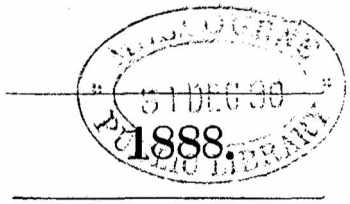
HANDBOOK

FOR THE

7-INCH RIFLED MUZZLE-LOADING GUNS OF 6½ AND 7 TONS ON SLIDING AND MONCRIEFF CARRIAGE.

(LAND SERVICE.)



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LIST OF PLATES.

MEMO.

This Handbook is corrected up to April, 1888. Any alterations which may be suggested, should be forwarded to D. of A. Department, Woolwich.

7-inch rifled muzzle-loading wrought-iron Guns of 6½ and 7 tons.

GUNS.

(Plates I., II., III.)

	7-ton Gun.					6½-ton Gun.
	Mark I. See L. of C., § 1230.	Mark II. See L. of C., § 1607.	Marks III. and IV. See L. of C., § 3419.	Mark I. See L. of C. § 1231.	Mark II. See L. of C. § 1644.	Mark III. See L. of C., § 1644.
Material — exterior	Wt. iron.	Wt. iron.	Wt. iron.	Wt. iron.	Wt. iron.	Wt. iron.
Material — tube	Steel.	Steel.	Steel.	Steel.	Wt. iron.	Steel.
Length — nominal .. inches	142·8	141·5	141·5	125·25	126	126
Length — total .. „	150	148	148	132	133	133
Preponderance (mean) cwt.	4·5	3	2·3	5·5	3	3
Bore — calibre .. .. inches	7	7	7	7	7	7
Bore — length .. .. „	126	126	126	111	111	111
Bore — capacity of unrifled portion cub. ins.	592	560	567	515	560	567
Rifling — system	Woolwich	Woolwich	Woolwich	Woolwich	Woolwich	Woolwich
Rifling — twist in calibres ..	U. 1 in 35	U. 1 in 35	U. 1 in 35	U. 1 in 35	U. 1 in 35	U. 1 in 35
Rifling — length .. inches	112·5	110·5	110·5	97·5	97·5	95·535
Rifling — grooves — number ..	3	3	3	3	3	3
Rifling — grooves — depth ins.	0·18	0·18	0·18	0·18	0·18	0·18
Rifling — grooves — width „	1·5	1·5	1·5	1·5	1·5	1·5
Vent — material	Copper	Copper	Copper	Copper	Copper	Copper
Vent — description	Radial	Radial	Radial	Radial	Radial	Radial
Vent — distance from end of bore inches	8·6	8·6	8·6	8·6	8·6	8·6

These guns should be examined after every 100 rounds.

SIGHTING.

Each gun is provided with 6 sights, viz. :—
2 tangent, 1 centre hind, 2 side fore, and 1 centre fore. The tangent sight bars are four-sided, and are marked as follows :—

For 7-in. 7 tons.

DEGREES.

YARDS.
M.V. 1561 f.s.

For 7-in. 6½ tons.

DEGREES.

M.V. 1175 f.s. { YARDS RED. }  { YARDS RED. } M.V. 1175 f.s.

YARDS.

FULL.

M.V. 1525 f.s.

The Mark V. pattern for the 7-ton gun and the Mark I. for the 6-ton gun are graduated to 15°, and allow deflection to be given 2° right and left.

The centre hind sight is a short scale for use at close quarters and moderate ranges. 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:—

For 7-in. 7 tons.

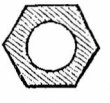
DEGREES.

YARDS.

M.V. 1561 f.s.

For 7-in. 6½ tons.

DEGREES.

YARDS REDD. M.V. 1175 f.s.  YARDS REDD. M.V. 1175 f.s.

YARDS.

FULL.

M.V. 1525 f.s.

The centre hind sights, Mark IV, for 7-ton, and Mark II, for 6½-ton guns, are graduated like the tangent sights belonging to the respective guns, but for shorter maximum range.

The side and centre fore-sights consist of a pillar, collar, and socket. The socket is permanently fixed in 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 removed without first raising the collar and turning the pillar round a quarter of a circle.

The side fore-sight, J pattern, and the centre fore-sight, H pattern, have a steel pillar, into which an acorn apex is screwed. This can be removed by a sight wrench provided for that purpose.

The sights are so arranged that, in laying the gun, the apex of the foresight will be brought clearly in view by taking what is termed a "full sight."

REFLECTING SIGHTS.

(*Pate IV.*)

The Mark III 7-ton gun, when mounted on Mark I or II counter-weight carriages, are furnished with reflecting sights in addition to those previously mentioned. These sights should be removed when not constantly in use, and kept in a dry store.

Instructions for Fitting the Reflecting Sights for 7″, 7 Ton M.L. Gun, Mark III., mounted on Moncrieff Carriage (Mark II.).

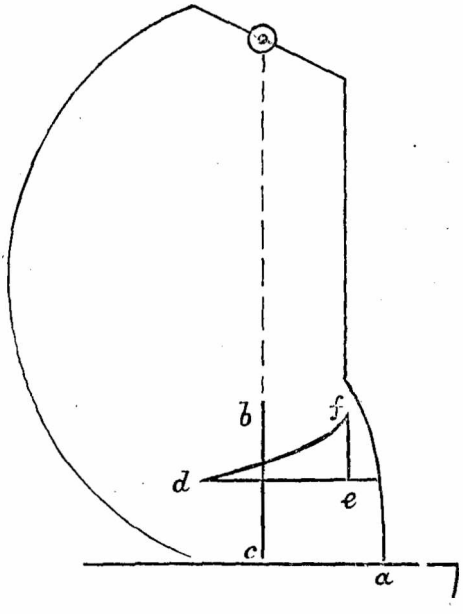
The necessary tools required are:—

Chisels, hand	2
„ cross cut	1
Drilling apparatus of any convenient character obtainable at the Station	1
Drills for the screw holes for fixing trunnion reflector, and for fixing the arc, to be made on the spot	
File, rough, 12-inch, flat	1
„ bastard „ „	1
Hammer, hand	1
Level, quadrant	1
„ spirit	1
Plumb line	1
Straight edge, about 5 feet long, the edges of which are parallel with each other	1
Taps for $\frac{5}{8}$-inch screws.	

The gun must first be run up into firing position, particular care being taken that the front edge *a* of rocker has its full bearing on the platform.

The axis of the bore of the gun is then brought into and fixed in a horizontal plane, by means of the elevating gear. This position of gun is correctly ascertained by introducing a straight edge down the muzzle, allowing a portion to project, and being careful that the narrow edge of straight edge bears well on the bottom of the bore of gun.

A spirit level or quadrant, applied to the projecting end of straight edge, will guide in getting and checking the gun's position.



A plumb bob is now dropped from the centre of the face of right hand trunnion, and, by its help, a vertical line, *b c*, is scribed on the side of the rocker. This line need only start at about eighteen inches from lower edge of rocker, and be continued upwards for a length of two feet, the direction being such that its continuation would pass through the axis of trunnion.

A distance of eighty-two and four-tenths (82·4) is then measured down this vertical line, starting from the axis of trunnion. Through the point thus obtained, a horizontal line, *d e*, is, with the help of the straight edge and spirit level, scribed on the side of rocker. This line should extend to within about six inches of either edge of rocker. Two points are then marked on this horizontal line, the one, *d*, at a distance 28″·04 to the left; the other, *e*, at a distance of 23″·09 to the right of the vertical line *b c*.

From the point *e* on the right, a vertical line is scribed upwards, and a distance of 16″·28 from the horizontal marked *f* on this line.

A short line is lightly scribed on the upper (front) surface of arc, at a distance of $16\frac{5}{8}$ inches from its upper and left hand end.

This line represents a temporary zero line.

The arc is now to be temporarily packed up and wedged or clamped to the side of the rocker, in such position that its lower and left hand corner shall cover the point *d*, and its lower and right hand corner shall come to the point *f*, both these points being squared off the side of rocker to meet the edge of arc.

The sliding or lower mirror is then clamped to the arc with the pointer or reader reading truly to the zero line.

A spot is now marked on the surface of the glass of this lower mirror, in such position that it shall be central to the top and bottom of the glass, but at a distance out from side of rocker of $5\frac{3}{4}$″, this position falling to the left of the imaginary vertical centre between edges of glass.

This spot may be marked on the glass with ink or whitening as most convenient.

The diagram *D* of the centre of sights, either drawn on paper pinned to a board or painted on the board, must now be fixed at some convenient distance in front of the gun, where some temporary arrangement for fixing may be applied. The diagram must be slung with its vertical lines, and also its surface truly vertical, the plumb bob being used to obtain this end.

It must also be fixed in such position that the lines of sight, sighted from the "centre sight" and right hand "tangent sight" of gun, when these are down at zero, shall correspond exactly with the centres of the centre sight and side sight crosses on the diagram.

In the event of the firing position of the gun being such that there is in the line of fire no suitable place upon which some arrangement may be fixed for carrying the diagram, then a spot on any distant object may be selected to take the place of the diagram. In such cases all sight lines will be sighted on this chosen spot as though it were the diagram, the distance of which would render its crosses undistinguishable, the whole verging on the point. Should there, however, be nothing decisive to take for a sighting point, then the carriage must be trained inland until the diagram may be fixed or a distant object seen in the line of gun, when its axis is at zero.

But the fixing of the sights, with the gun out of its firing position, should not be resorted to unless absolutely necessary, as the correctness of this arrangement of reflecting sight depends entirely upon the gun, when run up, retaining its relative position to the rocker and horizontal plane, as it did at the time the arc was fixed and graduated.

This can only occur in any position of training, when the racers are truly in the one horizontal plane, and should the gun have to be

trained round in order to fix the sights, the level of the surface of the racers at the determined position of carriage must be checked by the level of the racers at the firing position of the carriage, and any discrepancy rectified or allowed for.

Hence, also, the necessity every time the rocker is brought into firing position, of seeing that its front edge *A* bears well on the platform.

In the following instructions the diagram will be supposed to have been fixed, the only difference being in the case of a distant object being used in lieu of diagram, that instead of the crosses on diagram or their reflection being seen, they will be replaced by the distant point.

The Upper or Trunnion Reflector, the cross lines on which are already marked, is then fixed to the trunnion by the eye-bolt, and gradually turned until the reflection of its own *horizontal* cross line, and the *horizontal* cross line of the reflecting sight on diagram, shall be seen to cover each other, and also the ink spot on the lower or sliding mirror. As soon as the angle of trunnion reflector has been adjusted to fulfil these conditions, the reflector is firmly fixed against the trunnion, its position on the trunnion marked, as are also the position of the screw holes for the attachment.

The reflection of the centres of the *vertical* cross lines on trunnion reflector and diagram reflecting sight must now be observed, and if they do not cover each other, and also the spot on lower mirror, this spot must be removed, and another placed in such position to the right or left that covering may take place.

The right-handed tangent sight of gun is now raised to and clamped at 11° elevation, the gun is elevated and the carriage trained round, until the 11° line of side sight is brought to bear truly on the centre of the sight cross on diagram.

The lower mirror is now shifted to the right, and clamped in the position where the reflections of the horizontal cross line of trunnion reflector, and of reflecting sight on diagram are seen to cover each other and also the spot on its glass.

A short line on the upper (front) surface of arc is now lightly scribed from the reader or pointer of sliding mirror, this line representing the 11° of elevation.

The temporary lines of zero and 11° elevation now scribed on the upper (front) surface of arc, are then squared down to the side of rocker, and scribed lightly on the upper surface of arc, these two lines being the guiding lines for altering, if necessary, the angle of deflection of the arc; the reflections of the centres of the vertical cross lines must now be observed, and if they also cover each other and the spot, the angle of deflection, that is, the angle between the side of rocker and the face of the arc, is correct.

If these lines do not cover, then another, say smaller spot must be placed either to the right or left, in such position that it is covered by the reflections of the centres of both vertical lines.

The amount that this new small spot is to the right or left of the old spot is the amount of error in the angle of deflection. If it is to the right, the angle of deflection is too large; but if it is to the left this angle is too small.

Taking the three cases:—

Firstly.—Suppose the old spot is found to be covered by the reflections of the centres of the *vertical* lines, and no new spot required to be placed for adjustment, therefore that the bearing of the arc on the

rocker is at the correct angle, then whatever the amount this bearing is afterwards found to have to be reduced, that amount must be chipped off to a parallel line with the bearing, so that the angles of deflection may not be altered.

Now, the amount the bearing strips have to be reduced is the distance of the old spot on the lower mirror from an imaginary vertical centre line between the edges of glass, this distance being measured as near as possible in a perpendicular line to the side of rocker. Call this the "*reducing distance.*"

A line on the upper surface of arc is now scribed parallel to and at the "reducing distance" from the bearing edge of chipping strip. This last line is the one to which the strips must be reduced, in order that the arc may be carried nearer the side of rocker that the reflections of the line of sight may be given off from the *centre* of lower mirror.

Secondly.—Suppose a new spot has to be placed on lower mirror to the right of the old spot; that is, that the angle of deflection is too large. Then the left hand end of arc will have to be carried closer to the side of rocker in order to reduce this angle.

The distance of the new right hand, or smaller spot, from the old spot, is now measured in a perpendicular line to the side of rocker.

This distance is set off on the *zero line* on the upper surface of arc, starting from its bearing edge, giving a point for correcting the angle.

A line scribed through this point, and the bearing edge of arc, at the point where the 11° line cuts the edge, gives the direction of the corrected angle.

A line is now drawn parallel to this, the last line, and at a distance from it of the reducing angle. This will be the line to which edge of chipping strips must be reduced.

Thirdly.—Suppose a new spot has to be placed on sliding mirror to the *left* of the old one, necessitating the right hand end of arc being carried closer to the side of rocker in order to increase the angle of deflection.

The distance of new left hand, or smaller spot, from the old spot, is now measured in a perpendicular line to the side of rocker.

This distance is set off from the bearing edge of arc, along the 11° *line* scribed on upper surface of arc. Through the point thus obtained, and the bearing edge of arc at the point where the zero line cuts the edge, a line is scribed which gives the direction of the corrected angle.

The reducing distance is now set off from the bearing edge of chipping strip, along the *zero line*, and through this point a line on the upper surface of arc is scribed parallel to the new line of direction. This will be the line to which the chipping strips must be reduced.

The arc is now removed from the side of rocker, and the chipping strips reduced down to the line of corrected angle of deflection. It is then fitted to the side of rocker, and again clamped in position, such that its lower and left hand corner covers the point *d*, and its lower and right hand corner covers the point *f*.

The holes for attachment are next drilled, the arc removed, the holes tapped, and, finally, the arc firmly bolted to side of rocker. The heads of bolts, and their corresponding holes in arc are marked.

At the same time, the trunnion reflector is removed, the holes for attachment bored and tapped, and finally the reflector screwed firmly to the trunnion.

The right hand tangent sight is now lowered to zero; the gun depressed to zero, and the carriage trained back, so that the line of sight corresponds with the centre of side sight cross on the diagram.

The lower mirror is cleaned of its spots, and brought into such position that the reflections of the centres of crosses on diagram and on trunnion reflector shall cover each other as near the centre of lower mirror as possible. The centre of the reflections of the cross lines, where they cover each other, is marked on lower mirror by a spot, and through this spot cross lines are drawn in ink on the face of the glass, corresponding to the reflection of the cross lines of trunnion reflector.

The zero line is now scribed from the pointer upon the face of arc.

The gun is next elevated to 11°. by sighting over right hand tangent sight, the carriage being trained until the line of sight corresponds with the centre of side sight cross on diagram.

The lower mirror is then shifted to the right, and clamped in such position that the centre of its temporary cross lines, is covered by the reflections of the centres of the cross lines both of trunnion reflector and reflecting sight on diagram.

The 11° line is scribed from the pointer upon the face of arc.

The gun is now set to 10° elevation, by sighting to the centre of side sight crosses on diagram, the lower mirror brought to meet the reflected centres of crosses, and the 10° line scribed on face of arc.

The same process is gone through for each degree of elevation, until the zero line is again reached.

The straight edge is now inserted into the bore of the gun, and carefully adjusted to the bottom of bore, on which its edge rests.

Its end is to project sufficiently to carry the quadrant level.

The gun is now to be depressed 1°, this position being correctly ascertained by the quadrant level resting on the straight edge in bore of gun.

The lower mirror is then set to correspond with the reflected centres of the cross on trunnion reflector, and the reflecting sight cross on diagram.

The line representing 1° depression is next scribed on face of arc.

The gun is then depressed to two degrees of depression, by the assistance of the quadrant level, a similar process as the last gone through, and so on for each succeeding degree, until five degrees of depression has been scribed on the arc,

The glass of lower mirror is now taken out, and the temporary cross lines on front transferred to the back, by scraping off with a straight edge and knife the mercury for their foundation.

Each division between the degrees scribed on the face of the arc is now divided into six equal parts, the lines and number of degrees are engraved on the arc, as shown on drawing, and the lower mirror is clamped in its zero position.

The gun is once more brought to zero, by a sight line from tangent sight to diagram, and the glass of lower mirror, which has an amount of play between its edges and the brass frame, is set to meet the reflections of the trunnion reflector and diagram crosses.

The spaces between the edges of glass and the frame are now packed in tightly with wood strips, cut to fill the vacancies, care being taken that the cross lines are covered by the reflections.

The metal strips are then screwed down, and the position of the cross lines on lower mirror is engraved on the level edges of the metal strips, so that in the event of a broken glass a new glass may be inserted, and set to position at once by means of these lines on the frame.

The work is now completed.

MISCELLANEOUS FITTINGS.

The Mark III 7-ton gun, when mounted on Mark II counterweight carriages, is fitted with trunnion plates and eyebolts.

The 7 inch 6½-ton guns, Mark I & III, when mounted on garrison sliding medium carriages, No. 7, are furnished with brackets for attaching the graduated arcs.

The "wrench, pivot, No. 4," is supplied for use with the above-mentioned guns for removing the various fittings.

MOUNTINGS.

CARRIAGE, GARRISON, R.M.L. 7″ 7-TONS CASEMATE OR DWARF.

(Iron Sliding.)

PLATFORM, R.M.L. 7″ 7-TONS CASEMATE.

(Traversing, Iron, with Hydraulic Buffer.)

(*Plates V. and VI.*)

These mountings are constructed to fire over a 2 ft. 6 in. parapet with 20° elevation or 5° depression. Those of the earliest manufacture were fitted with the E.O.C. compressor gear to control recoil; but this gear in most cases has been superseded by the compression hydraulic buffer, which will eventually be fitted to all mountings of this description.

The carriage consists of two double plate brackets, connected by a front transom and a bottom plate. The bottom plate is further strengthened by two knee stays at the rear, and, if the carriage had been originally fitted for the E.O.C. compressor, with an angle-iron bar just in rear of the opening for the plates. The under side is fitted with a wrought-iron bracket for the buffer piston rod, and with two angle-iron guides, the rear ends of which are bent round at right angles to form carriage stops. The carriage is fitted with four metal rollers. The rear ones run on an eccentric shaft, the ends of which are cut hexagonally to take bent lever sockets for iron-pointed levers. The eccentric shaft is supported in the centre by a metal bracket bolted to the bottom plate, and at the ends is kept in its place by wrought-iron drop plates, which are bolted to the bracket sides, so that they can be readily unfastened to admit of the removal of the shaft. The sockets are each fitted with a pawl, and the carriage with stops, to keep the latter on its rollers when "running back."

The elevating gear consists of a wrought-iron capstan head on the outside of each carriage bracket, on a spindle which passes through the bracket, and carries, inside, a pinion which gears with an arc

pivoted to the gun. The capstan head is turned by an iron-pointed lever and is clamped by a jamming clamp, which works on a thread cut on the spindle. The arc is kept in gear with the pinion by a metal friction roller. The principal fittings on the carriage are metal trunnion bearings; wrought-iron capsquares with keys; bracket loops; clip plates; a stud for the preventor rope; and a socket for the pricker.

The platform consists of two sides of girder iron, 10″ deep and 5½″ wide, with the front ends bent round to form a breast. The girders are connected by front and rear transoms and bottom plates, as well as by an iron diagonal stay; a top plate is bolted over the breast.

The hydraulic buffer is attached to the platform by two holding-down bands, one of which is bolted to the rear bottom plate, and the other (the front) to a bearing plate fixed across the diagonal stay, which supports the front of the buffer. Leather packing pieces are placed between the bands and the buffer, and a set screw is fitted in the front band to prevent the buffer turning.

The buffer consists of a wrought-iron cylinder,* closed at the rear end with a cast-iron cap; at the front with a cast-iron flange and cover. The cover is formed with a stuffing-box for the packing, which is tightened up by a metal gland. Beneath the gland on the cover is a metal run-off cock, and at the rear end is a filling hole with plug. The piston and rod are of wrought iron; the piston, which is screwed on the rod, is 8·04 ins. in diameter, with three† holes, each 1·25 ins. in diameter, for the passage of the fluid.

The principal fittings on the platform are—A wood bollard at the rear for the preventor rope; a front buffer stop with four indiarubber buffers; two rear buffer stops; brackets for side arms and for iron pointed levers; traversing loops, and a sponge tank.

Footboards are placed on either side of the hydraulic buffer, and a moveable platform board is fitted at the rear for No. 1 to stand on.

Mountings fitted with the E.O.C. compressor differ but slightly from those fitted with the hydraulic buffer.

The E.O.C. compressor consists of seven iron plates, suspended from the carriage through an opening in the bottom plate so as to hang outside, and between iron bars fitted to the platform. The plates and bars are compressed together by rocking levers moved by a compressing and an adjusting nut fitted on a screw shaft which has a compressing lever fitted on its end, outside the right bracket of the carriage. By pushing down the compressing lever, both nuts travel outwards along the screw shaft, and force the lower arms of the rocking levers nwards, thus jamming the plates and bars together. The compression is regulated by raising or lowering an adjusting lever placed outside the left bracket, and keying it on its arc, when the adjusting nut gives the requisite compression.

The compressing lever should be worked by hand, but to ensure it acting automatically its lower end projects downwards to engage with a tripper on the platform, when the gun recoils.

The proper amount of compression is attained when one man can just force the compressing lever beneath its catch.

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* These cylinders will in future be made of steel.

† Until lately there were four holes, but one is now ordered to be plugged up.

Carriage, Garrison, R.M.L. 7″ 7-tons Casemate or Dwarf.

(Iron Sliding.)

Platform, R.M.L. 7″ 7-tons Dwarf.

(Traversing, Iron, with Hydraulic Buffer.)

(*Plates VII. and VIII.*)

These mountings are similar to those described for the casemate, differing principally in the height of the platform, which is raised to enable the gun to be fired over a 4 ft. 3 in. parapet.

On platforms for "A" pivot this height is obtained by using 18 in. trucks in front and 24 in. trucks in rear, also by placing a block of sabicu 5·25 ins. thick, with an inch plate on it, between the sides and the front truck plate, and inserting iron knee stays between the sides and the rear truck plate.

Platforms for "C" pivot have angular packing pieces and knee stays between the front and rear truck plates and the sides, and 24-in. trucks are used both in front and rear. A longitudinal pivot plate and a cross stay are added to the platform, and through them is a hole to suit an actual pivot.

Dwarf "D" platforms differ from dwarf "C" in having 18-in. trucks in rear instead of 24-in.; and, in addition to a knee stay, a sabicu block and iron plate are placed between each side and the rear truck plate. The hole in the pivot plate is just in front of the rear truck plate.

Weights.

Carriage			27 cwt. 3 qr.
Platform	casemate		53 „ 0 „
	dwarf	A pivot	77 „ 3 „
		C „	80 „ 3 „
		D „	80 „ 3 „

Carriage, Garrison, R.M.L. 7″ 7-tons S. Plate, Casemate or Dwarf. (Iron Sliding.)

Platform, R.M.L. 7″ 7-tons Casemate S. Plate.

(Traversing Iron.)

Platform, R.M.L. 7″ 7-tons Dwarf S. Plate.

(Traversing Iron.)

(*Plates IX. and X.*)

This carriage consists of two "single plate" brackets, connected by a transom and a bottom plate. The carriage is strengthened by two wrought-iron knee stays bolted at the rear and an angle iron stay riveted across the bottom plate.

The brackets are each formed by riveting an iron plate to the outside of an angle-iron frame, and a stay of T-iron.

In other respects the carriage is similar in its fittings to that of the "double plate" construction.

The platforms are similar to those described for the "double plate" carriages, but some of the early issues were made with 5° slope instead of 4°. The principal difference is in the trucks, which are of less diameter; consequently longer truck flanges are fitted to the platform to raise it to the necessary height for the respective parapets.

Weights.

Carriage	casemate	27	cwt. 3	qr.
	dwarf	29	,, 0	,,
Platform	casemate	55	,, 2	,,
	dwarf A or D pivot	69	,, 2	,,

Carriage, Garrison, Sliding, Medium No. 7.
(Iron R.M.L. 7″ 6½ tons 6 ft. Parapet for Platform No. 7.)

Platform, Traversing, Medium No. 7.
(Iron R.M.L. 7″ 6½ tons 6 ft. Parapet for Carriage No. 7.)

(*Plate XI.*)

These mountings are constructed to fire over a 6 ft. parapet with 30° elevation or 5° depression, and to allow a depression of 19° for under-cover loading.

The carriage is fitted with a tension buffer, to control recoil, and with ten rollers to ensure its running out when released from a brake fitted to the platform.

The platform is fitted with a "running back gear," and with a "brake gear" which automatically holds the carriage on recoil and controls it when "running up."

The carriage consists of two double plate brackets connected by two transoms, and a bottom plate. Each bracket is made by riveting two wrought-iron plates to a framing of cast iron, and is formed at the top to take a metal trunnion bearing. The brackets are strengthened with wrought-iron strips along the inner sides, and are fitted with wrought-iron eccentric bearings for the steel roller axles, and with wrought-iron clip plates to prevent the carriage jumping when firing.

The rollers are of steel with phosphor bronze bushes.

The bottom plate is riveted to the side brackets, above the rollers, and has a cast-iron rack fixed centrally along the underside for the spur wheel of the brake gear.

Elevating gear is fitted on both sides and is worked from the front of the carriage. It consists on each side of a metal hand wheel, transmitting motion through a shaft, bevel wheels and spur pinions, on the inner side of the bracket, to an arc pivoted to the breech of the gun. The gear is clamped by a jamming lever, with one thread of a screw on its face acting against a corresponding face of the spindle pinion bearing.

A graduated metal arc attached to the chase of the gun, and a pointer fitted to a cross bar fixed on the front of the carriage, indicate the elevation or depression given to the gun.

The hydraulic buffer is fixed centrally along the top of the bottom plate by its front cap and an iron band. The piston rod is secured to a wrought-iron bracket fixed to the front of the platform.

The buffer consists of a wrought-iron cylinder* closed at the rear by a wrought-iron cap, and at the front by a metal cap which is cast with a stuffing-box for the packing, and with flanges by which it is bolted to the bottom plate.

The piston rod is of wrought iron, 7 ft. 4 in. long and 2½ ins. diameter. The piston, which is screwed on the rod, is 6·05 ins. diameter and 2 ins. thick. It has four holes, each ·6 in. diameter.

The platform consists of two girders, connected by two transoms, of wrought iron.

Truck brackets of malleable cast iron are bolted to the girders, and are connected in front and rear by wrought-iron truck and vertical plates.

The trucks run on steel axles, held in malleable cast-iron flanges, which are secured to the truck brackets by central bolts fastened in position by keys. There is a feather in each flange which fits into one of four notches in the truck plate, so that the trucks can be turned to suit either A, C, E, or F pivots.

A pivot plate is fixed to the front vertical plate and to the underside of the rear truck plate. This plate is bored for C, E, and F pivots.

The brake gear consists of a malleable cast-iron spur wheel on a cross-shaft, gearing into the rack beneath the carriage. The rim on the right side of this wheel is turned to form a brake drum, which is fitted with a differential brake band and levers, so arranged as to permit the carriage to run back freely, and then, by tightening, automatically to retain it after recoil.

The brake band is slackened by lifting a lever on the left side, so as to control the running up.

The running-back gear consists of a wheel and pinion, gearing into the spur wheel of the brake gear, and worked by winch handles on both sides of the platform. A clutch on the pinion shaft engages the pinion gearing into the brake wheel, and so connects or disconnects it from the brake gear.

A loading derrick is fitted on the left girder of the platform. The projectile is placed in a removeable bearer, which is then lifted on to the derrick; and the derrick is swung round to the muzzle of the gun, when the latter is run back and depressed for loading.

The platform is fitted with front and rear buffer stops, wood side steps, a sponge tank, and brackets for the side arms.

The pivot block (No. 3) is 3′ 4″·75 in height. It must be set so as to stand 1′ 6″·375 above the top of the racers.

Height	Carriage, centre of trunnions	4 ft. 0 in.
	Platform „ „	3 „ 1 „
Space for recoil	.. .. ..	6 „ 0 „

Radii of racers	A	Front 5 ft. 0 in.	Rear	16 ft. 6 in.
	C	„ 6 „ 1 „	„	6 „ 1 „
	E	„ 10 „ 8·25	„	2 „ 2 „
	F	„ 12 „ 10	„	2 „ 2 „

Weights.

Carriage	54 cwt. 1 qr.
Platform	75 „ 1 „

* These cylinders will in future be of steel.

Carriage, Garrison, R.M.L. 7″, 6½ Tons, Single Plate.

(Iron sliding converted Naval).

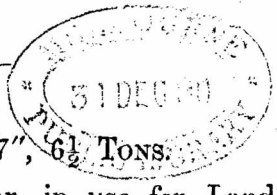
A number of naval carriages have been adapted for land service.

These carriages were originally fitted with the E. O. C. compressor, but this gear is now superseded by a hydraulic buffer in compression. For this purpose the bottom plate has been filled up and strengthened in front, and a wrought-iron bracket has been fitted on the underside for the attachment of the piston rod

The short axles for the rear rollers are removed and replaced by a rear eccentric shaft, which is attached to the carriage by a central bracket and drop plate. Stop plates for iron-pointed levers are added, and sockets for iron-pointed levers are fitted to the shaft, of the same pattern as those previously described.

These carriages are mounted on dwarf platforms for "C" and "D" pivots, already described (page 12).

Weight of carriage, 27 cwt. 2 qrs.



Carriage, Naval, R.M.L. 7″, 6½ Tons.

(Iron sliding, with Compressor Gear, in use for Land Service at certain Stations.)

Platform, R.M.L. 7″, 6½ Tons. Land Service.

(Iron, with Compressor Gear.)

A certain number of the above mountings have been appropriated for land service. The carriages, whether single or double plate, are very nearly identical with those already described, and are fitted with the E. O. C. compressor gear to control recoil.

They are furnished with the following fittings, viz.:—A bollard on the rear of each bracket, a metal sheave in an iron bracket on each side, a loop upon the front transom, and sockets to admit of the use of metal roller handspikes if required.

The platforms are formed of wrought-iron girders, connected by transoms in a similar way to the platforms, but they have a length of 12 feet only. They are fitted with the compressor gear, stops, and other fittings, similar to the platforms.

These platforms were made with the usual slope of 1½°, but this has been altered by the addition of brackets on the underside to a slope of 4°.

Mountings not altered to 4° slope will require a breeching rope when firing. This rope must be passed through the breeching bushes of the carriage, and firmly secured to loops in the work.

Weight	Carriage	27 cwt. 1 qr.
	Slide	37 „ 1 „

Carriage, Garrison, R.M.L. 7″, 6½ Tons.
(Converted from Naval. Iron, with hydraulic buffer.)

Platform, R.M.L. 7″, 6½ Tons, L.S.
(Converted from Naval Slide. Iron, for hydraulic buffer, 4° slope.)

These mountings are the naval carriage and slide already described, with the compressor gear removed, and a hydraulic buffer in tension substituted to control recoil.

The hydraulic buffer is fixed along the underside of the bottom plate by a wrought-iron bracket and band, and the piston rod is secured to the breast of the slide by a nut.

The hole in the bottom plate for the compressor gear is filled up with an iron plate, to admit of the attachment of the buffer.

The platform is strengthened by wrought-iron plates riveted along the girders and on the breast; one is also fixed along the underside of the front.

Pivot plates to suit 4° slope take the place of the existing plates; and cast-iron rollers are substituted for the metal ones.

The buffer consists of a steel tube 4·052 ins. internal diameter, and 5 ft. 2 in. long, fitted at each end with wrought-iron caps. A stuffing-box is formed in the front cap, and fitted with a metal gland and ring for the leather and cotton packing.

The piston and rod are in one forging; the rod is 2 ins. in diameter, the piston is 4·04 ins. diameter, with three holes for the passage of the fluid, each ·3 in. diameter.

Weight	Carriage	32 cwt.
	Platform	39 „

Racers.

The racers for 7″ or 9″ platforms are of wrought iron, and of the same section, viz.: 2¼″ deep and 2·78″ wide, with a flange ¾″ deep at the bottom of each side.

The radii of the racers are as follows:—

Pivot.	Front. ft.	Front. in.	Rear. ft.	Rear. in.
"A"	6	3	16	6
"C"	5	5¾	5	5¾
"D"	9	0	2	3¾

Hand Posts and Sighting Steps.

(List of Changes, § 5248.)

(*Plate XII.*)

These will be added to all platforms on sea faces, to enable No. 1 to look over the sights at a moving object up to the moment of firing.

They will not, however, be suitable for platforms with rear traversing gear. All demands must specify the nature of platform for which

the fittings are required, and the minimum distance between the rear of the platform and the work. The plate shows the attachment of two side posts, and steps to the 6½-ton gun 6-ft. parapet platform, the hydraulic buffer of which projects beyond the rear of the carriage, and would therefore foul a central post with which most platforms would be fitted.

Carriages, Garrison, R.M.L., 7 inch, 7 tons, Moncrieff, Mark I. and Mark II.

(Plates XIII, XIV, XV, and XVI.)

The principles of the Moncrieff garrison carriages are :—

1st. To obtain cover for the gun detachments by enabling the gun to recoil under a solid parapet, for loading.

2nd. To store up the force of recoil, and utilize it for raising the gun from the loading to the firing position.

These objects are attained by mounting the gun in a carriage attached to an elevator, or, into an elevator direct. In either case the gun in recoiling raises a counterweight. The form of the elevator is such that it rolls back on recoil along the top of the platform, the counterweight acting against the gun with increasing leverage.

The gun is held down by racks and brake gear, and is raised from the loading to the firing position by the force of gravity in the counterweight, when the brake gear is released.

Moncrieff carriages for 7-inch guns are constructed of wrought iron; there are two descriptions in the service.

In the first pattern, or Mark I, the gun is mounted in a carriage distinct from the elevator, and is loaded over the counterweight.

In the second pattern, or Mark II, the gun is mounted in the elevator, and is loaded under the counterweight.

In Mark I the carriage proper is formed of two brackets connected by two transoms and an axletree.

The brackets are formed of two plates of wrought iron rivetted on each side of a wrought-iron frame.

The carriage is fitted with metal trunnion bearings to support the gun, bearings to receive the shaft connecting it to the elevator, and at the rear with a wrought-iron axletree with wrought-iron trucks; and is fitted with elevating gear, and steps for laying the gun direct.

The elevator Mark I is formed of two sides connected by a transom, and at the lower end by wrought-iron boxes containing the counterweight.

The sides of the elevator are formed of two plates of wrought iron, rivetted to a wrought-iron frame, the rear edges are curved and have teeth cut in them to fit corresponding spaces in the racks on the platform to prevent slip.

The counterweight boxes (3) are bolted between the sides, they are packed with pieces of cast iron and wood of sufficient weight to raise the gun from the loading to the firing position.

The main shaft connecting the carriage to the elevator passes through metal bouched holes in the end opposite to the counter-weight.

A cycloidal rack is bolted to each side of the elevator into which pinions are geared to retain the gun in the loading position.

A shot guide is fixed on the cover of the centre counterweight box.

The elevator or carriage, Mark II, is constructed of two double plate sides (as Mark I).

They are connected at the lower part to the counterweight by horizontal bolts.

The rear edges of the carriage have teeth cut in them, similar to Mark I, and for the same purpose.

The counterweight consists of four blocks of cast iron.

In the upper part of the elevators are cylindrical metal bearings for the trunnions of the gun, which is secured in position by capsquares.

Platform, Mark I.

Is of girder iron connected by transoms.

It is 16 feet long, is made horizontal, and is supported on four wrought-iron flat-soled trucks running in wrought-iron flanged feet, and is traversed by gear driving the front and rear left-hand trucks. Guides are fixed to the platform sides for the trucks of the carriage to rest upon; also walls to support the gear, and a guide rack is fixed on the top of each side with recesses to correspond with the teeth on the elevator.

The platform is arranged for "D" pivot.

Platform, Mark II.

The sides are formed of two pieces of channel iron, rivetted by their flanges to a top and bottom plate. The sides are connected by transoms of angle iron rivetted to a central plate.

The platform is 17 feet long, horizontal, and supported on four cast-iron trucks running in cast-iron flanges, and traversed by gear driving either the front or rear right-hand truck. A guide rack is fixed on the top of each side, with recesses to correspond with the teeth on the elevator or carriage.

The platform is arranged for "D" pivot.

Elevating Gear.

In Mark I carriages the elevating gear is fixed in the carriage proper.

It consists of an endless screw and worm wheel, driving a shaft having pinions geared into the elevating arcs attached to the gun by the usual service pivots.

The worm wheel is fitted with two friction cones arranged on the shaft so as to exert friction on the worm wheel, which can be adjusted by the nuts on the shaft. A slight slip (about 2°) should be allowed when the gun is fired to lessen the strain on the gear.

The worm is worked by a hand wheel either in front or rear of the carriage, and is fitted with a clamping arrangement.

The right elevating arc is graduated, and a pointer fixed on the right bracket, so that while turning the rear elevating wheel the angle of elevation or depression can be read.

In Mark II the elevating gear is attached principally to the platform.

It consists of a long guide, along the centre of the platform, pivoted at the rear and with an arc under the front; this arc is geared

with a pinion moved by a worm wheel with friction cones (as Mark I) driven by a worm and hand wheel on the right side of the platform.

Pivoted to the elevator or carriage are two radius bars supporting, near their centre, a rod jointed to a bracket under the gun; and at the rear end carrying a roller which moves along a slot in the guide.

Elevation or depression is given to the gun by raising or lowering the guide.

During recoil, the roller in the elevating guide is carried by the radius bars to the rear of the slot; and, as the elevating guide is pivoted at the rear, the gun always comes to P.B. when in the loading position.

A graduated brass plate is fixed on the outside friction cone of the worm wheel, and a pointer to the platform, to register the elevation or depression.

Retaining Gear.

In Mark I carriages the retaining gear consists of a cycloidal rack fixed to the outside of the elevator on each side; a pinion is geared to this rack having on the same shaft a brake wheel with an internal ratchet wheel and pawls, arranged to allow the shaft with the ratchet wheel to revolve in one direction (during recoil) without resistance, but prevented from turning in the opposite direction by the pawls acting on the rim of the brake wheel which is held by a band and counterweighted lever. To run up, the lever must be raised.

The two brake levers are connected to a cross shaft with a handle on either side of the platform, so that both brakes can be raised by one man.

A plate attached to the front of each wall can be used to lock the brakes, when required, by lowering it to press on the crank of the connecting shaft and securing it by the set screw.

In Mark II the gear consists of a straight rack sliding along on each side of the platform connected to the outside of the carriage by a rod. The racks have ratchet teeth cut on the top and spur teeth on the under side, which latter gear into pinions on a cross shaft, having a brake wheel on each end (the brake wheels are similar to those for Mark I) and also a spur wheel for the hauling down gear for drill.

The brake levers are connected (as in Mark I) by cranks to a cross shaft worked by a lever on either side near the rear of the platform.

Hauling down or Running back Gear.

This gear will be replaced by a similar arrangement to that on the Mark II, to facilitate hauling down.

In Mark I it consists of a pawl wheel keyed on each pinion shaft of the retaining gear, and a socket with pawl for iron pointed lever outside each pawl wheel. The iron pointed levers are of a special pattern and are secured in the socket by a screwed pin.

A pawl is fitted on each side of the platform to engage in the teeth on the top of the rack when required.

In Mark II it consists of a wrought-iron spur wheel, keyed on near the end of the main shaft of the retaining gear; and wrought-iron spur pinions with ratchet wheels and sockets for iron pointed levers are arranged with clutches, to gear into the wheels when required for hauling down.

Traversing Gear.

In Mark I it consists of a combination of spur and bevil gearing acting on the spindles of the front and rear trucks on the left side; so arranged as to turn them in opposite directions, and at the speed required by the different radii of the trucks from the pivot.

In Mark II it consists of a bevil wheel cast on one side of both trucks on the left side of the platform; into each of these is geared a pinion having a bevil wheel keyed on the same shaft; the wheel is driven by a bevil pinion on the winch handle shaft.

The bevil wheels are of different diameters so that, in traversing the front and rear, the winch handles travel at the same speed.

Loading Gear.

In Mark I a shot guide is fixed on the lid of the centre counter-weight box to guide the projectile into the bore. A wood stage is fixed across the front of the platforms, and a small swinging stage on each side near the front for the numbers to stand upon when loading.

In Mark II a wood stage is fixed between the sides of the platform on which are two angle guides. The projectile is brought up on the truck and pushed along the angle guides to the centre of the platform; a selvagee is passed round the projectile and hooked to a chain rove through two sheaves under the counter-weight, and leading through one on the stage to the outside of the platform, by means of which the projectile is raised to the muzzle of the gun.

Two wooden trays for side arms are secured on the top of the transoms inside the sides.

Racers.

For Mark I they are of wrought iron without flanges, $2\frac{7}{8}$ inches wide and $2\frac{1}{4}$ inches thick, secured to bedding plates made of sufficient length to secure to both front and rear racer.

For Mark II racers of wrought iron have been approved, 7 inches wide and $1\frac{1}{4}$ inch thick, secured by screws into stone, with a plate 12 inches long, 7 inches wide, and 1 inch thick, to strengthen the joints; also, when required to be bedded in concrete, cast-iron sweep plates have been used, 1 foot 6 inches wide, $1\frac{1}{2}$ inch thick, and strengthened by ribs 4 inches deep.

	Radii to centre of			
	Racers.		Sweep plates.	
	Front.	Rear.	Front.	Rear.
Mark I.	8′ 3½″	5′ 8½″ ..	—	—
Mark II.	9′ 10″	5′ 7½″ ..	9′ 10″	5′ 7½″

Graduated Arc and Pointer.

Mark I has no graduated arc, but a pointer is fitted across the rear racer. In Mark II a graduated arc of zinc 1·5 inch wide and 0·1 inch thick is recessed into both the front and rear sweep plates, and a pointer is attached to the front and rear flange feet on the left side, to indicate the angle of traverse.

Pivots.

In Mark I the pivot block is of cast iron in two parts, bolted together; the lower part is bedded in the concrete foundation.

The pivot is driven tightly into the upper part and fits a suitable socket on the platform.

In Mark II the pivot block is similar, but the pivot bolt passes through a socket in the platform and fits loosely in the pivot block so that it can be withdrawn when required.

	Mark I.	Mark II.
	ft. ins.	ft. ins.
Height to centre of gun in firing position	10 11¾	12 3½
Height of parapet	9 10½	11 0
Elevation (maximum)	15°	15°
Depression „	5°	5°
	tons.	tons.
Weight — Carriage	1·7	3·02
Weight — Elevator	5·95	—
Weight — Platform and Gear	5·6	8·43
Weight — Counterweight	8·18	11·46

Nomenclature of Parts.

Description.	Reference in Plates. XIII, XIV, Mark I.	Reference in Plates. XV, XVI, Mark II.
Carriage. A.		
Bearings, metal — cylindrical, trunnion	..	A^1
Bearings, metal — with screws, shaft — elevating	A^1	
Bearings, metal — with screws, shaft — connecting	A^2	
Brackets, metal, with bolts and screws — shaft, elevating	A^3	
Brackets, metal, with bolts and screws — spindle, worm — centre	A^4	
Brackets, metal, with bolts and screws — spindle, worm — front	A^5	
Brackets, metal, with bolts and screws — spindle, worm — rear	A^6	
Capsquares, wrought-iron — left	A^7	A^2
Capsquares, wrought-iron — right	A^8	A^3
Carriages, body, iron — without fittings	A	
Carriages, body, iron — without fittings, with counterweight	..	A
Collars, wrought-iron, axletree, with screws	A^9	
Guides, wrought-iron, arc, elevating	A^{10}	
Loops, wrought-iron, lifting, counterweight	..	A^4
Rollers, wrought-iron	A^{11}	
Screws, wrought-iron — capsquare	A^{12}	A^5
Screws, wrought-iron — preserving	..	A^6
Stage, laying, complete	A^{13}	
Steps, side, complete — left	A^{14}	
Steps, side, complete — right	A^{15}	
Elevator. B.		
Elevator, body, wrought-iron, without fittings, with counterweight	B	
Guards, wrought-iron, turning, stage, loading	B^1	
Guides, wrought-iron, shot	B^2	
Screws, wrought-iron, securing loop washer	B^3	
Shaft, wrought-iron, connecting	B^4	
Washers, wrought-iron, loop, connecting shaft	B^5	

NOMENCLATURE OF PARTS—continued.

Description.	Reference in Plates. XIII, XIV, Mark I.	Reference in Plates. XV, XVI, Mark II.
PLATFORM. C.		
Axles for trucks — steel — bevil wheel	C^1	
Axles for trucks — steel — with nuts, plain	C^2	
Axles for trucks — wrought-iron, with collars and pins — bevil wheel	..	C^1
Axles for trucks — wrought-iron, with collars and pins — plain	..	C^2
Bearings, metal, with bolts or screws — flanges for trucks — front — inside	C^3	
Bearings, metal, with bolts or screws — flanges for trucks — front — outside	C^4	
Bearings, metal, with bolts or screws — flanges for trucks — rear — inside	C^5	
Bearings, metal, with bolts or screws — flanges for trucks — rear — outside	C^6	
Bearings, metal, with bolts or screws — shafts — main — inside	..	C^3
Bearings, metal, with bolts or screws — shafts — main — outside	..	C^4
Bearings, metal, with bolts or screws — shafts — 2nd motion	C^7	
Bearings, metal, with bolts or screws — shafts — longitudinal, long	C^8	
Bearings, metal, with bolts or screws — spindle — for clutch, pinions — left	..	C^5
Bearings, metal, with bolts or screws — spindle — for clutch, pinions — right	..	C^6
Bollards complete, with ratchet wheel — left	C^9	C^7
Bollards complete, with ratchet wheel — right	C^{10}	C^8
Bolts, wrought-iron cap, pinion, spindle, rack, retaining, with 2 nuts	C^{11}	
Brackets, complete with bolts and screws — cast iron — hook, preventor — left	C^{12}	
Brackets, complete with bolts and screws — cast iron — hook, preventor — right	C^{13}	
Brackets, complete with bolts and screws — cast iron — pinion spindle — elevating, outside	..	C^9
Brackets, complete with bolts and screws — cast iron — pinion spindle — rack, retaining	C^{14}	
Brackets, complete with bolts and screws — cast iron — pinion spindle — bevil, for trucks — front	..	C^{10}
Brackets, complete with bolts and screws — cast iron — pinion spindle — bevil, for trucks — rear	..	C^{11}
Brackets, complete with bolts and screws — cast iron — bevil winch handle — front — inside	..	C^{12}
Brackets, complete with bolts and screws — cast iron — bevil winch handle — front — outside	..	C^{13}
Brackets, complete with bolts and screws — cast iron — bevil winch handle — rear — inside	..	C^{14}
Brackets, complete with bolts and screws — cast iron — bevil winch handle — rear — outside	..	C^{15}
Brackets, complete with bolts and screws — cast iron — shafts — connecting brake levers — left	C^{15}	C^{16}
Brackets, complete with bolts and screws — cast iron — shafts — connecting brake levers — right	C^{16}	C^{17}
Brackets, complete with bolts and screws — cast iron — shafts — longitudinal — long — intermediate — front	C^{17}	
Brackets, complete with bolts and screws — cast iron — shafts — longitudinal — long — intermediate — rear	C^{18}	
Brackets, complete with bolts and screws — cast iron — shafts — longitudinal — long — rear	C^{19}	
Brackets, complete with bolts and screws — cast iron — shafts — longitudinal — short — front	C^{20}	
Brackets, complete with bolts and screws — cast iron — shafts — longitudinal — short — rear	C^{21}	
Brackets, complete with bolts and screws — cast iron — shafts — vertical — top	C^{22}	
Brackets, complete with bolts and screws — cast iron — shafts — vertical — bottom	C^{23}	
Brackets, complete with bolts and screws — cast iron — spindle, worm	..	C^{18}
Brackets, complete with bolts and screws — cast iron — stages, loading — left	C^{24}	
Brackets, complete with bolts and screws — cast iron — stages, loading — right	C^{25}	
Brackets, complete with bolts and screws — metal — rack, retaining — left	C^{26}	
Brackets, complete with bolts and screws — metal — rack, retaining — right	C^{27}	
Brackets, complete with bolts and screws — metal — pinion, spindle — spur, winch handle — left	C^{28}	
Brackets, complete with bolts and screws — metal — pinion, spindle — spur, winch handle — right	C^{29}	
Brackets, complete with bolts and screws — metal — spindle for clutch pinion — left	..	C^{19}
Brackets, complete with bolts and screws — metal — spindle for clutch pinion — right	..	C^{20}
Brackets, complete with bolts and screws — wrought-iron, guide — elevating — left	..	C^{21}
Brackets, complete with bolts and screws — wrought-iron, guide — elevating — right	..	C^{22}
Brackets, complete with bolts and screws — wrought-iron, guide — hook, preventor — left	C^{30}	
Brackets, complete with bolts and screws — wrought-iron, guide — hook, preventor — right	C^{31}	

NOMENCLATURE OF PARTS—continued.

Description.	Reference in Plates. XIII, XIV, Mark I.	XV, XVI, Mark II.
PLATFORM, C.—*continued.*		
Brackets, complete with bolts and screws, wrought-iron. — pinion, spindle, elevating, and friction roller — left	..	C^{23}
Brackets, complete with bolts and screws, wrought-iron. — pinion, spindle, elevating, and friction roller — right	..	C^{24}
Brackets, complete with bolts and screws, wrought-iron. — shaft — cross, 2nd motion	C^{32}	
Brackets, complete with bolts and screws, wrought-iron. — shaft — longitudinal, long, front	C^{33}	
Brackets, complete with bolts and screws, wrought-iron. — sheave, loading, gear, pair — bottom	..	C^{25}
Brackets, complete with bolts and screws, wrought-iron. — sheave, loading, gear, pair — centre	..	C^{26}
Brackets, complete with bolts and screws, wrought-iron. — sheave, loading, gear, pair — top	..	C^{27}
Flanges for trucks, — cast-iron — front — left	..	C^{28}
Flanges for trucks, — cast-iron — front — right	..	C^{29}
Flanges for trucks, — cast-iron — rear — left	..	C^{30}
Flanges for trucks, — cast-iron — rear — right	..	C^{31}
Flanges for trucks, — wrought-iron pairs — front — left	C^{34}	
Flanges for trucks, — wrought-iron pairs — front — right	C^{35}	
Flanges for trucks, — wrought-iron pairs — rear — left	C^{36}	
Flanges for trucks, — wrought-iron pairs — rear — right	C^{37}	
Ladders, wrought-iron, with bolts and stays — left	C^{38}	C^{32}
Ladders, wrought-iron, with bolts and stays — right	C^{39}	
Pawls, wrought-iron, bollard — left	C^{40}	C^{33}
Pawls, wrought-iron, bollard — right	C^{41}	C^{34}
Platform, body, wrought-iron, without fittings	C	C
Pointers, wrought-iron, with screws — and steel plate, rear	C^{42}	
Pointers, wrought-iron, with screws — and steel plate — front	..	C^{35}
Pointers, wrought-iron, with screws — and steel plate — rear	..	C^{36}
Spindles, wrought-iron, bollard, with — collar, nuts, and screws	..	C^{3}
Spindles, wrought-iron, bollard, with — nuts	C^{43}	
Stages, wood, with stays — landing — left	C^{44}	C^{38}
Stages, wood, with stays — landing — right	C^{45}	
Stages, wood, with stays — loading — central		C^{39}
Stages, wood, with stays — loading — front	C^{46}	
Stages, wood, with stays — loading — left	C^{47}	
Stages, wood, with stays — loading — right	C^{48}	
Studs, wrought-iron, pawl, bollard, with collars, nuts, and — pins	..	C^{40}
Studs, wrought-iron, pawl, bollard, with collars, nuts, and — screws	C^{49}	
Trays, wood, side-arm	..	C^{41}
Trucks — cast-iron — plain, front or rear, right, 21 inches diameter	..	C^{42}
Trucks — cast-iron — with bevil, wheel, left — front 21 inches diameter	..	C^{43}
Trucks — cast-iron — with bevil, wheel, left — rear ditto	..	C^{44}
Trucks — wrought-iron, plain — left 16 inches diameter	C^{50}	
Trucks — wrought-iron, plain — right ditto	C^{51}	
GEAR, ELEVATING. D.		
Arcs, elevating, wrought-iron — left	D^{1}	
Arcs, elevating, wrought-iron — right	D^{2}	
Bars, wrought-iron, radius, complete — left	..	D
Bars, wrought-iron, radius, complete — right	..	D^{2}
Collars, wrought-iron — bar, radius	..	D^{3}
Collars, wrought-iron — jamming	D^{3}	
Cones, cast-iron, friction — inside	D^{4}	D^{4}
Cones, cast-iron, friction — outside	D^{5}	D^{5}
Covers, wrought-iron, complete, worm wheel	..	D^{6}
Guides, wrought-iron, elevating, with arc, central	..	D
Levers, wrought-iron, jamming, with set screw	D^{6}	

NOMENCLATURE OF PARTS—continued.

Description.	Reference in Plates. XIII, XIV, Mark I.	XV, XVI, Mark II.
GEAR ELEVATING. D.—*continued.*		
Pinions, wrought-iron, elevating { left	D7	
Pinions, wrought-iron, elevating { right	D8	
Pinions, wrought-iron, elevating { with spindle and nut	..	D8
Pins, wrought-iron, with collar and pin { guide, elevating	..	D9
Pins, wrought-iron, with collar and pin { rod, connecting	..	D10
Plate, metal, indicator, with screws	..	D11
Pointer { steel, elevating arc	D9	
Pointer { wrought-iron indicator	..	D12
Rod, wrought-iron, connecting, central, with bolts	..	D13
Rollers, friction, { cast-iron, arc, elevating	..	D14
Rollers, friction, { wrought-iron, elevating	..	D15
Screws, wrought-iron, jamming, spindle, worm	D10	
Shaft, wrought-iron, with key and nuts	D11	
Spindles, wrought-iron, with collar and { nut, worm	D12	D16
Spindles, wrought-iron, with collar and { pin, friction, roller { arc, elevating	..	D17
Spindles, wrought-iron, with collar and { pin, friction, roller { guide, elevating	..	D18
Stages, wood, laying, with stays	..	D19
Wheels { metal, worm	D13	D20
Wheels { wrought-iron, hand	D14	D21
GEAR LOADING. E.		
Chain, wrought-iron, with hook	..	E1
Pins, wrought-iron, sheave { cheese head, with collar and pin { long	..	E2
Pins, wrought-iron, sheave { cheese head, with collar and pin { short	..	E3
Pins, wrought-iron, sheave { plain	..	E4
Sheaves, cast-iron { bottom	..	E5
Sheaves, cast-iron { centre	..	E6
Sheaves, cast-iron { top	..	E7
Truck, wrought-iron, projectile, complete	..	E8
GEAR RETAINING. F.		
Bands, friction, brake drum with bolts { steel { left	F1	
Bands, friction, brake drum with bolts { steel { right	F2	
Bands, friction, brake drum with bolts { wrought-iron { left	..	F1
Bands, friction, brake drum with bolts { wrought-iron { right	..	F2
Bars, wrought-iron, connecting, with bolts { left	..	F3
Bars, wrought-iron, connecting, with bolts { right	..	F4
Collars, wrought-iron, shaft, main	..	F5
Counterweight, cast-iron, brake lever, with set screws	F3	F6
Covers, wrought-iron, complete { brake drum { left	F4	F7
Covers, wrought-iron, complete { brake drum { right	F5	F8
Covers, wrought-iron, complete { wheel, spur and pinion clutch { left	..	F9
Covers, wrought-iron, complete { wheel, spur and pinion clutch { right	..	F10
Covers, wrought-iron, complete { rollers, rack, retaining { left	..	F11
Covers, wrought-iron, complete { rollers, rack, retaining { right	..	F12
Cranks, wrought-iron, connecting brake levers	F6	F13
Drums, brake, complete { left	F7	F14
Drums, brake, complete { right	F8	F15
Guards, wrought-iron, brake drum { left	..	F16
Guards, wrought-iron, brake drum { right	..	F17
Hooks, wrought-iron, preventor, with collars and nuts	F9	

NOMENCLATURE OF PARTS—continued.

Description.	Reference in Plates. XIII, XIV, Mark I.	Reference in Plates. XV XVI, Mark II.
GEAR RETAINING. F.—*continued.*		
Levers: metal, clutch	..	F18
Levers: wood, iron pointed, Moncrieff 4′ 1″, Mark III	F10	
Levers: R.M.L., 7-inch 4′ 4″	..	F19
Levers: wrought-iron brake band	F11	F20
Levers: wrought-iron brake shaft, connecting	F12	F21
Links, wrought-iron, adjusting, brake levers, with pins and keys, pairs	F13	F22
Pawls, wrought-iron, rack, retaining left	..	F23
Pawls, wrought-iron, rack, retaining right	..	F24
Pinions: steel, spur, rack, retaining, with spindles, collars, and nuts	F14	
Pinions: wrought-iron, spur clutch, 10 teeth	..	F25
Pinions: wrought-iron, spur rack, retaining, 8 teeth	..	F26
Pins, wrought-iron, securing, lever, clutch	..	F27
Plates, wrought-iron, with screws boss, brake band, pairs	..	F28
Plates, wrought-iron, with screws locking, brake lever	F15	
Racks, wrought-iron, retaining cycloidal left	F16	
Racks, wrought-iron, retaining cycloidal right	F17	
Racks, wrought-iron, retaining left	..	F29
Racks, wrought-iron, retaining right	..	F30
Rings, hook, preventor india-rubber (set of 8)	F18	
Rings, hook, preventor wrought-iron (set of 6)	F19	
Rollers, rack, retaining, metal (set of 8)	..	F31
Screws, wrought-iron: cover, brake drum (set of 8)	F20	
Screws, wrought-iron: cover, brake drum (set of 10)	..	F32
Screws, wrought-iron: links, adjusting, brake lever	F21	F33
Screws, wrought-iron: (or spindles) rollers, rack, retaining (set of 4)	..	F34
Screws, wrought-iron: plate, locking, brake lever	F22	
Shafts, wrought-iron: connecting brake lever	F23	F35
Shafts, wrought-iron: main, with nuts	..	F36
Sockets, wrought-iron, lever, with pawls	F24	F37
Spindles, wrought-iron, with nuts: collars and pins, bar, connecting	..	F38
Spindles, wrought-iron, with nuts: and collar, clutch, pinion	..	F39
Spindles, wrought-iron, with nuts: pawl, rack, retaining	..	F40
Springs, steel, for pawl, brake drum	F25	F41
Wheels, wrought-iron: pawl pinion, spindle, rack, retaining	F26	
Wheels, wrought-iron: pawl spindle, clutch, pinion	..	F42
Wheels, wrought-iron: spur, shaft, main, 40 teeth left	..	F43
Wheels, wrought-iron: spur, shaft, main, 40 teeth right	..	F44
GEAR TRAVERSING. G.		
Collars, wrought-iron, shaft, longitudinal, with screws	G1	
Covers, wrought-iron, complete: wheel .. pinion, bevil, shaft, vertical	G2	
Covers, wrought-iron, complete: wheel .. and pinion bevil front	..	G1
Covers, wrought-iron, complete: wheel .. and pinion bevil rear	..	G2
Covers, wrought-iron, complete: wheel .. and pinion spur left	G3	
Covers, wrought-iron, complete: wheel .. and pinion spur right	G4	
Covers, wrought-iron, complete: wheel .. bevil, front truck	G5	
Covers, wrought-iron, complete: wheel .. spur left	G6	
Covers, wrought-iron, complete: wheel .. spur right	G7	
Handles, wrought-iron, winch	G8	G3
Keys, wrought-iron, driving, shaft	G9	

NOMENCLATURE OF PARTS—continued.

Description.	Reference in Plates. XIII, XIV, Mark I.	Reference in Plates. XV, XVI, Mark II.
GEAR, TRAVERSING. G.—*continued.*		
Pinions, bevil — cast iron, shaft — longitudinal — long, 14 teeth	G^{10}	
Pinions, bevil — cast iron, shaft — longitudinal — short, 14 teeth	G^{11}	
Pinions, bevil — cast iron, shaft — vertical, 15 teeth	G^{12}	
Pinions, bevil — malleable, cast iron, with spindles for trucks, 8 teeth — front	..	G^{4}
Pinions, bevil — malleable, cast iron, with spindles for trucks, 8 teeth — rear	..	G^{5}
Pinions, bevil — metal, shaft — cross, 28 teeth	G^{13}	
Pinions, bevil — metal, shaft — vertical 28 teeth	G^{14}	
Pinions, bevil — winch handle, bevil — cast iron — spur with wrought-iron spindles, 14 teeth	G^{15}	
Pinions, bevil — winch handle, bevil — malleable cast-iron, bevil, with spindles — front, 12 teeth	..	G^{6}
Pinions, bevil — winch handle, bevil — malleable cast-iron, bevil, with spindles — rear, 9 teeth	..	G^{7}
Shafts, wrought-iron — cross, 2nd motion	G^{16}	
Shafts, wrought-iron — longitudinal — long	G^{17}	
Shafts, wrought-iron — longitudinal — short	G^{18}	
Shafts, wrought-iron — vertical	G^{19}	
Wheels, cast-iron — bevil — axles for trucks — front, 18 teeth	G^{20}	
Wheels, cast-iron — bevil — axles for trucks — rear, 26 teeth	G^{21}	
Wheels, cast-iron — bevil — front, 31 teeth	..	G^{8}
Wheels, cast-iron — bevil — rear, 40 teeth	..	G^{9}
Wheels, cast-iron — bevil — shaft, longitudinal — long, front, 30 teeth	G^{22}	
Wheels, cast-iron — bevil — shaft, longitudinal — short, rear, 30 teeth	G^{23}	
Wheels, cast-iron — spur, 58 teeth	G^{24}	

General Instructions for Care and Preservation.

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

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

All bright parts should be kept clean and slightly coated with Field's grease, No. 3.

All bearings should be well lubricated through holes made for the purpose; the small covering screws should be replaced directly after lubrication. All working parts should be kept clear of clotted grease, dirt, and corrosion.

When the mountings are not required for immediate use, the piston rods of the buffers must be unfastened and pushed home in the cylinders, and the removable parts of the various gears must be placed in store.

These articles should be frequently examined to ensure their being kept clean and in proper condition. They should also be placed in their respective places, and worked, at least once, in every three months.

Brake Gear.—The differential brake gear on the 6 ft. parapet mountings must be regulated by the adjusting screws until the tension of the brake bands is just sufficient to retain the carriage on recoil and prevent it "running up" before the bands are slackened by the levers.

Hydraulic Buffers.—As the quantity of fluid in the buffer is liable to diminish from various causes, care should be taken, before firing, that the contents of the cylinder accord with that given on the inscription plate.

To fill the Buffer.—Run the carriage up, remove the filling hole plug, and by means of the gallon measure run in the requisite quantity of fluid; replace the filling hole plug. If the buffer leaks at the gland and tightening up the latter does not stop it, the packing must be renewed.

To renew the Packing.—For compression buffers, run the carriage back, empty the buffer, unscrew the gland with the spanner No. 2, and extract the defective packing. Well tallow the new packing, insert it in the stuffing-box, and tighten it up with the gland.

For Tension Buffers.—For the cotton packing the same operation will be required as for the compression buffer; but, if the leather packing also requires renewal, it will be necessary to disconnect the piston rod from the platform before running back. The new leather must be thoroughly greased and carefully placed upon the rod so as not to damage the edges, and well pressed home by the metal ring before inserting the cotton packing.

Moncrieff Mountings.

The retaining racks, teeth of bevelled wheels, pivot bolts, and the inside of the trunnion rings must be well lubricated. The friction cones of the elevating gear must be kept clean and not allowed to set. These cones are adjusted by tightening up the nuts on the end of the cross shaft; if too much slip occurs in action, the nuts must be again screwed up and locked.

The brake drum must be kept free from rust and grease. The drum should be occasionally examined, to see that the pawls and springs are in working order. The pawls should be lubricated by oiling the ends of the studs.

The tension of the brake band must be just sufficient to retain the gun in the loading position. The tension can be regulated by altering the position of the counterweight on the lever.

General.

Before firing, see that the elevating gear is in proper adjustment; that the clip plates are bolted to the carriage; that the buffer contains the proper quantity of fluid; that the pivot bars are secured by the pivot plugs and keys; and that all gears are properly lubricated and in good working order.

NOTE.—The registered number of the mountings should always be quoted in reports, to admit of identification.

AMMUNITION.

PROJECTILES.

(Plates XVII. and XVIII.)

Nature.	§ Changes War Stores.	Weight Empty.	Nature and No. of Balls.	Approximate Bursting Charge.	Weight of Fuze.	Total Weight Filled.
		lbs. oz.		lbs. oz.	oz.	lbs. oz.
Common Shell, Mark V.	1765 2655	106 14	—	9 4	8	116 10
Double „ „ III.	1765 2655	145 6	—	12 12	8	158 10
Shrapnel „ „ IV.	2491	115 10	192 2-oz. sand shot	0 12	2	116 8
Palliser Shot „ VII.	2222	112 0	—	—	—	112 0
„ „ (Shell)„ IV.	3560	112 1	—	*2 10	—	114 11
Case Shot „ VI.	4083	—	71 8-oz. sand shot	—	—	68 2½

* Shot, Palliser. Formerly shell. To be weighted up with sand. § 5033.

7-inch M.L. projectiles are not furnished with gas-checks.

Many of the earlier pattern projectiles are still to be met with. The differences are mainly in manufacturing details.

Common shells are used on land fronts against earthworks, buildings, &c.; on sea fronts against shipping.

Shrapnel shells are used when the range is beyond the effective power of case shot; on land fronts against bodies of troops, on sea fronts against boats.

Double shells are chiefly for use against wooden shipping.

Palliser shot are used against armour plates.

Two case shot are used at close quarters against troops with a full charge.

WEDGE WAD.

(List of Changes, § 2686.)

This consists of two wedges of wood, each 5·5 inches in length, connected by a piece of cane 6·5 inches long. It is to be rammed home separately after the projectile.

An extractor is not to be used to unload a gun whilst a wedge wad remains rammed home. If the wad cannot be removed by means of a wad hook, the charge must be fired.

Fuzes.

(*Plate XIX.*)

(*See* List of Changes, § 4434.)

Percussion	.. ..	Direct Action, No. 3.
Time	.. ..	15 seconds, M.L., No. 41.

Instructions for the Preparation of Shells and Fuzes and for the Examination of Filled Shells.

(*Regulations for Magazines, &c.*, 1887.)

Filling and Securing Shells.

Common and Double.

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 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, filled primer, seven drams," 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.

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.* This must be done gradually, for if the whole of the powder is put in at once the tube is liable to become choked. Shake

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* Pistol, F.G., R.F.G., or R.F.G.^{2} powder.

the shell from side to side on its base, until the whole of the bursting charge has passed down the tube, taking care that none of the powder is left at the bottom of the socket. Drop in the "Primer, Shrapnel shell, Mark III," and, by means of the "Driver, screw, Shrapnel, large," screw it tightly into the tube, and then screw in the fuze or plug as may be required.

Fixing Plugs and Fuzes.

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

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

Distinguishing Marks.

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

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

Palliser shot (formerly shell) weighted up with sand, § 5033, will have a "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, $\frac{1}{2}$-in. wide round the body. Shells which have been emptied will be marked on the head with the letter "E" in red paint.

Storage of Filled Shells in charge of the Royal Artillery.

Filled shells for 7-inch R.M.L. guns will be placed upright on their bases in the shell store.

Preparing Fuzes.

Fuzes, Time, Wood.

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

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

Unscrew, and, when the bit is quite clear, remove the fuze from the hook. The length of the bit is so regulated that, when placed in the handle, it will enter sufficiently far into the composition when screwed down to the shoulder. If the bit should become unserviceable, the handle must be detached from the shank and the tightening-screw unscrewed, the square hole in the hook being made for that purpose. Care must be taken when substituting another bit that it is properly placed in the handle, and that the tightening screw firmly presses upon it, for, if any space be left between the handle and the head of the bit, the end will not enter a sufficient depth into the composition. The borer should be occasionally examined and cleaned. The operation of preparing the fuze and fixing it in the shell takes, on an average, about 15 seconds; with a little practice these operations may be performed in a shorter time.

Fixing Fuzes.

Fuzes, Percussion, Direct Action.

These fuzes require no preparation, except the removal of the metal cap of Marks I and II, or plug of Mark III; they are screwed firmly into the fuze-hole by means of the "Key, plug, G.S.," or the "Key, fuze, universal." The cap can be removed by bringing the centre of the bayonet joints in line with the studs on the side of the head of the fuze. The cap or plug will not be removed until after the shell has been placed in the muzzle of the gun.

Fuzes, Time, Wood, Muzzle-Loading.

These fuzes are fixed in the fuze-hole by screwing the fuze round by hand until it is held firmly in the fuze-hole; this operation should be performed fairly, and not so as 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.

Extracting Wood Fuzes.

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

Examination of Filled Shells.

Shells, Common and Double.

Remove the plug, and the "bags, primer," with the "hook, G.S. wads." Draw out the neck of the serge bag by means of the above hook, and untie the twine round the neck of the bag. If the powder is in a serviceable condition tie up the neck of the bag again, and proceed as directed in the instructions for filling. If the powder is caked from the effects of damp, empty the shell (this requires

careful manipulation): up-end the shell as required; insert the filling rod or any suitable-sized piece of brass wire so as to facilitate the exit of the powder, and to prevent the bag from doubling up, &c., until the whole of the powder is extracted. Take out the bag, and, if it is in a serviceable condition, replace it in the shell; if not, insert a new bag, and refill with serviceable powder, the bags, shalloon, primer, if serviceable, being also replaced. If the powder is so caked that it will not run out of the shell, or if any powder remains adhering to the interior of the shell, fill the shell with boiling water and allow it to stand for about five minutes, then pour out the water and fill up again with boiling water. After standing for 15 minutes more, the shell may be emptied, using the copper scraper for shells to facilitate the removal of the wetted powder. The scraper must not be applied until 15 minutes have elapsed after the second quantity of boiling water has been poured in. When the shell is perfectly dry, refill with serviceable powder.

Shells, Shrapnel

Remove the fuze-hole plug, unscrew the primer with the "screw-driver, Shrapnel, large, Mark III," and lift out the primer with the "pincers, Shrapnel, primer"; turn the shell nose downwards, and, if the powder charge flows out and is serviceable, refill and replace primer and plug; the shell should be well shaken if the powder does not come out quite freely, as a portion of the powder may possibly be jammed in the tube; if the powder cannot be extracted as above, being caked from the effects of damp, &c., the primer and plug will be replaced, and steps taken for the exchange of the shell.

Charges.

See List of Changes, § 3848, 4871.

Full.	30 lb. P.	Silk cloth cartridge.
Reduced.	17 lb. P.	,,

Directions for Making up Cartridges.

(*Regulations for Magazines, &c.*, 1887.)

Care will be taken to see that the cartridges are properly dry before being filled, and the proper charge will be carefully weighed out, and inserted in the empty cartridge by means of the "funnel, copper, cartridge." Cartridges will be choked by drawing together the mouth of the cartridge into several pleats with a nickel silver needle, threaded with two strands of silk twist.

The choke being temporarily secured by taking two turns round the choke, the becket is then drawn tightly in on both sides, and three turns are then taken round the choke and becket together, 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.

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. To do this:—

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

Cartridges, after being choked and hooped, will have the ends of the choke cut off to a convenient length, which should in no case exceed half the diameter of the cartridge.

Marking Filled Cartridges.

All cartridges issued from store 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 1 inch long. About $\frac{1}{4}$ oz. of ink will be sufficient for 100 cartridges.

The cartridges filled by the Royal Artillery will be distinguished by having no initial letter stamped on them. This order does not apply to cartridges filled by working parties of Royal Artillery for the Ordnance Store Department.

Finished Cartridges.

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

Drill Cartridges.

Drill cartridges are a special manufacture and issued complete. They are of wood covered with raw hide.

Range Table for 7-inch R.M.L. Gun of 7 Tons.

Based on Calculation.

Charge	30 lb. P.
Gravimetric density	$\frac{28{\cdot}0}{0{\cdot}990}$ *
Projectile, common shell, weight ..	115 lb.
Muzzle velocity	1561 f. s.
Mounting, iron, garrison.	
Jump	10 minutes.

Range.	Elevation.	Angle of descent.	Slope of descent.	Remaining velocity.	Penetration, wrought iron.	50 per cent. of rounds should fall within.			Time of flight.	Fuze scale, 15 seconds M.L. Wood Time.	
						Length.	Breadth.	Height.			
yds.	° ′	° ′	1 in.	f. s.	ins.	yds.	yds.	ft.	sces.	yds.	tenths.
0	...	...	...	1561	9·4	44	...	...	...	260	1·0
100	...	0 7	490	1532	9·3	44	0·1	0·3	0·20	350	1·5
200	0 2	0 15	229	1503	9·1	44	0·2	0·6	0·40	440	2·0
300	0 9	0 23	150	1476	8·9	44	0·3	1·0	0·60	530	2·5
400	0 16	0 31	108	1448	8·7	43	0·4	1·3	0·80	620	3·0
500	0 23	0 39	86	1421	8·4	43	0·5	1·6	1·02	710	3·5
600	0 30	0 48	71	1394	8·2	43	0·6	2·0	1·23	800	4·0
700	0 38	0 57	59	1368	8·0	43	0·7	2·4	1·35	890	4·5
800	0 46	1 6	51	1344	7·8	43	0·8	2·7	1·37	980	5·0
900	0 54	1 15	44	1320	7·6	43	0·9	3·1	1·39	1075	5·5
1000	1 2	1 24	37	1296	7·4	43	1·0	3·5	2·12	1160	6·0
1100	1 10	1 34	32	1274	7·2	43	1·1	3·9	2·3	1245	6·5
1200	1 19	1 44	29	1252	7·1	42	1·2	4·4	2·59	1325	7·0
1300	1 28	1 56	25	1231	7·0	42	1·3	4·9	2·84	1405	7·5
1400	1 37	2 8	23	1211	6·8	43	1·5	5·5	3·09	1480	8·0
1500	1 46	2 20	21	1191	6·6	43	1·6	6·0	3·35	1555	8·5
1600	1 55	2 32	20	1172	6·5	44	1·7	6·6	3·61	1630	9·0
1700	2 5	2 45	19	1153	6·4	44	1·8	7·1	3·87	1705	9·5
1800	2 15	2 58	18	1134	6·3	44	1·9	7·7	4·13	1780	10·0
1900	2 25	3 12	17	1116	6·2	44	2·1	8·3	4·39	1855	10·5
2000	2 35	3 26	16	1098	6·1	45	2·2	9·0	4·75	1920	11·0
2100	2 46	3 40	15	1085	6·0	45	2·3	9·7	4·92	1995	11·5
2200	2 57	3 55	14	1071	5·9	46	2·4	10·0	5·29	2080	12·0
2300	3 8	4 10	13	1058	5·9	46	2·6	11·0	5·56	2155	12·5
2400	3 20	4 26	12	1046	5·8	47	2·7	12·0	5·84	2230	13·0
2500	3 32	4 43	11	1035	5·8	47	2·8	13·0	6·12	2305	13·5
2600	3 44	5 0	10	1025	5·7	48	2·9	14·0	6·40	2375	14·0
2700	3 57	5 18	9·8	1015	5·6	48	3 1	15·0	6·68	2445	14·5
2800	4 10	5 36	9·4	1005	5·6	49	3·2	16·0	6·97	2515	15·0
2900	4 23	5 55	9·2	995	5·5	49	3·3	17·0	7·26	2585	15·5
3000	4 36	6 14	9	985	5·5	50	3·5	18·0	7·55	2655	16·0
3100	4 50	6 35	8·7	976	5·4	...	...	...	7·85	2725	16·5
3200	5 4	6 56	8·4	967	5·4	...	...	...	8·15	2795	17·0
3300	5 18	7 18	8·1	958	5·3	...	...	...	8·45	2865	17·5
3400	5 33	7 40	7·8	949	5·2	...	...	...	8·76	2935	18·0
3500	5 48	8 3	7·5	940	5·2	...	...	...	9·08	3005	18·5
3600	6 4	8 26	7·2	931	5·2	...	...	...	9·40	3075	19·0
3700	6 20	8 51	6·9	922	5·1	...	...	...	9·73	3145	19·5
3800	6 36	9 17	6·6	914	5·1	...	...	...	10·06	3215	20·0
3900	6 52	9 43	6·3	906	5·0	...	...	...	10·40	3285	20·5
4000	7 8	10 9	6	898	5·0	...	...	...	10·75	3355	21·0
4100	7 25	10 35	5·8	890	4·9	...	...	...	11·1	3425	21·5
4200	7 42	11 9	5·5	883	4·9	...	...	...	11·4	3495	22·0
4300	7 57	11 43	5·3	875	4·8	...	...	...	11·8	3565	22·5
4400	8 14	12 17	5·1	868	4·8	...	...	...	11·9	3635	23·0
4500	8 34	12 52	4·9	861	4·9	...	...	...	12·0	3705	23·5
4600	8 53	13 24	4·7	854	4·9	...	...	...	12·2	3775	24·0
4700	9 12	13 56	4·5	847	4·7	...	...	...	12·4	3840	24·5
4800	9 32	14 28	4·4	840	4·7	...	...	...	12·7	3905	25·0
4900	9 52	15 0	4·3	833	4·6	...	...	...	13·0	3970	25·5
5000	10 11	15 32	4·2	827	4·6	...	...	...	13·4	4035	26·0
5100	10 32	16 5	4·0	820	4·5	...	...	...	13·6	4100	26·5
5200	10 53	16 38	3·9	813	4·5	...	...	...	14·1	4160	27·0
5300	11 14	17 11	3·8	806	4·4	...	...	...	14·6	4220	27·5
5400	11 35	17 44	3·7	800	4·4	...	...	...	15·3	4280	28·0
5500	11 56	18 17	3·6	795	4·3	...	...	...	16·2	4340	28·5
...	...	...	...	...	...	...	...	...	...	4400	29·0
...	...	...	...	...	...	...	...	...	...	4460	29·5
...	...	...	...	...	...	...	...	...	...	4520	30·0

* To obtain this density of charge, the base of the shell when home should be 22·5 inches from the bottom of the bore.

RANGE TABLE FOR 7-INCH R.M.L. GUN OF 6½ TONS.

Based on Practice of 17. *and* 18. 11. 70.

Charge	30 lb. P.
Gravimetric density	28·0 / 0·990 *
Projectile, common shell, weight ..	115 lb.
Muzzle velocity	1525 f. s.
Mounting, iron, garrison.	
Jump	10 minutes.

Range.	Elevation.	Angle of descent.	Slope of descent.	Remaining velocity.	Penetration, wrought iron.	50 per cent. of rounds should fall within.			Time of flight.	Fuze scale, 15 seconds M.L. Wood Time.	
						Length.	Breadth.	Height.			
yds.	° ′	° ′	1 in.	f.s.	ins.	yds.	yds.	feet.	secs.	yds.	tenths.
0	...	...	...	1525	9·2	43	...	...	...	250	1·0
100	...	0 7	490	1496	9·0	43	0·1	0·3	0·20	340	1·5
200	0 4	0 15	229	1468	8·8	42	0·2	0·6	0·40	430	2·0
300	0 12	0 23	150	1440	8·7	43	0·3	1·0	0·61	520	2·5
400	0 20	0 32	108	1413	8·5	43	0·4	1·3	0·83	610	3·0
500	0 28	0 41	86	1387	8·3	43	0·5	1·6	1·05	695	3·5
600	0 36	0 50	71	1362	8·2	43	0·6	2·0	1·27	780	4·0
700	0 45	1 0	59	1337	8·0	43	0·7	2·4	1·50	865	4·5
800	0 53	1 10	51	1313	7·8	43	0·8	2·7	1·74	945	5·0
900	1 2	1 21	44	1289	7·7	43	0·9	3·1	1·98	1025	5·5
1000	1 11	1 32	37	1268	7·5	43	1·0	3·5	2·23	1110	6·0
1100	1 20	1 43	32	1246	7·4	43	1·1	3·9	2·47	1190	6·5
1200	1 29	1 55	29	1224	7·2	43	1·2	4·4	2·72	1265	7·0
1300	1 39	2 7	25	1203	7·1	43	1·3	4·9	2·97	1345	7·5
1400	1 49	2 20	23	1183	6·9	43	1·5	5·5	3·23	1420	8·0
1500	1 59	2 33	21	1162	6·7	43	1·6	6·0	3·49	1500	8·5
1600	2 10	2 46	20	1144	6·6	44	1·7	6·6	3·75	1575	9·0
1700	2 21	3 0	19	1127	6·5	44	1·8	7·1	4·01	1650	9·5
1800	2 32	3 14	18	1111	6·3	44	1·9	7·7	4·28	1720	10·0
1900	2 43	3 29	17	1095	6·2	44	2·1	8·3	4·55	1795	10·5
2000	2 55	3 45	16	1080	6·1	45	2·2	9·0	4·82	1865	11·0
2100	3 7	4 2	15	1066	6·0	45	2·3	9·7	5·10	1945	11·5
2200	3 19	4 19	14	1054	5·9	46	2·4	10·0	5·38	2020	12·0
2300	3 31	4 37	13	1042	5·9	46	2·6	11·0	5·67	2090	12·5
2400	3 43	4 55	12	1031	5·8	47	2·7	12·0	5·96	2160	13·0
2500	3 56	5 14	11	1020	5·7	47	2·8	13·0	6·25	2230	13·5
2600	4 9	5 33	10	1009	5·6	48	2·9	14·0	6·55	2300	14·0
2700	4 22	5 53	9·8	999	5·6	48	3·1	15·0	6·85	2370	14·5
2800	4 36	6 14	9·4	990	5·5	49	3·2	16·0	7·16	2440	15·0
2900	4 49	6 35	9·2	981	5·4	49	3·3	17·0	7·47	2510	15·5
3000	5 3	6 57	9	972	5·4	50	3·5	18·0	7·78	2580	16·0
3100	5 17	7 19	8·7	963	5·3	...	...	...	8·09	2650	16·5
3200	5 32	7 42	8·4	954	5·3	...	...	...	8·40	2720	17·0
3300	5 47	8 5	8·1	945	5·2	...	...	...	8·72	2790	17·5
3400	6 2	8 28	7·8	937	5·2	...	...	...	9·04	28·0	18·0
3500	6 17	8 52	7·5	929	5·1	...	...	...	9·36	2930	18·5
3600	6 32	9 16	7·2	921	5·1	...	...	...	9·68	3000	19·0
3700	6 48	9 41	6·9	914	5·1	...	...	...	10·0	3070	19·5
3800	7 4	10 6	6·6	906	5·0	...	...	...	10·3	3135	20·0
3900	7 20	10 32	6·3	898	5·0	...	...	...	10·7	3205	20·5
4000	7 36	10 59	6	891	4·9	...	...	...	11·0	3270	21·0
4100	7 53	11 26	5·8	883	4·9	...	...	...	11·3	3335	21·5
4200	8 10	11 54	5·5	876	4·8	...	...	...	11·7	3400	22·0
4300	8 28	12 23	5·3	868	4·8	...	...	...	12·0	3465	22·5
4400	8 46	12 52	5·1	861	4·8	...	...	...	12·4	3530	23·0
4500	9 4	13 22	4·9	854	4·7	...	...	...	12·7	3595	23·5
4600	9 23	13 53	4·7	847	4·7	...	...	...	13·1	3660	24·0
4700	9 42	14 24	4·5	841	4·6	...	...	...	13·4	3725	24·5
4800	10 1	14 56	4·4	834	4·6	...	...	...	13·8	3790	25·0
4900	10 21	15 29	4·3	828	4·5	...	...	...	14·2	3855	25·5
5000	10 41	16 2	4·2	821	4·5	...	...	...	14·5	3920	26·0
5100	11 3	16 35	4·0	815	4·5	...	...	...	14·9	3985	26·5
5200	11 23	17 8	3·9	808	4·4	...	...	...	15·3	4050	27·0
5300	11 45	17 42	3·8	802	4·4	...	...	...	15·7	4115	27·5
5400	12 7	18 16	3·7	796	4·3	...	...	...	16·0	4180	28·0
5500	12 29	18 50	3·6	790	4·3	...	...	...	16·4	4245	28·5
										4310	29·0
										4375	29·5
										4435	30·0

* To obtain this density of charge, the base of shell when home should be 22·5 inches from the bottom of the bore.

Range Table for 7-inch R.M.L. Gun.

Based on Practice of 2. 11. 85.

Charge	17 lb. P.
Gravimetric density	$\frac{28{\cdot}0}{0{\cdot}990}$
Projectile, double shell, weight	160½ lb.
Muzzle velocity	1047 f. s.
Mounting, wrought iron, dwarf, traversing.	
Jump..	18 minutes.

Range.	Elevation.	Angle of descent.	Remaining velocity.	Five minutes' elevation increases or decreases the range by	Five minutes will alter point of impact vertically or laterally at each range.	Time of flight.	Fuze scale, 15 seconds M.L.	
yards.	° ′	° ′	f. s.	yards.	yards.	seconds.	tenths.	yards.
0	..	..	..	..	..	..		
100	..	0 15	1039	..	..	0·30		
200	0 12	0 31	1031	33	0·29	0·59		
300	0 27	0 47	1024	31	0·43	0·88	2	350
							2·5	420
400	0 42	1 4	1017	31	0·58	1·17	3	490
							3·5	560
500	0 58	1 20	1010	31	0·72	1·47	4	630
							4·5	700
600	1 14	1 37	1003	31	0·87	1·77	5	770
							5·5	840
700	1 30	1 54	996	31	1·01	2·07	6	910
							6·5	980
800	1 46	2 12	989	29	1·16	2·37	7	1045
							7·5	1115
900	2 3	2 30	982	29	1·31	2·67	8	1180
							8·5	1250
1,000	2 20	2 48	975	29	1·45	2·98	9	1315
							9·5	1385
1,100	2 38	3 6	968	29	1·60	3·29	10	1450
							10·5	1520
1,200	2 56	3 25	962	29	1·74	3·61	11	1585
							11·5	1655
1,300	3 14	3 44	956	29	1·89	3·93	12	1720
							12·5	1785
1,400	3 32	4 4	950	28	2·03	4·26	13	1850
							13·5	1915
1,500	3 50	4 23	944	28	2·18	4·59	14	1980
							14·5	2000
1,600	4 9	4 42	938	28	2·32	4·92	15	2100
1,700	4 28	5 2	932	27	2·47	5·26		
1,800	4 48	5 23	926	27	2·61	5·60		
1,900	5 7	5 44	920	27	2·76	5·95		
2,000	5 27	6 4	914	27	2·91	6·30		

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.

Officer.	*No.* 1.
Tell off.	

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

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 the 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 the rear of the detachment, keeping under cover as much as possible; 6 and 8 go to the cartridge store (6 outside), 7, 9, and 10 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.

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, satisfying himself as to the correctness of fuzes and fuze implements.

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 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 sides.

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.

Officer.	*No.* 1.
Range——yards. *With——load.*	*With——load.*

"*Load.*"—No. 1 gives 7 the nature of shell and length of fuze required, and 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.

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 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 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 Nos. 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 scotch; 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.*

The gun is depressed, and the stores are replaced by the numbers who brought them up.

* 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.

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, 9, and 10, 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.*

No. 2 becomes 4, 4 1, 1 10, 10 9, 9 8, 8 7, 7 6, 6 5, 5 3, 3 2.

Drill with 7-inch R.M.L. Gun on Sliding Carriage on Traversing Platform, mounted to fire over a 6-ft. Parapet.

The Detachment consists of 10 Nos,, and falls in two deep.

To Tell Off.

Officer.	*No.* 1.
Tell off.	

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

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 the 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 embra-

* When changing rounds, the ammunition Nos. may remain unchanged if more convenient, as with the heavier guns.

sure, 4 and 5 forming upon their right and left, and the whole turning to the right about together. No. 1 follows in the rear of the detachment, keeping under cover as much as possible; 6 and 8 go to the cartridge store (6 outside), 7, 9, and 10 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.

No. 4 attends to side arms, supplies them to 2, elevates, attends to clamping of elevating gear, and traverses.

No. 5 attends to vent, elevates, supplies wedge wads, 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.	*No. 1.*
Prepare for Action.	*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 tackle, and removes the tampeon from the muzzle.

No. 4, side arms. (A rammer with jointed stave and sponge with wire rope stave is used.)

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, satisfying himself as to the correctness of fuzes and fuze implements.

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 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; 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 the 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 the elevating gear, No. 1 then gives the word "Depress." Nos. 2 and 3 depress until No. 1 gives "*Halt*," which he does when the gun is in a convenient position for sponging and loading; 4 and 5 will clamp at "*Halt*," and the whole of the numbers will then take post under cover.

To Load.

Officer.	*No. 1.*
Range——yards. *With——load.*	*With——load.*

"*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; 2 then holds the projectile home, whilst 4 & 5 elevate sufficiently* to prevent the projectile slipping forward; 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 rammer as soon as the projectile is in the bore, elevates, and replaces rammer. He cleans and damps the sponge.

* *i.e.*, to about 5° depression.

No. 5 elevates, and 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,	*Elevate. Halt.*
or	*Depress. Halt.*
Fire——rounds.	*Trail right. Halt.*
	Trail left. Halt.
	No.——ready.
	No.——fire.

2 and 3 work the elevating wheels, 4 and 5 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 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 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 No. 5, but will give the word "Under cover" as soon as the gun is laid.

The elevating Nos. 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.

Officer.	*No.* 1.
Cease firing.	*Depress. Halt.*
Replace stores.	*Replace stores.*

The gun is depressed, and the stores are replaced by the numbers who brought them up.

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, 9, and 10, 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.*

No. 2 becomes 4, 4 1, 1 10, 10 9, 9 8, 8 7, 7 6, 6 5, 5 3, 3 2.

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 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.

---

* When changing rounds the ammunition Nos. may remain unchanged if more convenient, as with the heavier guns.

Drill with 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.

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 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, throwing 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 coiling 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.

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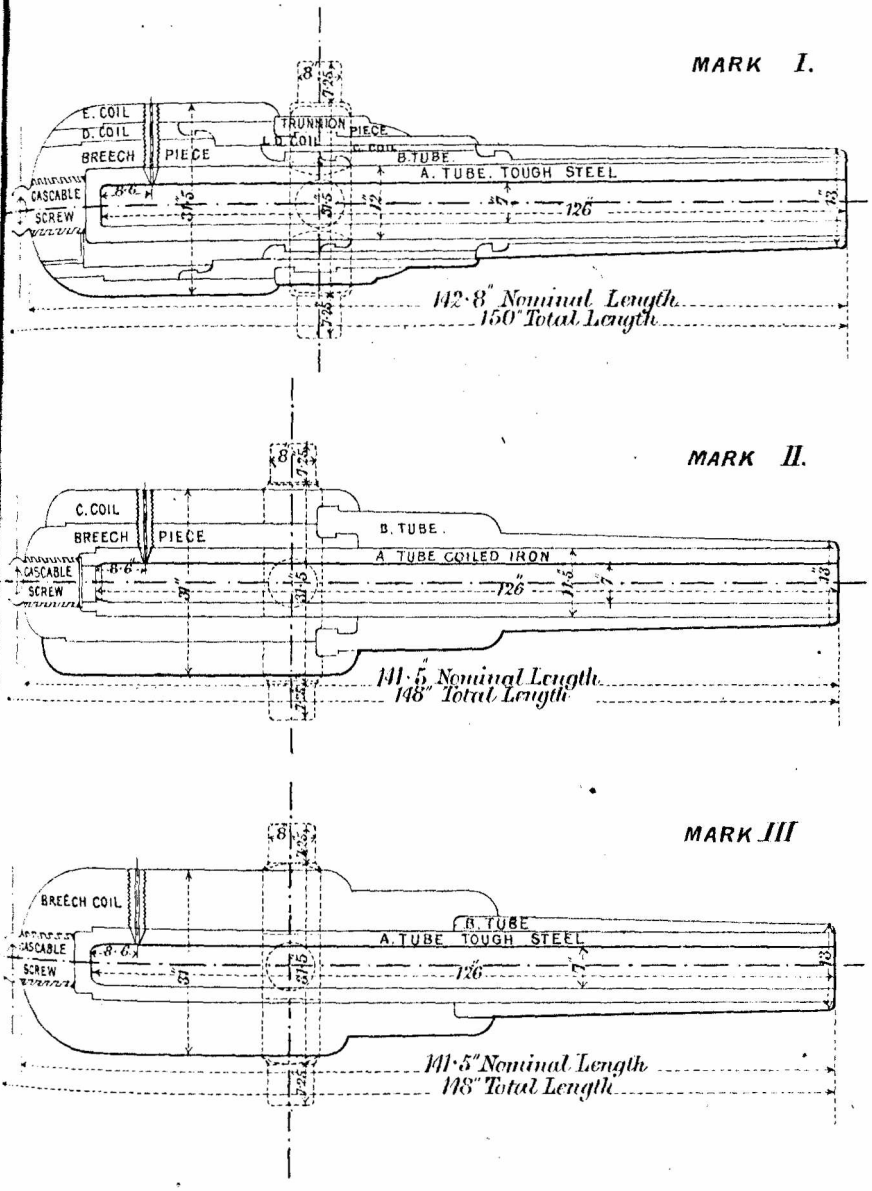
WROT IRON RIFLED MUZZLE LOADING 7 INCH GUNS OF 7 TONS.

Scale $\frac{3}{8}$ inch = 1 Foot

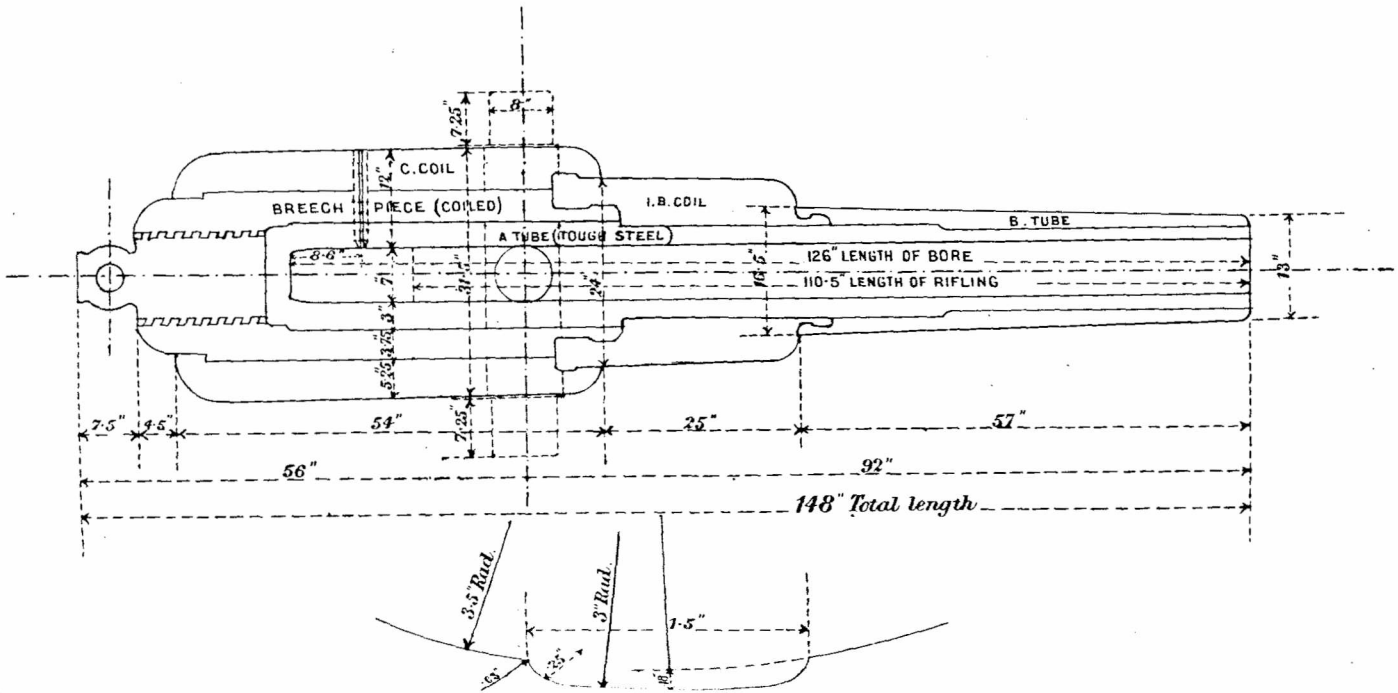


DANCERFIELD LITH 22, BEDFORD ST COVENT GARDEN. 2578

Plate II.

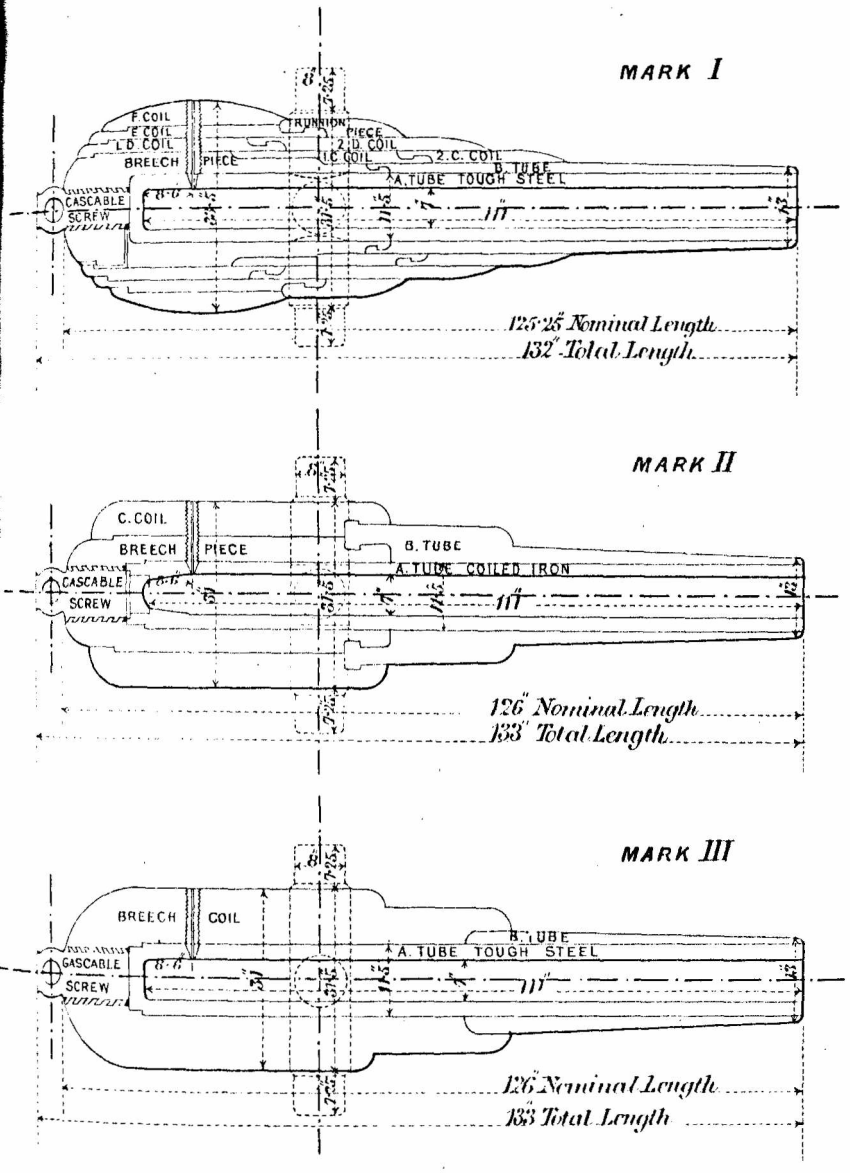
ORDNANCE R.M.L. 7-INCH 7-TON (MARK IV.)

Scale $\frac{1}{24}$ th.



WROT. IRON RIFLED MUZZLE LOADING 7 INCH GUNS OF 6½ TONS.

Scale ⅜ inch = 1 Foot.



DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 2578

ORDNANCE R.M.L. 7-INCH, 7-TON, MARK III.

MOUNTED ON MONCRIEFF CARRIAGE MARK II.

ARRANGEMENT OF REFLECTING SIGHTS.

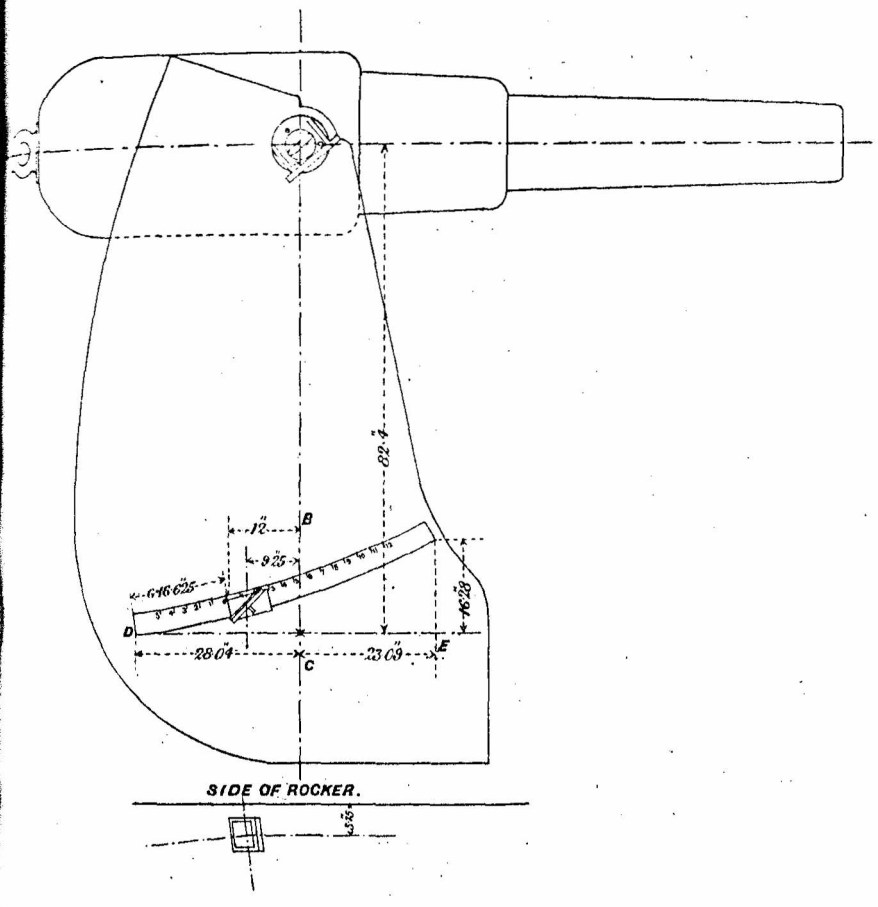
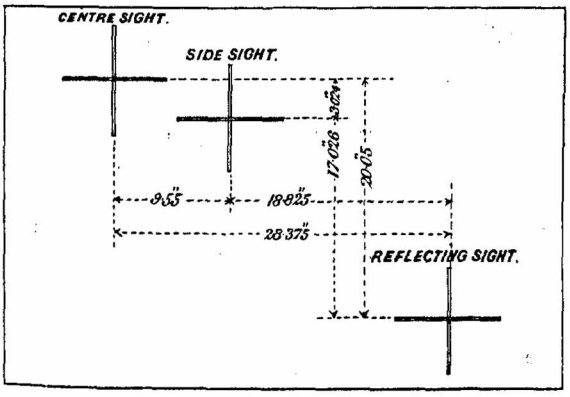


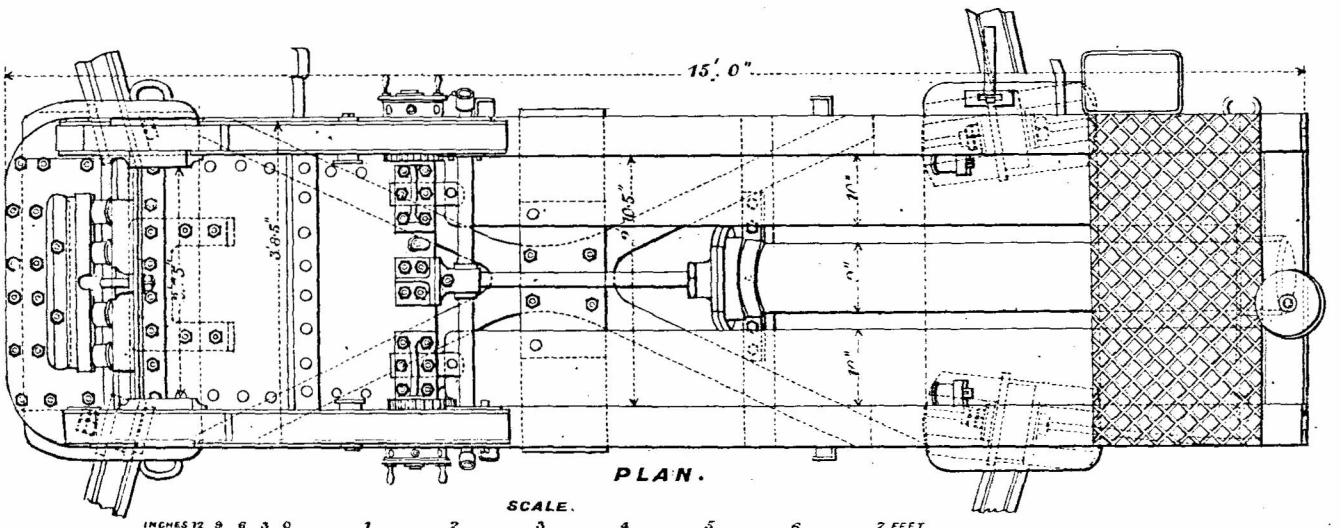
DIAGRAM FOR LINING SIGHTS.



DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 3272.

Plate VI.

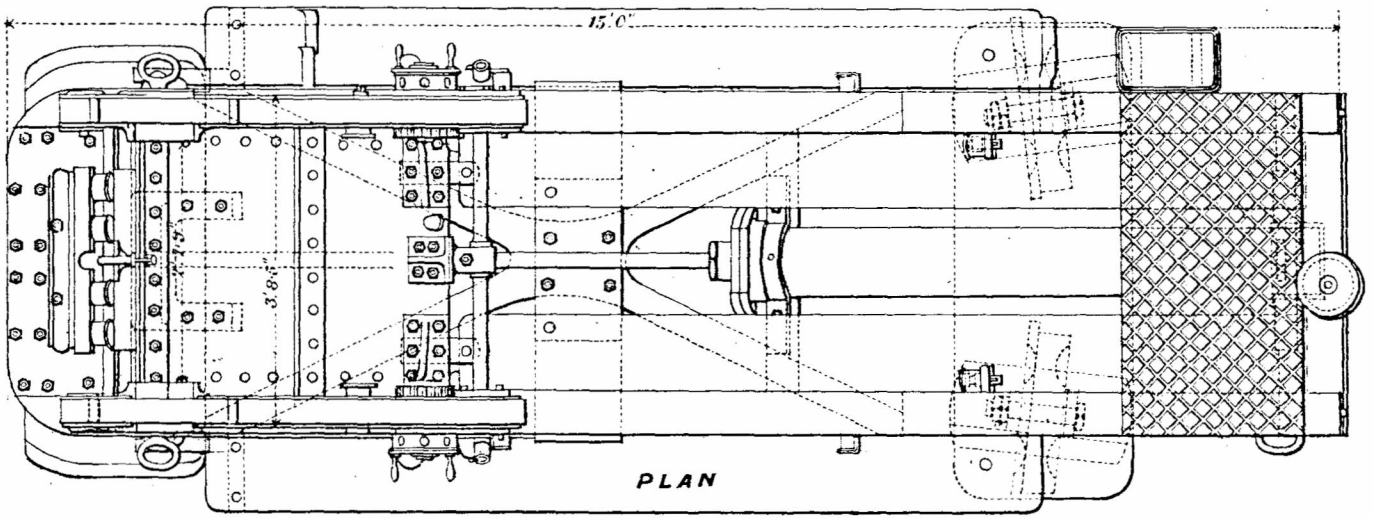
PLATFORM, R.M.L. 7" CASEMATE. (MARK I.)



	WEIGHT	TONNAGE	APPROVED	PAGE FROM LIST OF CHANGES
	CWT.	TONS.	MAY 1868	1635
CARRIAGE	27 3/4	1·375	19 10 75	2804
			7 8 76	2962
			19 10 75	2804
PLATFORM	77 3/4	7·156	15 11 75	2851
			25 1 77	3168

Plate VIII.

PLATFORM R.M.L. 7" DWARF, "A" PIVOT. (MARK I.)



PLAN

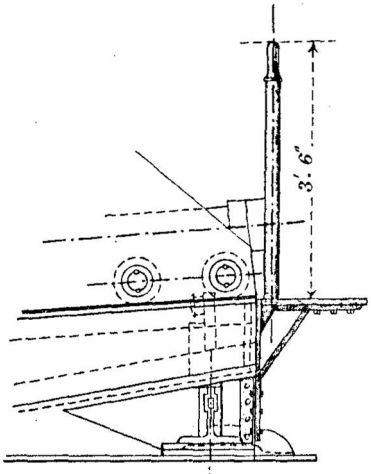
SCALE.

INCHES 12 9 6 3 0 1 2 3 4 5 6 7 FEET

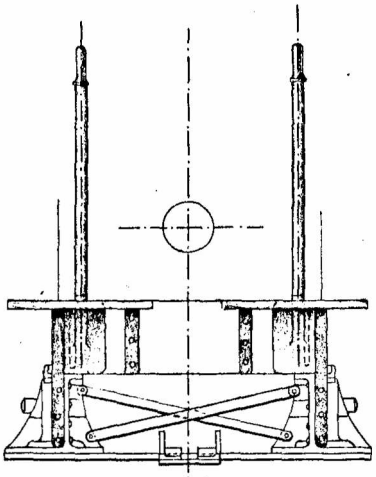
	WEIGHT	TONNAGE	APPROVED.	PARAGRAPH "LIST OF CHANCES"
CARRIAGE	27¾	1·975	MAY, 1868.	1635
			29-10-25	2804
			29-10-25	2804
PLATFORM	27¾	1·975	29-10-25	2804
			29-10-25	2804

POSTS, HAND, AND SIGHTING STEPS,

PLATFORM, 7 INCH, $6\frac{1}{2}$ TONS, 6 FEET, PARAPET.



SIDE ELEVATION



END ELEVATION

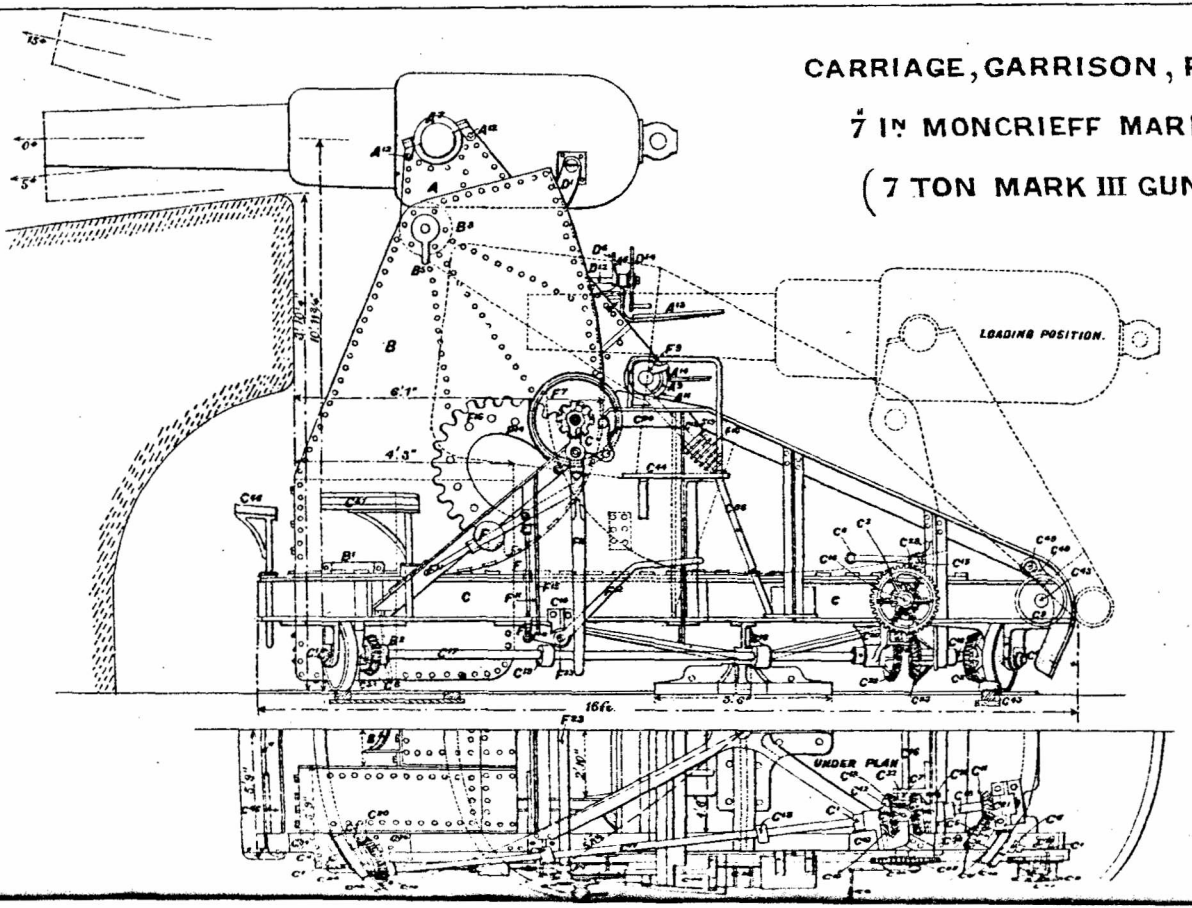
DANGERFIELD. LITH. 22, BEDFORD ST. COVENT GARDEN. 14835.9/87

Plate XIII.

CARRIAGE, GARRISON, R.M.L.

7" In MONCRIEFF MARK I.

(7 TON MARK III GUN.)



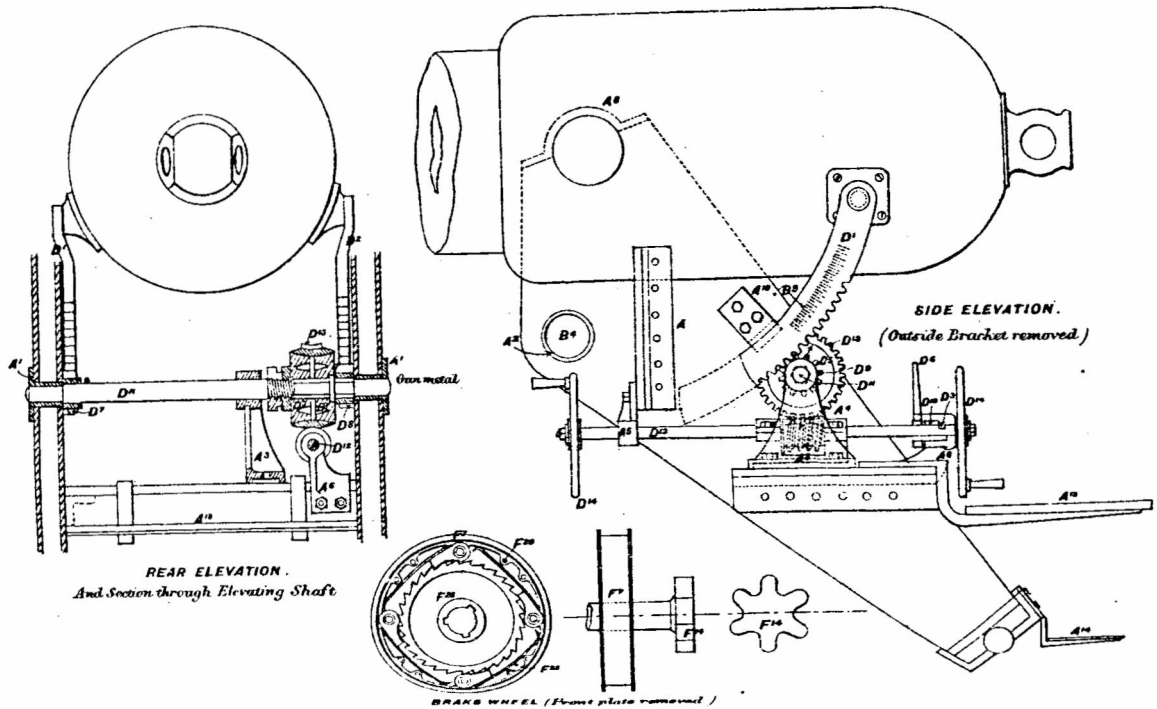
DANGERFIELD. LITH. 22, BEDFORD ST. COVENT GARDEN. 1878.

Plate XIV.

CARRIAGE, GARRISON R.M.L. 7 MONCRIEFF. MARK I.

(Elevating Gear.)

(7 TON MARK III GUN.)



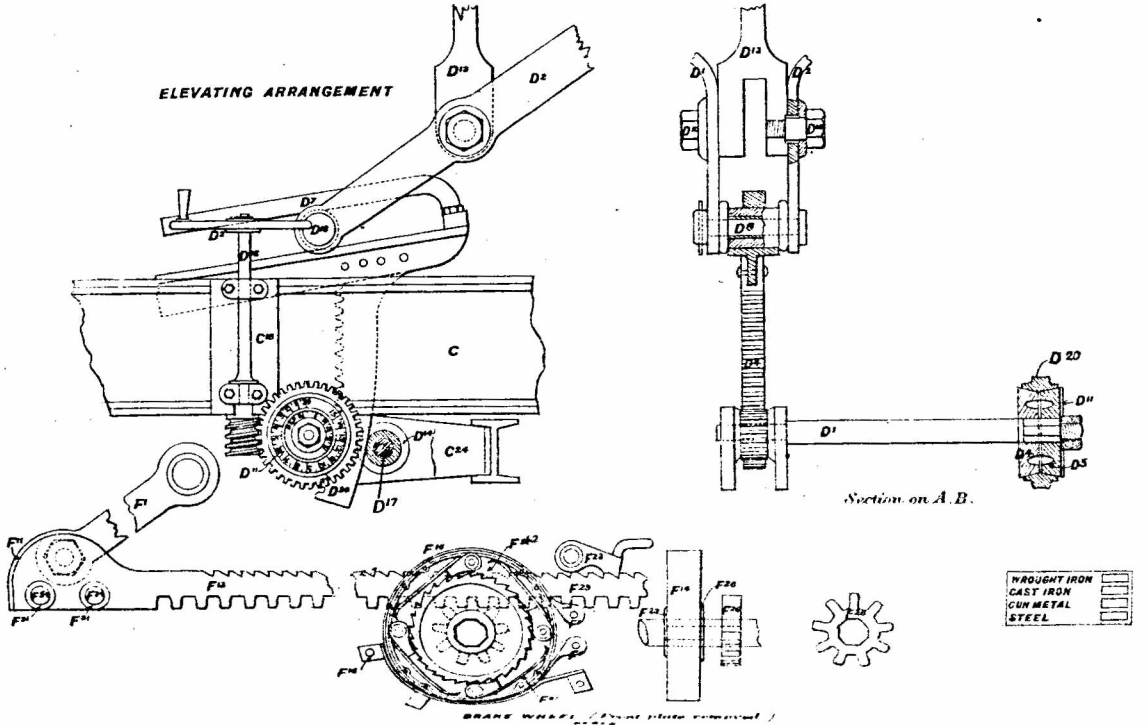
DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 3272.

Plate XVI.

CARRIAGE, GARRISON R.M.L.7 In. MONCRIEFF MARK II.

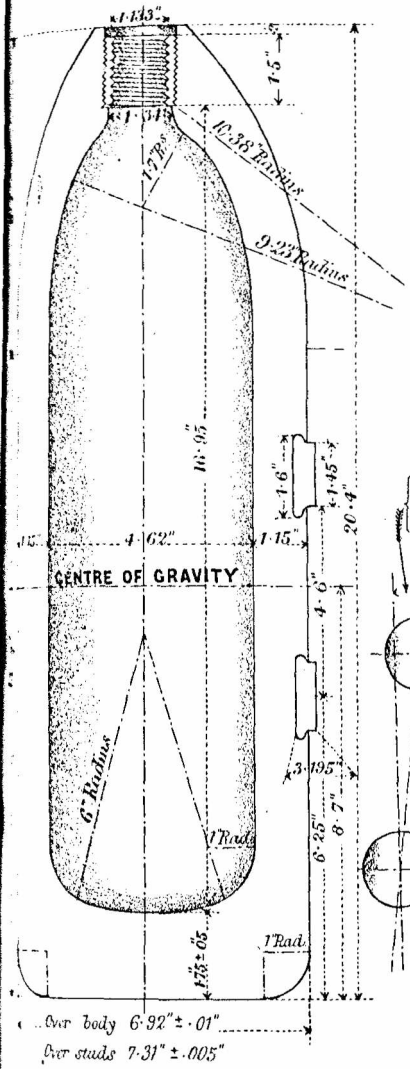
(ELEVATING AND PART OF RETAINING GEAR.)

Scale 1 Inch = 1 Foot.

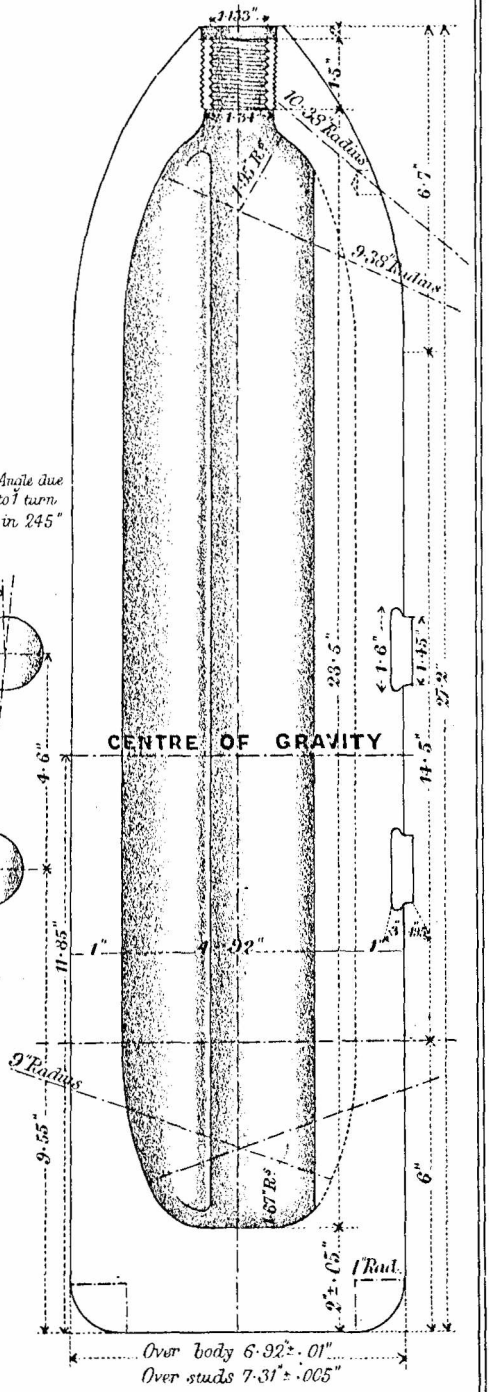


DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 3272

SHELL R.M.L. COMMON.
7 INCH MARK V.



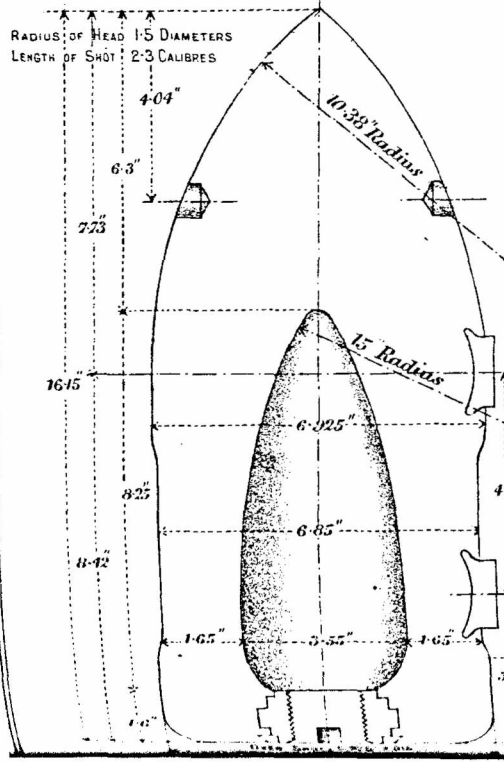
SHELL R.M.L. DOUBLE.
7 INCH MARK III.



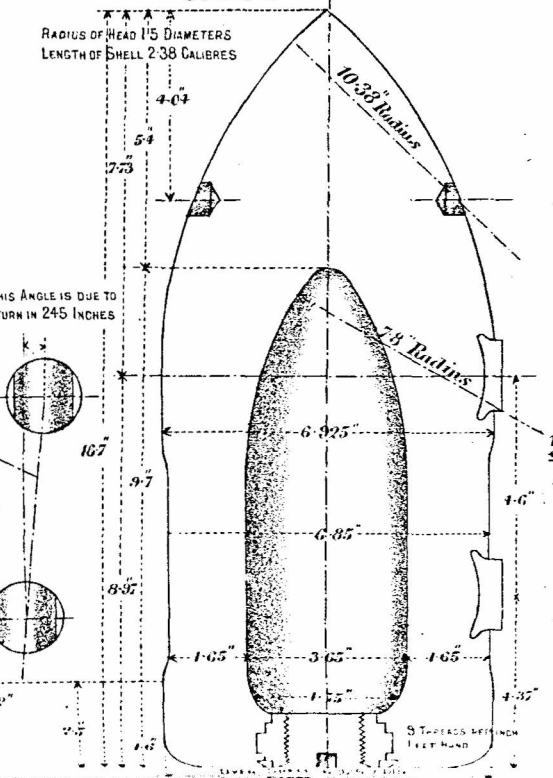
DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 3273.

Plate XVIII.

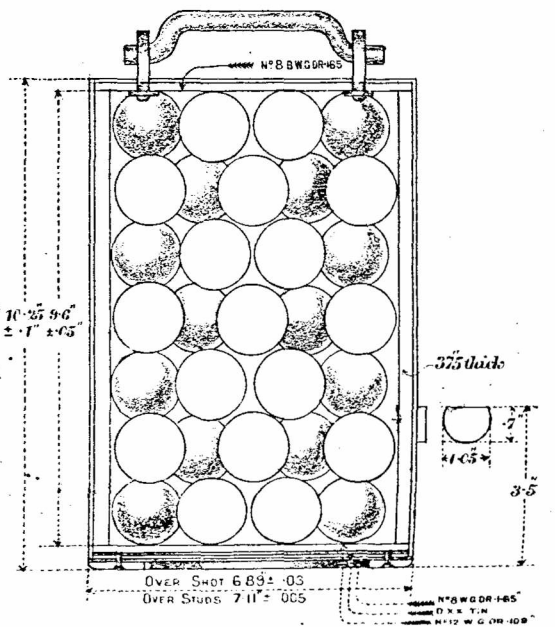
SHOT PALLISER
7 INCH MARK VII.



SHELL PALLISER
7 INCH MARK IV.
SCALE $\frac{1}{4}$

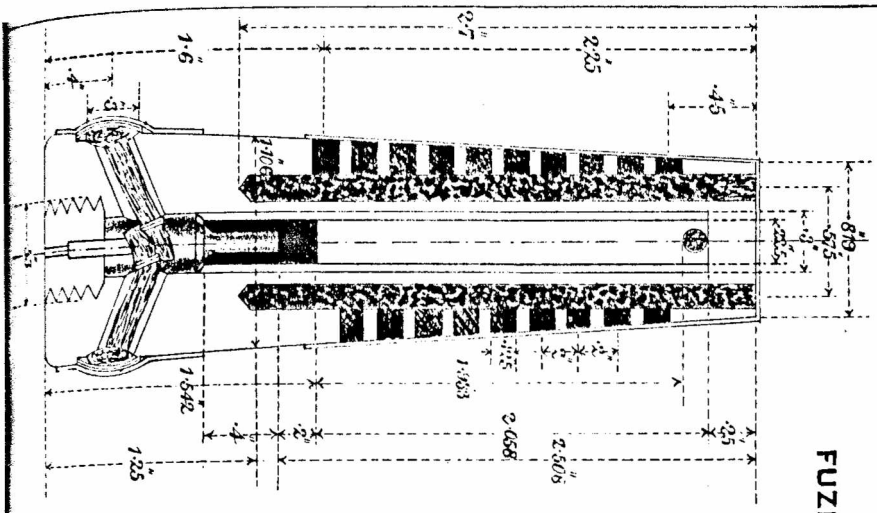


SHOT CASE M.L. OR B.L.
7 INCH MARK V

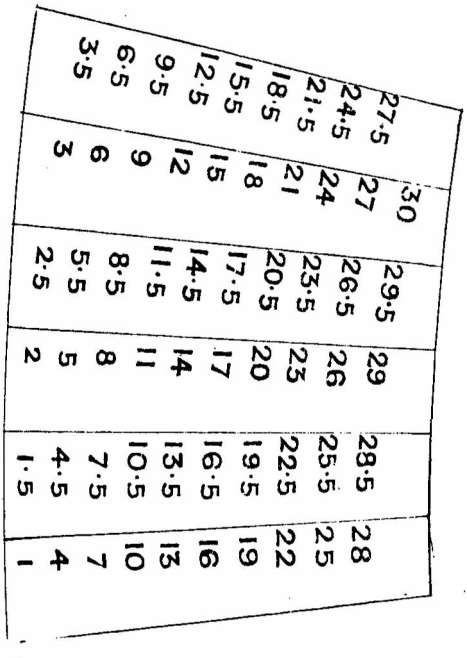


FUZE TIME M.L. 15 SECONDS No. 41 MARK II.

Full size.

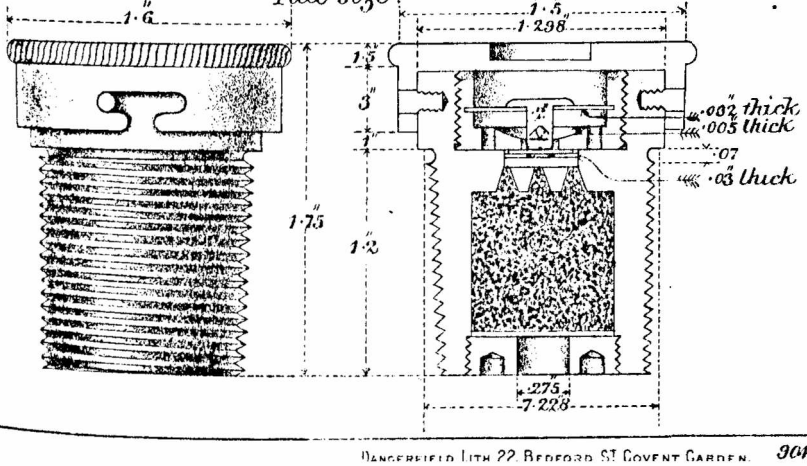


DEVELOPMENT OF PAPER SHOWING MARKING OF FUZE.



FUZE PERCUSSION DIRECT ACTION No. 3. MARK II.

Full size

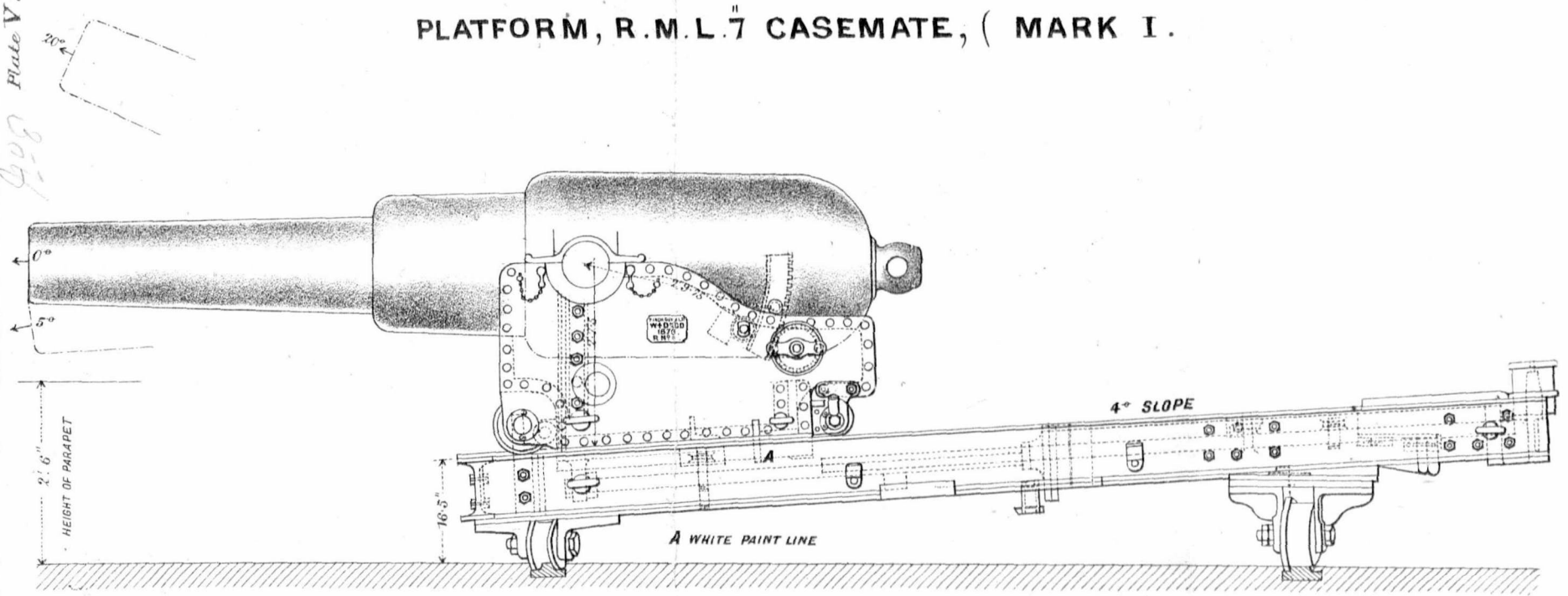


Dangerfield Lith 22 Bedford St Covent Garden. 9044. 1/85.

Plate V.

CARRIAGE, GARRISON R.M.L.^{r}7 CASEMATE, OR DWARF, (MARK I.)

PLATFORM, R.M.L.^{r}7 CASEMATE, (MARK I.

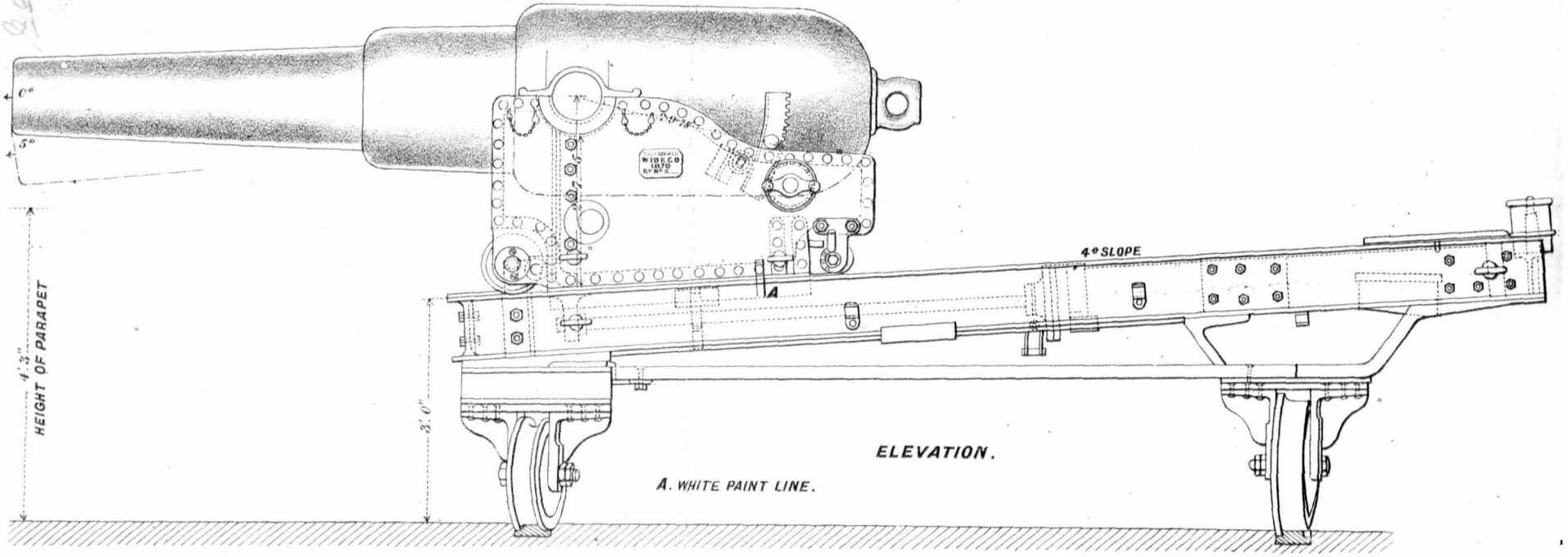


DANGERFIELD, LITH. 22, BEDFORD ST. COVENT ^

Plate VII.

CARRIAGE, GARRISON R.M.L.7" CASEMATE OR DWARF (MARK I.)

PLATFORM, R.M.L.7" DWARF, "A" PIVOT. (MARK I.)

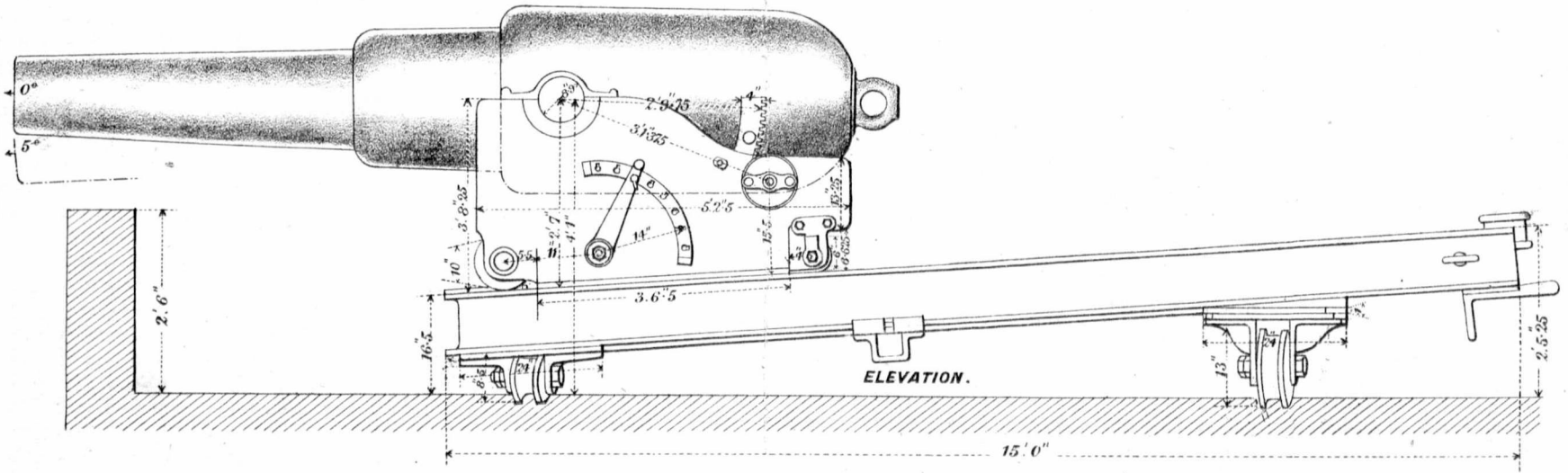


DANGERFIELD, LITH. 22, BEDFORD ST COVENT.

Plate IX.

CARRIAGE, GARRISON R.M.L. 7" S. PLATE CASEMATE OR DWARF.

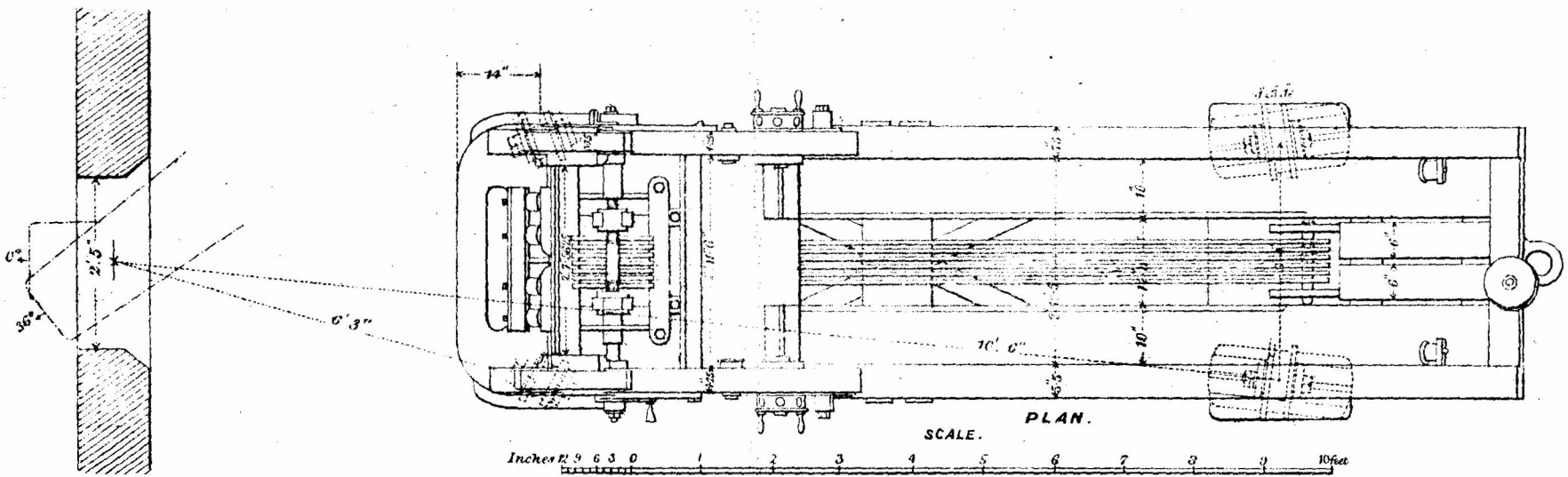
PLATFORM R.M.L. 7" CASEMATE. S. PLATE.



DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 3273.

Plate X.

PLATFORM R.M.L. 7" CASEMATE S. PLATE.



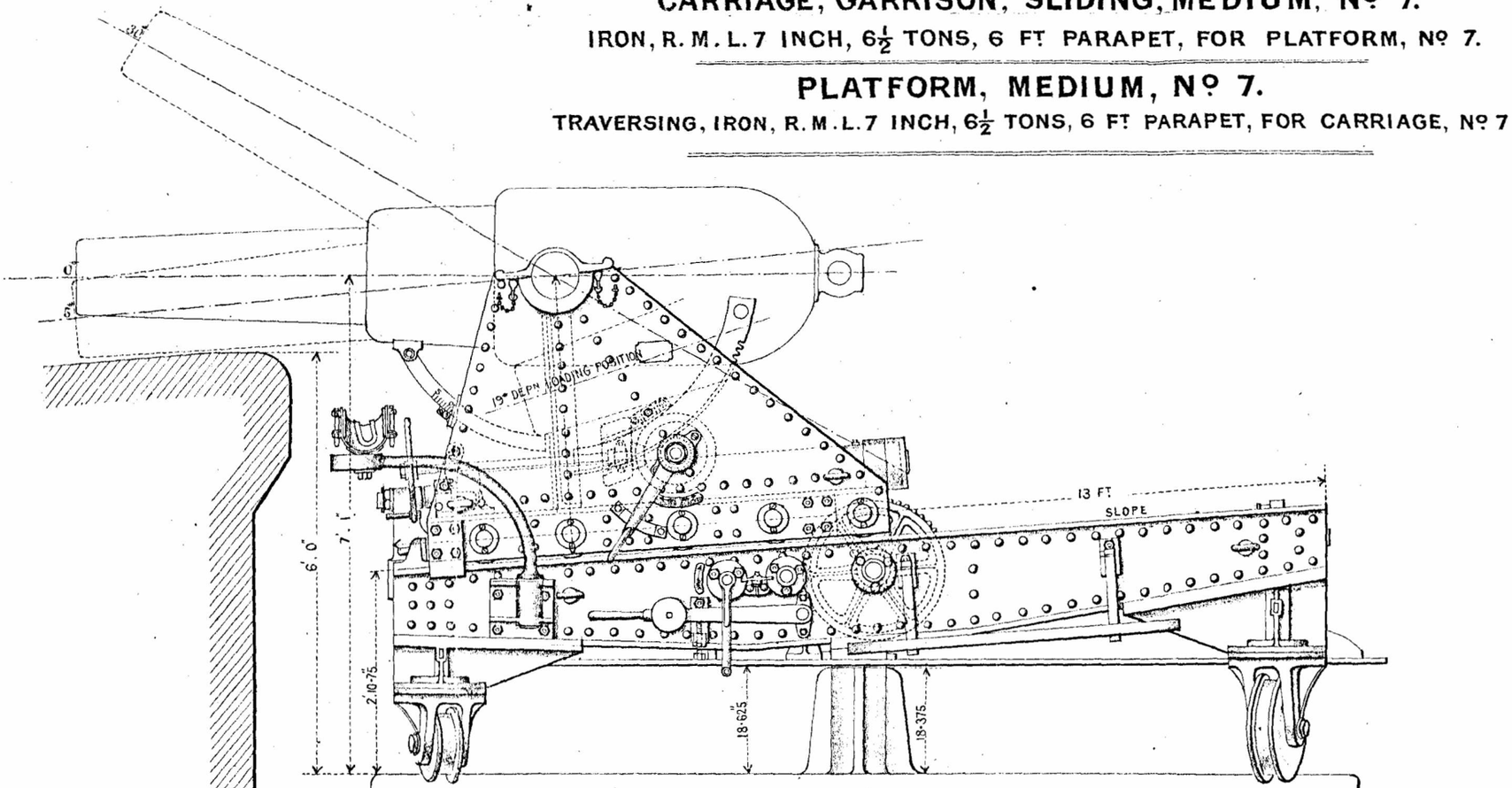
DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN. 3223.

CARRIAGE, GARRISON, SLIDING, MEDIUM, Nº 7.

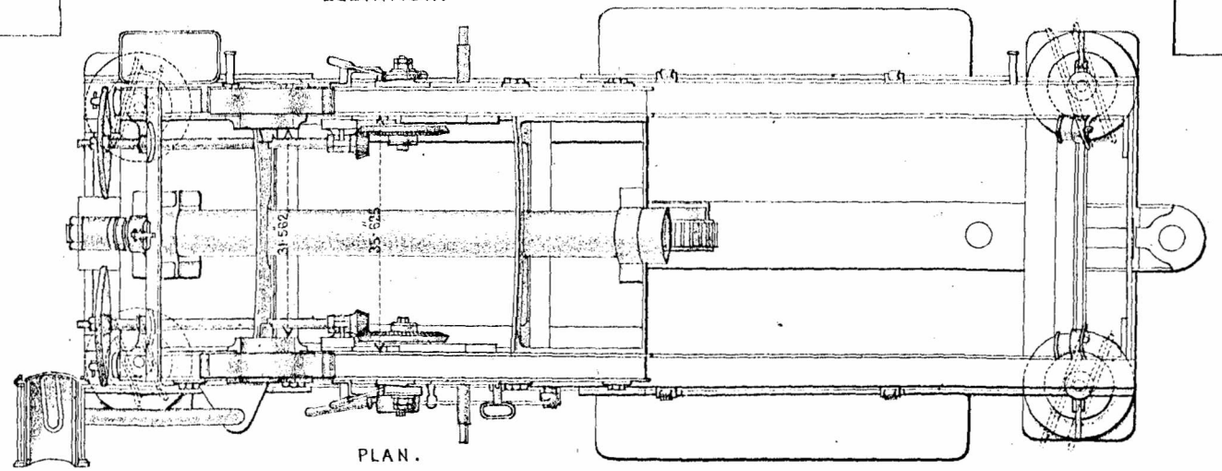
IRON, R.M.L. 7 INCH, 6½ TONS, 6 FT PARAPET, FOR PLATFORM, Nº 7.

PLATFORM, MEDIUM, Nº 7.

TRAVERSING, IRON, R.M.L. 7 INCH, 6½ TONS, 6 FT PARAPET, FOR CARRIAGE, Nº 7.



ELEVATION.



PLAN.

SCALE.

12 9 6 3 0 | 2 | 3 | 4 | 5 | 6 | 7 | 8 FEET

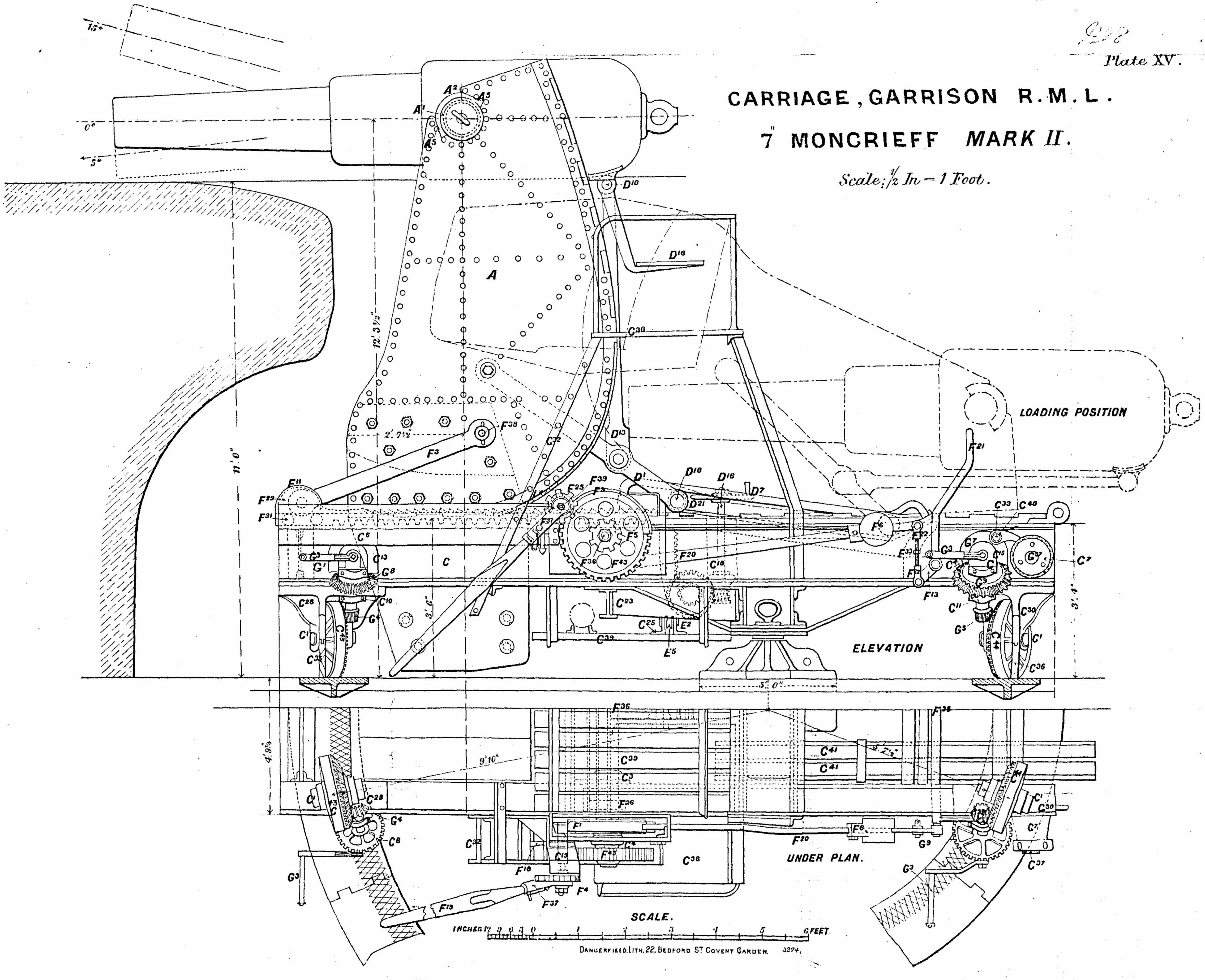
Underfield, Lith. 22, Bedford St Covent Garden. 14836. 9/87

Plate XV.

CARRIAGE, GARRISON R.M.L.

7" MONCRIEFF MARK II.

Scale; ½ In = 1 Foot.



DANGERFIELD, LITH. 22, BEDFORD ST COVENT GARDEN. 3274.