indicator in gear, Nos. 2, 3, 4, and 5 man the running back handles until the gun is run back to a convenient position for loading on which No. 1 gives "*Halt*" and puts the indicator out of gear.

The gun is unloaded by the numbers who loaded it.

TO CEASE FIRING AND REPLACE STORES.

As at page 218.

TO FORM DETACHMENT REAR.

As at page 195.

TO CHANGE ROUNDS.*

*Officer.**No. 1.**Change rounds.**Change rounds.*

No. 2 becomes 4; 4, 1; 1, 10; 10, 9; 9, 8; 8, 7; 7, 6; 6, 5; 5, 3; 3, 2.

* See foot note on page 237.

FIRING 7-INCH 6½ TON R.M.L. GUNS.

The following precautions will be observed before firing 7-inch 6½ ton R.M.L. guns, mounted on single plate carriages and slide fitted with compressors :—

(a) The pivot bars will be properly secured by the pivot plug and key.

(b) The clip plates on the carriage will be securely bolted.

(c) The compressors will be adjusted by setting up the adjusting lever until the compressor lever can only just be forced by hand below the stop on the arc when using great force.

(d) After each round for the first three or four rounds and until any rust, scale, or dirt on the bars becomes worn off, the adjustment of the compressors will be tested in the manner specified by (c).

(e) Carriages mounted on slides that are not altered to a 4° slope, will require to have a breeching rope passed through the breeching bushes of the carriage, and to be fastened securely to strong loops in the works.

DRILL WITH 7-INCH R.M.L. GUN ON MONCRIEFF CARRIAGE. MARKS I AND II.

The detachment, consisting of ten numbers, is told off and takes post under cover as with the same gun mounted on a traversing platform.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, attends to the brake in running up, and lays.

No. 2 searches, sponges, places projectile in bore, rams home (attends to lever if required), and elevates.

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No. 3 sponges, loads, uncaps fuze when in the bore, rams home (attends to lever if required).

No. 4 attends to side-arms, supplies them to 2, traverses (attends to lever if required).

No. 5 attends to vent, depresses the gun for loading, supplies wedge wads, elevates previous to running up (about 1°), traverses (attends to lever if required), makes ready, and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes, brings up the projectile, and places it on the front loading stage.

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

No. 9 assists 7.

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

To PREPARE FOR ACTION.

As with the gun on a traversing platform, except no preventor rope or iron shod levers are required; No. 5 provides a long lanyard.

2 and 3 bring up an iron-pointed lever each, which they lay down on each side of the gun.

Tackle will be necessary to run the gun back. Two sets of heavy gun tackle are brought up by 7 and 9.

The sponge and rammer are laid down on the right of the gun, close to the parapet, heads towards the muzzle, the shell extractor and wad hook outside the pit.

At "*Examine gun*," same as at 7-inch R.M.L. on a traversing platform, except 4 supplies 2 with the wad hook, and replaces it, and 5 attends to the elevating wheel and depresses, after the gun has been searched, until the muzzle rests on the elevator.

To LOAD.

As with the gun on a traversing platform, except as follows:—
No. 1 at "*Load*" gets the gun into a convenient position, *i.e.*, the upper edge of counterweight nearly horizontal, 5 depresses

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the gun if necessary ; 2 and 3, in mounting up, give the small loading stages a quarter turn inwards, and stand on them with their inward feet, the outward feet of both numbers being on the front loading stage; after the cartridge has been placed in the bore, they raise the projectile in its bearer to the guide block in front of the muzzle.

After the loading is completed, they turn the loading stages outwards. 5 gives 1° or more of elevation, as shown on the arc.

TO RUN UP.

Before running up, No. 1 will give the caution "*stand clear*;" then holding the brake he allows the gun to run up.

He must be very careful not to let it escape from his control, and on the other hand he must not check it too soon. Should the latter be the case, No. 1 gives "*Work levers*," 2 and 3 fix the latches and work their levers, small ends to the rear ; 2 and 4 man the right, 3 and 5 the left lever ; No. 1 will give "*Down*," "*Fresh purchase*," "*Halt*," as required.

When the gun is up, No. 1 will mount up the ladder to lay it, 2 and 3 slackening the latches and unshipping the levers ; 4 and 5 man the traversing handle.

TO LAY THE GUN.

4 and 5 traverse.

2 elevates or depresses.

The gun may be laid without exposing any number ; No. 1 using a reflecting sight, or elevating in accordance with the graduations on the elevating arc or trunnion pointer, and traversing to marks previously made on the racers.

TO MAKE READY AND FIRE.

When No. 1 has laid the gun, at "*Ready*" he drops the tube into the vent, throws the lanyard clear of the carriage, and comes down.

(a.m.¹)

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As soon as No. 5 has fired he drifts the vent, replacing the vent server and pricker, and coils up the lanyard.

TO UNLOAD AND RUN BACK.

(For drill purposes extra men will be required.)

To run back, 2 and 3 fix the latches, and work their levers, small ends to the front, and bear down, double manned, by 4 and 5. No. 1 giving "*Down*," "*Fresh purchase*," "*Halt*," as required. Tackle to be hooked by 7 and 9, assisted by 6 and 8, and manned by all available numbers.

Unloading should be effected from the firing position before the gun is run back.

TO CEASE FIRING AND REPLACE STORES.

TO FORM DETACHMENT REAR.

TO CHANGE ROUNDS.

As with the same gun mounted on a traversing platform.

9-INCH R.M.L. GUN OF 12 TONS.

DESCRIPTION.

	Mark I.	Mark II.	Mark III.	Mark IV.	Mark V.
Calibre ... ins.	9.0	9.0	9.0	9.0	9.0
Nominal weight ... tons.	12	12	12	12	12
Preponderance ... cwt.	Nil.	5	5	5	3
Length { of bore ...	10 ft. 5 in.	10 ft. 5 in.	10 ft. 5 in.	10 ft. 5 in.	10 ft. 5 in.
{ of rifling ...	8 ft. 11.5 in.	8 ft. 8 in.*	8 ft. 8 in.	8 ft. 8 in.	8 ft. 8 in.
{ total ...	13 ft.	13 ft.	13 ft.	13 ft.	13 ft.
Rifling { grooves, number	6	6	6	6	6
{ spiral increasing	From 0 at	breech to	1 in 45 cal	ibres at muzzle.	
Chamber ...	Cylindrical	Conical	Conical	Conical	Conical
"A" tube ...		Toughened steel			
"B" tube ...		Coiled iron			

* Those made before January, 1868, have the same length of rifling as Mark I.

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DIFFERENT PATTERNS.

The different patterns of these guns are distinguished one from another in *external* appearance as follows :—

Mark I. by being built up in 7 parts, including trunnion coil or ring.

Mark II. " 4 parts "

Mark III. " 3 parts "

Mark IV. " 4 parts "

Mark V. " 4 parts "

RIFLING.

The rifling is on "the Woolwich system," similar to that described for the 7-inch R.M.L. gun, with this difference, that the twist is "increasing."

VENTING.

The venting is similar to that of the 7-inch gun.

PROJECTILES.

Nature.		Weight. Empty.		Bursting.		Gas-check Plug and Nut.		Mean Total Weight.	
		lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
Common Shell, Studded,									
Mark VI		238	0	13	12	10	10	262	6
Common Shell, Studless,									
Mark I		232	2	14	8	9	6	256	0
Shrapnel Shell, Studded,									
Mark III		254	0	1	8	...	...	255	5
Shrapnel Shell, Studless,									
Mark I		245	5	1	5	9	6	256	0
Palliser Shot, Studded,									
Mark IV ... ..		...	...	...	...	...	...	250	0
Palliser Shot (Shell) Studded,									
Mark VI		240	15	*6	0	...	...	257	7
Palliser Shot (Shell) Studless,									
Mark II		244	3	*2	7	9	6	256	0
Case Shot, Mark V	107	0

* § 5033. Shot Palliser. Formerly shell. To be weighted up with sand.
(a.m.)

Q 2

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Section I.**R.M.L. Ordnance (9-inch).****SIGHTING.**

Same as with 7-in. R.M.L. gun, except that the deflection leaf reads 1° 30' on each side.

CHARGES.

Full	....	....	....	50 lb. P.
Reduced		....	....	33 lb. P.

FUZES.

Time. 15 seconds with detonator Mark III, for use with shrapnel shell.

Percussion. Direct action for common shell only.

**DRILL WITH 9-INCH R.M.L. GUN, IN CASEMATE
OR OPEN SHIELD BATTERY.**

The detachment consists of 10 Nos. and falls in two deep.

To TELL OFF.

As detailed at page 186.

To TAKE POST UNDER COVER.

As detailed at page 187, except that 7, 9, and 10 go to the shell store (7 and 9 outside).

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, and lays.

No. 2 searches, sponges, steadies and guides projectile in raising, rams home, runs up, elevates, and attends to mantlets.

No. 3 sponges, hooks and unhooks hoisting tackle, steadies, and

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guides projectile in raising, loads, uncaps the fuze when in the bore, rams home, runs up, elevates, and attends to mantlets.

No. 4 attends to side arms, supplies them to 2, and traverses.

No. 5 attends to vent, supplies 3 with automatic gas checks, raises projectile, supplies wedge wads, traverses, makes ready, and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes, brings up projectile, raises and rams it home.

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

No. 9 assists 7, raises and rams home projectile, removes empty barrow.

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

With Elswick compressor, 4 attends to compressor lever.

TO PREPARE FOR ACTION.

Officer.

Prepare for action.

No. 1.

Prepare for action.

Examine gun.

"*Prepare for action.*" No. 1 provides a piece of chalk and fixes sights.

No. 2, iron pointed lever and assists 4 with side arms.

No. 3, iron pointed lever, elevating wheels, hoisting tackle (double and single blocks), and removes the tampeon from the muzzle.

No. 4, side-arms and two rammer ropes when fitted with spring clips.

No. 5, pricker and vent server, wedge wads, two iron shod levers, tubes in box and lanyard. When the 9-inch gun is fitted with traversing gear he provides the handle and running back tackle instead of two levers.

No. 6, bucket, filled, and brush (one zinc cartridge cylinder and one dummy cartridge, for drill purposes only).

No. 7, fuzes, fuze and shell implements, and two selvagees for slinging projectile; he obtains the fuze boxes from 10, sees that fuzes and fuze implements are correct.

No. 8 goes to cartridge store and prepares to issue cartridges.

No. 9, transporting barrow and a brush, automatic gas-checks in box with lid unscrewed.

No. 10 goes to shell store and prepares to issue shells, 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.

8 and 10 satisfy themselves that the lamps in the ammunition stores are burning brightly, and that the hoisting gear at the cartridge and shell lifts works easily.

Any irregularity in these respects should be at once reported to No. 1.

The stores having been brought up, or found correct, No. 1 will satisfy himself that the foresights fit properly on the gun, and the deflection leaves of the hind sights work easily, that the clip plates are secured to the carriage ; he ascertains that the hydraulic buffer is filled with the proper amount of oil or that the compressor is in adjustment and that the racers are swept ; he receives reports from the Nos. responsible of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform, and stores, or as regards the ammunition stores, lifts, &c.

2 and 4 place the sponge and rammer in the supports on the right side of the platform, the shell extractor and wadhook in rear so as not to interfere with the working of any of the guns in the battery, and convenient for those for which intended.

2 sees that the elevating gear, 4 that the traversing gear is oiled and in good working order.

2 and 3 place the iron pointed levers in their supports on the platform, they should satisfy themselves that the mantlets work easily.

3 examines the bore to see the grooves are free from grit, &c., he secures the hoisting tackle to the loading bar, overhauling it till the lower block is at a convenient height for hooking to the selvagee on the projectile ; the lower block should then be hooked back to a loop on the left mantlet to keep the tackle out of the way until required.

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4 coils down the rammer ropes on either side of the gun.

5 straps the tube box round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube box strap; fills his box with friction tubes which he procures from 10; places the iron shod levers (if required) on the ground parallel to and either side of the gun or reeves the running back tackle; he places the pricker in the loop, examines the vent server and places it in the vent, the loop of the vent server lanyard over one of the sights, he also sees that the automatic gas-checks are placed in a convenient position.

6 supplies the tank (for the reception of the sponge head) with water from the bucket, and places the latter clear of the working of the gun.

When the carriages are not fitted with running back gear, 7 and 9 bring up two sets of tackle, double and treble blocks, hook the double blocks to the rear eyebolt of the platform, overhaul the tackle and coil down the fall.

"*Examine gun*," No. 5 drifts the vent, replaces the pricker in the loop, and the vent server. 2 searches the gun after the pricker is withdrawn, supplying himself with the wadhook and replacing it.

4 or 5 elevate until No. 1 gives "*Halt*," which he does when the gun is in a convenient position for sponging and loading; the whole of the numbers take post under cover.

When levers are used for elevating, 4 and 5 will clamp at "*Halt*."

To LOAD.	
<i>Officer.</i>	<i>No. 1.</i>
<i>Range</i> — yards.	<i>With</i> — load.
<i>With</i> — load.	

"*Load*."

No. 1 gives 7 the nature of shell (and length of fuze required), adjusts the tangent scale, and places himself where he can best superintend the service of the gun. No. 2 moves into position for

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R.M.L. Ordnance (9-inch).

sponging, receives the sponge from 4, and assisted by 3, sponges as soon as the vent server is in the vent. He returns the sponge to 4 and with 3 steadies the projectile in raising and guiding it into the bore ; he then receives the rammer (with right rammer rope attached) from 4, and as soon as the cartridge and projectile are in the bore he rams home assisted by 3, 7, and 9 ; should "*Not home*" be given by 2 the charge will be forced home. At "*Home*" 2 and 3 detach the rammer ropes (if fitted with spring clips) and hand them to 4 and 5 ; 2 springs the rammer assisted by 3 ; 3 inserts a wedge wad ; 2 and 3 press it steadily home, jamming it under the head of the projectile with two smart taps ; the rammer is sprung as before, 2 returns it to 4 and both go under cover.

No. 3 moves into position, and having assisted 2 to sponge, slews to his right, draws the cartridge from the cylinder with his left hand, choke to his left, and places it in the bore, receives an automatic gas-check from 5, and places it in the bore immediately in front of the cartridge, painted side to the rear.

The projectile is now brought up on the barrow with selvagee ready fixed ; 3 standing clear close to the front of the platform, 5 casts loose the lower block of the hoisting tackle, 3 hooks it into the selvagee and gives "*Hoist away*," and with 2 steadies and guides the projectile which is raised by 5, 7 and 9 manning the running end of the fall ; 3 gives "*High enough*," "*Ease off*," and having with 2 forced the projectile into the bore casts loose the selvagee, replacing it in the barrow ; he uncaps the fuze ; if the rammer ropes are fitted with spring clips he now hooks that on the left side receiving it from 5 ; after ramming home the charge he detaches the left rammer rope, hands it to 5, and assists to spring the rammer ; he receives a wedge wad from 5, places it in the bore, and with 2 presses it home and springs the rammer.

No. 4 hands the sponge to 2 and replaces it. He supplies the rammer as soon as the projectile is in the bore and replaces it, attending to the right rammer rope. He cleans and damps the sponge.

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No. 5, as soon as the cartridge is in the bore, hands an automatic gas-check to 3, casts loose the lower block of the hoisting tackle, and mans the fall in raising the projectile; he attends to the left rammer rope, and when the charge is home supplies 3 with a wedge wad; he hooks the lower block of the hoisting tackle to the loop on the left mantlet.

No. 6 supplies a cartridge to 3 (bringing it up on his shoulder, lid to the rear), standing at his right rear and keeping the cylinder closed till the sponge is out of the bore.

No. 7 brings up the projectile with selvagee on in barrow, assists to raise and ram it home.

No. 8 issues a cartridge to 6.

No. 9 assists 7 to prepare, bring up, and raise projectile, rams home (on the right of the gun), and removes empty barrow.

No. 10 issues shell.

N.B.—When rammer ropes fitted with spring clips are not in use they are coiled down between the racers close to the piers by 4 and 5.

To RUN UP.

Officer.

No. 1.

Run up.
Halt.

“*Run up,*” 2 and 3 put the iron pointed levers into the sockets and bear down; should it be observed that the gun is running up too rapidly 2 and 3 raise their levers and check it.

When the gun is in position No. 1 gives the word “*Halt.*” and 3 raise the levers till the sockets touch the stop plates. They then replace them. No. 5 hooks a tube to the lanyard 2 and 3 close the mantlets.

Section I.

R.M.L. Ordnance (9-inch).

TO LAY, MAKE READY, AND FIRE.

<i>Officer.</i>	<i>No. 1.</i>
<i>Commence firing</i>	<i>Elevate. Halt.</i>
<i>or</i>	<i>Depress. Halt.</i>
<i>Fire — rounds.</i>	<i>Trail right. Halt.</i>
	<i>Trail left. Halt.</i>
	<i>No. — ready.</i>
	<i>No. — fire.</i>

2 and 3 work the elevating gear ; 4 and 5 the traversing gear.* As soon as the gun is roughly in the line of fire, 5 quits the traversing handle and hands the tube with lanyard attached to No. 1, the other end of the lanyard hanging down the side of the carriage, or, if too long, coiled up and hung on the rear eye-bolt. No. 1 puts in the tube when he has laid the gun, giving the word "*Ready*," he jumps off the platform and at the word "*No.*" (naming his gun) 5 seizes the lanyard and stretches it out looking towards No. 1.

At "*Fire*" from the No. 1 he draws the lanyard strongly towards him without a jerk, he drifts the vent, replaces the vent server and prick, and coils up the lanyard, placing it under his belt.

Should no order to fire have been given by the officer, No. 1 will not receive a tube from 5, but will give the word "*Under Cover*" as soon as the gun is laid.

The elevating numbers stand clear, when No. 1 jumps down: 4 remains on the traversing handle.

When platforms are fitted with traversing gear, 4 and 5 will as soon as the gun has been fired, at once traverse it back to a position convenient for loading, without any word of command.

* If there is no traversing gear and the rear trucks are fitted to receive the iron pointed levers, 4 and 5 apply them; if not so fitted iron shod levers or tackles must be used, 6 and 7 assisting, if necessary.

R.M.L. Ordnance (9-inch).

Section I.

TO RUN BACK AND UNLOAD.

*Officer.**No. 1.**Run back. Halt.
Unload.*

At "Run back," with gear, No. 1 disconnects the traversing pinions by shifting and keying up the handle. He follows up the right front roller with a wedge wad ; 2 and 3 apply their levers and bear down, 4 and 5 attend to pawls and heave round the traversing handles, 6 and 7 fix the running back tackle, holding on to the fall and removing the tackle when the gun is back.

With tackle, No. 1 follows up the right front roller with a wedge wad ; 2 and 3 apply their levers and bear down ; 4 and 5 fix pawls ; 2 and 3 withdraw their levers and replace them ; 4 and 5 hook the treble blocks to the front eye-bolt of the carriage. The tackles are manned by all the available numbers on their own sides ; additional men will usually be necessary. No. 1 gives "Halt" when 2 and 3 apply their levers and bear down ; 4 and 5 release the small pawls.

In either case when the gun is back 4 and 5 unhook the front blocks and lay them down after overhauling the tackle. The gun is unloaded by the numbers who loaded it.

TO CEASE FIRING AND REPLACE STORES.

As at page 218.

TO FORM DETACHMENT REAR.

Similar to page 195.

TO CHANGE ROUNDS.*

*Officer.**No. 1.**Change Rounds.**Change Rounds.*

* When changing rounds the ammunition (Nos. may remain unchanged if more convenient, as with the heavier guns.

Section I.

R.M.L. Ordnance (9-inch).

No. 2 becomes 4 ; 4, 1 ; 1, 10 ; 10, 9 ; 9, 8 ; 8, 7 ; 7, 6 ; 6, 5 ; 5, 3 ; 3, 2.

SERVICE OF 9-INCH GUNS IN BARBETTE BATTERIES.

The guns are fitted with muzzle derricks. The service is the same as for guns mounted in casemates and behind shields, with the following exceptions :—

“General Duties.”—5 attends to muzzle derrick.

“To prepare for action.”—Rammer ropes are not supplied.

The barrow given in list of changes in stores 2166—14½ inches track can be used.

“To load.”—5, as soon as the cartridge is in the bore, raises the derrick and overhauls the tackle ; after supplying 3 with a wad he rounds in the tackle and throws back the derrick. In ramming home, 7 and 9 man the rammer stave with 2 and 3, 9 on the right.

If the guns are not fitted with muzzle derricks, the projectile must be carried to the gun in a shell bearer by 7 and 9, 2 and 3 assisting in raising it to the muzzle.

If with sunken ways runner ropes will be necessary.

If fitted with “chain nipping” gear No. 5 attends to the lever.

DRILL WITH 9-INCH R.M.L. GUN ON MONCRIEFF CARRIAGE. MARK II.

The detachment consists of 10 Nos., is told off, and takes post under cover, as with the same gun mounted on a traversing platform.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, attends to the brake in running up, and lays. He makes ready if the gun is laid by the tangent sights.

R.M.L. Ordnance (9-inch) on Moncrieff Carriage. Section I.

No. 2 searches, sponges, steadies, and guides the projectile in raising, rams home, attends to lever, and elevates.

No. 3 sponges, steadies, and guides projectile in raising, rams home, attends to lever, and traverses.

No. 4 attends to side-arms, assists at lever, attends to ratchet pawls, and traverses.

No. 5 attends to vent, supplies wedge-wads, traverses, makes ready and fires.

No. 6 supplies 3 with cartridge, and traverses.

No. 7 attends to fuzes, brings up projectile, raises it, assists to ram home if required.

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

No. 9 assists 7, raises projectile, assists to ram home if required, removes empty barrow.

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

TO PREPARE FOR ACTION.

As with the gun on a traversing platform, with these exceptions, viz. :—

3 brings up handle for hoisting winch instead of tackle.

4, handle for traversing, no rammer ropes are required.

5, iron-shod levers not required.

No. 1 should ascertain that the brake is in working order.

2 and 4 place the sponge and rammer in the tray between the sides of the platform.

7 and 9 bring up two sets of heavy gun tackle and four selvagees.

At "Examine Gun," 2 and 5 perform the same duties as at 9-inch R.M.L. on traversing platform ; 4 supplies 2 with wad-hook ; 4 and 5 are not required to elevate.

TO LOAD.

As with the gun on traversing platform, with the following exceptions :—

PART V.**Section I. R.M.L. Ordnance (9-inch) on Moncrieff Carriage.**

2 supplies himself with sponge and rammer, screwing on the extra lengths to staves when necessary, and replaces them.

No rammer ropes are used.

3 slews to his left to receive the cartridge, and having drawn it from the cylinder by the choke, reverses it, and places it in the bore.

The projectile on the barrow, with selvagee ready fixed, is run under the platform below muzzle of gun, the flaps of loading stage are opened by 2 and 3, and the hoisting tackle hooked by 3; 7 and 9 then hoist the projectile by means of the winch-handle, they assist to ram home if necessary.

6 stands at the left of 3 with cartridge.

RUN UP.

No. 1 gives the commands "*Run up.*" "*Stand clear.*"

At run up 2 and 3 place their levers in the sockets, small ends to front, and bear down; 4 and 5 throw up the ratchet pawls as soon as they are clear; 2 and 3 withdraw the levers and lay them down.

At "*Stand clear*" all the Nos. stand clear of the gun. No. 1 bears down on the brake handle and allows the gun to rise; if rising too fast, he checks it by raising the handle, but must not do so too suddenly.

At "*Halt*" 4 and 5 replace the pawls in the ratchets.

TO LAY THE GUN.

2 works the elevating wheel; 3 and 4 traverse in front, 5 and 6 in rear.

TO MAKE READY AND FIRE.

No. 1 makes ready, receiving tube and lanyard from 5.

TO RUN BACK AND UNLOAD.

Extra Nos. should be employed, to save time.

It may be done with the levers alone placed in the sockets; at

R.M.L. Ordnance (10-inch).	Section I.
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"*Run back*," small ends to front by 2 and 3, and keyed up by 4 and 5. 2, 4, and 6 then bear down on the right lever, 3, 5, and 7 on the left lever; at the word "*Down*" taking fresh purchases together.

If tackles are used, they are hooked by 7 and 9, assisted by 6 and 8.

At "*Unload*," which is done by the Nos. who loaded (when the gun is in the loading position), 4 supplies 2 with the shell extractor and wadhook, passing them under the gun.

TO CEASE FIRING, AND REPLACE STORES.

TO FORM DETACHMENT REAR.

TO CHANGE ROUNDS.

As detailed for 9-inch R.M.L. gun on traversing platform.

10-INCH R.M.L. GUN.

DESCRIPTION.

Calibre	....	....	....	10 inches.
Nominal weight	....	....	....	18 tons.
Preponderance	....	....	....	Not exceeding 3 cwt.
Length	{ of bore	....	....	12 feet 1½ inches.
	{ of rifling	....	....	9 feet 10 inches.
	{ total	....	....	15 feet.
Rifling	{ grooves, number	....	7	
	{ spiral increasing from 1 in 100 to 1 in 40	calibres.		
Chamber, conical.				

DIFFERENT PATTERNS.

There are only two patterns of this gun, differing from each other in Mark II. having a thinner steel tube, and two coils over the breech instead of one.

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Section I.**R.M.L. Ordnance (10-inch.)****RIFLING.**

The rifling of guns of 10 inches and upwards is on the Woolwich system as described for the 7-inch R.M.L. gun, but with an increasing twist.


VENTING.

The gun is vented on the right side at an angle of 45° with vertical axis, at a distance of $\frac{4}{10}$ of the length of the cartridge from the bottom of the bore.

SIGHTING.

The gun is provided with 6 sights, viz. :—

Two tangent scales, one on each side, graduated up to 12° , and furnished with deflection leaves, allowing 40 minutes deflection right or left. The bar of the sight is four-sided, and marked as follows :—

DEGREES.						
COMN. SHELL FULL.	{	YDS.		FUZE	{	COMN. SHELL.
70 LB. P.		FUZE		YDS.		REDUCED, 44 LB. P.
PALLISER SHOT						
FULL.						
YDS. 70 LB. P.						

One centre hind-sight. This is a short scale (with deflection leaf on the head), graduated to 8° , for short ranges.

It has engraved upon it information similar to that given upon the tangent scales.

Two trunnion sights. Similar to 9".

* One centre foresight. Similar to the trunnion sight.

R.M.L. Ordnance (10-inch).

Section I.

PROJECTILES.

Nature.	Weight empty.		Burst.		Gas-check, plug, and nut.		Mean total weight.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Common shell, studded, Mark III ...	376	5	21	0	12	15	410	4
Common shell, studless, Mark I ...	379	7	19	9	11	0	410	0
Shrapnel shell, studded, Mark III ...	403	0	1	9	...	...	404	9
Shrapnel shell, studless, Mark I ...	397	6	1	10	11	0	410	0
Palliser shot, studded, Mark IV ...	400	8	...	...	13	2½	413	10½
Palliser shot (shell), studded, Mark II ...	391	15	*6	12	13	2½	411	13½
Palliser shot, studless, Mark I ...	395	9	*3	7	11	0	410	0
Case shot, Mark III ...	...	...	...	...	...	...	143	0

* § 5033. Shot Palliser Formerly shell. To be weighted up with sand.

NOTE.—*Vide* § 4,081, page 89, for use of “full” and “reduced” charges with certain projectiles.

CHARGES.

Full	...	...	...	70 lbs. P.
Reduced	...	...	...	44 lbs. P.

FUZES.

Time, 15 seconds, M.L., for use with shrapnel.
Percussion, direct action for common shell only.

(a.m.¹)

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PART V.

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Section I.**R.M.L. Ordnance (11-inch).****11-INCH R.M.L. GUN.****DESCRIPTION.**

Calibre	11 inches
Nominal weight	....	....	....	25 tons
Preponderance ....	....	....	....	2 cwt.
Length {	of bore	....	....	12 feet 1 inch
	of rifling	....	....	9 feet 11 inches
	total	....	....	15 feet 2½ inches
Rifling {	grooves, number	....	....	9
	spiral increasing from	....	....	0 to 1 in 35

DIFFERENT PATTERNS.

There are two patterns of this gun, only 7 of Mark I. having been made.

RIFLING.

The rifling is on the Woolwich system with increasing twist.

VENTING.

Similar to 10-inch. R.M.L. gun.

SIGHTING.

The same as with 10-inch R.M.L. guns.

R.M.L. Ordnance (11-inch).

Section I.

PROJECTILES.

Nature.			Weight Empty. ¹		Burst.		Gas-check Plug and Nut.		Mean Total Weight.	
			lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Common shell, studded,										
Mark I			506	4	30	2	14	8½	550	14½
Common shell, studless,										
Mark I			513	11	22	0	12	5	543	0
Shrapnel shell, studded,										
Mark I			529	10	1	12	...	...	531	6
Shrapnel shell, studless,										
Mark I			533	10½	2	0½	12	5	548	0
Palliser shot (shell), studded,										
Mark IV			527	8	*6	7	14	11	548	10
Palliser shot (shell), studless,										
Mark II			530	9	*5	2	12	5	545	0
Case shot, Mark II ... ..			...	...	...	...	...	...	200	...

* § 5033. Shot Palliser. Formerly shell. To be weighted up with sand.

NOTE.—*Vide* § 4,081, page 89, for use of “full” and “reduced” charges, with certain projectiles.

CHARGES.

Full ....	....	....	....	....	85 lbs. P.
Reduced	....	....	...	....	60 lbs. P.

FUZES.

Time 15-second, M.L., for use with shrapnel shell.
Percussion, direct action for common shell only.*

* Not to be used in guns loaded by hydraulic rammer.

(a.m.¹)

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PART V.

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Section I.**R.M.L. Ordnance (12-inch, 25-tons).****12-INCH R.M.L. GUN OF 25 TONS.****DESCRIPTION.**

Calibre ....	....	....	....	12 inches.
Nominal weight	....	....	....	25 tons.
Preponderance	....	....	....	6 cwt.
Length	{	of bore	....	12 feet 1 inch.
		of rifling	....	10 feet 7 inches.
		total	....	15 feet 2½ inches.
Rifling	{	grooves, number	....	9.
		spiral, increasing from	1 in 100 to 1 in 50.	

DIFFERENT PATTERNS.

There are two patterns of this gun.

Of Mark I. there are only four in the service, known externally by having steps in front of the trunnion, and also at the breech. Their weight is 23½ tons, but by an order of 3rd July, 1868, to avoid confusion, it was approved that they should all bear the same designation, viz., "Ordnance Rifled M.L. 12-inch of 25 tons," this being the weight of the later patterns

RIFLING.

The rifling is on the "Woolwich system," with increasing twist.

VENTING.

Similar to 10-inch R.M.L. gun.

SIGHTING.

The same as with 11-inch R.M.L. guns.

R.M.L. Ordnance (12-inch, 35 tons).

Section I.

PROJECTILES.

Nature.	Weight empty.		Bursting.		Gas Check, Plug, and Nut.		Mean Total Weight.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Common shell, studded, Mark II ...	457	6	38	10	16	1	512	1
Common shell, studless, Mark I ...	576	4	23	6	14	6	614	0
Shrapnel shell, studded, Mark III ...	494	13	1	5	...	...	496	12
Shrapnel shell, studless, Mark I ...	597	10	2	0	14	6	614	0
Palliser shot, studded, Mark V ...	596	4	...	...	15	15	611	9
Palliser shot (shell), studded, Mark IV	584	5	*15	8	15	5	615	2
Palliser shot (shell), studless, Mark II	594	6	*5	4	14	6	614	0
Case shot, Mark II ... ..	...	...	...	...	...	...	246	0

* § 5033. Shot Palliser. Formerly shell. To be weighted up with sand.

NOTE.—*Vide* § 4,081, p. 89, for use of “full” and “reduced” charges with common projectiles.

CHARGES.

Full 85 lbs. P.²
 Reduced 55 lbs. P.

FUZES.

Time 15-seconds, M.L., for use with shrapnel shell.
 Percussion, direct action for common shell only.

12-INCH R.M.L. GUN OF 35 TONS.

DESCRIPTION.

Calibre ....	....	12 inches.
Nominal weight ....	....	35 tons.
Preponderance....	....	1 cwt. 2 qrs.
Length {	of bore	13 feet 6½ inches.
	of rifling	11 feet 3 inches.
	total	16 feet 3 inches.
Rifling {	grooves, number	9.
	spiral, increasing from	0 to 1 in 35 calibres.

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Section I.**R.M.L. Ordnance (12-inch, 35-tons).****PATTERN.**

There is only one pattern of this gun.

RIFLING.

The rifling is on the Woolwich system, with increasing twist.

VENTING.

As for 10-inch R.M.L. Gun.

SIGHTING.

The gun is provided with six sights, viz., 2 tangent scales, one on each side, graduated up to 10°, and furnished with deflection leaves giving 30 minutes on either side. The bar of the sight is four-sided, and marked as follows :—

DEGREES.

BLANK,



COMMON SHELL, REDUCED
85 LBS. P.².
YARDS, 4,500.

PALLISER SHOT FULL.
110 LBS. P., YARDS, 4,800.

One centre hind-sight, viz., a third tangent sight, with steel bar.

PROJECTILES.

Nature.	Weight Empty.		Burst.		Gas Check, Plug and Nut.		Mean Total Weight.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Common shell, studded, Mark III ...	573	0	41	0	16	1	630	1
Common shell, studless, Mark I ...	672	6	27	4	14	6	714	0
Shrapnel shell, studded, Mark I ...	610	6	1	15	...	...	612	5
Shrapnel shell, studless, Mark I ...	697	9½	2	0½	14	6	714	0
Palliser shot (shell), studded, Mark IV ...	686	3	*10	4	16	3½	712	10½
Palliser shot (shell), studless ...	692	6	*7	4	14	6	714	0
Case shot, Mark II ...	...	...	...	...	...	...	246	0

* § 5033. Shot Palliser. Formerly shell. To be weighted up with sand.

R.M.L. Ordnance (10, 11, and 12-inch).			Section I.
CHARGES.			
Full ....	....	....	110 lbs. P.
Reduced	....	....	85 lbs. P ² .

FUZES.

Time, 15-seconds, M.L., for use with shrapnel shell.

Percussion, Pettman General Service, for sea fronts, for use with common shell intended to burst on impact.

DRILL WITH 10-INCH, 11-INCH, AND 12-INCH R.M.L. GUNS MOUNTED IN CASEMATES OR OPEN SHIELD BATTERIES.

The detachment consists of 15 Nos., and falls in two deep.

To TELL OFF.

As detailed at page 186.

To TAKE POST UNDER COVER.

As detailed at page 187, except that 12 and 11 form upon the right and left of 4 and 5 ; 6 goes to the head of the cartridge lift ; 7 and 9 to the head of the shell lift ; 8 and 14 to the cartridge store ; 10, 13, and 15 to the shell store.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, and lays.

No. 2 searches, sponges, steadies and guides projectile in raising, rams home, runs up, and elevates.

No. 3 searches, sponges, loads, hooks and unhooks hoisting tackle, steadies and guides projectile in raising, uncaps fuze when in the bore, attends to "port bar," rams home, runs up, and elevates.

No. 4 attends to side-arms and supplies them to 2, rams home, and traverses.

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No. 5 supplies 3 with automatic gas-checks, wedge wads, raises projectile, rams home, attends to snatch block, and traverses.

No. 6 supplies cartridges to 3, and rams home.

No. 7 attends to fuzes, brings up projectile, raises it, and rams it home.

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

No. 9 assists 7, raises projectile, and removes empty barrow.

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

No. 11 raises projectile, assists 6 with cartridge (if required), rams home, attends to mantlet, and traverses (if required).

No. 12 rams home, attends to vent and mantlet, traverses (if required), makes ready and fires.

Nos. 13 and 15 at the shell store.

No. 14 at the cartridge store.

N.B.—Nos. 1, 6, and 12 assist to raise projectile when necessary.

TO PREPARE FOR ACTION.*Officer.**Prepare for action.**No. 1.**Prepare for action.
Examine gun.*

"*Prepare for action.*"—No. 1 provides a piece of chalk and fixes sights.

No. 2, iron pointed lever, elevating wheel, and assists 4 with side-arms.

No. 3, iron pointed lever, elevating wheel, and hoisting tackle (10-inch double and single, 11-inch and 12-inch double and treble blocks). He removes the muzzle tampeon.

No. 4, side-arms.

No. 5, wedge wads, traversing handle (or handles), and tackle for running back.

No. 6 (zinc cartridge cylinder, and dummy cartridge for drill

R.M.L. Ordnance (10, 11, and 12-inch).

Section I.

purposes), bucket filled and brush, and two wood cartridge cylinder bearers for use if required.

No. 7, fuzes, fuze and shell implements, and two selvagees for projectile; he obtains the fuze boxes from 10, and sees that fuzes and fuze implements are correct.

No. 8 goes to the cartridge store and prepares to issue cartridges.

No. 9, transporting barrow and a brush, automatic gas-checks in box with lid unscrewed.

No. 10 goes to the shell store, and prepares to issue shells, 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.

No. 11 assists 2 and 4, and brings up rammer ropes when fitted with spring clips.

No. 12, tubes in box, lanyard, pricker and vent server.

Nos. 13 and 15 go to the shell store.

No. 14 to the cartridge store.

Nos. 8 and 10 satisfy themselves that the lamps in the ammunition stores are burning brightly.

Nos. 13 and 14 that the hoisting gear at the shell and cartridge lifts work easily.

Any irregularity in these respects should be at once reported to No. 1.

The stores having been brought up, or found correct, No. 1 will satisfy himself that the foresights fit properly on the gun, the deflection leaves of the hind sights work easily, and that the clip plates are secured to the carriage; he ascertains that the hydraulic buffer is filled with the proper amount of oil, and that the racers are swept; he receives reports from the Nos. responsible of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform, stores, or as regards the ammunition, stores, lifts, &c.

Nos. 2 and 4 place the sponge and rammer in the supports on

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the right side of the platform, the shell extractor and wadhook in rear, so as not to interfere with the working of any of the guns in the battery, and convenient for those for which intended.

No. 2 sees that the elevating gear, 4 that the traversing gear is oiled and in good working order; 2 and 3 place the iron pointed levers in their supports on the platform.

No. 3 examines the bore to see the grooves are free from grit, &c., secures the hoisting tackle to the loading bar, overhauling it until the lower block is at a convenient height for hooking to the salvagoe on the projectile. The lower block should then be hooked back to a loop on the left mantlet to keep the tackle out of the way until required.

No. 5 reeves the running back tackle, and sees that the automatic gas-checks are placed in a convenient position.

No. 6 supplies the sponge tank with water from the bucket, and places the latter clear of the working of the gun.

No. 11 coils down the rammer ropes either side of the gun and sees that the mantlets work easily.

No. 12 places the pricker in the loop on the side of the carriage, examines the vent server and places it in the vent, the loop of the vent server lanyard over one of the sights; straps the tube box round his waist on the right side, coils up the lanyard and passes the bight of it under the tube box strap; fills his box with friction tubes which he procures from 10.

"*Examine gun;*" 12 drifts the vent, and replaces the vent server, 2 and 3 search the gun after the pricker is withdrawn, 2 supplying himself with the wadhook and replacing it; 11 and 12 elevate until the gun is in a convenient position for loading.

TO LOAD.

<i>Officer.</i>		<i>No. 1.</i>
<i>Range</i> —yards.		<i>With</i> —load.
<i>With</i> —load.		

R.M.L. Ordnance (10, 11, and 12-inch).

Section I.

"*Load*," No. 1 gives 7 the nature of shell (and length of fuze required), adjusts the tangent sight, and places himself where he can best superintend the service of the gun.

2 moves into position for sponging, receives the sponge from 4, and, assisted by 3, sponges the gun, being careful to observe that the vent server is in the vent. He returns the sponge to 4, and, with 3, steadies the projectile in raising and guiding it into the bore. He then receives the rammer (with right rammer rope attached) from 4, and, assisted by 3, steadies the stave, whilst the cartridge and projectile are being rammed home. The rammer ropes being manned by 4, 6, and 12 on the right, 5, 7, and 11, on the left of the gun. Should "*Not home*" be given by 2, they again stand to the ropes and force the charge home. At "*Home*" they go under cover. 2 and 3 detach the rammer ropes (if fitted with spring clips), hand them to 11 and 12, spring the rammer, 3 inserts a wedge wad, which is pressed steadily home by 2 and 3, and jammed under the head of the projectile by two smart taps; they spring the rammer (2 handing it to 4), and go under cover.

3 moves into position, and having fixed the port bar and assisted 2 to sponge, slews to his right, withdraws the cartridge from the cylinder, placing it on his right shoulder, choke to his front; he then turns left about until his back is towards the muzzle and slides the cartridge from off his shoulder into the bore, receives an automatic gas-check from 5, and places it in the bore immediately in front of the cartridge, painted side to the rear. The projectile is now brought up on the barrow with selvagee ready fixed; 3 standing clear, close to the front of the platform, 5 casts loose the lower block of the hoisting tackle; 3 hooks it into the selvagee, and gives "*Hoist away*," and with 2 steadies and guides the projectile, which is raised by 5, 7, 9, and 11, manning the running end of the fall; 3 gives "*High enough*," "*Ease off*," and, having with 2 forced the projectile into the bore, casts loose the selvagee, replacing it in the barrow, and uncaps the

Section I. R.M.L. Ordnance (10, 11, and 12-inch).

fuze. The barrow may be pushed clear by 3 before hoisting; 3 now hooks on the left hand rammer rope which he receives from 11, and the charge and wedge wad are rammed home in succession, the rammer sprung as before detailed, and the port bar unshipped by 3.

4 hands the sponge to 2 and receives it back from him; he hands him the rammer as soon as the projectile is in the bore and mans the rammer rope. When the projectile and wedge wad have been sent home he receives the rammer back from 2, and replaces it.

5, as soon as the cartridge is in the bore, hands an automatic gas-check to 3, casts loose the lower block of the hoisting tackle, attends to snatch block, mans the fall in raising the projectile, and the rammer rope in ramming home. When the charge is home he supplies 3 with a wedge wad, and hooks the lower block of the hoisting tackle to the loop on the left mantlet.

6, after supplying 3 with cartridge, which he brings up on his shoulder, lid to the rear, mans the rammer rope on the right of the gun.

7 brings up projectile in barrow with selvagee on, having previously, when necessary, adjusted the fuze according to No. 1's directions, assist to raise and ram it home.

8 issues a cartridge to 6.

9 assists 7 to prepare, bring up and raise projectile, removes barrow and selvagee.

10 issues shell.

11 assists 3 with cartridge if required, raises and rams home projectile, and attends to the left mantlet and left rammer rope.

12 rams home and attends to right mantlet and right rammer rope.

13 and 15 work the shell lift.

14, the cartridge lift.

N.B.—When rammer ropes, fitted with “spring clips,” are not in use, they are coiled down between the racers, close to the piers by 11 and 12.

R.M.L. Ordnance (10, 11, and 12-inch).

Section I.

To RUN UP.

*Officer.**No. 1.**Run up.**Halt.*

"Run up," 2 and 3 put the iron pointed levers into the sockets and bear down ; should it be observed that the gun is running up too rapidly 2 and 3 raise their levers and check it.

When the gun is in position No. 1 gives the word "*Halt.*" 2 and 3 raise the levers till the sockets touch the stop plates ; they then replace them. No. 12 hooks a tube to the lanyard ; 11 and 12 close the mantlets.

To LAY, MAKE READY, AND FIRE.

*Officer.**No. 1.**Commence firing**or**Fire — rounds.**Elevate. Halt.**Depress. Halt.**Trail right. Halt.**Trail left. Halt.**No. — Ready.**No. — Fire.*

2 and 3 work the elevating gear, 4 and 5 the traversing handles. Should extreme right or left be given 11 and 12 assist 4 and 5.

At "*Ready*" 4 and 5 remain on the traversing handles, the other gun numbers stand clear. No. 12 places the tube in the vent,* and keeping well in rear so as not to pull it out stands ready to fire, looking towards No. 1. At "*Fire*" he draws the lanyard strongly towards him without a jerk ; he drifts the vent,

* In the service of guns when the firing No. cannot put the tube into the vent without mounting on the platform, this should be done by No. 1. (See "Drill detail for 9" R.M.L., page 236.)

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replaces the vent server and pricker and coils up the lanyard, placing it under his belt. Should no order to fire by the Officer have been given when the gun is laid, No. 1 will give the word "*Under cover.*"

11 and 12, assisted by 4 and 5 if necessary, will, as soon as the gun has been fired, at once traverse it back to a position convenient for loading, without any word of command.

TO RUN BACK AND UNLOAD.

*Officer.**No. 1.*

Run back. Halt.
Unload.

At "*Run back*" No. 1 disconnects the traversing pinions by shifting and keying up the handle. He follows up the right front roller with a wedge-wad.

2 and 3 apply their levers and bear down ; 4 and 5 fix the small pawls ; 2 and 3 then withdraw their levers and replace them ; 11 and 12 connect running back tackle ; 6 and 7 assisting to overhaul ; 4, 5, 11, and 12 man the winch handle ; 6 and 7 holding on to the fall ; No. 1 gives "*Heave round,*" and, as soon as the gun is back, "*Halt,*" when 2 and 3 apply their levers and bear down ; 4 and 5 release the small pawls ; 11 and 12 remove the tackle.

No. 1 then places the traversing apparatus in gear, and keys up.

The gun is unloaded by the same numbers who loaded it.

TO CEASE FIRING AND REPLACE STORES.

As at page 218.

TO FORM DETACHMENT REAR.

The gun Nos. turn outwards and form up as laid down at page 195, the remaining numbers coming up into their places.

R.M.L. Ordnance (10, 11, and 12-inch).

Section I.

TO CHANGE ROUNDS.			
<u>Officer.</u>			<u>No. 1.</u>
<i>Change rounds.</i>			<i>Change rounds.</i>
	No. 2 becomes	4	
	" 4 "	1	
	" 1 "	12	
	" 12 "	11	
	" 11 "	9	
	" 9 "	7	
	" 7 "	6	
	" 6 "	5	
	" 5 "	3	
	" 3 "	2	

Thus the gun-floor Nos. only will change rounds.

When required for drill the other numbers will be marched on to the gun-floor, the detachment being told off afresh.

SERVICE OF GUNS MOUNTED ON TURNTABLES.

The method of serving a 10-inch, 11-inch, or 12-inch R.M.L. gun mounted on a turntable is the same as detailed for guns on traversing platforms.

To shift from one port to another at "*Turntable right*" (or "*left*") 2, 3 and 6 attend to the catches, 4, 5, 11, and 12 to the winch of the table.

After practice the carriage is to be run back to the stops, and the platform to be left in the centre of the turntable.

The turntable is for removing a gun from one port to another, and not for traversing.

SERVICE OF 10-INCH, 11-INCH, AND 12-INCH GUNS IN BARBETTE BATTERIES (WITH SUNKEN WAYS).

The guns are fitted with muzzle derricks and supplied with loading stages.

The running end of the fall of hoisting tackle is led through an ordinary single 8-inch Bothway block, which is hooked into a permanent eye let into the wall of the parapet. Two snatch blocks are hooked to the loops or eyes on the derrick, and the bell ropes of the rammer are passed through them. The snatch blocks are hooked for "loading" by 2 and 3, unhooked by them when the wedge wad has been rammed home, and laid down with the rammer ropes when not in use by 11 and 12 who attend to them. The upper block of the hoisting tackle should be moused with spunyarn. The service of the guns is the same as for those mounted in casemates and behind shields, with the following exceptions :—

"General duties."—5 attends to muzzle derrick, 7 and 9 attend to loading stage.

"Prepare for action."—5, an 8-inch single Bothway block, 11, two 4-inch snatch blocks, which he hooks on to the derrick, 9 tackle for hoisting projectiles on to loading stage.

"To load."—5, as soon as the cartridge is in the bore, raises the derrick and overhauls the tackle ; after supplying 3 with a wad, he rounds in the tackle and throws back the derrick ; 7 and 9 (assisted by 13 and 15) having placed a projectile on the loading stage, run it under the muzzle of the gun, and after the rammer has been withdrawn from the bore, run the stage back to its former position.

If no crane or derrick is available for lifting projectiles on to the loading stage, they can be rolled on on a plank.

The paragraphs relating to portbar, mantlets, and transporting barrow do not apply to this drill, the barrow being required for conveying projectile to loading stage only.

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Section I.

N.B.—For guns mounted “en barbette” without sunken ways, a transporting barrow is used for conveyance of projectile to the muzzle of the gun instead of a loading stage.

DRILL WITH 10-INCH R.M.L. GUN MOUNTED ON SMALL PORT CARRIAGE.

RAISING THE GUN BY RAM.

Prepare to raise the Gun.

Raise the Gun.

Halt.

Nos. 2, 3, 4 and 5 man the pump lever handles of the ram ; 2 and 4 on the right, 3 and 5 on the left ; 11 and 12 (assisted, if necessary, by 6 and 7) man the winch handles of the quick motion screw for following up—6 and 12 on right, 7 and 11 on left.

RAISING THE GUN BY SCREW LIFT.

In the event of the failure of the hydraulic ram, the slow motion screw lift must be worked. This will require 4 men on each handle, to be relieved when necessary by other men of the detachment and supernumeraries.

N.B.—No. 1 attends to the release valve, and must be careful after each change of position of the gun, and *Before firing*, that the release valve is open until the gun rests on the trunnion blocks, when it should be again closed.

The detachment consists of 15 Nos. The drill is the same as for similar guns mounted on casemate traversing platforms with the following exceptions :—

The sponge and rammer being slung from the roof 12 (in addition to his other duties) assists 4 to supply and replace them.

No. 1 attends to the release valve.

(a.m.)

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Section I.**R.M.L. Ordnance (12'5-inch).****12'5-INCH R.M.L. GUN.****DESCRIPTION.**

		Mark I.	Mark II.
Calibre		12'5 inches.	12'5 inches.
Nominal weight		38 tons.	38 tons.
Preponderance		<i>Nil.</i>	<i>Nil.</i>
Length {	of bore ...	198 inches.	198 inches.
	of rifling ...	170'5 inches.	156'875 inches.
	total ...	230 inches.	222'8 inches.
Rifling {	grooves, No. ...	9	9
	increasing twist from	0 to 1 in 35.	1 in 438 at breech to 1 in 35 at muzzle.
Woolwich system			
Chamber {	length ...	No enlarged chamber, but the end of the bore is coned.	41'125 inches.
	diameter ...		14 inches.
	capacity ...		6,000 cubic inches.

VENTING.**Mark I.**

Similar to 35-ton gun.

Mark II.*

Axial, with safety shutter.

* A removable cascable is issued to each fort in which guns of this pattern are mounted, for use in slinging the piece after the removal of the shutter.

SIGHTING.

The tangent scale sights are, as well as the trunnion and centre foresight of Mark I. guns, available for issue with Mark II. guns.

They are similar to the 35-ton gun.

CHARGES.

Mark I. gun 160 lbs P.² made up in two bags of 80 lbs. each.

Mark II. gun "Full" 210 lbs. Prism² made up in quarter charges.

Mark II. gun "Reduced" 157½ lbs. Prism² made up in three quarter charges.

R.M.L. Ordnance (12.5-inch)

Section I.

PROJECTILES.

Nature.	Weight. Empty.		Burster.		Gas-check Plug and Nut.		Mean Total Weight.	
	lb.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Common shell, studded, Mark I ...	780	8	29	4	17	3½	826	15½
Common shell, studless, Mark I ...	769	5½	33	0	15	10½	818	0
Shrapnel shell, studded, Mark I ...	803	6	2	7	17	3½	823	0½
Shrapnel shell, studless, Mark I ...	799	14½	2	7	15	10½	818	0
Palliser shot (shell), studded, Mark III	789	0	*11	14	17	3½	818	1½
Palliser shot (shell), studless, Mark II	794	2	*8	3	15	10½	818	0
Case shot, Mark III ...	...	...	...	...	...	...	805	0

* § 5033. Shot Palliser. Formerly shell. To be weighted up with sand.

NOTE.—*Vide* § 4081, p. 89, for use of “full” and “reduced” charges with certain projectiles.

FUZES.

Time—15 seconds, M.L., for use with shrapnel shell.

Percussion—Pettman general service, for sea fronts, for common shell, fired with full charges. Direct action for common shell fired with reduced charges.

DRILL WITH R.M.L. ORDNANCE 12.5-INCH GUN ON A CASEMATE TRAVERSING PLATFORM.

The Detachment consists of 17 Nos., and falls in two deep.

To TELL OFF.

As detailed at p. 186.

To TAKE POST UNDER COVER.

As detailed at p. 187, except that 12 forms on the right of 4 ; 6 and 11 go to the head of the cartridge lift ; 7 and 9 to the (a.m.)¹

s 2

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Section I.**R.M.L. Ordnance (12·5-inch).**

head of the shell lift ; 8 and 14 to the cartridge store ; 17 to the foot of the cartridge lift ; 10 and 13 to the shell store ; 15 to the foot of the shell lift ; 16 goes under cover outside 12.

GENERAL DUTIES.

No. 1 commands, directs, or superintends the boring and fixing fuzes, assists (if required) to raise projectile, lays, and attends to indicator.

No. 2 searches, sponges, assists 3 with cartridge, steadies, and guides projectile in raising, rams home, assists 12 to attend to mantlet, and elevates.

No. 3 searches, sponges, loads, hooks, and unhooks hoisting tackle, steadies and guides projectile in raising, uncaps fuze when in bore, attends to port bar, rams home, pumps the running-up jack, and assists 11 to attend to mantlet.

No. 4 attends to side arms and supplies them to 2, rams home, and traverses.

No. 5 supplies 3 with automatic gas-checks and wedge wads, raises projectile, rams home, attends to snatch block, traverses, and attends to lever of chain nipping gear.

No. 6 supplies cartridge to 3, raises projectile, and rams home.

No. 7 attends to fuzes, brings up projectile, raises it, and rams home.

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

No. 9 assists 7, raises projectile, rams home, and removes empty barrow.

No. 10 attends to shell store.

No. 11 supplies 3 with cartridge, raises projectile, rams home, attends to mantlet, and traverses.

No. 12 rams home, attends to mantlet, and traverses. Attends to compressor stop.

Nos. 13 and 15 supply shells to the lift from the shell store.

Nos. 14 and 17 supply cartridges to the lift from the cartridge store.

R.M.L. Ordnance (12'5-inch).

Section I.

No. 16 assists 4 with side arms, rams home, attends to vent and preventor gear, makes ready, and fires.

TO PREPARE FOR ACTION.

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

Prepare for action.
Examine gun.

“*Prepare for action.*”—No. 1 provides a piece of chalk and fixes sights.

No. 2, elevating wheel, and assists 4 with side arms.

No. 3, hoisting tackle, consisting of double and treble blocks, and handle of running-up jack. He removes the muzzle tampeon.

No. 4, side arms.

No. 5, wedge wads and two traversing handles.

No. 6, cartridge cylinder and dummy cartridge for drill purposes, bucket filled, and brush, and two wood cartridge bearers.

No. 7, fuzes, fuze and shell implements, and selvagee for slinging projectile. He obtains the fuze boxes from 10, and sees that fuzes and fuze implements are correct.

No. 8 goes to the cartridge store and prepares to issue cartridges.

No. 9, transporting barrow and brush; automatic gas-checks in box with lid unscrewed.

No. 10 goes to the shell store and prepares to issue shells, 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.

No. 11 cartridge cylinder and dummy cartridge for drill purposes, brings up rammer ropes when fitted with spring clips.

No. 12 assists 4 with side arms.

Nos. 13 and 15 go to the shell store.

Nos. 14 and 17 to the cartridge store.

No. 16 provides tubes in box, lanyard, pricker, and vent server.

PART V.**Section I.****R.M.L. Ordnance (12'5-inch).**

Nos. 8 and 10 satisfy themselves that the lamps in the ammunition stores are burning brightly.

Nos. 13 and 14 that the hoisting gear at the shell and cartridge lifts work easily.

Any irregularity in these respects should be at once reported to No. 1.

The stores having been brought up, or found correct, No. 1 will satisfy himself that the foresights fit properly on the gun, and the deflection leaves of the hind sights work easily. He ascertains that the hydraulic buffer is filled with the proper amount of oil, and that the racers are swept; that the running-up jack, indicator, and clutch lever are in working order; he receives reports from the Nos. responsible of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform and stores, or as regards the ammunition stores, lifts, &c., also sees that the compressor and preventor gear are in adjustment.

2 and 4 place the sponge and rammer in the supports suspended from the roof, the shell extractor and wad hook in rear, so as not to interfere with the working of any of the guns in the battery, and convenient for those for which intended.

2 sees that the elevating gear, 4 that the traversing gear is oiled and in good working order.

3 examines the bore to see the grooves are free from grit, &c., secures the hoisting tackle to the loading bar, overhauling it until the lower block is at a convenient height for hooking to the selvagee on the projectile. The lower block should then be hooked back to a loop on the left mantlet.

5 ascertains that the lever of chain nipping gear is in working order, and sees that the automatic gas-checks are placed in a convenient position.

6 places the sponge bucket clear of the working of the gun.

11 coils down the rammer ropes either side of the gun, and, with 12, sees that the mantlets work easily.

R.M.L. Ordnance (12.5-inch).

Section I.

16 places the pricker in the loop on the side of the carriage, examines the vent server and places it in the vent (the loop of the vent server lanyard over one of the sights), straps the tube box round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube box strap: fills his box with friction tubes, which he procures from 10.

No. 1 gives the word "*Examine gun*;" 16 drifts the vent, replaces the vent server, 2 and 3 search the gun after the pricker is withdrawn, 2 supplying himself with the wad-hook, and replacing it; 12 elevates until the gun is in a convenient position for loading and clamps the elevating gear.

To LOAD.

<i>Officer.</i>	<i>No. 1.</i>
<i>Range</i> —yards.	<i>Trail right or left (if necessary),</i>
<i>With</i> —load.	<i>Halt.</i>
	<i>With</i> —load.

"*Trail right or left.*"—No. 1 adjusts the indicator for traversing; 4, 5, 11, and 12 trail right or left.

The gun is traversed to a convenient position for loading if necessary.

"*Load.*"—No. 1 gives 7 the nature of shell (and length of fuze required) adjusts the tangent sight, and places himself where he can best superintend the service of the gun.

2 moves into position for sponging, receives the sponge from 4, and, assisted by 3, sponges the gun, being careful to observe that the vent server is in the vent. He returns the sponge to 4, assists 3 with cartridge and to steady the projectile in raising and guiding it into the bore. He then receives the rammer from 4

NOTE.—With the 12.5-inch chambered gun the charge is 210 lbs. prism². It is divided into four cartridges, and is brought up to the gun in two cylinders by Nos. 6 and 11. A wooden bearer is passed through each lid, and the numbers carry them up litter fashion, No. 6 leading. No. 3, before taking out the first cartridge, tears off the red shalloon patch. No. 2 assists No. 3 to take out each cartridge and place it in the bore.

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R.M.L. Ordnance (12'5-inch).

(with right rammer rope attached), and assisted by 3, steadies the stave, until the cartridge and projectile are nearly rammed home. They then fall back on the rammer ropes. The rammer ropes being manned by 4, 6, 12, and 16 on the right, 5, 7, 9, and 11 on the left of the gun. Should "*Not home*" be given by 2, they again stand to the ropes, and force the charge home. At "*Home*" they go under cover; 2 and 3 detach the rammer ropes (if fitted with spring clips), hand them to 11 and 12, spring the rammer; 3 inserts a wedge wad, which is pressed steadily home by 2 and 3, and jammed under the head of the projectile by two smart taps. They then spring the rammer (2 handing it to 4), and go under cover.

3 moves into position, and having fixed the port bar and assisted 2 to sponge, slews to his right, withdraws the first cartridge from the cylinder, placing it on his right shoulder, choke to his front; he then turns left about until his back is towards the muzzle and slides the cartridge from off his shoulder into the bore.

He does the same with the second cartridge, receives an automatic gas-check from 5, places it in the bore immediately in front of the cartridge, painted side to the rear. The projectile is now brought up on the barrow with selvagee ready fixed; 3 standing clear close to the front of the platform, 5 casts loose the lower block of the hoisting tackle, and 3 hooks it into the selvagee and gives "*Hoist away*," and with 2 steadies and guides the projectile, which is raised by 5, 6, 7, 9, 11, and 1 if necessary, manning the running end of the fall; 3 gives "*High enough*," "*Ease off*," and, having, with 2, forced the projectile into the bore, casts loose the selvagee, replacing it in the barrow, and uncaps the fuze. The barrow may be pushed clear by 3 before hoisting. 3 now hooks the left rammer rope, which he receives from 11, and the charge and wedge wad are rammed home in succession, the rammer sprung by 2 and 3, and the port bar unshipped by 3. 4, assisted by 16, hands the sponge to 2 and receives it back from him; he hands him the rammer as soon as the projectile

R.M.L. Ordnance (12'5-inch).

Section I.

is in the bore, and mans the rammer rope. When the projectile and wedge wad have been sent home, he receives the rammer back from 2, and assists 16 to replace it.

5, as soon as the cartridge is in the bore, hands an automatic gas-check to 3,* casts loose the lower block of the hoisting tackle attends to snatch block, mans the fall in raising the projectile, and the rammer rope in ramming home. When the charge is home he supplies 3 with a wedge wad, and hooks the lower block of the hoisting tackle to the loop on the left mantlet.

6, after supplying 3 with cartridge, which he brings up, mans the fall of hoisting tackle and afterwards the rammer rope on the right of the gun.

7 brings up projectile in barrow with selvagee on, having, when necessary, adjusted the fuze according to No. 1's directions, assists to raise and ram it home.†

8 issues cartridges.

9 assists 7 to prepare, bring up, raise and ram home projectile, removes barrow and selvagee.

10 issues shell.

11 after supplying 3 with cartridge, raises and rams home projectile, and attends to the left mantlet and left rammer rope.

12 rams home, attends to the right mantlet and right rammer rope.

13 and 15 work the shell lift.

14 and 17 the cartridge lift.

16 lowers the sponge and rammer in succession from the rope support in the roof of the casemate, and assists 4 to hand them to 2, replacing them with 4's assistance, and mans the right rammer rope.

* At drill the gas-check is attached.

† The charge is divided into two cartridges, and is brought up to the gun in two cylinders by Nos. 6 and 11. A wooden bearer is passed through each lid, and the Nos. carry them up litter fashion, No. 6 leading. No 2 assists 3 to take out each cartridge and place it in the bore.

Section I.

R.M.L. Ordnance (12'5-inch).

N.B.—When rammer ropes fitted with “spring clips,” are not in use, they are coiled down between the racers close to the piers by 11 and 12.

To RUN UP.

Officer.No. 1.*Run up. Halt.*

“*Run up.*”—12 releases the compressor by raising the weighted lever, holding it up until the carriage has moved clear; when clear, he presses down the lever towards the front of the platform. No. 3 pumps up the jack until the gun begins to move to the front. No. 3 checks it if necessary by forcing the lever to the rear.*

When up to the front stops No.1 gives “*Halt,*” and 3 lowers the rear of the carriage as described for checking it. The clutch gear of the running back chains should never be used in running up or back when the jack is out of order; 16 presses down lever of preventor gear, hooks a tube to the lanyard; 2, 3, 11, and 12 close the mantlets.

To LAY, MAKE READY, AND FIRE.

Officer.No. 1.

Commence Firing
or
Fire — Rounds.

Elevate. Halt.
Depress. Halt.
Trail right. Halt.
Trail left. Halt.
No. — Ready.
No. — Fire.

No. 1 adjusts the indicator for traversing, and then, looking

* With mountings not fitted with preventor gear, in order that the gun should not run up to the stops violently, No. 3 should lower the rear of the carriage gradually and with care, commencing to lower as soon as the carriage has moved forward about 18 inches, lowering rapidly, or not, according to his judgment. Should the release valve be external No. 1 attends to it.

R.M.L. Ordnance (12'5-inch).

Section I.

over his sights, gives "*Elevate*," &c., as required. 2 at "*Elevate*" releases the clamping arrangement of elevating gear by lifting the handle of the clamp towards the front; he then turns the hand wheel to the right (or towards the front). At "*Depress*" he reverses the movement of the hand wheel; at "*Under cover*" or "*Ready*" he clamps the elevating arc by pressing the handle down towards the rear. 4, 5, 11, and 12 work the traversing handles, turning them towards the rear for "*Trail right*," the reverse for "*Trail left*."

At "*Ready*" the traversing number remains on the handle; the other Nos. stand clear. 16 places the tube in the vent,* and keeping well in rear so as not to pull it out stands ready to fire, looking towards No. 1. At "*Fire*" he draws the lanyard strongly towards him without a jerk; he drifts the vent, replaces the vent server and pricker, and coils up the lanyard, placing it under his belt. Should no order to "*Fire*" by the Officer have been given when the gun is laid, No. 1 will give the word "*Under Cover*." As soon as the gun has been fired it will be traversed back to a position convenient for loading without any word of command.

TO RUN BACK AND UNLOAD.

Officer.No. 1.

Run back. Halt.
Unload.

At "*Run back*" No. 1 adjusts the indicator for running back; 5 raises the lever of chain nipping gear until the teeth of the sprocket plates catch in the running-in-and-out chains on the platform, and holds it up (or secures it) until the gun having been

* In the service of guns when the firing No. cannot put the tube into the vent without mounting on the platform, this should be done by No. 1. See Drill detail for 9-inch R.M.L., p. 236.

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Section I.**R.M.L. Ordnance (12'5-inch).**

run back the carriage is lowered on to the platform, after which he forces the lever down until it is held by the catch; 3 works the lever of running up jack until the rear of the carriage is raised.

4, 12, 16, on the right, 7, 9, 11, on the left, work the traversing handles, 12 raises the compressor lever. As soon as the gun is back No. 1 gives "*Halt*," and 3 forces the lever of jack as far to the rear as possible until the rear of the carriage rests on the platform.

No. 1 then adjusts the indicator for traversing.

"*Unload*." The gun is unloaded by the same Nos. who loaded it.

To CEASE FIRING AND REPLACE STORES.

As at page 218.

To FORM DETACHMENT REAR.

As at page 195.

To CHANGE ROUNDS.

<i>Officer.</i>		<i>No. 1.</i>
<u>Change rounds.</u>		<u>Change rounds.</u>

To CHANGE ROUNDS.

No. 2 becomes 4.

"	4	"	1.
"	1	"	16.
"	16	"	12.
"	12	"	11.
"	11	"	9.
"	9	"	7.
"	7	"	6.
"	6	"	5.
"	5	"	3.
"	3	"	2.

R.M.L. Ordnance (12'5-inch).

Section I.

Thus the gun-floor Nos. only will change rounds.

When required for drill the other numbers will be marched on to the gun-floor, and the detachment told off afresh.

The drill for Mark II. gun is the same as for Mark I. except that in preparing for action No. 16 provides "a rimer and extractor" instead of "pricker and vent server," also the following :—

PREPARE FOR ACTION.

At "*Examine gun*," No. 16 removes plug shutter, by unscrewing it, opens the shutter, by taking the handle in his left hand and pressing it to the left, draws it towards him and swings it round to the left. He then removes the vent head, by taking the handle in his left hand, and giving it a quarter turn to the left, draws it out clear of the vent.

The vent-sealing tube is next fixed in the vent head. This is done by holding the vent head vertically in the left hand, at the same time pressing the catch with the left thumb; the tube is then placed in the vent head, wire first, and the catch released. The vent head is now inserted by placing the feather in line with slot and pushing it home, giving it a quarter turn to the right. The shutter is then closed by swinging it round to the right and pushing it home, when it will lock itself.

TO LAY THE GUN.

During the laying, No. 16 will adjust the vent head in the manner described above; also the lanyard to the pulleys, and attend to it.

TO MAKE READY AND FIRE.

No. 1, before he comes down from the platform, will hook the lanyard to the tube wire.

NOTE 1. Should any difficulty be found in removing the vent head with the fired tube attached, the vent head should be removed first, being released from the tube by pressing down the

Section I.

R.M.L. Ordnance (12·5-inch).

catch, and the tube is then extracted by application of the special extractor, supplied, under its head.

2. Two vent heads are issued with each gun, and to save time it is well to use both, No. 16 bringing up the spare one with its tube inserted in it.

3. There being no vent-server with this gun, the vent head containing the old tube is not to be removed until the gun has been re-loaded.

SERVICE OF 12·5-INCH R.M.L. GUN IN BARBETTE BATTERY WITH SUNKEN WAYS.

The guns are fitted with muzzle derricks and supplied with loading stages.

The running end of the fall of the hoisting tackle is led through an ordinary single 8-inch Bothway block, which is hooked into a permanent eye let into the wall of the parapet.

Two 4-inch snatch blocks are hooked to the loops or eyes on the derrick and the bell ropes of the rammer are passed through them. The snatch blocks are hooked for "*Loading*" by 2 and 3, unhooked by them when the wedge wad has been rammed home, and laid down with the rammer ropes when not in use by 11 and 12, who attend to them. The upper block of the hoisting tackle should be moused with spun yarn.

The service of the guns is the same as for those mounted in casemates and behind shields, with the following exceptions:—

"*General duties*," 5 attends to muzzle derrick; 7 and 9 attend to loading stage.

"*Prepare for action*," 5 an 8-inch single Bothway block; 11 two 4-inch snatch blocks, which he hooks on to the derrick; 9 tackle for hoisting projectiles on to loading stage.

2 and 4 place the sponge and rammer on the ground on the right of the gun.

"*To load*," 5, as soon as the cartridge is in the bore, raises the derrick and overhauls the tackle; after supplying 3 with a wad

he rounds in the tackle and throws back the derrick, 7 and 9, assisted by 13 and 15, having placed a projectile on the loading stage, run it under the muzzle of the gun, and after the rammer has been withdrawn from the bore, run the stage back to its former position.

If no crane or derrick is available for lifting projectiles on to the loading stage, they can be rolled on on a plank.

The paragraphs relating to portbar, mantlets, and transporting barrow do not apply to this drill, the barrow being required for conveying projectile to loading stage only.

N.B.—For guns mounted en barbette without sunken ways, a transporting barrow is used for conveyance of projectile to the muzzle of the gun, instead of a loading stage.

SERVICE OF GUNS MOUNTED ON TURNABLES.

When 38-ton guns are mounted on turntables to shift from one port to another it may be done by the same numbers as with the 10-inch, 11-inch, and 12-inch R.M.L. Guns. *Vide* p. 257.

SILENT DRILL.

This is always to be done at practice or inspections unless smoke, darkness, or other cause necessitates words of command.

It possesses the advantage of enforcing silence, and compels the numbers working at the gun to fix their attention on the No. 1 or other number giving the signal.

The preliminary commands and “*Fire*” are given by word of mouth.

Officer.

Prepare for action.
Examine gun.
With—load.

No. 1.

Prepare for action.
Examine gun.
With—load.

Section I.

R.M.L. Ordnance.

1 mounts up on the platform and adjusts his tangent scale ; the other numbers act as usual.

(3. "*Hoist away*") 3 raises either hand, fingers pointing upwards.

(3. "*High enough*") 3 again raises his hand and waves it across twice.

(3. "*Ease off*") 3 raises his hand above his head and lowers it quickly.

When the rammer head is adjusted the signal to ram home will be made, if required, by 2 holding up his hand ; if the odd numbers cannot see him 2, 3 must do the same.

For "*home*" the hand is again raised.

For "*not home*" the hand is raised and waved across.

(1. "*Run up*") 1 holds up his right hand, palm to the front.

TO LAY, MAKE READY, AND FIRE.

Officer (word of command).

Fire—rounds,

or

Commence firing.

No. 1 (signal).

Elevate. Halt.

Depress. Halt.

Trail, right. Halt.

Trail, left. Halt.

Ready.

No.—fire (word of command).

(1. "*Elevate*") 1 looking over his sights holds up either hand, fingers pointing upwards.

(1. "*Depress*") 1 turns his hand, so that the fingers point downwards.

(1. "*Halt*") he drops the hand to the side.

(1. "*Trail right or left*") he motions with the hand in the required direction, the arm well back.

(1. "*Halt*") he brings his arm smartly down to his side.

(1. "*Ready*") If the firing No. makes ready, 1 points to the vent ; if 1 makes ready he holds out his hand to receive the tube from the firing No.

B.L. Ordnance (6-inch and 8-inch).

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"Fire" to be given by word of command.

Should no order to fire have been given by the Officer.

(1. "Under cover") 1 jumps off the platform, and doubles under cover.

In all respects not above mentioned the drill is the same as laid down for the different natures of ordnance.

The above signals will supply any that may be required for B.L. or R.B.L. guns.

SECTION II.

B.L. Ordnance.*

6-INCH AND 8-INCH GUNS ON H.P. MOUNTINGS.

DRILL.

The detachment consists of 9 numbers and falls in two deep.

To tell off. As at page 186.

To take post under cover.

As detailed at page 187, except that 5 goes to the shell store with 7 and 9, and 1 remains at the breech.

GENERAL DUTIES.

1 commands, directs or superintends the setting and fixing of fuzes, puts in tube, lays, and makes ready (fires only if he uses the electric firing gear when laying by means of the reflecting sights).

* Owing to the variety of B.L. mountings, the same numbers cannot be detailed for the same duties as in most of the M.L. drills.

(a.m.¹)

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B.L. Ordnance (6-inch and 8-inch).

2 assists 3 to lock and unlock the breech, inserts and withdraws breech block, places and removes loading tray, rams home and traverses.

3 locks and unlocks the breech, inserts and withdraws breech block, cleans chamber, loads, uncaps or removes the safety pin, rams home, runs up and traverses.

4 Supplies side arms, elevates, fires (except when 1 does so), attends to handle of lowering pump, unhooks the lanyard after firing, and extracts the old tube.

5 brings up projectile and places it on the loading tray, ships and mans the handle of the lowering pump.

6 supplies 3 with cartridges and mans the lowering pump.

7 attends to fuzes, brings up projectile and places it on the loading tray.

8 attends to cartridge store and issues cartridges to 6.

9 attends to shell store and issues shells, tubes and fuzes.

TO PREPARE FOR ACTION.

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

Prepare for action.
Examine gun.

"Prepare for action." 1 provides sights, tubes in box, lanyard and fuze key.

2 assists 4, removes covering plates, assisted by 3 and 4.

3 traversing wheels, percussion lock, removes muzzle tampeon and assists to remove covering plates.

4 tube extractor, rimer, rammer, sponge, ejector, loading tray, and assists to remove covering plates.

5 shell bearer or barrow and handle of lowering pump.

6 at drill, cartridge cylinders, which he leaves at the cartridge store, and 2 dummy cartridges.

7 fuzes, of the required nature, fuze and shell implements.

B.L. Ordnance (6-inch and 8-inch).

Section II.

8 goes to cartridge store and prepares to issue cartridges.

9 provides a brush for cleaning shell. He goes to the shell store and prepares to issue shells, tubes and fuzes; examines the shells carefully, cleaning them if necessary, and loosens the fuze hole plugs of such shells as will be first required.

EXAMINE GUN.

Examine gun. 2 and 3 open the breech; 1 sees that the bore is clear and satisfies himself that the gun and carriage are in every respect ready for action; 2 and 3 close the breech.

TO LOAD.

<i>Officer.</i>		<i>No. 1.</i>
<i>Range</i> ——— <i>yards.</i>		<i>With</i> ——— <i>load.</i>
<i>With</i> ——— <i>load.</i>		

"*Load.*" 1 gives 5 the nature of shell and fuze required, and adjusts the tangent scale to the required elevation and deflection.

2 and 3 traverse the gun if necessary until the breech is opposite a loading port. They then unlock and withdraw the breech block.

2 receives the loading tray from 4 and inserts it in the chamber. The projectile brought up by 5 and 7 is placed on the loading tray, 3 having previously uncapped or removed the safety pin from the fuze.

2 having received the rammer from 4, rams the projectile home, assisted by 3. He then withdraws the rammer and hands it to 4 who replaces it, then withdraws the loading tray, and hands it to 4, who replaces it.

3 inserts the two half charges, pressing them home as far as they will go. 2 and 3 then close the breech.

4 supplies 2 with loading tray and rammer and replaces them.
(a m.)

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Section II.

B.L. Ordnance (6-inch and 8-inch).

5 and 7 bring up projectile and place it on the loading tray.

6 brings up a cartridge in cylinder.

The gun having been loaded is roughly traversed into the line of fire. 1 gives the word "*Stand clear*," and 3 raises the gun into the firing position by bearing down on the lever, being careful to see that when the gun is up, the by pass valve is closed.

TO LAY, MAKE READY, AND FIRE.

*Officer.**No. 1.**Commence firing**Elevate, &c. as before at*
*p. 236.**or**Fire — rounds.**No. — Ready.**No. — Fire.*

2 and 3 traverse the gun as required.

4 elevates or depresses as required.

1 inserts a percussion tube, hooks the lanyard, letting the end hang free, cocks the lock, giving the word "*Ready*." He then comes down, and at the word "*No. —*" (naming his gun) 4 seizes the lanyard, stretching it out and looking towards 1.

At "*Fire*" 4 will draw the lanyard strongly towards him. He unhooks it, hands it to 1 and extracts the old tube.

When laying by means of the reflecting sights and firing by means of the electric firing gear, 1 will himself fire instead of 4.

(The pattern of the electric firing gear has not yet been settled).

TO CEASE FIRING AND REPLACE STORES.

The stores are replaced by the numbers who brought them up.

TO FORM DETACHMENT REAR.

Similar to detail at page 195.

B.L. Ordnance (9-inch).

Section II.

TO CHANGE ROUNDS.

2 becomes 4 ; 4, 1 ; 1, 7 ; 7, 6 ; 6, 5 ; 5, 3 ; 3, 2. Cartridge and shell store numbers will not change rounds. When required for drill, they can be brought to the gun and told off afresh.

PROVISIONAL DRILL FOR 8-INCH B.L. GUN ON A
GARRISON CARRIAGE AND TRAVERSING PLAT-
FORM. CENTRAL PIVOT.

CHARGE.

100 lbs. prism¹ black, made up in two half charges of 50 lbs.

PROJECTILE.

Nature.	Weight, empty including Base Plug and Lead Disc.		Bursting. Charge.		Fuze	Mean Total Weight of Filled Shell.	
	lbs.	ozs.	lbs.	ozs.		lbs.	ozs.
Common Shell, Mark II ...	195	7	13	10	15	210	0
Shrapnell Shell, Mark III ...	208	3½	0	15½	15	210	0
Palliser Shot (Shell), Mark I...	207	14	*2	2	...	210	0
Palliser Shot (Shell), Mark II ...	...	...	...	...	...	210	0
Case Shot, Mark II ...	...	...	...	...	...	210	0

Palliser Shot, formerly shell. To be weighted up with sand.

FUZES.

Percussion, direct action.

Time, Armstrong, medium, time and concussion.

Section II.

B.L. Ordnance (8-inch).

The detachment consists of 11 Nos., and falls in two deep in left rear of the gun.

TO TELL OFF.

As detailed at page 186.

TO TAKE POST UNDER COVER.

<i>Officer.</i>	<i>No. 1.</i>
<i>Take post under cover.</i>	<i>Right turn.</i>
	<i>Double march.</i>

The detachment stepping off, wheels to its left at the left corner of the platform, the front rank filing to the left of the gun, the rear rank to the right, 2 and 3 halting close to the gun shield; 4 and 5 forming up upon their right and left, the whole turning to the right-about together. No. 1 follows in rear of the detachment keeping under cover as much as possible; 6, 8 and 11 go to the cartridge store (6 and 8 outside), 7, 9 and 10 to the shell store (7 and 9 outside).

GENERAL DUTIES.

1 commands, directs, or superintends the setting and fixing of fuzes, puts in tube, lays and makes ready.

2 locks and unlocks the breech, inserts and withdraws breech block, inserts and removes loading trays, loads, and rams home.

3 assists to insert and withdraw breech block, cleans chamber, steadies and guides projectile on to loading tray, uncaps or withdraws safety pin from fuze, loads, rams home, removes shalloon cover from base of last cartridge, elevates and unhooks lanyard after firing.

4 runs up, supplies rammer and loading trays, attends to vent, traverses and fires.

5 raises projectile (if derrick is used) and traverses.

B.L. Ordnance (8-inch).

Section II.

- 6 brings up a cartridge to 2.
 7 attends to fuzes, brings up projectile, raises and rams it home.
 8 brings up a cartridge to 3.
 9 assists 7, raises projectile, rams home, and removes empty barrow.
 No. 10 attends to shell store and issues shells.
 No. 11 attends to cartridge store and issues cartridges.

PREPARE FOR ACTION.

Officer.*Prepare for Action.*No. 1.

Prepare for Action.
Examine Gun.

- "*Prepare for Action.*" 1 provides a piece of chalk, sights, and fuze key, tubes in box and lanyard.
 2 provides rammer and removes breech cover.
 3 provides grease pot, appliances for cleaning chamber, removes muzzle tampeon.
 4 provides loading trays, tube extractor and rimer.
 5 provides traversing handle, ejector, and hoisting tackle.
 6 provides a cartridge cylinder and dummy cartridge for drill purposes.
 7 provides fuzes, fuze and shell implements, and a selvagee or ring, for slinging projectiles.
 8 provides a cartridge cylinder and dummy cartridge for drill purposes.
 9 provides transporting barrow and brush.
 10 goes to shell store and prepares to issue shells, tubes and fuzes, he examines the shells carefully, cleaning them and removing burrs if necessary, he loosens the fuze hole plugs of such as will be first issued.

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B.L. Ordnance (8-inch).

11 goes to the cartridge store and prepares to issue cartridges.

3 sees that the elevating gear, 5 that the traversing gear, is oil and in good working order.

4 puts in the percussion lock, straps the tube pocket round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube box strap, fills his box with percussion tubes, which he procures from 10.

5 rigs the hoisting tackle.

4 places the rammer, ejector, and loading trays on the right side of the gun.

10 and 11 see that the lamps in the ammunition stores are burning brightly, and that the hoisting gear at the shell and cartridge lifts work easily (if any).

Any irregularity in these respects should be at once reported to 1.

The stores having been brought up or found correct, 1 will see that the foresights fit properly on the gun, that the deflection leaves of the hind sights work easily, that the hydraulic buffers are filled with the proper amount of oil (and adjusted for the charge), and that the racers are swept.

He receives reports from the Nos. responsible, of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform and stores, or as regards the ammunition stores, lifts, &c.

EXAMINE GUN.

"Examine Gun." 3 elevates or depresses until the gun is in a convenient position for loading.

2 raises the breech lever and unlocks the breech (assisted by 3 if necessary) then presses the spring stud with the palm of the left hand, bearing down the lever with his right, which releases the block, he then again raises the lever; 2 with his left and

B.L. Ordnance (8-inch).

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3 with right hand withdraw the breech-block, and swing it round on its carrier until it is clear.

1 looks through the bore and sees that it is clear.

2 and 3 examine the breech block.

4 sees that the firing mechanism is in working order.

To LOAD.

Officer.

No. 1.

With—load.

With—load.

Range—yards.

“*Load.*” 1 gives 7 the nature of shell and fuze required and adjusts the tangent scale.

If the breech is closed 2 and 3 proceed as at “Examine Gun.”

2 receives the shell tray from 4 and inserts it in the chamber, after the shell is on the tray, assisted by 3, he pushes it into the bore, receives the rammer from 4, and, assisted by 3, 7 and 9, rams it home, returns shell tray and receives cartridge tray from 4, places it in the chamber, receives first, cartridge from 6 and places it in the bore, and after 3 has placed in his cartridge removes tray and returns it to 4.

3 cleans chamber, steadies and guides projectile on to tray (if derrick is used) uncaps or withdraws safety pin from fuze, assist to push shell into the bore after removing selvaage or ring, rams home shell, places in last cartridge, first removing shalloon patch.

4 supplies 2 with and replaces the rammer and loading trays, removes the old tube.

5 (if derrick is used) raises the projectile.

When the last cartridge is home, 2 takes hold of the breech handle with his right hand and releases the spring catch of the breech carrier with his left hand and swings the breech block round smartly, 2 with the left, and 3 with the right hand push

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B.L. Ordnance (8-inch).

in the breech block. 2 then turns to his left and seizes hold of the lever with both hands gives it a sharp jerk until the eccentric comes in the line with the slot in the face of the breech, he then presses the spring stud with the left hand, folding down the lever with the right hand which locks the breech.

6 brings up a cartridge to 2.

7 brings up the projectile on a barrow (having adjusted the fuze according to the directions of 1) with the selvagee or ring fitted for lifting to the left side of the gun; he hooks the hook of the hoisting gear to the selvagee or ring, raises and rams home projectile.

8 brings up cartridge to 3.

9 assists 7 to prepare, bring up, raise and ram home the projectile; he also removes the barrow and selvagee.

10 issues shell.

11 issues cartridge.

The gun is then run up by 4.

TO LAY, MAKE READY, AND FIRE.

<i>Officer.</i>	<i>No. 1.</i>
<i>Commence firing</i>	<i>Elevate, &c., as before at p. 236.</i>
<i>or</i>	<i>No. — Ready.</i>
<i>Fire — rounds.</i>	<i>No. — Fire.</i>

1 inserts a tube.

3 elevates.

4 and 5 traverse.

At "*Ready*," 5 remains on the traversing handle, the other Nos. stand clear; 1 hooks the lanyard allowing the end to hang free, cocks the lock; giving the word "*Ready*," he jumps off the platform, and at the word, "*No. —*" (naming his gun), 4 seizes the lanyard, and stretches it out looking towards 1.

B.L. Ordnance (8-inch).

Section II.

At "*Fire*," 4 draws the lanyard strongly towards him, and returns it to 1.

TO UNLOAD.

To be filled in when method of unloading is settled.

TO CEASE FIRING AND REPLACE STORES.

The gun is first examined and then depressed by 3.

The stores are replaced by the numbers who brought them up.

TO FORM DETACHMENT REAR.

1 doubles to the left rear of the platform, faces to his left, and gives the words "*Outwards turn*." 2 and 4 turn to their left, 3 and 5 to their right; at the command "*Double march*," 2 and 4 wheel to their right, 3 and 5 to their left, and all when clear of the platform, wheel to the right round 1's left shoulder.

6 and 7 and the remainder come up into their places, when 2 and 3 have passed him 1 gives "*Halt*," "*Front*," and changes his flank by the rear.

TO CHANGE ROUNDS.

1	becomes	9
9	"	8
8	"	7
7	"	6
6	"	5
5	"	4
4	"	3
3	"	2
2	"	1

PART V.**Section II.****B.L. Ordnance (9'2-inch).**

Thus the gun floor Nos. only will change rounds when at drill.
The higher Nos. will not change rounds.

When required for drill they will fall in and be marched to the gun floor, the detachment being told off afresh.

**PROVISIONAL DRILL FOR THE 9'2-INCH B.L. GUN
ON GARRISON CARRIAGE AND TRAVERSING
PLATFORM. CENTRAL PIVOT.**

CHARGE.

175 lbs. prism¹ brown, made up in $\frac{1}{2}$ charges of 87 $\frac{1}{2}$ lbs.

PROJECTILE.

Nature.	Weight empty.		Bursting charge.		Fuze.	Total weight of filled shell.	
	lbs.	ozs.	lbs.	ozs.	ozs.	lbs.	ozs.
Common Shell	361	12	18	4	...	380	0
Shrapnell Shell	378	10	1	6	...	380	0
Palliser Shot	380	0	...	...	...	380	0
Case Shot	380	0	...	...	...	380	0

FUZES.

Percussion, direct action.

Time, Armstrong, medium, time and concussion.

The detachment consists of 10 numbers on the gun floor and 5 numbers (or number depending on local arrangements), for supply of ammunition from the magazines.

To TELL OFF.

As detailed at page 186.

To TAKE POST UNDER COVER.

As detailed at page 187, except that 10 forms up on the left of 4 ; 6 and 8 go to the head of the cartridge lift ; 7 and 9 to the head of the shell lift ; 12 and 14 to the cartridge store (12 at the foot of the cartridge lift) ; 11, 13 and 15 to the shell store.

GENERAL DUTIES.

1 commands, directs or superintends the setting and fixing of fuzes, puts in tube, lays, makes ready, and folds down the locking lever.

2 withdraws and inserts the breech block, cleans chamber, inserts and removes loading trays, loads, rams home, traverses, unhooks lanyard after firing and hands it to 1, and attends to vent when necessary. If required assists 3 with the ratchet lever.

3 raises the locking lever and works the ratchet lever, assists to withdraw and insert breech block, insert and withdraw loading trays, clean chamber, loads, and rams home ; uncaps or withdraws safety pin from the fuze when the head of the projectile is on the loading tray, removes shalloon disc from the base of the last cartridge, and traverses.

4 supplies and removes side arms, traverses, assists if necessary on the right rammer rope.

5 hooks and unhooks the leading block for the left rammer rope, assists 7 to hoist the projectile, swings derrick as required, mans the left rammer rope, overhauls the chain ready to hoist the next round and traverses.

6 brings up a cartridge to 2 and 3.

7 attends to fuzes, brings up projectile, raises it, and if necessary assists 5 on the left rammer rope.

8 brings up a cartridge to 2 and 3.

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9 assists 7 and removes empty barrow.

10 elevates the gun into the loading position, hooks and un-hooks the leading block of the right rammer rope, depresses the gun sufficiently for 2 and 3 to insert the breech block, mans the right rammer rope, runs up, elevates, and fires.

12 and 14 issue and send up cartridges.

11, 13 and 15 issue and send up projectiles.

TO PREPARE FOR ACTION.

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

Prepare for action.
Examine gun.

"*Prepare for action.*" 1 provides a piece of chalk, sights, fuze key, percussion lock and lanyard, tube box and tubes.

2 removes breech cover, brings up appliances for cleaning the chamber, tube extractor and rimer.

3 supplies grease pot and waste, and removes muzzle tampeon.

4 supplies side arms, rest for side arms and traversing handle, assisted by 10.

5 supplies rammer rope and block, traversing handle, winch handle, and a piece of spun yarn.

6, cartridge cylinder and dummy cartridge for drill.

7 supplies fuzes, fuze and shell implements, and selvagee for slinging projectile.

8, cartridge cylinder and dummy cartridge for drill.

9, transporting barrow and brush.

10, elevating wheel, rammer rope and block, and assists 4.

12 and 14 go to the cartridge store and prepare to issue cartridges.

11, 13, and 15 go to the shell store and prepare to issue shells, tubes, and fuzes.

B.L. Ordnance (9'2-inch).

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1 puts in the percussion lock, straps the tube box round his waist on the right side, coils up the lanyard and passes the bight of it under the tube box strap, fills his box with percussion tubes.

4 and 5 see that the traversing gear is oiled and in good working order.

5 examines the hoisting gear, makes fast one end of his piece of spun yarn to the link immediately above the hook of the hoisting chain, and makes fast the other end to the derrick within easy reach.

4 will lay down the side arms on the right rear of the gun, heads to the front, also the loading trays.

10 sees that the elevating and running up gear are in good order.

11 and 12 see that the hoisting gear of the shell and cartridge lifts are in good order.

13 and 14, that the lamps in the ammunition stores are burning brightly.

15 examines shell carefully, cleaning them if necessary and removing burrs; he loosens the fuze hole plugs of such shell as will be first issued.

The stores having been brought up and found correct, No. 1 will see that the foresights fit properly on the gun, that the deflection leaves of the hind sights work easily, that the hydraulic buffer is filled with the proper amount of oil, and that the racers are swept. He receives the reports from the numbers responsible of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform, and stores, or as regards the ammunition stores, lifts, &c.

EXAMINE GUN.

"*Examine gun.*" 10 elevates the gun into the loading position (if run back), 2 and 3 mount up on to the loading platform, 3 raises the locking lever and works the ratchet lever, assisted by 2 if necessary, 2 and 3 then withdraw the breech block. 1 looks

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B.L. Ordnance (9'2-inch).

through the bore and sees that it is clear, 2 and 3 examine the breech block and reinsert it, 10 depressing the gun on command or signal from 2 to enable them to push it home.

LOAD.

<u>Officer.</u>	<u>No. 1.</u>
<i>Range</i> — yards.	<i>Trail right or left if</i>
<i>With</i> — Load.	<i>necessary.</i>
	<i>Halt.</i>
	<i>With</i> — Load.

"Load." 1 gives 7 the nature of shell and fuze required and adjusts the tangent scale; if the breech is closed 2, 3, and 10 proceed as at "*Examine gun*," 2 first extracting the old tube and riming the vent if necessary.

2 receives the front portion of the loading tray from 4 and inserts it in the chamber, 3 receives the rear portion, attaches it to the front portion and pushes it into the chamber; 2 and 3 then guide the projectile on to the loading tray, 3 giving the word "*hoist*," "*lower*," as may be required to 7. As soon as the projectile is resting on the tray 3 uncaps or removes safety pin from the fuze, gives the word "*lower*," removes the selvagee, and as soon as it is free gives the word "*clear*" to 5, who then swings back the derrick. 2 and 3 then push the projectile as far as they can into the bore, 3 prevents it slipping back, while 2 picks up the rammer supplied by 4; it is then rammed hard home by 2, 3, 5, and 10, assisted if necessary by 4 and 7.

As soon as the projectile is home 2 withdraws the rammer, laying it down behind him; 3 withdraws the loading tray and hands it to 4. 2 inserts the cartridge tray received from 4. 2 and 3 having received cartridges from 6 and 8, insert them separately and push them home as far as possible, using the

B.L. Ordnance (9'2-inch).

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rammer if necessary. 3 tears off the shalloon patch from the base of the rear cartridge, and removes the cartridge tray which he hands to 4, who replaces it and the rammer. 2 releases the catch and gives the word to 10 to depress, and with 3 swings round and pushes home the breech-block; 3 working the ratchet lever.

1 jumps up, gives the word "*run up*," and inserts a tube.

2 and 3 jump down and go to the traversing handles.

4 will hand up and receive back the sponge if required to be used; hand up the shell tray, attach the rammer ropes, and lay the rammer with its head on the loading platform between 2 and 3, bring up the cartridge tray, laying it down in rear of the platform if called upon to man the right rammer rope, hands the cartridge tray to 2, receives the shell tray from 3, and lays it down in its proper place, steps in again, receives the cartridge tray from 2, and replaces it and the rammer. He then mans the right traversing handle. 7 and 9 bring up a projectile with a selvagee round it into which 7 hooks the hoisting chain, and works the winch handle assisted by 5; when high enough he steps clear for a moment, so as not to be under the weight, while 5 swings round the derrick, mans the winch again immediately ready to "*hoist*" or "*lower*" according to 3's directions. If not required to ram home, doubles back at once for another round. 1 will inspect or set the fuze before the hoisting chain is hooked in.

5 attaches the block of the rammer rope to the eyebolt on the carriage for that purpose, and leads the end of the rope to the rear, ready for 4 to attach to the stave; assists 7 at the winch handle, and swings the derrick round as required; at the word "*clear*" from 3 he will swing the derrick back and overhaul the chain by means of the piece of spun yarn attached, ready to hook in to the next round; man the left rammer rope, unhook the block as soon as the rammer is done with, and then goes to the left traversing handle. 6 and 8 each bring up a cartridge in cylinder, and as soon as the cartridges are withdrawn by 2 and 3 return for a fresh round.

(a.m.¹)

U

Section II.

B.L. Ordnance (9'2-inch)

10. Elevates the gun about 12°, hooks the block of the right rammer rope, and leads the end of the rope to the rear ready for 4 to attach it to the rammer stave, mans the rammer rope, un-hooks the block as soon as the rammer is done with, depresses, runs up by lifting a lever on the right side of the platform, and mans the elevating wheel.

TO LAY, MAKE READY, AND FIRE.

<i>Officer.</i>	<i>No. 1.</i>
<i>Commence Firing,</i>	<i>Elevate (as before at 236).</i>
<i>or</i>	<i>No.—Ready.</i>
<i>Fire—rounds.</i>	<i>No.—Fire.</i>

10 elevates or depresses, 2, 3, 4, and 5 traverse.

At “*Ready*” the traversing numbers remain on the handles, the other numbers stand clear. 1 hooks the lanyard, allowing the end to hang free, folds down the locking lever, cocks the lock, giving the word “*Ready*,” he jumps off the platform, and at the word No. (naming his gun) 10 seizes the lanyard, and stretching it out looking towards 1.

At “*Fire*” 10 draws the lanyard strongly towards him and returns it to 1.

In case of a miss fire should it be necessary to open the breech the tube must be first extracted.

TO UNLOAD.

This operation will be the reverse of that of loading, the shell being pushed back by the ejector.

TO CEASE FIRING AND REPLACE STORES.

The gun is first examined and then depressed by 10. The stores replaced by the numbers who brought them up.

B.L. Ordnance (12-inch).

Section II.

DETACHMENT REAR.

Similar to detail at page 195.

TO CHANGE ROUNDS.

1 becomes 10.

10 " 9.

and so on, only the gun floor numbers changing rounds. If the higher numbers are required to be changed for drill, they will be marched on to the gun floor and the detachment told off again.

PROVISIONAL DRILL FOR 12-IN. B.L. GUN ON A CASEMATE TRAVERSING PLATFORM.

CHARGE.

275 lbs. prism¹ brown, made up in four quarter charges of 73 $\frac{3}{4}$ lbs.

PROJECTILES.

Nature.	Weight, empty including Base Plug and Lead Disc.		Bursting Charge.		Fuze.	Mean Total Weight of Filled Shell.	
	lbs.	ozs.	lbs.	ozs.		lbs.	ozs.
Common Shell, Mark II	681	14	31	3	15	714	0
Shrapnel Shell, Mark II	711	5	1	14	13	714	0
Palliser Shot (Shell), Mark I	707	12	*6	4	...	714	0
Palliser Shot (Shell) Mark II... ..	...	...	...	...	...	714	0
Case Shot, Mark I ... ..	...	...	...	...	...	714	0

* § 5033 Palliser shot. Formerly shell. To be weighted up with sand.
(a.m.¹)

U 2

PART V.

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Section II.**B.L. Ordnance (12-inch).****FUZES.**

Percussion, not yet decided.

Time, Armstrong, medium, time and concussion.

The Detachment consists of 18 Nos., and falls in two deep. Should, however, arrangements be made so that two men can bring up the cartridges, 17 Nos. will suffice.

To TELL OFF.

As detailed at page 186.

To TAKE POST UNDER COVER.

As detailed at page 187, except that 8 forms on the left of 4; 6, 10, 11, and 12 go to the head of the cartridge lift; 7 and 9 to the head of the shell lift; 14 to the foot of the cartridge lift; 16 and 17 to the cartridge store; 13 to the foot of the shell lift; 15 and 18 to the shell store.

GENERAL DUTIES.

1 commands, runs up, directs or superintends the setting and fixing of fuzes, lays, and makes ready.

2 assists 4 to swing in and out the withdrawing apparatus, attends to it, raises and lowers locking lever, inserts and withdraws breech block, cleans chamber, inserts and removes loading trays, loads, rams home and elevates.

3 brings the gun to the position for loading, attends to the withdrawing apparatus, inserts and withdraws breech block, cleans chamber, attaches, inserts and removes loading trays, loads, uncaps or withdraws safety pin from fuze, rams home, removes shalloon cover from base of last cartridge, elevates, and unhooks lanyard after firing.

4 runs up, swings in and out the withdrawing apparatus, attends to vent, traverses, and fires.

B.L. Ordnance (12-inch).

Section II.

5 attends to ratchet lever, steadies projectile in raising, and traverses.

6 supplies cartridges to 2 and 3.

7 attends to fuzes, brings up projectile, raises it, and rams home.

8 supplies rammer and loading trays.

9 assists 7, raises projectile, rams home, and removes empty barrow.

10 supplies cartridges to 2 and 3.

11 supplies cartridges to 2 and 3 and traverses.

12 supplies cartridges to 2 and 3 and traverses.

13 and 15 supply shells to the lift from the shell store.

14 and 16 supply cartridges to the lift from the cartridge store.

17 attends to cartridge store and issues cartridges.

18 attends to shell store.

2, 3, 11 and 12 attend to mantlets.

TO PREPARE FOR ACTION.

Officer.

No. 1.

Prepare for action.

Prepare for action.

Examine gun.

"*Prepare for action.*" 1 provides a piece of chalk, sights, fuze key, tubes in box, and lanyard.

2 removes breech cover, brings up appliances for cleaning chamber.

3 supplies grease pot, removes muzzle tampeon.

4 provides tube extractor and rimer.

5 supplies two traversing handles, and hoisting tackle.

6 provides a cartridge cylinder and dummy cartridge for drill purposes.

7 supplies fuzes, fuze and shell implements, and a selvagee or ring for slinging projectile.

Section II.

B.L. Ordnance (12-inch).

8 brings up rammer and loading trays.

9 provides transporting barrow and brush.

10 supplies cartridge cylinder and dummy cartridge for drill purposes.

11 supplies cartridge cylinder and dummy cartridge for drill purposes.

12 supplies cartridge cylinder and dummy cartridge for drill purposes.

13 and 15 go to the shell store.

14 and 16 go to the cartridge store.

17 goes to the cartridge store and prepares to issue cartridges.

18 goes to the shell store and prepares to issue shells, tubes and fuzes, he examines the shell, carefully cleaning them if necessary, and removing burrs ; he loosens the fuze-hole plugs of such shell as will be first issued.

2 sees that the elevating gear, 4 that the traversing gear is oiled and in good working order.

4 puts in the percussion lock, straps tube pocket round his waist on the right side, coils up the lanyard, and passes the bight of it under the tube-box strap, fills his box with percussion tubes, which he procures from 18.

7 rigs the hoisting tackle.

8 places the rammer and loading trays on the right side of the gun.

13 and 14 see that the hoisting gear at the shell and cartridge lifts work easily.

17 and 18 see that the lamps in the ammunition stores are burning brightly.

Any irregularity in these respects should be at once reported to 1.

The stores having been brought up, or found correct, No. 1 will see that the foresights fit properly on the gun, that the deflection leaves of the hindsights work easily, that the hydraulic

B.L. Ordnance (12-inch).

Section II.

buffers are filled with the proper amount of oil, and that the racers are swept.

He receives reports from the Nos. responsible, of any irregularity or deficiency in connection with the different parts of the gun, carriage, platform and stores, or as regards the ammunition stores, lifts, &c.

EXAMINE GUN.

Examine gun.—2 and 3 elevate or depress until the gun is in a convenient position for loading, and after doing so mount up on the platform.

2 raises the locking lever ; 5 works the ratchet lever.

2 and 3 withdraw the breech block.

1 looks through the bore and sees that it is clear.

2 and 3 examine the breech block.

To Load.

Officer.

No. 1.

Range—yards.

With—load.

With—load.

“*Load.*” The gun, if necessary, would be run up by 1 and 4. 1 gives 7 the nature of shell and fuze required, and adjusts the tangent sight.

If the breech is closed 2, 3 and 5 proceed as at “*Examine gun.*” 2 receives the front portion of the shell loading tray from 8, and inserts it in the chamber ; 3, receives the rear portion, attaches it to the front portion, and pushes it into the chamber.

2 and 3 receive the projectile from 5, and when high enough guide it on to the loading tray ; 3, having uncapped the fuze, or removed the safety pin, gives “*lower,*” removes the ring or selvagee, and pushes the projectile as far as possible into the bore.

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Section II.**B.L. Ordnance (12-inch).**

2 having received the rammer from 8, rams the projectile hard home with the assistance of 3, 7 and 9, after which he lays down the rammer behind him.

2 and 3 withdraw the loading tray and return it to 8; 3 receives the cartridge tray from 8 and inserts it in the breech.

2 and 3 having received the cartridges from 6, 10, 11 and 12, insert them separately, and push them home as far as possible, using the rammer if necessary; 3 removes the shalloon patch from the base of the last cartridge.

3 removes the cartridge loading tray and returns it to 8, who replaces it and the rammer.

4, while the breech is open, removes the old tube.

When the cartridge is home 4 releases the holding catch, and 2 and 3 swinging the breech block round insert it in the breech; to close the latter 5 works the ratchet lever and 2 lowers the locking lever.

5 steadies the projectile while it is being raised.

6 brings up a cartridge to 2 and 3.

7 brings up the projectile on a barrow (having adjusted the fuze according to the directions of 1) with the selvagee or ring fitted for lifting, to the left side of the platform; he hooks the hook of the hoisting gear to the selvagee or ring, and heaves round the winch handle until the projectile is high enough, he also assists to ram home.

8 supplies and returns rammer and loading trays.

9 assists 7 to prepare, bring up, raise and ram home the projectile; he also removes the barrow and selvagee.

10, 11 and 12 bring up each a cartridge to 2 and 3.

13 and 15 work the shell lift.

14 and 16 work the cartridge lift.

17 issues cartridges.

18 issues shell.

TO LAY, MAKE READY, AND FIRE.

*Officer.**No. 1.**Commence Firing.**Elevate, &c., as before at p. 236.**or**No. — ready.**Fire — rounds.**No. — fire.*

1 inserts a tube.

2 and 3 elevate or depress ; 3 clamps.

4, 5, 11 and 12 traverse.

(See note at page 269.)

At “*Ready*” the traversing Nos., except 4, remain on the handles, the other Nos. stand clear. 1 hooks the lanyard, allowing the end to hang free, cocks the lock, giving the word “*ready*,” he jump off the platform, and at the word No. — (naming his gun) 4 seizes the lanyard, stretching it out and looking towards 1.

At “*Fire*” 4 draws it strongly towards him, and then returns it to 1.

In case of a miss fire, should it be necessary to open the breech, the tube must be first extracted.

TO UNLOAD.

This operation will be the reverse of that of loading.

The detail cannot at present be settled, as there is as yet no implement with which to eject the shell.

TO CEASE FIRING AND REPLACE STORES.

The gun is first examined and then depressed by 2 and 3.

The stores are replaced by the Nos. who brought them up.

TO FORM DETACHMENT REAR.

Similar to detail at page 195.

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300

Section II.

B.L. Ordnance (3-pr. Hotchkiss Gun).

TO CHANGE ROUNDS.

No.	1	becomes	12.
"	12	"	11
"	11	"	10
"	10	"	9
"	9	"	8
"	8	"	7
"	7	"	6
"	6	"	5
"	5	"	4
"	4	"	3
"	3	"	2
"	2	"	1

Thus the gun-floor Nos. only will change rounds when at drill.

The higher Nos. will not change rounds, many of them being in magazine clothing. When required for drill they will fall in and be marched on to the gun-floor, the detachment being told off afresh.

 DRILL FOR THE 3-PR. HOTCHKISS GUN.

The detachment consists of 5 numbers, and falls in two deep in rear of and facing the gun.

TO TELL OFF.

*Officer.**Tell off.**No. 1.*

At "*Tell off*" 1, &c., as for B.L. drill.

B.L. Ordnance (3-pr. Hotchkiss Gun).

Section II.

TO TAKE POST.

(As for B.L. drill.)

2 halting on the right side of the breech, 3 on the left, facing inwards, 1 in rear of the gun.

4 and 5 in rear with the ammunition.

ACTION.

1 satisfies himself that the extractor and firing-pin are uninjured and in good working order, and that the bore is clear.

2 that the breech-block and lever work easily.

4 and 5 bring up and open ammunition cases in a convenient position for 3 to serve, and remove pads on base of cartridges.

DUTIES IN ACTION.

1 commands, lays, and fires.

2 opens and closes the breech.

3 loads.

4 and 5 supply ammunition.

TO LOAD.

*Officer.**No. 1.*

“Range—Yards.”

(Naming the object.)

“Load.”

“Load.”

1 adjusts the tangent sight to the required elevation and deflection (if any), &c.

2 takes hold of the arms of the lever with both hands, and forces it smartly downwards to the rear, opening the breech. As soon as 3 has placed the cartridge in the bore, he closes the breech by the reverse action.

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Section II.**B.L. Ordnance (3-pr. Hotchkiss Gun.)**

3 takes a cartridge from the case, places it in the bore, pressing it hard home.

4 and 5 keep up a supply of ammunition.

TO COMMENCE FIRING.*Officer.*

“Commence.”

1 looks over his sight and, placing his left shoulder against the pad, lays, guiding the shoulder-piece with the left hand, places the forefinger of his right hand on the trigger and fires at his own discretion, keeping the gun bearing on the object.

The other Nos. reload as before.

CEASE FIRING.

1 discontinues the fire; 2 opens the breech; 3 returns the cartridge, if unfired, to the ammunition box; 2 then closes the breech.

ON A MISS-FIRE.*No. 1.*

“Miss-fire.”

After a pause 2 opens the breech; 3 carefully removes the cartridge, which is to be placed on one side if the cap has been struck. If time admits, as at practice, the cartridge may be tried again.

If the cap has not been struck it will be necessary to replace the striker by a new one.

DETACHMENT REAR.

(As for B.L. drill.)

DRILL FOR NORDENFELT 0'45-INCH 5-BARRELLED GUN, MOUNTED ON CONE MOUNTINGS.

The detachment consists of one non-commissioned officer and four gunners, and falls in two deep in rear of the gun.

TO TELL OFF.

As for gun drill.

TO TAKE POST AT THE GUN.

1 gives the order "*Right turn*," turns with the detachment, "*Double march*." The whole double to their places as below detailed, and halt facing to the front.

POSITION AND GENERAL DUTIES.

1 stands close in rear of the breech, commands, attends to drill stop, elevates, traverses, and lays.

2 stands in line with, and close to the breech on the right side, adjusts right bolt of shield, raises shield, attends to hand lever, and fires.

3 stands in line with, and close to the breech on the left side, adjusts left bolt of shield, attends to sand plate and to distributor and hopper at the gun.

4 stands in the most convenient place for supplying 3 with hoppers from 5, and returns empty ones.

5 has charge of the ammunition, and supplies 4 with filled hoppers.

PART V.

304

Section II.

Ordnance Nordenfelt Gun (0'45-inch.)

ACTION.

1 satisfies himself that the gun and its fittings are in good working order, and pushes back the drill stop.*

2 turns to his left, adjusts the right bolt of the shield, raises the shield, releases the hand lever, and feels each extractor and firing pin to see they are uninjured, after 3 has raised the cover.

3 turns to his right, adjusts the left bolt of the shield, raises sand plate, raises and lowers the cover, puts distributor on the cover with "cut off" lever horizontal, and places the hopper on top, putting the hopper lever horizontal.

4 supplies 3 with two hoppers which he receives from 5, and then returns for others.

5 supplies hoppers to 4.

TO LAY THE GUN.

<u>Officer.</u>		<u>No. 1.</u>
Range — Yards.	|	Lay.

"Lay." 1 having adjusted the tangent scale lays the gun; elevating or depressing with his left hand and traversing with the right.

If "Commence firing" is not ordered, 1 gives "Take post," when the numbers will take post as detailed for "action."

COMMENCE FIRING.

<u>Officer.</u>		<u>No. 1.</u>
Commence Firing.	|	Commence firing.

* When at drill this stop will remain forward.

 Ordnance Nordenfelt Gun (0'45-inch).

Section II.

"Commence firing."

3 having placed the "*cut off*" lever of the hopper horizontal, he holds the hopper in position with his left hand until the last cartridge is seen through the side hole, when he replaces it with a full one.

2 draws back the hand lever and forces it forward half way, and fires by order of 1 by forcing it right forward, then drawing it back to its full extent, repeats the operation.

4 and 5 keep 3 supplied with ammunition.

RAPID FIRING.

2 works the hand lever continuously on the order "*rapid firing*" being given.

Should it be necessary to cease firing for a short time to allow the smoke to clear away, or to allow 1 to relay his gun, 1 will give the order "*stand fast*," on which 2 will draw the lever back to its full extent, and rapid firing will be continued at the order "*commence*."

In rapid firing a distinct pause is to be made at each position of the lever, both forward and back.

CEASE FIRING.

Officer.

No. 1.

Cease firing.

Cease firing.

"Cease firing." 1 places the drill stop forward, lowers his sights, and clamps the elevating gear; he will see that all the cartridges are taken out of the barrels or reservoirs by 3.

2 forces the lever to the rear, thus extracting empty cartridge cases; these having been removed by 3, he forces the lever forward and fixes it by its chain; turns down the shield assisted by 3; he then turns to the front.

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306

Section II.

Ordnance Nordenfelt Gun (0'45-inch).

3 places the "*cut off*" levers of distributor and hopper vertical, removes them, and replaces distributor in trail box, raises cover to remove cartridges and empty cases (if any) from the gun, leaving it open till the next word of command, assists 2 to turn down the shield, and then turns to his front.

4 returns hoppers to 5 at the limber.

5 replaces hoppers and closes the limber boxes.

TO CHANGE ROUNDS.

<i>Officer.</i>		<i>No. 1.</i>
<u>Change rounds.</u>	|	<u>Change rounds.</u>

In changing rounds in action, 1 becomes 5 ; 5, 4 ; 4, 3 ; 3, 2 ; 2, 1.

In changing rounds when the gun is limbered up, 1 becomes 5 ; 5, 3 ; 3, 2 ; 2, 4 ; 4, 1.

SECTION III.

Rifled Breech-Loading Ordnance.

GENERAL OBSERVATIONS.

The system of rifled B.L. ordnance, introduced in 1859, was known as the Armstrong B.L. system.

Such guns are now described as R.B.L. in distinction to B.L. which is the later type of breech-loader.

There are two natures of R.B.L. guns in the garrison service, viz., 7-inch and 40-pr.

40-PR. R.B.L. GUNS.

DESCRIPTION.

		32-cwt. gun.	35-cwt. gun.
Calibre (<i>i.e.</i> , diameter of grip)		4.75 in.	4.75 in.
Nominal weight	....	32 cwt.	35 cwt.
Preponderance	....	5 cwt. 1 qr. 19 lb.	4 cwt. 3 qrs.
Length	{ of barrel	....	8 ft. 10.375 in.
	{ of powder chamber	....	13.5 in.
	{ of shot chamber	....	7 in.
	{ total, nominal	....	10 ft. 1 in.
Rifling	{ grooves, number	56	56
	{ uniform	....	1 turn in 36.5 calibres.
(a.m. ¹)			x

PATTERNS.

The 32-cwt. gun was introduced in 1859 for the navy as a broadside or pivot gun ; it is also now used in the land service for batteries of position, siege and garrison purposes.

The 35-cwt. gun was introduced in 1860. It has a longer and stronger breech piece and a raised coil in front of the vent slot.

The fittings of the two guns are interchangeable, except the breech screws, which have a different shape and pitch of thread.

PARTS.

The *vent piece* is a block of wrought iron or steel for the purpose of closing the breech. The vent passes vertically through it as far as the centre, and is then bored horizontally in a position coinciding with the axis of the bore.

The *breech screw* fits the thread cut in the breech piece, its object being to send home and retain the vent-piece in its proper position.

The *tappet ring* is fitted on the octagonal part of the breech screw, on which it acts as a wrench, the power being communicated through its projections from the tappets on the lever.

The *lever* fits on the breech screw behind the tappet ring ; it is free to revolve round the breech screw, but is prevented from falling off by two keep pins working in grooves. The object of the lever and tappet arrangement is to gain a powerful momentum in tightening up and relaxing the vent piece from its seat in the gun.

The *indicator ring* is a thin narrow ring of wrought iron fitted on the breech screw in front of the tappet ring ; it must be so adjusted on the screw that when the vent piece is home the raised line of brass or arrow on the ring will coincide with or be slightly to the left of the mark on the breech.

The *breech bush* is a ring of copper screwed into the end of the powder chamber by means of the facing implements.

The *vent piece copper ring* is a corresponding ring on the face of the vent piece. The object of these rings is to prevent the escape of gas ; they are coned in opposite directions so as to fit closely into one another.

During continuous practice with 40-pr. R.B.L. guns, the vent pieces should be changed at the end of every fifteen rounds ; the vent piece not in use is thus allowed time to become thoroughly cool, and opportunity should then be taken to examine it carefully with reference to the state of the copper ring, &c.

RIFLING.

The rifling is the Armstrong polygroove.

VENTING.

The vent passes vertically down the centre of the vent piece, and is continued at right angles in prolongation of the axis of the bore ; the vertical portion is partially bushed with copper.

SIGHTING.

The gun is provided with four sights, viz., 2 tangent scales, and 2 trunnion sights, one of each on each side ; the former being graduated (in the latest pattern) to 15°, and furnished with sliding leaf heads. The tangent sights are set in the gun at an angle of 2° 16' to compensate for the drift ; they are provided under the cross-head with an "elevating nut," by turning which any number of minutes of elevation less than 10' may be given.

Many tangent sights of the older pattern still exist having "barrel heads" for giving deflection.

The bars of the tangent sights are four-sided, and (in the latest pattern) are marked as follows :—

(a.m.')

x 2

PART V.

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Section III.**R.B.L. Ordnance (40-pr.).****DEGREES.****BLANK.****FUZE 25.**

**SHELL, FULL, 5 LBS.
YARDS, 3,800.**

The trunnion sights are of the "drop" pattern, and secured by a bayonet joint.

Tangent sights are interchangeable for all guns of the same nature.

PROJECTILES.

Nature.	Weight empty.		Burst.		Mean total weight.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Common shell Mark II.	38	5	2	4	40	9
Segment shell Mark I.	38	9	...	13	39	6
Shrapnel shell Mark I.	39	0	...	3	39	3
Case shot... .. Mark II.	...	...	...	...	31	8
Solid shot (for practice only) ... ..	...	...	...	...	40	13½

CHARGES.

"Full" 5lbs. R.L.G.².

"Saluting" 3lbs. Blank.

The full charge has a lubricator screwed into a socket which is choked in the cartridge.

VELOCITY.

Muzzle velocity, 1,180 feet.

FUZES.

Wood, time, 15-seconds, with detonator Mark III.
Percussion, R.L. Mark II., for all shell, acting on graze or impact.
Primers for vent pieces are used with these guns.

TIN CUPS

Are used at practice only, to assist in closing the breech, and as a protection to the copper rings. They are issued in the proportion of 1 to 10 rounds.

**DRILL WITH 40-PR. R.B.L. GUN ON TRAVELLING
SIEGE CARRIAGE.**

The detachment consists of nine numbers, and falls in two deep.

To TELL OFF.

As detailed at page 186.

To TAKE POST UNDER COVER.

As detailed at page 187.

To TAKE POST AT THE GUN.

Where there is no parapet, the detachment files on the gun; 2 and 3 halting in line with the breech, 4 and 5 the centre of the trail, the whole one yard from it; 1 in rear of the gun, 8 in rear of the near limber box, 9 in rear of the off limber box, 6 and 7 on the outsides of 8 and 9.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing

PART V.

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Section III.**R.B.L. Ordnance (40-pr.).**

fuzes, directs the gun into the line of fire when running up, and lays.

No. 2 runs up, sponges (if necessary), rams home, and traverses.

No. 3 runs up, removes safety pin, loads, rams home, and traverses.

No. 4 runs up, attends to breech screw, vent piece, and tin cups when used, attends to sidearms and supplies them to 2, and to elevating and traversing screws in laying.

No. 5 runs up, attends to breech screw and vent piece, primes, makes ready, and fires.

No. 6 supplies 3 with cartridges.

No. 7 attends to fuzes and brings up projectile.

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

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

TO PREPARE FOR ACTION.*Officer.**No. 1.**Prepare for action.*

Prepare for action.
Examine gun.

"Prepare for action."

The stores are brought up as follows :--

No. 1, 6 ft. handspike, sights, a piece of chalk ; file for vent piece, hammer and punch.

No. 2, 6 ft. handspike, and assists 4 with sidearms.

No. 3, 6 ft. handspike and elevating screw ; he also removes apron and tampeons.

No. 4, 6 ft. handspike, sidearms, and support, tin cups in pocket and tin cup extractor.

No. 5, 6 ft. handspike, primers in pocket, tubes in box, lanyard, oil can, and hemp.

No. 6, two cartridge cases, which he leaves at the cartridge

store or limber, bucket filled, and brush, two drill cartridges for drill purposes.

No. 7, fuzes, fuze and shell implements. He obtains the fuze boxes from 9, having ascertained from No. 1 the nature of fuzes required, satisfying himself as to the correctness of fuzes and fuze implements.

No. 8 prepares to issue cartridges.

No. 9 provides a brush for cleaning shell, prepares to issue shells, tubes, and fuzes. He examines the shells carefully, cleaning them if necessary, and removing burrs. He loosens the fuze hole plug of shells that will be first issued.

The stores having been brought up, No. 1 will satisfy himself that the foresights fit properly on the gun, that the deflection leaves of the tangent sights work easily, and that the platform is properly swept. He receives reports from the numbers responsible of any irregularity or deficiency in connection with the gun, ammunition, or stores. He ascertains that the breech fittings are properly put on and well oiled.

Should the indicator ring require adjusting, he adjusts it in the following manner :—The vent piece is screwed home as for firing ; 2 places a handspike in the breech ; 1 knocks out the keep pins with a hammer and punch ; the lever and tappet ring are then removed by 4 and 5 on to the handspike ; the indicator ring is passed over the octagonal part of the breech screw, so that the arrow marked on it, or raised line, will correspond with a similar mark on the gun. If the arrows cannot be made to coincide the indicator ring is to be so placed that the arrow on it will be to the left of the mark on the gun, as close as the cogs on it will permit. The tappet ring and lever are then replaced.

These should be put on so that the lever ball will be resting on a cam of the tappet ring on the right side of the gun, in a convenient position for 4 to give two taps after the breech is screwed up.

The side arms are laid down to the right of the gun and

parallel to it, heads to the front, resting on the support provided, sponge next the gun, and in line with the breech when the gun is run up. The sponge bucket is placed near the sponge head.

The handspikes are laid down bevels up, two on each side of the platform, close to the carriage, points to the front; those of 2 and 3 outside and about 2 feet in advance of those of 4 and 5. No. 1 places his handspike parallel to the others, but in rear of the platform. The tin cup extractor is placed in a loop on the carriage. If the indicator, tappet ring, with keep-pins and lever, have been detached, 4 and 5 bring them up and put them on, under the superintendence of No. 1. No. 4 sees that the elevating screw is properly oiled; 5 straps the tube box round his waist on the right side, and the primer pocket on his left side, doubling the lanyard in four and placing it under his belt. He fills the tube box with friction tubes, which he procures from No. 9.

If the gun is to be prepared for drill only, 8 and 9 provide two selvages and a tackle. They hook the movable block to a selvagee passed through the trail eye, and the standing end to one passed round a holdfast in rear of the platform. No. 6 provides two dummy cartridges, 7 a drill shell, and 4 a drill vent piece.

At "*Examine gun*," 4 moves the elevating screw handle until the axis of the bore is horizontal; he then opens the breech by taking the lever handle in his right hand, back up, and swinging it round a half circle towards him from cam to cam; this will strike a blow hard enough to move the screw, which is then unscrewed two turns, and the vent-piece is released. 5 then steps in, and, with 4, lifts the vent piece out of the slot and lays it on the flat surface on the top of the breech coil.

At "*Clear*," from No. 1, 4 and 5 drop in the vent piece, 5 then takes the lever handle in his left hand, back up, and turning the handle towards him, screws up the breech screw until it is home. 4 and 5 then go under cover.

If No. 1 gives "*Sponge out*," No. 2 provides himself with the

sponge (as in detail for 4 next page) and sponges out the gun. At "*Clear*," 4 and 5 acts a before detailed, 2 passes the sponge over his head as he turns left about, replaces it, and goes under cover.

No. 1 then directs 5 to fire a tube.

TO LOAD.

<i>Officer.</i>	<i>No. 1.</i>
<i>Range</i> —yards.	<i>Run up.</i> <i>Halt.</i>
<i>With</i> —load.	<i>With</i> —load.

The gun is generally run up before loading. At "*Run up*," 2, 3, 4, and 5, take up their handspikes at the centre, with the hands next the parapet, backs up, the other hands at the small ends, backs down ; 2 and 3 apply their handspikes horizontally over the spokes of the wheels in front, under the brackets close to the breast, and bear down ; 4 and 5 use their handspikes as levers of the second order, under the rear part of the wheels ; all the numbers facing to the rear ; No. 1 applies his handspike under the trail eye, and guides the gun into the line of fire. As soon as the wheels nearly touch the hurter, No. 1 gives "*Halt*," slides his right hand, back up, to the centre of the handspike, and throws it to the rear. 2, 3, 4, and 5 withdraw their handspikes, turn inwards, lay them down, and go under cover.

At "*Load*," No. 1 gives No. 7 the nature of shell and fuze required, and during the loading fixes his tangent scale at the required elevation and deflection, and places himself where he can best superintend the service of the gun.

4 unscrews the breech screw and with 5 lifts out the vent piece ; 4 removes the old tin cup with the extractor, and 5 cleans the vent piece, if required, and drops in a primer, worsted end down ; 4 and 5 then go under cover.

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2 and 3 then step in and place themselves in position for loading; 3 receives a shell from 7, removes the safety pin of the fuze, and introduces the shell its own length into the bore, point to the front; 2 then receives the rammer from 4, and, assisted by 3, rams home the projectile,* their outward hands back under, inner hands back up; 3 then turns to his right, withdraws the cartridge from the cartridge case, places it in the bore, choke to the front, and goes under cover; 2 presses the cartridge gently home, withdraws the rammer, allowing the head to fall, seizing it near the head with the left hand back up, turns left about, lays it down, and goes under cover.

Should "*Sponge out*" be given, 2 receives the sponge from 4, introduces it into the bore, and sponges out in two motions; he then withdraws the sponge, cleaning the chamber well and hands it back to 4.

No. 4 lifts the sponge (if required) with his left hand back under, turning to the right about as he does so, and hands it to 2, waits for it, replaces it, and then takes up the rammer with his left hand back under close to the rammer head, hands it to 2, and goes under cover or takes post.

As soon as the gun is loaded, 4 and 5 step in, 4 passes a tin cup down the slot, edge to the front, and presses it into the bore; 4 and 5 then drop in the vent piece, 5 screwing up the breech screw as before detailed, 4 (for additional security) placing his hands on the top of the lever handle and giving two smart taps; 4 and 5 then go under cover.

No. 6 brings up a cartridge in its case, and places it on the right of 3. While the projectile is being rammed home, he uncovers the case, and as soon as 3 has withdrawn the cartridge, he removes the empty case.

* "At drill in ramming home, the projectile and the cartridge of the preceding round, should be forced out of the bore."

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

8 issues a cartridge to 6.

9 issues a shell to 7.

TO LAY, MAKE READY AND FIRE.

<i>Officer.</i>	<i>No. 1.</i>
<i>Commence Firing.</i>	<i>Elevate. Halt.</i>
<i>or</i>	<i>Depress. Halt.</i>
<i>Fire—rounds.</i>	<i>Trail, right. Halt.</i>
	<i>Trail, left. Halt.</i>
	<i>No.—ready.</i>
	<i>No.—fire.</i>

No. 1 looks over the sights, steadying himself by leaning on the lever.

2 and 3 pick up their handspikes and go to the end of the trail facing to the rear ready to traverse, 4 works the screw until "Halt" is given and attends to traversing wheel with carriages so fitted. 5 makes ready a tube.

At "Trail right," 3 heaves over the trail, and at "Trail left," 2 heaves it over.

N.B.—When the gun is mounted on Clerk's platform, at "Extreme right (or left)," 2 and 3 apply their handspikes, and, with 4 and 5, heave over the side pieces, drawing out the iron bolts in rear for that 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 raise the trail; 4 double-man's 2's handspike; 1 and 5 shift the plank.

If it is necessary to run back, 2 and 3 apply their handspikes in front of the wheels, using them as levers of the second order;

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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.

At drill, the gun is run back with tackle as with standing carriages.

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

No. 1 lowers his tangent scale except when firing at a moving object, and gives "*Ready;*" 5 presses a 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; 2 and 3 lay down their handspikes, and with 4 go under cover. At the word No. — (naming his gun) 5 stretches his lanyard, looking towards 1.

At "*Fire*" 5 draws the lanyard strongly towards his body without a jerk, replaces it under his belt, and goes under cover. In the event of a miss-fire No. 5 will drop in a tube, keeping as clear of the wheel as possible, and resume the position of "*Ready,*" At practice, in the event of a second tube failing and it being necessary to take out the vent-piece, five minutes should be allowed to elapse before the breech screw is unscrewed, and then the vent-piece is removed as quickly as possible.

TO RUN BACK.

Officer.No. 1.*Run back. Halt.*

At "*Run back,*" which No. 1 gives (*at drill*) immediately after the gun has been fired, the detachment double out, man the fall of the tackle arranged by 8 and 9 for the purpose, and haul the gun back, No. 1 scotching the right wheel and giving "*Halt*" when the gun is sufficiently run back.

TO CEASE FIRING AND REPLACE STORES.

<u>Officer.</u>	<u>No. 1.</u>
<i>Cease firing.</i>	<i>Examine gun.</i>
<i>Replace stores.</i>	<i>Sponge out. Clear.</i>
	<i>Depress. Halt.</i>
	<i>Replace stores.</i>

As before detailed.

N.B.—The above drill has reference to a detachment under cover, but is applicable, with trifling modifications, to the case where there is none, and the detachment takes post at the gun.

TO FORM DETACHMENT REAR.

As at page 195.

TO CHANGE ROUNDS IN ACTION.

<u>Officer.</u>	<u>No. 1.</u>
<i>Change rounds.</i>	<i>Change rounds.</i>

In changing rounds No. 2 becomes 4 ; 4, 1 ; 1, 9 ; 9, 8 ; 8, 7 ; 7, 6 ; 6, 5 ; 5, 3 ; and 3, 2.

TO CHANGE ROUNDS WHEN LIMBERED UP.

<u>Officer.</u>	<u>No. 1.</u>
<i>Change rounds.</i>	<i>Change rounds.</i>

In changing rounds No. 2 becomes 4 ; 4, 6 ; 6, 8 ; 8, 1 ; 1, 9 ; 9, 7 ; 7, 5 ; 5, 3 ; and 3, 2.

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TO UNLIMBER.

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

<u>Officer.</u>	<u>No. 1.</u>
<i>Unlimber.</i>	<i>Prepare to unlimber.</i>
	<i>Lift.</i>
	<i>Limber, drive on.</i>
	<i>Lower.</i>

"*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.

<u>Officer.</u>	<u>No. 1.</u>
<i>Limber up.</i>	<i>Prepare to limber up.</i>
	<i>Lift.</i>

The several Nos. place themselves as for unlimbering, and at "*Lift*," lift the trail until the muzzle rests on the ground; they then close in towards the breech and haul down the trail when the limber is in position for limbering up; No. 1 keys up, and the detachment forms the order of march as hereinafter detailed.

POSITION OF DETACHMENT WHEN LIMBERED UP.

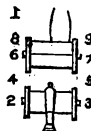
In Order of March.

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

2 and 3 in line with the axle-tree of the gun carriage.

4 and 5 in line with the centre of the trail.
 6 and 7 in line with the axle-tree of the limber.
 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 the 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 axle-tree, one yard to the right or left of the wheel.

CHANGE OF POSITION OF DETACHMENTS.

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 2, who turns about immediately he arrives at his post.

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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 No. 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 "*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 (or left).

Right (or left) turn.

Double march.

Front turn. Halt.

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

TO FORM DETACHMENT REAR FROM THE ORDER OF MARCH.

Officer.

No. 1.

Detachment rear.

*Right about turn.
Double march.
Halt. Front.*

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 "*Double March.*" 8 and 9, followed by the other numbers, 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 to the front himself at the same time.

40-PR. SIDE-CLOSING R.B.L. GUN, MOUNTED ON LATTICE GIRDER CARRIAGE.

The drill for the 40-pr. side closing gun mounted on lattice girder carriage, is the same as that for the 40-pr. R.B.L. on travelling siege carriage with the following exceptions* :—

In all cases for "vent piece" read "breech block."

* This gun can be shifted from firing to travelling trunnion holes in a similar manner to the 40-pr. M.L., but the gun must be unlimbered.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, directs the gun into the line of fire when running up, lays, and makes ready.

No. 5 runs up, attends to breech screw and vent, and fires.

TO PREPARE FOR ACTION.

No. 4, 6-ft. handspike, side arms, and support, tin cups in pocket, tin cup extractor, oil can, and hemp.

No. 5, 6-ft. handspike, tubes in box, lanyard, pricker, and vent server. He examines the vent server and places it in the vent, the loop of the vent server lanyard over one of the hind sights.

At "*Examine Gun*," No. 4 elevates sufficiently to enable No. 1 to look through the bore; and, after unscrewing the breech screw, presses the catch of breech block with his left hand, withdraws the breech block with his right hand as far as the stop.

At "*Clear*," from No. 1, 4 pushes home the breech block, 5 then takes the lever handle in his left hand, back up, and turning the handle from him, screws up the breech screw until it is home. 4 and 5 then go under cover.

If No. 1 gives "*Sponge out*," No. 2 provides himself with the sponge and sponges out the gun. At "*Clear*," 4 and 5 act as before detailed, 2 passes the sponge over his head as he turns left about, replaces it, and goes under cover.

TO LOAD.

At "*Load*" No. 4 withdraws the breech block, releases the tin cup with the special extractor passed through the breech screw, removes it from the side, and cleans the breech block if required; 4 then goes under cover.

As soon as the gun is loaded, No. 4 puts in the tin cup from the side, pushes home the breech block, and with No. 5 screws up the breech screw as before detailed, 4 (for additional security) placing his hands on the top of the lever handles and giving two smart taps; 4 and 5 then go under cover.

TO MAKE READY AND FIRE.

Officer.

No. 1.

Fire—Rounds.

No.—Ready.

No.—Fire.

No. 1 lowers his tangent-scale and gives "Ready," takes a tube attached to the lanyard from 5, who has shifted the lanyard to his right hand, puts it into the vent, 5 extends his right arm, faces the gun, 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, replaces it under his belt, and mounts on the step, and drifts the vent, replaces the vent server and goes under cover.

N.B.—The thumb-piece of the catch should fly-up, and the stop on the handle of the breech block should close in the angle of the upper bracket on the gun, when the breech block is home.

After screwing up the breech screw, No. 1 will inspect the indicator ring previously adjusted, to see whether the breech block is in its proper position or not.

7-INCH R.B.L. GUNS.

DESCRIPTION.

These are of two patterns, the lighter being that first introduced.

(a.m.¹)

r 2

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Section III.		R.B.L. Ordnance (7-inch)	
		82-cwt. Gun.	72-cwt. Gun.
Calibre (or diameter of grip)	7 inches	7 inches
Nominal weight	82 cwt.	....	72 cwt.
Preponderance	6 cwt. 3 qrs.....	....	8 cwt.
Length {	of barrel	97.5 inches	99.5 inches
	of powder chamber	16 " 	14.25 "
	of shot chamber	9 " 	9 "
	total, nominal	120 " 	118 "
Rifling.... {	grooves, number	76 " 	76 "
	polygroove, uniform, 1 turn in 37 calibres.		

CONSTRUCTION.

The 72-cwt. gun consists of—“A” tube or inner barrel ; breech piece and “B” tube ; trunnion ring ; four coils.

The 82-cwt. gun differs from the above in having two additional coils, one in front of the vent slot, termed a “strengthening coil,” and an additional coil in front of the trunnions.

PARTS.

The parts of these guns are similar to those of the 40-pr. R.B.L. gun (*vide* p. 290), the only important difference being that the breech and vent piece in 7-inch guns are bushed with wrought iron instead of copper, the latter being not sufficiently hard.

RIFLING AND VENTING.

Same as 40-pr. R.B.L. (*vide* p. 291).

SADDLE.

This is of gun-metal, and is screwed on to the gun in rear of the vent slot, for the vent piece to rest on.

SIGHTING.

The guns are provided with two tangent and two trunnion sights.

R.B.L. Ordnance (7-inch).

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The 72-cwt. gun has hexagonal gun-metal tangent sights, graduated from 0° to 10° , and screwed-in fore or trunnion sights. The earlier patterns of tangent sights in both guns are "barrel-headed," the latter patterns being the sliding leaf sights.

The 82-cwt. gun has a steel four-sided bar, and is now graduated as follows :—

0° to 15° .

BLANK.  SHELL, FULL 11 LBS.,
FUZE 24.

FULL 11 LBS.
YARDS, 3,600.

The 82-cwt. gun has drop trunnion sights.

PROJECTILES.

Nature.	Weight empty.		Burster.		Mean total Weight.	
	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Common shell* Mark II.	83	0	6	8	89	8
Common shell No Mark.	98	0	7	10	105	10
Segment shell Mark I.	98	9½	3	2	101	11½
Case shot „ V.	...	...	...	...	68	2½

* For 82-cwt. gun only.

The case shot have three soft metal studs near the base to prevent them from entering too far into the bore.

CHARGES.

"Full" for 82-cwt. gun	11 lbs. R.L.G. ²
"Full" for 72-cwt. gun	10 lbs. R.L.G. ²
"Saluting"	7 lbs. Blank.

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Section III.**R.B.L. Ordnance (7-inch).**

The full charge has a lubricator screwed into a socket, which is choked into the cartridge.

Primers for vent pieces are used with these guns.

FUZES.

Wood, time, 15-seconds with detonator, Mark III.

Percussion, direct action for common shell.

TIN CUPS.

Are always used to assist in closing the breech, and as a protection to the breech and vent piece bushes.

DRILL WITH 7-INCH R.B.L. GUN ON TRAVERSING PLATFORM.

The detachment consists of 9 Nos., and falls in two deep.

To TELL OFF.

As detailed at page 186.

To TAKE POST UNDER COVER.

As detailed at page 187.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, holds on to the preventor rope, and lays.

No. 2 runs up, sponges (if necessary), rams home, elevates, and traverses.

No. 3 runs up, removes safety pin, loads, rams home, elevates and traverses.

No. 4 runs up, attends to breech screw, vent piece, and tin cups, attends to side arms, and supplies them to 2; and to elevating screw and coin in laying.

No. 5 runs up, attends to breech screw and vent piece, attends to the preventor rope, primes, makes ready, and fires.

No. 6 supplies 3 with cartridge, and brings up projectile.

No. 7 attends to fuzes and brings up projectile.

No. 8 attends to cartridge store and serves out cartridges to 9 with lubricators attached.

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

TO PREPARE FOR ACTION.

Officer.

Prepare for action.

No. 1.

*Prepare for action.
Examine gun.*

"Prepare for action."

The stores are brought up as follows :—

No. 1, sights, a piece of chalk, file for vent-piece, preventor rope, hammer and punch.

No. 2, 7-foot handspike, truck lever, iron shod lever, and assists 4 with side arms.

No. 3, 7-foot handspike, truck lever, iron shod lever, and elevating screw, removes apron and tampeons.

No. 4, side arms and support ; tin cups in pocket and extractor.

No. 5, primers in pocket, tubes in box, lanyard, oil can and hemp, and iron lever.

No. 6, two cartridge cases, which he takes to the cartridge store, bucket filled, and brush (two dummy cartridges for drill).

No. 7, fuzes, fuze, and shell implements, one set of luff tackle, and one shell bearer. He obtains the fuze boxes from 9, having ascertained from No. 1 the nature of fuzes required, satisfying himself as to the correctness of fuzes and fuze implements.

No. 8 prepares to issue cartridges.

No. 9, one set of luff tackle and a brush ; prepares to issue shells, tubes and fuzes ; he examines the shells carefully, cleaning them if necessary, and removing burrs ; he loosens the fuze hole plugs of shells that will be first issued.

The stores having been brought up, No. 1 will satisfy himself

that the foresights fit properly on the gun, that the deflection leaves of the hind sights work easily, and that the platform is properly swept ; he attaches the preventor rope to the carriage, and, assisted by 3, takes two turns with it round the bollard, the running end coming off to the left at the top. He receives reports from the Nos. responsible of any irregularity or deficiency in connection with the gun, ammunition, and stores. He ascertains that the breech fittings are properly put on and well oiled.

Should the indicator ring require adjusting, he adjusts it in the following manner :—The vent piece is screwed home as it would be for firing. 2 places a handspike in the breech ; 1 knocks out the keep pins with a hammer and punch, the lever and tappet ring are then removed by 4 and 5 on to the handspike. The indicator ring is passed over the octagonal part of the breech screw, so that the arrow marked on it, or raised line, will correspond with a similar mark on the gun. If the arrows cannot be made to coincide, the indicator ring is to be so placed that the arrow on it will be to the left of the mark on the gun, as close as the cogs of the indicator ring will permit. The tappet ring and lever are then replaced. They ought to be put on so that the lever ball will be resting on a cam of the tappet ring on the right side of the gun in a convenient position for No. 4 to give two taps after the breech is screwed up ; 4 depresses the gun about 3°.

The side arms are laid down to the right of the gun, and parallel to it, heads to the front, resting on the support provided, sponge next the gun, and in line with the breech when the gun is run up.

The sponge bucket near the sponge head.

The handspikes and iron shod levers are laid down bevelled side uppermost, the handspikes next the gun, the truck levers between them, the whole with their points to the front.

The tin cup extractor and lever are placed in loops on the carriage.

If the indicator and tappet rings, with their keep pins, have been detached, 4 and 5 bring them up.

4 sees that the elevating screw is properly oiled.

5 straps the tube box round his waist on the right side, coils up the lanyard, and places the bight of it under the tube box strap. He fills the tube box with friction tubes, which he procures from 9.

The standing blocks are hooked by 7 and 9 to the rear eye-bolts of the platform, the tackles overhauled, and the falls coiled down.

"Examine gun."

Nos. 4 and 5 take a purchase with their handspikes over the cheeks and under the breech, and bear down ; 2 double man's 4's handspike. The coin is withdrawn, and the elevating screw put in by 3, No. 1 holding up the stool bed with an iron shod lever applied over the bottom step of the carriage. No. 1 gives *"Lower,"* when 4 and 5 withdraw their handspikes and lay them down. 4 and 5 then mount up on the platform, and open the breech ; 4 by taking the lever handle in his right hand, back up, and swinging it round a half circle towards him from cam to cam, 5 in his left hand, back up. This will strike a blow hard enough to move the screw, which is then unscrewed two turns, and the vent piece is released ; 4 and 5 lift the vent piece out of the slot, and lay it on the saddle on the top of the breech coil. At *"Clear,"* from No. 1, they drop in the vent piece ; 5 takes the lever handle in his left hand, back up, and turning the handle towards him, with 4 screws up the breech screw until it is home. 4 and 5 then go under cover.

If No. 1 gives *"Sponge out,"* 2 mounts up, taking the sponge with him, and sponges the gun out ; at *"Clear,"* 4 and 5 act as before detailed, 2 passes the sponge over his head as he turns left about, replaces it and goes under cover.

No. 1 then directs 5 to fire a tube.

To LOAD.	
<i>Officer.</i>	<i>No. 1.</i>
<i>Range—yards.</i>	<i>Run up. Halt.</i>
<i>With—load.</i>	<i>With—load.</i>

“*Run up.*” No. 1 takes in the slack and holds on the preventor rope ; 2, 3, 4 and 5 take up the truck levers ; 2 and 3 raising the small ends to enable 4 and 5 to hook the points to the eyebolts. When this is done 2 and 3 haul down the small ends by means of the ropes ; 4 and 5 place the pawls ; 4 goes under cover ; 5 holds on to the preventor rope behind 1 ; 2 and 3 guide the levers whilst the carriage is in motion ; 1 and 5 ease off hand over hand, and hold on when the mark on the preventor rope comes over the bollard.

“*Halt.*” When the gun is in its proper position No. 1 gives “*Halt ;*” 2 and 3 bear down the small ends of the levers ; 4 and 5 throw back the pawls ; 2 and 3 allow the small ends of the levers to rise gently, manning the ropes when the levers are out of reach. When the rear of the carriage rests on the platform, the levers are unhooked, withdrawn, and laid down outside the handspikes by 2, 3, 4, and 5, who go under cover.

“*Load.*” 2 and 3 as soon as 4 and 5 have lifted out the vent-piece, mount on the side pieces by the steps and place themselves in a position for sponging or loading.

They lift the shell in the bearer to the bore, into which 3 forces it with his right hand, having first withdrawn the safety pin ; 2 then receives the rammer from 4, and, assisted by 3, rams home the projectile,* their outward hands back under, inner hands back up ; 3 then turns to his right, takes the cartridge out of the case, places it in the bore, and goes under cover ; 2 presses the cartridge gently home, withdraws the rammer. Allowing the head to fall, seizes it near the head with the left

* At drill the cartridge of the preceding round should be forced out of the bore in ramming home the projectile.

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hand back up turns to his left about, gets down, replaces the rammer, and goes under cover.

Should "*Sponge out*" be given by No. 1, 2 receives the sponge from 4, introduces it into the bore and sponges out in two motions; he then withdraws the sponge, cleaning the chamber well, and hands it back to 4.

4 and 5 mount up, unscrew the breech screw and lift the vent piece on to the saddle, using the iron lever if necessary; 4 removes the old tin cup with the extractor, and goes to the sidearms, lifts the sponge (if required) with his left hand back under, turning to the right about as he does so, and hands it to 2, waits for it, replaces it, and then takes up the rammer in the same way he did the sponge, hands it to 2 and goes under cover, 5 unhooks and takes in the slack of the preventor rope.

As soon as the gun is loaded 4 and 5 mount up, 4 passes a tin cup down the slot, edge to the front, and presses it into the bore; 5 primes the vent piece. They then drop in the vent piece, and screw up the breech screw as before explained, 4 (for additional security) placing both hands on the top of the lever ball, and giving two smart taps; 4 and 5 then go under cover.

6 and 7 bring up the projectile in bearer, 6 carrying the cartridge case in his right hand; the bearer is placed on the platform on the right of 3; 7 removes it when the shell has been placed in the bore by 2 and 3; 6 uncovers and raises the cartridge case to enable 3 to withdraw the cartridge.

TO LAY, MAKE READY, AND FIRE.

*Officer.**No. 1.**Commence firing**or**Fire—rounds.**Elevate.**Lower. Coin.**With screw elevate. Halt.**Depress. Halt.**Trail right. Halt.**Trail left. Halt.**No.—Ready.**No.—Fire.*

No. 1 looking over his sights gives "*Elevate*," then "*Lower*," and when the gun is at the required elevation, "*Coin*." If a slight amount of elevation or depression is required, he gives "*With screw*," "*Elevate*," or "*Depress*."

"*Elevate*," 2 and 3 take up their handspikes and step forward in line with the breech, place their handspikes, bevels down, over the steps of the carriage and under the breech, and bear down; 5 double man's 3's handspike; at "*Lower*," they allow the small ends to rise gently; at "*Coin*," they withdraw their handspikes and step outwards; 4 withdraws the coin as soon as 2 and 3 elevate, and at "*Coin*" forces it sharply home. If the order is "*With screw*," "*Elevate*," or "*Depress*," 4 works the screw until "*Halt*" is given, and 2 and 3, laying down their handspikes, take up the iron shod levers, placing themselves ready to traverse. As the platforms on which the gun is mounted are pivoted in front, centre, or in rear, the position taken up by 2 and 3 differs according to the manner in which the platform is pivoted (for details see page 206).

At "*Ready*," 2 and 3 withdraw their levers, and place them, bevels up, as scotches under the trucks, 2, 3, and 4 then go under cover.

No. 5 hands the tube with lanyard attached to 1, the other end of the lanyard hanging down the side of the carriage, or if long being coiled up and hung on the rear eyebolt, No. 1 puts in the tube when he has laid the gun giving the word "*Ready*," he jumps off the platform and gives the word No. (naming his gun) No. 5 seizes the lanyard and stretches it out looking towards No. 1. At "*Fire*" from the No. 1 he draws the lanyard strongly towards him without a jerk, replaces it under his belt, hooks the preventor rope (except at drill) and goes under cover."

Should no order to "*Fire*" have been given by the Officer No. 1 will not receive a tube from 5, but will give the word "*Under Cover*" as soon as the gun is laid.

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To RUN BACK.

Officer.No. 1.*Run back.
Halt.*

"Run back," 4 slackens the compressor if the carriage is fitted with one.

The truck levers are applied as in running up; No. 1, standing between the cheeks, holds the small ends of the truck levers and guides them; 4 and 5 hook the front blocks to the front eye-bolts on the carriage. All the numbers, except No. 1, man the falls on their respective sides, and at "*Heave*," haul the gun back.

"*Halt*." When the gun is run far enough back, No. 1 hauls down the levers by the ropes till the pawls fall; the levers are then allowed to come up, No. 1 rising with them. The front blocks are unhooked by 4 and 5, who carry them to the rear, lay them down clear of the racers, and coil down the end of the fall; 2, 3, 4, and 5 unhook the truck levers and lay them down; 5 hooks the preventor rope.

To CEASE FIRING AND REPLACE STORES.

Officer.No. 1.*Cease firing.
Replace stores.**Examine gun.
Elevate.
Lower. Coin.
Replace stores.*

As before detailed.

The gun is laid "Under metal."

"*Replace Stores*," the stores are replaced by the numbers who brought them up.

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Section III.**R.B.L. Ordnance (7-inch).****TO FORM DETACHMENT REAR.**

As at page 195.

TO CHANGE ROUNDS.

<i>Officer.</i>	<i>No. 1.</i>
<i>Change rounds.</i>	<i>Change rounds.</i>

In changing rounds No. 2 becomes 4 ; 4, 1 ; 1, 9 ; 9, 8 ; 8, 7 ;
7, 6 ; 6, 5 ; 5, 3 ; 3, 2.

**DRILL WITH 7-INCH R.B.L. GUNS ON
NAVAL SLIDES.**

The same stores are brought up as for traversing platforms except that no truck or iron shod levers are required. 2, 3, 4 and 5 each provide a 7-foot handspike.

The gun is served as if on a traversing platform, the slide is traversed and the gun run up as with R.M.L. guns similarly mounted.

**DRILL WITH 7-INCH R.B.L. GUN ON MONCRIEFF
CARRIAGE.**

The detachment, consisting of nine Nos., is told off, and takes post under cover, as with the same gun mounted on a traversing platform.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, attends to the brake in running up, and lays.

No. 2 sponges, places projectile in bore, rams home, attends to lever if required, and elevates.

No. 3 removes safety pin, or uncaps fuze, loads, rams home, attends to lever if required.

No. 4 attends to breech screw, vent piece, and tin cups, attends to sidearms, supplies them to 2, traverses, attends to lever if required.

No. 5 attends to breech screw and vent piece, primes, depresses the gun for loading, elevates previous to running up (about 1"), traverses, attends to lever if required, makes ready, and fires.

No. 6 supplies 3 with cartridges, and brings up projectile.

No. 7 attends to fuzes, and brings up the projectile.

No. 8 attends to cartridge store serves out cartridges to 6, with lubricators attached.

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

TO PREPARE FOR ACTION.

As with the gun on a traversing platform, except no preventor rope, handspikes, truck levers, or iron shod levers are required. No. 5 provides a long lanyard.

2 and 3 bring up an iron-pointed lever each, which they lay down on each side of the gun.

Tackle will be necessary to run the gun back.* Two sets of heavy gun tackles are brought up by 6 and 7.

The sponge and rammer are laid down on the right of the gun, close to the parapet, heads towards the muzzle, the shell extractor and wadhook outside the pit.

At "*Examine gun*," same as at 7-in R.B.L. on a traversing platform, and 5 attends to the elevating wheel and depresses until the gun is in a convenient position for loading.

TO LOAD.

No. 1 at "*Load*" gets the gun into a convenient position, 5 depresses if necessary.

* Two heavy gun tackles allowed for each gun mounted singly, or for every two guns when together.

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Section III.**R.B.L. Ordnance (7-inch).**

After the loading is completed, 5 gives 1° or more of elevation, as shown on the arc.

TO RUN UP.

Before running up, No. 1 will give the caution "*Stand clear,*" then holding the brake he allows the gun to run up.

He must be very careful not to let it escape from his control, and, on the other hand, he must not check it too soon. Should the latter be the case, No. 1 gives "*Work levers,*" 2 and 3 fix the latches, and work their levers, small ends to the rear; 2 and 4 work the right, 3 and 5 the left lever; No. 1 will give "*Down,*" "*Fresh purchase,*" "*Halt,*" as required.

When the gun is up, No. 1 will mount up the ladder to lay it, 2 and 3 slackening the latches and unshipping the levers; 4 and 5 man the traversing handle.

TO LAY THE GUN.

4 and 5 traverse.

2 elevates or depresses.

The gun may be laid without exposing any number, No. 1 using a reflecting sight, or elevating in accordance with the graduations on the elevating arc or trunnion pointer, and traversing to marks previously made on the racers.

TO MAKE READY AND FIRE.

When No. 1 has laid the gun at "*Ready,*" he drops the tube into the vent, throws the lanyard clear of the carriage, and comes down.

As soon as No. 5 has fired, he coils up the lanyard and replaces it under his belt.

TO UNLOAD AND RUN BACK.

(For drill purposes extra men will be required.)

To run back, 2 and 3 fix the latches and work their levers, small ends to the front, and bear down, double-manned by 4 and

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5. No. 1 gives "*Down*," "*Fresh purchase*," "*Halt*," as required. Tackles to be hooked by 4 and 5, assisted by 6 and 7, and manned by all available numbers.

Unloading should be effected when the gun is run back.

TO CEASE FIRING AND REPLACE STORES.

TO FORM DETACHMENT REAR.

TO CHANGE ROUNDS.

As with 7-inch R.B.L. on traversing platform.

DRILL WITH 7-INCH R.B.L GUNS ON REAR CHOCK CARRIAGES.

In preparing for action, No. 1 brings up a roller handspike, which he lays down in rear.

The stores detailed for a gun mounted on a traversing platform are brought up by the several numbers, but the truck and iron shod levers and preventor rope are not required.

A tackle is brought and arranged by Nos. 8 and 9 for running back.

The gun is served as when mounted on a traversing platform.

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S.B. ORDNANCE.

DRILL WITH S.B. GUNS.

The detachment consists of nine numbers, and the drill is the same as with the 64-pr. R.M.L. gun, with the following exceptions :—

In preparing for action no shell extractor is required. Wedge wads are not used with S.B. guns. When junk or grummet wads are used they are supplied by 5.

At the 8-inch, 10-inch, and 68-pr. guns 3 assists 2 to sponge, then slews his body to the right and receives a cartridge from 6 (the rest of his duties as with 64-pr. R.M.L.).

If shells are used they are brought up in a shrapnel shell box, without a lid, fuze downwards, by 6 and 7; 6, who is on the right, also carrying a filled cartridge case in his right hand.

The box is passed under the muzzle by 7 to 2.

With their inward hands 2 and 3 lay hold of the rope handles, their outward hands supporting the box; they raise it as high as the muzzle and capsize it smartly, throwing the shell into the bore. 7 takes the box to the rear. 6 the empty cartridge case.

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Section IV.

In firing 68-pr. solid shot, the shot is placed on a bearer and passed under the muzzle by 7, and is lifted in by 2 and 3.

In unloading, where solid shot have been used, 4 and 5 at "Unload" take up their handspikes and apply them at once under the breech, to let the shot roll out of the bore, lowering it again as soon as the shot has been received on a bearer and placed on the head of the platform by 2 and 3, and replacing their handspikes.

DRILL WITH S.B. HOWITZERS.

10-INCH AND 8-INCH HOWITZERS.

The drill is the same as with S.B. guns, except that No. 2 after sponging, reverses the sponge, and rams home. Should reduced charges be used as in ricochet firing, the cartridges must be either lengthened with wads or rammed home separately, the same rule applies with all shell guns.*

At "Ready" the men step one pace from the merlon in order to be clear of the explosion, or if there be no merlon, Nos. 2 and 3 take an oblique pace to the rear.

Howitzers on perch-trail carriages are provided with friction levers, which bear on the naves of the wheels; chocks also are fitted over the trucks, in order to check the recoil.

After the howitzer is run up and traversed, "*Fix levers and chocks*" is given, when Nos. 4 and 5 apply their handspikes in the straps and under the cheeks of the carriage, and No. 1 puts in the pins or hooks the chains.

After the handspikes are taken up for running back, "*Unfix levers*" is given. Nos. 4 and 5 apply their handspikes as before. No. 1 withdraws the pins.

* At drill with howitzers and shell guns it is necessary to use either a very long dummy cartridge, or to ram home several junk wads before commencing to drill, otherwise the rammer-head and bottom of the shells are apt to get fixed in the chamber.

Section IV. S.B. Ordnance (10-inch and 8-inch Howitzers).

TO UNLIMBER AND LIMBER UP HOWITZERS ON
PERCH TRAIL CARRIAGES.

"Prepare to unlimber." No. 1 unhooks the keep-chain, and 8 and 9 the draught-chain; 2 passes a handspike under the perch to 3, to be double-manned by 4 and 5; 4 and 5 place handspikes under the wheels as scotches, 4 in front, 5 in rear. Nos. 1, 6, 7, then stand to the trail, 2, 3, 4, and 5 man the handspikes, 8 stands to the splinter bar, 9 to the shafts.

"Unlimber," the Nos. at the trail raise it, until it is clear of the pintail; No. 1 gives *"Limber."* *"Drive on,"* and the limber is removed a short distance to the rear. Nos. 1, 6, and 7 stand to the trail eye, whilst the other Nos. shift the handspike towards the trail plate. The trail is then lowered carefully and steadily to the ground.

Limbering up is the converse of this, but caution is required that the 8-inch howitzer be not turned completely over.

MORTARS.

Cal.	Wt. cwts.	Max. charge		Shell empty		Bursting ch.	
		lb.	oz.	lb.	oz.	lb.	oz.
13"	36	9	0	195	3	10	15
10"	18	4	0	87	2	5	4
8"	9	2	0	46	1	2	9

Practical rules for charges and time of flight :

13" 3 lb. charge	= 850 yds. range, each additional	$\frac{1}{2}$ lb. = 180 yds.
10" $1\frac{1}{2}$ lb. "	= " "	$\frac{1}{4}$ lb. = "
8" 1 lb. "	= " "	$\frac{1}{6}$ lb. = "

$$\text{Time of flight} = \frac{\sqrt{\text{Range in feet}}}{4}$$

$$\text{Or " = No. of hundreds of yards in range} + 17.$$

10-INCH OR 13-INCH L.S. MORTARS ON STANDING BEDS.

The detachment consists of 9 Nos., and is told off as with M.L. guns.

TO TAKE POST AT THE MORTAR.

Officer.

No. 1.

Take post at the mortar.

*Right turn.
Double march.*

"*Right turn.*"—The detachment files on to the mortar, 2 and 3 halting in line with the muzzle and one yard clear of it, 4 and 5 the trunnions, No. 1 follows in rear of the detachment and halts in rear of the mortar, 6 and 8 go to the cartridge store (6 outside) 7 and 9 to the shell store (7 outside).

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes and lays.

No. 2 sponges, assists to put in shell at the 13-inch, runs up, and traverses.

No. 3 plants pointing rods, puts in cartridge, assists to put in shell at the 13-inch, uncaps the fuze when in the bore, runs up and traverses.

No. 4 attends to sponge and supplies it to 2, wipes shell, and at the 13-inch assists to put it in, runs up, and traverses.

No. 5 attends to vent, runs up, traverses, makes ready, and fires.

No. 6 supplies 3 with cartridges, brings up and puts in shell.

No. 7 attends to fuzes, brings up and puts in shell.

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

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

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Section IV. S.B. Ordnance (10-inch and 13-inch Mortars).**TO PREPARE FOR ACTION.**Officer.No. 1.*Prepare for action.**Prepare for action.*

No. 1 provides a plummet with line attached and a piece of chalk.

No. 2, sponge and handspike.

No. 3, pointing rods and handspike, also removes muzzle cap.

No. 4, handspike, sponge bucket filled, and sheepskin.

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

No. 6, cartridge case.

No. 7, fuzes and fuze implements.

No. 8 prepares to weigh out cartridges.

No. 9, shell implements, and beam or hand hooks.

The sponge is laid on the ground to the right of the mortar, head to the rear, resting on the muzzle cap; the handspikes as with guns on standing carriages; the pricker on the left trunnion; sheepskin to right of the muzzle, clear of No. 2. The cartridge case is with No. 8 at the cartridge store. 5 drifts the vent and places the vent server in the vent.

No. 1 satisfies himself that the vent and bore are clear, and strikes a chalk line on the mortar.

TO PLANT THE POINTING RODS AND LAY THE MORTAR.

(Vide p. 34).

TO LOAD.

<i>Officer.</i>	<i>No. 1.</i>
<i>Range</i> —yards.	<i>Run up.</i>
<i>With</i> —load.	<i>Halt.</i>
	<i>Muzzle (right).</i>
	<i>" (left).</i>
	<i>Heave.</i>
	<i>Halt.</i>
	<i>Crosslift (right).</i>
	<i>" (left).</i>
	<i>Heave.</i>
	<i>Halt.</i>
	<i>With</i> —load.

Mortars are laid before loading.

"*With*—load."—No. 1 moves the mortar until the chalk line on the mortar is in line with the two pickets. He places himself in rear of the platform so as to cover the pickets, holding the plummet line with his right hand, in front of; and at a little distance from his right eye (his left hand steadying the plummet), and gives "*run up*," when the handspikes are applied under the running up bolts as with standing carriages. "*Halt*." All turn to the rear, handspikes across the body, points on the platform towards the mortar.

In all traversing the men stand between the parapet and handspikes.

"*Muzzle right*."—No. 2 crosses to the left side of the bed, shifting the small end of his handspike into his right hand, and takes a purchase under the right front horn; 3, a purchase under the left front horn; 4, a purchase under the right rear horn; 5

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Section IV. S.B. Ordnance (10-inch and 13-inch Mortar).

crosses over to the right side of the bed and takes a purchase under the left rear horn. No. 1 giving "*Heave*," and "*Halt*."

"*Muzzle left*" is the converse of "*Muzzle right*."

"*Cross lift right*."—Nos. 3 and 5 take a purchase under their respective horns ; 2 and 4 shift over to the left side of the mortar, and take a purchase under their respective horns also ; No. 1 giving "*Heave*," "*Halt*."

"*Cross lift left*."—Nos. 2 and 4 under the horns on their own sides ; Nos. 3 and 5 shift over ; No. 1 giving "*Heave*," "*Halt*."

"*Load*."—The handspikes are laid down, as with M.L. guns, No. 1 sends by 6 to 8 the proper weight of charge, and also gives 7 the length of fuze.

No. 2 places himself in position for sponging, receives the sponge with his left hand at the centre, back down, brings the sponge in line with the axis of the bore, presses the head to the bottom, bending over on the left knee, and supporting the stave with his left hand, gives it two half turns with his right. He then grasps the stave firmly with both hands, wipes the whole surface of the bore from breech to muzzle, gradually bending over the right knee and straightening the left, and having withdrawn the sponge, returns it to No. 4. At the 13-inch, he assists to lift the shell into the bore, mounting on the bed for that purpose.

No. 3 turns to his left, receives a cartridge from 6, turns to his right-about, and places it in the bore, pressing it well home, and taking care that the seam does not come under the vent. At the 13-inch, he assists to lift the shell into the bore, mounting on the bed for that purpose. When the shell is in the bore he uncaps the fuze. When carcasses or light balls are fired, he uncovers the holes and loosens the priming.

No. 4 supplies and replaces the sponge as with a M.L. gun, then picks up the sheepskin, and, standing in front of the muzzle, wipes the bottom of the shell or carcass and assists to put it in, taking care that the fuze is in the centre. He then replaces the sheepskin.

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Nos. 6 and 7 bring up a shell (with the beamhooks at the 13-inch, handhooks at the 10-inch), 6 on the right, 7 on the left, 6 carrying the cartridge case in his right hand and leaving it in front of 3. They come up on the left side, wheel to the right-about, and front the muzzle. After the shell has been wiped, they place it in the bore, assisted by 4, and at the 13-inch by 2 and 3 as well, 6 carries the empty cartridge case, and 7 the beam or hand hooks, to the rear; 8 having weighed out a charge in accordance with No. 1's directions, issues it to 6.

TO MAKE READY AND FIRE.

<u>Officer.</u>	<u>No. 1.</u>
<i>Fire one round.</i>	<i>No.—ready.</i>
<i>“Ready.”</i>	<i>No.—fire.</i>

Nos. 2 and 3 take two oblique paces outwards to the rear to be clear of the explosion.

No. 5 presses a tube into the vent, keeping his right hand on a level with the vent, and at “*Fire*” draws the lanyard strongly towards his body without a jerk, replaces it under his belt, and takes post. As soon as the mortar is fired he steps in at once, clears the vent, and replaces vent server. 2 and 3 after the mortar is fired resume their positions.

TO RUN BACK AND UNLOAD.

<u>Officer.</u>	<u>No. 1.</u>
	<i>Run back.</i>
	<i>Heave.</i>
	<i>Halt.</i>
	<i>Unload.</i>

After the vent has been drifted, 2, 3, 4, and 5 take up their handspikes and run the mortar back.

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No. 1 gives "*Heave.*" At "*Halt,*" the handspikes are laid down and the Nos. take post.

"*Unload.*"—The same Nos. who loaded reverse the operation. With the 13-inch a drag rope, provided for the purpose by No. 8, may be hooked to a hand hook applied to one of the lugs of the shell and manned by all the Nos. The shell is hauled out by a sudden jerk, and falls clear of the platform.

TO CEASE FIRING AND REPLACE STORES.

<i>Officer.</i>	<i>No. 1.</i>
<i>Cease firing.</i>	<i>Cease firing.</i>
<i>Replace stores.</i>	<i>Replace stores.</i>

The stores are replaced by the Nos. who brought them out.

TO FORM DETACHMENT REAR AND CHANGE ROUNDS.

As with the 64-pr. R.M.L. gun, only in "*Detachment rear*" No. 1 gives "*Right about turn*" instead of "*Outwards turn.*"

8-INCH MORTAR ON STANDING BED.

The detachment consists of 6 Nos., and is told off as with R.M.L. guns.

In taking post 2 and 3 halt in line with the muzzle, 5 the vent, 4 goes to the shell store, 6 to the cartridge store.

GENERAL DUTIES.

No. 1 commands, directs, or superintends boring and fixing fuzes, lays, hands the sponge to 2, and replaces it.

No. 2 sponges, wipes shell, runs up, and traverses.

No. 3 plants pointing rods, supplies himself with and puts in cartridge, uncaps the fuze, runs up, and traverses.

No. 4 bores and fixes fuzes, prepares, brings and puts in shell.

No. 5 attends to the vent, makes ready, and fires.

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No. 6 attends to the cartridge store, weighs and serves out cartridges to 3.

TO PREPARE FOR ACTION.

Officer.

No. 1.

Prepare for action.

Prepare for action.

No. 1 provides a plummet with line attached, and a piece of chalk and sponge bucket filled.

No. 2, sponge and handspike, and sheepskin.

No. 3, pointing rods, handspike, also removes muzzle cap.

No. 4, fuzes, fuze and shell implements.

No. 5, tubes in a box, lanyard, pricker, and vent server.

No. 6, cartridge case, and prepares to weigh out cartridges.

TO LOAD.

The mortar is served in a similar way to the 10-inch.

In running up or back 2 and 3 only apply their handspikes.

At "*Cross-lift (right) (left)*" they apply their handspikes under the horns on that side towards which the mortar has to be traversed; 2 working in front, 3 in rear.

At "*Muzzle right*" 2 applies his handspike under the right rear horn, and 3 his under the left front horn.

"*Muzzle left*" is the converse of "*Muzzle right*."

In loading, No. 1 supplies and replaces the sponge, 2 after sponging wipes the shell, 3 doubles to the rear for the cartridge, brings it up and places it in the bore, 4 brings up the shell, puts it in, 3 takes back the empty cartridge case.

TO RUN BACK AND UNLOAD.

TO CEASE FIRING AND REPLACE STORES.

TO FORM DETACHMENT REAR. ¶

As at the 10-inch.

PART V.**Section IV. S.B. Ordnance (8-inch Mortar).****TO CHANGE ROUNDS.**

<i>Officer.</i>	<i>No. 1.</i>
<i>Change rounds.</i>	<i>Change rounds.</i>
2 becomes 4 ; 4, 1 ; 1, 6 ; 6, 5 ; 5, 3 ; 3, 2.	

ROYAL AND COEHORN MORTARS.

The detachment consists of 4 Nos.

GENERAL DUTIES.

No. 1 commands, lays, attends to vent, makes ready, and fires.

No. 2 sponges, and wipes shell.

No. 3 plants pointing rods, prepares shell, brings up and puts in cartridges and shell, and uncaps fuze.

No. 4 attends to the cartridge store, weighs, and serves out cartridges to 3.

8-INCH, 10-INCH, AND 13-INCH MORTARS ON TRAVELLING BEDS.

The detachments are the same as for mortars on standing beds. The service is almost the same, but the mortars are laid by traversing at the end of the perch.

The side arms are carried strapped on the beds.

For the purposes of unlimbering and limbering up, three dragropes are required with the 13-inch and 10-inch, and two with the 8-inch, four 6-foot handspikes with the 8-inch. A lifting jack is strapped to the perch of the 13-inch for the operation of limbering up, for which it is desirable to provide two oak skids, 3' X 6" X 9", and two 4-foot oak planks.

8-INCH MORTAR. (SIX NUMBERS.)

To UNLIMBER.

Officer.Unlimber.No. 1.*Prepare to unlimber.**Lift.**Limber, drive on.**Lower.**Off wheels.**Right the bed.**Heave.**Take post.*

No. 1 gives "*Prepare to unlimber*," and unkeys, 2, 3, 4, and 5 stand to the perch. No. 1 gets a drag-rope ready to hook to the perch eye. 6 places himself between the shafts. The wheels being scotched with handspikes, that of 2 in front, 3 in rear. "*Lift*." The perch is lifted carefully off the pintail, and No. 1 makes fast the drag-rope. "*Limber, drive on*." 6 moves forward a few yards with the limber, and lowers the shafts. The whole of the Nos. man the drag-rope, and at "*Lower*" ease off carefully till the mortar rests on its muzzle. "*Off wheels*." 2 and 4 remove the right wheel and lay it down, dish down, two yards to the right, 3 and 5 the left one in the same way, 1 and 6 attending to the linchpins and washers, 1 on the left and 6 on the right.

"*Right the bed*." All the Nos. heave well on the drag-rope and let the bed fall on to the ground. No. 1 casts off the drag-rope, and the detachment takes post.

To LIMBER UP.

Officer.Limber up.No. 1.*Prepare to limber up.**Lift and heave.**On wheels.**Limber up.*

Section IV.

S.B. Ordnance (10-inch Mortar).

"Prepare to limber up." 6 places two handspikes on the ground, about 6 inches in rear of the perch eye, as a fulcrum for the handspike of 2, who, assisted by 3, thus raises the bed high enough for 4 to place his handspike under it. This raises the perch sufficiently high for the bed to be lifted as follows:—2 passes a handspike under the perch to 3, double-manned by 4 and 5. Nos. 1 and 6 each make fast a drag-rope to the perch eye, 1 passing his to the front, 6 to the rear. *"Lift and heave,"* 2, 3, 4, and 5 lift at the handspike. Nos. 1 and 6 haul on the front drag-rope till the bed is vertical; the handspike Nos. when they can no longer lift, fall back on to the rear drag-rope, and ease off till the muzzle rests on the ground.

"On wheels." The Nos. that took them off replace them. *"Limber up."* The perch is hauled down by the whole of the Nos., 2 and 3 first placing handspikes to receive the wheels when they touch the ground. 2, 3, 4, and 5 steady the perch while the limber is backed by 6. No. 1 casts off the drag-ropes, and keys up; the detachment then forms the order of march. No. 1 in line with the point of the off-shaft, 2 and 3 with the axletree of the mortar, 4 and 5 with the centre of the perch, and 6 with the splinter bar.

10-INCH MORTAR. (NINE NUMBERS.)

TO UNLIMBER.

<u>Officer.</u>	<u>No. 1.</u>
<i>Unlimber.</i>	<i>Prepare to unlimber.</i>
	<i>Lift.</i>
	<i>Limber, drive on.</i>
	<i>Lower.</i>
	<i>Off wheels.</i>
	<i>Right the bed.</i>
	<i>Heave.</i>
	<i>Take post.</i>

S.B. Ordnance (10-inch Mortar).

Section IV.

"Prepare to unlimber." No. 1 unkeys the pintail, 2 and 3 remove the drag-shoe, 4 and 5 scotch the wheels, 2, 3, 4, 5, 6, and 7 then stand to the perch.

Nos. 1 and 8 each have a drag-rope ready to hook to the perch eye. 9 places himself in the shafts.

"Lift." Nos. 2, 3, 4, 5, 6, 7 raise the perch carefully * 9 moves the limber a few yards to the front.

Nos. 1 and 8 come up and make fast their drag-ropes, stretching them out to the rear on each side of the perch. 9 assists on the ropes.

The perch is slightly raised,† the Nos. fall back on the ends of the ropes; the bed rises to a vertical position, and the mortar falls on its muzzle. When the muzzle is coming to the ground the detachment must hold on well, to prevent the mortar overturning.

"Off wheels." Nos. 2, 4, 6, remove the right wheel, 3, 5, 7, the left; 8 and 9 remove linchpins and washers. The wheels are placed dish down, on their respective sides, two yards clear of the bed.

"Right the bed." The whole of the Nos. man the ropes, except 2 and 3, who apply their handspikes under the muzzle of the mortar, and at the word *"Heave"* from No. 1, the perch is hauled down and the bed rests on the ground.

Nos. 1 and 8 remove the drag-ropes, and the whole take post at the mortar.

* This must be done with care or the perch may fly up.

† If the detachment is weak when the perch has been detached from the pintail, a drag-rope may be made fast to the perch eye, and the other end to the pintail of the limber, which should be run forward about four yards from the perch eye, then with drag-ropes on the drag-washers of the limber, manned by the detachment, the mortar can be lowered with ease on to the front of the bed; it may be limbered up in the same way, and indeed it will be found the best and easiest to follow this method both for unlimbering and for limbering up, unless spare numbers are available.

With the 13-inch especially, on account of its great weight, it is safest to do so. In this case, the drag-rope is made fast to the perch eye and axletree bed of the limber.

PART V.

Section IV.

S.B. Ordnance (10-inch Mortar).

To LIMBER UP.

Officer.
Limber up.

No. 1.
Prepare to limber up.
Lift and heave.
On wheels.
Limber up.

"*Prepare to limber up.*" 6 places two handspikes on the ground, about 6 inches in rear of the perch eye, as a fulcrum for the handspike of 2, who, assisted by 3, thus raises the bed high enough for 4 to place his handspike under it. This raises the perch sufficiently high for the bed to be lifted as follows:—2 passes a handspike under the perch to 3, double-manned by 6 and 7, outside. 4 passes one behind them to 5, double-manned by 8 and 9, outside.

Nos. 1 and 8 each make fast a drag-rope to the perch eye, No. 1 passing his to the front, 8 to the rear. No. 1 hauls on the front drag-rope.

"*Lift and heave.*" The perch is raised; when the Nos. can no longer lift with effect, they drop off and man the ropes, at first in front, and as the muzzle comes to the ground, in rear.

"*On wheels.*" The wheels are put on by the Nos. that took them off.

"*Limber up.*" 4 and 5 each place a handspike so as to scotch the wheels when they touch the ground.

The perch is then hauled down by the whole of the Nos. except 2, 3, 4, and 5, who assist with handspikes in front of the bed, placing their handspikes over the lower spokes of the wheels and under the bed and bearing down; 2, 3, 4, 5, 6, 7, steady the perch when horizontal, Nos. 1 and 8 cast off the drag-ropes. 8 and 9 then bring up the limber; the perch is lowered on to the pintail, and No. 1 keys up.

The stores are replaced on the carriage by the Nos. that took them off.

S.B. Ordnance (13-inch Mortar).

Section IV.

The detachment then forms the order of march as with M.L. guns on travelling carriages.

13-INCH MORTAR. (NINE NUMBERS.)

To UNLIMBER.

Officer.No. 1.Unlimber.*Prepare to unlimber.**Lift.**Limber, drive on.**Lower.**Off wheels.**Right the bed.**Heave.**Take post.*

The operation is conducted in the same way as with the 10-inch, but requires two detachments. The best mode of procedure is that described in the footnote †, page 335, under the head of "To Unlimber" the 10-inch.

To LIMBER UP.

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

<i>Fresh purchase.</i>	} <i>repeated if necessary.</i>
<i>Lift.</i>	
<i>Lower.</i>	

*Prepare to place the jack.**Lift.**Lower.**Fix drag-ropes.**Cross handspike.**Lift and heave.**On wheels.*(a.m.¹¹)

A A

Section IV.

S.B. Ordnance (13-inch Mortar).

"Prepare to limber up." 2, 3, 4, 5, apply their handspikes crosswise, under the perch, double manned by the same numbers of the second detachment, and by 8 and 9 of both detachments; 6 and 7 of both detachments bring up and attend to the jack and skidding respectively.

"Lift." The bed is raised, and a 6" \times 9" skid on its flat placed under it, on each side as far to the front as practicable.

Lower." The bed is lowered on to the skidding.

"Fresh purchase." The same numbers apply their handspikes under the bed. *"Lift."* The bed is raised and the "6 \times 9's" turned on their edge and worked to the front; this is to be repeated until the bed is skidded close up to the axletree arms.

"Lower." The bed is allowed to rest on the skidding.

"Prepare to place the jack." One handspike is applied horizontally under the rear horns, manned by 2 and 3 of both detachments; the other under the bolt of the dragshoe chain on the perch, manned by 4 and 5 of both detachments. The two numbers 7 apply a handspike on each side under the bed, the points resting on an oak plank, double manned by 8 and 9 of both detachments.

"Lift." The bed is raised, one No. 6 places a plank, the other the jack on it under the centre of the bed, and as far to the front as possible.

"Lower." The bed is lowered on to the jack, which is then worked up to its full extent.

"Fix drag ropes." 8 and 9 each hook a drag rope to the perch eye, and pass the ends to the front, 8 of the second detachment hooks a drag rope to the perch eye and passes the end to the rear. 6 and 7 place a handspike vertically on each side of the mortar, between it and the sides of the bed, and make a clove hitch on the drag rope round the small ends; the ends leading to the front are twisted together, and manned by all the Nos., except 2, 3, 4, 5, of both detachments; who at *"Cross handspikes"* apply handspikes under the rear horns and perch as before described.

"Lift and heave." The bed is brought vertical, the handspike Nos. when they can no longer lift, falling back to the end of the rear drag rope, two at a time, and holding on to prevent the mortar falling over to the front. *"On wheels."* The wheels are put on by the same Nos. that took them off.

"Limber up." 4 and 5 each place a handspike so as to scotch the wheels when they touch the ground.

The perch is then hauled down by the whole of the Nos. except 2, 3, 4, 5, 6, 7, who assist with handspikes at the sides and in front of the bed, the remaining Nos. and the second detachment hauling on the ropes. 2, 3, 4, 5, 6, 7, steady the perch, when horizontal, Nos. 1 and 8 cast off drag ropes. 8 and 9 then bring up the limber, and the perch eye is lowered on to the pin-tail, when No. 1 keys up the keep chain, and 2 and 3 the draught chain.

The stores are replaced on the carriage by the Nos. that took them off, and the detachment forms the order of march.

32-PR. S.B.B.L. GUN.

(For Flank Defence.)

A 32-pr. S.B.B.L. gun has been issued in very limited numbers for flank defence.

The gun is the old 42 cwt. 32-pr. S.B., altered from muzzle-loading to breech-loading. The breech is closed by a breech screw with interrupted thread.

It is intended for rapid firing with case shot only in caponiers, flanks, &c.

A Handbook for the gun has been drawn up, and will be issued to districts which have the gun as part of their armament.

(a.m.¹)

A A 2

ORDNANCE FOR

GENERAL

No. at the Gun.	S.B. Guns* and 61-pr. R.M.L. on Garrison Standing Carriage, 9 Numbers.	40-pr. and 64-pr. R.M.L. and 40-pr. R.B.L. Gun on Travelling Siege Carriage, 9 Numbers.	64-pr. and 80-pr. R.M.L. and 7" R.B.L. Gun on Traversing Platform, 9 Numbers.
1.	Commands, directs, or superintends boring and fixing fuzes, directs the gun into the line of fire in run- ning up, and lays.	Commands, directs, or superintends boring and fixing fuzes, directs the gun into the line of fire in running up, and lays.	Commands, directs, or superintends boring and fixing fuzes, holds on to preventor rope, and lays.
2.	Searches, sponges, rams home, runs up, elevates, and tra- verses.	Searches.† sponges, rams home, runs up, traverses.	Searches, sponges, rams home, runs up, elevates, and tra- verses.
3.	Loads, uncaps or re- moves safety pin from fuze when in the bore, rams home, runs up, elevates, and traverses.	Loads, uncaps (except with R.B.L. guns) or removes safety pin from fuze, rams home, runs up, and tra- verses.	Loads, uncaps (except with R.B.L. guns) or removes safety pin from fuze, rams home, runs up, elevates, and traverses.
4.	Attends to side arms, and supplies them to 2, runs up, attends to elevating screw and coin in laying.	Attends to side arms, and supplies them to 2, runs up, and elevates.	Attends to side arms, and supplies them to 2, runs up, attends to elevating screw, and coin in laying, and compressor.
5.	Attends to vent, runs up, makes ready, and fires.	Attends to vent, runs up, makes ready, and fires.	Attends to vent, sup- plies wedge wads, runs up, holds on to preventor rope, makes ready, and fires.

* With the modifications mentioned in the Drill for S.B. guns.

† With R.B.L. guns, No. 2 does not search the gun; 4 attends to breech screw and vent piece and tin cups; 5 to breech screw and vent piece and primer, in addition to their other duties.

GARRISON DUTIES.

DUTIES.

7" on Moncrieff Carriage and Platform, 10 Numbers.	7" and 9" on Traversing Platform, 10 Numbers.	10", 11", and 12" on Casemate Platform, 15 Numbers.	12.5" on Traversing Platform, 17 Numbers.
Commands, directs, or superintends boring and fixing fuzes, runs up, and lays.	Commands, directs, or superintends boring and fixing fuzes, and lays.	Commands, directs, or superintends boring and fixing fuzes, assists to raise projectiles (if required), and lays.	Commands, directs or superintends boring and fixing fuzes, assists (if required) to raise projectile, lays, and attends to indicator.
Searches, sponges, places projectile in bore, rams home (attends to lever if required), and elevates.	Searches, sponges, rams home, runs up, and elevates (with 9" steadies projectile, and attends to mantlet).	Searches, sponges, steadies and guides projectile in raising, rams home, runs up, and elevates.	Searches, sponges, assists 3 with cartridge and projectile, rams home, assists 12 to attend to mantlet, and elevates.
Sponges, loads, uncaps fuze when in the bore, rams home (attends to lever if required).	Sponges, loads, uncaps fuze when in the bore, rams home, runs up, and elevates (with 9" hooks and unhook hoisting tackle, steadies projectile, and attends to mantlet).	Searches, sponges, loads, hooks and unhook hoisting tackle, steadies and guides projectile in raising, uncaps fuze when in bore, attends to port bar, rams home, runs up, and elevates.	Searches, sponges, loads, hooks, and unhook hoisting tackle, steadies and guides projectile in raising, uncaps fuze when in bore, attends to port bar, rams home, pumps the running-up jack, and assists 11 to attend to mantlet.
Attends to side arms, and supplies them to 2, traverses (if required).	Attends to side arms, and supplies them to 2, and traverses.	Attends to side arms and supplies them to 2, rams home, and traverses.	Attends to side arms and supplies them to 2, rams home, and traverses.
Attends to vent, depresses the gun for loading, supplies wedge wads, elevates about 10 before running up, traverses, and (attends to lever, if required) makes ready, and fires.	Attends to vent, supplies wedge wads, traverses, with 9" raises projectile, supplies 3 with automatic gas check, makes ready, and fires.	Supplies 3 with automatic gas check, wedge wads, raises projectile, attends to snatch block, rams home, and traverses.	Supplies 3 with automatic gas check, wedge wads, raises projectile, rams home, attends to snatch block, traverses, and attends to lever of chain nipping gear.

ORDNANCE FOR GENERAL

No. at the Gun.	S.B. Guns* and 64-pr. R.M.L. on Garrison Standing Carriage, 9 Numbers.	40-pr. and 64-pr. R.M.L. and 40-pr. R.B.L. Gun on Travelling Siege Carriage, 9 Numbers.	64-pr. and 80-pr. R.M.L. and 7" R.B.L. Gun on Traversing Platform, 9 Numbers.
6.	Supplies 3 with cartridges.	Supplies 3 with cartridges.	Supplies 3 with cartridges, and with 80-pr. brings up projectile.
7.	Attends to fuzes, and brings up projectile.	Attends to fuzes and brings up projectile.	Attends to fuzes, and brings up projectile.
8.	Attends to cartridge store, and serves out cartridges to 6.	Attends to cartridge store, and serves out cartridges to 6.	Attends to cartridge store, serves out cartridges to 6.
9.	Attends to shell stores, issues shells, tubes, and fuzes.	Attends to shell stores, issues shells, tubes, and fuzes.	Attends to shell stores, issues shells, tubes, and fuzes.
10.	—	—	—
11.	—	—	—
12.	—	—	—
13 & 15.	—	—	—
14 & 17.	—	—	—
16.	—	—	—

NOTE.—The above table of general duties has been compiled for the requirements of a every gun would tend to inconvenience and overcrowding, the Commanding Officer may use the Nos. charged with the magazine duties should always be selected for their special fitness.

* In the service of guns when the firing number cannot put the tube into the vent without

GARRISON DUTIES.

DUTIES.

7" on Moncrieff Carriage and Platform, 10 Numbers.	7" and 9" on Traversing Platform, 10 Numbers.	10", 11", and 12" on Casemate Platform, 15 Numbers.	12.5" on Traversing Platform, 17 Numbers.
Supplies 3 with cartridges.	Supplies 3 with cartridges.	Supplies 3 with cartridges, and rams home.	Supplies cartridge to 3, raises projectile, and rams home.
Attends to fuzes, and brings up projectile.	Attends to fuzes, brings up projectile (with 9" raises and rams it home).	Attends to fuzes, brings up projectile, raises and rams it home.	Attends to fuzes, brings up projectile, raises, and rams it home.
Attends to cartridge store, and serves out cartridges to 6.	Attends to cartridge store, and serves out cartridges to 6.	Attends to cartridge store, and serves out cartridges to 6.	Attends to cartridge store, and serves out cartridges.
Assists 7.	Assists 7 (with 9" raises projectile, rams home, and removes empty barrow).	Assists 7, raises projectile, and removes empty barrow.	Assists 7, raises projectile, rams home, and removes empty barrow.
Attends to shell stores, issues shells, tubes, and fuzes.	Attends to shell stores, issues shells, tubes, and fuzes.	Attends to shell store, issues shells, tubes, and fuzes.	Attends to shell stores, issues shells, tubes, and fuzes.
—	—	Raises projectile, assists 6 with cartridges, if required, rams home, attends to mantlet, and traverses if required.	Supplies cartridge to 3, raises projectile, rams home, attends to mantlet, and traverses.
—	—	Rams home, attends to vent and mantlet, traverses, if required, makes ready, and fires.	Rams home, attends to mantlet, and traverses. Attends to compressor stop.
—	—	At shell store.	Supply shells to the lift from the shell store.
—	—	At cartridge store.	Supply cartridges to the lift from the cartridge stores.
—	—	—	Assists 4 with side arms, rams home, attends to vent, makes ready, and fires.

single gun. When, from construction of the works the employment of full detachments with his discretion in reducing some of the detachments by breaking off Nos. 8, 10, 13, 14, 15, and 17.

* With the modifications mentioned in the Drill for S. B. guns.
mounting on the platform, this duty should be performed for him by No. 1.*

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