

**B.R. 258(41)**

**HANDBOOK AND DRILL BOOK**

FOR THE

**2-PDR. Q.F. MARK VIII GUN**

ON THE

**SINGLE MARK VIII\* MOUNTING.**

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**1941**

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ADMIRALTY

(Gunnery Branch).

*March, 1941.*



ADMIRALTY, S.W.1.

7th August, 1941.

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The accompanying Handbook and Drill book for the 2-pdr. Q.F. Mark VIII Gun on the Single Mark VIII\* Mounting, having been approved by My Lords Commissioners of the Admiralty, is promulgated for information and guidance.

O.U. 6373 (40) Pamphlet for the 2-pdr. Mark VIII gun on Single Mark VIII Mounting is hereby superseded, and all copies should be disposed of in accordance with the instructions in O.U. 2A—O.U. Catalogue.

*J. V. Markham*

*By Command of Their Lordships.*

To Flag Officers and Commanding Officers  
of H.M. Ships and Vessels concerned.



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## PARTICULARS OF THE EQUIPMENT.

**Gun, Q.F. 2-pdr. Mark VIII H.V.**

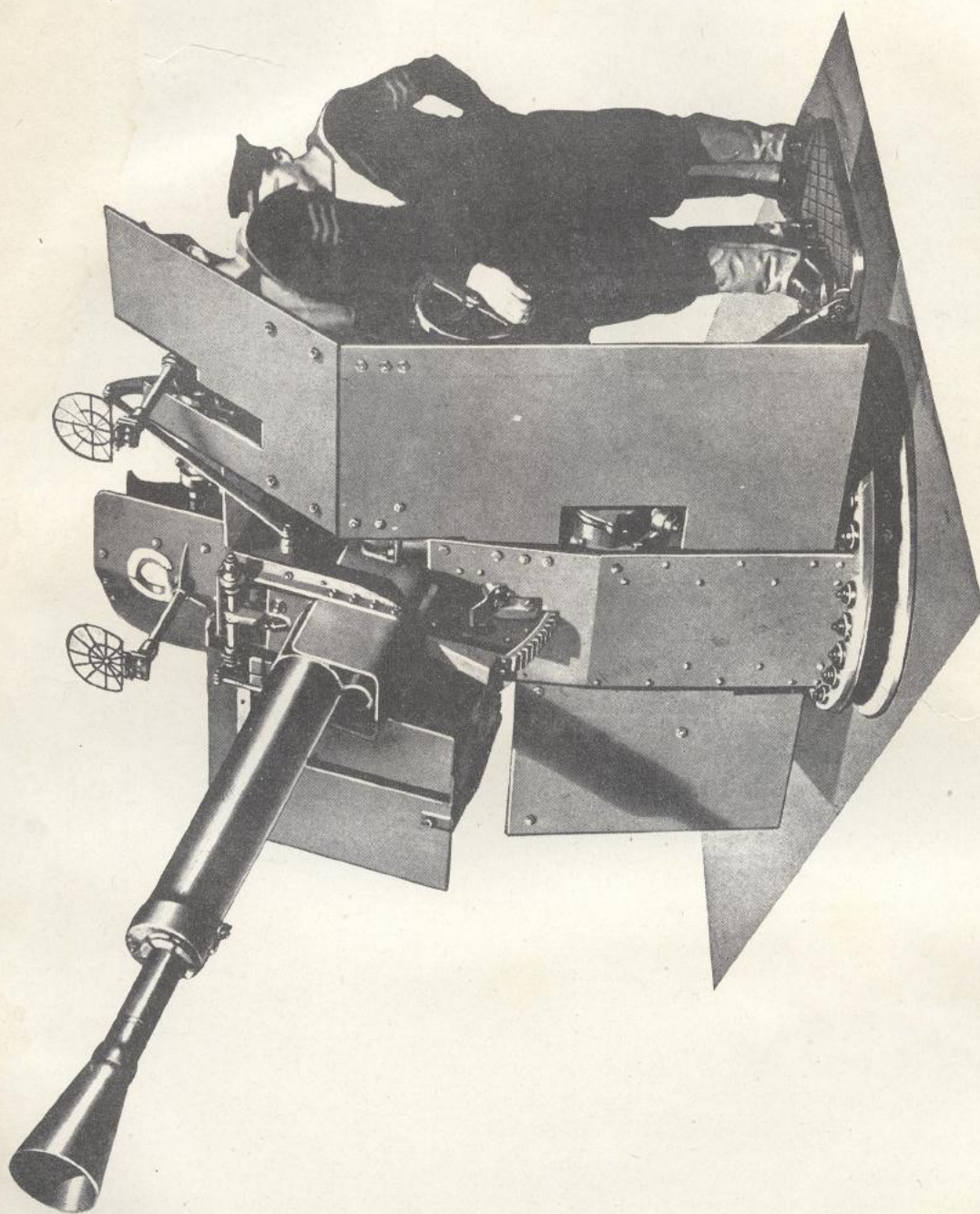
Muzzle Velocity	..	..	..	..	..	..	..	2,400 f.s.
Length of Barrel	..	..	..	..	..	..	..	62 ins.
Diameter of Bore	..	..	..	..	..	..	..	1.575 ins.
Length of Rifling	..	..	..	..	..	..	..	54.84 ins.
Twist of Rifling	..	..	..	..	..	..	..	1 in 30 right-handed.
No. of Grooves	..	..	..	..	..	..	..	12.
Length of Recoil—								
Average Working	..	..	..	..	..	..	..	7.5 ins.
Maximum (metal to metal)	..	..	..	..	..	..	..	8 ins.
Minimum to ensure correct functioning of mechanism	..	..	..	..	..	..	..	7.3 ins.
Overall Length of Gun	..	..	..	..	..	..	..	8 ft. 4.6 ins.
Capacity of Waterjacket	..	..	..	..	..	..	..	22 pints.
Rate of Fire (Automatic)	..	..	..	..	..	..	..	115 rounds/min. approx.
Capacity of Buffer System	..	..	..	..	..	..	..	1 quart.
Total Weight. Waterjacket and Buffer System, filled	..	..	..	..	..	..	..	7 cwt.
Range Tables—								
Low Angle	..	..	..	..	..	..	..	No. 430.
High Angle	..	..	..	..	..	..	..	No. 431.
Trajectory Chart	..	..	..	..	..	..	..	No. O.C. 76.

**Single Mark VIII Mounting.**

Weight of Mounting (without gun or shield)	..	..	..	..	..	..	1 ton 3 cwt. 12 lbs.
Weight of Shield	..	..	..	..	..	..	5½ cwt.
Maximum Elevation	..	..	..	..	..	..	70°.
Maximum Depression	..	..	..	..	..	..	10°.
Working Radius	..	..	..	..	..	..	6 ft.







2-PDR. Q.F. MARK VIII GUN ON THE SINGLE MARK VIII\* MOUNTING.



# CHAPTER I.

## THE GUN.

### GENERAL ARRANGEMENT.

(Plates 5 and 9.)

This chapter gives a brief general description of the gun, sufficient only to understand the action of the gun on firing. In Chapters II and III the parts of the gun and the action of individual parts of the gun are described in greater detail. A gun similar to the right inner gun of the eight-gun equipment is used on the single Mark VIII Mounting. It is fully automatic with rate of fire uncontrolled, unlike guns on the M Mark VII Mounting (four-gun equipment) which are adapted for controlled fire only, and certain guns on M Mark V and M Mark VI Mountings (eight-gun equipment) which have not yet been converted for automatic fire.

2. The main principles of any automatic gun are as follows :

- (a) The gun consists of two parts, recoiling and non-recoiling.
- (b) The gun will fire and recoil. The recoil must be absorbed and the recoiling portions returned to the firing position.
- (c) The fired cartridge must be withdrawn from the chamber and ejected and a fresh round must be taken from the ammunition feed and placed in the chamber.
- (d) The ammunition feed must be moved so that another round is placed in a position from whence it can be automatically removed and placed in the gun when the gun again fires. These operations are all automatic and the energy to carry them out is supplied by the force of recoil.
- (e) While the pressure of discharge remains in the gun, the breech must remain sealed.

A plate inscribed A.H.V. (automatic high velocity) is attached to the rear block. This must be replaced by one marked A.L.V. if at any time the gun should be converted to use low velocity ammunition by substituting the Mark I buffer liner for the Mark III which is normally fitted.

#### **The Barrel.**

3. The barrel is a rifled tube, shaped externally at its rear end in the form of a square. On each side of the square are dovetailed the recoil plates, whilst on the underside of the square are lugs for taking the ends of the buffer piston rod.

#### **The Recoil Plates.**

4. The recoil plates support between them at their rear end the axes of the crank and the crank pinion. Attached to the crank is the connecting rod, which connects the lock with the crank.

#### **The Gun Casing.**

5. The gun and recoil plates are supported by the gun casing. The gun casing consists of two side-plates, cross-connected at their front ends by the connecting block and at their rear ends by dovetailing with the rear block.

#### **The Side Plates.**

6. The side-plates have at their rear ends slots, in which the crank bearings work. On its inner side, each side-plate is formed with a cam, which serves to control the path of the extractors of the lock. These are usually referred to as the "island cams."

#### **Bottom Bracket.**

7. Secured between the bottom edges of the two side-plates, at their rear ends, is the bottom bracket. This bracket is fitted with guide ways for the actuating rack, the object of the actuating rack being to rotate the crank and hence to open or close the lock. This bottom bracket also holds the rack retaining pawls, of which the object will be explained later.

#### **Rack Actuating Lever and Crank Springs.**

8. A handle, fitted on the rack actuating lever enables the lock to be withdrawn by hand after the crank locking latch handle on the mechanism cover has been raised to free the crank from the latch. The rotation of the handle withdraws the actuating rack, thereby turning the crank pinion and opening the lock. Inside the actuating rack and the rack actuating lever are the crank springs. The object of the crank springs is automatically to carry the lock forward to the firing position during each loading cycle.

#### **Crank Locking Latches.**

9. Latches pivot in brackets attached to the side-plates. When the mechanism is closed the bottoms of the latches register with flats formed on the top of the latch pins fitted to the crank. The object of the latches is to prevent rebound of the crank.



### **Crank Operating Levers.**

10. These are pivoted on pins formed on the recoil plates, and towards the end of recoil are operated by cam pieces formed on the side plates. They then force up the crank latch pins and assist in the initial rotation of the crank and withdrawal of the lock.

### **Ejector Tube Spring.**

11. This is a spring, shaped so as to retain the empty cylinders in the ejector tube. The legs of the spring are anchored to brackets riveted to each side plate and are shaped so that the extractor bears down and depresses the spring clear of the ejector tube opening as the lock moves forward to the closed position, thus giving an unobstructed entry for the empty cartridge case into the ejector tube.

### **Cartridge Supports.**

12. These are a pair of flat levers, hinged, one to each recoil plate, which close together under the action of springs in front of the lock when the latter is withdrawn. As the lock comes to the rear, the supports meet in front of the lock in line with the chamber and support the projectile when the extractor falls from the upper to the lower guides and serve to guide the round into the chamber. The supports are forced out against the side plates by the lock as the latter closes.

### **Recoil Gauge.**

13. A recoil gauge is fitted on the left filling piece. On the right filling piece is the operating slide for a round counter. The round counter itself is on the rear block.

### **Connecting Block.**

14. The connecting block has a hole through the centre to take the barrel, while the lower part of the connecting block contains the two buffer cylinders and the ejector tube. The buffer cylinders are fitted with liners. Buffer pistons work inside the liners which have tapered ports on each side to control the flow of liquid from one side of the piston to the other. The rear ends of the piston rods are secured to lugs on the rear of the barrel. The buffers absorb the shock of recoil of the barrel and bring the barrel to rest. They also absorb jar as the barrel runs out to the firing position. On the top of the connecting block, at the front, is a reservoir for recoil liquid, connected to the buffer cylinders by passages through the block.

### **The Feed Box (Plate 9).**

15. At the breech end, on its upper side, the connecting block is recessed to take the feed box. The function of the Feed Box is to move the ammunition feed each time the gun fires so that another round is brought into line with the extractor. The upper and lower feed levers are mounted on a common axis. A stud on the lower feed lever takes in a recess in the gun, while a stud on the upper feed lever takes in a slot in the feed plate. Thus the movement of the barrel in recoil is transmitted to the feed plate. The feed slide is fitted just underneath the feed plate and carries a stud which works in a cam groove in the feed plate. The design of the groove is such that, as the feed plate moves with the recoil of the barrel, the feed slide moves transversely. The latter carries the feed pawl. As the barrel recoils, the feed pawl slips over the waiting round and as the barrel runs out, the pawl engages the round and brings it into line with the feed opening. Retaining pawls prevent the round slipping back while the feed pawl is disengaged.

### **The Waterjacket.**

16. Screwed into the front end of the connecting block is the waterjacket. The barrel is water-cooled for the whole of its length and glands are fitted at the front end of the waterjacket and the rear end of the connecting block. A steam tube is fitted inside the waterjacket above the barrel. This allows for the escape of steam when the water becomes heated with prolonged firing.

### **Barrel Spring.**

17. Inside the waterjacket and fitting round the barrel is the barrel spring. The spring runs the barrel out into the firing position again after recoil. The force of recoil is transmitted to the spring through the barrel nut.

### **Feed Box Cover.**

18. The top of the gun casing is covered by the feed box and mechanism covers. The feed box cover carries the firing gear. This gear, being in contact with the firing gear on the mounting and also in contact with the lock, transmits the firing movement from the mounting gear to the lock itself. A safety lever is fitted on the feed cover which has two positions, "Safe" and "Fire."

### **Mechanism Cover.**

19. The mechanism cover at its front end butts against the rear end of the feed box cover. Inside the mechanism cover at its rear end is the crank stop bolt against which the crank strikes and which acts as a buffer and limits the rotation of the crank when the lock is fully open. On this cover is a hinged inspection cover which allows the mechanism to be sighted without removing the rear cover itself.

### **Flash Eliminator.**

20. The flash eliminator which diminishes flash from the gun is screwed to the muzzle end of the barrel.

A protecting ring is supplied for screwing over the end of the barrel when the flash eliminator is not in use.



## ACTION OF THE GUN ON FIRING.

(Plates 5 and 6.)

21. The position of the gun ready to fire is shown on Plate 5. The barrel is out, lock closed, ends of latch pin on crank registering under the latches and the safety sear disengaged. There is sufficient compression on the barrel spring to keep the barrel out at all angles of elevation.

The position of the lock operating mechanism at this moment can be seen in detail from Plate 6, Fig. (i). The elevation view shows the latch pin on crank registering under the latches and, with the lock closed, it will be seen that the crank is  $\frac{1}{8}$ th inch below its dead centre. The plan view shows the actuating rack and rack retaining pawls. The springs are trying to force the rack retaining pawls in, but they cannot do so, because metal faces (B) on the recoil plates bear against studs (A) on the rack retaining pawls and hold them out against the action of the springs. The action of the latches on firing is described separately at the end of this chapter. With the lock in the firing position the crank is past the dead centre, thus forming a toggle. When the gun fires the force of recoil is taken by the lock, which transmits it via the connecting rod and the crank, to the crank journals in the recoil plates, which pull the barrel to the rear, also through the engagement of the crank pinion in the teeth of the rack the latter is forced to the rear and the crank springs inside it are compressed.

22. During recoil, the horns of the extractor travel along the top of the "island cams" on the side-plates and, at full recoil, reach the position marked (1) in Fig. (ii).

The force of recoil is absorbed partly by the compression of the barrel spring and the crank springs, but chiefly by the buffer cylinders as the liquid is forced from one side of the piston to the other.

When the barrel has recoiled 3 ins. the metal faces (B) on the recoil plates draw clear of the studs (A) on the rack retaining pawls. When the recoil has reached 7 ins., the pawls are forced inwards by their springs in front of the bent on the actuating rack.

The barrel is brought to rest by the action of the buffer cylinders at approximately 7.4 ins. of recoil, the flow of liquid being totally throttled.

The barrel spring having been compressed during recoil now starts to run the barrel out to the front again. The crank pinion and the crank, being fixed in the recoil plates, must also run out, but the rack, on reaching a point corresponding to 7 ins. recoil, is held back from running out any further by the rack retaining pawls.

This is the position shown in Plate 6, Fig. (ii).

The barrel is running out, the rack has just come up against the retaining pawls and cannot run out any further. The lock is still closed and is in the position shown.

23. As the recoiling portions continue to run out, the crank pinion moves along the rack, which is now held. The crank pinion therefore rotates, in turn rotating the crank and withdrawing the lock from the barrel. During the initial opening of the lock, the horns of the extractor will still be supported on the top of the "island cams."

When the barrel has only about 3 inches more to run out, the chamfered faces (D) on the recoil plates strike the studs (A) on the retaining pawls and force the pawls outwards again, clear of the bents of the rack.

This is the position shown in Plate 6, Fig. (iii). The barrel is still running out. The retaining pawls have just been forced clear of the rack and the crank is rotating with considerable momentum and withdrawing the lock. The horns of the extractor are being forced down by the guide pieces, fitted partly on the feed box cover and partly on the mechanism cover.

The barrel continues to run out until in the firing position. The crank springs being in compression try to return the rack, which is now free, to the front again; but the momentum already given to the crank is sufficient to continue its rotation and hence continue the rotation of the crank pinion and hold the rack back against the action of the crank springs.

24. Plate 6, Fig. (iv) shows the position when the barrel has got fully out. The rack is still to the rear. The crank has rotated until brought to rest by the crank buffer stop inside the mechanism cover. The lock is now fully withdrawn and the horns of the extractor have come clear of the "island cams" to the rear.

The extractor will continue to drop until the horns are in their lower position, resting on top of the recoil plates, as shown at (2) on Plate 6, Fig. (iv). With the extractor in this position the fired cartridge is in line with the ejector tube and the round drawn from the feed box is in line with the chamber.

The crank having come to rest on the crank stop bolt, the crank springs are able to force the rack to the front again. As the rack moves forward it rotates the crank pinion, thus rotating the crank in the opposite direction. The lock is forced forward, inserting a new round into the chamber and the empty cylinder into the ejector tube. As the lock moves forward the horns of the extractor travel underneath the "island cams" on the side plates.

25. The last motion of the crank straightening out pushes down on the side levers, causing the extractor actuating levers to lift the extractor. The "island cams" on the side plates are of such a shape that full control of the extractor is retained and any tendency of the extractor to fly upwards before reaching the face of the breech is prevented. The extractor, rising to the firing position, leaves the fired case in the ejector tube and grips the base of a fresh round in the feed box. (Plate 6, Fig. (i).)

As the lock leaves the face of the breech during the early part of run out of the barrel, the spring gibs in the extractor are locked by the locking bars which pass behind them, so that the round



withdrawn from the feed box and about to be entered into the breech and the empty cylinder are securely held while the lock is to the rear.

As the lock approaches the face of the breech, the end of the lower locking bar coming in contact with a cam on the right side plate withdraws the locking bars and allows the extractor to pass upwards over the bases of the cartridges.

#### **Action of the Crank Locking Latches and Operating Levers.**

26. The object of the latches is to prevent rebound of the crank when the mechanism closes and thus ensures that the toggle is not broken when the gun fires.

On the final motion of the lock closing, as the crank straightens out, the latches are pushed forward out of the way by the ends of the latch pin, but as soon as the latter has passed the latches return to the closed position under the influence of strong springs and the operating faces of the latches register over corresponding faces on the latch pin and so prevent any tendency of the crank to rebound. When the barrel has recoiled 6.5 inches the crank is raised towards its dead centre by the tails of the crank operating levers engaging with the cams formed on the side plates. This makes the effort required to start the rotation of the crank very much less and hence increases the speed of rotation of the crank. This is an advantage for, as already explained, the crank depends on its own momentum to complete its final motion and fully withdraw the lock and it is therefore very necessary that the speed of rotation of the crank should not be slowed down.

Plate 6, Fig. (ii) shows the operating levers tripped and the crank raised to the horizontal.

Two stops are fitted on the recoil plates which limit the movement of the crank operating levers and prevent them falling out of position.

27-30.



## CHAPTER II.

## THE LOCK.

(Plates 6 and 7.)

31. The lock resembles earlier patterns.

To facilitate the removal of rounds from the lock the extractor is made detachable. The lock should be lifted by the rollers at the back of the lock frame and not by the horns of the extractor, as the lock may slip out of the extractor and be damaged.

The lock frame and all parts of the lock are sand-blasted during manufacture. This tends to hold oil on the surface and prevent rust.

**Lock Frame.**

32. The lock frame is box-shaped. The bottom is extended on each side to form guide strips which travel in horizontal grooves, in the recoil plates. Two rollers, carried on the top of the lock frame, travel on bearing surfaces underneath the feed box and mechanism covers and assist to steady the lock.

At the front of the lock frame are two vertical guide strips on which the extractor travels.

A recess is provided in the lower part of the lock frame to carry the striker and mainspring. At the back of this recess is a locking lug, over which the mainspring cap engages by means of a bayonet joint and keeps the mainspring and striker in place.

The trigger sear is carried in a recess in the front portion of the lock frame. Vertical guideways in the recess engage with corresponding guides on the trigger sear.

Suitable holes are provided for the axis pins of the side levers, extractor actuating levers and tumbler, trigger sear lever and safety sear. A pin carrying a collar is fitted through the upper portion of the frame to form the trigger sear stop. This limits the forward travel of the trigger sear lever.

On the right hand side, the top of the lock frame forms a shield to the upper end of the trigger sear lever.

On the left hand side a portion of the top of the lock frame is cut away, but the ramps thus formed have no function in the guns under description.

A guard stud is fitted low down on the right, near the front of the lock frame. This forms an extension to the right hand surface of the frame, against which the right cartridge support bears during the movement of the lock. The object of the guard stud is to prevent the right cartridge support from bearing against the lower gib locking bar, as this might have a tendency to release the bar lock. The guard stud can be seen in Plate 6.

The sides of the lock frame are joined together at the rear by the bottom distance piece, dovetailed and riveted in place. This, together with the axis bolt of the guide rollers at the top, prevents the sides of the lock frame from springing.

T

**Extractor.**

33. The back of the extractor is grooved to engage the vertical guide strips on the front face of the lock frame.

At the top of the extractor are two horns. These bear against the extractor guides underneath the feed box and mechanism covers, and against the "island cams" on the side plates, and convey the vertical movement to the extractor as the lock moves backwards and forwards. A small flat is machined on the front of each horn to form a bearing surface for the toes of the safety pawls. Underneath the bosses carrying the horns bearing surfaces are formed for the toes of the extractor actuating levers, whereby the extractor is raised as the lock moves forward.

The top of the extractor is flat and takes against a hard steel piece in the underside of the feed box cover when the extractor is right up and forward. The top of the extractor is cut away in the middle to clear the tripper and safety cam of the firing gear.

The middle of the lower part of the extractor is drilled to form the firing hole.

A box-shaped extension is provided on the left of the extractor to carry the lever connecting the gib locking bars, lever hinge pin and spring. At the top and bottom of this extension two slots are provided across the extractor for the upper and lower gib locking bars. Near the bottom, the walls of the extension are cut away in wake of the left cartridge support. This allows the left cartridge support to assist if necessary the action of the spring operating the gib locking bar connecting lever. The front bottom corner of the extension and the end of the locking bar are slightly chamfered to clear the buffer piston rod nuts.

The front face of the extractor is flanged to engage the rims of the cartridges, the flanges being flared out to the front at their upper ends to ensure easy entry. The flanges are chamfered off at the bottoms to give clearance for the ejector tube spring as the lock moves forward.

The extractor is suitably recessed and cut away to take the upper gib, snib, lower gib and their respective springs. Slots are provided to receive the upper gib cover plate. The bottom of the extractor is drilled to take the hinge pin of the lower gib, which is secured by a split pin on the left.

The upper front face of the extractor and the upper gib are recessed to clear the cartridge retainer in the feed box.



### Side Levers.

34. The side levers are formed on a central boss which is fitted with a bayonet joint to engage with the connecting rod. Underneath the central boss a recessed surface is formed to depress the toe of the safety sear during the final movement of the lock on closing.

The toes of the side levers are suitably radiused to engage the extractor actuating levers.

The arms are drilled to take the side lever axis pin and a thread is cut in the left arm. A small indent is provided in the right arm to engage the spring retaining nib in the head of the side lever axis pin.

Dovetailed and riveted into the top of the central boss is the tumbler controlling piece, carrying a cam groove on the right hand side with which the toe of the tumbler engages.

### Side Lever Axis Pin.

35. The pin is threaded to engage the threads in the left arm of the side levers. The head is extended to form a spring arm with a retaining nib which engages the indent on the right of the side levers when the pin is fully home.

### Extractor Actuating Levers.

36. The toes of the extractor actuating levers are shaped so as to engage under the head of the extractor.

A raised cam is formed on each extractor lever to engage the side levers. The cam is so arranged that the maximum lifting leverage is obtained on the extractor at the first engagement of the side and extractor levers towards the end of the forward movement of the lock. The leverage decreases as the extractor is raised.

The right extractor lever carries the axis for both levers. The extractor levers are loosely coupled together so that it is only necessary to hold one of the levers in position when shipping the lock. A small key, riveted into the left extractor lever, engages a keyway cut in the end of the axis. This coupling is not rigid.

### Striker, Firing Pin, Main Spring and Cap.

37. The body of the striker is shaped so as to be an easy sliding fit in the recess in the lock frame.

A conical extension on the front of the striker carries the firing pin. The latter is of the usual design. A steel rivet is fitted through the head of the striker after insertion of the firing pin to prevent the split legs of the pin from closing and allowing the pin to move forward out of its housing.

The side lever axis pin passes through a slot in the body of the striker. In rear of this slot the striker is hollowed out to take the main spring.

The back of the striker body is extended upwards to form a cocking lug, against which the toe of the tumbler bears during withdrawal and cocking of the striker. A small flat is machined on the tip of the lug to permit of overcocking during stripping and assembly of the lock. This allows the toe of the tumbler to be disengaged from the working surface of the lug and to bear on the flat, in which position the pressure of the mainspring will keep the striker in the overcocked position by a wedging action. When in the overcocked position, the stud on the tumbler disengages from the tumbler controlling piece.

The top of the striker in front of the cocking lug is relieved to clear the toe of the tumbler. A bent is formed on the front to engage the trigger sear.

Underneath, a bent is formed to engage the safety sear.

Bents and sears are very slightly undercut, to prevent the possibility of being jarred off.

The main spring is a circular section, spiral spring. It is kept in compression by the main spring cap which is held in place by a bayonet joint on the body of the lock.

A red line is engraved across the back of the cap. The bayonet joint is disengaged with the red line vertical and locked when it is horizontal.

The protrusion of the striker should be High 0.130 in., Low 0.110 in.

### Safety Sear.

38. The safety sear is pivoted at its front end. The axis pin is entered from right to left and is kept in place by a projection on the head which fits into a recess in the lock frame and is covered by the side levers.

A stepped cock notch is provided in the top of the safety sear to engage the bent in the bottom of the striker.

The safety sear spring is riveted into a recess underneath the sear.

The rear of the sear extends to form a toe. The toe is engaged by the side levers during the final closing movement of the lock when the safety sear is depressed clear of the striker.

### Trigger Sear, Spring, Plug and Cap.

39. The trigger sear is shaped to fit inside the front part of the lock frame. Raised guides each side of the trigger sear at top and bottom travel in vertical guideways in the lock frame.

The top of the sear is extended to register under the safety cam of the firing gear. The bottom of the sear is formed into a bent to engage the bent on the head of the striker. The middle of the sear is slotted to take the short arm of the trigger sear lever.

The upper part of the sear is hollowed out to take the trigger sear spring. A plug fits inside the top of the spring. Trigger sear, spring and plug are kept in place by the trigger sear cap, which is



recessed so as to grip the lock frame under the compression of the spring. The cap is slotted to admit the end of a screwdriver for depressing the spring plug when stripping.

#### **Trigger Sear Lever.**

40. The trigger sear lever is bell-cranked. The short arm engages the slot in the trigger sear. The long arm is engaged by the tripper on firing. The toe of the long arm is slightly notched to prevent any tendency for the tripper to be forced upwards against its spring as it moves to the rear to fire the lock. Forward travel of the long arm is limited by the trigger sear stop.

#### **Tumbler.**

41. The tumbler pivots on the extractor actuating lever axis. The short arm is shaped to engage the cocking lug of the striker and is suitably radiused to engage the flat on the cocking lug when over-cocking. A stud on the left hand side of the long arm engages in the groove of the tumbler controlling piece on the side levers.

#### **Upper and Lower Gibs, Snib and Springs.**

42. The upper gib is shaped in front to fit the base of the cartridge in the feed opening, sloping ramps being provided at top and bottom to ensure easy sliding movement across the base of the cartridge. The front face is recessed to clear the cartridge retainer in the feed opening. A box shaped recess at the back takes the upper gib spring. Below this recess a horizontal slot is provided for the upper gib locking bar.

The snib and snib spring are carried in a slot in the bottom of the upper gib. The head of the snib is bevelled to allow the base of the cartridge to slide easily across as the extractor rises. The snib spring is a small spiral spring.

The upper gib spring is a double-ended, flat spring.

The upper gib, upper gib spring, snib and snib spring are kept in place by the upper gib cover, fitting into grooves at the back of the extractor and retained by a spring tongue-piece and two indents.

The lower gib is recessed at the back to take the lower gib spring. The hinge pin passes through the bottom from right to left and is secured by a split pin. The top of the lower gib is shaped in front to slide over the rim of the cartridge and is extended to form a limit stop to the forward travel of the gib. A flat surface is formed at the back to bear against the lower gib locking bar.

#### **Upper and Lower Gib Locking Bars.**

43. The Mark II Bars are not interchangeable. The connecting lever engages in slots near the left end of each bar. Stop lugs formed at the same ends limit the travel of the bars. The leading edges of the recesses in the bar are chamfered to assist the replacement of the gib as the bars move across into the locked position. This also enables the bars to carry out the duty of the gib spring if the latter breaks. The right hand ends of the bars are bevelled to travel over the locking cam.

When the lock is forward and the extractor right up, the lower locking bar takes over the extractor retaining piece in the right recoil plate. This prevents the extractor from dropping when the extractor actuating levers are first released on withdrawing an empty lock by hand.

#### **Gib Locking Bar Connecting Lever.**

44. The lever is pivoted at the centre. The lugs at the end of the lever are shaped so that they work freely in the slots in the bars. The connecting lever spring is riveted into a recess in the upper part of the lever.

The action is such that the gibs are kept locked by the bars under the action of the spring excepting during the upward movement of the extractor as the lock closes, when the bars are positively moved to unlock by the end of the lower bar engaging the cam on the right side plate. The bars are also unlocked momentarily as the lower bar passes the extractor retaining piece.

### **ACTION OF THE LOCK.**

45. On firing, the barrel and lock move to the rear together, the horns of the extractor travelling along the tops of the "island cams," and the round held in the upper gib is withdrawn from the feed opening.

At the end of recoil, the barrel starts to run out and the crank starts to rotate and withdraw the lock when the rack retaining pawls engage with the rack.

As the side levers unlock, the tumbler withdraws the striker towards the rear under the action of the tumbler controlling piece. At the same time, the extractor actuating levers fall down out of engagement with the extractor.

As the striker body moves clear, the toe of the trigger sear is replaced by the trigger sear spring in front of the bent on the top of the striker and the long arm of the trigger sear lever moves forward until it rests on the trigger sear stop. At the same time the safety sear engages the bent in the bottom of the striker.

As the lock continues to move to the rear the extractor guides in the covers force down on the horns of the extractor and impart downward movement to the extractor.

46. When the crank reaches the fully open position, the horns of the extractor run off the rear of the island cams and the extractor drops down till the horns rest on the tops of the recoil plates. The round in the upper gib is supported by the cartridge supports which have closed in front of the lock during its movement to the rear.



The crank now starts to close under the action of the crank spring and the lock moves forward. The horns of the extractor travel along the tops of the recoil plates, the island cams preventing any upward movement. The round in the upper gib is entered into the chamber. Further movement of the lock replaces the cartridge supports.

The bottoms of the gib locking bar on the right and the bar connecting lever casing on the left depress the ramps of the ejector tube spring and give clear entry into the ejector tube for the fired cartridge.

47. Just before the extractor starts to rise, under the action of the side and extractor levers, the end of the lower locking bar is pushed in by the cam on the right side plate. This withdraws the bars and frees the gibs so that the extractor is free to move upwards over the cartridge cases.

As the extractor rises the lower gib disengages from the empty case and the ejector tube spring rises behind the case and prevents it falling back out of the ejector tube. The lower gib moves up into engagement with the round in the chamber. The upper gib engages the base of the next cartridge in the feed opening. At the same time the lower locking bar moves up clear of the cam, leaving the bars free to return to the locked position under the action of the connecting lever spring.

Just before full toggle, the extractor reaches its highest position, the top of the extractor striking the steel piece underneath the feed box cover. At the same time the toe of the safety sear is depressed by the side levers and the striker moves forward a few hundredths of an inch until the upper bent takes against the trigger sear.

*Note.*—The safety sear is adjusted to be released by the crank as follows:—

- (1) The sear must be released when the crank is 0.03 inch from fully closed.
- (2) The sear must not be released when the crank is 0.06 inch from fully closed.

48. When at full toggle, the crank is 0.125 inch below the dead centre.

The ends of the cam surfaces on the extractor actuating levers and the toes of the side levers bearing on the cams are so designed that the rotation of the crank from dead centre to full toggle is "idle movement" and transmits no further movement to the extractor.

On the firing gear being operated, the trigger sear lever is pushed to the rear by the tripper and raises the trigger sear until the striker is released.

*Note.*—Component locks are marked for the guns to which they belong. A spare lock is fired in a gun at proof.

## STRIPPING AND ASSEMBLY OF THE LOCK.

### To Remove the Lock.

49. Put hand safety lever to safe and remove the mechanism cover. Work the rack actuating lever and withdraw the lock to the rear. Remove the extractor. Tilt the lock slightly forward to disengage the guides and lift up to the rear until the connecting rod rests on the rear block. Disengage the bayonet joint and remove the lock.

### To Replace the Lock.

50. Lift up the connecting rod and engage the bayonet joint. Enter the lock and engage the guides. Lift up the extractor levers and replace the extractor, taking care that the levers engage the extractor correctly. Work the rack actuating lever and ease the lock to the front. Replace the mechanism cover.

### To Strip the Lock.

51. Remove the side lever axis pin. In guns fitted with Mark II striker it will first be necessary to fire the lock and then to make the assembly lines on the side levers coincide with those on the lock frame. Overcock the striker, and remove the side levers. Release the striker. Remove the extractor actuating levers and tumbler. Take off cap and remove mainspring and striker. Remove axis pin of trigger sear lever, then remove cap, spring and trigger sear. Remove safety sear.

*Assemble* in reverse order.

52. Particular care must be taken when re-assembling the lock, that the extractor actuating levers are below and **NOT** above and behind the horns of the extractor.

53. Should the lock be assembled with the extractor actuating levers above and behind the extractor horns the following will occur:—

- (i) The lock cannot be withdrawn fully to the rear if incorrectly assembled in its forward position.
- (ii) The lock cannot be run fully forward if incorrectly assembled in its rear position.

In both cases it will not be possible to load the gun.

### To Strip the Extractor.

54. Remove gib cover and spring. Remove the axis pin of the gib locking bar connecting lever and withdraw the bars. Upper gib, snib and spring can then be removed. Remove lower gib.

*Assemble* in reverse order.

55."



### CHAPTER III.

#### DETAILED DESCRIPTION OF THE COMPONENT PARTS OF THE GUN.

(Plates 5 and 8.)

##### **Barrel.**

56. The barrel is a single, steel, rifled tube of total length 62 inches and with a bore diameter of 1.575 inches.

The muzzle end is threaded externally to take the barrel nut. In rear of the threads a shoulder is formed to provide a seating for the barrel nut, supporting ring and packing.

At about one-quarter the length of the barrel from the muzzle, the external diameter increases and a shoulder is formed to support the barrel nut locking sleeve. Keys are formed on the outside of the barrel at this point, which engage keyways in the barrel nut locking sleeve and prevent the latter from turning.

At about two-thirds the length of the barrel from the muzzle, the external diameter again increases.

At the rear end the barrel is shaped externally to a square cross-section. The front ends of the recoil plates are secured to either side of this squared portion by dovetails and locked by means of horizontal tapered keys secured with riveted check screws. Two lugs extend downwards underneath the squared portion. The lugs are drilled to take the ends of the buffer piston rods. Keyways are provided in the tops of the holes which engage with keys on the piston rods and prevent the rods from turning.

On the top of the squared portion stops are formed each side at the rear to ensure correct assembly of the feed box.

The upper part of the rear face of the barrel is cut away to give additional clearance for the nose of the round held in the upper gib as it moves to the rear and downwards while the barrel is running out.

Vertical grooves in the rear face of the barrel give clearance for the flanges on the front of the extractor.

The outside of the barrel is coppered as a protection against rust.

##### **Recoil Plates. (Plates 5 and 6.)**

57. The front ends of the recoil plates are dovetailed to the squared portion of the barrel on either side of the breech opening and locked by means of horizontal tapered keys secured with riveted check screws. In front of the dovetails, a slotted projection is formed which engages the stud on the bottom feed lever and works the feed pawl during recoil and run out.

Towards the rear, square bosses project outwards from the recoil plates. These are drilled to form the bearings of the crank journals. The bosses are undercut to form bearing surfaces which travel in slots cut in the side plates. These support the recoil plates and allow them to slide freely in recoil. Vertical lines are engraved on the ends of the crank journal bearings. Similar marks are provided on the ends of the crank journals, vertical at full toggle, to enable the position of the crank to be easily seen.

At the rear, the recoil plates are extended downwards to carry the axis of the crank pinion.

In front of the crank pinion axis and slightly below it, the recoil plates are held together by a tie bolt. The bolt is suitably shaped to clear the teeth of the rack and the crank pinion. The recoil plates butt against shoulders on the tie bolt and are held together by castellated nuts secured by split pins. A small key is formed on the right-hand end of the tie bolt which takes in a keyway in the right recoil plate and prevents the bolt from turning.

Inside the bottoms of the recoil plates at the rear end, projections (C), Plate 6, Fig. (i), are formed to engage the front of the actuating rack. These cause the rack to move to the rear together with the recoil plates when the barrel recoils. They also limit the forward movement of the rack when the barrel is right out and are in engagement at full toggle.

The fronts of the rear lower extensions of the recoil plates are bevelled on the outside (D), Plate 6, Fig. (i), to take against the raised lugs (A) of the rack retaining pawls and disengage the pawls from the rack during run out.

Inside the lower part of the recoil plates are horizontal guideways in which travel the guides of the lock frame. Towards the rear, the upper flanges of the guideways are cut away to enable the lock to be unshipped. At about this point, the lower flange of the guideway forms the limit stop to the travel of the crank at full toggle.

Axis studs are formed on the outside of each recoil plate to carry the crank operating lever. Suitable stops are arranged to limit the travel of the crank operating lever in both directions.

Near the front of the recoil plates, lugs are provided on the inside to carry the upper ends of the axis pins of the cartridge supports. The lower ends of the axis pins engage in holes drilled in the upper flanges of the lock guideways.

At the front end of the lock guideway, the extractor retaining piece is dovetailed into the right recoil plate. The extractor retaining piece takes under the lower gib locking bar when the lock is forward and supports the extractor when the lock is being withdrawn by hand until the horns are on top of the island cams.



**Latches. (Plate 6.)**

58. The latches are keyed to levers which pivot in brackets attached to the sideplates. A stop on each latch enters a slot in the bracket and limits the travel of the latch. A spring loaded plunger bears against the forward side of the latch and keeps it in the closed position, excepting when it is operated either by the crank latch pin as the mechanism closes or by the latch lever when the crank locking latch handle is raised. Embodied in the handle are the handle proper, which is known as Part 1 and is keyed to one end of a spindle which passes through the mechanism cover, Part 2, which is keyed to the other end of the spindle, and rollers which are secured to arms projecting downwards from Parts 1 and 2. When the handle is raised the rollers engage with arms on the latch levers causing the latches to move forward clear of the latch pin. A spring loaded catch retains the handle in the housed position. The handle may be found on either the right or left side of the gun. This is to suit other mountings. It will be observed that both parts 1 and 2 are handed. It will be necessary, therefore, to replace them in their original positions in each gun.

The crank operating levers pivot on studs in the recoil plates and are kept in place by the side plates. In addition to the stops referred to previously under recoil plates further stops are riveted to the sideplate which limits the forward movement of the tails of the operating levers when the gun runs out and so prevent a foul with the ends of the latch pin when the crank closes.

The action of the latches is described in Chapter I.

**Cartridge Supports.**

59. The cartridge supports are triangular, hinged brackets, shaped to support the cartridge when the extractor reaches its lower position and as the lock moves forward.

Near the bottom, a groove is formed to take the spring, which is secured in place with a fixing screw.

Stops extend behind the axis lugs and limit the rotation of the cartridge supports to approximately 30 degrees.

**Crank. (Plates 5 and 6.)**

60. The crank carries double helical teeth which engage similar teeth in the crank pinion. Double helical teeth are used in preference to simple straight teeth in order to give smoothness of transmission and greater strength and to eliminate backlash. The teeth of the crank are cut away to clear the blocking stud on the crank pinion when correctly meshed.

The crank journals are forged solid with the crank and extend each side into the recoil plates. On the ends of the journals lines are engraved, so as to be vertical at full toggle. This enables the position of the crank to be easily seen by comparison with similar marks on the ends of the journal bearings. The ends of the crank journals are drilled and tapped to take the keep screw of the recoiling tool.

The arms of the crank are drilled to take the crank pin which is secured in place by a taper pin through the right arm of the crank.

Underneath the arms of the crank, surfaces are formed to take against the lower flanges of the lock guideways in the recoil plates at full toggle. These surfaces are adjusted to give equal bearing at full toggle with the crank pin  $\frac{1}{8}$  inch below the dead centre.

Lugs are formed on the upper parts of the crank arms to carry the latch pin. In front of the latch pin, surfaces are formed on the top of the crank to take against the crank stop bolt in the mechanism cover when the crank is fully to the rear.

**Latch Pin. (Plates 5 and 6.)**

61. The latch pin passes through the lugs on the crank from left to right. The ends of the latch pin are suitably shaped to engage with the latches. A collar on the latch pin takes against the left crank arm. The right hand end of the latch pin is threaded to take the latch pin nut. A fixing screw, secured by a split pin, prevents the nut from unscrewing. The latch pin is prevented from turning by a feather near the left hand end, which takes in a featherway in the crank. A leather sleeve is fitted around the middle of the pin to prevent damage to the teeth of the rack when dismantling the mechanism. The sleeve is cut away to clear the recoiling tool.

**Crank Pinion. (Plates 5 and 6.)**

62. The crank pinion and journals are forged solid in one piece. Double helical teeth on the pinion engage similar teeth on the crank and on the actuating rack. The space between two of the teeth is filled by a blocking stud. This prevents incorrect assembly. Gaps are cut in the teeth of the crank and of the actuating rack to clear the blocking stud when correctly meshed.

**Connecting Rod. (Plates 5 and 6.)**

63. The crank pin bearing is at the rear of the connecting rod. An oil hole in the top of the connecting rod communicates with oil channels in the crank pin bearing.

About half-way along the connecting rod the diameter is reduced and a shoulder is formed. This provides a seating for the adjusting washers. The shoulder is cut away on either side to give access to the edges of the washer for removal. Adjusting washers of the following thicknesses are supplied: 0.003 inch, 0.005 inch, 0.01 inch and 0.02 inch.

The washers are adjusted in the first place before supply so as to give a clearance of 0.092 in. between the front face of the extractor and the barrel, and should not require subsequent alteration.



In front of the shoulder, the connecting rod is threaded to take the connecting rod nut. The end of the rod is shaped to fit into the side levers with a bayonet joint connection.

#### **Gun Casing.**

64. The gun casing consists of the right and left side plates, cross-connected at the front by the connecting block and at the rear by the rear block. Towards the rear, the bottoms of the side plates are connected by the bottom bracket. The water jacket is screwed into the front of the connecting block. The top of the gun casing is recessed to take the feed box.

#### **Side Plates. (Plate 5.)**

65. The front portions of the side plates are dovetailed and riveted to the sides of the connecting block, and are cut away to clear the feed box. Radiused clearances are cut in each plate for the toe of the bottom feed lever during recoil and run out.

Barrel stops are formed on the side plates to take in front of the recoil plates and limit the forward travel of the barrel.

Towards the front, runner strips provide a support for the barrel during recoil and assist to prevent the barrel from turning.

The insides of the side plates carry the island cams, around which the horns of the extractor travel, thus controlling the vertical movement of the extractor as the lock moves backwards and forwards. Particular attention has been given to the control of the extractor during the last part of the forward movement of the lock and the cams are kept full at this point to ensure that the upward movement of the extractor remains fully controlled. In the earlier Mk. VIII guns, extensions have been added to the original cams for this purpose. The island cams are slightly chamfered in front at the bottom to give clearance for the toe of the bottom feed lever at full recoil.

Inside the island cams, towards the front, holes are drilled for the axis pins of the safety pawls. Squared holes are provided to take the safety pawl spring sockets. Slots are cut in the upper flanges of the island cams for the toes of the safety pawls.

66. At the bottom of the side plates, towards the front, brackets carry the ejector tube spring. The spring slides into place from the front and is retained by spring nibs on the legs of the spring. Split pins through the brackets prevent the nibs from disengaging.

The side plates are slotted to provide bearings for the recoil plates. The fronts of these bearing slots are cut away to allow of the insertion of the lug of the recoiling tool in front of the crank journal bearings. A small clearance is allowed between the front of the bearing boss and the front end of the slot when the barrel is fully out.

The right and left filling pieces fit into the rear of the slots. Above and below the slots, studs are provided to engage the lugs of the side plate covers.

67. Guideways with interrupted flanges are formed outside the upper edges of the side plates, to engage corresponding flanges in the feed box and mechanism covers. Similar guideways are provided underneath to take the bottom bracket. Forward movement of the bottom bracket is prevented by stops at the front ends of the guideways. Vertical dovetails inside the rear ends of the side plates engage the rear block, which is secured in place by four set screws.

The deflection pivot bracket is secured across the bottom of the side plates. This bracket is situated underneath the front end of the rack bolt. The deflection pivot projects downwards from the bracket in the form of a cylindrical boss. It fits into a recess provided in the deflection plate in the cradle.

A bracket inside the right side plate carries the gib locking bar cam.

#### **Ejector Tube Spring. (Plate 5.)**

68. The spring is shaped so as to retain the empty cylinders in the ejector tube. The front end of the spring takes under the bottom of the ejector tube and limits the upward travel of the spring. Towards the rear, the legs of the spring form ramps. These are pressed down as the lock moves forward so that the spring is depressed clear of the tube during entry of the empty cylinder. The attachment of the spring is described above, under Side Plates.

#### **Safety Pawls. (Plate 5.)**

69. The safety pawls are intended to guard against the nose of a round held in the upper gib moving forward and striking against the base of the cartridge in the feed opening. This might occur if for any reason the extractor is unable to drop down below the island cams before the lock moves forward.

The right safety pawl is intended to hold the lock in a safe position in the event of a failure with C.N.F. ammunition. The left safety pawl is intended to hold the lock in a safe position in the event of a failure with H.E. ammunition. The left pawl is  $\frac{1}{2}$  inch shorter than the right pawl, due to the difference in length between the C.N.F. round and the H.E. round with graze fuze.

The front ends of the safety pawls are attached to the side plates by pivot screws and nuts, secured by split pins, the body of the nut forming the actual pivot. Recesses on the undersides of the pawls engage the pawl springs. The latter are supported in sockets screwed into squared nuts which engage in square holes in the side plates. The end of the threaded part of the socket is riveted into chisel cuts in the nut so that the socket cannot turn. The rear ends of the pawls are formed into toes which protrude through the slots in the island cams. The toes are shaped square in rear to engage the flats on the fronts of the horns of the extractor. The fronts of the toes are rounded to allow them to be depressed as the extractor moves to the rear. The upward travel of the pawls is limited by the island cams.



**Side Plate Covers. (Plate 5.)**

70. The side plate covers are of gunmetal and serve to cover the slots in the side plates in which the recoil plates slide during recoil. Lugs on the top and bottom of the covers engage behind studs on the side plates. The filling pieces engage behind webs at the rear of the covers and keep them in place. The webs are cut away to clear the slides of the recoil gauge and the round counter gear. The covers are recessed to clear the crank journal bearings during recoil. The recess is slotted along the centre to permit of the gun being worked in recoil by means of the recoiling tool. The covers are in all respects similar and are interchangeable.

**Filling Pieces. (Plates 5 and 6.)**

71. The filling pieces are grooved top and bottom to fit into the slots in the side plates. At the rear, the filling pieces are dovetailed on the inside to engage with the rear lock which serves to keep the filling pieces in place.

The right filling piece is drilled to take the axis of the round counter operating lever, and carries a limit stop for the lever in its forward position. A recessed groove is formed on the outside of the right filling piece for the round counter slide.

The left filling piece is recessed to take the recoil gauge spring and plunger and a recessed groove is formed on the outside for the recoil gauge slide. Along the top of the groove a recoil scale is engraved in inches and tenths, from 6.5 inches to 8.0 inches.

**Recoil Gauge.**

72. The slide travels in the recessed groove in the left filling piece. An arrow mark is engraved on the slide to read against the scale on the filling piece. A resetting stud is provided towards the rear of the slide. The inside of the slide is serrated and is engaged by the knurled surface of the recoil gauge spring plunger. This serves to keep the slider in position after recoil until reset.

**Bottom Bracket. (Plate 5.)**

73. The bottom bracket provides a bearing surface for the actuating rack, and carries the rack retaining pawls.

On each side of the bottom bracket are raised webs, on the outside of which are formed grooves with interrupted flanges to engage the side plates. Near the front ends of the webs, pivot holes are drilled for the rack retaining pawls. The shoulders in front of the axis holes are undercut to retain the pawls in place.

At the rear, on top of the bottom bracket, square-shaped lugs are provided to carry the rack retaining pawl springs. These are single-ended flat springs, dovetailed into place and secured by retaining screws. Undercut guideways are provided in the lugs for the toes of the pawls.

**Rack Retaining Pawls. (Plate 6.)**

74. Axis studs are formed under the front ends of the pawls. Guidestrips on the front ends of the pawls engage under the shoulders on the bottom bracket and keep the pawls in place when assembled.

Near the middle of the pawl is a raised lug (A) (Plate 6, Fig. (i)). The toe of the pawl spring bears against the outside of this lug. On the inside, the lug is chamfered at the rear. This part is struck by the recoil plate during run out when the pawl is forced outwards and disengaged from the front of the rack. This is shown at (D) (Plate 6, Fig. (iii)).

The rear toes of the retaining pawls are shaped to engage the bents of the actuating rack. A stud extends downwards into a slot in the bottom bracket and limits the inward travel of the pawl. A projecting strip in the end of the toe takes into a guide slot in the rear of the bottom bracket.

**Rear Block. (Plate 5.)**

75. The rear block locks the rear ends of the side plates together and keeps the filling pieces and bottom bracket in place.

The edges of the block are dovetailed to engage with the side plates and the filling pieces. The block is kept in place by four fixing screws.

A hole is drilled in the right edge of the block for the axis of the round counter operating lever.

Across the top, a lug is formed, drilled to take the mechanism cover locking pin. A recess, shaped to the connecting rod, is cut in the front of this lug to prevent bruising of the connecting rod when unshipping the lock. The front of the lug is flattened to allow the mechanism cover to be withdrawn, and provides the limit stop when pulling the cover to the rear preparatory to unshipping.

A gunmetal housing bracket is attached near the top of the block for the handle of the rack actuating lever.

76. In the middle, a glazed window is fitted, in front of which the Veeder round counter is attached. On the left of the window, a slot is cut for the rim of the counter resetting wheel and an arrow mark is engraved to show the direction in which to turn to reset. Each side, slightly below the window, holes are drilled to take the stud on the standing part of the recoiling tool.

Radiused clearances are provided each side in front for the crank pinion axis bosses in the recoil plates at full recoil. The front bottom corners of the block are recessed to engage behind the bottom bracket.

In the bottom of the block, a boss is formed for the rack actuating lever, threaded on the inside with working and locking threads. A lug on the back of the boss limits the travel of the actuating lever handle on screwing home. An arrow mark is engraved on the top of the boss to ensure correct entry of the threads when assembling the lever.



**Round Counter. (Plate 5.)**

77. The Veeder round counter is contained in an airtight gunmetal casing, secured by four screwed rivets to the front of the rear block. A resetting wheel is attached on the left. The rim is knurled and projects through a slot in the rear block.

The round counter slide is carried in the right filling piece and is hollowed out inside to take a spring. The spring keeps the slide to the front. Towards the rear, a slot on the outside of the slide engages the toe of the operating lever. The latter is made solid with its axis, which passes through the right filling piece and the edge of the rear block. The end of the axis is slotted to engage the spindle of the counter. The lever is kept in place by a collar and split pin.

On the barrel recoiling, the slide is pushed to the rear and the spring compressed. This turns a ratchet in the counter until it has engaged one tooth of a ratchet wheel. When the barrel runs out, the spring pushes the slide and lever to the front and turns the counter through one unit.

**Actuating Rack. (Plates 5 and 6.)**

78. Double helical teeth are formed on the top of the rack to engage similar teeth on the crank pinion. The teeth are cut away to clear the blocking stud on the crank pinion when correctly meshed.

The rack is broader at the rear and is formed into shoulders on each side. The upper part of each shoulder forms a bearing surface for the recoil plates. The lower part forms a bent for the rack retaining pawls.

The inside of the rack is hollowed out to form a casing for the rack actuating lever, crank springs and rack bolt. The front of the casing forms the front seating of the crank spring. The rack bolt passes through a hole in the front of the casing. The rack bolt thrust bearing behind the front nut of the rack bolt takes against the front end of the rack around this hole when withdrawing the lock by hand. With the lock forward and crank locked, there is a clearance of several hundredths of an inch between the end of the rack and the thrust bearing.

Four feet on the bottom of the rack engage under flanged guides and travel over the bearing surfaces in the bottom bracket. Oil holes are drilled to connect with oil channels in the bottoms of the feet.

**Rack Actuating Lever. (Plates 5 and 6.)**

79. The rack actuating lever carries double start, flat, working threads of 3-inch pitch, which engage corresponding threads in the rear block. Locking threads are cut at the rear end of the working threads. These engage the working threads in the rear block during the final quarter of a turn of the handle on closing. An assembly arrow is engraved on the front end of the working threads, to be in line with an arrow mark on the rear block when assembling.

The rack actuating lever is hollowed out for about three quarters of its length from the front to form a casing for the crank springs. The rear of the actuating lever is drilled to take the rack bolt, which passes through the crank springs. The rack bolt is rigidly secured to the actuating lever by the rear rack bolt nut, the male threads of which screw into a recess in the rear of the actuating lever. The recess is extended behind the nut to take the locking collar.

The actuating lever is cranked to carry the handle, which is pivoted on an axis pin secured by a split pin. The handle carries a metal sleeve handgrip, kept in place by a set screw. The lower end of the handle is in the form of a double eye. Slots are cut in the webs of the eyes to lock the handle in the vertical or horizontal positions. With the actuating lever screwed home on the locking threads and the handle in the vertical position, the sleeve takes into the housing piece on the rear block and prevents the lever from turning.

**Caution.**

*Improper housing of the handle, rack actuating lever, has led to broken handles in consequence of which guns have been put out of action. The attention of all concerned is called to instruction on the instruction plate, which should be rigidly adhered to.*

**Rack Bolt, Crank Springs, Front and Rear Nuts, Thrust Bearings and Locking Collar. (Plates 5 and 6.)**

80. The **Rack Bolt** is a solid steel bolt. The rear end is threaded to engage the female threads of the rear nut and a shoulder is formed on the bolt against which the rear nut bears when screwed home. The end of the rack bolt projects behind these threads to engage the locking collar. The projection is machined flat on three sides and rounded on the fourth to ensure correct assembly of the locking collar and to prevent the rack bolt from turning. When assembled, the rounded part of the projection is underneath. A vertical groove is cut in the end of the projection to allow the point of a scribe to be inserted for removal of the locking collar. A hole is drilled horizontally through the projection to take the split pin retaining the locking collar.

The front end of the rack bolt is threaded to take the **Front Nut**, which is secured by a split pin passing through nut and bolt. In rear of these threads a shoulder is formed to take the rack bolt thrust bearing.

81. The **Crank Springs** are flat section, spiral springs, one section wound left-handed and the other right-handed. They are separated by the crank spring thrust bearing. The object of this bearing is to ensure easy operation when turning the rack actuating lever by hand, as the rear section of spring revolves with the actuating lever while the front portion remains stationary in the rack. The initial compression of the springs together is 189 lbs. With the rack on the retaining pawls the compression is 345 lbs. The inside edges of the springs are radiused to prevent marking the rack bolt.

82. The **Thrust Bearings** are ordinary ball bearings and races. The rack bolt thrust bearing is smaller than the crank spring thrust bearing.

83. The **Rear Nut** carries male and female threads which engage with the actuating lever and



rack bolt respectively. The threads are not of the same pitch (male, 12 threads per inch; female, 14 threads per inch). The nut is flanged at the back and carries two recesses which engage corresponding projections on the front of the locking collar.

84. **The Locking collar** is shaped to fit into the recess in the back of the actuating lever. The centre of the collar is slotted to fit over the end of the rack bolt. There is a small hole in the upper part of the slot to allow the point of a scriber to be inserted when removing the collar. Projections are formed on the front of the collar to engage corresponding locking recesses in the rear nut. A projection on the top of the collar engages a locking recess in the actuating lever. A taper pin, secured by a split pin, passes through the actuating lever, locking collar and rack bolt and retains the collar in place.

#### **Connecting Block. (Plates 5 and 8.)**

85. The connecting block is a metal casting whose top is shaped to accommodate the feed box. In front of the feed box is formed the buffer reservoir. The usual air and filling plugs are fitted. Ports are drilled to connect the buffer reservoir to the buffer cylinders, after which the top of the reservoir is closed by a plate, screw riveted and sweated into place.

The right and left side plates are dovetailed and riveted to the sides of the connecting block.

The connecting block is hollowed out to take the barrel. The barrel spring sleeve and the water jacket are screwed and sweated into the front of this part. The barrel spring sleeve forms the rear seating for the barrel spring. The upper flange of the sleeve is recessed to take the rear end of the steam tube. Holes are cut in the sleeve to assist circulation of the cooling water.

The connecting block is threaded in rear to take the breech gland and lugs are formed to support the gland packing spring.

86. Either side, below the barrel, the connecting block is drilled to form the buffer cylinders. A thin steel tube is sweated into the buffer cylinders to give increased strength to the cylinder walls. Inside each tube is a liner which is positioned by a key fitted near the front of the cylinder. The rear ends of the cylinders are threaded to take the buffer stuffing boxes. Drain plugs are fitted underneath near the front of each cylinder.

87. Between the buffer cylinders is the ejector tube. At the rear end of the tube a slight lip is formed on the top. The cartridge deflector is let into the lip. This is shaped so as to assist the entry of the empty cylinders into the ejector tube. About one cylinder's length from the rear of the tube the ejector stop is let into the bottom of the tube. This is intended to prevent the cylinders in the tube from slipping back at elevation. A flat is machined underneath the rear end of the ejector tube to form a limit stop for the ejector tube spring.

The bottom of the connecting block, underneath the front of the ejector tube, is recessed to take the front wedge piece. The recess is radiused on the deflection pivot and has two threaded holes to take the front securing bolts.

#### **Breech Gland. (Plates 5 and 8.)**

88. The breech gland is of bronze and screws into the rear of the connecting block. The packing consists of asbestos, mutton suet and graphite, in the proportions of 8-4-1 respectively. Alternatively the packing may be made of two separate rings with scarfed joints, each ring consisting of plaited two-ply non-metallic asbestos yarn previously impregnated with high melting point lubricant. This is also used for the muzzle and buffer piston rod packings. The packing is held between metal supporting rings. The gland spring is compressed between the front supporting ring and lugs inside the connecting block and keeps the packing under pressure at all times. The spring is of square section, spirally wound and ground square on the ends. The muzzle gland spring is similar.

The rear of the gland is slotted to take the breech gland spanner. A copper joint ring is inserted under the head of the breech gland.

#### **Buffer Cylinders, Liners, Pistons and Glands. (Plate 8.)**

89. **Liners** of manganese bronze fit into the buffer cylinders and are kept from turning by locating studs. A groove in the liner engages the stud, which is underneath in the right cylinder and on top in the left cylinder.

Diamond shaped ports are cut in the tops and bottoms of the liners, tapering towards the rear. The widest part of the port is in line with the buffer pistons at 1 inch of recoil. The rear end of the ports is in line with the pistons at 7.2 inches of recoil. In rear of the ports the internal diameter of the liners is decreased to form a choke and prevent excessive recoil at high elevations. Mark III liners having a maximum width of port of 0.7 inch are fitted in these guns to suit high velocity ammunition. Should it be desired to fire low velocity ammunition it would be necessary to exchange these for Mark I liners, which have a port 0.9 inch wide.

At the rear ends of the liners, holes are drilled in each side to engage a suitably bent piece of wire or the stud in the end of handle, extension, wrench "H" and box spanner "B" when inserting and removing the liners.

90. **The Buffer Pistons** are solid with their piston rods. The flanges of the pistons are chamfered off to a reduced thickness at the top and the bottom, abreast the ports, to ensure that the ports are not entirely closed when the barrel is right out.

Shoulders are formed on the buffer piston rods which take in front of the recoil lugs on the barrel. Where the piston rods pass through the lugs, keys are formed on the tops of the rods to engage keyways in the lugs and prevent the piston rods turning. The keys are tapered off at the rear to guide them into the keyways when the barrel is being assembled in the casing. The recoil lugs are a slack fit to allow the buffer piston rods to "float." The rods are threaded at the rear for the recoil nuts. Featherways are cut along the threads to engage the feathers of the recoil nut locking washers.

91. Owing to inaccessibility for entering split pins, the recoil nuts are locked by serrated locking washers, which are forced against serrations on the fronts of the nuts by the recoil nut springs. The



locking washers are prevented from turning by feathers which take into featherways in the piston rods. The recoil nuts have blind ends, so that the nuts cannot be screwed home so far as to bind the springs metal to metal. The recoil nuts are turned off conically at the rear to clear the extractor and to facilitate the shipping of the recoil nut box spanner.

92. The rear ends of the buffer cylinders are closed by manganese bronze stuffing boxes. A fibre packing ring with a metal supporting ring takes under a shoulder in the front of the stuffing box and forms a watertight joint. The stuffing box is recessed to take the packing, front and rear supporting rings and the gland. The packing is similar to the barrel packings.

93. **The Gland** is of gunmetal. The heads of the stuffing box and gland are slotted to engage the piston packing gland box spanner. The front of the stuffing box is drilled to allow recoil pressure to act on the front supporting ring and to assist to compress the packing during recoil.

Buffer liners, pistons, stuffing boxes and glands are interchangeable, though they may sometimes be found marked R and L.

The buffer cylinders are water-tested after manufacture to a pressure of 1,500 lbs.

The recoil system holds approximately 1 quart of liquid when full. The liquid used is equal parts of distilled water and pure (white) glycerine.

#### **Waterjacket. (Plate 5.)**

94. The waterjacket is a tube of  $\frac{1}{4}$ -inch thick steel, tapered and threaded at the rear to screw into the connecting block and threaded in front to take the waterjacket cap. These parts are screwed and sweated together.

The inside of the jacket is tinned over to prevent rust.

A drain plug is fitted underneath the waterjacket in front. A filling plug is fitted on top of the waterjacket towards the rear.

After building up, the waterjacket is steam tested to a pressure of 35 lbs.

The capacity of the waterjacket when filled is 22 pints.

95. **The Waterjacket Cap** is of bronze and is screwed and sweated over the front end of the jacket. The cap is threaded to take the muzzle stuffing box and steam tube.

96. **The Steam Tube** is a solid drawn metal tube. A plug is screwed and soldered into the rear end. The head of the plug is rounded to engage in the recess in the connecting block.

Ports are cut in the top of the steam tube at each end to allow steam to enter the tube.

97. **The Slide Valve** is a solid drawn metal tube and is an easy sliding fit over the steam tube.

98. **The Front Plug** is hollowed out to take the end of the steam tube and threaded externally to screw into the waterjacket cap. The front end of the steam tube is soldered into the front plug so that the steam ports are uppermost when the plug is screwed home. The centre of the front plug is drilled to take the steam plug, which is of the usual pattern and cork covered. The front plug is slotted to take a screwdriver.

#### **Barrel Spring. (Plate 5.)**

99. The barrel spring is a spiral spring of circular cross-section. The ends are ground flat to bear on the seatings on the connecting block at the rear, and on the barrel nut locking sleeve in front.

Gunmetal adjusting washers of the following thicknesses are supplied to fit between the front of the spring and the barrel nut locking sleeve in case it is required to increase the compression:—1 inch,  $\frac{1}{2}$  inch and  $\frac{1}{4}$  inch.

The initial compression is 445 lbs. At metal to metal recoil (8 inches) the compression is 820 lbs.

The spring is tempered and nickel-plated (blackened in oil in earlier guns). The free length of the spring when uncompressed should be between 30.5 and 31 inches.

#### **Barrel Nut Locking Sleeve. (Plate 5.)**

100. The barrel nut locking sleeve is of steel and is flanged at the front. The back of this flange forms the front seating for the barrel spring. The front face of the flange carries serrations which engage corresponding serrations at the rear end of the barrel nut and prevent the barrel nut from turning. Keyways are formed on the inside of the locking sleeve which engage over keys on the barrel when the barrel nut is screwed home and prevent the locking sleeve from turning.

#### **Barrel Nut. (Plate 5.)**

101. The barrel nut is of steel and transmits the recoil of the barrel to the locking sleeve and barrel spring. It also forms an extension to the waterjacket and allows cooling water to circulate around the muzzle.

The barrel nut is hollowed out to approximately the same internal diameter as the locking sleeve. The front of the nut is threaded to engage the threads on the muzzle. In rear of the threads, a shoulder is formed to take the barrel nut packing. The latter is of lead, as soft packing is very liable to be damaged when screwing home the barrel nut. In rear of the packing a metal supporting ring butts against the raised shoulder on the barrel. The front of the barrel nut is recessed to take the barrel nut spanner. The rear of the barrel nut is flanged, with a serrated face which engages the front face of the barrel nut locking sleeve.

The barrel nut is coppered over except for the threads and the serrated rear end.

#### **Muzzle Gland. (Plate 5.)**

102. The muzzle gland is carried in the muzzle stuffing box which is screwed into the waterjacket cap. The stuffing box is of bronze, flanged in front and hollowed out to take the muzzle gland spring. Lugs at the rear of the stuffing box support the spring.



The packing is similar to the breech gland packing and is carried between two metal supporting rings. The muzzle gland screws into the front of the stuffing box and compresses the spring and packing. The gland is of bronze. The flanges of the gland and stuffing box are slotted to take the muzzle stuffing box and gland spanner.

#### **Feed Box. (Plate 9.)**

103. The body of the feed box is a box-shaped casting of manganese bronze and is shaped to fit into the recess in the top of the gun casing. The front and rear ends and the underside are flanged at the edges each side. The flanges engage over the edges of the gun casing and prevent lateral movement of the feed box.

The inside is recessed to form the feedway. The right hand side is open for its whole length and the edges are faired out to give a lead in for the ammunition. Raised bearing strips are formed across the top and bottom of the feedway.

A steel protecting strip is riveted into the front of the feedway abreast the noses of the rounds. Towards the rear, abreast the rims of the cartridges, steel cartridge guide strips are riveted into the top and bottom of the feedway. These are extended to form a steel facing to the top and bottom of the feed opening.

104. The rear face of the feed box is cut away in the middle to form the feed opening. Around the feed opening the rear face is recessed to give clearance for the extractor and the extractor actuating levers. A groove is formed above the feed opening to carry the cartridge retainer.

On the left of the feed way, the casting is formed into two box-shaped webs towards the front and rear. These act as projectile and cartridge stops respectively and are suitably shaped out to fit the side of a round. When the round is held against the stops by the feed pawl the base of the cartridge is in line with the feed opening.

A gap is formed between the projectile and cartridge stops to allow empty links to pass out to the left.

The cartridge stop is drilled vertically to take the feed lever axis.

105. On the top of the feed box, on the right, two pairs of lugs are formed to carry the retaining pawls. Steel plates are dovetailed and sweated into the top of the feed box between each pair of lugs to form a seating for the retaining pawl springs and to limit the travel of the pawls.

The top of the feed box body between the front and rear retaining pawls is cut away to give clearance for the feed pawl.

Four raised webs, rectangular in shape, are formed on the top of the feed box at the corners to support the feed plate carrier. A squared projection is formed on the top of each web to engage corresponding recesses in the feed plate carrier.

Lightening holes are cut in the top of the feed box.

106. **The Cartridge Retainer (Plate 5)** engages behind the rim of the cartridge in the feed opening and prevents the cartridge dropping to the rear when the gun is elevated.

The retainer consists of two parts. Part I is an arm of spring steel, dovetailed into the feed box and held by a fixing screw. The rear end is formed into a double eye in which is pivoted Part II. The toe of Part II engages behind the rim of the cartridge. A small spiral spring, in tension, hooks over the head of the fixing screw of Part I and over a hook in the top of Part II and prevents Part II from dropping down, while allowing it to turn if necessary. As the cartridge is withdrawn to the rear, Part I of the retainer is forced to spring upwards until the toe of Part II disengages from the rim of the cartridge.

The object of the hinged toe is to prevent breakage when the lock is withdrawn by hand a few inches to the rear with a round in the upper gib and then allowed to spring forward again with the extractor still on the top of the island cam.

107. **The Retaining Pawls** are pivoted on horizontal axis pins. The toes of the retaining pawls project into the feedway at about 30° to the horizontal and are knurled to take against the sides of the rounds. Inside the upper part of the toe a recess is formed with a stud to take the end of the retaining pawl spring. The other end of the spring is seated against the steel plate let into the feed box.

At the upper ends of the pawls heels are formed to engage the releasing cams. A small projection near the root of the heel registers against the end of the spring plate and limits the downward travel of the pawl.

#### **Feed Levers. (Plate 9.)**

108. **The Bottom Feed Lever** is made solid with the feed lever axis. On the toe of the lever a stud is formed to engage in the slot in the recoil plate. The stud is chamfered off underneath to clear the barrel and a flat is cut on the side of the stud to reduce the amount of radiused clearance required in the side plates. The toe of the lever is chamfered on the top to clear the island cam.

Three keyways are cut in the top of the feed lever axis. These engage corresponding keys in the top of the feed levers. One of the keys is larger than the others to ensure correct assembly of the top feed lever.

109. **The Top Feed Lever** fits over the keyways and is secured in place by a spring, split, screw, securing pin. The toe of the lever carries a stud on the top which engages the short cam groove in the feed plate.



### Feed Plate, Feed Slide and Carrier.

110. **The Carrier** rests on the top of the feed box. Recesses in the edge of the carrier engage projections on the feed box and prevent lateral movement. The corners of the carrier are extended in front and rear to engage outside the gun casing. Lightening holes are cut in the body of the carrier. A recess is cut in the rear edge of the carrier towards the right hand side to clear the safety stud on the underside of the feed box cover.

On the top of the carrier is a flanged guideway, in which the **feed plate** travels backwards and forwards in the "fore-and-aft" direction.

Underneath the carrier a flanged guideway is formed for the **feed slide**, which slides to and fro in an "athwartships" direction. At each end of the feed slide guideway, the carrier is cut away to clear the heel of the feed pawl.

111. **The Feed Plate** is flanged at the sides to travel in the upper guideway in the carrier. Two cam grooves are formed in the body of the plate. The long groove engages the stud on the top of the feed slide. The short groove engages the stud on the top feed lever. The long cam groove is cut so as to give gradual acceleration and deceleration to the feed slide during recoil and run out. The groove is extended to the front to give further movement to the feed slide after the carrier has been removed from the gun casing and so enable the feed slide to be disengaged from its guides in the carrier.

112. **The Feed Slide** is flanged at the front and rear edges to travel in the lower guideway in the carrier. The flanges are interrupted towards the middle of the slide so that when the feed plate is withdrawn towards the rear as far as possible the feed slide can be disengaged from its guides in the carrier.

A stud is formed on the top of the slide to engage the long cam groove in the feed plate.

Two raised webs are formed on the bottom of the slide to give strength. These are formed into bosses near the right hand end to carry the feed pawl axis pin.

The thickness of the slide is reduced underneath over the right hand half to provide room for the feed pawl and spring. The right hand edge is cut away to clear the heel of the feed pawl.

113. **The Feed Pawl** is pivoted underneath the feed slide. The axis pin is kept in place by the guideways in the carrier. The pawl extends to form two toes underneath. The ends of the toes are knurled and take against the embossed projection on the links of the belt when feeding ammunition across. The heel of the pawl is extended into a toe to engage the releasing cam. The upper surface of the heel bears against the underneath of the feed slide and limits the projection of the toes of the feed pawl into the feedway. The centre part of the feed pawl is cut away for lightness.

114. **The Feed Pawl Spring** is carried on the feed pawl axis pin and kept in place by two indented tongues. The upper toe of the spring bears against the underneath of the feed slide. The lower toe bears against a surface formed on the feed pawl between the backs of the toes.

### ACTION OF THE FEED BOX.

(Plate 9.)

115. On the barrel recoiling, the round in the feed opening is withdrawn by the extractor. At the same time, the bottom feed lever is pulled to the rear and the top feed lever moves together with it, the stud on the top feed lever carrying the feed plate to the rear.

The stud on the feed slide is forced over to the right by the cam groove on the feed plate, and the feed slide and pawl move to the right. The feed pawl spring is compressed and the toes of the pawl ride over the next round in the feedway and spring out behind it. The round is prevented from moving by the retaining pawls.

On the barrel running out, the motion of the feed levers, feed plate and slide is reversed. The feed pawl feeds up one more round into the feed opening, the toes of the retaining pawls being forced in against their springs as the round passes under them, and springing out again behind the round. The empty link from the preceding round is pushed across by the new round into the left opening.

The next round arrives in the feed opening as soon as the barrel is fully out and before the lock has moved to the front.

The pitch of a belt (round to round) is approximately 2.4 inches.

(The releasing cams, etc., are described under the Feed Box Cover.)

### Feed Box Cover. (Plate 10.)

116. Undercut interrupted flanges under the edges of the cover either side engage the flanges on the side plates and connecting block and hold the cover in place.

Four lugs are formed on either side of the cover to carry the spindle of the pawl releasing gear.

The cover is cut away in the centre for the tripper and safety cam of the firing gear. The case for the tripper carrier is dovetailed into the top of the cover over this cut away portion.

In front of the tripper carrier case, two gunmetal bearings are riveted to the cover to carry the firing rod and spring. The firing rod guard plate is riveted to the tops of the bearings.

In front of the tripper carrier case and to the right, a hole is tapped in the cover to take the extractor depressing tool. A hard steel stop plate is riveted to the underneath of the cover to form a stop for the extractor in its highest position. Strengthening webs are formed on the top of the cover about this point to give increased stiffness.

117. Towards the rear of the cover, a bracket is attached to carry the hand safety lever. The lever works the safety rod connecting with the tripper carrier case. A safety locking bolt is also



connected to the hand safety lever. This projects into the gun casing and prevents the feed box cover from being removed so long as the safety lever is to "Fire."

The words "Fire" and "Safe" are engraved on the cover abreast the hand safety lever.

Underneath the cover a safety stud is formed. This takes in a recess in the feed plate carrier and engages in front of the extractor and prevents the feed box cover from being removed until the lock has been withdrawn.

Under the rear of the cover are riveted the right and left extractor guides. These are cam-shaped and force down the horns of the extractor as the lock approaches the rear of the island cams. Bearing surfaces are also provided for the guide rollers on the lock frame.

A lifting handle is attached to the cover in rear of the tripper carrier case.

**118. The Pawl Releasing Gear** is carried on the outer side of the feed box cover. The object of the gear is to lift the feed and retaining pawls clear of the feedway when unloading.

The releasing cams are carried on a spindle. When the spindle is turned, the cams bear down on the heels of the pawls and withdraw the toes of the pawls from the feedway. On being released, the spindle turns under the action of a spring, the cams are withdrawn and the pawls spring out again under the action of the pawl springs.

Two cams are provided to release the retaining pawls, the rear cam being extended to form a pawl releasing hand lever. The feed pawl releasing cam is between the retaining pawl releasing cams. All the cams are keyed to the spindle. Correct assembly is ensured by one keyway being larger than the others. Recesses in the side of the feed box cover prevent the cams from moving along the spindle.

The spring is carried on the spindle. One end takes underneath the edge of the feed box cover. The other end fits into a hole in the retaining pawl releasing lever.

The spindle is kept in place by a nut and split pin at the front end. The ends of the keys from a shoulder and take behind the front axis lug on the cover and prevent the spindle from moving forwards. A coupling is keyed and riveted to the rear of the spindle. The coupling is hollowed out into a squared recess and takes the end of the feed releasing tool.

#### **Mechanism Cover. (Plate 5.)**

**119.** The mechanism cover is a manganese bronze casting and carries the crank stop bolt. Interrupted flanges inside the bottom edges engage corresponding flanges at the top of the side plates and hold the cover to the gun casing.

At the front, the sides of the cover butt against the front of the recess in the side plates. The top butts against the rear end face of the feed box cover.

Steel extractor paths are riveted inside the front of the cover each side. These prolong the extractor guides under the rear of the feed box cover. Two steel lock path strips are dovetailed and riveted in front to prolong the bearing surfaces under the feed box cover for the rollers of the lock.

A box-shaped extension is formed on top of the cover to give clearance for the crank. The rear part is hinged and forms an inspection cover. A spring operated thumb catch is fitted at the rear of the inspection cover.

**120.** Inside, towards the rear, bosses are formed to take the crank stop bolt. The bosses are slotted underneath to clear the tops of the side plates. Flats on the rear of the bosses engage a flat on the front of the cover locking pin lug in the rear block when the mechanism cover is pulled to the rear when unshipping.

Inside, at the rear, bosses are formed to carry the cover locking pin. Right and left locking pin bushes are fitted into the bosses and are prevented from turning by check screws. Featherways in the bushes engage the locking feather on the pin. The latter is inserted handle uppermost and then turned downwards to lock.

**121. The Crank Stop Bolt** is entered into the cover from right to left. The head of the bolt is flanged. A check screw in the cover engages a slot in the flange and prevents the stop bolt from turning. A shoulder is formed on the left hand end of the pin and threads are cut to take the crank stop bolt nut, which is secured in place by a split pin. Slots are cut in the bolt underneath near the ends to clear the side plates.

The stop bolt carries two cushions, composed of rawhide washers enclosed in a hardened steel sleeve. The sleeve is hollowed out at each end to take the washers. The centre of the sleeve between the washers is of smaller internal diameter, but is approximately 0.1 inch greater than the diameter of the stop bolt.

The rawhide washers forming the cushion are approximately 0.08 inch thick, secured together with brass end plates and rivets. The washers are a driving fit inside the sleeve and on the stop bolt.

#### **Firing Gear on the Gun. (Plates 5, 10 and 11.)**

**122.** The gun portion of the firing gear is carried on the feed box cover.

**123. The Firing Rod** is carried in bearings on the top of the feed box cover. The rod is kept to the front by a spiral spring. The front end of the spring seats against a riveted collar on the rod. The rear end seats in front of the rear bearing. The rear end of the rod passes through a bearing in the front of the tripper carrier case. (Plate 11.)

A plug is riveted into the rear end of the rod. The plug is hollowed out inside at the rear to take the **Firing Rod Plunger** and spring. The rear end is enlarged into a collar, which takes behind the bearing in the front of the tripper carrier case and limits the forward travel of the rod. The collar is threaded on the inside to take the plunger retaining plug. The firing rod plunger projects through a hole in the plug and is kept to the rear by its spring. This plunger serves no purpose in guns designed for automatic firing.



124. **The Tripper Carrier Case** is a gunmetal box, dovetailed into the top of the feed box cover and kept in place by a steel rivet, which passes through the firing rod guard plate, a projecting web on the front of the case, and through the feed box cover. The top of the case is closed by a cover plate which slides in from the rear and is kept in place by the safety cam bearing fixing screw. A stop is provided on the cover to limit the rearward travel of the tripper carrier.

The case is shaped inside to take the **Tripper Carrier, Safety Cam and Bearing**. A slot is cut in the back of the case towards the right to admit the **Safety Rod**. On the right of the case, a box-shaped extension is formed to carry the **Safety Pawl**. The safety pawl axis pin passes through horizontally from front to rear and is retained by a split pin.

125. **The Safety Cam** is a small leg-of-mutton shaped lever. A toe on the top engages a slot in the end of the safety rod. The lower portion forms the safety cam. When the safety lever is put to "Safe" the safety cam is turned down so as to engage over the top of the trigger sear and prevent any possibility of its rising and allowing the striker to go forward.

126. **The Safety Cam Bearing** is a rectangular block, slotted to carry the safety cam and drilled to take the safety cam axis pin. Guides on either side of the bearing engage guideways in the bottom front end of the carrier case. The safety cam bearing is secured in place by the fixing screw, which passes down through the top of the case on the left.

127. **The Safety Rod** connects the hand safety lever to the safety cam and also operates the safety pawl. (Plate 10.)

The rear end is slotted on the top to engage the hand safety lever, and flanges are formed on each side to travel in the guideway of the safety bracket.

The rod is suitably shaped to slide on the top of the feed box cover and to pass through the slot in the back of the tripper carrier case.

At the front of the rod, on the left, a slot is formed to engage the toe of the safety cam. In rear of this, the top of the rod is formed into a cam surface to engage underneath the safety pawl. The projecting toe at the front of the safety rod is undercut at the back to engage over the front of the safety pawl when the rod is to the rear in the "Fire" position. This ensures that the safety pawl cannot be jarred up during firing, and so hinder the vertical movement of the tripper.

128. **The Safety Pawl** is suitably shaped to engage under the safety lug of the tripper throughout the full travel of the tripper carrier. The underside of the pawl rests on the top of the safety rod and is rounded off towards the rear. The front of the pawl is gashed to engage under the toe of the safety rod when the latter is to the rear.

129. **The Tripper Carrier** (Plate 11) has interrupted flanges each side at the bottom which engage under flanged guides inside the tripper carrier case. The guides are interrupted towards the rear of the case to allow of assembly of the carrier in the case. The top of the feed box cover forms a bearing surface for the bottoms of the flanges on the carrier.

The tripper carrier is hollowed out vertically in front to form a sleeve of square section to carry the **Tripper** and tripper spring. The tripper and its spring are kept in place by a cover, sliding over flanges on the top of the carrier and retained by a popple in the top of the tripper spring. The popple is stamped "A" (for automatic), indicating that the stronger tripper spring and modified tripper for automatic firing are fitted.

A slot is cut on the right of the tripper sleeve in the carrier, through which the safety lug of the tripper projects. The lug reaching the bottom of the slot limits the downward travel of the tripper in the carrier.

The front face of the carrier is formed into a flat surface to engage the rear end of the firing rod. A hole is drilled through the front face into the tripper sleeve for the firing rod plunger.

At the rear, the carrier is hollowed out to take the carrier spring. The rear end of the spring fits into a recess in the back of the carrier case and seats against a retaining cover which slides into a groove from above. The carrier spring returns the carrier to the front each time the firing rod is released.

130. **The Tripper** is of square section, and is an easy sliding fit in the vertical sleeve in the front of the carrier. The upper part of the tripper is hollowed out to take the tripper spring. On the right hand side of the tripper, at the top, a safety lug is formed under which the safety pawl engages.

A slot is formed in the front face of the tripper to clear the firing rod plunger.

The bottom of the tripper is chamfered off towards the front. The right-hand portion of the bottom is cut away in the rear to form an engaging surface for the toe of the trigger sear lever. The left-hand part of the bottom is cut away to clear the ramps on the lock frame.

#### **ACTION OF THE FIRING GEAR. (Plate 11.)**

##### **Lock Forward : Hand Safety Lever to "Safe." (Fig. (iv).)**

131. The safety rod is forward, and has pushed forward the toe on the top of the safety cam. The bottom of the safety cam is pushed down and engages the top of the trigger sear, thus preventing the sear from rising and releasing the striker.

The safety pawl has been pushed up by the cam surface on the top of the safety rod and, taking under the safety lug on the tripper, has withdrawn the tripper clear of the toe of the trigger sear lever.

At the same time, the safety locking bolt, attached to the safety lever, has been withdrawn clear of the locking flanges of the feed box cover.

If now the firing gear is operated, the firing rod will push the tripper carrier to the rear without any movement of the trigger sear lever or trigger sear.



**Lock Forward : Hand Safety Lever to "Fire." (Fig (i).)**

132. The safety rod is to the rear, and the safety cam is withdrawn clear of the top of the trigger sear.

The cam surface on the top of the safety rod has been withdrawn and the safety pawl released, allowing the tripper to move down, under the action of its spring, until the safety lug on the tripper rests at the bottom of the slot in the right of the tripper sleeve in the carrier.

The bottom of the tripper toe now overlaps the trigger sear lever by approximately 0.15 inch.

At the same time, the safety locking bolt has locked the feed box cover to the gun casing.

133. On operating the firing gear (Fig. (ii) ), the firing rod moves to the rear and pushes carrier and tripper to the rear together. The trigger sear lever is pushed to the rear and raises the trigger sear until the striker is released and the gun fires.

As long as the firing lever on the mounting is kept to "FIRE" the gun will continue to fire automatically, provided that the supply of ammunition through the feed box is not interrupted.

On the firing lever being released the firing rod is returned to the forward position by its spring and allows the tripper carrier also to move forward under the influence of the carrier spring. The gun, however, is not "SAFE" until the hand safety lever has been pushed forward to the safe position, with the results previously described.

**Travel of Working Parts.**

134. The following maximum movements of the various working parts, *i.e.*, at full travel, are sufficient to take up the clearances between the various parts, and allow enough overlap for the proper functioning of the gear without overstraining any part.

Maximum movement of firing rod lever on mounting	..	..	..	1.0 inch.
" " " firing rod on gun	..	..	..	0.65 "
" " " carrier, tripper	..	..	..	0.57 "
" " " lever trigger sear	..	..	..	0.53 "

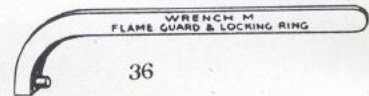
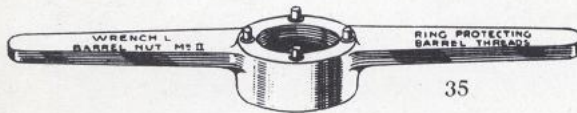
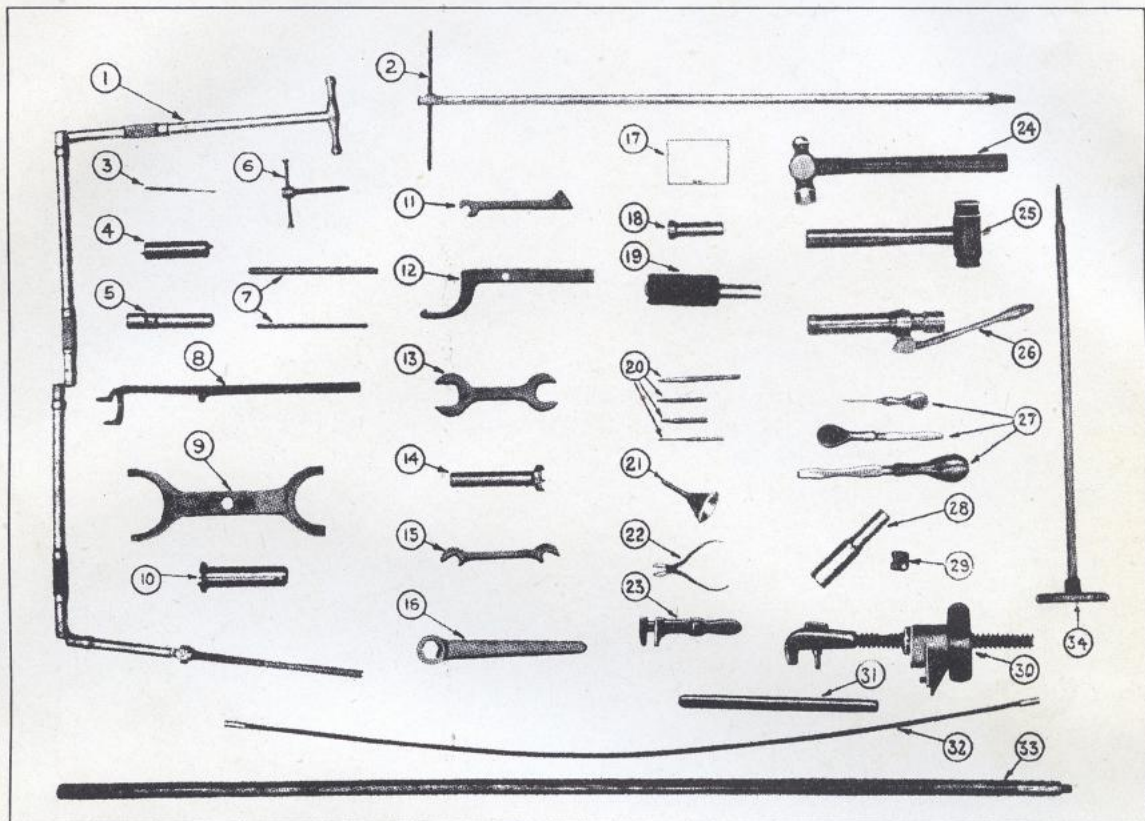
A movement of the lever, trigger sear, of 0.335 inch is enough to fire the lock.  
The firing effort on the firing rod of the gun should be from 35 to 40 lbs.







## TOOLS AND IMPLEMENTS USED WITH THE GUN.



1. Rod, assembling barrel spring.
2. Handle, extension, wrench H, and box spanner B.
3. Extractor, firing pin point.
4. Box spanner A.
5. Box spanner B.
6. Tool, depressing extractor.
7. Tommies, No. 1 and No. 2.
8. Tool, connecting, ammunition connecting link.
9. Wrench C.
10. Wrench D.
11. Wrench E.
12. Wrench F.
13. Wrench G.
14. Wrench H.
15. Wrench J.
16. Wrench K.
17. Box, small stores.
18. Ejector, broken shells.
19. Brush, cleaning.
20. Drifts, Nos. 30, 32, 34, and 35.
21. Funnel.
22. Pliers, side-cutting, 6-inches.
23. Spanner, shifting.
24. Hammer, fitter's, 32-oz.
25. Hammer, hide-faced, No. 3.
26. Plug, clearing chamber.
27. Screwdrivers, large, medium and small.
28. Gauge, plug, bore, low limit, for P.C.
29. Gauge, striker, protusion, No. 20.
30. Tool, recoiling.
31. Tommy, recoiling tool forcing nut.
32. Rod, ejecting empty cartridge case.
33. Rod, brush, cleaning.
34. Tool, feed releasing gear.
35. Wrench L, barrel nut-ring, protecting barrel threads.
36. Wrench M, flame guard and locking ring.



## CHAPTER IV.

## STRIPPING AND ASSEMBLY OF THE GUN, EXAMINATIONS, Etc.

**Implements.** (See plate facing this page.)

141. The purposes for which the lettered spanners and wrenches are supplied are as follows :—

Box Spanner	" A "	..	..	Rear Nut.
"	" B "	..	..	Buffer Piston Rod Nut.
Wrench	" C "	..	..	Barrel Nut, Breech Gland, Muzzle Stuffing Box and Gland.
"	" D "	..	..	Connecting Rod Nut.
"	" E "	..	..	Recoil Plate Tie Bolt and Nuts.
"	" F "	..	..	Steam Tube Front Plug and Muzzle Stuffing Box.
"	" G "	..	..	Latch Pin Nut.
"	" H "	..	..	Buffer Piston Packing Glands.
"	" J "	..	..	Buffer Stuffing Box and Gland.
"	" K "	..	..	Nut, Rod, Assembling Barrel Spring.
"	" L "	..	..	Barrel nut, Mark II, and protecting ring.
"	" M "	..	..	Flash Eliminator.

**To Dismount the Gun from the Mounting.**

142. Take off the mechanism cover and withdraw the lock to the rear. Then remove the feed box cover, feed slide carrier and feed box.

Close the lock. Remove the front and rear bolts securing the gun to the cradle. Rig the dismounting slings and lift the gun out of the mounting, taking care not to damage the mounting firing gear. The gun should be rested on chocks.

A special mandril is provided to ship in the muzzle of the gun. This enables the movement to be controlled when the weight is taken by the purchase.

**To Mount the Gun on the Mounting.**

143. Reverse the above procedure, taking care that the proper front and rear wedge blocks are used, and that the deflection stop on the front wedge block is bearing hard up against the end of the slot in the front of the cradle before finally screwing up the gun securing bolts.

**To Strip the Gun (after Dismounting).**

144. Remove the lock.

Disconnect the round counter lever.

Remove feed box cover, feed slide carrier and feed box.

Place a metal drift or hammer handle across the top of the side plates and beneath the crank.

Then screw in on the rack actuating lever and house the handle, thus compressing the spring.

Now take out the split pin and screw fixing pin, and remove the latch pin nut and latch pin from the crank.

Then take out split pin and taper pin from the rear of the actuating lever and remove locking collar with the point of a scriber. Unscrew and remove the rear nut.

Ease back on the handle of the rack actuating lever until compression is off the spring and remove rack actuating lever with springs and thrust bearing complete.

Take out the four set screws securing the rear block and remove the rear block by tapping upwards with a hide hammer. Avoid hitting the threaded boss of the rear block, as this may damage the threads.

145. *CAUTION.*—Before removing the rear block, be sure that the round counter lever is disconnected.

Turn the crank as far over to the rear as it will go, and remove the actuating rack and rack bolt.

Then remove right and left filling pieces and side plate covers.

Drain the water jacket, remove the flash eliminator.

Remove the muzzle gland and stuffing box.

Insert the rod, assembling barrel spring, up the bore from the rear. Place spanner on the rod and screw up the nut. Then unscrew the barrel nut and take out the barrel nut locking sleeve and barrel spring.

146. *CAUTION.*—Do not stand in front of the muzzle while unscrewing the barrel nut.

Pull gun back a few inches to the rear and ease back the rear gland.

Unscrew the piston rod nuts.

Pull gun and recoil plates to the rear and lift out of casing. (The side plates have to be sprung slightly outwards to clear the latches.) Screw the protecting ring on flash eliminator threads.

Remove bottom bracket.

Drain the buffer system.

Remove buffer glands and stuffing boxes. The buffer liners can then be drawn out, using the stud in the end of the handles, extension, for wrench " H " and box spanner " B," or by means of a suitably bent piece of wire.

Remove steam tube.



### To Strip the Feed Plate Carrier.

147. Turn upside down and pull feed plate to the rear as far as it will go. Feed slide can then be disengaged and lifted out.

*Re-assemble* in the reverse order, taking care that the feed plate is the correct way up *when the carrier is assembled in the gun.*

### To Strip Firing Gear on Feed Box Cover.

148. Put safety lever to "Fire."

Unscrew fixing screw and slide off cover of tripper carrier case to the rear. Remove carrier spring cover and carrier spring. Remove carrier complete with tripper.

Depress the popple of the tripper spring and slide off the tripper spring cover. Remove tripper spring and tripper.

Remove safety lever.

Disengage safety cam from safety rod and remove safety cam and bearing. Remove safety rod.

Remove safety pawl.

Remove set screw securing collar on firing rod and withdraw firing rod to the rear.

*Re-assemble* in the reverse order.

*Note.*—(1) The tripper should be a very easy fit in the tripper carrier and should drop freely of its own weight in its housing in the tripper carrier.

(2) To overcome the possibility of incorrect assembly, Mark I Safety Pawls are to be modified by fitting a stop screw (A.F. O 4211/40).

See that the tripper carrier goes right forward in the tripper carrier case, and, when in this position, the firing rod plunger should not protrude inside the tripper carrier when the firing rod is at rest.

### To Assemble the Gun.

149. Insert buffer liners with large ends of ports to the front, and push home until locating stud engages groove in front end.

Replace pistons, stuffing boxes and glands and screw up. Pull back piston rods to the rear.

Turn gun casing upside down and refill buffer system through the cylinder drain holes, working the pistons slowly to and fro while filling. Turn casing the right way up.

Replace breech stuffing box, spring, packing and gland and screw up all except the last three or four turns. Grease over inside the gland.

Replace bottom bracket and tap home from the rear.

Replace steam tube, being careful that the escape holes in the tube are on top.

Pull buffer piston rods to the rear and turn so that feathers are uppermost.

See crank operating levers in place on recoil plates. Oil over the barrel in wake of the breech gland. Remove the protecting ring.

Enter barrel and slide in until piston rods are engaged in lugs (about 8 inches from home). Replace piston rod nuts, locking washers and springs and screw hard home.

Remove filling plug of buffer reservoir; then push the barrel right out. Complete filling the buffer system (gun horizontal), and replace filling plug.

The barrel should now slide freely in the breech gland when a force of not more than 60 lb. is applied. This is important and should be checked, as any undue stiffness will probably cause short recoils.

Insert barrel spring and barrel nut locking sleeve.

Replace barrel nut packing and supporting ring.

Insert rod, assembling barrel spring. Slip on the barrel nut, taking care not to damage the barrel nut packing. Place spanner and nut on rod and screw up. Engage barrel nut threads and continue to screw up until barrel nut is right home. Do not stand in front of the muzzle when assembling the barrel spring. Remove rod, assembling.

Replace muzzle stuffing box, packing and gland. Tighten up breech gland the full amount,

Replace flash eliminator.

Turn crank right over to the rear, enter the rack with rack bolt, rack bolt thrust bearing and front nut in place and push right home, when teeth will engage. Then lift up the connecting rod and work through full limits to check that the teeth are correctly meshed.

Replace latch pins.

Replace side plate covers and filling pieces.

Replace rear block and tap down carefully into place.

Insert rack actuating lever and screw home. Lift up connecting rod and work the rack to and fro and note that the rack slides freely over the actuating lever. This will not be the case unless the rear block is exactly in its proper position.

Screw up the four set screws securing the rear block.

Hang the crank. Insert crank springs and thrust bearings. Enter rack actuating lever, taking care not to bruise the starts of the threads and screw home, compressing the springs. House actuating lever handle.

Pull rack bolt towards the rear and screw on rear nut. Push home gently and screw up the rear nut into the rack actuating lever. (The two ends of box spanner "A" are used for this operation.)

See that the rounded side of the projection on the rear end of the rack bolt is underneath and that the locking recesses in the rear nut are vertical. Replace locking collar and pins. Release actuating lever handle and ease back.

Connect up round counter.

Replace feed box and feed slide carrier.



Replace lock. See safety lever to "Safe" and replace feed box cover. Replace mechanism cover.

Refill waterjacket.

### To work the Gun in Recoil.

150. The gun should always be worked in recoil after assembly to ensure that the barrel is working freely in the glands. This should never be done with the lock unshipped.

Put safety lever to "Fire." Note that safety lever cannot be put to "Safe" with the striker released.

Ship recoiling tool so that standing part engages hole in rear block and moving part hooks in front of crank bearing. Screw up thumbscrew into threads of hole in crank journal.

Work Tommy screw and withdraw the barrel to full recoil, afterwards easing the barrel out to the firing position and removing the recoiling tool. In this operation the extractor will not drop down on to the lower guides.

*Note.*—When working the gun in recoil the buffer system should be full.

The gun can readily be worked in recoil for about  $1\frac{1}{2}$  inches without the use of the recoiling tool. This is effected by raising the crank locking latch handle and turning the rack actuating lever handle. Care is necessary not to put too great a strain on the handle, and the barrel should not be withdrawn more than  $1\frac{1}{2}$  inches by this method.

Guns should not be worked in recoil, when loaded as repetition of this movement is liable to lead to separation of the shell from the cartridge case.

### NOTES ON UPKEEP AND EXAMINATIONS OF THE GUN.

151. The following upkeep routine should be carried out as far as practicable.

*Note.*—Vaseline should never be applied to any of the working parts of the gun.

#### Daily.

152. Work firing gear and note that all parts are working freely and that the firing rod releases the striker.

Wipe over the feed box covers.

Work unloaded guns in recoil, using the recoiling tool and lubricating freely the muzzle and breech glands.

#### Weekly.

153. Sponge out bores. (Also after firing and after bad weather.)

Lightly oil over working parts.

Visually examine, clean and oil all locks and feed boxes.

Loaded guns are to be unloaded and worked in recoil, using the recoiling tool and muzzle and breech glands freely lubricated. Top up buffer reservoir.

Top up waterjackets. (More frequently if firing.)

#### Monthly.

154. Strip and examine locks. (More frequently if firing.)

Test recoil liquid for acidity.

#### Quarterly.

155. Drain off waterjackets and refill with fresh water.

#### Six Monthly.

156. Strip and examine buffer cylinders.

Strip and examine firing gear on feed box cover.

157. *Special Note.*—Whenever a gun has been dismantled for any reason the barrel should be tested as follows for freedom after the gun has been bolted down in the mounting again.

Remove barrel spring and crank spring.

See that the barrel will slide in recoil, horizontal, when a force of not more than 80 lb. is applied.

During the test the glands should be screwed up to  $\frac{1}{4}$  inch from home and be watertight.

This will prevent the occurrence of short recoils due to tightness of recoiling parts, glands, etc.

### To Prepare the Gun for Firing.

158. See waterjacket and buffer reservoir full.

Remove oil from bore and pass gauge, plug, bore low limit, through the bore.

Gauge protrusion of striker. This should be not less than 0.11 inch and not greater than 0.13 inch.

See buffer piston nuts fully screwed home.

Liberal oil over all working parts inside gun casing and feed box.

Work gun in recoil.

Set round counter to zero.

See ejector tube clear and ejector tube spring correct.

Examine ammunition and see that belts are correctly loaded, checking the position of the rounds in the links with the gauge supplied.

See spare lock correct and handy.



**After Firing.**

- 159. Sponge out bore.
- Clean and oil lock.
- Mop up any leakage water.
- Top up water jacket.
- See ejector tube empty and clear.
- No further examinations should be necessary unless trouble has been experienced.

**To Fit a Spare Barrel.**

- 160. Remove barrel and recoil plates complete.

Remove screws securing tapered horizontal keys, which will be found on the outer side of the recoil plates, a little before the line of the dovetail. The screws are riveted into chisel cuts, and may give trouble in removal.

Put strong clamps over breech end and recoil plates top and bottom; to prevent the possible distortion of the dovetails.

Drive out the tapered keys with a metal drift towards the muzzle. The drift is inserted up a slot to be found on the inside of the recoil plates, just behind the rear face of the breech end.

Remove clamps.

Remove recoil plates from the barrel, the dovetails are tapered. The recoil plates come off in an upward direction.

Place recoil plates on the spare barrel and clamp up when the key slots in both parts are in line. This should be when the underface of the breech end and recoil plates are flush.

Replace tapered keys, care being taken to see that there are no burrs on the keys before insertion. A little tallow will assist in getting the keys right home. When the keys are right home, the recoil plates should be solid with the barrel and securing screw holes in line.

If the key will not go right home, the tapered sides should be carefully eased as necessary.

Insert locking screws and rivet up when hard home.

**PRECAUTIONS TO BE TAKEN IN LOW TEMPERATURES.****General.**

161. The principal factors affecting the performance of automatic guns and mountings in temperatures of 32° F. and less are as follows :—

- (i) Ice formation in the bore.
- (ii) Frozen or sticky lubricant in the locks, producing a cushioned striker blow and consequently a missfire.
- (iii) Ice formation in the mechanism causing complete failure to function and ice formation in the feed box causing failure to feed.
- (iv) Ice formation on the elevating and training gears and at points on the mounting where there are small clearances between fixed and moving structures.

**Preparations.**

162. (i) Remove the cover plate of all gear boxes and wash out with petrol, then coat with Cooper's grease.

(ii) Remove dust covers and wash out training rack and roller paths with petrol, then coat with Cooper's grease.

(iii) Wash out with petrol through every grease nipple, then relubricate with Cooper's grease. This must be done very thoroughly.

(iv) Wash off existing lubricants from all outside working parts and cover the outside of the mounting with Cooper's grease, paying particular attention to the elevating arc and all other places where a moving and a fixed part are separated by only a small clearance.

(v) Strip the gun completely and remove all existing lubricants and replace them as follows after drying the mechanism thoroughly :—

Replace all G.S. mineral oil by mineral oil non-freezing.

Replace all mineral jelly by Cooper's grease No. 4.

(vi) Lubricate the locks extremely lightly with mineral oil non-freezing.

(vii) Re-assemble the gun.

(viii) Grease the exterior of the gun with Cooper's grease No. 4.

**Maintenance.**

163. (i) Electric heaters (with corresponding balance weights) are being supplied for fitting to barrel casings and these should be used as described in paragraph 164.

(ii) Guns should, whether loaded or unloaded, be kept at full depression where possible to avoid water collection or ice formation in the bores, and trained across the direction of wind and spray. It is important to prevent water finding its way into the barrel.

(iii) Unpainted canvas covers greased on both sides with Cooper's grease No. 4 should be kept shipped over the feed rails and the rear casings secured by lanyards. These covers may be left on when the guns are firing and need only be removed when loading.

(iv) Ammunition should be greased as laid down in paragraph 179.



(v) Barrel casings should be filled with a mixture of 50/50 glycerine and water, except when electric heaters are in use, when no glycerine should be used.

(vi) Bores should be sponged out with a mixture of 50/50 glycerine and water, enough caustic soda being added to make the solution slightly alkaline.

(vii) Carry out the following routine every hour :—

Put the gun to safe.

Run the mounting through the full limits of elevation and training, leaving it at full depression for two or three minutes to drain the barrel.

Remove any ice formation found, paying particular care to exposed parts of firing gear.

Work the firing gear, checking first that the gun is at "Safe."

Replace any Cooper's grease which has been removed when clearing away ice.

Return the mounting to the selected bearing and put the gun to "Fire."

#### **Instructions for the Use of Electric Heaters.**

164. (i) When the temperature reaches 30° F. the heating circuits should be made. The heat applied is regulated to produce a temperature of 180°-190° F. in the barrel casings at an air temperature of 0° F. and a surface wind of 2-3 knots. If the conditions encountered exceed this in severity, there will still be sufficient heating effect to ensure functioning; but if, on the other hand, the conditions are less severe, then the temperature of the cooling liquid will rise to a point when the water content will evaporate and constant topping up will become necessary.

It is therefore essential to apply the heat with care and intelligence and adapt the amount of heating to the prevailing weather conditions. The following rough rule may be used as a guide :—

Make circuits at 30° F.; keep cork plugs lightly fitted into the barrel casings; if and when they blow out, switch off the heating circuit for one hour. It should be remembered when estimating temperature that wind has a most important effect and that conditions may well arise such that the temperature in still air is of the order of 35°-40° F. when the temperature at an exposed mounting may be down to 30° F. or less.

(ii) In order to prevent excessive chamber pressures which would otherwise be caused due to heat, the following procedure is to be carried out when the electrical heaters are in use with guns kept loaded ready for immediate action :—

Special reduced charge practice ammunition will be supplied on the basis of one full box of 30 rounds per barrel. The first round of the belt is to be removed and replaced with a round of special ammunition which will be loaded into the chamber.

The special reduced charge H.V. practice rounds will consist of H.E., H.V., I.T. shell weighted H.E.S. and plugged for practice with a charge of 1.760 grains of H.S.C.T. 134-055, in lieu of the normal 1,860 grains. These rounds will be stencilled "H.V. reduced."

All guns loaded as above are once every five days to be unloaded and the rounds so recovered returned to the nearest N.A. depot if opportunity immediately offers, alternatively they may be jettisoned. The rounds replaced must be as stated above if the heaters are in use.



## CHAPTER V.

## NOTES ON AMMUNITION.

176. Fixed ammunition is used, the particulars being as follows :—

**2-pdr. H.V. Mark VIII Gun.**

Charge H.S.C.T. 134/055	.. .. .	1850 gr.	
Projectiles :—H.E. H.V. Mk. I T.	.. .. .		
Fuze D.A. No. 243 with Igniters SHELL	} .. .. .	1 lb. 13 oz.	12 dr. $\pm$ 5 dr.
No. 1 Mk. I or Plug Base Shell No. 14	.. .. .		
Practice Tracer, Mark II T.	.. .. .	1 lb. 13 oz.	14 dr. $\pm$ 5 dr.
„ Mark I	.. .. .	1 lb. 13 oz.	6 dr. $\pm$ 5 dr.
Weight of complete round H.E.	.. .. .	2 lb. 14 oz.	0 dr.
One round complete with articulated link	.. .. .	3 lb. 5 oz.	0 dr.
Weight of full box	.. .. .	140 lb. 0 oz.	0 dr.

177. **Articulated Links** are made of spring steel, hardened and tempered. Raised indents are provided to engage the toes of the feed pawl. The part of the link that takes the projectile is specially indented to fit the slightly smaller diameter of the nose of the round and to prevent the links being incorrectly assembled on the rounds when belting up.

A gauge is provided to ensure that the round is in its correct position in the links.

178. **End Connecting Links** are provided one per each belt of 14 rounds. The connecting link is on the last end of the belt to enter the feed box.

The connecting link is similar to the articulated link, except that the centre pocket is in the form of a hook, designed so as to clip on over the middle of the end round of the next belt.

A modified “ Tool Connecting Ammunition Connecting Link ” is supplied for connecting up the belts.

Pressed steel links, once removed from ammunition boxes, should be kept very lightly oiled and free from rust to prevent metallic action setting up and stopping the easy withdrawal of the round from the link. Any excess of oil is apt to seep into the cartridge cases and cause misfires. Consequently a minimum quantity should be applied and never directly to the cartridges.

When sheradised (a form of galvanising) links are supplied oil is *not* to be applied.

The method of loading the belts on to the feed rails is illustrated in the Drill Book.

**READY USE AMMUNITION EXPOSED TO WEATHER.**

179. During war and emergency, ammunition actually on the guns is to be lightly coated all over the outside of the links, and outside of the ammunition, with Coopers Grease. On that part of the ammunition covered by the links, the grease should be applied, as far as may be possible, using a painter's tool or other suitable brush. Ammunition supplied linked should not be unlinked for this purpose, and the grease is only to be applied to ammunition which may be expected to be exposed on the guns to weather conditions for a protracted period.

In the case of ammunition supplied unbelted in bulk, the links should be lightly coated inside and outside and the ammunition lightly coated all over the outside with Coopers Grease, before being belted up, when it is expected to be exposed on the guns to weather conditions for a protracted period.

As much protection as possible, from both sun and bad weather, should be given at all times, to ammunition at gun positions by extemporised shelter, capable of speedy removal.

At the end of four weeks, or earlier if the appearance of the ammunition gives serious cause to doubt its serviceability, the first five rounds out of each belt on the gun should be fired in order to test the functioning of the primer and the fuze. The firing should, if possible, be carried out at low elevation in order that the functioning of the fuze may be seen or heard on water.

If the proof is 100 per cent. correct the ammunition may be left in place on the rails, a similar proof being carried out at monthly intervals.

In the event of the proof not being 100 per cent. correct, the ammunition should be removed from the guns and returned at the first convenient opportunity to the nearest Naval Armament Depot for examination. New ammunition greased as above should then be placed on the guns.

Packages returned to N.A. Depots under this order should be clearly marked to show that the ammunition has been kept in loading racks and marked with A.F.O. number 4633/41.

NOTE.—The limits of four weeks may be extended to a maximum of three months if, in the opinion of the Commanding Officer, the ammunition appears serviceable. Before extending the period of four weeks and during the four weeks, a few rounds should be removed to ensure that no heavy corrosion is occurring under the links.

**Separated Ammunition.**

If a fused projectile, separated from its cartridge case, remains in the bore of the gun, no attempt should be made by ship's staff to eject it, and the gun should be provisionally condemned.

An ejector, fused, shell, is supplied, however, to armament depots and gunnery schools for use in such circumstances. The use of this ejector should be under the direct control of an experienced gunnery officer who should exercise rigid precautionary measures. When a live projectile has not moved after a few blows on the ejector, the fact should be reported to the Admiralty, before further action is taken.



## THE BELT FILLING MACHINE.

### Plate 12.

180. The machine consists of a **body**, on which are supported two revolving **sprockets** and a **forcing screw** carrying a **buffer** and a **clutch link**.

The **sprockets** are shaped to fit the belted rounds, and are mounted on a **sleeve** to which they are rigidly attached by **feathers** and retaining **collars**.

Inside the sleeve is a **spindle**. This is alternately free to slide backwards and forwards or to rotate inside the **sleeve** and is coupled to it by a **spigot** which travels in a cam groove in the **sleeve**. Rigidly attached to the **spindle** is an eight-toothed **clutch** capable of engagement every 45 degrees with the **clutch-link**, which travels backwards and forwards with the **forcing screw**.

Between the **clutch link** and a shoulder on the **spindle** is the **clutch spring**. This is always tending to force the **clutch** into engagement with the link.

The spring-loaded **sprocket stop** prevents the **sprockets** from revolving excepting when it is withdrawn by its **actuating lever** which engages in a slot formed in the stop. The **actuating lever** is of bell crank form, and carries on its upper arm a **tripper** which is normally held against a stop on the **actuating lever** by the **tripper spring**. The **tripper** is operated by a **tripping bracket** secured to the **clutch link**.

### ACTION OF THE BELT-FILLING MACHINE.

181. The **handle** is revolved in an anti-clockwise direction until the **forcing screw** is fully withdrawn. The rounds are first made up loosely in the links by hand and then led over the **sprockets**. The **handle** is now revolved in a clockwise direction, which causes the buffer and the **clutch link** to move towards the **sprockets** and the **spindle** to move with them because of the pressure exerted by the **clutch spring**.

When the **spigot** reaches the inclined plane in the cam groove, the **spindle** is checked, and the **clutch link** begins to move out of engagement with the **clutch** while compressing the **clutch spring**. When disengagement is complete the **spindle** is free to turn and the **spigot**, moving along the inclined plane, turns the **spindle** and the **clutch** through 45 degrees, this enables the **clutch** to re-engage with the **clutch link** under the action of the **clutch spring**. The **tripping bracket** passes over the **tripper** without depressing the **sprocket stop actuating lever**. The **tripper spring** pulls the tripper back to its former position.

On the buffer reaching the base of the cartidge the round is pushed home into the links until a stop formed on the **handle** comes into engagement and prevents further movement.

182. The direction of rotation of the handle is now reversed, and the **forcing screw** with **buffer** and **clutch link** are withdrawn, the **tripping bracket** on the latter depressing the **tripper** and with it the **sprocket stop actuating lever** as it passes. This unlocks the **sprocket stop** just before the **spigot** reaches the inclined plane. The **spindle** is prevented from turning since the **clutch** and **clutch link** remain locked together throughout the withdrawal. The **sleeve**, therefore, is forced to turn through 45 degrees as the **spigot** travels along the inclined plane. This brings the next round into line.

When the **tripping bracket** has passed clear of the **tripper** the **actuating lever** and **tripper** rise and the **sprocket stop** moves forward under the influence of its **spring**. As soon as the **sprockets** have turned through 45 degrees; the stop springs into the next locking hole.

183. Action is continuous as the handle is revolved alternately either way. On the forward strokes the **sprockets** remain locked and the **spindle** turns. On the withdrawal strokes the **spindle** is prevented from turning and the sprockets revolve.

One belt of 28 rounds can be passed through the machine in approximately 1½ minutes.

### USE OF ROUNDS LINKED UP BY SHIP'S STAFF

184. Ammunition linked up by ship's staff should not be used if similar ammunition linked up by naval armament depôts is available on board.

185. The necessity for occasional hand unloading of feed boxes and chambers in order to enable servicing of guns after exposure to weather will result in a collection of unrectified links and an accumulation of loose H.E. and tracer ammunition. Such ammunition and links are to be carefully examined by ship's staff to ascertain if undamaged and that the projectiles are still firmly held in the cartridge cases. If the results are satisfactory reassembly into links may be effected on board and the resulting belts of ammunition held as a reserve on board. If, however, such ammunition is coated with Cooper's grease, it should be landed at the same time as the remainder for examination and overhaul by N.A. depôts.

### PRECAUTION WHEN USING MUZZLE COVERS.

185a. Where muzzle covers are provided to prevent accumulation of water in the bore, on no account must H.E. ammunition be fired through them, and to avoid any risk of this occurring, the following precaution is to be taken when the use of muzzle covers is necessary—or is likely to become necessary:—

The muzzle cover should be removed before firing, if time permits, but *in any case* the belt is to be loaded so that the first two rounds fired are practice or practice tracer. A full belt so loaded should be used whenever a muzzle cover is shipped."



## CHAPTER VI. THE MOUNTING.

(Plates 1A and 1B.)

186. The mounting is arranged to accommodate the 2-pdr. Mark VIII, L.V., or Mark VIII\* H.V. gun in a cradle, and to carry the layer on the left and trainer on the right on platforms attached to the carriage.

### **The Lower Racer Base Plate. (Plate 2.)**

187. The lower racer base plate is of cast steel, and is bolted to a steel packing ring by sixteen 0.75-inch holding-down bolts. The packing ring is secured to the deck and machined in place to take the lower racer base plate. In the lower racer base plate is machined the lower roller path. Outside the lower roller path a flange is formed with an overhanging lip on the outside. The underside of the lip is machined to form a roller path for the clip rollers. The training rack, which is of bronze, is attached by 0.5-inch countersunk screws to the lower racer base plate inside the lower roller path. In the centre boss of the lower racer base plate is carried a large upstanding bush, machined inside, into which fits the centre pivot suspended from the upper racer plate.

### **The Racer Rollers. (Plate 2.)**

188. The weight of the revolving structure is carried on 34 conical rollers. The rollers are flanged at their inner ends and rotate on axis pins which are screwed into a live roller ring. The outer ends of the pins have squared heads to fit a spanner. Spectacle links with square cut holes connect each pair of axis pins and prevent them from turning. The links are held in place by split pins.

### **Clip Rollers. (Plate 2.)**

189. There are 14 clip rollers arranged circumferentially around the upper racer plate, to prevent the mounting from jumping on firing or when there is a motion on the ship. Eight are in front and six in rear. The clip rollers are slightly conical.

Each roller axis pin is screwed into a vertical supporting bolt, the lower part of which is rectangular in section and fits into a rectangular hole in the upper racer plate, so preventing the clip roller axis pin from slewing.

The upper part of the hole in the upper racer plate is circular in section and of greater diameter than the vertical supporting bolt. This hole is covered by a steel collar through which the vertical supporting bolt passes, a shoulder being formed in the latter which takes against the underside of the steel collar and so prevents the clip roller rising above a certain point. This ensures that the clearance between the clip roller and the flange on the lower racer plate cannot become unduly small.

The rollers, vertical bolts and steel collars are interchangeable. The clip rollers are adjusted by the makers to give a clearance of from 4 to 6 thousandths of an inch.

Two Belleville spring washers under the nut on the clip roller supporting bolts absorb the shock on firing.

### **The Upper Racer Plate. (Plate 2.)**

190. The upper racer plate on which the carriage and platforms are built up is of cast steel; on the underside of it is machined the upper roller path. In the centre of the upper racer plate is a hole with a recessed lip into which is secured the centre pivot. Outside the upper roller path rectangular slots are cut in the upper racer plate for the supporting bolts of the clip rollers.

On opposite sides of the upper racer plate (approximately in line with the trunnions) are two circular cover plates (three countersunk screws) for giving access to the bolts by which the lower racer plate is bolted to the packing ring.

### **The Centre Pivot. (Plate 2.)**

191. The centre pivot assembly is secured in the recessed hole in the centre of the upper racer plate by four  $\frac{1}{4}$ -inch screws, three of which are hexagon headed, and one is countersunk, under the training gear box. It projects downwards into the bush formed in the lower racer plate. It consists of a brass cage of 17 vertical steel rollers revolving between an inner and an outer roller race. (The cage is in two parts, held together by means of a spring ring circlip.)

The outer roller race is supported by a lip at the top which fits in a recess in the boss of the base-plate. The inner roller race is held up to the centre pivot by a retaining collar secured by three  $\frac{1}{4}$ -inch countersunk screws.

Screwed into the top of the centre pivot vertically above the roller cage are two large oil cups (see further in paragraph referring to Centre Pivot Rollers).



### The Carriage. (Plates 1A and 1B.)

192. The two side plates of the carriage are built up on the upper racer plate and terminate in the trunnion bearings. The right-hand plate carries the training gear and firing gear. The left-hand plate carries the elevating gear, and between the two extends the elevating pinion shaft.

### The Cradle. (Plates 1A and 1B.)

193. The cradle is supported in trunnion bearings which are bolted to the two side plates of the carriage. The bearings are bronzed bushed and the trunnion pins are of steel. A steel elevating arc is bolted to the underside of the cradle and is engaged by the elevating pinion.

The ammunition box, which is carried by the light trunnion of the cradle, contains rails by which the articulated links are led to the feed block on the gun.

The gun is secured in place in the cradle by a spigot and two  $\frac{3}{4}$ -inch bolts in rear and two  $\frac{7}{8}$ -inch bolts in front. Spring washers are fitted under the heads of the two  $\frac{3}{4}$ -inch bolts.

194. **Cradle Balancing**, with the feed rails loaded. The cradle is balanced with lead weights by the makers as follows:—

- (a) Without flash eliminator, barrel heater, or shield, the cradle containing the gun and sights is first balanced by the wedge-shaped weight above the trunnions.
- (b) With the flash eliminator in position, the cradle is balanced again by a weight placed on the underside of the rear of the cradle (this weight is the smaller of the two under the cradle and is in front of the other).
- (c) With the trainer's shield in position, the cradle is balanced a third time by the rearmost weight under the cradle; this weight is the larger of the two in this position.
- (d) With the flash eliminator and barrel heater in position, the weight for balancing the flash eliminator is removed and replaced by a larger balance weight, the smaller weight being kept in the spare part box.

### The Elevating Gear. (Plate 3.)

195. The elevating gear is operated by a handwheel through bevel gearing and worm and wormwheel to the elevating pinion which engages the elevating arc.

"The **worm** is provided with keyways and is free to slide along keys on the **worm shaft**. The worm is contained in a **worm box** fitted with ball thrust bearings at each end.

Screwed into one end of the worm box is a **screwed steel sleeve** with a shoulder formed at its outer end. On this shoulder there are two flats over which fits the **ring (B)**. This ring when secured to the **worm thrust nut** by the **grub screw** prevents the screwed sleeve from turning.

On the screwed sleeve is a **spring** of square section which bears at one end against the shoulder on the screwed sleeve *and* the ring 'B' and, at the other end, against the screwed ring 'A' *and* the shoulder at the end of the moving box.

The shock of firing is transmitted partly to the elevating shaft, and there is a tendency for the worm wheel to drive the worm along the worm shaft. Any movement there may be is taken up by the shock absorber in the following way: The elevating worm wheel tries to force the worm to the right, the worm bearing on the thrust bearings forces the worm box to the right. The screwed sleeve being screwed into the worm box, also moves over to the right, the shoulder on this sleeve takes against the left end of the spring and compresses it against the screwed ring (A).

If the elevating worm wheel forces the worm and hence the worm box to the left, the spring is compressed between the left end of the worm box, and the ring (B) in the worm thrust nut."

### Training Gear. (Plate 4.)

196. The training gear is operated by a handwheel, through bevel gearing and worm and wormwheel to the training pinion which engages and travels round the training rack. The worm has thrust bearings and a thrust cover with a serrated locking plate for maintaining the correct adjustment.

### Firing Gear. (See inset on Plate 1a.)

197. The firing gear consists of two systems of bell crank levers, one on the carriage and one on the cradle. The firing lever, which is operated by the trainer's left hand, has two positions—SAFE and FIRE. When put over to FIRE, it places the firing arc of the system on the carriage in a position concentric with the trunnion, and by means of the firing cam and the roller with which it is in contact moves forward the system of bell crank levers on the cradle which control the firing rod on the top of the feed box cover.

The design of the firing cam is such that in the FIRE position it operates the firing rod at all angles of elevation of the gun. On releasing the firing lever from the FIRE position, a spring on the firing lever and a spring on the lever on the cradle return both systems of levers to the SAFE position. There is a bottle screw and check nut for adjustment of the firing gear.

*Note.*—The firing gear is being modified by the fitting of a return link so that the firing lever when put to SAFE will positively pull the rod and link assembly 'off' without reliance on the return spring on the gun.

### The Sights.

198. The sights are of the cartwheel type for the layer and trainer, moving parallel with the gun in elevation so that their eyepieces remain in a position that is convenient for the layer and trainer. The foresights are adjustable vertically and the eyepieces laterally for alignment when sight testing. The layer's eyepiece has three positions—"Far," "Near and D/B" and "Line up," this latter being used only when testing sights. See further under "Eyeshooting."

*Note.*—Some of the earlier mountings carried a fence sight for the trainer.

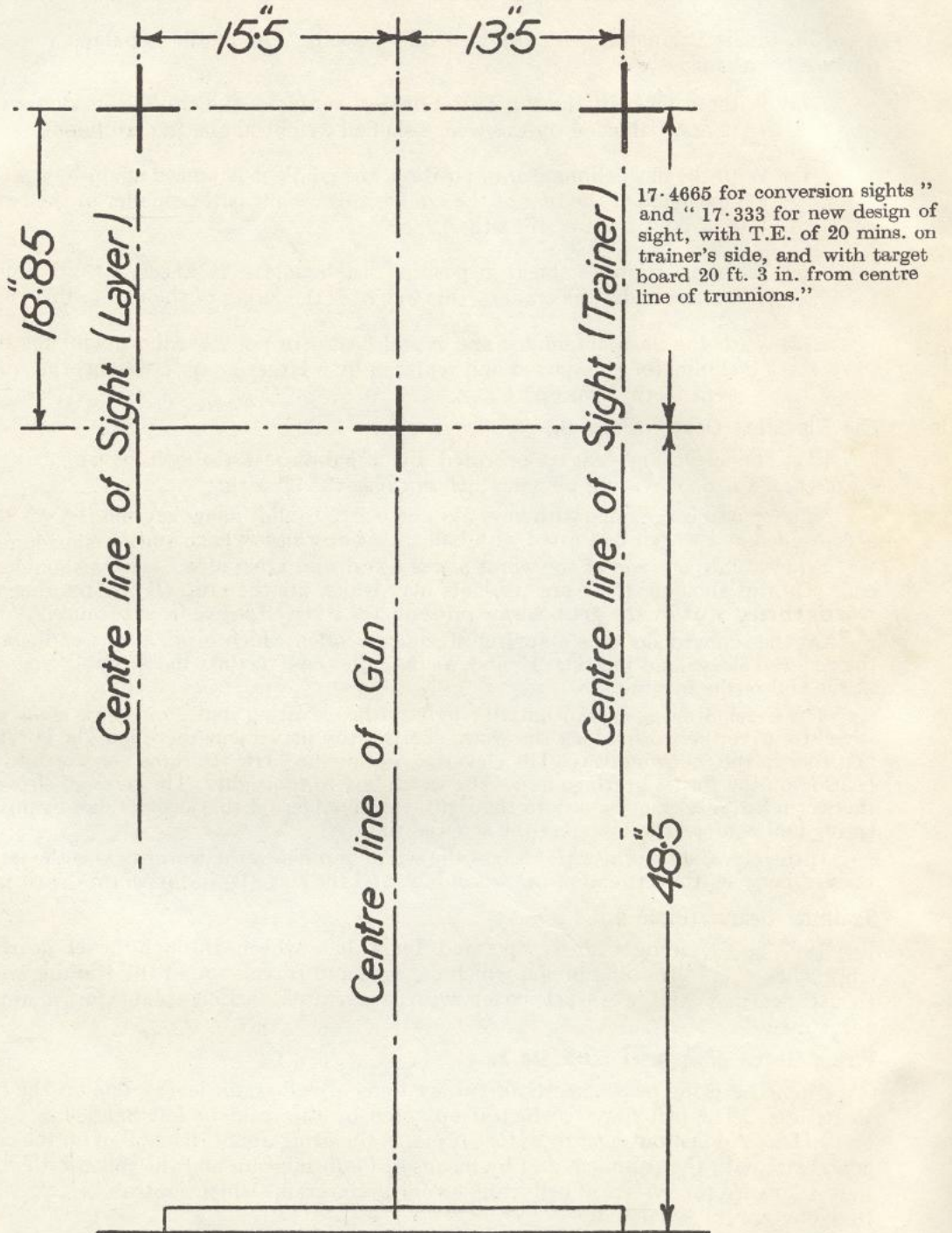


The sight is convertible for use with H.V. or L.V. ammunition by sliding the foresight carrier along the sight bar, to which it is attached by one  $\frac{5}{16}$ -inch fitted hexagon-headed bolt, with securing nut on the other side. By this means it can be fixed in either of two positions, giving a long or short effective length of sight bar. For use with H.V. ammunition, it is set in the "long" position.

**Sight Testing Diagram.**

*2 pdr. MK VIII \**

**SIGHT TESTING DIAGRAM**



**Housing Arrangements and Permanent and Semi-permanent Stops.**

199. The elevating gear can be held with the gun at (approximately) any desired elevation by the insertion of a pin passing through the handwheel spindle and the boss of the bracket.

The mounting can be secured in training by a training housing stop (locking bolt). The same stop also is used as a semi-permanent and permanent stop.

The Cartwheel and Fence foresights can be unshipped and stowed in a wooden box attached to the left-hand side of the carriage.

**Spare Part Box.**

200. Each mounting is supplied with a wooden box containing the standard list of spare parts, and spanners and the Tecomit grease gun.



## MAINTENANCE.

201. The following lubrication arrangements are provided. Except for the needle oil cups and hand grips, for which thin oil is required, and unless otherwise stated, the lubricant used should be light torpoyl.

Where grease nipples are provided, this lubricant must be applied by a "Tecalemit" Grease Gun (supplied).

202. **Training Rack.**—By removing a cover plate on the upper racer plate carrying a tally engraved:—

### REMOVE COVER TO LUBRICATE TRAINING RACK.

Heavy torpoyl can be applied to the training rack. But experience has shown that, under bad weather conditions, heavy torpoyl is not satisfactory as a preservative for the rollers and roller paths of exposed upper deck gun mountings as it rapidly washes off and leaves the working service dry.

Comprehensive trials are being carried out with various lubricants to determine which is the most satisfactory for this purpose but, as an interim measure, ships should, where the supply from storing yards permits, use Grease, Rectified, Non-floating (Rate Book).

In the event of this grease proving unsatisfactory under conditions of extreme cold, use should be made of Cooper's grease No. 4.

203. **Racer Rollers.**—Four large brass oil cups (needle fed) on the upper racer plate allow oil to drip into an oil groove in the live roller ring. From this oil groove vertical holes connect with an oil hole up the centre of the axis pin of each of the racer rollers from which the oilways on the bearing surfaces are supplied (*see inset in plate 2*). For these oil cups light mineral oil should be used.

204. **Clip Rollers.**—Each of the fourteen clip rollers has a grease nipple at the top of its vertical supporting bolt by which oil passes down through an oilhole in the bolt and a hole in the axis pin to oilways on the surface of the roller axis pin (*see inset in Plate 2*).

205. **Centre Pivot Rollers.**—Two large brass oil cups (needle fed) in the centre of the upper racer plate allow oil to drip to the cage of the centre pivot rollers (light mineral oil).

### Training Gear.

206. One oil hole (closed by screw) in the hand-grip (light mineral oil).

One grease nipple on the training handwheel bracket.

Two grease nipples on the training bevel gearbox.

Four grease nipples on the training worm and wormwheel gearbox.

### Elevating Gear.

207. One oil hole (closed by screw) in the handgrip (light mineral oil).

Three grease nipples in the elevating bevel gearbox.

Four grease nipples in the elevating worm and wormwheel gearbox.

One grease nipple on the end of the elevating pinion shaft (on the right-hand side of the mounting).

### Cradle.

208. Two grease nipples (one on each trunnion).

### Firing Gear.

209. Six grease nipples, access to one of which is obtained through a hole in the back of the ammunition box.

### Sight.

210. Two grease nipples on the sight trunnion bracket, two grease nipples on the sight connecting link.

### The Protective Shield.

211. The shield, which is made of  $\frac{1}{2}$ -inch armour plate, is in two sections giving protection to the trainer's and layer's sights respectively.

The part protecting the trainer's sight moves in elevation with the gun, the remainder is fixed to the carriage; *see paragraph re* balancing the weight of the cradle, and of the moving part of the shield.

## STRIPPING.

### Elevating Gear. (Plate 3.)

212.—(1) Chock up the cradle front and rear so that the gun will not run down when removing the elevating gear.

(2) Remove the elevating handwheel (secured by split pin), take out the bolts securing the bevel gear box cover. Remove the cover with the bevel wheel.

(3) Take out split pin and take off the nut securing the bevel pinion to the worm shaft. Remove bevel pinion, disconnect muff coupling.

(4) Remove locking plate and grub screw which retains the ring (B), unscrew the worm thrust nut and withdraw the ring (B). Unscrew the steel sleeve (two flats) retaining the shock absorber spring and remove the spring and washer. The worm shaft can now be withdrawn to the front, *i.e.*, downwards. Unscrew the screwed ring A, fitted with four slots for a peg spanner, in the end bearing of the box.



5. Remove the cover of the elevating worm gear box and take out worm assembly. The thrust bearings come away as part of this assembly.

(6) Remove the access cover on the right hand side of the carriage in line with the elevating pinion shaft. Withdraw split pin (1) and remove retaining nut and washer. Withdraw split pin (2) and unscrew castle-headed nut. Withdraw the shaft and wormwheel to the left hand side supporting the elevating (rack) pinion to prevent it falling. To examine the ball-bearing behind the access cover remove the slotted nut (3) from the inside of the carriage plate and withdraw the bearing.

*Note*:—When assembling, the following steps should be taken to ensure that the worm is in its mid position, and that the gun is not tending to drive back and preload the spring, which would occur if the gun were out-of-balance.

(a) Depress the gun fully against the depression stop and weight the muzzle to ensure that it is muzzle heavy.

(b) Gently rock the elevating handwheel to ensure that the worm is free.

(c) Screw up the screwed sleeve until it just touches the spring without compressing it, and then tighten a further three turns, thus compressing the spring .25-in. Position the ring B on the sleeve and screw in the worm thrust nut until it just comes in contact with the ring and hence with the spring. While the thrust nut is being screwed in, the elevating handwheel should be gently rocked within its limits of free travel. It will be noted that the amount of free travel is reduced as the thrust nut is screwed up, and is at minimum when the bottom of the thrust nut just touches the ring, but will increase again if the nut is screwed up beyond this position.

(d) Replace the locking plate for the thrust nut and also the grub screw securing the ring to the thrust nut. It may be necessary to drill a fresh hole in the ring to take this screw."

#### **Training Gear. (Plate 4.)**

213.—(1) Secure the mounting by a rope lashing over the gun so that it cannot take charge when the training gear is removed.

(2) Remove the training handwheel (secured by split pin), take out the four  $\frac{1}{2}$ -inch bolts securing the bevel gear box cover. Remove bevel wheel and pinion and vertical shaft. Remove the pin securing the inner end of the muff coupling.

(3) Take off the training worm box cover (six  $\frac{1}{2}$ -inch screws). Remove the access plate on the left side of the carriage.

(4) Take off locking plate of worm thrust nut, and unscrew and remove the thrust nut. The worm shaft can now be withdrawn to the left.

(5) Lift out the training worm with the thrust bearings.

(6) Take out the three  $\frac{5}{8}$ -inch bolts and the nut off one  $\frac{5}{8}$ -inch stud securing the training worm gearbox. Lift and remove the box with the worm wheel and training pinion.

*Note*:—When assembling, the thrust adjusting nut should be screwed up until the correct adjustment is obtained. If screwed up too hard it will cause excessive training effort. Replace locking plate.

#### **Centre Pivot. (Plate 2.)**

214.—(1) Unscrew the three hexagon headed screws and one countersunk screw securing the pivot to the upper racer.

(2) Remove the two  $\frac{1}{2}$ -inch (headless) preserving screws and insert forcing screws (not provided), screw down the forcing screws evenly so as to force the whole centre pivot bearing upward.

(3) Lift out the centre pivot, leaving the outer roller race behind.

(4) To examine the centre pivot rollers (having removed the centre pivot bearing as above):

(i) Unscrew three  $\frac{1}{4}$ -inch countersunk screws securing the lower retaining collar.

(ii) Remove brass cage with rollers complete.

(iii) Remove the spring circlip and dismantle the cage and rollers.

#### **To examine a Racer Roller. (Plate 2.)**

*Note*:—Two gaps are provided in the upper roller path, one on each side near the centre line of the trunnions.

215.—(1) Remove the circular guard plate.

(2) Train the mounting until the roller to be withdrawn is in line with a gap (of which there are two) in the upper roller path and opposite one of the holes in the web of the clip roller flange of the lower racer plate.

(3) Remove the split pin in the axis pin of the roller to be removed and the split pin in the axis pin of the adjacent roller and withdraw the spectacle link. Due to the shape and fit of the link on square portion of axis pin it is necessary to use pliers to force the link off the axis pins.

(4) Mark square end of axis pin with centre pop to show which flat is at the top so that when putting back, the oil hole in the axis pin will correspond with the oil hole in the retaining ring.

(5) Unscrew and remove the roller axis pin (using square box spanner).

(6) Lift the roller into the gap in the upper roller path sufficiently for the flange to clear the edge of the lower roller path and withdraw the roller.

#### **To examine a Clip Roller. (Plate 2.)**

*Note*:—The 0.75-inch radius of the clip roller flange of the lower racer base plate has been cut away in one position to provide the necessary clearance for removing or replacing a clip roller (see



further below). The position of the cut-away part is indicated by an arrow with the wording " Position for removal of Training Clip Rollers " stamped on the lower racer base plate and filled in with red wax.

A part of the vertical supporting bolt has been radiused to allow it to be turned through  $90^\circ$  when dropped into the cut-away part of the lower racer base plate mentioned above.

216.—(1) Unscrew the compression nut and allow the vertical supporting bolt to drop down.

(2) Turn the clip roller assembly through  $90^\circ$ . Withdraw split pin securing the retaining nut on the clip roller axis pin. Unscrew the nut.

(3) Unscrew the clip roller axis pin from the vertical supporting bolt (two flats are provided for a spanner) and remove the clip roller.

*Note :—*A certain number of mountings have gone to sea without the lower racer base plate having been cut away to provide the clearance referred to above and without the radius on the vertical supporting bolts. In these mountings it will therefore be necessary to lift the mounting by the upper racer plate sufficiently to permit the clip roller axis pin to drop far enough to be turned, so that the clip roller comes round to the outside.

217-224.







### Aircraft diving steeply.

229. If an aircraft is diving steeply, the "lift" effect of its wings gives it a direction of flight slightly above that in which its fuselage is pointing.

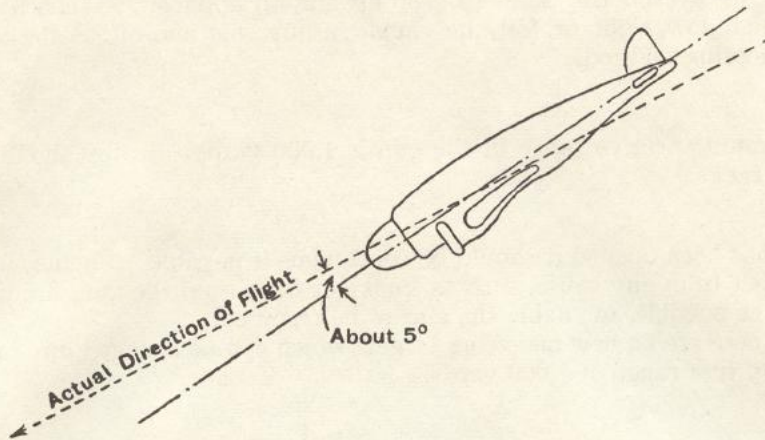


FIG. II.

Allowance must be made for this when aiming at diving aircraft, or missing low will result, a common fault in aiming at dive bombers. The approach angle is probably about 5° more UP than it appears.

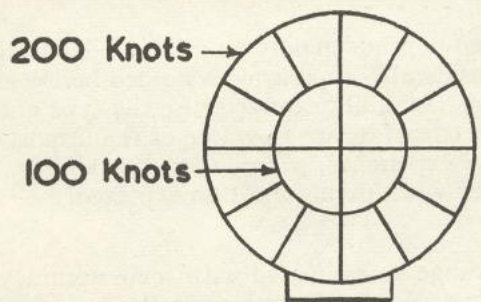
*Note.*—This effect can be ignored in shallow dives, *e.g.*, angles of dive of 20 degrees or less.

### THE SIGHTS.

230. The layer and trainer each have a Cartwheel Sight, which shows the aim-off required for aim-off speeds of 100 and 200 knots at 1,000 yards range; radial wires at each "hour" assist them to lay and train so that the aircraft is flying towards the centre of their sight.

*Note (i)* :— In some ships the trainer has a Fence Sight, which shows trainer's aim-off speeds of 100 and 200 knots at 1,000 yards range. A "100-knot ring" may be attached to the 100-knot bars to enable the trainer to see what total aim-off has been applied, and to assist him in gauging lateral aim-off from his estimate of total aim-off.

*Note (ii)* :—300 knot sights are now supplied; when fitted the sight is no longer adjustable to suit L.V. guns. The sighting testing diagram for these sights is given in the Diagram on page 34.



CARTWHEEL SIGHT

### The Method of Using the Sights.

231. The aimer having decided, from the appearance of the aircraft, the aim-off required at the moment, uses his foresight as a scale to apply the aim-off. He must keep his eye to the sight the whole time, and, as soon as he appreciates a change in approach angle, alter his aim-off accordingly. Care must be taken to keep the eye centrally placed in the aperture backsight.

At a weapon controlled by two men, trainer and layer, this principle of aiming-off still applies, but the application of aim-off has to be shared between the trainer and the layer, because the former can move the gun only laterally, and the latter can move it only vertically. They must co-operate to point the gun in any required position.

To avoid confusion such as would arise if the layer and trainer each formed different estimates of the aim-off speed and hence of their own components of it, the trainer is made the "master-hand," and uses his estimate of aim-off speed to gauge the trainer's aim-off required, and aims accordingly: the layer has to accept this estimate, and elevates or depresses until the target appears to be flying towards the centre of his sight, thus automatically completing the trainer's estimate of the total aim-off.

This rule will not, however, apply when the trainer's aim-off is small, as is usually the case in low bombing, or diving attacks on own ships. To meet the latter conditions, a second and most important rule is that, if the trainer's aim-off is small, the layer must make his own estimate of total aim-off speed, and aim accordingly.



### Use of Tracer.

232. Ammunition will be supplied linked up ready for use, every fourth round being fitted with tracer. If ammunition has to be linked up on board it should be linked up in this proportion.

The secret of correct observation of tracer is to keep the eye focussed on the target, and not to follow the path of the tracer. The aimer should keep his eye to the sight and concentrate his attention on the target, using his eyeshooting sight to keep his aim-off applied. When he observes his tracer passing the target high, low, right or left, he should adjust his aim-off as necessary and continue aiming-off by eyeshooting methods.

### Opening Fire.

233. The maximum effective range of the gun is 1,000 yards, and fire should not be opened on targets outside this range.

### Maintaining Fire.

234. Once fire has been opened it should be continuous if possible. Should, however, the trainer lose sight of the target from any cause, such as smoke or flash from the gun, fire must be checked for **as short an interval as possible**, to enable the aim to be regained.

Provided that there are no new menacing targets which can be engaged, fire may be continued at retreating targets, up to a range of 1,000 yards.

### Allowance for T.E.

235. The layer's aperture backsight may be set in either of two positions, "Line up" or "Normal." In the first position, no T.E. is applied; in the "Normal" position, T.E. for a range of 700 yards is applied. Some sights may still have a third position ("FAR") marked on them: this is no longer to be used, as it applied T.E. for 1,300 yards range, and the gun is not to be used outside 1,000 yards.

### Allowance for Wind and Own Ship's Speed.

236. The wind will carry both the aircraft and the shell to leeward, but will carry the former more than the latter. A rough rule for making an allowance for wind:—

For a wind blowing at 30 knots across the line of fire aim 20 knots (of aim-off speed) to leeward, *i.e.* 2/3 of wind you feel. (30 knots = a strong wind).

When estimating the strength of the wind, consider wind you feel, not true wind, so as to include an allowance for the effect of own ship's speed on the shell.

### Forecasting the Target's Movements.

237. Aim must be held correctly continuously, and the maximum possible rate of fire maintained while the attacking aircraft presents a reasonable target.

Should the aircraft be observed to alter its direction of flight—it will usually give an indication of this by banking—the aim-off must be altered **at once**, in direction and in amount, to allow for the alteration. To do this successfully, the amount of the alteration must be forecast.

### Estimation of Aircraft Speed.

238. Judging of target speed depends mainly on a knowledge of the expected performance of the different types of aircraft. Considerable experience is needed before any assistance in this estimation can be obtained from eye or ear. An ability to recognise the type of aircraft that is attacking, and a knowledge of the speed to expect from it, are therefore of the utmost importance in eyeshooting. A study of Recognition Cards, and experience, will develop this ability.

An increase in aircraft speed when diving must be expected.

### Estimation of Range.

239. It is important that range be estimated with some accuracy to avoid wasting ammunition by opening fire too early, and to avoid wasting opportunities by opening fire too late.

The estimation of range by eye depends entirely on practical training and experience. It must be remembered that varying weather conditions may produce misleading effects, and differences in size of aircraft are also apt to cause errors. For example, if one is accustomed to dealing with medium-sized aircraft, there will be a tendency to under-estimate the range of larger aircraft, and thus to open fire too early, and conversely, to under-estimate the range of smaller aircraft.

### Use of Eyeshooting Sights against Low-Angle Targets.

240. The principles of eyeshooting can be applied equally well against surface targets at close range, such as E-boats. To assist in gauging the smaller amounts of aim-off required, small spots of metal or short lengths of thin wire may be placed at 20-knot intervals along the vertical and lateral crosswires of the cartwheel sight, between the centre of the sight and the 100-knot ring.

These marks enable the correct initial deflection to be applied: spotting corrections for elevation and line, based on observation of the fall of shot or of tracer, can then be applied by altering the point of aim.

### Illumination of Foresights.

241. An illuminating device, consisting of four small clips each containing a tube of mesothorium compound, is supplied for fitting to the foresights for use in night firing. The clips are attached to the junctions of the 100 knot ring with the vertical and horizontal crosswires and are kept in place by four rubber rings tensioned between the clips.



## CHAPTER VIII.

## PRELIMINARY GUN DRILL.

For the purpose of teaching "Gun Drill," a certain procedure is carried out which is omitted when drilling a gun's crew in quick time.

This procedure is common to all guns and is given below.

Fall the class in, number from right to left, detail the requisite numbers to form the gun's crew, move the spare numbers clear and stand them at ease.

*Note.*—During the early stages of drill the instructor should use the "names" of the crew, *i.e.*, gunlayer, trainer, etc., instead of their "numbers" whenever possible.

## DUTIES AT THE GUN.

As each man's number is called he will spring to attention, be detailed for his duty and, when the next man's number is called, will stand at ease.

One .. Gunlayer.

Two .. Loader and Communication number, and so on, as laid down in the drill.

## CLOSING UP IN SLOW TIME.

At the order "**Close up**" 1 only, moving at the double, will place himself in rear of the elevating handwheel facing the muzzle.

## "Close up."

The order "**Close up**" having been given, the remainder will close up as detailed, *i.e.* :—

At the right side of the gun, facing the feed rails, 2 ; and so on as laid down in the drill.

## FALLING OUT IN SLOW TIME.

At the order "**Fall out**" 1 only, moving at the double, will place himself in rear of the gun, leaving sufficient room on his left for the remainder of the gun's crew to "fall in."

## "Fall out."

The order "**Fall out**" having been given, the remainder will fall out as detailed, *i.e.* :—

On the left of 1 .. .. . 2

On the left of 2 .. .. . 3

Whenever the gun's crew are fallen out, the C.G. taking charge will dress the gun's crew by the right. Whoever fell the gun's crew out will stand them at ease.

## CLOSING UP IN QUICK TIME.

At the order "**Close up**" all numbers moving together will close up as already detailed.

## "Close up."

## NUMBERING.

At the order "**Number**," each man in succession will call his number sufficiently loud for the remainder of the gun's crew to hear.

## CHANGING ROUNDS.

At the order "**Change Rounds**," each man adds one to his number and closes up in his new position, the highest number becoming 1. When there are spare numbers the highest spare number becomes 1, the highest number at the gun becoming lowest spare number.

## "Change Rounds."

## FALLING OUT IN QUICK TIME.

At the order "**Fall out**," all numbers moving together will fall out as already detailed.

## "Fall out."

## STILL AND REST.

The order "**Still**" may be given by anyone to prevent an accident.

Trainer at once removes his hand from the firing lever and puts the gun safety lever to "Safe," and all numbers are to remain perfectly still.

Nothing cancels the order "**Still**" except the order "**Carry On**," when the last order given is carried out.



To stop the drill for instructional purposes the order "**Rest**" is used. At that order all numbers will turn to face the instructor, those carrying weights placing them on the deck and the whole standing at ease.

The instructor gives the order "**Rest**" to point out mistakes or give fresh detail.

Nothing cancels the order "**Rest**" except the order "**Carry on**," when the last order given is carried out.

*Note.*—For demonstration purposes the instructor may require all the gun's crew round one position of the gun. To do this he will give the order "**Round the feed rails, Carry on**," or "**Round the elevating gear, Carry on**." At that order the gun's crew and spare numbers will gather round the part named, so that all can see. When finished the instructor will order, "**Gun's crew close up**."

### DRILL FOR 2-PDR. MARK VIII GUN ON SINGLE MARK VIII\* MOUNTING.

The equipment is intended for close range H.A. fire and may be used for close range L.A. fire. Eyeshooting sights and D.A. fuzed ammunition are used in both cases.

### DUTIES AT THE GUN.

- One .. Gunlayer (G.L.) lays the gun.
- Two .. Loader and communication number (2).
- Three .. Trainer (T.). In charge. Trains and fires the gun.

The trainer is the Captain of the Gun. In the absence of the O.O.Q. he is responsible for everything at the gun.

#### "Closing up."

Positions of the gun's crew when closed up :—

At the elevating wheel facing the muzzle	..	..	..	..	..	..	G.L.
At the right side of the mounting facing the feed rails	..	..	..	..	..	..	2
At the training wheel facing the muzzle	..	..	..	..	..	..	T.

### ACTION.

All numbers clear away obstructions in the way of working the gun and unship any guard rails or stanchions which may foul the arc of fire.

G.L. provides and ships the eyeshooting sights. Removes the locking pin from the elevating handwheel (if fitted).

2 opens the R.U. locker and see the feed rails clear of any obstructions.

T. lifts the housing stops and in conjunction with G.L. runs the mounting through the full limits of elevation and training, returning it to horizontal and to the most convenient bearing for loading.

*Note.*—Where the armament is so disposed that it is possible to fire on bearings which may cause injury to other guns or gun's crews, the Officer of the Quarters, G.L. and T. are to make themselves acquainted with the limits of safe training of the gun. When the safety stops have been removed, they must not allow the gun to be trained on dangerous bearings until the guns' crews affected have been withdrawn, or the guns in the line of fire have been trained clear.

G.L. revolves the crank handle, thus withdrawing the lock, and opens the inspection door on top of the rear cover.

T. goes to the front of the mounting and looks down the bore from the muzzle end to see that it is clear. He then orders "**Test firing mechanism**" and sees the safety lever on top of the gun to "**SAFE**."

G.L. revolves the crank handle, thus closing the lock. He then closes the inspection door.

T. bears down on his firing lever. The gun should not fire. He then releases the firing lever, puts the safety lever on top of the gun to "**FIRE**," again bears down on his firing lever and he should hear the striker go forward.

G.L. and 2 place three belts of 14 rds. each on the feed rails, and connect them up. They must be hung on the rails with their connecting links outboard from the feed box.

T. having satisfied himself that the gun is properly cleared away, will report to O.O.Q. "**Number . . . pom-pom closed up, cleared away, bore clear.**"

This is termed the "**CLEARED AWAY POSITION**."

#### *Note on Articulated Links.*

These links are of pressed steel, and it is essential that they should be kept free from corrosion and rust by lightly greasing with Coopers Grease No. 4, to ensure that no undue force is required to draw the round from the link.

The grease should be applied with a painter's tool to avoid excess of grease which is apt to prevent a round fully entering the chamber of the gun.

Where belts are stowed in ready use lockers for any length of time they should be periodically examined for rust, corrosion or seizing up of the rounds in the links.

Stretched or distorted links will cause jams in the gun, and should therefore not be used, but returned to the armament depot.

### LOAD.

G.L. revolves the crank handle, opens the inspection door, watches the opening in the feed box and orders "**Feed in**."

2 lifts the inboard end of the first belt and forces it into the feed box, pushing it under the retaining pawls and the feed pawl until G.L. reports "**Over**."



G.L. reports "**Over**" when he sees a round correctly in position in the opening of the feed box, then closes the lock smartly and withdraws it again, ordering "**Feed in**" once more.

2 forces the belt into the feed box until G.L. reports "**Over.**"

G.L. closes the inspection door; he then closes the lock smartly, sees and reports "**Crank handle housed**" and then assists 2 to place a fourth belt on the feed rails.

T., having seen all loading operations correctly carried out and the safety lever to "**Safe,**" reports "**Pom-pom loaded and to Safe.**" This is known as the "**Half Cock**" position.

*Note.*—(a) When loading, it is necessary to close the lock smartly to ensure that the extractors are right up. White lines on the crank axis and the crank axis journal indicate when the lock is properly closed, as they will then be in line.

(b) The work of 2 is made easier if he stands on an empty ammunition box placed facing the feed rails.

(c) Care must also be taken not to load the gun with the front cover off, as the extractor may jump above its correct position and allow the extractor actuating levers to jump on top of the extractor horns, it is then possible to run the lock back sufficiently to allow the front cover to be replaced on running the lock forward the extractor will be pushed down by the front cover to its correct position for the striker to go forward, through the firing hole in the extractor; therefore the gun may be fired and the lock will travel a short distance to the rear and then jam. To clear this jam it is necessary to remove the axis pin connecting the crank to the connecting rod, to allow the lock to be withdrawn fully to the rear.

### LOOK-OUT BEARING.

Trainer trains on bearing ordered.

### OPENING FIRE—1. HIGH ANGLE TARGET.

#### Object, Bearing, Angle of Sight.

Gunlayer and trainer lay and train on the target, using their eyeshooting sights, reporting "**Layer Target**" and "**Trainer Target**" respectively as soon as they are on.

2, on hearing these reports, will put the safety lever to "**Fire**" and report "**Ready.**" This is known as the "**Ready**" position, with the gun in all respects ready to fire.

*Note.*—If the gun has not already been loaded, this must be done as quickly as possible and the gun brought to the "**Ready.**"

#### Fire.

Trainer bears down on his firing lever and keeps up a continuous volume of fire.

2 sees that the rounds feed themselves correctly into the gun and connects fresh belts of ammunition as space occurs on the rails. If he sees that all the ammunition on the rails is going to be fired before he can replenish it, 2 will tap T. on the shoulder in order to stop him firing. If, due to a mistake in drill, all ammunition is expended 2 orders "**Reload.**" T. continues to press his firing lever until the gun stops firing. 2 then puts safety lever to "**Safe,**" reporting "**Lever to Safe.**" G.L. and 2 carry out the load drill as before. On completion G.L. reports "**Gun loaded,**" 2 then puts safety lever to "**Fire**" and firing is continued.

### OPENING FIRE—2. LOW ANGLE TARGET.

#### Object and Bearing.

As for high angle.

#### Fire.

As for high angle, except that T. fires in bursts of about 5 rounds.

### ALARM.

As a large number of attacks will probably be in the nature of a surprise, the order "**Alarm**" can be used and may be given with the gun in any state of readiness. At this order the gun is brought to the ready position as quickly as possible.

### "AIRCRAFT CHECK" or "CHECK."

T. releases the firing lever.

2 puts safety lever to "**Safe**" and reports "**Half Cock.**"

### ALARM.

Gun is brought to the "**Ready**" as before.

### CEASE FIRING.

T. releases the firing lever.

2 puts safety lever to "**Safe**" and reports "**Half Cock**" (see Note (a)).

T. orders "**Withdraw the lock, empty the gun.**"

G.L. lays the gun roughly horizontal.

The gun is emptied as follows:—

G.L. withdraws the lock.

T. and 2 remove front and rear cover plates.

2 lifts out extractor with rounds complete.

2 presses in on the gib locking bolt and slides both rounds out of the extractor, he then replaces the extractor, taking care that the extractor lifting levers are beneath the horns of the extractor.

T. and 2 replace cover plates.



2 forces belt into the feed box until G.L. reports "**Over.**"

G.L. closes the lock smartly and reports "Crank handle housed" when he has done so.

This is known as the "**Cease Fire**" position, gun empty, lock closed, one round in the feed box ready for loading into the gun.

**Caution.**—Under NO circumstances is a live round to be unloaded into the ejector tube.

**Notes.**—(a) If firing has taken place the gun is to be treated as a misfired gun.

(b) After one minute's continuous fire the water in the barrel casing blows off steam, and after  $1\frac{1}{2}$  minutes 50 per cent. of the water is blown out of the casing. During a pause after a prolonged firing therefore the barrel casing must be refilled, and, if time permits, the boiling water should be run off before refilling.

(c) No attempt should be made to dislodge a fused projectile which has become separated from its cartridge and remains in the bore. The gun should be provisionally condemned.

(d) If the gun's crew is required to leave the gun, either a sentry must be left on the gun or all ammunition must be returned and the feed box and feed rails left empty.

### UNLOAD.

The gun is emptied as detailed under "**Cease Fire**," the lock left withdrawn and covers replaced. 2 provides the tool for releasing the feed and ships it in place.

G.L. and 2 working in conjunction, release the retaining pawls and withdraw the belt.

T., after satisfying himself that the gun is empty, will report "**Pom-pom unloaded.**" Ammunition which has been removed from its proper stowage will be dealt with by the O.O.Q., see page 45.

### SECURE.

G.L. closes the lock and houses the crank handle.

G.L. and T. lay and train to the housing position, T. inserts the housing stop and G.L. replaces the elevating handle securing pin (where fitted).

2 returns ammunition as directed by the O.O.Q.

All numbers replace gear cleared away.

T. sees the ejector tube clear of empty cases and, when satisfied that the mounting has been properly secured, will report "**Pom-pom Secured**" and will fall the crew out and stand them at ease.

### MISSFIRE DRILL.

Should the gun stop firing, T. releases the firing lever and orders "**Still, Lever to Safe, Carry On.**"

2 then tries to put the safety lever to "Safe." Should this not be possible he orders "**Missfire,**" and the gun is kept on a safe bearing and elevation and not touched for 1 minute.

After this time has elapsed the gun is treated as for a "Stoppage."

If 2 can put the safety lever to "Safe," he reports "**Stoppage.**"

**Note.**—If the safety lever can be put to "Safe" without using excessive force, the striker cannot have gone forward and the gun cannot be dangerous due to a misfired round being in the chamber.

2 then inspects the gun and makes one of the following reports:—

Case I	..	..	..	..	..	..	"Gun out, lock closed."
Case II	..	..	..	..	..	..	"Gun out, lock not closed."
Case III	..	..	..	..	..	..	"Gun not out."

Action is then to be taken to clear the stoppage.

#### Case I. Gun out, lock closed.

This position is indicated by crank axis being forward with white marks in line.

G.L. lays to loading elevation and then withdraws the lock.

2 removes the rear cover and sees whether there is a round in the extractor jaws in line with the chamber. If there is not, he reports "**Missfeed,**" and the gun is reloaded without further delay.

If there is a round he removes it and reports "**Cap struck (or not struck).**"

(i) If the cap has been struck, the round is immediately lowered overboard.

(ii) If the cap has not been struck, the spare lock is shipped and the gun reloaded.

If the gun subsequently fails to fire, the fault probably lies in the firing gear exclusive of the lock.

#### Case II. Gun out, lock not closed.

Indicated by crank axis being forward with the white marks not in line.

2 slightly withdraws the lock and closes it again as smartly as possible.

Should this fail, 2 screws the extractor forcing down tool into the front cover and forces the extractor fully down, removes the tool, then withdraws the lock and closes it again as smartly as possible, first seeing the round in the feed box is properly fed up.

If this fails, 2 removes the round from the extractor and reloads.

#### Case III. Gun not out.

Indicated by crank axis not being right forward.

G.L. and 2 remove the front and rear covers and inspect the mechanism.

The most probable cause of a stoppage in this position is a jam in the feed, but it may also be due to short recoil, hard extraction or an empty cylinder fouling the gun.

Before attempting to clear the stoppage the following action must be taken:—

T. and 2 provide the tool for pulling back the gun and take the weight of the gun.



G.L. unhouses the crank lever, taking care not to let it take charge, and rotates it to the rear to take the tension off the crank spring.

The gun is now safe to work about without fear of either the recoil or crank spring taking charge, and the stoppage can be cleared and the gun reloaded.

A jam in the feed can best be cleared by removing the feed box for inspection ; other stoppages must be cleared as the situation demands.

### DRILL AMMUNITION.

*Notes.*—(a) Drill rounds are not to be unloaded through the ejector tube, as this procedure is not only contrary to the drill for CEASE FIRE and UNLOAD, but causes considerable damage to the barrel casings, burrs up the rims of the cartridges and renders them unserviceable.

(b) Drill rounds are made of white metal to render them readily distinguishable from Service.

(c) Service ammunition is not to be used for drill purposes at the gun.

### DISPOSAL OF AMMUNITION.

(i) The disposal of ammunition is dealt with fully in the Naval Magazine and Explosive Regulations.

(ii) The following table shows in brief the disposal of all ammunition removed from its proper stowage, as far as the action required concerns the Officer of Quarters. All such ammunition is to be inspected by him or his deputy, who will decide on the condition of the ammunition. In case of difficulty the Gunnery Officer is to be consulted.

#### I.—AMMUNITION OTHER THAN MISSFIRED AMMUNITION.

##### Q.F. CARTRIDGES.

Condition.	Disposal.
1. Removed from hot gun and heated ..	Fire round if it cannot be used at practice the same day. If this is not possible, throw overboard in deep water.
2. Removed from cold gun or not heated ..	Wipe clean, examine for rigidity of attachment of shell to case, and return to box and use at next opportunity.
3. Not wet nor damaged .. ..	Wipe clean and return to box.
4. Wet .. ..	If not drenched, wipe dry and return to box for use at first opportunity, or return to depot. If drenched, throw overboard in deep water.
5. Damaged .. ..	Wipe clean and stow in separate box for return to depot.
After period in ready use position—	
(a) If never outside home waters nor exposed to high temperature.	Mark and return to magazine.
(b) If abroad or been exposed to high temperature.	Throw overboard in deep water. If impossible, mark and return to armament depot.
7. Shell separated from cylinder—	
(a) Round from hot gun and heated ..	Remove charge, break up and throw overboard. Fire primer and remove it.
(b) Round from cold gun or not heated	Wipe clean and stow in separate box for return to depot.

#### II.—MISSFIRED AMMUNITION.

1. Cap struck .. .. Throw overboard.



## APPENDIX I.

ORDNANCE, Q.F. 2-PDR. MARK VIII GUNS ON MARK VIII MOUNTINGS.  
SCHEDULE OF COMPONENTS.

N.O.D.	Item.	Description.
2191/24	—	Barrel.
2191/25	—	Chamber and rifling, Mark I.
2191/26	1	Lock frame.
	2	Stud, guard frame.
2191/27A	1	Lever, actuating, extractor, left, Mark II.
	2	Bent, left extractor actuating lever.
	3	Lever, actuating, extractor, right, Mark II.
	4	Bent, right extractor actuating lever.
	5	Rivet, screwed, long (1 in No. left lever, 1 in No. right lever).
	6	Rivet, screwed, short (3 in No. left lever, 3 in No. right lever).
2191/28B	1	Lever, side, Mark II.
	2	Bent, side lever.
	3	Rivet, bent (8 in No.).
	4	Screw, check, frame guard stud and tumbler controlling piece (2 in No.).
	5	Piece, controlling, tumbler.
2191/148	1	Striker, Mark II with rivet.
	2	Pin, axis, side lever, Mark II.
2191/28	2	Tumbler.
	3	Sear, safety.
	5	Spring, main, Mark II.
	6	Lever, trigger sear, Mark II.
	7	Sear, trigger.
	8	Pin, axis, safety sear.
	9	Spring, safety sear and connecting lever (2 in No.).
	10	Pin, firing.
	11	Cap, main spring, Mark II.
2191/29	1	Spring, trigger sear.
	2	Plug, trigger sear.
	3	Pin, axis, trigger sear lever.
	4	Pin stop, trigger sear.
	5	Nut, securing, roller spindle with rivet.
	6	Rivet, safety sear and connecting lever springs (2 in No.).
	7	Washer, distance.
	8	Roller (2 in No.).
	9	Collar, roller spindle with rivet (2 in No.).
	10	Collar, stop, trigger sear.
	11	Spindle, roller.
	12	Piece, distance, bottom.
	13	Rivet, bottom distance piece.
	14	Cap, trigger sear.
2191/30	—	Extractor.
2191/31	1	Gib, upper.
	3	Cover, upper gib.
	4	Gib, lower.
	6	Pin, hinge, lower gib with split keep pin.
	7	Snib, upper gib.
	8	Pin, hinge, gib locking bars connecting lever with split keep pin.
	9	Spring, upper gib.
	10	Spring, gib snib and lower gib (2 in No.).
2191/134	1	Bar, locking, upper gib, Mark II.
	2	Bar, locking, lower gib, Mark II.
	3	Lever, connecting, gib locking bars, Mark II.
2191/32	1	Rod, connecting, crank.
	2	Pin, crank.
	3	Pin, keep, taper.
	4	Nut, connecting rod.
	5	Washer, adjusting, connecting rod, No. 1.



## APPENDIX I—continued.

N.O.D.	Item.	Description.
2191/32	6	Washer, adjusting, connecting rod, No. 2.
	7	Washer, adjusting, connecting rod, No. 3.
	8	Washer, adjusting, connecting rod, No. 4.
2191/33	—	Crank.
2191/34	3	Screw, fixing, latch pin nut with split keep pin.
	4	Pinion, crank.
	6	Stud, blocking, crank pinion.
2191/35	1	Support, cartridge, left.
	2	Pin, axis, cartridge support with split keep pin (2 in No.).
	3	Spring, cartridge support (2 in No.).
	4	Support, cartridge, right.
	5	Screw, fixing, cartridge support spring (2 in No.).
	6	Piece, retaining, extractor, Mark II.
	7	Bolt, tie, recoil plates.
	8	Nut, tie bolt with split keep pin (2 in No.).
	10	Key, recoil plate (2 in No.).
	11	Screw, fixing, recoil plate key (2 in No.).
2191/36	—	Plate, recoil, right.
2191/37	—	Plate, recoil, left.
2191/38	—	Rack.
2191/39	1	Spring, crank, left, spiral.
	—	Spring, crank, right, spiral.
	2	Bolt, rack.
2191/40	—	Lever, actuating, rack.
2191/41	1	Handle, rack actuating lever.
	2	Sleeve, rack, actuating lever handle, Mark II.
	3	Pin, axis, rack actuating lever handle with split keep pin.
	4	Key, sliding, rack actuating lever.
	5	Pin, rack actuating lever sliding key with split keep pin.
	6	Screw, retaining, rack actuating lever handle sleeve, Mark II.
	7	Spring, rack actuating lever sliding key.
	8	Collar, locking, rack actuating lever.
	9	Nut, rear, rack bolt.
	10	Nut, front, rack bolt with split keep pin.
	11	Bearing, ball thrust, rack bolt.
	13	Pin, securing, rack actuating lever locking collar with split keep pin.
	14	Washer, thrust, crank spring.
2191/44	—	Connecting block.
2191/45	1	Spring, ejector, Mark IV.
	2	Bracket, left, ejector, spring.
	3	Bracket, right, ejector spring.
	4	Spring, ejector spring catch with rivet (2 in No.).
	5	Catch, ejector spring (2 in No.).
	6	Screw, fixing, ejector spring bracket (4 in No.).
	7	Screw, fixing, deflector (2 in No.).
	8	Deflector, cartridge, Mark II.
	9	Screw, fixing, ejector stop and reservoir cover plate (6 in No.).
	10	Stop, ejector.
	11	Plate, cover, reservoir.
2191/46	1	Piece, filling, left.
	2	Piece, filling, right.
	3	Screw, set, rear block (4 in No.).
	4	Plunger, recoil gauge.
	5	Spring, plunger, recoil gauge.
	6	Plate, name.
	7	Screw, fixing, name plate (2 in No.).
	8	Slide, recoil gauge.
	9	Pin, stop, recoil gauge, slide (2 in No.).
2191/47	10	Pin, stop, rounds counter operating lever.
	—	Water jacket.
	3	Tube, steam.
	4	Valve, slide, steam tube.
	5	Plug, front, steam tube.
	6	Plug, rear, steam tube.
	7	Stem, steam plug with fixing pin.
	8	Washer, steam plug.
	9	Cork, steam plug.



## APPENDIX I—continued.

N.O.D.	Item.	Description.
2191/47	10	Plug, filling and emptying (2 in No.).
	11	Washer, adjusting, barrel spring, A.
	12	Washer, adjusting, barrel spring, B.
	13	Washer, adjusting, barrel spring, C.
	14	Ring, joint, breech gland.
2191/51	1	Nut, barrel, Mark II.
	2	Sleeve, locking, barrel nut.
	3	Packing, barrel nut.
	4	Ring, supporting, barrel nut packing.
	5	Spring, packing, muzzle gland, Mark II.
	6	Packing, muzzle gland.
	7	Ring, supporting, muzzle gland packing (2 in No.).
	8	Gland, muzzle.
	9	Box, stuffing, muzzle.
2191/146	2	Guard, flame.
	1	Ring, locking.
	3	Ring, protecting, barrel threads.
2191/52	1	Cap, waterjacket.
	2	Spring, packing breech gland, Mark II.
	3	Ring, supporting, breech gland packing (2 in No.).
	4	Loop, chain (4 in No.).
	5	Hook, S. (10 in No.).
	6	Gland, breech.
	7	Packing, breech gland.
	8	Chain, steam plug—7 links with 2 S hooks and eye.
	9	Chain, waterjacket, emptying and filling plugs—eye with 2 S hooks and loop (2 in No.).
	10	Eye, chain (5 in No.).
2191/53	1	Sleeve, barrel spring.
	2	Screw, check, barrel spring sleeve.
2191/54	—	Spring, barrel.
2191/55	1	Block, rear.
	2	Bracket, housing, rack actuating lever handle.
	3	Rivet, screwed, long, rack actuating lever handle housing bracket.
	4	Rivet, screwed, short, rack actuating lever handle housing bracket.
2191/56	1	Lever, operating, rounds counter.
	2	Spring, rounds counter.
	3	Wheel, reset, rounds counter with keep pin.
	4	Slide, rounds counter.
	5	Collar, rounds counter operating lever with split keep pin.
	6	Coupling, rounds counter reset wheel spindle.
2191/57	1	Counter (Veeder), rounds counter.
	2	Case, rounds counter.
	3	Bearing, end, rounds counter (2 in No.).
	4	Rivet, screwed, rounds counter (3 in No.).
	5	Frame, rounds counter window, Mark II.
	6	Spindle, rounds counter reset wheel.
	7	Screw, fixing, rounds counter and bearing and window frame (14 in No.).
	8	Joint, rounds counter end bearing (2 in No.).
	10	Joint, rounds counter window (2 in No.).
	11	Window, rounds counter.
2191/128	—	Plate, side, right, Mark II.
2191/129	—	Plate, side, left, Mark II.
2191/63	1	Bracket, deflection, pivot.
	2	Bracket, gib locking bar cam.
	3	Cam, gib locking bar.
	4	Rivet, screwed— Deflection pivot bracket (4 in No.). Locking bar cam bracket (2 in No.). Connecting Block (8 in No.).
	8	Rivet, screwed, gib locking bar cam (4 in No.).
	9	Key, deflection pivot bracket (2 in No.).
	10	Screw (2 in No.).
2191/64	—	Bracket, bottom.
2191/65	1	Pawl, retaining, rack, right.
	2	Pawl, retaining, rack, left.



## APPENDIX I—continued.

N.O.D.	Item.	Description.
2191/65	3	Spring, rack retaining pawl (2 in No.).
	4	Screw, securing, rack retaining pawl spring (2 in No.).
2191/66	1	Arrangement of safety pawl.
	2	Pawl, safety, right.
	3	Spring, safety pawl (2 in No.).
	4	Nut, pawl spring socket, Mark II (2 in No.).
	5	Pawl, safety, left.
	6	Socket, safety pawl spring, Mark II (2 in No.).
	7	Nut, pivot, safety pawl (2 in No.).
	8	Screw, pivot, safety pawl with split keep pin (2 in No.).
2191/67	1	Piston, buffer (2 in No.).
	3	Box, stuffing, buffer (2 in No.).
	4	Gland, buffer (2 in No.).
2191/135	3	Liner, buffer, Mark III (2 in No.).
2191/66	1	Packing, buffer (2 in No.).
	2	Packing, joint, buffer stuffing box (2 in No.).
	3	Ring, supporting, buffer packing (4 in No.).
	4	Ring, joint, buffer stuffing box (2 in No.).
	5	Washer, packing, buffer and reservoir, emptying and filling plugs (4 in No.).
	6	Nut, piston, Mark II, with collar and check screw (2 in No.).
	7	Key, liner (2 in No.).
	8	Plug, emptying and filling buffer and reservoir (4 in No.).
	9	Chain, buffer emptying plugs. Eye with 2 S hooks and loop (2 in No.).
	10	Washer, spring, piston nut (2 in No.).
	11	Tube, buffer (2 in No.).
	12	Washer, locking, piston nut (2 in No.).
2191/72	—	Box, feed.
2191/74	1	Pawl, retaining, cartridge (2 in No.).
	2	Spring, retaining pawl (2 in No.).
	3	Pin, axis, retaining pawl (2 in No.).
	4	Screw, fixing, Part I cartridge retainer.
	5	Cam, releasing, retaining pawl.
	6	Plate, retaining, pawl spring (2 in No.).
	7	Cam, releasing, feed pawl.
	8	Spindle, releasing cams.
	9	Strip, protecting.
	10	Rivet, protecting strip (2 in No. long).
		" " " (2 in No. short).
	11	Lever, releasing, retaining pawl.
	12	Coupling, releasing cam spindle with 2 rivets.
	13	Retainer, cartridge, Part 2.
	14	Spring, cartridge retainer.
	15	Nut, releasing cam spindle, with split keep pin.
	16	Spring, retaining pawl releasing lever.
	17	Retainer, cartridge, Part I, with axis pin.
2191/75	1	Plate, feed.
	2	Lever, feed, bottom.
	3	Lever, feed, top.
	4	Pin, securing, feed levers.
2191/76	1	Slide, feed.
	2	Pawl, feed.
	3	Rivet, cartridge guides (6 in No. long).
		" " " (6 in No. short).
	4	Pin, axis, feed pawl.
	7	Guide, cartridge, top.
	8	Guide, cartridge, bottom.
	9	Spring, feed pawl.
2191/77	—	Carrier, feed plate and feed slide.
2191/78	1	Bush, retaining, contact plunger with split keep pin.
These parts have no function in guns on Mark VIII Mounting	2	Plunger, contact, Part I.
	3	Plunger, contact, Part II, with keep pin.
	4	Plunger, contact, Part III.
	5	Spring, contact plunger (2 in No.).
	—	Cover, mechanism, Mark III.
2191/125	—	Cover, mechanism, Mark III.
2191/155	10	Pin, locking, Mark II.
	11	Handle.



## APPENDIX I—continued.

N.O.D.	Item.	Description.
2191/155	12	Nut.
2191/81	1	Bolt, stop, crank.
	2	Nut, crank stop bolt, with split keep pin.
	3	Sleeve, crank stop bolt.
	4	Cushion, crank sleeve (2 in No.).
	5	Screw, check, crank stop bolt and locking pin bushes (3 in No.).
	8	Path, lock (2 in No.).
	12	Rivet, lock path (2 in No.).
2191/82	14	Hook, inspection cover catch, with 4 rivets.
	2	Bush, right, locking pin.
	3	Bush, left, locking pin.
	4	Eye, chain.
	5	Hook, S (2 in No.).
	6	Chain, mechanism cover locking pin.
2191/83	—	Cover, feed box.
2191/84	1	Guide, extractor, left.
	2	Guide, extractor, right.
	3	Handle, Mark II.
	4	Plate, stop, Mark II.
	5	Pin, screwed, safety.
	6	Rivet, extractor guides, handle, stop plate and pinion bracket (16 in No.).
2191/85	7	Stud, location (2 in No.).
	1	Cover, inspection.
	2	Pin, hinge, with split keep pin.
	3	Nut, hinge pin.
	5	Catch.
	6	Pin, axis, catch.
	7	Spring, catch.
	8	Pin, stop, catch.
2191/86	1	Cover, side plate (2 in No.).
	2	Stud, side plate cover (4 in No.).
2191/87	1	Bracket, safety.
	2	Lever, hand, safety.
	3	Catch, safety hand lever.
	4	Pin, axis, safety hand lever catch.
	5	Rivet, safety bracket (5 in No.).
	6	Rod, safety.
	7	Bolt, locking, safety.
	8	Nut, safety hand lever axis pin, with split keep pin.
	9	Spring, safety hand lever catch.
	10	Pin, axis, safety hand lever.
2191/88	1	Case, trigger sear lever tripper carrier, Mark III.
	2	Cover, trigger sear lever tripper carrier case, Mark II.
	3	Carrier, trigger sear lever tripper, Mark II.
	5	Bearing, safety cam, Mark II.
	6	Cover, trigger sear lever tripper carrier, Mark II.
	7	Pin, axis, safety cam.
	8	Pawl, safety, Mark II.
	9	Cover, retaining, trigger sear lever tripper carrier spring, Mark II.
	10	Cam, safety.
	11	Popple, trigger sear lever tripper spring.
	12	Pin, axis, safety pawl.
	13	Cover, safety pawl.
	14	Screw, safety pawl axis pin.
2191/135	2	Tripper, trigger sear lever, Mark II.
2191/89	1	Screw, fixing, safety cam bearing, Mark II.
	2	Plunger, firing rod, Mark II.
	3	Plug, flathead, firing rod.
	4	Plug, firing rod plunger spring.
	5	Collar, firing rod.
	6	Plug, retaining, firing rod plunger.
	7	Spring, trigger sear lever tripper carrier.
	9	Spring, firing rod plunger.
	10	Spring, firing rod.
	11	Screw, lubricating.
	12	Rivet, trigger sear lever tripper carrier case



APPENDIX I—*continued.*

N.O.D.	Item.	Description.
2191/89	13	Rod, firing, rear, with rivets.
	14	Plate, guard, rear firing rod.
	15	Rod, firing, front, with rivets.
	16	Rivet, firing rod bearing and guard plate (12 in No.).
	17	Bearing, firing rod (2 in No.).
	18	Bush, bearing, front firing rod, with rivet.
	19	Washer, front firing rod.
	20	Screw, securing, firing rod collar.
	21	Screw, check, firing rod plunger retaining plug.
	1	Spring, trigger sear lever tripper, Mark II.
2191/135	1	Bracket, pinion, Mark III.
2191/150	2	Pinion, Mark II.
	3	Collar, pinion, with split keep pin.
2191/135	6	Plate, fire description, A.H.V.
	4	Screw, fixing, fire description plate (2 in No.).
2191/122	—	Handle, crank locking latch.
	3	Left, Part I, with split keep pin.
	4	Left, Part II, with split keep pin.
	5	Spindle, with split keep pin, R. and L. handles.
	11	Collar.
	6	Roller, parts I and II, R. and L. handles (2 in No.).
	7	Axis, roller, Parts I and II, R. and L. handles (2 in No.).
	12	Stop, Part I, R. and L. handles.
	8	Catch, crank locking latch handle.
	9	Spring.
2191/123	10	Pin, axis.
	1	Pin, latch, locking crank, Mark II.
	2	Nut, latch, pin, Mark II.
	3	Path, extractor, Mark II (2 in No.).
	4	Rivet, screwed, extractor path (4 in No.).
2191/124	5	Sleeve, latch pin.
	1	Bracket, crank locking latch, R.H.
	2	Bracket, crank locking latch, L.H.
	3	Spring, plunger (2 in No.).
	4	Plunger, crank locking latch (2 in No.).
	5	Stop, crank operating lever (2 in No.).
	6	Rivet, screwed, bracket and crank lever stop (16 in No.).
	7	Latch, locking crank, with split pin (2 in No.).
	8	Lever, crank locking latch, R.H.
	9	Lever, crank locking latch, L.H.
	10	Lever, operating crank (2 in No.).



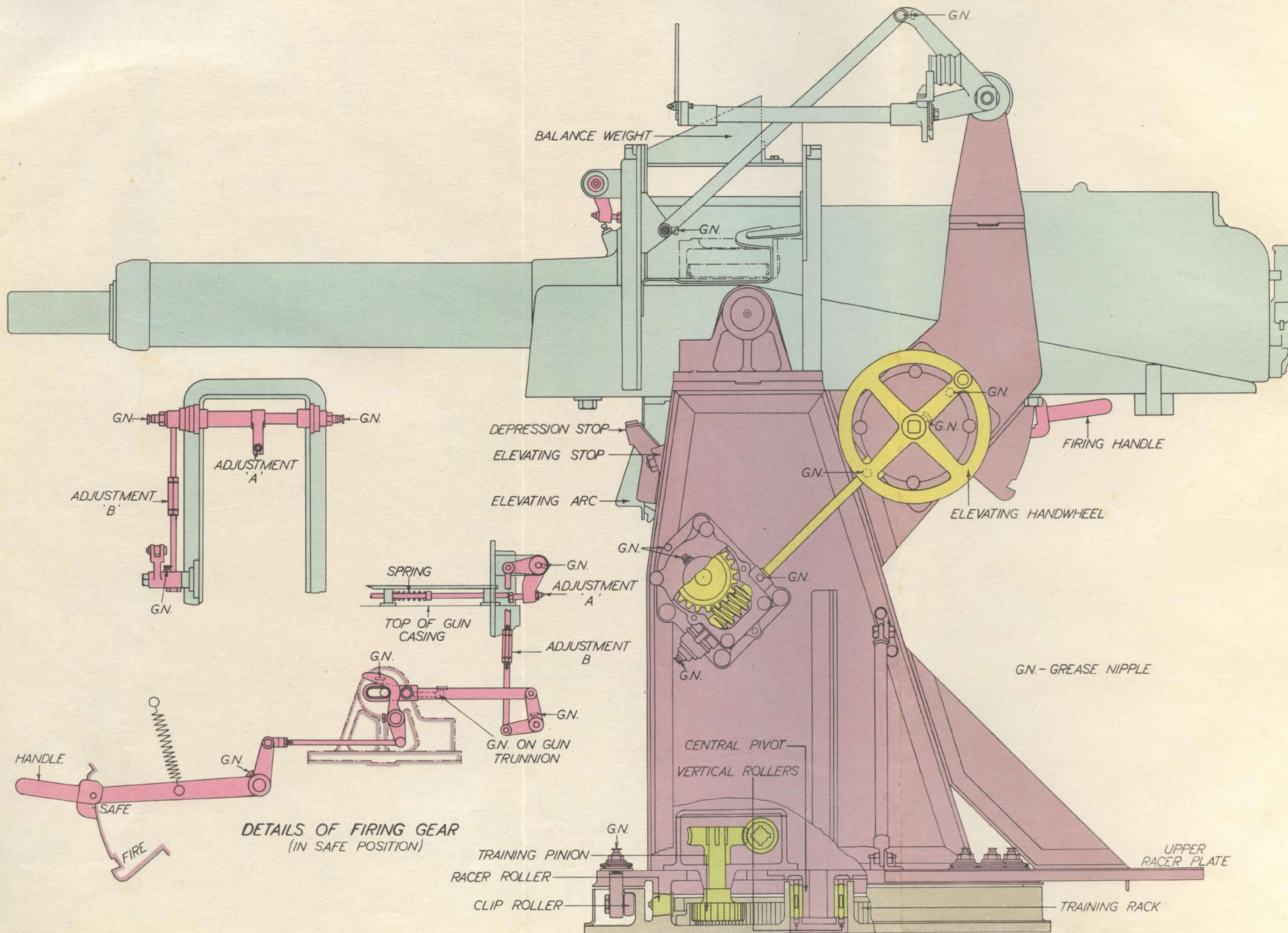




## 2 PDR. MARK VIII GUN ON MARK VIII\* SINGLE MOUNTING

### GENERAL ARRANGEMENT

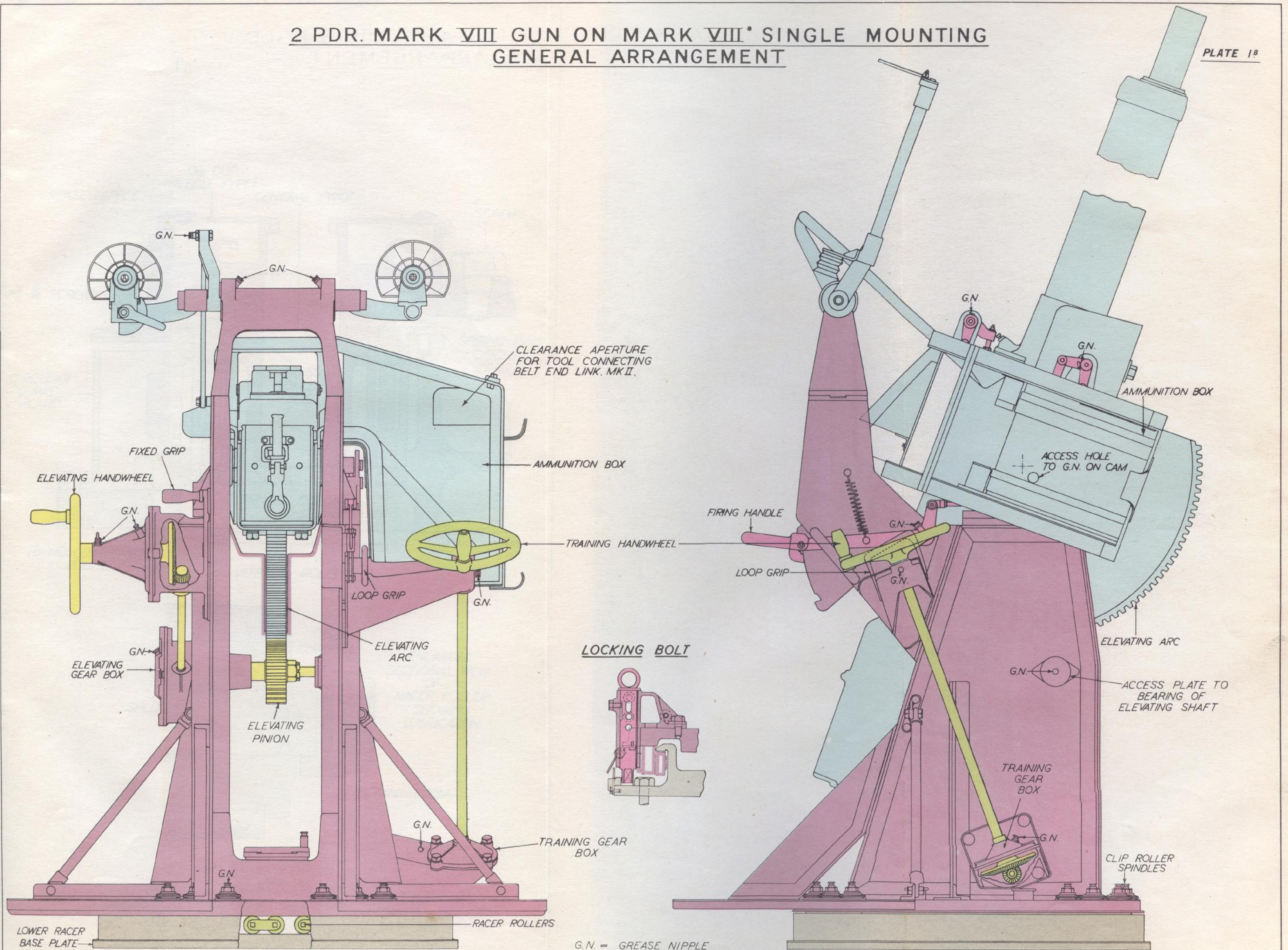
PLATE 1A





# 2 PDR. MARK VIII GUN ON MARK VIII\* SINGLE MOUNTING GENERAL ARRANGEMENT

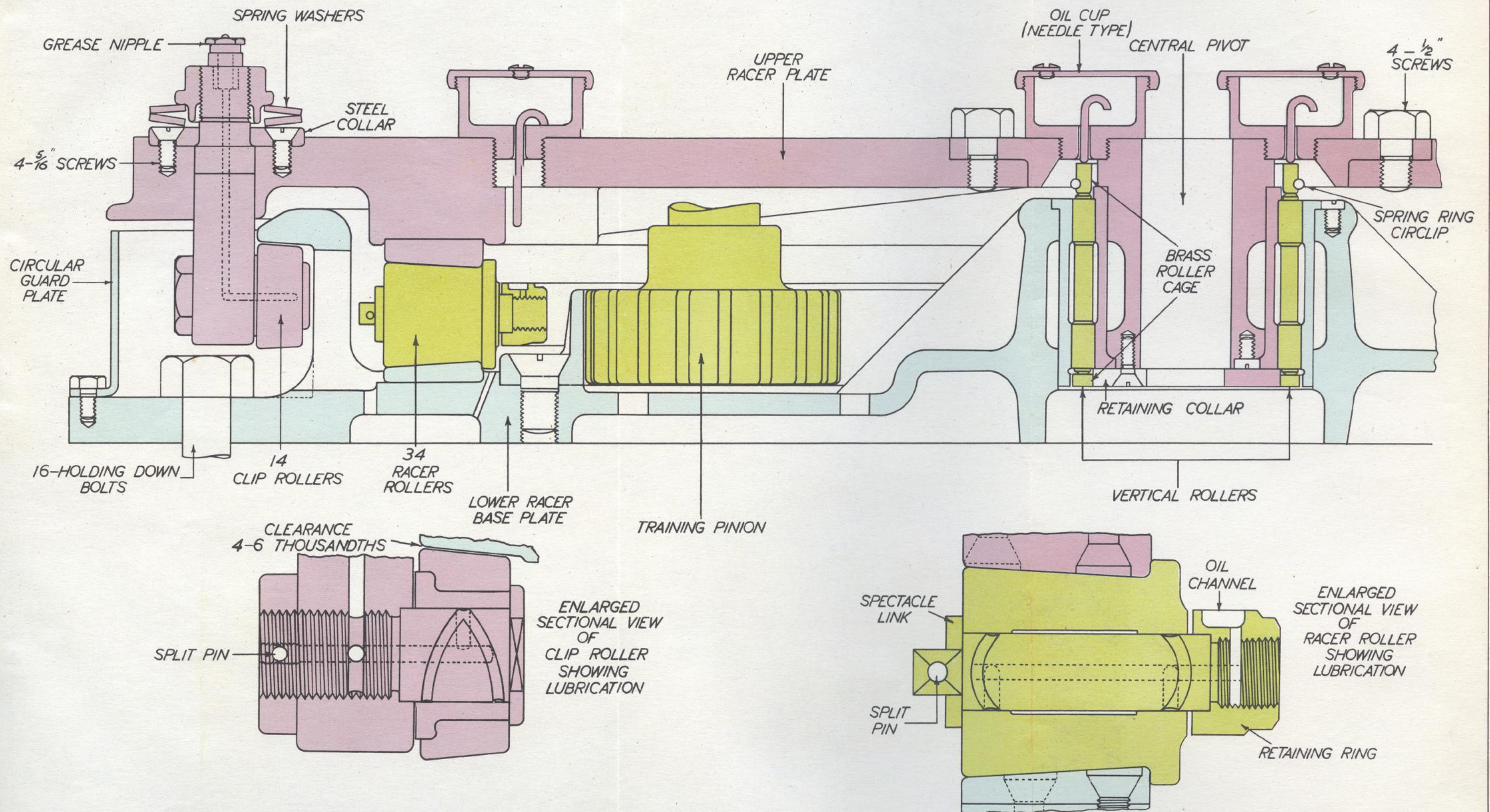
PLATE 1<sup>B</sup>





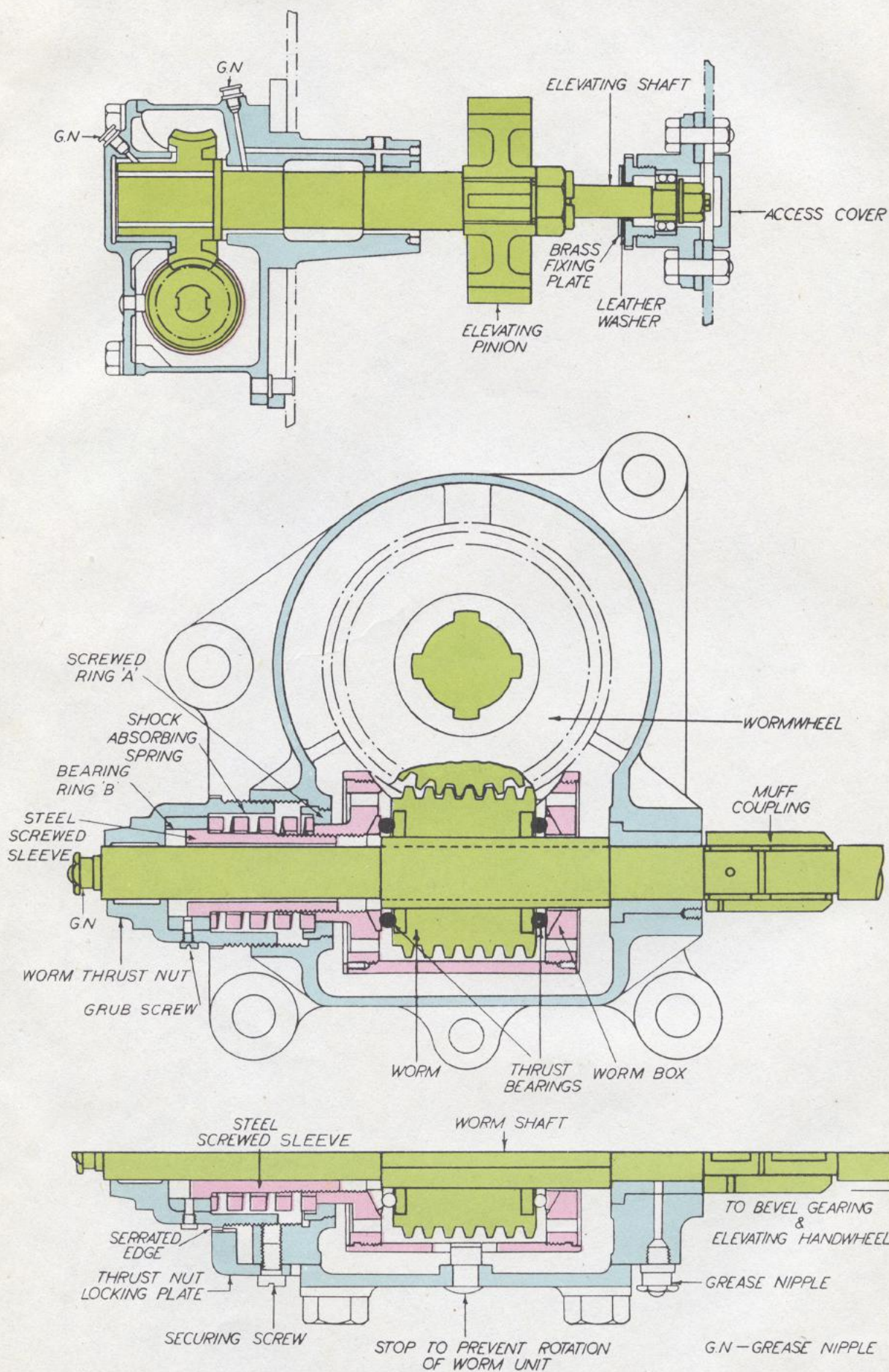
# DETAILS OF BASE PLATE, CENTRE PIVOT, ROLLER PATH AND CLIP ROLLERS.

PLATE 2.





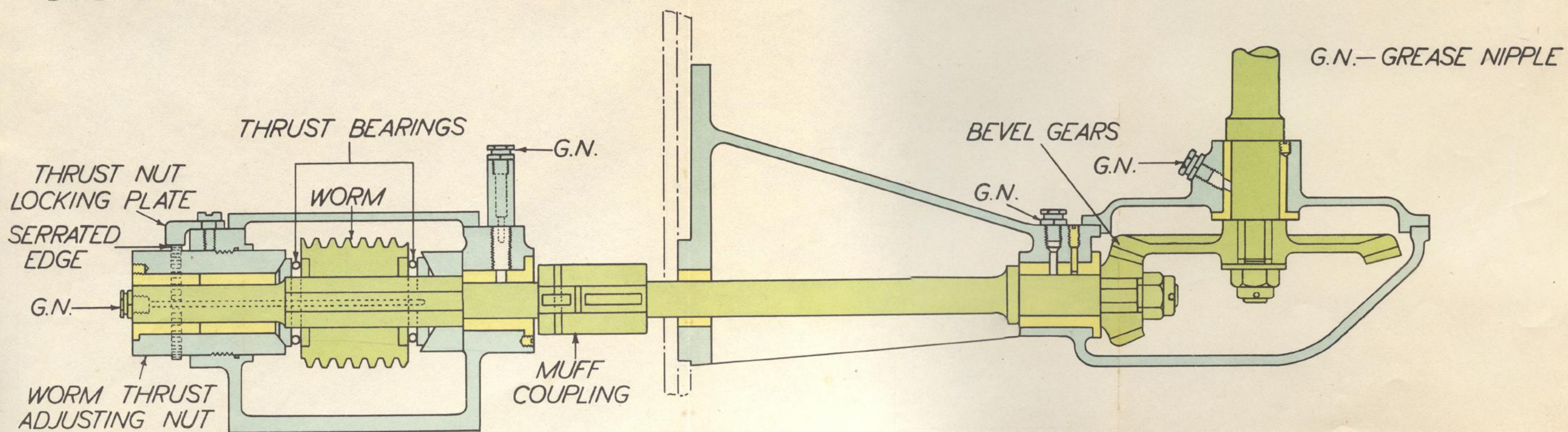
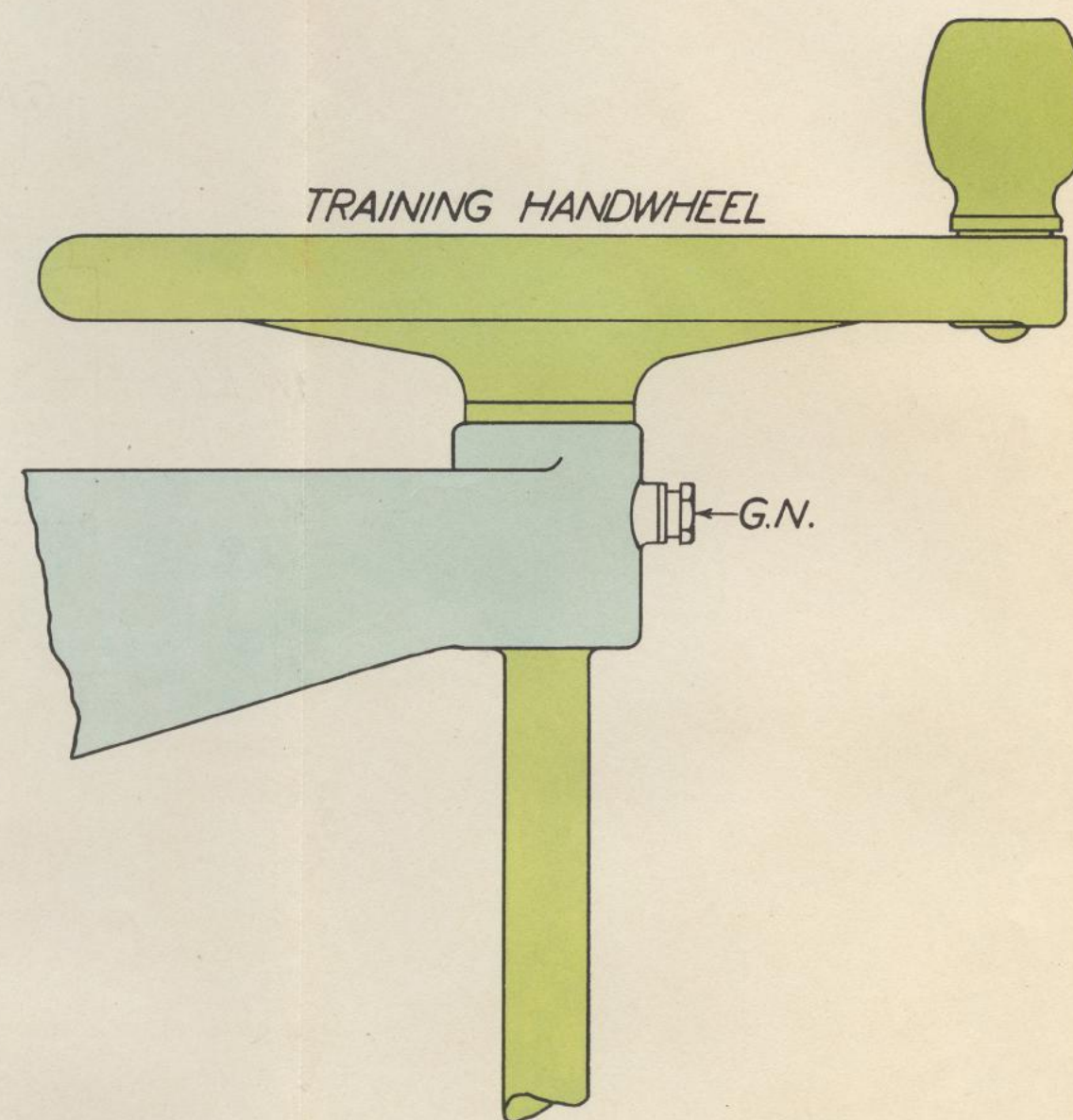
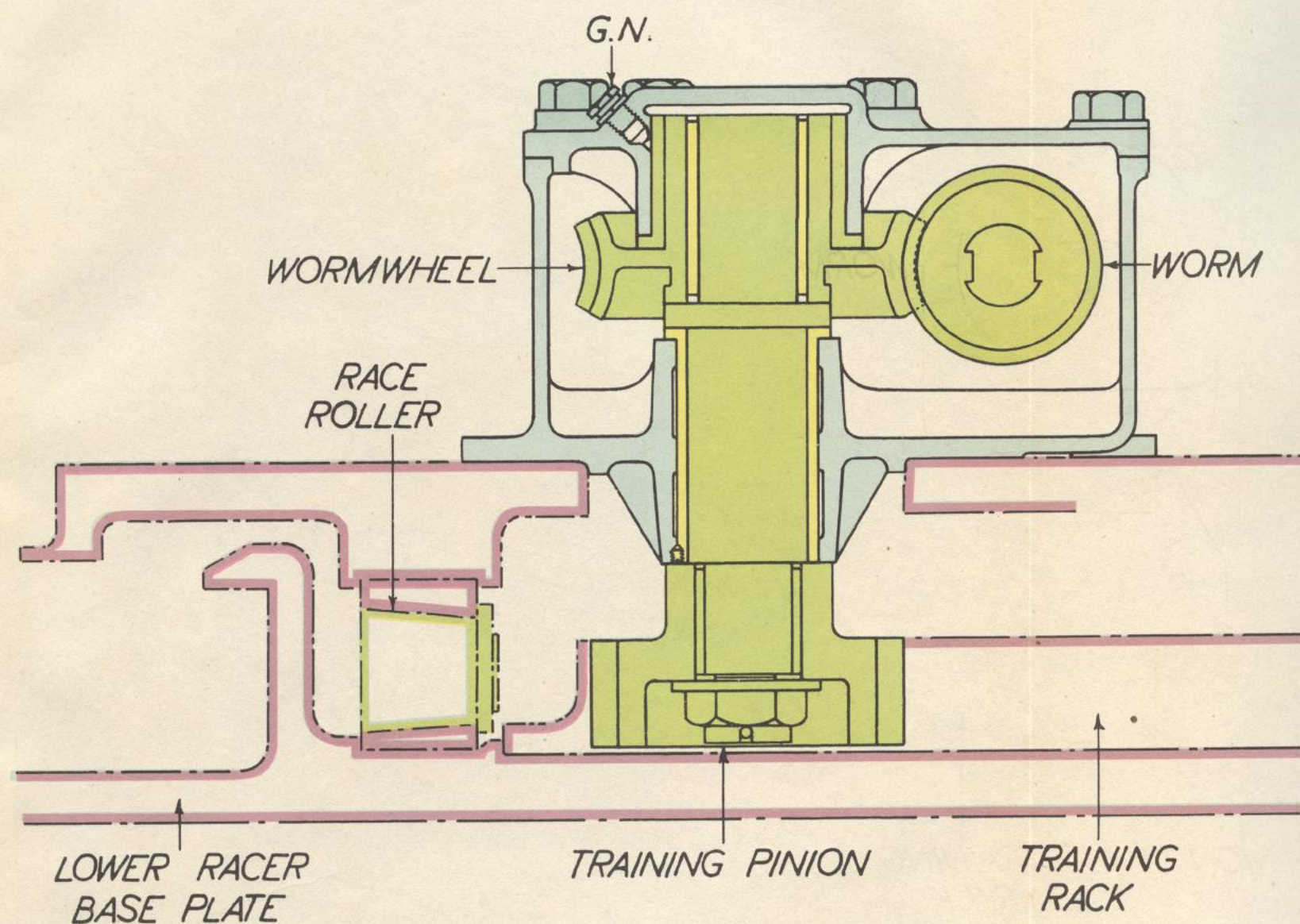
# THE ELEVATING GEAR.





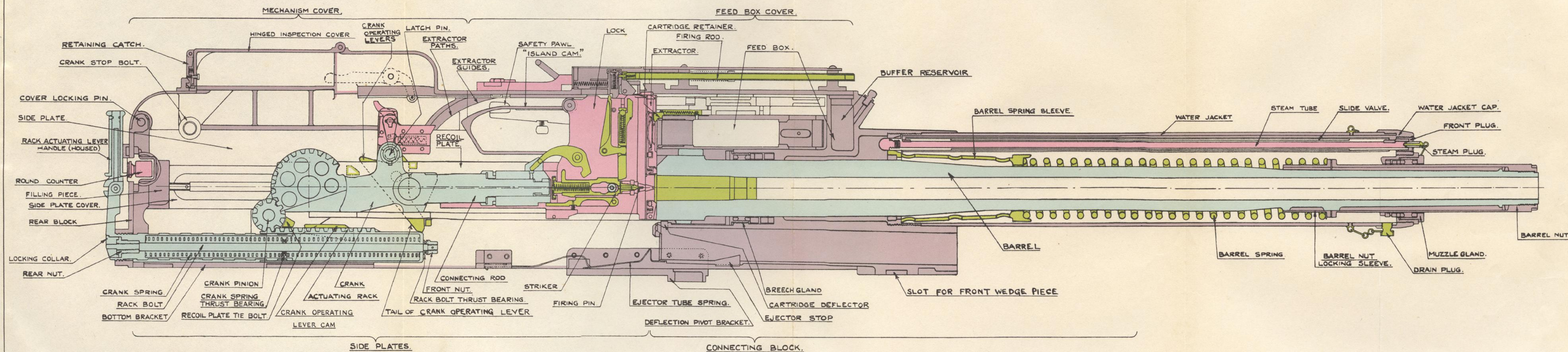
# THE TRAINING GEAR.

PLATE 4.





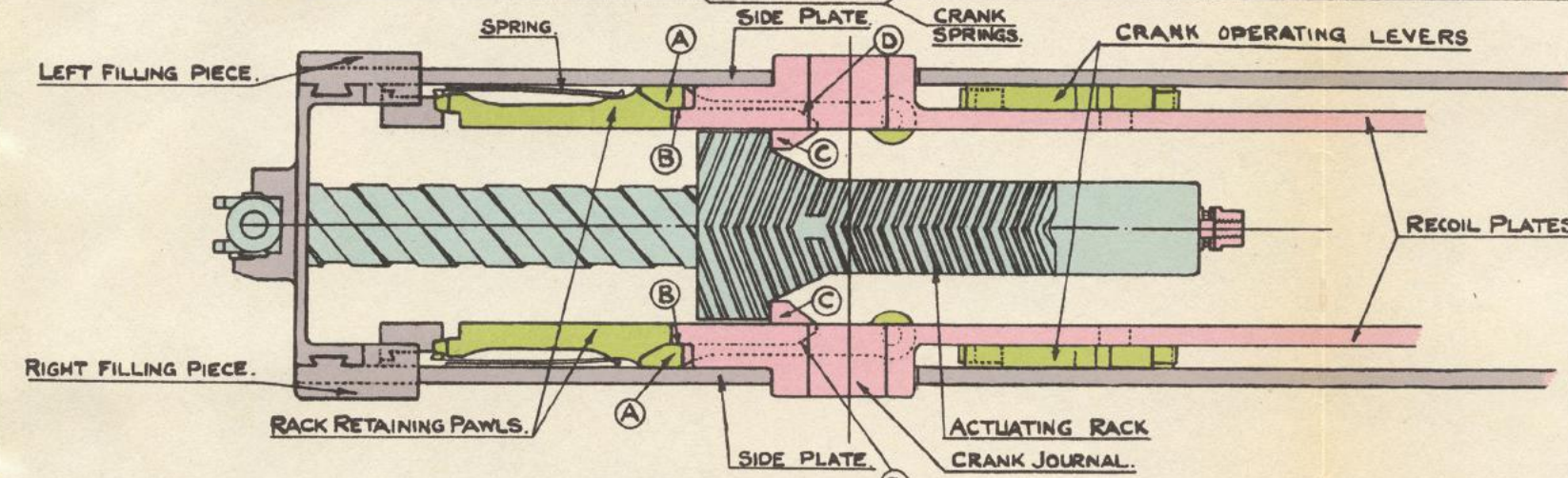
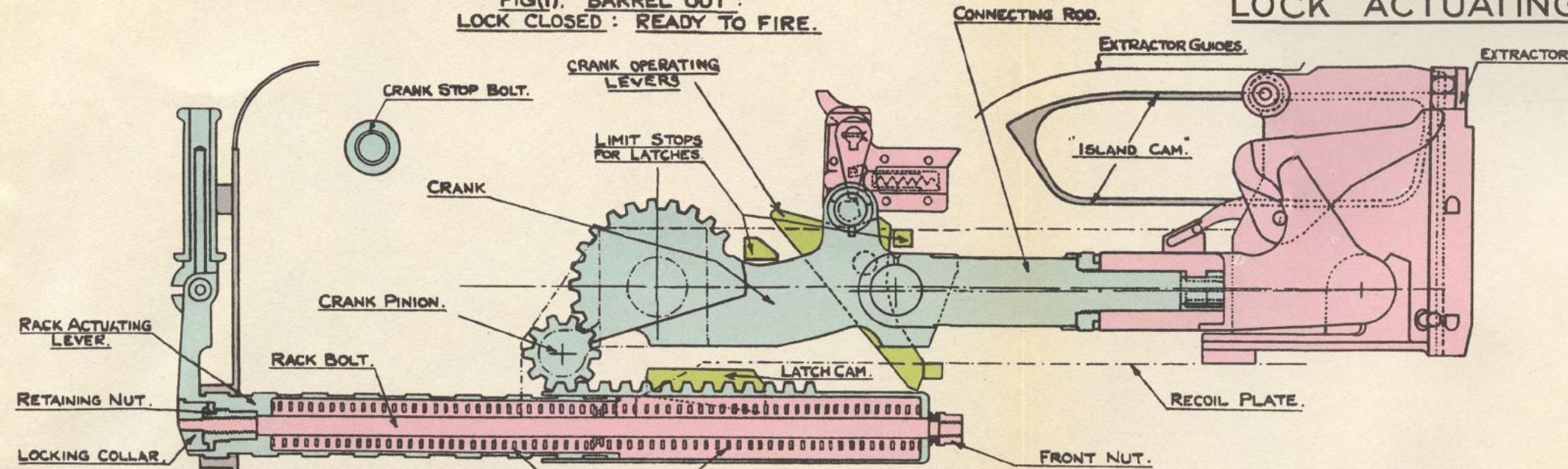
# GENERAL ARRANGEMENT OF GUN



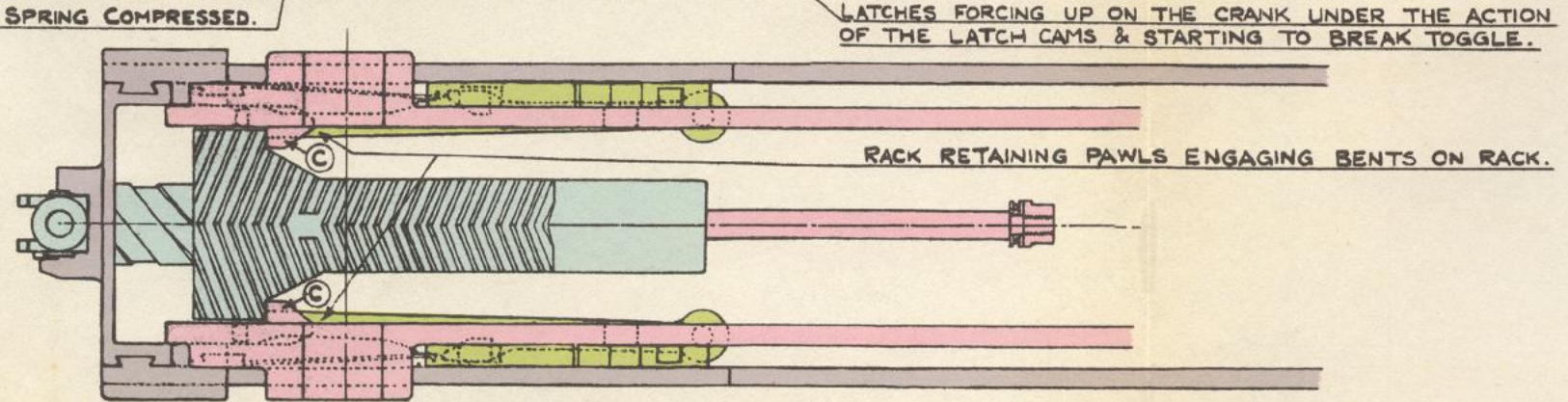
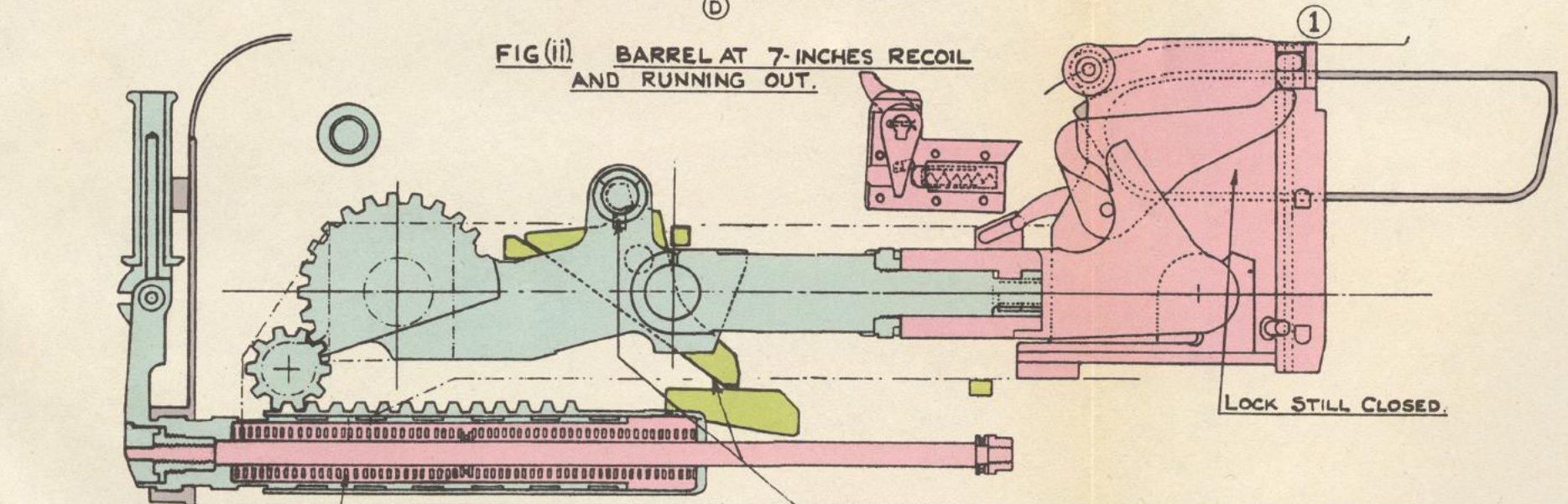


# LOCK ACTUATING MECHANISM

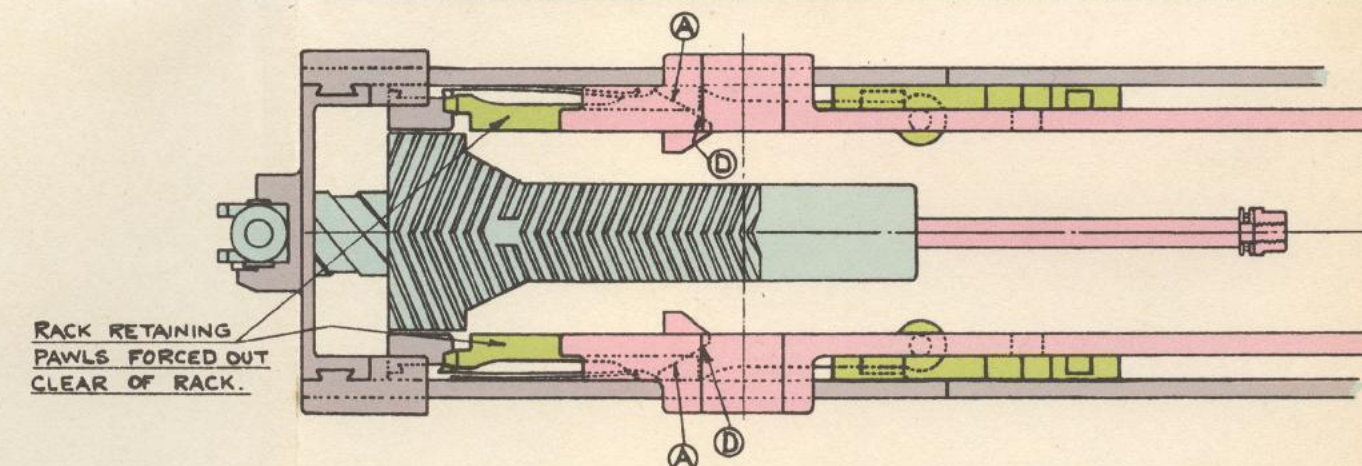
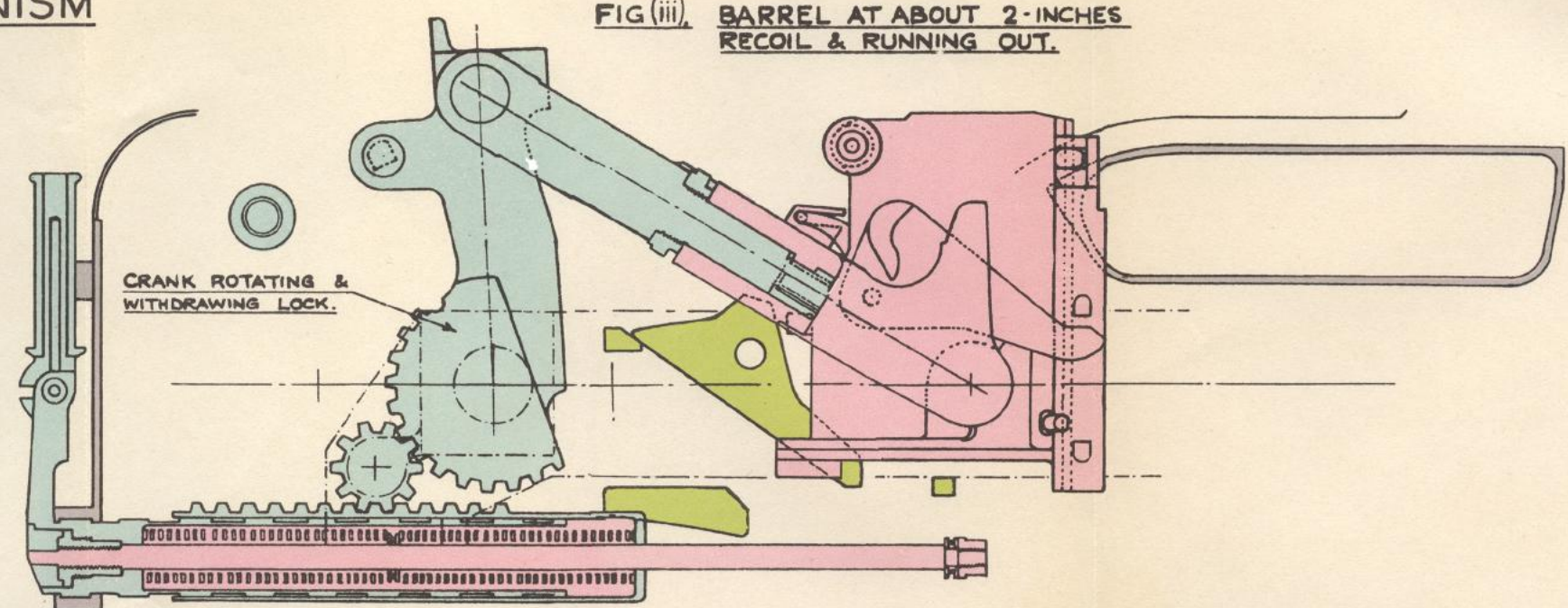
FIG(i). BARREL OUT :  
LOCK CLOSED : READY TO FIRE.



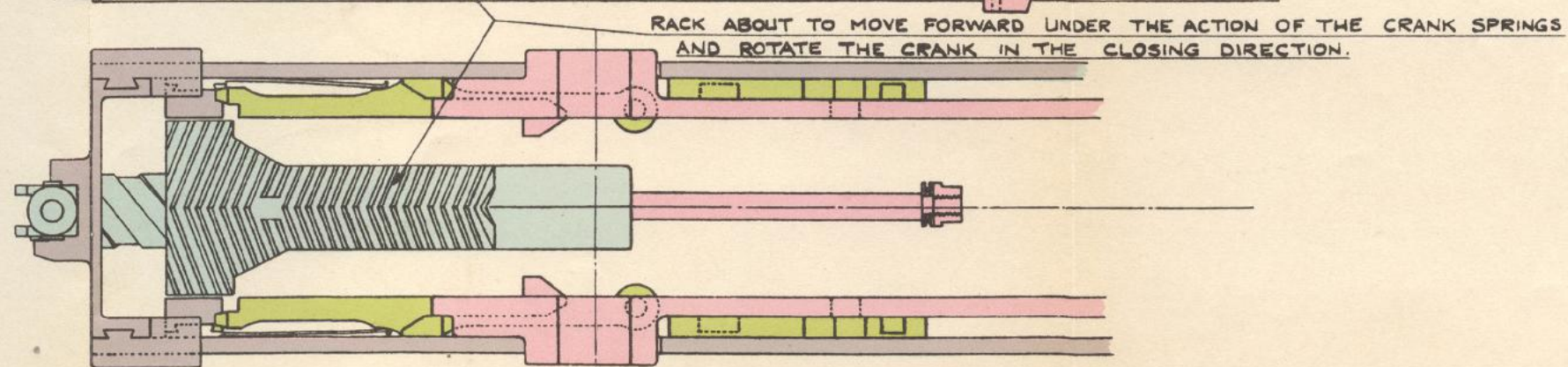
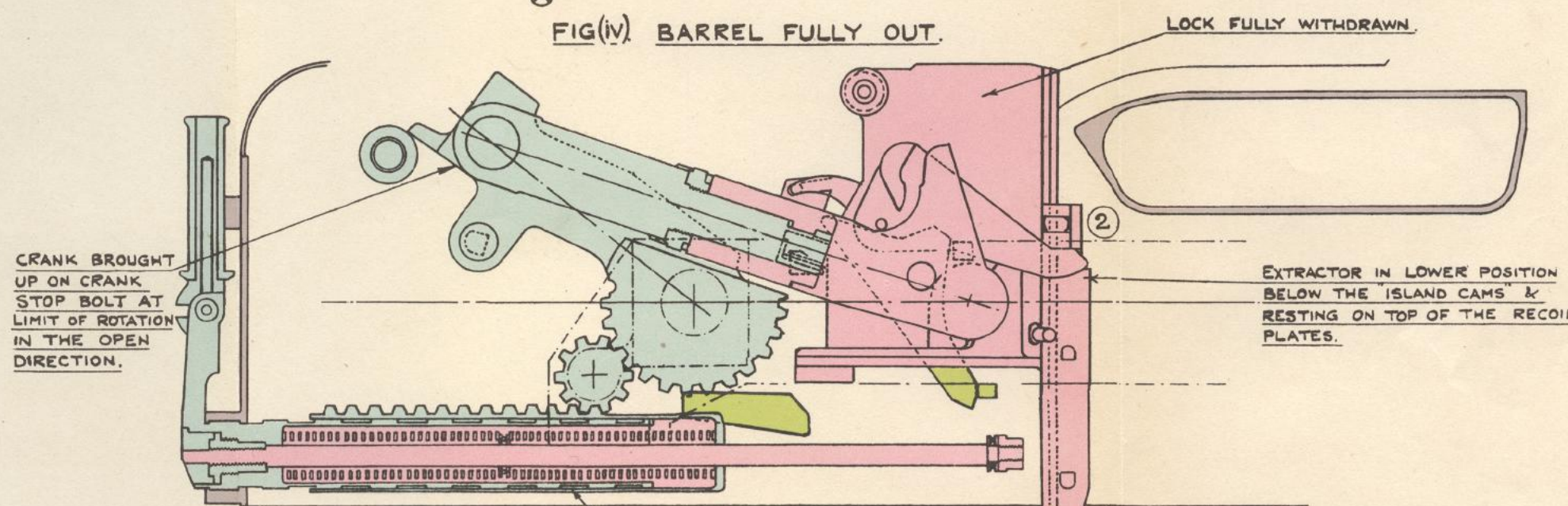
FIG(ii). BARREL AT 7-INCHES RECOIL  
AND RUNNING OUT.



FIG(iii). BARREL AT ABOUT 2-INCHES  
RECOIL & RUNNING OUT.



FIG(iv). BARREL FULLY OUT.





# ACTION OF THE LOCK.

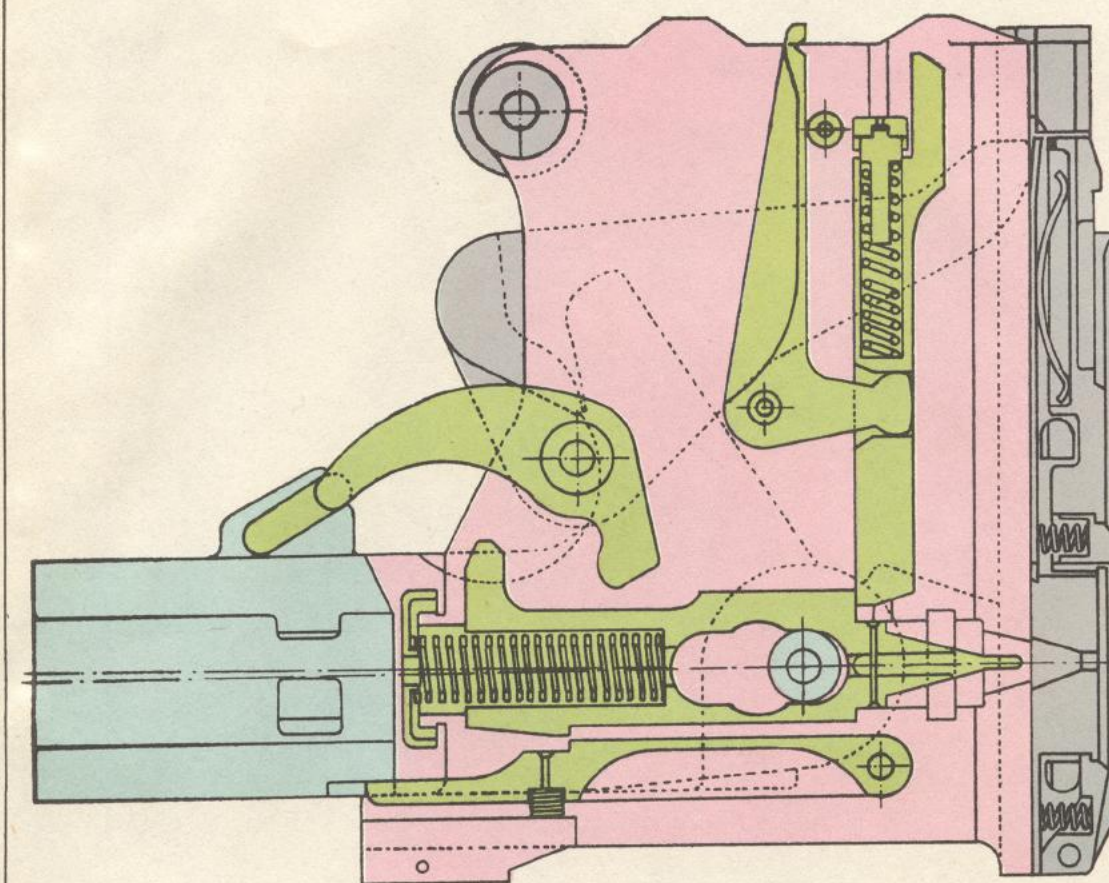


FIG (i).  
LOCK COCKED: SAFETY SEAR  
DEPRESSED: READY TO FIRE.

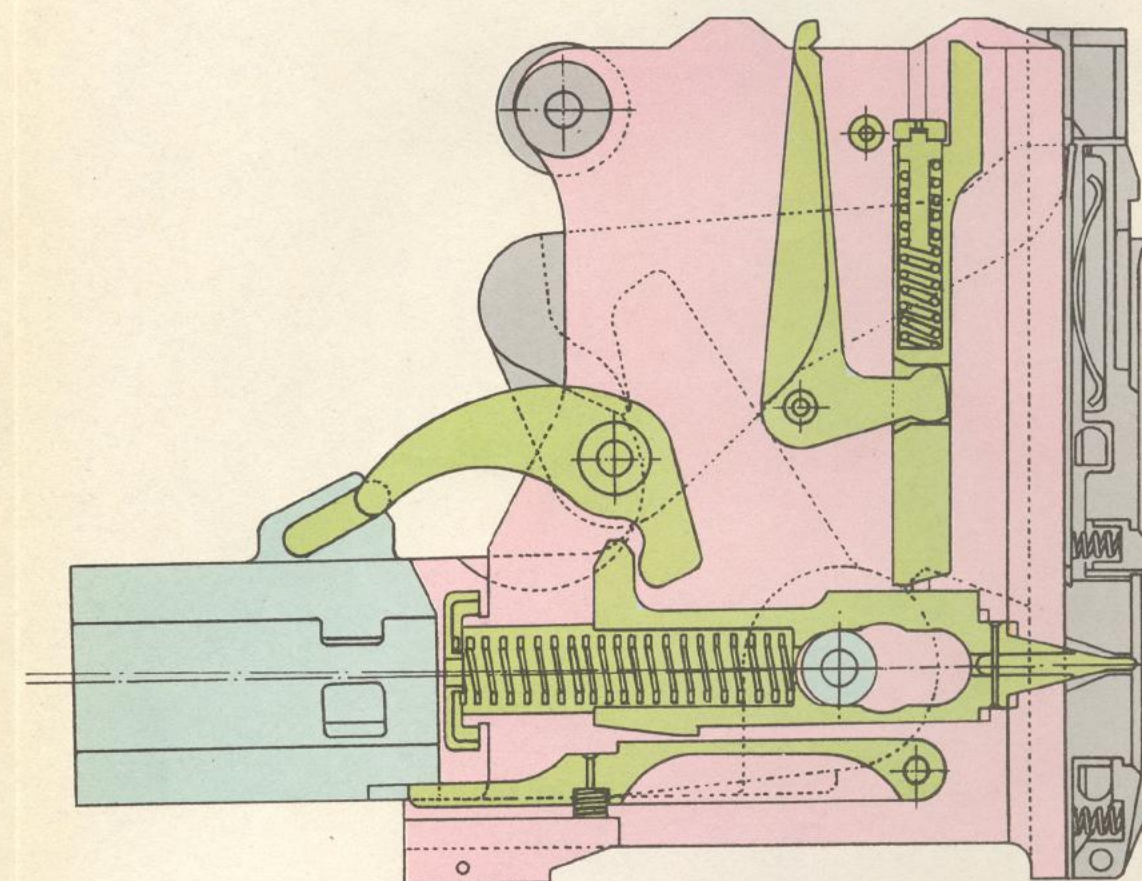


FIG (ii).  
LOCK FIRED.

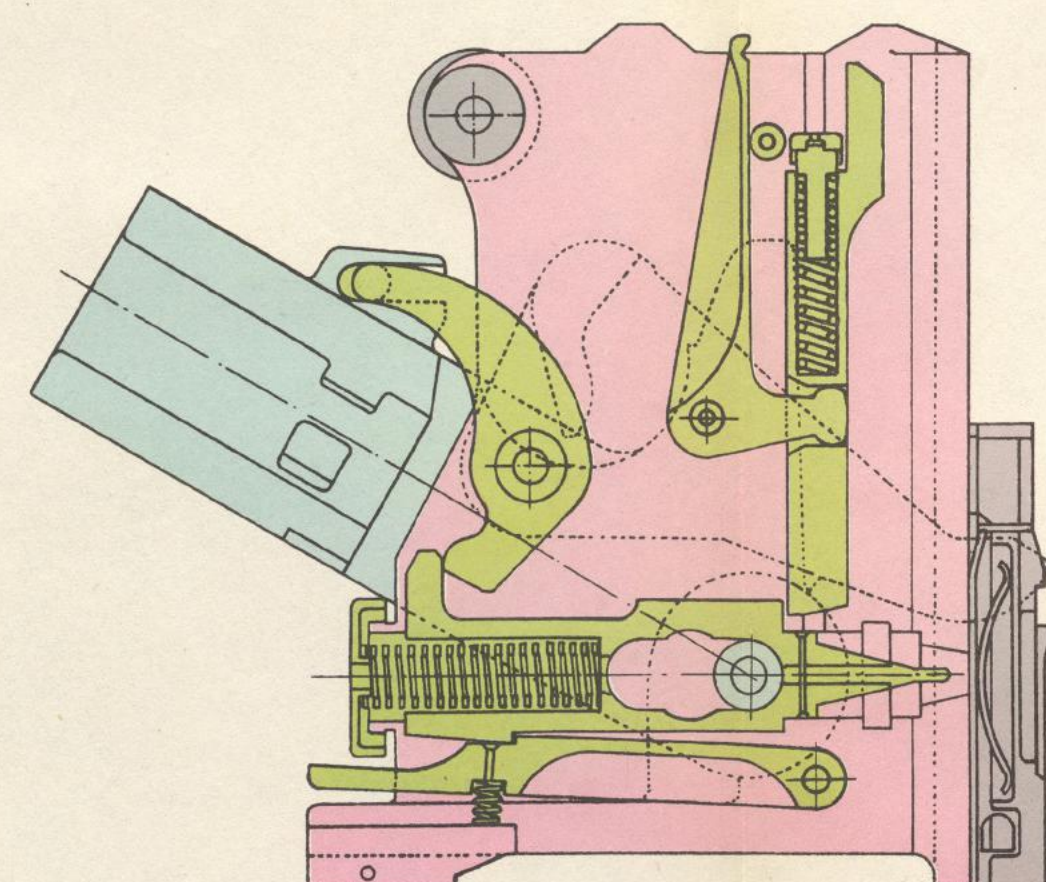
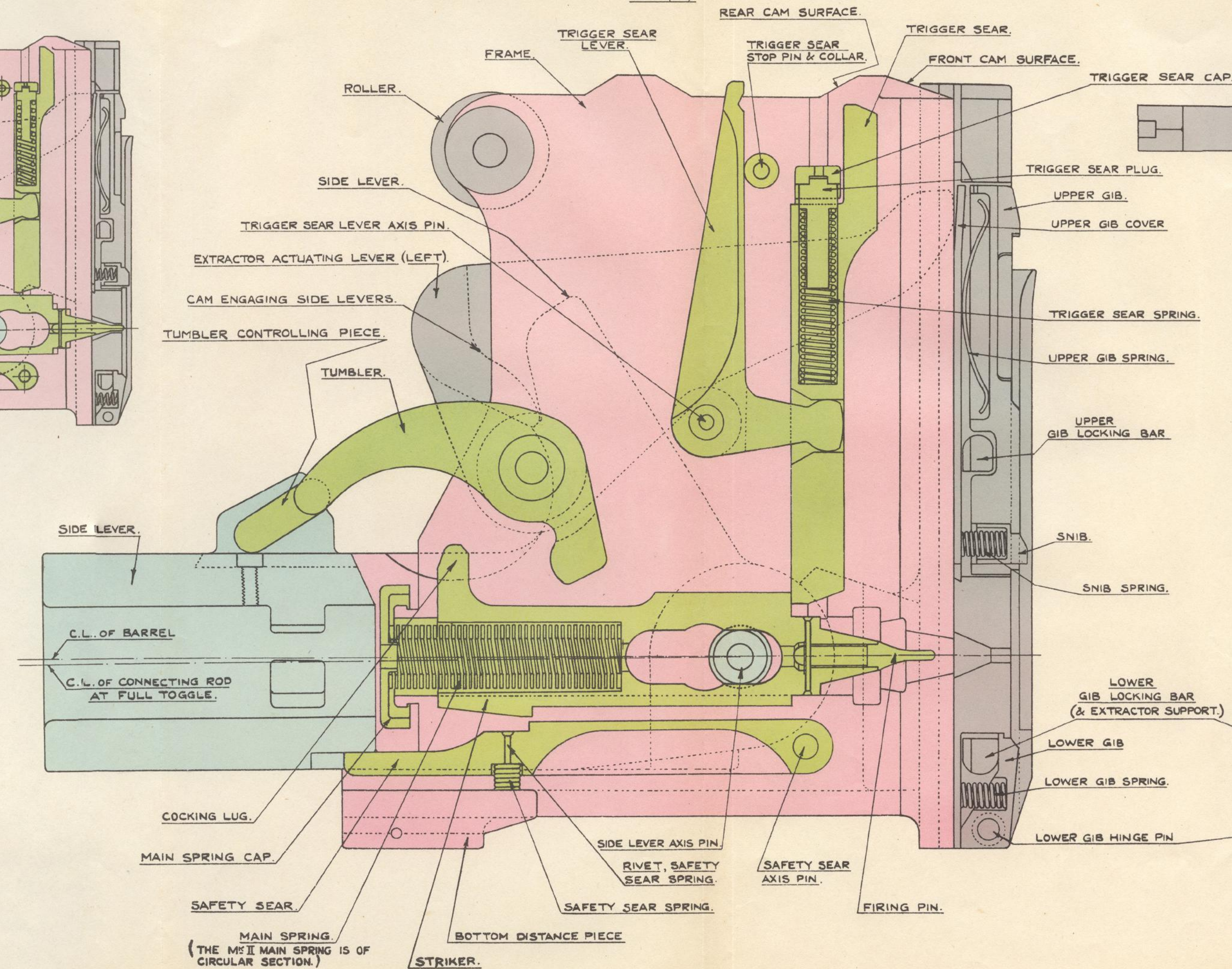


FIG (iii).  
LOCK WITHDRAWN: STRIKER COCKED:  
EXTRACTOR IN LOWER POSITION.

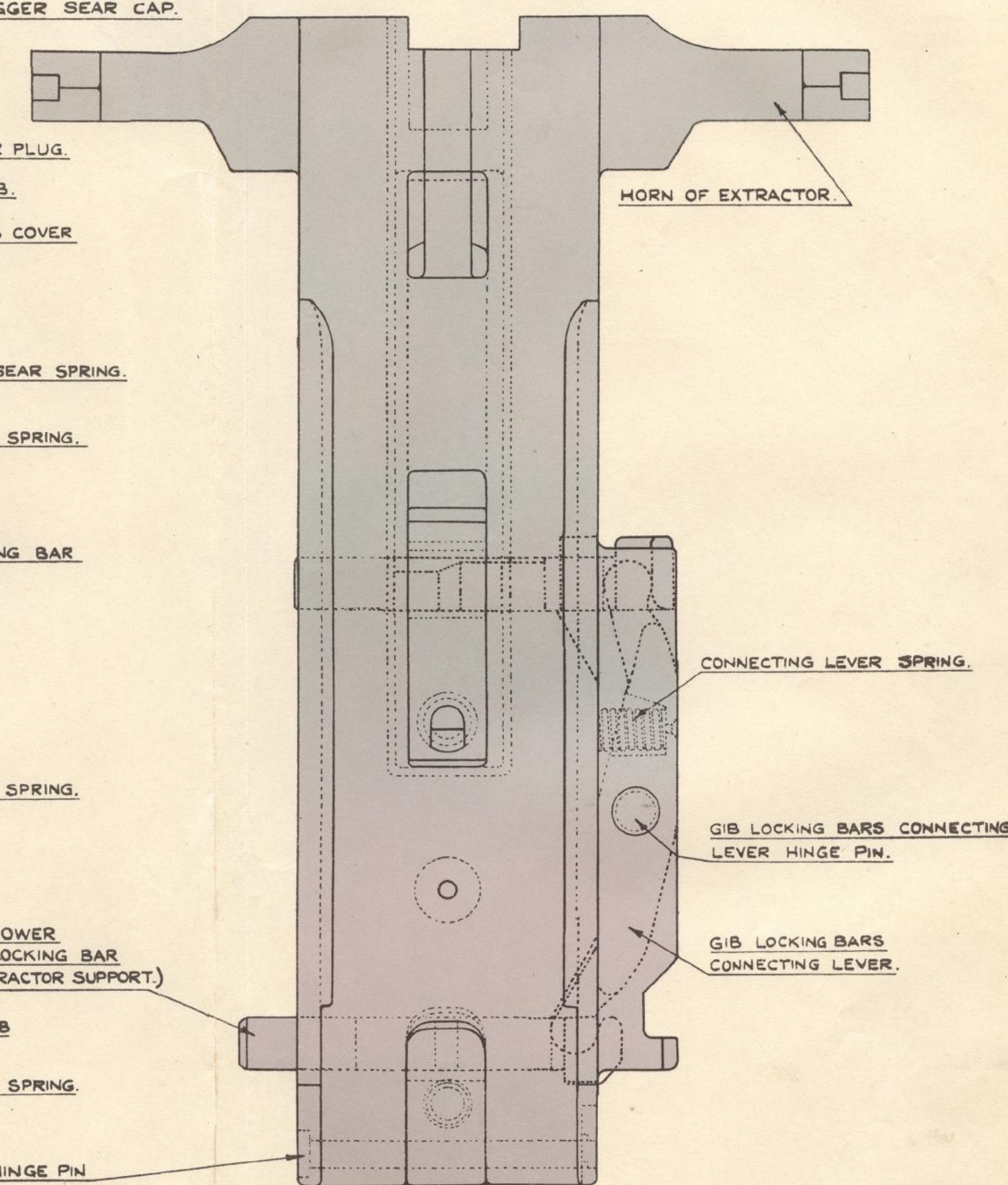
# SECTIONAL ELEVATION OF LOCK.

FIG. (IV).



# FRONT ELEVATION OF EXTRACTOR.

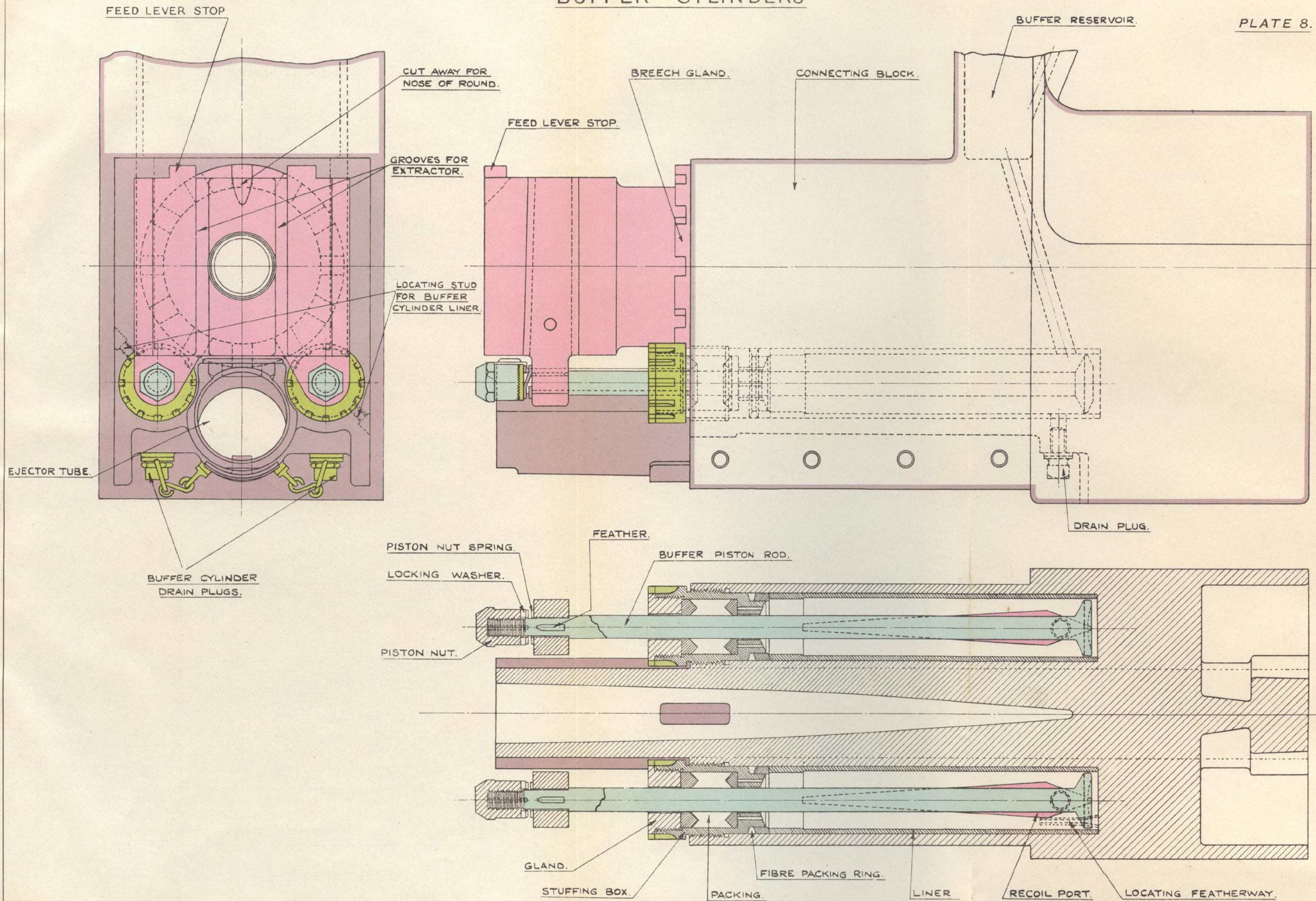
FIG. (V).





# BUFFER CYLINDERS

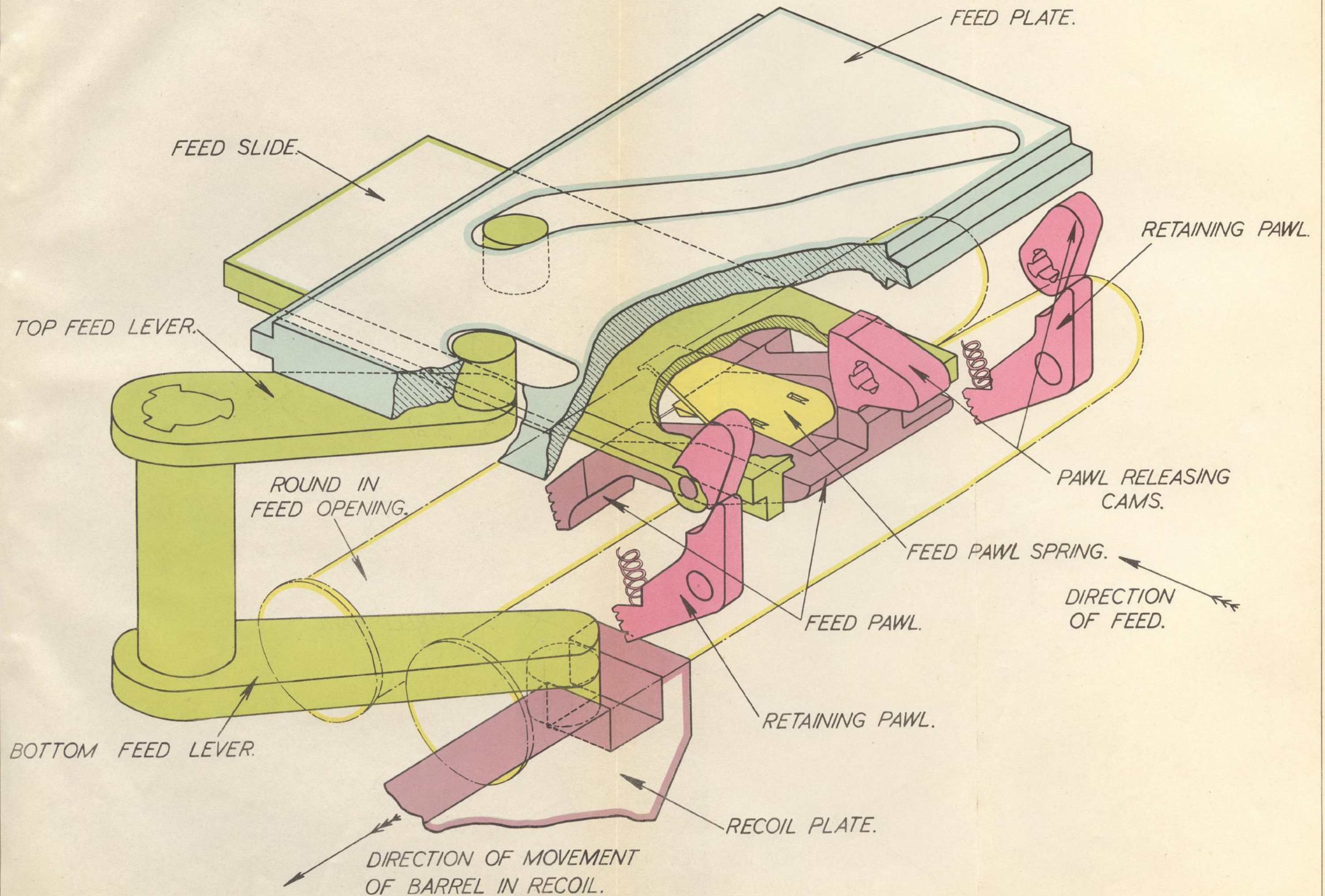
PLATE 8.





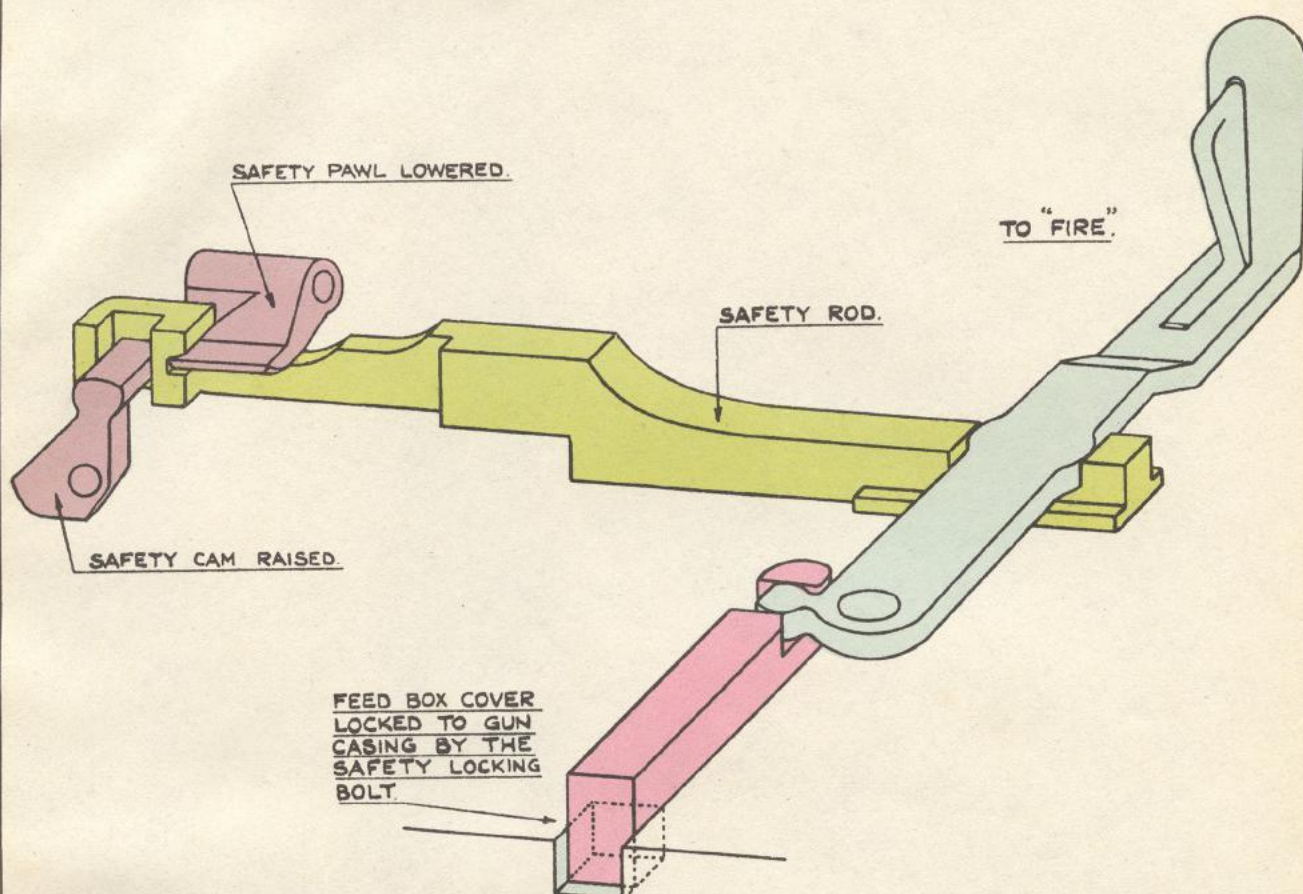
DIAGRAMMATIC VIEW OF FEED ARRANGEMENTS.

PLATE 9.



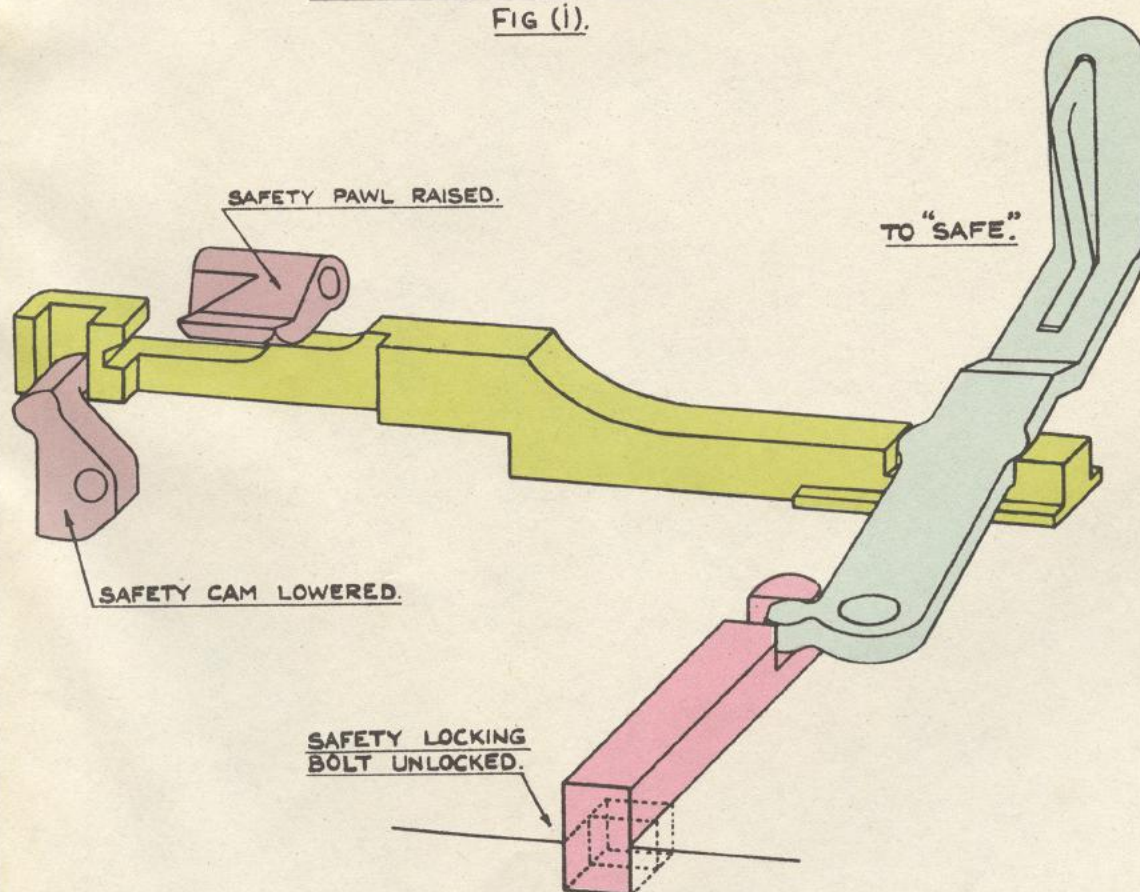


# ACTION OF HAND SAFETY LEVER



HAND SAFETY LEVER TO "FIRE".

FIG (i).

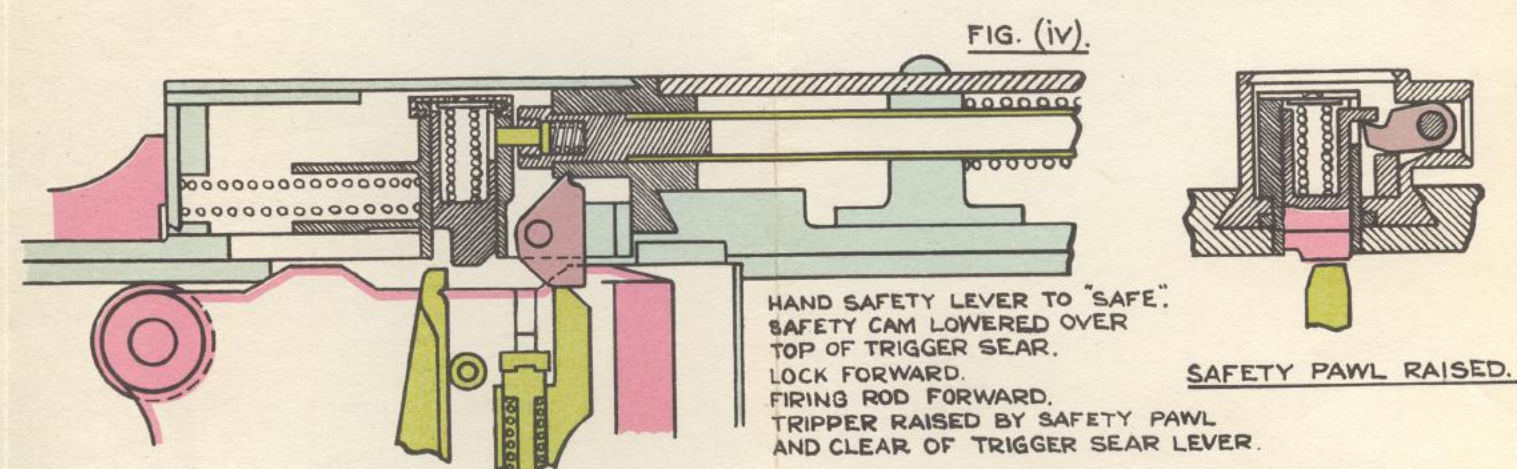
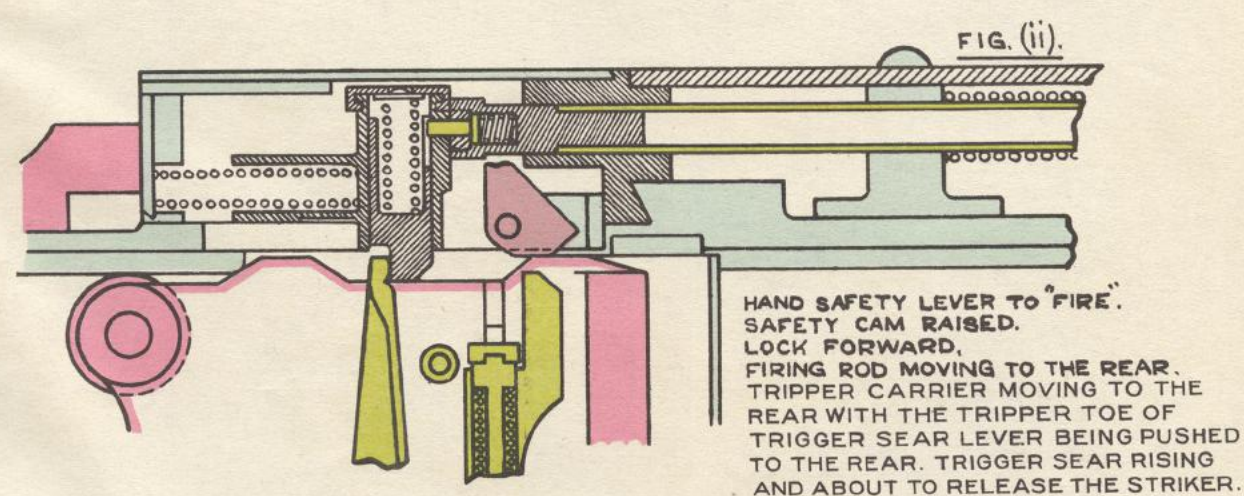
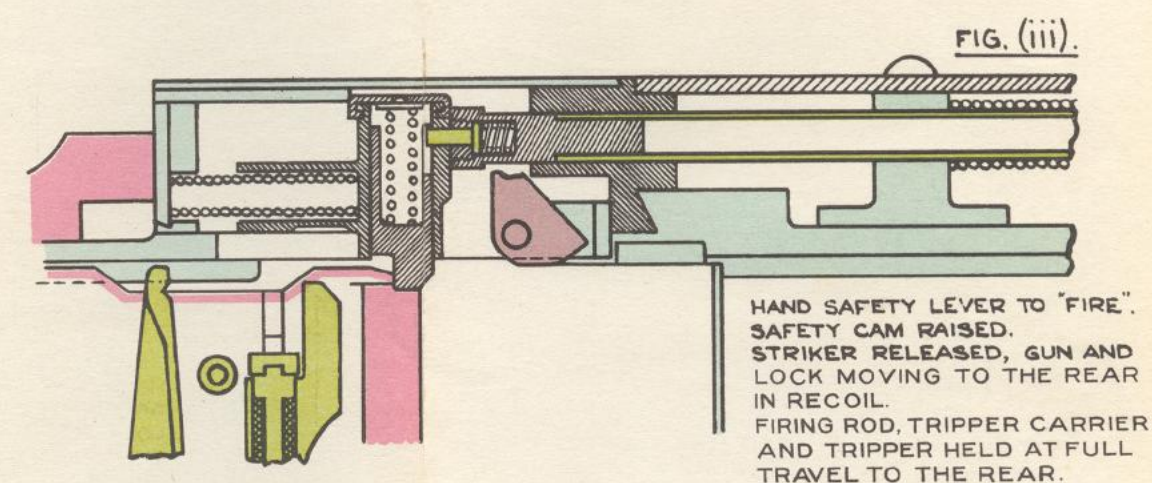
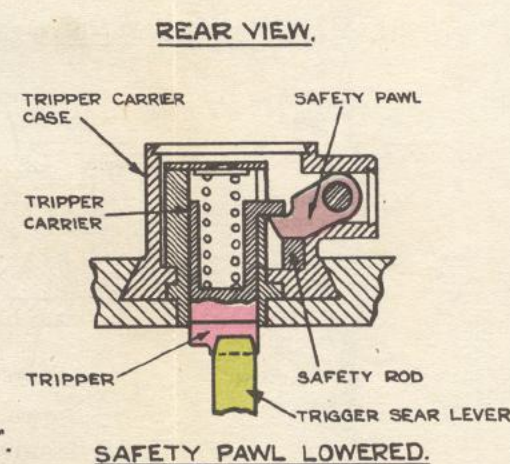
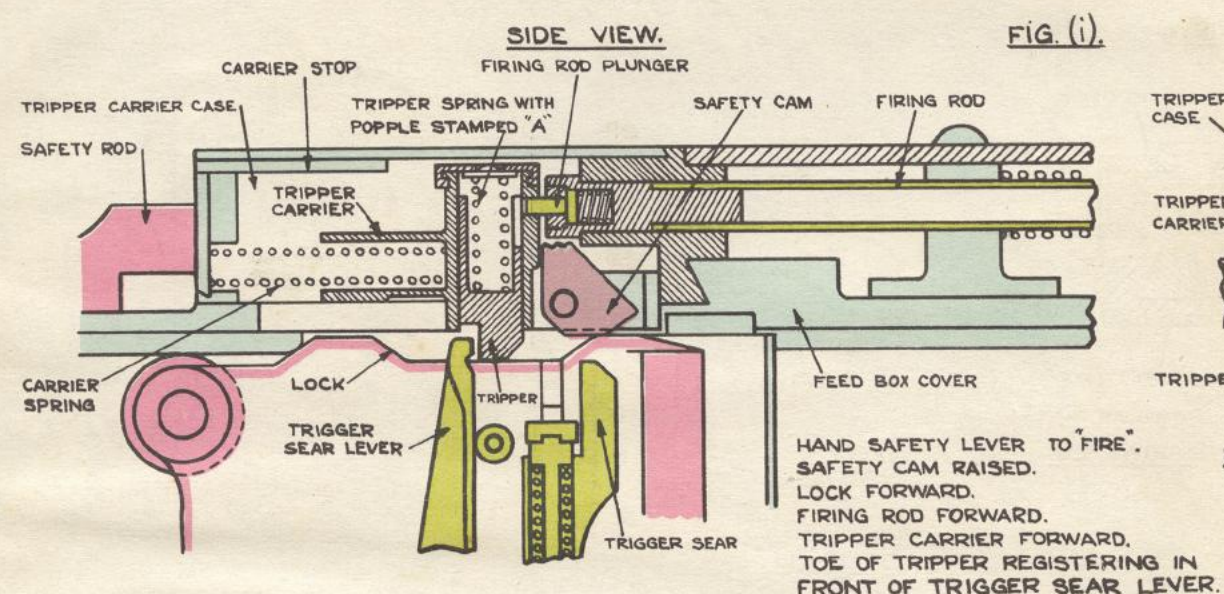


HAND SAFETY LEVER TO "SAFE".

FIG (ii).



# ACTION OF FIRING GEAR ON THE GUN





# BELT FILLING MACHINE SHOWING A ROUND PUSHED FULLY HOME INTO THE LINK

PLATE 12

