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THE "KINGSWAY" SERVICE SERIES

THE Machine Gunners' Handbook

Including the

Maxim, Vickers and Lewis Automatic Machine Guns

Arranged by
2nd Lieut. J. BOSTOCK, K.O. Yorkshire L.I.
(Hythe Staff)

SEVENTH EDITION

PRINTED AND PUBLISHED
BY W. H. SMITH & SON
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THE MACHINE GUNNER'S

RANGE & TRAJECTORY CARD WITH ANGLES OF ELEVATION, Etc., FOR MARK VI AMMUNITION.

Range.	Approximate Angles of Elevation.		Rise in Minutes.	Culminating Point of Trajectory in Feet.
Yards.	Degrees.	Mins.		
100	—	10	—	—
200	—	14	7	—
300	—	21	6	1
400	—	27	8	2
500	—	35	9	3½
600	—	44	13	6
700	—	56	13	9
800	1	10	12	13
900	1	23	15	17½
1,000	1	38	15	23½
1,100	1	53	16	31½
1,200	2	11	18	41
1,300	2	28	20	52
1,400	2	49	20	66
1,500	3	9	21	82
1,600	3	30	25	100
1,700	3	55	25	122
1,800	4	22	28	146
1,900	4	50	29	174
2,000	5	20	32	206
2,100	5	53	37	241
2,200	6	29	38	282
2,300	7	11	47	325
2,400	7	57	47	374
2,500	8	46	52	429
2,600	9	39	55	489
2,700	10	37	59	558
2,800	11	37	62	637
2,900	12	41	—	—

[SEE OVER.

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TRAJECTORY DISCS.

ILLUSTRATING THE CONE OF FIRE AS IT WILL APPEAR IN OVER HEAD FIRE, ETC.

Range	Diameter of Discs.		Height of Centre of Disc above ground, Muzzle of Gun is taken as being 20 inches above ground.		
	75% Cone	100% Cone	700 yards Trajectory.	800 yards Trajectory.	900 yards Trajectory.
Yards	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
100	8¼	2 0	5 5	6 5	8 8¼
200	1 3¾	3 6	8 6	10 6	12 10
300	2 0	5 0	10 2	13 4	16 10
400	2 8¼	6 6	10 7	14 8	19 6
500	3 6	8 0	9 4	14 5	20 3
600	4 0	10 0	5 11	12 1	19 0
700	4 6	12 0	—	7 6	15 6
800	5 6	14 0	—	—	9 1
1,000	6 8	16 0	—	—	—
1,500	10 0	24 0	—	—	—
2,000	13 4	32 0	—	—	—

DEPTH OF ZONE BEATEN BY 75% OF SHOTS FIRED FROM A MAXIM GUN.

Dispersion of Cone.	500	1,000	1,500	2,000	Yards Range.
DEPTH	150	70	60	50	Yards.
WIDTH	4	8	13	19	Feet.

PROBABLE ERRORS IN RANGING TO BE ALLOWED FOR WHEN DIRECTING FIRE.

Method of Ranging.	P.C. of Error.	Extent of Ground to be searched to overcome probable errors in Ranging.				
		500	1,000	1,500	2,000	Range.
Judging Distance.	15	150	300	450	600	Yards
Judging Distance Combined with "Key Ranges."	10	100	200	300	400	"
Range Finding Instruments	5	50	100	150	200	"

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MARK VII AMMUNITION.

Angles of Elevation.	Angle of Descent.	Culminating Point.	Trajectory Discs. Vert.	Trajectory Discs. Hor.	Lowest shot 100% Could below Centre of Disc.	Height of Centre of Disc above ground. 700 yds.	800 yds.	900 yds.
100 yds 12′ 3″			11″	6″	1′ 1″	3′ 5″	4′ 3″	5′ 0″
200 ,, 15′			1′ 10″	1′ 0″	2′ 2″	5′ 5″	7′ 2″	8′ 11″
300 ,, 18′ 5″			2′ 9″	1′ 6″	3′ 3″	6′ 9″	9′ 1″	11′ 4″
400 ,, 22′ 5″	1 in 309	1·3ft.	3′ 8″	2′ 0″	4′ 4″	8′ 11″	9′ 10″	13′ 2″
500 ,, 27′	1 in 180	2·3ft.	4′ 8″	2′ 6″	5′ 5″	9′ 11″	9′ 8″	13′ 9″
600 ,, 32′ 5″	1 in 120	3·8ft.	5′ 7″	3′ 0″	6′ 6″	9′ 10″	8′ 2″	13′ 2″
700 ,, 38′ 5″	1 in 90	6·1ft.	6′ 7″	3′ 6″	7′ 7″	—	5′ 1″	10′ 10″
800 ,, 46′	1 in 67	8·9ft.	7′ 6″	4′ 0″	8′ 8″	—	—	6′ 7″
900 ,, 54′	1 in 50	12·8ft.						
1000 ,, 1° 3′ 5″	1 in 40	17·8ft.						
1100 ,, 1° 14′ 5″	1 in 30	24·1ft.						
1200 ,, 1° 27′	1 in 24	32·4ft.						
1300 ,, 1° 41′	1 in 20	42ft.						
1400 ,, 1° 57′	1 in 15	54ft.						
1500 ,, 2° 15′	1 in 13	69ft.						
1600 ,, 2° 35′	1 in 11	87ft.						
1700 ,, 2° 58′	1 in 9	105ft.						
1800 ,, 3° 23′ 5″	1 in 8	132ft.						
1900 ,, 3° 52′	1 in 7	161ft.						
2000 ,, 4° 24′	1 in 6	195ft.						

Heights of Trajectories above Line of Sight at 800 yds.

At 100 yds.	2′ 9″
At 200 ,,	5′ 7″
At 300 ,,	7′ 8″
At 400 ,,	8′ 8″
At 500 ,,	8′ 9″
At 600 ,,	7′ 8″
At 700 ,,	4′ 5″

75% Zones: 500 yds 220 yds 2½′ 1,000 yds 140 yds 5′ 1,500 70 yds 10′

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NER'S

ARD WITH
ETC., FOR
ION.

Culminating Point of Trajectory in Feet.
—
—
1
2
3½
6
9
13
17½
23
31½
41
52
66
82
100
122
146
174
206
241
282
325
374
429
489
553
637
—

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INTRODUCTORY.

These notes show, in some measure, the system followed at the School of Musketry, Hythe, in giving effect to the instructions laid down in the Official Text Books on Machine Guns; and are compiled with a view to assisting instructors in framing a correct sequence of instruction, and with the desire to increase interest in what is undoubtedly the weapon of the future.

The chapters have been arranged in their natural order of sequence, showing a progressive method of training; but it must be understood that instruction in the mechanism of the gun; in the drill and methods of laying, ranging, and firing; in packing and unpacking limbered wagons; in filling a belt quickly and correctly; in the use of the range finder, etc., will all form part of the daily training of a Machine Gun Section, to afford practice in these most important matters, and also as a means of varying the subjects to be taught.

In publishing this Seventh Edition opportunity has been taken to insert plates illustrating the Vickers Gun, and also a full description of the Lewis automatic gun recently introduced into our Service.

July, 1915. J. B.

GENERAL DESCRIPTION.

Method of Imparting Instruction.

General description should be brief, the main idea being to show the principles on which the gun works, before going into the detailed working of the gun.

Names of various parts are better taught as they are met with during instruction in mechanism.

1. Explain briefly that the gun is divided into two portions—the non-recoiling and the recoiling, and when firing, is worked automatically by two forces: *The explosion*, which forces the recoiling portion backwards and opens the breech, and the *fusee spring*, which carries it forward, and closes the breech.

2. Remove the fusee spring box, open the cover, and by pushing back the muzzle demonstrate the effect of the explosion upon the recoiling portion. The action of the fusee spring may next be shown by moving forward the recoiling portion, the right hand holding the crank handle vertical while the fusee is held in the left hand. While moving the recoiling portion backwards and forward, the instructor explains that this automatic action continues as long as pressure is maintained on the double button.

3. The high rate of fire produces abnormal heating of the barrel, which leads to the con-

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sideration of the cooling apparatus, therefore discuss:

(*a*) The water supply.

(*b*) How applied and retained in the barrel casing.

(*c*) Steam tube and steam escape.

(*d*) Rate of evaporation, and orders for replenishing water.

The above forms a brief but useful lesson in description of the gun. It has already been hinted that it is waste of time to endeavour to teach names of parts at this lesson. Gunners should, therefore, proceed to instruction in the action of mechanism without delay.

For detailed *description of* ·303 *inch Maxim Gun see pages* 2–16.

·303 MAXIM GUN.

General Description.

Weight of the ·303" gun, 60 lbs. Mark II, Converted, 64 lbs. Weight of the tripod, 48 lbs.

Weight of ammunition box containing one filled belt, 21 lbs.

The gun may be considered as divided into two portions—the non-recoiling and the recoiling. It is worked automatically by two forces: the explosion of the charge which forces the recoiling portion backwards, and

a strong spring (called the fusee spring) which carries it forward.

Non-Recoiling Portion.

The non-recoiling portion consists of the barrel casing and breech casing, and is attached to the mounting by the crosshead and elevating joint pins.

The *barrel casing* is of gun metal, holding about seven pints of water to keep the barrel cool when firing; it has three openings, one on the upper right side near the breech for filling, one underneath near the muzzle for drawing off the water, and the third (also near the muzzle) for allowing the steam but not the water to escape.

The first two are closed with screwed plugs, the last is open and connected with the steam tube.

A *cork plug* is provided which can be inserted in the steam escape hole when the gun is travelling, in order to prevent waste of water from jolting. The plug should always be taken out before commencing to fire, and put in again before the gun changes position.

To prevent the escape of water, there is at the forward end of the barrel casing *asbestos packing*, which is held in position round the barrel by the packing gland. At the rear end of the barrel there is a *cannelure*, also filled with asbestos packing, which prevents

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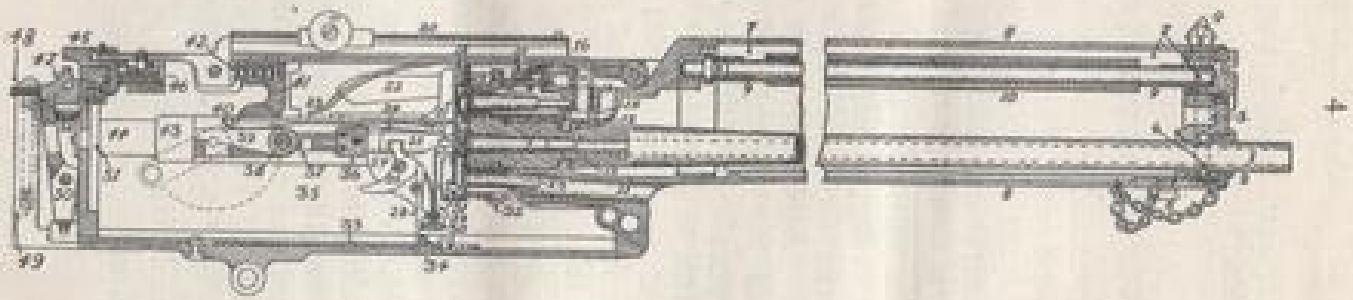
Plate I

·303-inch Maxim Magazine Rifle Chamber Machine Gun.
Longitudinal Section Showing Gun Ready for Firing.



List of Parts as shown in Plate I.

1. Barrel.
2. Packing Gland.
3. Steam Escape Hole.
4. Foresight.
5. Screwed Plug for Emptying.
6. Asbestos Packing.
7. Holes in Steam Tube.
8. Barrel Casing.
9. Steam Tube.
10. Slide Valve.
11. Ejector Tube.
12. Cannelure for Asbestos Packing.
13. Gun-metal Valve.
14. Feed Block.
15. Bottom Lever Feed Block.
16. Top Lever Feed Block.
17. Feed Block Slide.
18. Upper Extractor Stop.
19. Extractor.
20. Tangent Sight.
21. Gib Spring.
22. Side Cams.
23. Cover Spring.
24. Sear.
25. Firing Pin.
26. Tumbler.
27. Lock Casing.
28. Trigger.
29. Lock Spring.
30. Keeper Bracket.
31. Extractor Stop.
32. Ejector Tube Spring.
33. Trigger Bar.
34. Projection on Trigger Bar.
35. Breech Casing.
36. Screwed Head.
37. Connecting Rod.
38. Crank Pin.
39. Crank.
40. Connecting Rod Spring.
41. Gun-metal Block.
42. Tangent Sight Spring.
43. Side Plates.
44. Slides, Right and Left.
45. Cover Lock.
46. Cover Lock Spring.
47. Safety Catch.
48. Milled Heads with Oil Brushes.
49. Handles.
50. Firing Lever.
51. Shutter.
52. Firing Lever Spring.

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the escape of water when the gun is working, and a *gun-metal valve* immediately in front of the barrel block, which prevents the escape of water when the gun is not firing and the barrel home.

The *steam tube* consists of a fixed tube and an outer tube, termed the *slide valve*, so arranged as to slide freely along the fixed tube. In the fixed tube there is a hole near each end, and a third hole in the threaded portion in front, to connect with the steam escape hole in the barrel casing. This tube is fixed into the solid end of the barrel casing, and is retained in position by a screw, which, being kept in adjustment by a keeper screw, ensures that the third hole coincides with the steam escape hole in the barrel casing. At the breech end it fits into a recess.

If the gun is fired with elevation, the valve slides backwards, and, closing up the hole at the rear end of the tube, prevents the water entering; at the same time it leaves the front hole uncovered, which, being above the water level, allows the steam to enter the tube and escape through the steam escape hole, which is bored in the solid part of the front end of the barrel casing. Similarly, if the gun is fired with depression, the valve slides forward and allows the steam but not the water to escape through the rear hole.

In the lower part of the barrel casing is the *ejector tube*, through which the empty

cartridge cases are ejected from the gun. The tube is fitted with a spring, which prevents the cases falling backwards into the gun.

The *breech casing* consists of two outside plates, a bottom plate, which is riveted to them, and the rear cross piece, the whole being closed by a cover.

The outside plates are dovetailed into the barrel casing and, together with the cover, are secured by means of the cover joint pin.

On the outside of the right-hand plate there are the following fittings: (1) A socket and stud for securing and supporting the *buffer spring;* (2) the *resistance piece;* and (3) the *check lever*, which pivots on a stud and is secured by a collar and split pin. On the outside of the left-hand plate are three studs for holding the fusee spring box, the rear one being on the slide mentioned below; there are also two other studs on this plate for fixing a shoulder piece to the gun if required. In both plates are slots partly closed by slides, in which the crank bearings move, and on the inside of both plates are *solid cams*, which control the path of the extractor. Below these, and supporting the side plates, are rests, along which the recoiling portion travels.

Along the bottom plate lies the trigger bar, and underneath is a bracket to which the

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elevating gear is attached by means of the elevating joint pin.

The outside plates are connected at the rear end by the *rear cross piece*, into which they both dovetail; this piece is fitted with (1) hollow handles for traversing, which are also used for carrying *oil*, and are closed by milled heads, fitted with camel hair brushes; (2) a *firing lever* and spring, the lower end of which fits into the trigger bar, while the upper end is provided with a double button for firing; (3) an automatic *safety catch*, which is so arranged that unless it is held up the firing lever cannot be pressed forward; and (4) a pivoted *shutter*, which, when moved to the right or left, uncovers an aperture through which (when the lock is removed and the crank handle vertical) the barrel can be inspected or cleaned from the rear.

The *cover* is fitted with (1) springs to ensure the extractor dropping on recoil; (2) a gun-metal block to keep the lock down when back; and (3) at the rear end, a lock to fasten it.

The *Tangent Sight.*—On the upper surface is the *tangent sight*, consisting of a stem, a plate graduated up to 2,800 yards, and slide. Running through the centre of the slide is a pinion, the teeth of which work in the rack on the stem. A *pawl* is secured to the pinion by a fixing pin. On the underside of one end of

the pawl are teeth, which engage in the circular rack on the slide.

When the slide is at rest the stud on the inside of the milled head (nearest the slot for the slide spring) bears on the stud on the pawl immediately over the teeth, being actuated by the slide spring, thus forcing the teeth into the circular rack. This keeps the slide stationary on the stem. On rotating the milled head, this stud is partly disengaged from the stud on the pawl, thus permitting a second stud on the milled head to press on one side of the V-shaped ramp at the other end of the pawl. This action releases the teeth sufficiently to permit the pawl being moved round the circular rack by the action of the stud bearing on one side of the V-shaped ramp on the pawl; this moves the slide along the stem. On releasing the milled head, the spring positions the cover, thus causing the stud on the pawl to become once more engaged with the stud on the milled head and force the teeth into the rack.

Recoiling Portion.

The *recoiling portion* (which is mounted inside the non-recoiling portion) consists of the barrel and two side plates which carry the lock and the crank.

The *barrel* is coated with copper to prevent it from rust; the *gun-metal valve* referred to above, which prevents the escape

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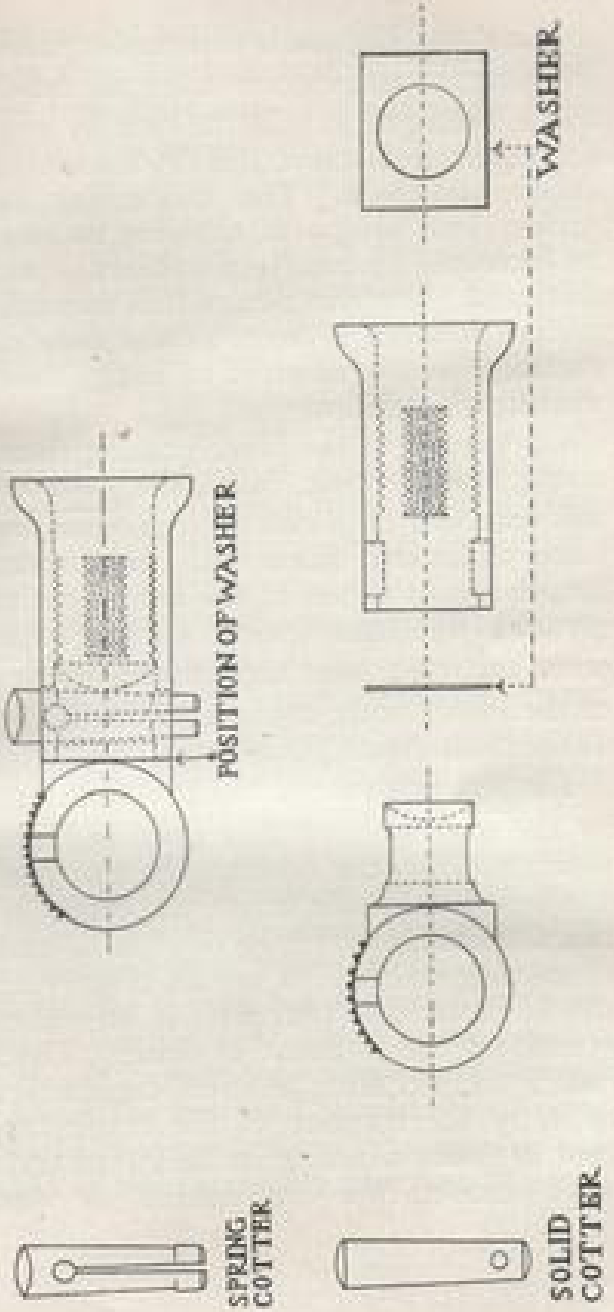
of water to the rear, is fitted just in front of the breech end, which is formed in the shape of a block; this block has a stud on each side called the *barrel trunnions*, by means of which the barrel is attached to the side plates.

The *side plates* are each provided with a hole to receive the barrel trunnions, and in the case of the ·303″ hooks for engaging the recesses on the top of the barrel block; also guides in which the flanges of the lock move, which are enlarged at the rear end to act as crank stops; in addition, each has a *bearing*, through which the crank passes, thus connecting the latter with the barrel; these bearings move in slots in the breech casing. The left-side plate is fitted with a *connecting rod spring* to hold the connecting rod upright when the lock is removed, and the right side-plate is fitted with a *side plate spring* near the barrel, to keep the extractor in its highest position when the lock is home. The left side-plate is prolonged to the front, and has a recess in which the bottom lever of the feed block engages.

The *crank* is fitted with a connecting rod, which is free to rotate on the crank pin, and, outside the breech casing on the right, with a handle which has a curved projecting arm, and on the left with a fusee, to which is attached a chain.

Plate II.

ADJUSTABLE CONNECTING ROD, MARK II.



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The *connecting rod* is attached to the crank by means of an axis pin, called the *crank pin*, and is arranged to take the lock by means of an interrupted screw, thereby connecting the crank and lock. The connecting rod is divided into two parts, enabling its length to be increased by inserting washers of varying thickness. By this means it is ensured that a firm pressure is kept on the base of the cartridge at the moment of firing, thus preventing separations.

On the left of the breech casing there is a strong spiral spring, called the *fusee spring*, the rear end of which is connected by the fusee chain and fusee with the crank; the fore-end is attached to the breech casing by means of the fusee spring box and *adjusting screw*, which passes through the front end of the fusee spring box, and through the nut at the front end of the spring.

The *lock* is attached to the connecting rod by the screwed head, and when in the firing position closes the breech. In this position it is held by the side levers, the crank (which bears against stops on the side plates) and the connecting rod, which are all slightly above the horizontal, to prevent the breech being opened at the moment of firing. The lock has a reciprocating motion communicated to it by the rotation of the crank, and is kept in position during its backward and forward movements by means of flanges

working in guides on the side plates, and, when at the end of its backward travel and clear of the guides, by the *gun-metal block* underneath the cover.

The *extractor* is moved upwards by means of the *side and extractor levers*, and when in its highest position is retained there by means of the side plate spring; this ensures the hole for the firing pin being opposite the centre of the base of the cartridge when the lock is home. The upward and downward movements of the extractor are regulated by guide ribs and stops; the upper stop forms part of the lock casing, and the lower one is removable.

The *feed block*, which fits under the cover into a recess cut in the breech casing, is provided with a *slide* to which are attached two *pawls* with springs, for the purpose of moving the cartridges from right to left; the slide has a transverse motion given to it by means of *two levers*, which are fitted together; the top lever has a slot which engages a stud on the slide, and on the bottom lever is a stud which engages in a recess in the left side plate; by this means the slide is connected with the recoiling portion. The feed block has also two *stationary pawls*, which engage under the belt and prevent it slipping backwards during firing. To facilitate the entrance of the cartridges, the feed block is

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and the adaptation of the mechanism to the smaller calibre, by the introduction of new parts or the alteration of existing parts.

The Mark II differs from the Mark I in being fitted with the service ·303-inch barrel and muzzle attachment for ball firing, whereas the Mark I has a special muzzle attachment and a heavy barrel. In both Marks I and II Converted Guns the attachment for ball firing must always be on the guns, as, owing to the greater weight of the component parts, these guns will not work without it. The tangent sight is graduated to 2,500 yards. The weight is 64 lbs. In other respects they resemble the ·303-inch gun, except that the connecting rod is not above the horizontal, and that there is a space of about 1-10th of an inch between the projecting arm of the crank handle and the resistance piece.

ACTION OF MECHANISM.

It is not alone sufficient for a high standard of knowledge of mechanism to be reached; it must also be maintained, and therefore instruction should be continuous throughout the year, for it is easily forgotten if neglected.

A theoretical knowledge of mechanism is not sufficient. Instruction must be so

thorough and practical as to ensure that all mechanical operations are performed correctly from force of habit, so that they will be carried out instinctively in moments of excitement.

A belt and dummy cartridges will invariably be used for purposes of instruction.

A Service lock must always be in the gun when firing either ball or blank ammunition. For instructional purposes, when ammunition is not being fired, the D.P. (instructional) lock should be used in the gun whenever possible.

The following is the correct sequence in which instruction in mechanism should be given; each stage must be thoroughly understood before proceeding to the next:

LOADING.

To Load the Gun.—Pass the tag end of the belt through the feed block from the right side; then, with the right hand, turn the crank handle on to the buffer spring, and with the left hand pull the belt straight through as far as it will go, let go the crank handle; the first cartridge will then be gripped by the extractor. Repeat the above, and when this has been done, the first cartridge will be in the chamber and another gripped by the upper part of the extractor. The gun is then ready for firing.

On pressing the double button, the gun will fire automatically until pressure is

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released. The lock will then be home, and the extractor will be found to be gripping—(*a*) a live cartridge in the feed block, (*b*) a live cartridge in the chamber; and there will also be an empty case in ejector tube.

Unloading.

To Unload the Gun.—Turn the crank handle on to the buffer spring twice in succession, letting it fly back to the check lever each time; press up the bottom pawls and remove the belt from the feed block. Then release the lock spring.

Backward Movement of the Recoiling Portion.

Action on Recoil.—Suppose the gun to have just fired, the extractor will then be gripping a live cartridge in the feed block, and the case which has just been fired in the chamber. The explosion causes the recoiling portion to move backwards through a distance of about one inch, thereby extending the fusee spring.

Action in the Feed Block.—A recess in the prolongation on the left side plate actuates a stud on the bottom lever of the feed block. The bottom lever acts on the top lever, which moves the slide and the top pawls to the right, to engage behind the cartridge held in place by the bottom pawls.

Rotation of the Crank.—The backward movement of recoil causes the projecting arm of the crank handle to roll on the resistance piece, thereby rotating the crank. The rotation of the crank draws back the lock, throws the crank handle on the buffer spring, and causes the fusee to wind the fusee chain round it, further extending the fusee spring.

As the lock moves backwards, the extractor withdraws the empty case from the chamber and a live cartridge from the belt in the feed block. The horns of the extractor move along the upper surface of the solid cams until the cartridge is clear of the belt. When the extractor arrives at the rear end of the cams, it falls—partly by its own weight, and partly by the action of the cover springs, thus bringing the cartridge drawn from the feed block in line with the chamber, and the empty case drawn from the chamber in line with the ejector tube. The empty case and live cartridge are prevented from slipping down the face of the extractor by the extractor spring and by the lower projection of the gib respectively. When the lock is quite back, its flanges are clear of the guides on the side plates, and it is kept in position by the gun-metal block on the cover.

Cocking Action.—The rotation of the crank gives a downward motion to the connecting rod and screwed head, which

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latter, bearing on the tail of the tumbler, rotates it on its axis, and thus forces the firing pin to the rear. The long arm of the lock spring is engaged in a recess in the front of the firing pin, while the short arm bears against the nose of the trigger; consequently, the withdrawal of the firing pin compresses the lock spring by drawing the long arm towards the short one. As the tumbler rotates, the nose of the trigger is forced by the short arm of the lock spring under the bent of the tumbler, and the continued motion of the tumbler forces the firing pin still further back, until the bent of the sear (which is actuated by the sear spring) is forced into the bent of the firing pin and retains it. The firing pin is thus prevented from flying forward.

Forward Movement of the Recoiling Portion.

Action of the Fusee Spring.—When the force of recoil is expended, the action of the fusee spring comes into play, carrying the recoiling portion forward.

Action in Feed Block.—As the recoiling portion travels forward, the recess in the prolongation on the left side plate actuates the stud on the bottom lever of the feed block. This bottom lever acts on the top lever, which moves the slide and the top pawls to the left, the pawls thus bringing a fresh cartridge in the belt to a position against

the cartridge and bullet stops, ready to be gripped by the extractor.

The belt, as it moves to the left, slides over the bottom pawls, which are depressed as the cartridge passes over them, and rise behind the second cartridge, holding the belt in position and preventing it from sliding back after the first cartridge has been withdrawn by the extractor.

Rotation of Crank.—Owing to the unwinding of the chain from the fusee, assisted by the rebound of the crank handle from the buffer spring, the crank is given an upward motion, which is imparted to the connecting rod and screwed head. This causes the lock to move forward, placing the live cartridge and the empty case respectively in the chamber and ejector tube; the extractor is moved upwards by the side levers acting on the extractor levers, the extractor spring slides over the empty case, thereby leaving the empty case in the ejector tube, where it is held by the ejector tube spring until pushed out by the next case. The lower projection of the gib slides over the base of the live cartridge in the chamber; the firing pin hole is thus brought opposite the cap, and a fresh cartridge, which has been automatically moved up into position in the feed block, is engaged.

As soon as the extractor reaches its highest position, the side plate spring engages in a slot in its side and retains it there; with

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worn extractor levers, the extractor might otherwise fall again, and the horns fail to clear the solid cams for backward movement.

Firing Action.

(*a*) *For the First Shot.*—As the screwed head rises slightly above the horizontal, it lifts the sear, thereby disengaging it from the firing pin, which then moves slightly forward till the bent of the tumbler engages the nose of the trigger. If the double button on the firing lever is now pressed, the trigger bar is drawn backwards until the projection on it engages and draws back with it the tail of the trigger, thereby releasing the tumbler. The long arm of the lock spring then propels the firing pin on to the cap and explodes the cartridge. (*b*) *For Subsequent Shots.*—The firer, by maintaining pressure on the double button, holds back the trigger bar. Therefore, each time the lock goes forward, the projection on the trigger bar holds back the tail of the trigger before the lock is quite home. By this means the nose of the trigger is prevented from engaging in the bent of the tumbler. On the lock getting home, the screwed head lifts the sear, thus permitting the lock spring to carry the firing pin on to the cap and explode the charge.

The lifting of the sear is so timed that the firing pin cannot be released until the lock is in the firing position.

Action inside Lock when Double Button is Released.—On releasing the double button, the short arm of the lock spring forces the nose of the trigger under the bent of the tumbler, so that when the sear is lifted, the nose of the trigger engages in the bent of the tumbler, and the firing pin is unable to go forward.

SUMMARIZED SEQUENCE OF INSTRUCTION IN ACTION OF MECHANISM.

Having thoroughly studied the detailed action of mechanism, the instructor will find it useful to briefly memorize it as follows:—

1. How to load the gun.
2. To unload the gun.
3. *Backward movement of recoiling portion.*
   (*a*) Action on recoil.
   (*b*) Action in the feed block.
   (*c*) Rotation of the crank.
   (*d*) Cocking action.
4. *Forward movement of recoiling portion.*
   (*a*) Action of fusee spring.
   (*b*) Action in feed block.
   (*c*) Rotation of crank.
5. Firing action—(*a*) For first shot; (*b*) For subsequent shots.
6. Action inside lock when double button is released.

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Muzzle Attachment for Ball Firing.

(*See Plate* IV.)

(i) In order to increase the force of recoil a muzzle attachment is provided. It is to be used when, on account of a badly worn lead, dirt, dried oil, or the water freezing in the barrel casing, the recoil of the barrel is insufficient to work the gun after the usual remedies of adjusting the fusee spring, and oiling the working parts, have been tried. It is screwed into the packing gland seating at the front end of the barrel casing, the screwed end of the attachment acting as a packing gland.

(ii) The attachment consists of a steel cylinder with a hole bored longitudinally through it. The front end of this hollow cylinder is partially closed by the screw.

(iii) The action of the attachment is as follows: The powder gases escape from the muzzle of the barrel, and are partially confined in the interior of the attachment at a high pressure. The pressure of the gas, acting on the muzzle of the barrel, gives the additional recoil necessary to work the mechanism of the gun. The screw should be tightly screwed up before putting the attachment on; it is only to be unscrewed when the attachment requires cleaning.

(iv) When the attachment is taken into use to overcome a defect in the working of the gun, the fusee spring, if already lowered,

should be brought up to its normal weight; when it is used for instructional purposes on a gun in good working order, the weight of the fusee spring should be increased by 2½-3½ lbs., above normal. In every case, however, the spring should be further adjusted, if necessary, so as to obtain a rate of fire of 450 rounds per minute (500 rounds per minute with Mark VII ·303-inch ammunition).

(v) *To fix the attachment*, unscrew the packing gland from the barrel casing. Screw the attachment into the gland seating of the barrel casing by means of the gib key. If water is found to escape when fitting the attachment, the elevating joint pin should be removed, and the rear end of the gun lowered.

(vi) On the first opportunity the gun should be thoroughly cleaned and examined, so that it may be used without the assistance of the ball firing attachment.

(vii) In the case of Converted Guns, the muzzle attachment should be cleaned after firing as follows: Remove it from the gun, take out the front screw, and then, with the special cleaner supplied, carefully scrape away the metallic fouling from the face of the screw and the inside of the attachment. The end of the barrel should also be cleaned, but great care should be taken to avoid scraping off the copper. No. 1 cleaner is for use with the Mark I Converted Gun. No. 2 cleaner is for use with the Mark II Converted Gun, or, if available, with the ·303-inch Gun.

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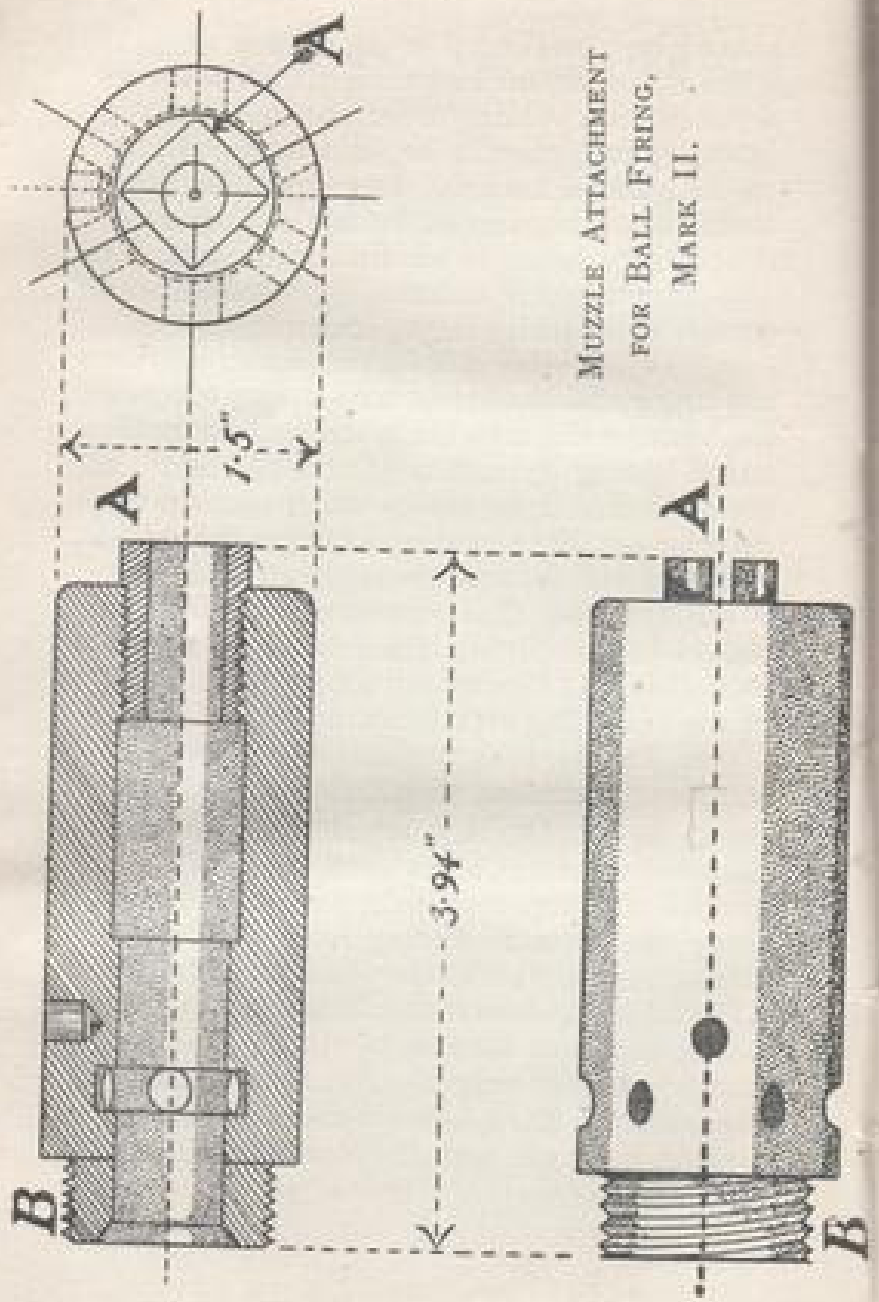

Plate IV.

Muzzle Attachment for Ball Firing, Mark II.

GUNS, MAXIM, ·303 INCH.
Muzzle Attachment and Special D.P. Barrel for Blank Firing.

Parts.

Attachment, muzzle (blank firing).
Key, protector checknut.
Key, gunmetal gland and adjusting screw.
Key, cup muzzle and casing.
Belt, ammunition, M.G. Blank (choked).
Barrel, D.P.

Instructions for Fixing and Adjusting.

1. Remove the barrel for ball firing from the gun, and assemble the special D.P. barrel, marked "D.P.B." on the upper side of the block.

2. Remove the packing gland from the gun and assemble the gland A, screwing hard home with tool 1.

3. Screw muzzle cup B, home to the barrel with tool 3.

4. Remove fusee spring and test for free travel of recoiling portions.

5. Adjust fusee spring to weigh 3 lbs, weighed in the usual manner from the crank handle.

6. Assemble adjusting screw C into outer casing D from the inside, to within about a quarter of an inch of the head, using a large screwdriver and tool No. 1 if necessary. Then assemble the outer casing to gland A, screwing hard home with tool 1 or 3, and assemble adjusting nut E on the adjusting screw.

7. Turn the adjusting screw C lightly home to the muzzle cup B, care being taken that the

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recoiling portions are not forced back. Then, noting its position by the uppermost number marked on the flats at the outer end, unscrew 6½ revolutions and tighten adjusting nut E.

8. Load the gun with the special bushed belt, painted red at the ends and having breaks of 25 cartridges, in the feed block, and fire. If the recoil is insufficient, turn the adjusting screw in by eighths of a revolution until there is just sufficient recoil. Then prove that the recoil is not excessive by raising fusee spring to 5 lbs. If the recoil of the gun is then insufficient, the adjustment of the attachment is correct. The fusee spring must then be adjusted back to 3 lbs. before recommencing firing.

Note.

It is not advisable to fire bursts of more than 25 rounds at one time.

It may be necessary to release the front top pawl in addition to the bottom pawls when removing the belt.

Instructions for Cleaning.

The attachment and barrel should be cleaned with paraffin and flannelette as soon as possible after firing has finished for the day. To do this, the attachment and muzzle cup must be removed from the gun, but the attachment need not be stripped. Care must be taken when cleaning the barrel not to force the cleaning rod hard home to the bush, as this might alter its position.

STRIPPING MACHINE GUNS FOR INSTRUCTIONAL PURPOSES.

In the early stages of instruction it is very sound for the instructor to strip a gun so as to more easily explain the automatic working of the various parts.

At further lessons the gunners should be allowed to strip all the parts until thoroughly familiar with them.

Afterwards, the gunner should always be given a definite task, e.g., "Replace the barrel," "Replace a broken firing pin," etc., and in these cases attention should be drawn to the gunner only removing necessary parts. See chapter on "Repairs."

The gun is stripped in the following order:

Note.—All pins are driven in from right to left, and out in the reverse direction.

(i) *Lock and Feed Block.*—Raise the cover, turn the crank handle on to the buffer spring, see that the extractor drops, place finger between the extractor and stop, raise the lock and allow the crank handle to come slowly back on to the check lever; slide the live cartridges out of the extractor, keeping the latter down. Give the lock ⅛ turn to the left and lift off. Lift the feed block out.

(ii) *Fusee Spring Box.*—With the right hand at the rear and the left hand at the front, press the box forward until clear of the lugs, and remove. Disconnect the fusee chain and remove the box and the spring. Care should be taken to throw no cross strain on the chain.

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(iii) *Tangent Sight and Cover Lock.*—Lower the cover, putting a screwdriver across the breech casing under the gun-metal block, drive out the axis pin of the stem and remove with its piston and spring. Close the cover, press in the cover lock with the large screwdriver, remove the stop screw; the lock with its piston and spring can then be removed.

(iv) *Cover.*—Drive out the fixing pin of the cover joint pin, remove the collar and joint pin and take off the cover.

(v) *Rear Cross Piece.*—Drive out the tapered fixing pin, grasp with the left hand the left handle of the rear cross piece, slightly raise the casing and, with the mallet, strike the top edges of the casing alternately until the rear cross piece is clear of the dovetails on the casing. Lift out the trigger bar.

(vi) *Slides, Right and Left, and Check Lever.*—Pull out the slides. Drive out the fixing pin from the check lever collar, remove the collar and check lever.

(vii) *Recoiling Portion.*—Fold back the connecting rod on to the crank, turn the crank handle to a vertical position, and draw out to the rear the recoiling portion. Disconnect the side plates by dropping them and springing them outwards. If necessary, by taking out the fixing pin, the crank handle can be driven off with a drift and hammer, and the fusee unscrewed from the left bearing of the crank, but as a rule these parts should not be stripped.

(viii) *Foresight.*—The position of the foresight should first be carefully marked. Remove the fixing screw and foresight.

(ix) *Steam Tube and Packing Gland.*—Upend the barrel casing so that it stands on the rear end of the breech casing. Remove the keeper screw and unscrew the steam tube. Unscrew and remove the packing gland and packing.

(x) *Breech and Barrel Casings, and Ejector Tube Spring.*—Rest the barrel casing on a table or bench, with the filling hole uppermost, and the breech casing clear of the bench; place the left hand under the breech casing and strike the top edges alternately with a mallet, and the casings will come apart. Lift the ejector tube spring with the point of the screwdriver and tap out the spring with the drift and hammer. (In converted guns remove fixing wire and unscrew fixing screws.)

Note.—The breech and barrel casings should only be separated when repairs are necessary. Care must be taken not to strike the barrel casing, and the blows should be struck as close to the dovetailing as possible.

(xi) *Lock.*—(*a*) Release the lock spring, lay the lock on a bench, left side uppermost. Drive out the sear, tumbler, and lock spring axis pins. (*b*) Remove the keeper bracket, extractor levers, lock spring, tumbler, firing pin, and sear. (*c*) Drive out the trigger axis

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pin, extractor stop keeper pin, remove the trigger, extractor stop, and slide the extractor from the face of the lock casing. (*d*) Push out the gib spring cover, take out the gib spring and gib. (*e*) Drive out the extractor spring fixing pin, and remove the extractor spring. (In converted guns the extractor spring is riveted to the extractor.)

Note.—(*e*) should only be done in case of breakage.

(xii) *Feed Block.* (*a*) Drive out the spring fixing pin of the top and bottom levers, drive out the bottom lever and remove the top lever and slide. (*b*) Drive out the axis pin of the bottom pawls and remove pawls with feed block spring. (In converted guns unscrew fixing screws and remove feed block springs.) (*c*) Drive out the fixing pin of the band roller axis pin, remove the collar, axis pin, and band roller. (*d*) Remove the top pawls from the slide by pressing them outwards. The springs for the pawls, if weak or broken, are only to be removed by an armourer or qualified artificer.

(xiii) *Tangent Sight.*—(*a*) Remove the top fixing screw of the graduated plate. (*b*) Run the slide off the stem. (*c*) Remove the fixing screw of the milled head, and lift the latter off the slide. (*d*) Remove the fixing pin, pawl, and pinion, from the slide. (*e*) Place the milled head, face upwards, on a bench; then with a drift, applied to the rectangular nib on the spring slide, knock the latter down

flush with the face, when it can be lifted out with the pliers.

(xiv) *Rear Cross Piece.*—(*a*) Drive out the axis pin of the firing lever, and remove the latter with its spiral spring. (*b*) Drive out the axis pin of the safety catch, and lift out the latter, also the piston and spring from their seating. (*c*) Remove the pivot screw and shutter. (*d*) Unscrew, from the handles, the milled heads with their leather washers and oil brushes.

Before assembling the gun all parts should be tried in their places separately to see that they work freely.

Assembling the Gun.—Reverse all the foregoing operations with the exception that the recoiling portions must be replaced before the packing and packing gland. In order to assemble the barrel and breech casings, they will have to be turned upside down, i.e., the filling hole down, and the bottom plate of breech casing uppermost; they should be positioned by the crosshead joint pin; care must be taken that the ejector tube spring is in position before joining the casings together. When assembling the feed block the longer of the two bottom pawls must always be placed at the front. When assembling the tangent sight, it will be found convenient to place the slide on the stem before attaching the milled head; in this position the pinion is prevented from turning with the pawl when engaging the arms of the slide spring outside the lugs on the pawl.

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Instructions for Packing Barrels.

To renew the packing at the breech end of the barrel.—Should the gun leak at the breech, empty the barrel casing, remove the lock, feed block, and fusee spring box, drive out the taper pin from the rear cross piece. Drive out the split pin from the check lever, take off the collar and lever. Draw out the slides, right and left. Turn the crank handle upright and draw out the recoiling portion. *Wind a strand of asbestos (part of a 5 yards' piece) in the cannelure of the barrel, pressing it together with a thin piece of wood, or the point of a turnscrew or knife, until the cannelure is full;* then oil the asbestos and replace the recoiling portion and slides.

Replace the check lever, etc., fusee spring box, feed block, and lock.

To renew the packing at the muzzle end of the barrel.—Should the gun leak at the muzzle, stand the gun on the rear cross piece, unscrew the packing gland and repack, or, if necessary, replace the asbestos, having first oiled it, by winding it loosely round the barrel, and whilst winding push it in with punch No. 2, a piece of wood, or any blunt-ended instrument which will fit; screw on the packing gland as tightly as can be done by hand, return the gun to a horizontal position, fix the lock, and work the recoiling portion backwards and forwards to ensure that it moves freely. If the packing is found to press too hard on the barrel, the gland should

be removed and one or two strands taken out of the asbestos.

Spare Parts and Implements.

A filled spare part box, containing the following, is issued with each gun:

*Bags, water and muzzle	1	*Pins—*continued:*		*Springs—*continued:*	
Balances, spring	1	fixing axis pins	24	ejector tube	2
Blocks, feed	1	fixing extractor spring	4	extractor	2
Boxes, strips and eyelets	2	fixing fusee chains	2	feed block	4
Chains, fusee	2	Pins, firing	2	feed block slide	4
Corks, for plugs	2	Pliers, cutting (pairs)	1	firing lever	2
Eyelets repairing belts	½ oz.	Plugs, clearing	2	fusee	2
Funnels	1	Punches:		gib	2
Gibs, Mark II	2	No. 1	1	lock	4
Hammers	2	No. 2	2	safety catch	2
Handles, crank	2	No. 3	2	sear	2
Keys, gib, gun-metal valve	2	No. 4	1	§shutter	2
Levers, extractor:		Pull-throughs, double	2	side plate	2
left	1	Screwdrivers:		tangent sight	2
right	1	bent	1	tangent sight slide	2
Locks	1	large	1	§trigger bar	2
Lock, cover	2	small	1	Strikers, for pin, firing, Mark II	4
Packing, asbestos, pieces:		Sears	2	Strips:	
11 in. long	4	Sights:		long, N.P.	25
5 yards long	2	fore	1	short, N.P.	25
Plugs:		tangent	1	Tools, belt repairing	1
axis, lock, spring	2	Spanners, shifting	2	Triggers	1
,, sear	2	Springs:		Tumblers	1
,, trigger & tumbler	6	buffer	4	Vessels, water	2
		connecting rod	2	Wrenches, pin	2
		cover	4	Wire gauze, pieces	2
		cover lock	2		

*Except for Armaments. §Only supplied for guns which have no firing lever spring.

Cotters and washers are integral parts of the gun, but are kept in the spare part box. They must accompany the gun on all occasions.

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In addition, the following are supplied to complete the equipment:

Attachment, muzzle, Mk. II (ball), ·303-inch and converted Mk. II	1 per ·303-inch gun, carried in spare part box.
Barrels	*see* paragraph 72.
Belts, ammunition	*see* Equipment Regulations.
Cleaner, muzzle attachment	1 per converted gun.
Lock, skeleton, brass	*see* Equipment Regulations.
Lock, D.P. (instructional)	
Plug, cork	1 per gun.
Plug, belt and Reflector, mirror	*see* Equipment Regulations.
Protector, muzzle	1 per gun.
Rod, cleaning	1 per gun.

The following reserve parts are available for issue when required, and can be fitted locally:

Box, fusee spring.	Piston, safety catch.
Bracket, keeper.	Piston, tangent sight.
Brush, oil, with wooden holder.	Plate, graduated, tangent sight.
Brush, oil, with milled head.	Plate side, right.
Catch, safety, double handed.	Plate side, left.
Chain, piece, 10 links, for plugs.	Plug, screwed.
Collar, hand roller, axis pin.	Rod, connecting, Mark II.
Collar, check lever.	Roller, hand.
Collar, cover joint pin.	Ring, split, for spring balance.
Cotters, Nos. 0, 1, 2, 3, 4. Rod connecting.	Screw, adjusting fusee spring.
Cover, gib spring.	Screw, fixing, feed block spring.
Extractor stop.	Screw, fixing, ejector tube spring.
Gland, packing.	Screw, fixing foresight.
Head, plug, screwed.	Screw, fixing, graduated plate, upper.
Lever, check.	Screw, fixing, graduated plate, lower.
Lever, firing.	Screw, fixing, milled head, tangent sight.
Pawl, tangent sight.	Screw, keeper, steam tube.
Pin, axis, hand roller.	Screw, pivot, shutter.
Pin, axis, bottom pawls.	Screws, stop, cover lock.
Pin, axis, top pawls.	Shutter, Mark II, for rear cross piece.
Pin, axis, firing lever.	S-hooks.
Pin, axis, safety catch.	Slide, breech casing, right.
Pin, axis, tangent sight.	Slide, breech casing, left.
Pin, fixing, check lever.	Stud, fusee spring box.
Pin, fixing, crank handle.	Stud, screwed plug.
Pin, fixing, pawl, tangent sight.	Tang, belt, ammunition.
Pin, fixing, rear cross piece.	Tube, steam.
Pin, fixing top and bottom levers, feed block.	Trigger-bar.
Pin, joint cover.	Washers, Nos. 1, 2, 3, 4. Rod connecting.
Pin, keeper, extractor stop.	
Pin, stop, check lever.	
Piston, cover lock.	

NOTE.—Instructions for fitting these parts, where necessary, are contained in armourer's Instructions.

GENERAL INSTRUCTIONS FOR THE MAINTENANCE AND PRESERVATION OF GUNS.

For cleaning and oiling Maxim Guns and mountings in the hands of the troops, the following stores are allowed per annum in peace, for one gun and its mounting:

Dubbing	½ lb.
Flannelette, Mark II	11 yards.
Old linen	3 lbs.
Mineral oil, burning	½ pint.
Russian petroleum for lubricating	8 pints.
Spirits of turpentine	1 pint.
Soap, yellow	4 bars.

The *barrels* should be examined and thoroughly *cleaned daily*, and then left with a coating of oil in the bore.

To Clean the Barrel.

Open the cover, turn the crank handle over against the buffer spring, raise the lock and let it rest upon the top of the rear cross piece. Place a piece of flannelette, about 4 inches by 2 inches, *in each eye or slot of the cleaning rod*, care being taken that the latter is surrounded with the flannelette, which should be well oiled; then insert the rod into the muzzle of the barrel, placing the movable bush on the muzzle and pass it up and down

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till the barrel is clean; replace the oiled flannelette by dry pieces, and finally pass freshly oiled pieces through, leaving the barrel well oiled. If the flannelette is tight, and is pushed through the breech, it is necessary to reverse it before pulling it back, otherwise it will jam.

To Use the Double Pull-through.

If slight rust or metallic fouling is present, place the gunmetal protector on the muzzle to keep the cord central, open the cover, remove the lock and place the crank handle in a vertical position, keeping it there by placing an empty cartridge case between the crank handle and the resistance piece. Drop the weight through the bore from the breech, pass it through the hole in the crank and the shutter hole, and having well oiled the gauze, pull it with the assistance of another man backwards and forwards until the fouling or rust is loosened; the barrel can now be cleaned with the cleaning rod and flannelette as described above. When by compression the gauze fits too loosely to clean the grooves of the barrel, its diameter can be increased by inserting under each side narrow strips of flannelette or paper. When the gauze is worn out, it should be replaced by one of the spare pieces which are issued with each double pull-through.

Cleaning after Firing Ball or Blank.

When ball ammunition has been fired, daily cleaning of the barrel is necessary for at least ten days afterwards. Subsequent cleaning must depend on the discretion of the officer in charge of the gun; in a dry climate, once a week should be sufficient, but in situations where the barrel is exposed to a moist atmosphere it may be necessary daily. The bore should at all times be left coated with oil.

When the D.P. barrel has been used for firing blank ammunition it should be thoroughly cleaned as soon as possible and left coated with oil. Subsequent weekly cleaning should suffice, but this must also depend on local conditions.

Cleaning of Mechanism.

To clean the mechanism, a mixture of *equal parts of Russian petroleum and paraffin* should be used. If any parts are clogged with dried oil, spirits of turpentine should be used to remove it. After cleaning each part, it should be thoroughly dried and slightly oiled with Russian petroleum. Very little oil should be used for this purpose, as it is apt to catch the dust and clog.

The plan of hanging the lock and moving the recoiling portion by pulling on the crank handle affords a ready means of *oiling the recoiling portion and bearing parts of the barrel,*

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viz., (a) just in front of the gunmetal valve (which can be got at by removing the feed block), and (b) at the muzzle end, in front of the packing gland. (In converted guns, insert the oil can through one of the drain holes of the muzzle attachment).

Hanging the Lock.

The lock is hung as follows: Turn the crank handle on to the buffer spring; then, with the extractor in the lowest position, raise the lock slightly till clear of its guides; allow the handle to come back a little, and the lock to rest on the top of the guide; it will now be found to be fixed.

Treatment in Frosty Weather.

In frosty weather, when water is kept in the barrel casing, a blanket or some other thick covering should be kept wrapped round the barrel casing to prevent the water freezing. The working parts of the gun should only be slightly oiled with a lightly-oiled rag. In climates where the temperature is likely to fall much below freezing point, not more than about 5 pints of water should be put into the barrel casing (20 per cent of glycerine mixed with the water will prevent it from freezing so quickly).

When Stowed Away.

When guns are returned to store, packed for transmission, or stowed away in any place

where they cannot be readily examined, the barrels and unpainted parts should be coated with "Composition, preserving, arms." The mixture is to be made hot, and a piece of flannel dipped in it, with which the exterior parts will be dabbed. To coat the inside of the barrels, draw a bunch of lamp cotton, well saturated with the mixture, through from both ends; the lamp cotton is to be attached to a piece of twisted copper wire.

History Sheet.

A memorandum of examination or history sheet accompanies each gun when issued. It will be carefully preserved and will be handed over with the gun to which it belongs whenever the gun is transferred from the charge of one officer to that of another, particulars being duly recorded. An immediate record will be made in the sheet of any accident which may happen to the gun, and of the result of each official examination it may undergo. *On every occasion on which ball ammunition is fired, the number of rounds fired will be shown, the number of the barrel being inserted in the column of remarks.*

Issue of Barrels.

A new or part-worn, but serviceable, barrel is issued as part of each gun. This barrel is only to be used for firing ball ammunition.

An old barrel, marked D.P., is also issued,

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to be used only for firing blank ammunition and for drill purposes. On mobilization these two barrels are to be returned to store. In addition, two new barrels (armament, one) are issued with each gun, and are to be kept in store, and only taken into use on mobilization, one in the gun and one spare. New barrels in store are distinguished by a band of white paint round the centre.

POINTS TO BE ATTENDED TO BEFORE, DURING, AND AFTER FIRING.

It is most important that every gunner should gain familiarity with the points outlined below, and that every firer should carry them out for himself on the range.

The smooth working of the gun almost entirely depends upon the observance of these points, and instructors cannot emphasize them too much.

1. Points to be Attended to Before Leaving Camp or Barracks for Firing.

(*a*) Oil Up.

The surfaces on which all movable parts work should be thoroughly well oiled with petroleum, especially the following:

Bearing parts of the barrel, and all recoiling portions.

The lock guides on the side plates, also the working parts of the lock itself, especially the levers and extractor.

Face of the feed block and the edges of the steel guides inside the feed block.

Bearings of the crank, cover springs and gun-metal block.

(*b*) Test Friction of Recoiling Portion. (Maxim Gun only.)

In order to see that the recoiling portion works freely, cock the lock, remove the fusee spring box and spring, turn the crank handle upwards, take hold of it with the right hand and the fusee with the left, move the recoiling portion, with the gun horizontal, backwards and forwards, to see that it works freely, and also that the barrel goes close home forward. The weight necessary to move the recoiling portion should not exceed 4 lbs. (converted guns 7 lbs.), measured by placing the loop of the spring balance over the knob of the crank handle, and pulling to the rear when the handle is slightly above the horizontal.

(*c*) Weigh Fusee Spring. (For Vickers Gun, see page 132.)

Replace the fusee spring and weigh it with the spring balance as follows: Cock the lock, place the loop of the spring balance over the knob of the crank handle, and pull the balance vertically upwards, resting the wrist on the breech casing; (*See Plate V.*) the reading indicated when the crank handle commences to move will be the weight of the

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fusee spring. This weight should be between 5 and 7 lbs. (for converted Mk I guns, between 10 and 12 lbs.; Mk II, between 5 and 7 lbs.), and care should be taken, when weighing, to see that the lock works quite freely, and that there are no cartridges or empty cases in the extractor. If the spring is over, or not up to, weight, remove the fusee spring box and adjust by means of the adjusting screw at the end; generally 6 turns of the screw make a difference of about 1 lb. Turning the screw in the direction of the hands of a watch increases the weight, and vice versa. The tension of the fusee spring should always be kept as high as possible, consistent with maintaining the normal rate of fire of 450 rounds per minute. (With Mark VII ·303-inch ammunition, the normal rate of fire is 500 rounds per minute.)

(*d*) Examine Barrel, etc.

Examine the barrel, to see that the bore is clear; also the tripod, clearing plug, lock, and other important parts.

(*e*) See to Water Supply.

See that the barrel casing is filled with water. To fill the casing, remove the screwed plug at the breech end, also the cork plug, pour in the water, and replace the plugs.

(*f*) Oil in Handles, etc.

Ensure that the handles have been filled with oil; ascertain that the spare lock and feed block, and also the clearing plug and cleaning rod, are with the gun.

(*g*) Examine Belts.

Examine the belts, inspect the brass strips, see that the belts are correctly filled and packed carefully in the ammunition belt boxes. Keep the belts dry if possible; should they get wet, lay them out to dry. New or stiff belts should be well plugged.

(*h*) If Water Frozen Use Muzzle Attachment. (Maxim Gun only.)

Should the water in the barrel casing become frozen solid, on the gun being fired the barrel will probably not recoil far enough to work the gun, and will remain back. To remedy this, put on the muzzle attachment for ball firing, leaving the fusee spring at its normal weight. Turn the crank handle on to the buffer spring, then bring it back to a vertical position and force the barrel to the front, pulling the belt if necessary; let the crank handle return to the check lever, and fire the gun. This should be repeated until the barrel recoils correctly. When the gun begins to work correctly, the muzzle attachment may be taken off.

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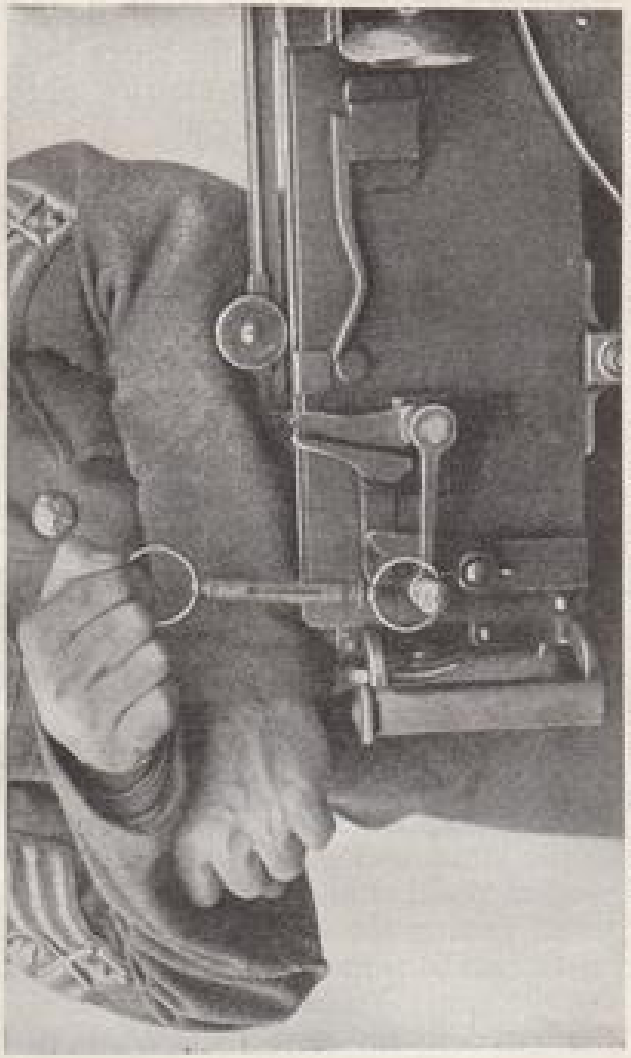
Plate V.
METHOD OF TESTING THE WEIGHT OF THE FUSEE SPRING



Care in weighing the fusee spring and testing the friction of the recoiling portion requires emphasising. Note the support given to the right arm.

POINTS TO BE ATTENDED TO DURING FIRING.

(*a*) Watch Water Supply.

See that a sufficient supply of water is kept in the barrel casing, so that the barrel is never uncovered.

The water in the barrel casing begins to boil when the gun has fired about 600 rounds with the greatest rapidity; after this, if the firing is continued, the amount of water evaporated is about 1½ pints for each 1,000 rounds. When the barrel casing is filled with water about 2,000 rounds may be discharged at short intervals without replenishing, but this depends upon the rapidity with which the gun is fired.

(*b*) Belt Not Pulled.

The belt is on no account to be pulled when the gun is firing.

(*c*) Temporary Cessation: Oil Up and change belt.

During a temporary cessation of fire, oil the lock and all frictional parts, remove a partly-used belt, and replace it by a full one. See that the clamps of tripod legs have not worked loose.

(*d*) Ammunition Box Up and In Line.

Keep the belt always in line with the feed block and the ammunition box, if possible, up to, but not above, the cross-head joint pin.

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(*e*) Belts Re-filled.

See that the belts are re-filled without delay.

(*f*) Clamps.

See that clamps of tripod legs do not work loose.

Points to be Attended to After Firing.

(*a*) Unload and Clear Ejector Tube.

See that the gun is unloaded and that no cartridges are left in the ejector tube. To clear the ejector tube, place an empty cartridge case in the lowest part of the extractor, replace the lock and let it go forward, holding the crank handle, until the empty case in the ejector tube is pushed out.

(*b*) Oil Bore.

See that the chamber and bore are well oiled *immediately* after firing.

(*c*) Release Lock Spring.

See that the lock spring is released.

(*d*) Gather Live Rounds from Cases.

See that any live cartridges that happen to be among the cases are collected.

(*e*) Clamp up Before Moving.

See that before moving, the shutter is closed, the gun is securely fixed by clamping the traversing gear, and that all pins are secure in their holes, so as to prevent damage to pins or cords. (In carriage mountings, the elevating gear will also be clamped.)

(*f*) Thorough Cleaning in Barracks.

On return to barracks the gun and the barrel should be thoroughly cleaned as soon as possible, and the interior left coated with oil; the lock should be taken out and thoroughly examined to ensure that there has been no breakage. It will not be necessary to strip the lock for this purpose. Ammunition belts should be examined and if wet or damp should be hung up to dry. Vickers Gun, Remove side plates and barrel; oiling the outside as well as the bore.

ABBREVIATED MEMORY TABLE OF

Points to be Attended to Before, During, and After Firing.

	Before Firing.	*During Firing.*	*After Firing.*
1	Oil up.	Watch Water Supply.	Unload and clear ejector tube.
2	Test Recoiling Portion.	Belt not pulled.	Oil Bore.
3	Weigh Fusee Spring.	Temporary Cessation. Oil up and change belt.	Release Lock Spring.
4	Examine barrel, spare parts, etc.	Ammunition box up and in line.	Gather live rounds from cases.
5	See to Water Supply.	Belts refilled.	Clamp up before moving.
6	Oil in handles, etc.	See clamps of tripod legs not loose.	Thorough cleaning in Barracks.
7	Examine belts.		
8	Action when water is Frozen.		

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Precautionary Measures and Range Discipline.

If carelessly handled, the machine gun is a dangerous weapon, but by careful training and constant attention to certain precautionary measures, reasonable care becomes habitual, and the risk of accidents is minimized. The following are the principal points and these should be attended to, not only when firing service ammunition, but also at drill with dummies:

(i) Before opening the cover, perform the unloading motions. This must always be carried out correctly without slurring, and each motion must be carefully and distinctly performed.

(ii) As soon as the order, "Unload," is given, and the unloading motions have been performed (see page 164), (a) the cover should be opened, the lock raised and turned backwards on to the rear cross piece; (b) if firing is to be resumed without change of position, withdraw the belt until the uppermost cartridge or dummy is flush with the edge of the ammunition box.

(iii) When a gun is in action, no man should be allowed in front of the bracket head until the gun is reported clear, after the order to unload has been given.

(iv) When range or field practices are being carried out, the gun should invariably be reported clear after unloading, including clearing of ejector tube, and before anybody is allowed to go forward to examine the target, or for any other reason.

STOPPAGES.

Stoppages in the Automatic Action of the Gun During Firing.

1. Stoppages in the automatic action of the gun during firing may be classed under two main headings:

(i) Temporary, which are due to—

(*a*) Failure of some part of the gun, of which a duplicate is carried, and which therefore can be easily and quickly replaced, or faulty ammunition.

(*b*) Some cause which can generally be avoided by a high standard of training and a thorough knowledge of their gun by the detachment. These are generally due to neglect on the part of the detachment of some of the points to be observed before, during, and after firing.

(ii) *Prolonged*, which are due to failures of some part of the gun which cannot, as a rule, be put right by the detachment under fire or without skilled assistance. These necessarily put the gun out of action for a more or less prolonged period.

On the knowledge and training of the detachment depends the rapidity with which "temporary" stoppages can be overcome. "Prolonged" stoppages, however, require skilled assistance as a rule before they can be overcome, but a knowledge of their causes and remedies is none the less essential before the detachment can be considered thoroughly efficient

The following table of temporary stoppages, set out under five columns, gives a clear

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indication of the method to be employed in teaching the detachment the practical side of the mechanism. Column I shows the four positions of the crank handle when the gun stops firing. The first three positions may vary slightly, as shown by the dotted lines. These positions, which afford a ready indication of the cause of stoppage—and therefore of the correct "immediate action" to be performed—must be recognized clearly before the instruction proceeds.

At this stage the detachment should not be required to know what these four positions indicate. The indication given below the diagram will be explained when the probable causes of the stoppages are being taught.

Column II gives a detailed description of the "immediate action" to be performed by the firer (sometimes with the assistance of No. 2) as soon as the position of the crank handle has been recognized after the gun has stopped firing.

Column III deals with the probable causes of these stoppages, but it is of first importance that the instructor does not proceed to this stage until he is assured that every "immediate action" can be correctly and immediately carried out without the slightest hesitation or forethought.

A thorough knowledge of the causes of temporary stoppages will not only give the detachment a practical knowledge of the working of the gun, but will also be a help in the discovery of the cause of any unusual breakdown which may occur.

In Column IV is given the method for preventing the recurrence of certain stoppages, the cause of which may be only temporarily cured by the immediate action. It will sometimes be possible to carry out these preventions in two or three minutes; at other times their execution may cause the gun to be temporarily out of action for a longer period; but, in either case, no skilled assistance or special appliances other than those carried with the machine gun section will be required.

Column V shows how the various temporary stoppages can be simulated for instructional purposes. It is unnecessary to teach these methods of preparation to the machine gunner, but every instructor must have a thorough knowledge of this column in order to teach the correct "immediate action" for any temporary stoppages.

Whenever instruction is being carried out, a belt and dummy cartridges will be *invariably* used, and in order to simulate the various stoppages, empty cases, bulged dummy cartridges, separated cases, and dummy cartridges with the rims thickened, will be required by the instructor.

The instructor must also see that a spare lock, feed block, belt, and a clearing plug, are by the gun, without which the correct immediate action cannot always be carried out.

As the clearing of a stoppage often knocks the sights off the aiming mark, the instructor should lay stress on the importance of relay-

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ing the gun, and for this purpose the instructional machine gun or landscape target will be used.

In addition to the instructions conveyed in the table, the following points should be observed:

(i) If, when the cover is opened to investigate the cause of stoppage, it is seen that the extractor is not quite up, no attempt should be made to raise it. On the contrary, it should be first pushed down before the crank handle is turned over to the front, as by this means all risk of firing a cartridge accidentally is avoided.

(ii) When a temporary stoppage necessitates the employment of the spare lock, feed block, etc., the part which has been removed should be repaired as soon as possible, so as to make it again available as a reserve.

(iii) Should it ever be necessary to release the lock spring with the lock out of the gun, this should be done with the extractor fully up, and the firing pin hole opposite the firing pin.

Immediate Action for Temporary Stoppages.

First Position of Crank Handle.

1. Turn the crank handle on to the buffer spring, pull the belt to the *left front* and let go crank handle, and resume firing.

2. If failure recurs, lighten fusee spring by three turns.

Second Position.

Force the crank handle forward, open cover, clear the face of extractor, if necessary clear the obstruction in the chamber with the clearing plug, and reload.

Third Position.

1. Strike the crank handle on the check lever by a glancing blow with the palm of the hand; if this fails:

2. Slightly raise crank handle, pull the belt to the left front, and let go the crank handle, striking it down again on the check lever.

3. If (2) fails, examine position of recoiling portion (at crank bearings) and feel slide.

4. If home and slide free, force the crank handle forward, open the cover, clear the face of the extractor, change the lock, remove the cartridge in position in the feed block and reload

5. If not home, or if home, slide jammed, remove feed block and take spare one and fresh belt into use.

Fourth Position.

1. Turn the crank handle on to the buffer spring, pull the belt to the left front, and let go crank handle. If this fails:

2. Place crank handle on to buffer spring *twice*, change the lock, and reload.

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TEMPORARY STOPPAGES MAXIM GUN.

FIRST POSITION OF CRANK HANDLE.

Position of Crank Handle and its Indication.	Immediate Action.	Probable Cause.	Prevention of Recurrence.	Method of Preparation for Instructional Purposes.
FIRST: *Indication.* The lock is unable to come back far enough to allow the extractor to drop.	(1) Turn the crank handle on to the buffer spring, pull the belt to the left front and let go crank handle. (2) If failure recurs, lighten fusee spring by three turns. NOTE.—*If the continual lightening of the fusee spring results in the crank handle stopping in the third position, take muzzle attachment into use and put fusee spring back to normal weight.*	The extractor has not dropped. This may be due to:— (a) Too heavy fusee spring. (b) Excessive friction, due to want of oil; grit or tight pockets in the belt, or excessive packing in cannelure or packing gland. (c) Insufficient energy of recoil due to deteriorated ammunition or worn barrel.	(b) Clean and oil working parts. Examine the belt, which should be dried if damp; or if the stoppage is due to a new or stiff belt, the pockets should be plugged. If due to excessive packing, examine and repack cannelure or packing gland. (c) The barrel should be examined at the first opportunity, and if much worn in the lead should be changed.	(1) Raise the lock and place an empty case over firing-pin hole, and a dummy cartridge between the projections of the gib. Pull a cartridge into position in the feed block, replace lock with the horns of the extractor on the top of the solid cams. When actually firing this can be simulated by increasing the weight of the fusee spring.

NOTE.—In the above cases the energy of recoil is insufficient to overcome the strength of the fusee spring owing to either the latter being too great or to the energy having become lessened either by excessive friction or owing to insufficient pressure on explosion of a charge. The lock is therefore arrested before it has been drawn back far enough to allow the extractor to clear the solid cams and to drop. The cartridge in the lock which has been drawn from the feed block, by bearing against the one which is being, or has been, fed up to the feed block, prevents the lock from going forward again.

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SECOND POSITION OF CRANK HANDLE.

Position of Crank Handle and its Indication.	Immediate Action.	Probable Cause.	Prevention of Recurrence.	Method of Preparation for Instructional Purposes.
SECOND: *Indication.* The lock is unable to go fully home after recoil.	Force the crank handle forward, open cover, clear the face of extractor, if necessary clear the obstruction in the chamber, as detailed in column 4, and reload.	(a) Damaged cartridge. The cartridge is unable to enter the chamber completely although it has commenced to do so.	(a) Immediate action will cure this.	(a) Bulge a dummy cartridge and place it on the extractor between the projections of the gib and place empty case over firing-pin hole. A cartridge should be pulled into position in the feed block. Replace lock. For range purposes: Place a bulged cartridge in the belt.
		(b) Broken or separated case; the front portion of which causes an obstruction and prevents the next cartridge from going into the chamber.	(b) (i.) The front portion of the broken case may come out on the live cartridge in the lock. Immediate action and reloading will cure this. (ii.) The front portion of the broken case may remain in the chamber. Lay the lock back on	(b) Cut an empty case in two and place the front portion in the chamber and the rimmed portion over the firing-pin hole, also a dummy cartridge between the projections of the gib, then allow the lock to go forward.

		NOTE.—If a succession of separated cases occur the cause may be due to want of support by the lock. *Remedy:—* *Lengthen the connecting rod.*	the rear cross piece, take the clearing plug (seeing that the centre pin is back) and insert into chamber; replace the lock, and taking hold of the crank handle push the plug well home by means of the lock; this will tighten the grip of the plug inside the case by pushing the centre pin forward. Then, keeping a firm pressure on the crank handle, give the clearing plug a rocking motion, withdraw the lock, draw back the handle of the clearing plug to give primary extraction; withdraw clearing plug, thereby removing the obstruction.	A cartridge should be pulled into position in the feed block. For range purposes a cartridge may be filed about one inch from the base and inserted in the belt. Care must be taken that the cartridge is not filed too far through, as there is the danger of the bullet being left in the barrel.

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Position of Crank Handle and its Indication.	Immediate Action.	Probable Cause.	Prevention of Reccurrence.	Method of Preparation for Instructional Purposes.
Thumb: *Indication:* The extractor is unable to rise to its highest position. If the feed block slide is jammed, there is a fault in the feed.	(i) Strike the crank handle on to check lever by a glancing blow with the palm of the hand. If failure recurs, strengthen the fusee spring by 3 turns.	(i) (a) Too light fusee spring. (b) Excessive friction.	(i) (b) Clean and oil working parts.	(i) Perform the correct loading motions, except that when completing the loading the crank handle must be eased back gently until it is in the third position. For range purposes:—Lighten the fusee spring.
	Note.—If the continued strengthening of the fusee spring results in the crank handle stopping in the first position, change the lock, pulling the fusee spring back to normal; if failure recurs take muzzle attachment into use.			
	(ii) If (i) fails, slightly raise the crank handle, pull the belt to the left front, let go the crank handle and then strike it down on the check lever.	(ii) A cartridge fed up slightly crossways, or a long brass strip is bent.	(ii) Carefully examine the belt.	(ii) Perform half the loading motions. Place the crank handle on to the buffer spring. Open the cover, place an empty case over the firing pin hole, pull a cartridge half way into position in the feed block, and, holding it there, close the cover and let the crank handle go slowly back. For range purposes:—Bend a long brass strip.
	(iii) A. If (i) and (2) fail, examine feed block slide. If jammed, No. 1 holds up the crank handle and opens the cover. No 2, with the assistance of No. 1, removes the feed block, and replaces it by the spare one. Meanwhile No. 2 forces down the horns of the extractor, and places the crank handle on the buffer spring. As soon as the spare feed block is in position, No. 1 closes the	(iii) A (1) Badly filled belt, or a belt with worn or loose pockets. The cartridges projecting unevenly from the belt prevent it entering or passing freely through the feed block. (iii) A (2) Belt box not being in line with the feed block; the belt does not lead up correctly to the feed block and becomes jammed.	(iii) A (1) Carefully examine the new belt. (iii) A (2) See that the new belt box is in line.	(iii) A (1) Pull out the fourth cartridge in the belt about ¼ inch. Perform half the loading motions and hang the lock. Pull the crank handle to the rear and at the same time pull the belt to the left. Let go the crank handle, raise the lock and place a dummy cartridge between the projections of the gib, and an empty case over the firing pin hole. Replace the lock, shut the cover, and let

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Position of Crank Handle and its Indication.	Immediate Action.	Probable Cause.	Prevention of Recurrence.	Method of Preparation for Instructional Purposes.
	cover and pulls the top cartridge of a fresh belt into position and lets go the crank handle.	NOTE.—*The effect of a fault in feed is that the top pawls being engaged behind a cartridge in the belt, are held fast when some obstruction, such as above, prevents the belt from passing freely through the feed block. The recoiling portions, being connected by the top and bottom levers to the slide are arrested and prevented from going home. The distance they are held back depends upon the point at which the obstruction asserts itself.*		go the crank handle. For range purposes:— Fill a belt badly. (III) A (2) For range purposes:—Place the belt box at an angle to the feed block.
	(III) B. If free, No. 1 opens the cover. No. 2 forces down the horns of the extractor. No. 1 clears the face of the extractor, and changes the lock. He removes the cartridge in position in the feed block and reloads.	(III) B (1) Damaged cartridge grooves. (2) Broken gib spring. (3) Broken gib. In these cases the extractor is prevented from rising to its highest position. It may be necessary sometimes to slide the cartridge or the empty case upwards when clearing the face of the extractor.		(III) B. Damage the rim of the leading dummy cartridge in the belt, pull it into position in the feed block. Place a dummy cartridge between the projections of the gib, and an empty case opposite the firing pin hole. Replace the lock, close the cover, and let go the crank handle.

		(4) Thick rimmed cartridge. NOTE.—*If it is apparent that the stoppage is due to a thick rimmed cartridge, it will not be necessary to change the lock.*		For range purposes:—Damage the rim of a dummy cartridge and place it in the belt. NOTE.—(1) As damage to the extractor has to be simulated by damaging a cartridge rim, this cartridge must be removed before reloading. (2) This stoppage should seldom be practised on the range, since the thickened rim may cause damage to the grooves.

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FOURTH POSITION OF CRANK HANDLE.

Position of Crank Handle and its Indication.	Immediate Action.	Probable Cause.	Prevention of Recurrence.	Method of Preparation for Instructional Purposes.
FOURTH: *Indication:* That there has been no explosion, or if any, that there has been little or no recoil, the lock remaining in its forward position.	(*a*) Turn the crank handle on to the buffer spring, pull the belt to the left front, and let go crank handle. (*b*) If this fails, place crank handle on to buffer spring, twice, change the lock, and reload.	(*a*) (*c*) No cartridge in the chamber. (*a*)Defective ammunition. (*b*) (*c*) Broken or damaged firing pin. (*c*) Broken lock spring.		(*a*) Load, and press the double button. On range:— (*a*) Place a dummy cartridge in belt. (*b*) The effect of these will be simulated by placing two dummy cartridges in belt.

NOTE.—*Worn or damaged side or extractor lugs may result in the extractor being unable to ride, or if the side covers are lost, there may either be a succession of separated cases, or the lock may become jammed.*

PROLONGED STOPPAGES.

The causes of *prolonged* stoppages are so varied that they cannot be set out in detail. The following are amongst the most probable, and the detachment should be thoroughly trained to recognize them and to apply such remedy as lies in their power pending a permanent repair:

1. *Broken cover springs.*—The extractor may not drop when the lock is drawn back, and the gun will stop with the crank handle in the first position. This may possibly be overcome by liberal oiling of the lock, but in any case single shots can be fired by holding the crank handle forward until the extractor drops by its own weight.

2. *Broken ejector tube spring*, causing either a block in the ejector tube or an accumulation of empty cases in the breech casing. It may be found possible to keep the gun in action if care is taken to prevent the latter.

3. *Cotter working out*, thus causing the screwed head and connecting rod to become separated. To remedy, proceed as follows:

(*a*) Take out the cotter. (This will be found either on the crank or at the bottom of the breech casing.)

(*b*) Press down the screwed head with the large screwdriver to cock the lock.

(*c*) Turn the screwdriver edgeways, and

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insert it behind the horns of the extractor and between the face of barrel and front of the lock flange, and force the lock to the rear.

(*d*) Turn crank handle on to the buffer spring, press down the extractor, raise the lock, and remove the live cartridge; then lift out the lock.

4. *Damaged parts of the lock, no spare being available.*—The gun will fire without the sear, or if the bents of the sear or firing pin are badly worn or broken off, but only single shots, and only by pressing and releasing the firing lever quickly. The gun will also fire if the nose of the trigger and bent of the tumbler are badly worn or broken off, but only rapid firing. In this case the gun will fire the instant the crank handle reaches the check lever, although the firing lever has not been pressed. If this occurs during firing, to stop the gun the filled end of belt should be thrown over the breech casing to the left.

If the sear and firing pin action only is in good order, the gun can be worked as follows:

(*a*) Group the cartridges in the belt, say 20 or 30 rounds in each group.

(*b*) Lay the gun before commencing to load, place crank handle on buffer spring, pull belt to left, and let handle go; repeat, but before allowing the handle to reach

check lever, and the gun to fire, grip rear cross piece with left hand to control gun in the ordinary way.

When firing has been stopped by throwing the belt over the breech casing as described above, hold the crank handle with the right hand, open the cover, press down the horns of the extractor, draw the lock back and, if there is a live cartridge on the face of the extractor, remove the feed block and belt, close the cover and allow the lock to fly forward, when the live cartridge which is on the face of the extractor will be fired automatically. The lock can then be changed with safety. On no account should the lock be allowed to fly forward until the feed block has been removed and the cover shut.

If, on drawing the lock back, it is found that there is no live cartridge on its face, the lock may be changed at once, and the necessity for removing the feed block and the subsequent precautions will not arise.

5. *Gun-metal valve working loose.* This will prevent the barrel from going home. It may be temporarily remedied by tapping it round with a hammer and punch, but it should be tightened at the earliest opportunity with the gib key, the barrel being removed.

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MEMORY TABLE OF STOPPAGES IN ABBREVIATED FORM.

TEMPORARY STOPPAGES.

Position of Crank handle.	Immediate Action.	Probable Cause.	Prevention of Recurrence.
	1. Crank handle on buffer spring and pull belt left front. Let go. 2. Lighten fusee spring three turns.	1. Too heavy fusee spring. 2. Excessive friction. 3. Deteriorated ammunition or worm barrel. 4. Tight pockets.	Weigh and adjust if necessary. Oil up and remove grit. Take muzzle attachment into use, or change barrel. Substitute dry belt.
	Force crank handle forward, open cover, clear obstruction, and reload.	1. Damaged cartridge. 2. Broken or separated case.	Immediate action. Clearing plug, or new washer.
"A." Extractor not risen	1. Strike crank handle down. 2. Slightly raise crank handle, pull belt, and strike handle down. 3. Examine position of receiling portion and slide.	1. Slight cross feed. 2. Light fusee spring. 3. Excessive friction. 4. Thick rimmed cartridge. 5. Damaged cartridge grooves. 6. Broken gib. 7. " " spring.	Immediate action. Weigh and adjust if necessary. Oil up and remove grit. Remove cartridge from feed block. Change lock. " " " "

"B." Fault in Feed.	4. If home, slide free, change lock. 5. If not home, slide jammed, remove feed block and take spare one into use.	1. Badly filled belt or loose pockets. 2. Damaged belt. 3. Box not in line with feed block.	Immediate action.
	1. Crank handle on buffer spring, pull belt left front. Let go. 2. Crank handle twice forward, change lock and reload.	1. Defective ammunition. 2. Broken or burred firing pin. 3. " " weak lock spring. 4. " side or extractor levers.	Immediate action. Change lock. " " " "

PROLONGED STOPPAGES.

1.	Broken cover springs	Liberal oiling or single shots.
2.	" ejector tube spring	Prevent accumulation.
3.	Cotter pin working out	Use screwdriver, cock lock, etc.
4.	Damaged parts of lock (no spare available)	Throw belt over—single shots, or groups.
5.	Gun-metal valve loose	Tap round.

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EXAMINATION.

The following are the principal points to be observed in the examination of Maxim guns without issuing gauges:

Recoiling portion. See this moves freely. Pull not to exceed 4 lbs.

Foresight. See that the barleycorn is in good condition.

Tangent sight. See that the top edge and V on leaf are in good condition, and that the slide works correctly.

Crank handle. The crank should bear against the stops. To try this, remove lock and place a piece of thin paper between crank and stop. If the crank fails to nip the paper the crank handle is probably bent, and bearing on the check lever or against the resistance piece.

Safety catch. See the spring and catch act automatically when the firing lever is released.

Firing lever. Test the firing lever by seeing that the trigger bar does not release the trigger before the safety catch is clear, and also see that the trigger is released before the stop on the lever bears against the stop on the rear cross piece.

Ejector Tube. See the spring grips cartridge case; it should not take more than 2¼ to 4 lbs. to push it out of the tube.

Connecting Rod, Mark II. See that the spring cotter is in its place. Test the length of rod by raising the lock and putting one of

the special dummy cartridges, issued to Armourers, into the extractor over the firing pin hole; turn the crank handle on to the buffer spring, hold the extractor up against the top stop and let the crank handle come back slowly on to the check lever; if the rod is the correct length, the crank handle will require a slight pressure of the hand to force it on to the check lever.

Steam tube. See that outer tube moves freely on inner tube when the gun is elevated and depressed.

Barrel. Condition of rifling, lead and coppering.

Lock. Test extractor and side levers by bringing the crank handle gently on to the check lever. If levers are correct, the extractor will be right up.

Test the bents of sear and firing pin. To do this, turn crank handle on to buffer spring, lift up safety catch, and press firing lever forward and keep it there. Then bring crank handle gently down on to check lever. The extractor should be well up to the top position before the firing pin is released. Examine the face of extractor for burrs and flaws at gaps and firing pin hole. Try grooves with dummy cartridges to see that they are not damaged and that the cartridges pass freely down; also try depth of gib recess with dummy cartridge (inspection dummies must be used for this purpose) to see gib holds cartridge horizontally. See that the bents

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of the trigger and tumbler are not too much worn. See that the point and bent of the firing pin are in good condition.

A broken firing pin can be recognized without stripping the lock by releasing the lock-spring with the extractor up. If correct, the firing pin will then protrude from the firing pin hole, and can be withdrawn by depressing the tail of the tumbler. If broken, it will remain protruding.

General. See that all pins and fixing pins are correct.

REPAIRS AND ADJUSTMENTS.

Instructions for Fitting Connecting Rods, Mark II, and Washers in Guns.

(i) Strip the gun and remove the side plates and crank. Then drive out the fixing pin of crank pin (from under side of crank), drive out the crank pin and remove the connecting rod.

Fit on the adjustable connecting rod and replace the crank and fixing pins, care being taken, in fitting on the connecting rod, that the slot for the connecting rod spring is on the left. This is also to be attended to when fitting on the various washers.

In the ·303-inch gun, see that the locks turn to the proper position in the connecting rod.

If the faces do not come properly together, ease away the rounded end of the stem of the threaded portion of the screwed head until they turn up correctly. In peace this should only be done by an armourer.

N.B.—The rods are specially marked for ·303-inch or ·303-inch converted guns. Care must, therefore, be taken, when fitting them, that they are placed in the class of gun for which they are marked.

(ii) After fitting the connecting rod, the gun and spare locks should both be tried in the gun before the fusee spring is replaced to see that, with one of the special armourer's

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dummy cartridges held in the extractor over the firing pin hole and placed in the chamber, a gentle pressure of the hand is required to force the crank handle on to the check lever when the crank handle is allowed to come back slowly.

If no pressure is required, a washer should be fitted in the following manner: First put on the thinnest washer and again try the gun. If one lock requires more pressure on the crank handle than the other, that lock should be taken into use as the gun lock and the other kept as a spare.

(iii) Four washers, each with its own cotter, are provided, marked respectively 1, 2, 3 and 4; No. 1 being the thinnest.

When necessary they can be fitted as follows, without stripping the gun:

Turn the crank handle on to the buffer spring, raise the lock and allow it to rest on the rear cross piece. Drive down the cotter, raise the lock to an upright position, pull out the cotter with the pliers, and take off the lock with the front part of the connecting rod attached. Now place the washer required over the stud on the boss; then rejoin the connecting rod. Insert the cotter of the same number as the washer used (from the top side), allow the lock to rest on the feed block, and drive the cotter to its place.

(iv) The washers are of the following thicknesses: No. 1 ·0025-inch, No. 2 ·005-

inch, No. 3 ·01-inch, No. 4 ·02-inch, and, if necessary, any combination of them may be used; but the cotter will probably require to be slightly reduced on the edge in order to make it fit properly. When a combination of washers is used, the cotter belonging to the thickest washer of the combination should be employed.

Instructions for the Use of the Tool for Repairing Belts.

Remove the damaged strips and eyelets. If a long strip requires fitting, first join the two portions as follows: Place an eyelet in the hole of the dished end. Insert the punch of the tool into the unopened end of the eyelet, the opened end to rest upon the die, and gently press the handles together. Then put the punch in the other end of the eyelet and press the handles; then, keeping the belt horizontal, move the handles of the tool backwards and forwards in a circular direction with the punch of the tool as the centre, so as to shape the head of the eyelet nicely.

Put the strips into position on the belt, insert the eyelets, and repeat the above operation.

Short strips are fitted in a similar manner except that they do not require joining at one end previous to placing them upon the belt.

Care must be taken to press the eyelets

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as far through the strips as possible before using the tool in order to form a good head.

Instructions for Fitting Spare Cover Lock.

See that the new "lock, cover" works freely on the cover and in the socket.

The rear edge of the cover may require rounding (to fit the rounded edge of the lock) and the screw slot lengthening to allow the lock to clear the rear cross piece when the cover is forced down.

See that the lock engages the rear cross piece when the cover beds hard on the top of the breech casing.

Where necessary, "ease," or file away, the lock to make it fit.

After fitting, the cover lock should be fire-blacked.

Replacement of Defective Parts of the Lock.

When components belonging to the lock become defective, they may be replaced, from the spare parts, without fully stripping the lock, proceeding as follows:

1. *Firing Pin.*

Release the lock spring and remove:

(*a*) Lock spring axis pin.
(*b*) Keeper bracket.

(*c*) Lock spring and extractor levers.
(*d*) Tumbler axis pin and tumbler.
(*e*) Lift sear and remove firing pin.

2. *Trigger, lock spring or extractor levers.*

Release lock spring and remove:

(*a*) Lock spring axis pin.
(*b*) Keeper bracket.
(*c*) Lock spring and extractor levers.
(*d*) Trigger axis pin and trigger.

3. *Gib, gib spring, or extractor spring.*

Release lock spring and remove:

(*a*) Lock spring axis pin.
(*b*) Keeper bracket, lock spring, and extractor levers.
(*c*) Keeper pin of extractor stop.
(*d*) Extractor stop and extractor.
(*e*) Push out gib spring cover.
(*f*) If extractor spring is to be replaced drive out its fixing pin and remove.

4. *Sear.*

Compress lock spring and:

(*a*) Lift sear clear of firing pin.
(*b*) Drive out sear axis pin.
(*c*) Remove sear.

5. *Tumbler.*

Compress lock spring and:

(*a*) Drive out tumbler axis pin.

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(*b*) Pull trigger back slightly.
(*c*) Remove tumbler.

NOTE: The serviceable components are replaced in the reverse order.

MOUNTING, TRIPOD, ·303-INCH MAXIM GUN, MARK IV.

The mounting consists principally of a crosshead, elevating gear, and socket, mounted on three legs.

It is constructed to give 13 degrees elevation and 25 degrees depression at heights varying from 14½ inches to 30 inches from the axis of the gun to the ground. By arranging the position of the rear and front legs respectively, elevation may be given up to about 43 degrees and depression to 55 degrees. An all round traverse can be obtained.

The crosshead, to which the gun is pivoted, is formed with a pivot to fit into the socket and an arm which carries the elevating gear.

The elevating gear, which is actuated by a handwheel, consists of an inner and outer screw (right and left-handed) and a nut working within a tumbler. The tumbler is split and provided with a jamming bolt, by which the wear may be taken up.

The socket is bored to receive the crosshead and is provided with three lugs, to which the legs are hinged; a clamp and screw with handle is attached to the front to secure the crosshead in any desired angle of traverse; the clamp works in a recess in the upper portion of the crosshead and prevents it from rising. Both faces of the rear lug and one face of each front lug are fitted with clutch plates having radial serrations to correspond with similar serrations on the faces of the leg joints. Joint studs with disc spring and jamming handle are fixed to the front lugs, by which the legs are securely clamped to the socket in the required position.

The legs are of tubular steel, the lower ends being fitted with shoes to steady the mounting on the ground, and the upper ends having a joint with radial serrations mentioned above. The rear leg is provided with a joint pin with nut and jamming handle.

On a portion of the periphery of the leg joints numbers are stamped at regular intervals so that when read in conjunction with a zero mark the relative position of the legs to their normal position may be readily seen.

A strap is fixed to the rear leg to secure the three legs during transport.

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When firing, the ammunition box is placed on the ground on the right side of the gun.

Weight of mounting . . 48 lbs.

Method of Carrying Tripod Mountings on Carriage, M.G., Infantry Maxim.

Mountings will, when issued to the Special Reserve and the Territorial Force, be carried in the wire receptacle of Marks II, II* and III Infantry Carriages.

The crosshead will be carried separate from the tripod, and both will be secured (with the drag ropes already carried) by two straps to the wire receptacle.

HOOD PROTECTING:

Mark IV Tripod Gun Mount.

The hood is made of leather, lined with brown felt, and is for use in protecting the gun mount when tripod is carried in G.S. limbered wagons.

Packsaddlery, Machine Gun, ·303-inch.

The packsaddlery for use with equipment supplied with the Mark IV Tripod will be as follows:

Description.	Per gun and tripod set.	Per ammunition set.	Weight of each article.
Section No. 5A.			lbs. ozs.
Harness, Pole-Draught, G.S.			
Cases, horse-shoe, harness .	1	1	1 0½
Section No. 5B. Packsaddlery, G.S.			
Bits, bridoon (*f*) . . .	1	1	0 15
Bars, hanging, Mark II pairs (*d*)	—	1	6 6
Breechings, Mark III, IV or V	1	1	1 13½
Chains, collar, G.S., Mark III	1	1	2 2
Collars, breast, Mark III, IV, or V	1	1	1 8½
Collars, head, Mark III or IV	1	1	1 12
Cruppers, Mark III or IV (large) or Mark V . .	1	1	0 10½
Girths, Mark III, IV or V pairs (*c*)	1	1	0 13
Girths, leather, Mark I (*d*) .	—	2	0 11
Pannels, Mark III or IV (small) or Mark V pairs (*b*)	1	1	11 0

(*b*) 1½ lbs. of horse hair will be issued with each pair of new pannels. This should be put under the quilted parts, if necessary, after the pannels have been worn a short time.

(*c*) As Mark V girths are not held on charge in pairs, 2 single girths will be required with each tree.

(*d*) When "racks Mark II" (canvas) are issued, 1 pair of "bars hanging" and 1 "girth, leather" will be required. When "racks, Mark I" are used, the "girth, web, racks and hangers" is used with it. It is not suitable for the Mark II rack; neither are the "bars, hanging" and "girth, leather," suitable for the Mark I rack.

(*f*) Or bits, snaffle, with head in lieu.

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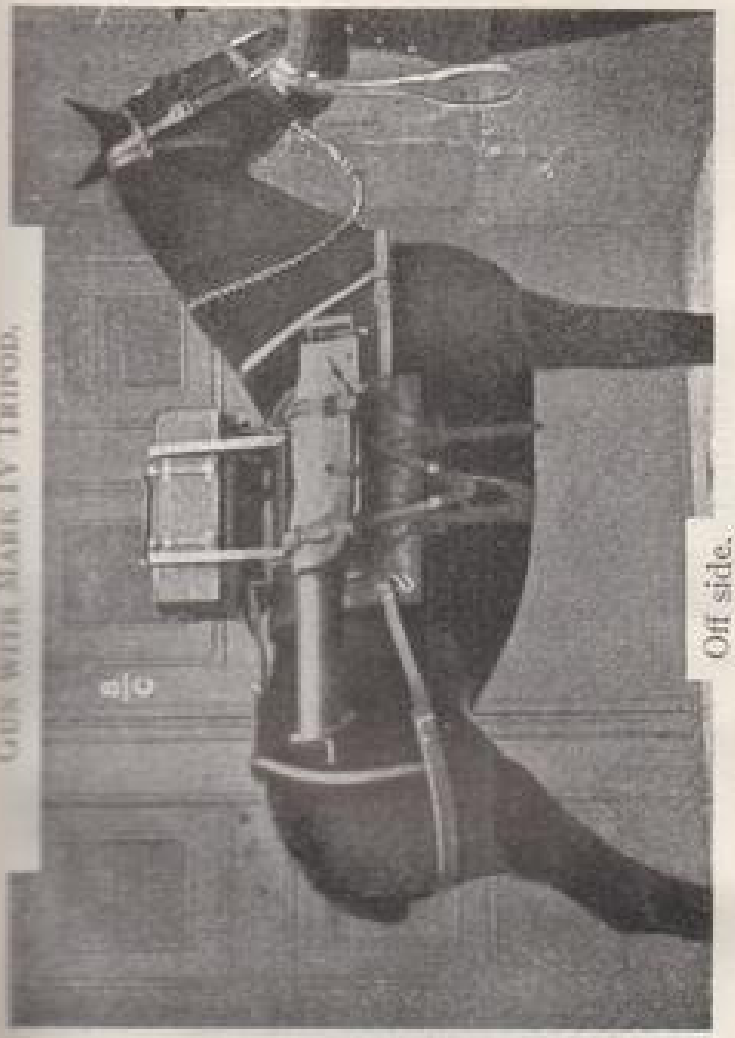
Description.	Per gun and tripod set.	Per ammunition set.	Weight of each article.
			lbs. ozs.
Reins, bridoon	1	1	0 12
Straps, girth, Mark II . .	4	4	0 4½
Surcingles, Mark III . .	1	1	2 2
Trees, adjustable . . .	1	—	7 4
Trees, Mark III or IV(small) modified	—	1 (a)	11 12
PACKSADDLERY, MACHINE GUN, ·303-INCH.			
Bottles, water	1	—	6 8
Caps, shovel, Mark II . .	—	1	0 11
Frames, wood, Mark II. .	1	1 (a)	4 0
Girths, web, racks and hangers, Mark II (d) . . .	1	1	1 10
Hangers, gun, adjustable tree	1	—	10 12
Hangers, tripod, adjustable tree	1	1	0 10
Rack, boxes, ammunition in belts (Mark I (d)) (Mark II (d))	—	2	15 1 4 12
Straps, girth (e)	4	4	0 1½

(a) Frames, wood, Mark I, will be issued with trees, small. Packsaddlery, M.G., until the stock of the latter is exhausted, when the Packsaddlery, G.S. Tree, small, Mark III or IV (modified) (15219 L. of C.) or Tree, Adjustable and frame, wood, Mark II, will be issued in lieu.

(d) When "racks Mark II" (canvas) are issued, 1 pair of "bars, hanging" and 1 "girth, leather," will be required. When "racks, Mark I" are used, the "girth, web, racks and hangers" is used with it. It is not suitable for the Mark II rack; neither are the "bars, hanging" and "girth, leather," suitable for the Mark I rack.

(e) For "girths, web, racks and hangers" only.



GUN WITH MARK IV TRIPOD.

Off side.

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MARK IV TRIPOD.

Near side.

The Loads will be distributed as under:

Near side.	Weight.	Centre on "Frame, wood."	Off side.	Weight.
	lbs.			lbs.
Tripod, Mark IV . .	47	Box 32 lbs.	Gun	67
Bottle, water . . .	21			
	68		Total .	67

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STORES CARRIED IN G.S. LIMBERED WAGONS FOR CAVALRY MACHINE GUN SECTION.

Articles.	No.	Approximate weight. lb.	Approximate weight. ozs.	Where carried.
FORE PORTION.				
Bar, carrying Maxim gun on tripod	1	1	10	Along top of ammunition belt boxes.
Belts, ammunition, Maxim ·303-inch, 250 rounds (in belt boxes (filled)	24	292	8	As shown.
Belts, ammunition, Maxim ·303-inch, 250 rounds (spare	2	32	4	As shown.
Box, spare parts and implements, Maxim, ·303-inch (filled) (a)	1	31	0	As shown.
Cans, filled (lubricating, No. 9 (b)	2	2	10	In case as shown.
Cans, filled (half-pint (c)	2	0	14	In case as shown.
Cases, can, ·303-inch tripod mountings	1	2	3	As shown.
Flannelette	3 yds.	0	2	Rolled in "Linen, old" as shown.
Guns, machine, protectors, muzzle	1	0	3	In case with gun.
Guns, Maxim, ·303-inch, in leather case, with cleaning rod and spare gun barrel	1	103	4	As shown.
Guns, Maxim, plugs, cork complete	1	0	1	In case with gun.
Linen, old	½ lb.	0	8	See above.
Mountings, tripod, ·303-inch Maxim gun, Mark IV, complete, with hoods, protecting	1	50	0	In leather case as shown.

(a) 10 yards of spare cord for mekometers are carried in addition to the usual stores, in this box (in one of the two wagons).

(b) For mineral oil 1 / For petroleum oil 1 } Per gun packed in one case, can, ·303-inch.

(c) For petroleum oil 1 / For turpentine 1 } Per gun packed in one case, can, ·303-inch.

Method of carrying. Remove dividing board and place diagonally across rear part of rear portion of wagon. Place gun in centre of fore portion, from front to rear. Eleven belt boxes on one side (and on to gun case), with tripod in hood (legs flat on floor), and spare part box as a wedge between it and the gun case on the other side, prevent all lateral motion without detriment to speed in handling the gun. Remainder of boxes (3) at end of tripod legs. Heavier end of gun and tripod to rear of wagon.

Muzzle attachment for ball firing	1	1	7	In case with gun.
Pins, joint, crosshead	1	10	0	With mounting as above.
Pins, joint, spare elevating gear	1	0	5	With mounting as above.
Plugs, belt, Maxim, ·303-inch set	1	0	4	In case with gun.
Reflectors, mirror, machine gun, ·303-inch	1	0	1	Rolled in "Linen, old" as above.
HIND PORTION.				
Axes, head, 4½ lbs.	1	4	8	In bottom of rear of wagon, loose.
Axes, pick helves, 36-inch, ferruled	1	3	4	In bottom of rear of wagon, loose.
Blankets, saddle (d)	2	10	8	Rolled with saddle luggage.
†Cartridges, small arm, ball, ·303-inch cordite boxes (e)	4	322	0	In four boxes in front bed of wagon.
Hook, bill	1	2	0	Loose under harness.
Luggage, saddle, with appurtenances, etc., shown in Cavalry F.S. Manual	1	43	4	Rolled in blanket under packsaddlery
Machine, belt-filling, in chest (f)	1	42	0	Right front under packsaddlery.
Packsaddlery, machine gun, ·303 inch (g) sets*	1	214	0	Stripped as shown.
Shovel, G.S.	1	3	8	With pick in bottom of wagon (rear part).
Surcingle, leather (h)	1	0	15	Strapped round luggage saddle.
Valise, horseshoe, with 3 sets of shoes (and nails)	1	20	0	In bottom of wagon.
Load		1,194	3	
G.S. limbered wagon equipped with spare parts and wagon equipment stores		1,269	13	
Total loaded G.S. limbered wagon		2,464	0	= 22 cwt. (about).

(d) For off horses. (e) Fore part.

(f) Only carried by one of the two wagons. The box is carried loose in the rear portion, and is clamped to the perch or use.

(g) Gun packsaddle in fore part, 2 ammunition pack saddles in rear part. *See* footnote.

(h) For the off lead horse.

* A set of machine gun packsaddlery consists of 1 gun packsaddle and 2 ammunition packsaddles. Each ammunition packsaddle has two racks, and each rack will accommodate three belt boxes.

The M.G. packsaddlery is normally carried in the limbered wagons. When required for use it will be carried by such of the draught horses of the vehicle, allotted to the machine gun section as may be found most convenient.

† One of the two wagons will carry an extra box of S.A.A.

N.B.—The stores for Mounted Infantry Machine gun section are generally similar to the Cavalry (*see* Mounted Infantry Field Service Manual) and are packed in a similar manner.

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STORES CARRIED IN G.S. LIMBERED WAGON FOR INFANTRY MACHINE GUN SECTION.

Articles.	No.	Approximate weight. lb.	Approximate weight. ozs.	Where carried.
FORE POSITION.				
Axes, pick { head	1	4	8	Across rear of wagon on top of belt boxes.
Axes, pick { helve, 36-inch, ferruled	1	3	4	
Bags, sand, common	15	8	14	Off hind portion in bundle as shown.
Bar, carrying Maxim gun on tripod	1	1	10	On top of gun case.
Belts, ammunition, Maxim, ·303-inch (in boxes) (a)	14	292	8	As shown.
Box, spare parts and implements, Maxim (filled) (b)	1	31	0	Off fore portion under belt boxes.
Cans { lubricating, No. 9 (c)	2	1	10	Off hind corner.
Cans { half-pint (d)	2	—	14	
Cases, cans, ·303-inch, tripod mountings	1	2	3	Under sand bags, off hind corner.
Clinometer, field (in case)	1	2	8	
Drum, oil, 5 gallons, with bung (containing spare supply of water)	1	37	8	As shown.
Flannelette	6 yds.	—	4	With clinometer.
Guns { machine, protectors, muzzle	1	—	3	In case with gun.
Guns { Maxim { ·303-inch, complete (in leather case, with cleaning rod and spare gun barrel)	1	103	4	In case as shown.
Guns { Maxim { plug, cork, complete	1	—	1	
Hooks, bill	1	2	0	Between gun case and near side of wagon.
Lamps, siege, candle with stand (in box)	2	12	10	In box as shown.

(a) Each belt contains 250 rounds, S.A.A.
(b) Contains in addition to usual stores, 20 yards of spare cord for mekometers.
(c) One for mineral oil, one for oil, petroleum, Russian, lubricating, packed in the case, can, ·303-inch.
(d) One for oil, petroleum, Russian, lubricating; one for turpentine, packed in the case, can, ·303-inch.

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Linen, old (for cleaning) lbs.	1	1	0	With flannelette round clinometer.
Mountings, tripod { ·303-inch Maxim gun, Mark IV, complete (with hood protecting)	1	50	0	As shown.
Mountings, tripod { pins, joint { crosshead	1	—	10	
Mountings, tripod { pins, joint { elevating gear	1	—	5	
Muzzle attachment, for ball firing	1	1	7	In case with gun.
Plug, belt, Maxim, ·303-inch	1	—	4	In case with gun.
Reflector, mirror, M.G., ·303-inch	1	—	1	Rolled in with clinometer.
Shovel, G.S.	1	3	8	As shown.
HIND POSITION.				
Axes, pick { head	1	4	8	Loose in bottom of wagon.
Axes, pick { helve	1	3	4	
Bags, sand, common	15	8	14	In near fore portion under lamps, siege.
Bar, carrying Maxim gun on tripod	1	1	10	In bed of wagon.
Belts, ammunition, Maxim, ·303-inch (in boxes) (a)	14	292	8	10 along off side bed; 4 on top off fore corner.
Blanket, saddle (e)	1	5	4	Round saddle.
Box, spare parts and implements, Maxim (filled)	1	30	12	In middle of bed of wagon as shown.
Cans { lubricating, No. 9 (c)	2	1	10	In cases under seat.
Cans { half-pint (d)	2	—	14	
Cases, cans, ·303-inch, tripod mountings	1	2	3	As above.
Clinometer, field (in case)	1	2	8	In corner next siege lamp, as shown.
Drum, oil, 5 gallons, with bung (containing spare supply of water)	1	37	8	Under seat.
Guns { machine, protector, muzzle	1	—	3	In case with gun. Fore and aft along bed of wagon in middle.
Guns { Maxim { ·303-inch, complete (in leather case, with cleaning rod and spare gun barrel)	1	103	4	
Guns { Maxim { plug, cork, complete	1	—	1	
Hook bill	1	2	0	In bed of wagon.
Lamps, siege, candle, with stand (in box)	2	12	10	In near fore corner as shown.
Luggage, saddle, with appurtenances, etc., as shown in Infantry F.S. Manual	1	41	4	In blanket, saddle, as shown.

(e) For the off-horse.

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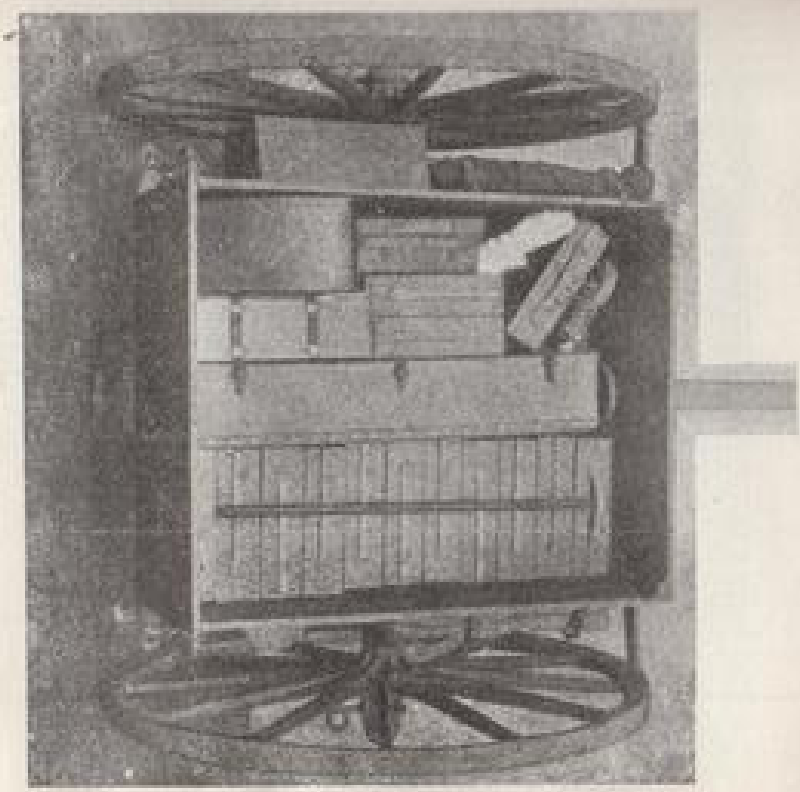
STORES CARRIED IN G.S. LIMBERED WAGON FOR INFANTRY MACHINE GUN SECTION.—cont.

Articles.	No.	Approximate weight.		Where carried.
		lb.	ozs.	
Machine, filling belts, Maxim, ·303-inch, Mark II (in chest) (*f*)	1	42	0	In off hind corner.
Mountings, tripod: ·303-inch Maxim gun, Mark IV, complete (with hood, protecting)	1	50	1	Athwart floor at rear of wagon.
Mountings, tripod: pins, joint: crosshead	1	—	10	Athwart floor at rear of wagon.
Mountings, tripod: pins, joint: elevating gear	1	—	5	Athwart floor at rear of wagon.
Muzzle attachment for ball firing	1	1	7	
Reflector, mirror, M.G., ·303-inch	1	—	1	In case with gun.
Shovel, G.S.	1	3	8	In case with gun.
Valise, horseshoe, with two sets of shoes, and nails . .	1	12	0	Fore and aft on near side. Alongside shovel and case, spare, as shown.
Load	—	1,224	9	
G.S. limbered wagon equipped with spare parts and wagon equipment stores	—	1,169	13	(Kits as shown).
Total loaded G.S. limbered wagon	—	2,404	6	22½-cwt. (about).

N.B.—In addition to above, the packs of Nos. 1, 2, 3 and 4 of Infantry machine gun detachments will be carried in the hind portion of the limbered wagon.

(*f*) The chest is carried loose in the vehicle, and the machine is clamped to the perch for use, 4 spare springs, action lever and 2 spare springs, pawl, are also in the chest.



WAGON, LIMBERED, G.S.
Fore portion.
PACKED FOR CAVALRY MACHINE GUN SECTION.

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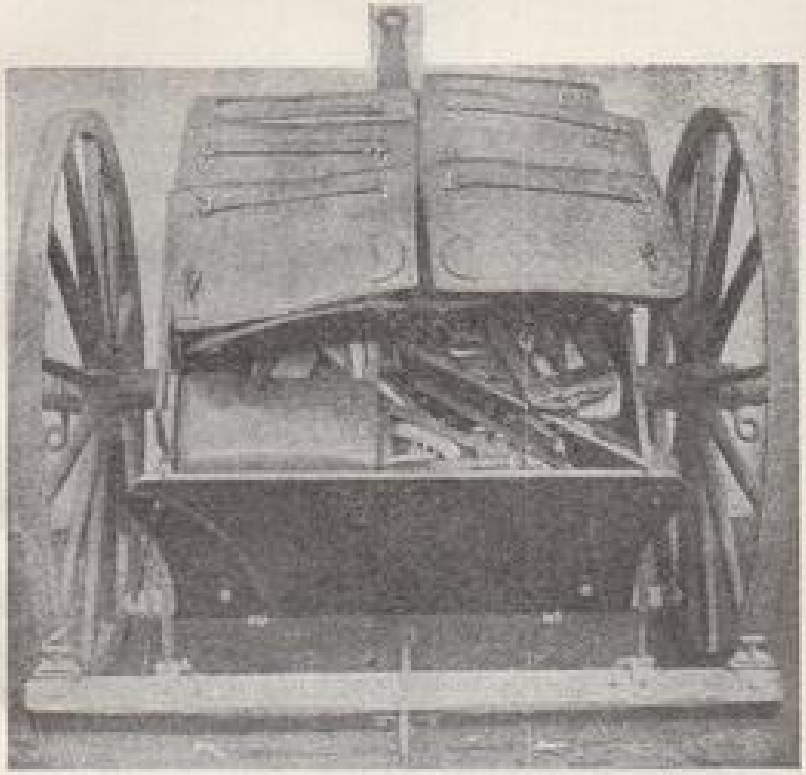
WAGON, LIMBERED, G.S.
Hind Portion.
PACKED FOR CAVALRY MACHINE GUN SECTION.



WAGON, LIMBERED, G.S.
Fore Portion.
PACKED FOR INFANTRY MACHINE GUN SECTION.

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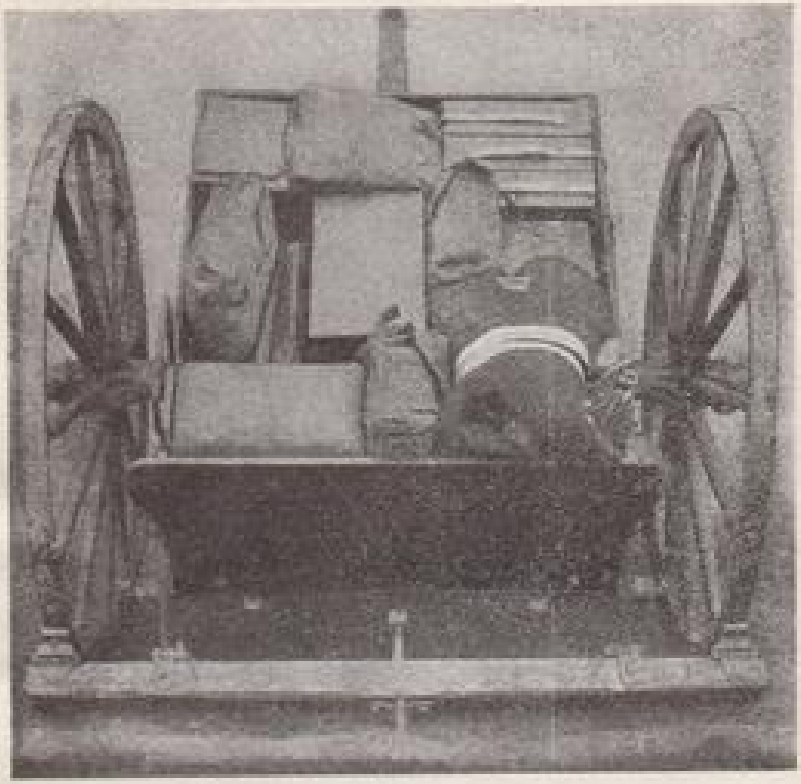
WAGON, LIMBERED, G.S
Hind Portion.
PACKED FOR INFANTRY MACHINE GUN SECTION.



VICKERS LIGHT MACHINE GUN

POINTS IN WHICH THE VICKERS LIGHT GUN ·303-INCH AND THE MAXIM ·303-INCH GUN DIFFER.

Vickers Light Gun, ·303-inch.	*Maxim Gun, ·303-inch.*
Weight, ready for firing, 38½ lbs. (with water in casing).	67 lbs.
Length about ¾-inch shorter than the Maxim gun.	
Width about 1¼-inch narrower than the Maxim gun.	
Depth about 1¾-inch shallower than the Maxim gun.	
The barrel casing (which has longitudinal corrugations to strengthen it, and afford greater cooling surface) is of steel.	Is of gun metal and without corrugations.
It has a gun metal shoot, in the front end of it, which acts as a guide for the barrel, when it is being replaced after stripping.	There is nothing to act as a guide for the barrel.

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The rear end of the barrel casing goes back sufficiently far to permit the lead being surrounded by water whilst the gun is firing. This greatly assists in the cooling of the barrel at the point where it is most required.	The chamber is not surrounded by water.
The foresight is of blade pattern, and has a protector.	The foresight is a Barley corn, and has no protector.
The barrel casing is riveted to the breech casing.	The barrel casing is dovetailed into the breech casing.
There is no ejector tube and spring, but there is an opening at the bottom of the breech casing through which the empty cases fall to the ground.	Has an ejector tube, spring, but no opening.
There are two covers (front and rear). On the rear of the front cover is an extractor stop.	Only one cover. There is no extractor stop.
The tangent sight is	The tangent sight

placed about ½-inch from the rear end of the breech casing and the sight is U pattern. When down, the tangent sight rests on a bridge which is solid with the rear cover, thereby strengthening it.	is about 3-ins. from the rear end of the breech casing, and the sight is a V.
The rear cover lock has to be lifted to open.	The cover lock has to be pushed in to open.
The cover is fitted with 2 steel ramps in lieu of 2 cover springs, and has no gun metal block.	
On the inside of the rear cover are guides for the outside plates to fit into.	There are no guides.
There is also the trigger bar, which is of steel.	Trigger bar of gun metal, and runs along inside of bottom plate.
On the right hand plate is the check lever, which is about the centre of the breech casing, near the bottom edge.	The check lever is fitted near the rear end of the breech casing.

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There is no buffer spring or resistance piece.	
The check lever has a small spiral spring and piston inside it. This causes the crank handle to be momentarily held down while the breech is closed.	Has no spiral spring or piston.
The slide, right, carries the roller.	Has a resistance piece and buffer spring in lieu of roller.
On the outside of the left hand plate is an elevating stop.	There is no elevating stop.
There is no stud for the shoulder piece.	
On the inside of both plates, are the cams for controlling the path of the backward movement of the horns of the extractor.	Cams are riveted to the side plates.
These cams are solid with the plates.	
They have a step near the rear end which prevents the lock going forward if it has not travelled back far enough to allow the extractor to clear the cams.	They have no stop.

The rear cross piece is of steel. It is joined to the outside plates at the bottom by a screwed joint pin.	Is of gun metal. The rear cross piece is connected to the outside plates by dovetails and fixing pin.
There are guides cut in it, into which fit the ends of the outside plates.	
The handles are of wood with steel cylinders for oil.	Are of gun metal and form oil bottles.
The barrel is browned. With the barrel of the Maxim gun, which is coppered, it is possible for rust to form under the copper without being detected. The outside of the barrel must be oiled after the gun has been used.	The barrel need not be oiled after firing.
There is a groove round it near the muzzle in which lies the body of the clamping screw of the muzzle attachment.	There is no groove.

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The front of the barrel block bears against the rear end of the barrel casing.	
There is no gun metal valve.	
The left side plate has no connecting rod spring.	Has a connecting rod spring.
Both side plates have side plate springs.	Only the right side plate has a spring.
Connecting rod has an adjusting nut and washers.	Has cotter and washers to adjust by.
The crank handle revolves in a direction opposite to that in which they work in the Maxim gun.	
The lock, which is inverted, as compared to the lock of the Maxim gun, is joined to the connecting rod by means of an interrupted flange.	Is joined by an interrupted screw.
The lock has no extractor spring, as the cases are free to fall off the extractor when clear of the barrel.	
The lock casing has a	The lock spring

piece riveted inside at the top, which acts as a guide for the lock spring. No axis pin is required to keep it in position.	is kept in position by an axis pin.
The whole lock can be easily stripped by means of the hand screw which forms the axis pin of the trigger bar lever.	Drifts and mallet required to strip the lock.
The feed block is of steel. Has no band roller.	Is of gun metal.
The top pawls are made with finger pieces and can be pressed down by hand to allow the belt to be released.	An implement has to be used. Has 2 springs, which are riveted.
They have only one spring, which is removable.	Has no finger piece.
The bottom pawls are joined together by a finger piece.	The bottom pawls are separate.
The fusee spring box is of steel.	Is of gun metal.
The fusee spring can be adjusted without removing the box, as the vice pin of the screw is loose.	To adjust the spring the box has to be removed, the vice pin being fixed,

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	prevents the screw from turning when on the gun.
The fusee has a clutch fixture, and is easily removable.	The fusee is screwed into the crank and cannot be so quickly removed.

General Advantages of Light Gun.

(*a*) Lightness.

(*b*) Simplicity in stripping and assembling.

(*c*) Greater general strength, especially of recoiling portions. (Side levers have been subjected to withstand a pressure of 75,000 lbs.).

(*d*) No tools required to strip the lock or change barrel.

(*e*) Better means of safety, e.g., gun cannot be fired unless the cover is down.

(*f*) Faults in feed more easily rectified.

(*g*) Having no ejector tube, economizes space, in depth.

(*h*) Reverse action of crank shortens breech casing.

VICKERS LIGHT AUTOMATIC MACHINE GUN.

·303-inch Calibre Magazine Rifle Chamber.

Nomenclature of parts of gun.

Lock. Consisting of—Casing; side levers; axis bush and split pin; extractor levers right and left; extractor; gib; gib spring and cover; sear and spring; trigger and axis pin; tumbler and axis pin; lock spring; firing pin.

Block, feed. Consisting of—Body; slide; top and bottom levers and split pin; top and bottom pawls (front and rear) and axis pins; top pawl spring; bottom pawl spring.

Rear Cross Piece. Consisting of—Body; T fixing pin; joint pin; check nut and keeper pin; firing lever with pawl and axis pin; trigger bar lever; safety catch, axis pin, spring with piston; milled heads with oil brushes and leather washers.

Box, fusee spring.

Spring, fusee, including fittings.

Screw, adjusting, with vice pin, fusee spring.

Fusee, with chain and fixing pin.

Plate, side, right, including side plate spring.

Plate, side, left, including side plate spring.

Crank, including crank pin and fixing pin.

Rod, connecting, including adjusting nut and six washers, three No. 1 (·003 inch); three No. 2 (·005 inch).

Handle, crank, including fixing pin.

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Barrel, with asbestos packing.

Sight, tangent. Consisting of — Stem; graduated plate and two fixing screws; slide; pinion; pawl and fixing pin; slide spring; milled head and fixing screw; axis pin; tangent sight spring and piston.

Cover, rear. Consisting of—Cover; cover lock, axis pin and spring; trigger bar and spring; cover joint pin with check nut and keeper-pin.

Cover, front.

Casing, barrel. Consisting of—Casing; steam tube with slide valve and keeper screw; packing gland; asbestos packing; two screwed plugs each with link, S-hook and stud; protector for condenser boss with chain and swivel.

Plug, cork, including chain and two S-hooks.

Sight, fore.

Casing, breech. Consisting of—Casing; check lever, keeper pin, piston and spring; sliding shutter with catch, keeper pin, spring and plunger; slide left; slide right with roller, collar and split fixing pin; front cover catch, keeper pin, plunger, plug and spring.

Muzzle attachment for ball-firing. Consisting of—Gland; cup, muzzle, with clamping screw; cone, front; disc; outer casing with split keeper pin with S-hook and chain.

N.B.—Casings, breech and barrel, are riveted together, and cannot be separated.

·303-inch Vickers Gun.

Explanation of Plates.

Similar numbers indicate corresponding parts in all the plates.

1. Casing, barrel.
2. Tube, steam.
3. Bracket, foresight.
4. Gland.
5. Casing, breech.
6. Cover, front.
7. Cover, rear.
8. Sight, tangent.
9. Bar, trigger.
10. Lock, rear cover.
11. Rear-crosspiece.
12. Lever, firing.
13. Lever, trigger bar.
14. Catch, safety.
15. Plugs, screwed.
16. Ditto.
17. Protector, screwed, condenser boss.
18. Plug, cork.
19. Guide, front, barrel bearing.
20. Crosshead.
21. Cams, right and left.
22. Steps of cams, right and left.
23. Catch, front cover.
24. Pin, screwed, joint cover.
25. Pin-T, fixing, rear-crosspiece.
26. Pin, screwed, fixing, crank handle.
27. Slides, right and left.
28. Roller.
29. Pin, screwed, joint, rear-crosspiece.
30. Bracket, check lever.

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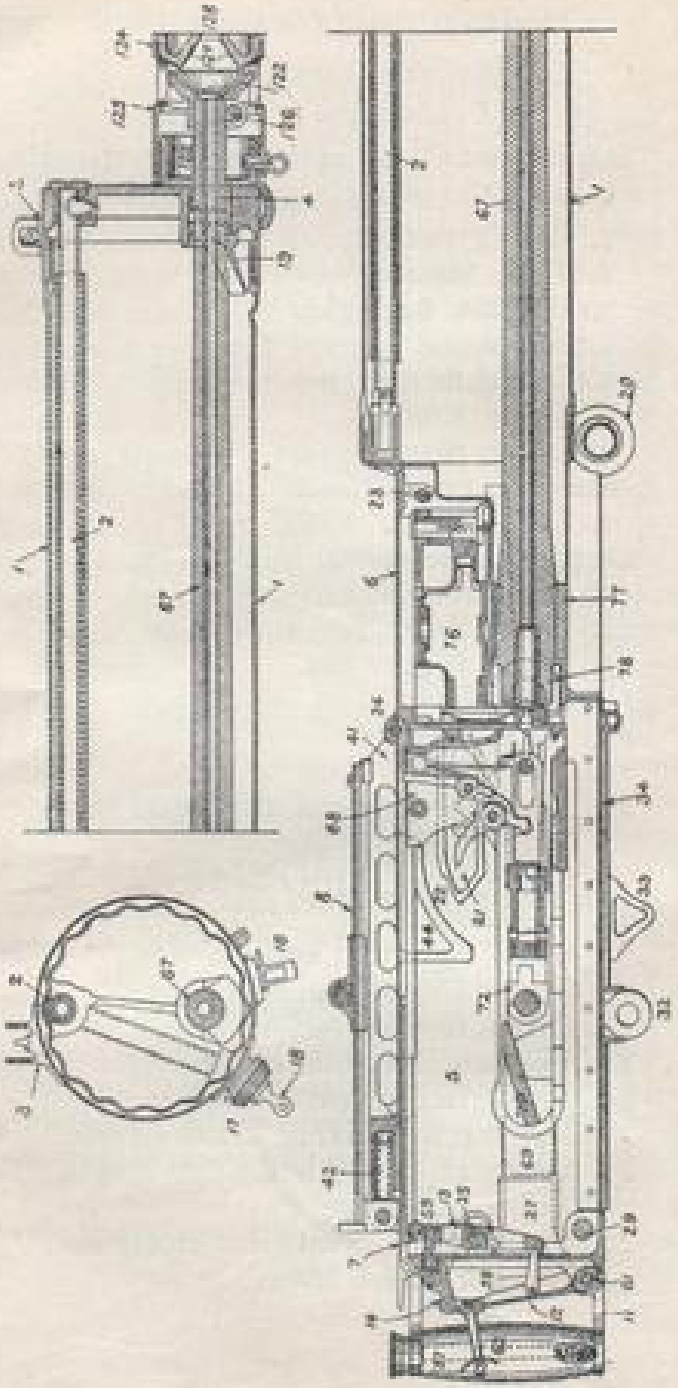

31. Lever, check.
32. Bracket, elevating joint.
33. Stop, mounting.
34. Plate bottom, breech casing.
35. Shutter, sliding.
36. Hooks of front cover catch.
37. Hole for keeper pin, front cover catch.
38. Lever of catch, front cover.
39. Grooves in front cover catch to clear "36."
40. Plunger, front cover catch.
41. Bridge, rear cover.
42. { Spring tangent sight. / Piston " "
43. Grooves in rear cover for ribs on "5."
44. Ramps, rear cover.
45. Spring, rear cover lock.
46. Spring, trigger bar.
47. Lug on trigger bar for "46."
48. Base of tangent sight stem.
49. Hooks of rear cover lock.
50. Lug on rear cover lock for "45."
51. Slot in trigger bar for "86."
52. Lug on trigger bar for "13."
53. Thumb-piece, sliding shutter catch.
54. Ditto.
55. Plunger, sliding shutter catch.
56. Arms of rear-crosspiece.
57. Grips, rear-crosspiece.
58. Pawl, firing lever.
59. Spring, safety catch, with piston.
60. Pin, screwed, axis, safety catch.
60a. Finger grips, safety catch.
61. Pin, screwed, axis, firing lever.

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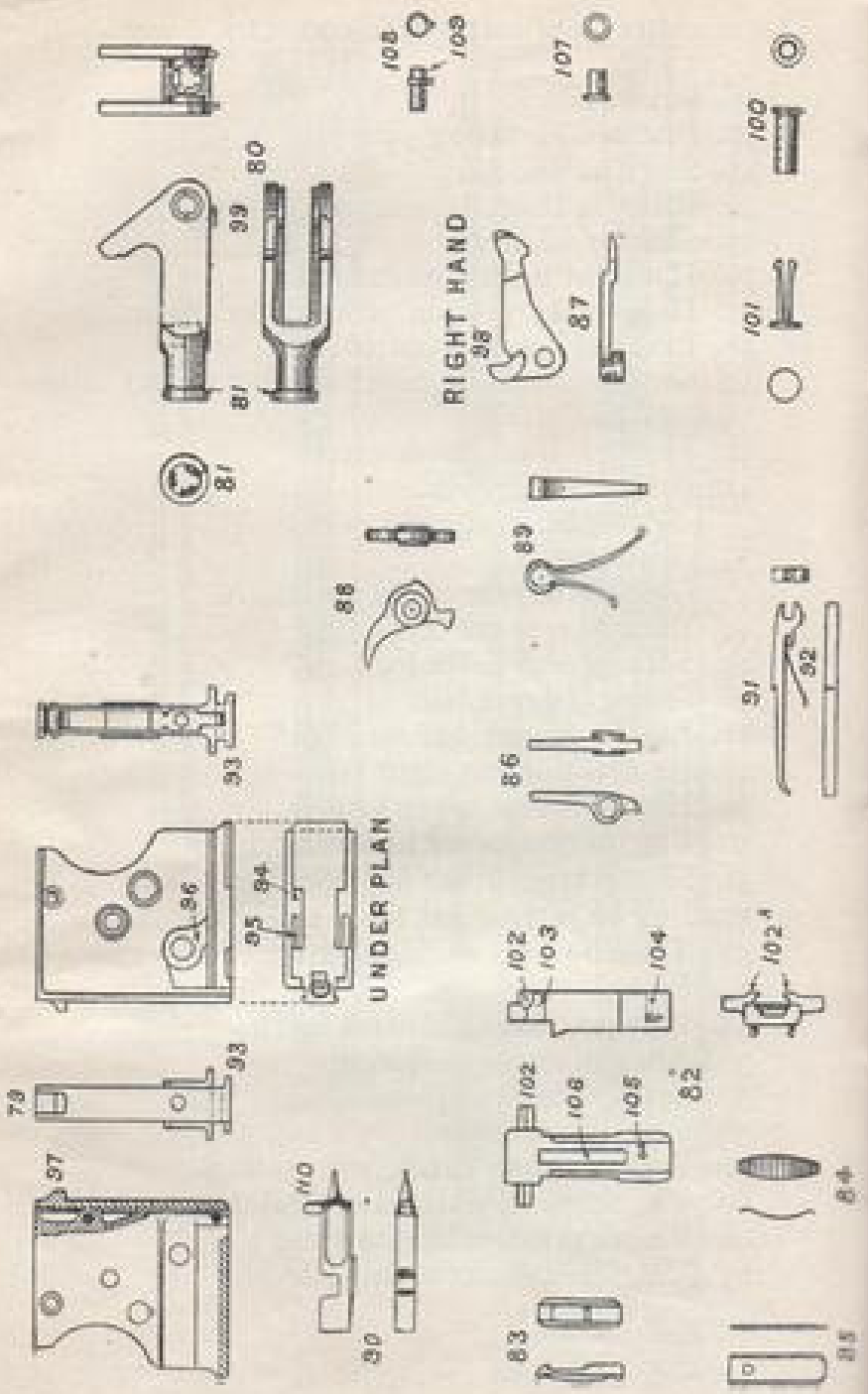

62. Thumbpiece, firing lever.
63. Ditto.
64. Pin, keeper, check lever.
65. Piston, check lever.
Spring, " "
66. Recess in check lever for "65."
67. Barrel.
68. Casing, lock.
69. Plate, side, right.
70. Crank.
71. Handle crank.
71a. Tail of crank handle.
71b. Knob of crank handle.
72. Rod, connecting.
72a. Stem of connecting rod.
73. Fusee.
73a. Chain, fusee.
74. Spring, fusee.
74a. Hook, fusee spring.
75. Box, fusee spring.
75a. Screw, adjusting, fusee spring.
76. Block, feed.
77. Cannelure in "67" for asbestos packing.
78. Trunnion block, barrel.
79. Lock.
80. Levers, side (pair).
81. Socket of side levers for "72a."
82. Extractor.
83. Gib.
84. Spring, gib.
85. Cover, gib spring.
86. Trigger.
87. Lever, extractor, right.

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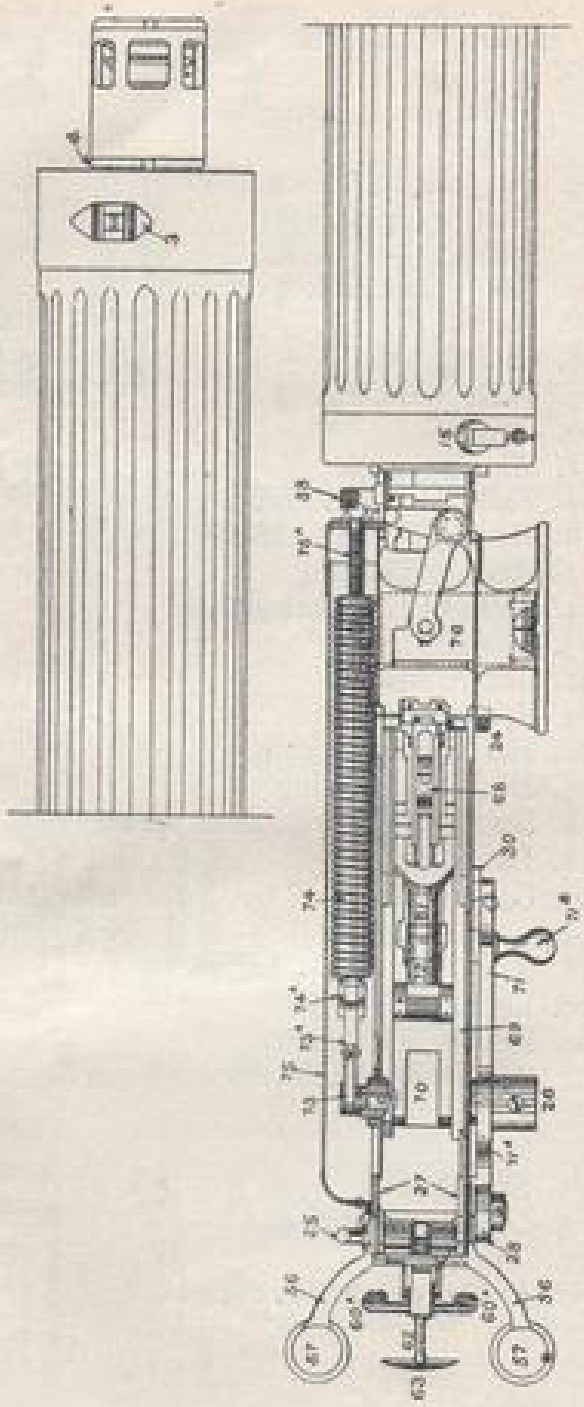

88. Tumbler.
89. Spring, lock.
90. Pin, firing.
91. Sear.
92. Spring, sear.
93. Flanges of lock casing.
94. Interruptions in flanges of lock casing.
95. Slots in lock casing for " 99."
96. Bearings on lock casing for " 90."
97. Upper extractor stop of lock casing.
98. Bent of extractor lever for " 80."
99. Lugs on side levers for " 95."
100. Bush, axis, side levers.
101. Pin, split, keeper, bush, axis, side levers.
102. Horns of extractor.
102a. Grooves in extractor for " 79."
103. Shoulders of extractor for " 87."
104. Grooves in extractor for side plate springs.
105. Hole in extractor for " 90."
106. Recess in extractor for " 83."
107. Pin, axis, trigger.
108. Pin, axis, tumbler.
109. Key of pin, axis, tumbler.
110. Projection on firing pin for " 89."
111. Lever, top, feed block.
112. Lever, bottom, feed block.
113. Pins, split, fixing, top and bottom levers, feed block.
114. Stud of top lever for feed block slide.
114a. Slide, feed block.
115. Pawl, top, feed block, rear.
115a. Thumb grips of " 115 " and " 116."

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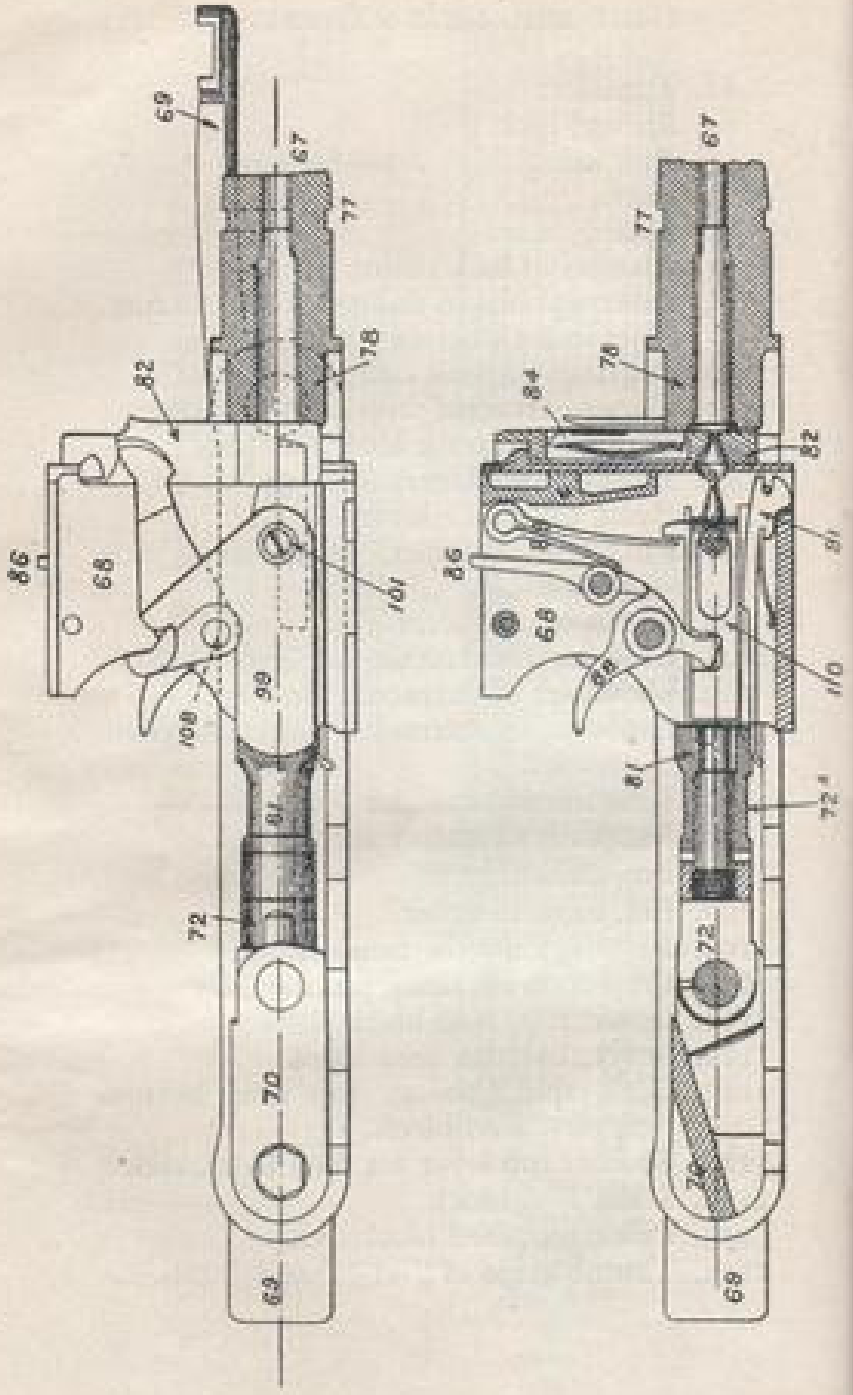

116. Pawl, top, feed block, front.
117. Spring, top pawls, feed block.
118. Pawls, bottom, feed block (pair).
119. Pin, axis, bottom pawl, feed block.
120. Fingerplate of bottom pawls, feed block.
121. Spring, bottom pawls, feed block.
122. Cup, muzzle attachment.
123. Casing, outer, muzzle attachment.
124. Cone, front, muzzle attachment.
125. Gland, muzzle attachment.
126. Screw, clamping, cup, muzzle attachment.
127. Disc, muzzle attachment.
128. Vent, bullet, muzzle attachment.

General Description.

(1) Weight of gun 28½ lbs. (including muzzle attachment weighing about 1 lb.). 38½ lbs. with water in casing.

(2) The gun may be considered to be divided into two portions, the non-recoiling and the recoiling. It is worked automatically by two forces, (1) the explosion of the charge (2) a strong spring (called the fusee spring).

Non-recoiling portion.

(3) The non-recoiling portion consists of the barrel casing and breech casing, and is attached to the mounting by the crosshead and elevating joint pins.

(4) The barrel casing is of steel with longitudinal corrugations, the interior being tinned to prevent rust. It has three openings, one on the upper right side near the breech for

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filling, one underneath near the muzzle for drawing off the water, and the third (also near the muzzle) for allowing the steam, but not the water, to escape. The first two are closed with screwed plugs; the last is open and connected with the steam tube.

(5) A cork plug is provided which can be inserted in the steam escape hole when the gun is travelling in order to prevent waste of water from jolting. The plug should always be taken out before commencing to fire and put in again before the gun changes position. The cork plug fits into a special fitting made to receive the tube connected with a condenser. This fitting is provided with a protector to be used when the condenser is not connected to the gun.

(6) The front end of the barrel casing contains a gunmetal guide to lead the barrel into the front of the barrel casing when the barrel is being replaced after stripping; it forms a bearing for the barrel and at the same time a seating for the asbestos packing

(7) To prevent the escape of water there is at the forward end of the barrel casing asbestos packing, which is held in position round the barrel by the packing gland. At the rear end of the barrel there is a cannelure, also filled with asbestos packing, which prevents the escape of water.

(8) The steam tube, which is of brass, consists of a fixed tube and an outer tube, termed the slide valve, so arranged as to slide freely along the fixed tube. In the

fixed tube there is a hole near each end, and a third hole in the threaded portion in front, to connect with the steam escape hole which is bored into the solid part of the front end of the barrel casing. This tube is fixed into the solid end of the barrel casing, and is retained in position by a screw which, being kept in adjustment by a keeper screw, ensures that the third hole coincides with the steam escape hole. At the breech end it fits into a thimble fixed to the rear end of the barrel casing.

If the gun is fired with elevation, the valve slides backwards and, closing up the hole at the rear end of the tube, prevents the water entering; at the same time it leaves the front hole uncovered, which, being above the water level, allows the steam to enter the tube and escape through the steam escape hole in the barrel casing. Similarly, if the gun is fired with depression, the valve slides forward and allows the steam, but not the water, to escape through the rear hole. When the gun is horizontal, either one or both holes are uncovered by the valve.

(9) The foresight is blade-shaped in design. It is protected by side wings formed on the block fixed to the barrel casing, in which the foresight dovetails. There is an opening in the right wing through which the foresight is assembled, and a punch hole in the left wing for adjusting and removing.

(10) The breech casing, which is riveted to the barrel casing, consists of two outside

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plates (right and left) and a bottom plate. It is closed at the top by the two covers, front and rear, and at the end by the rear cross piece.

(11) There is an opening in the bottom plate through which the empty cartridge cases fall to the ground. This opening has a sliding shutter which, when shut, prevents dirt, etc., entering the gun. The shutter must be moved to the rear before the gun can be loaded. If the shutter is closed after loading, one shot only can be fired, but the empty case would remain in the breech casing and another cartridge would be fed up; the extractor dropping on to the shutter would prevent the lock going forward.

There is a seating for ejection on the bottom of the barrel casing which ensures the empty case being knocked off the extractor should it fail to drop off before the lock travels forward.

(12) On the outside of the right hand plate is the check lever, which pivots on a stud and is secured by a keeper pin. The stud has a groove cut in it to allow for the movement of the check lever and pin. The check lever has a small spiral spring and piston inside it, which bear against a second stud and, by their action, force the check lever over, thus causing the crank handle to be momentarily held down while the breech is closed.

(13) On the outside of the left hand plate are two studs for holding the front end of the fusee spring box. There is also an elevating stop, without which it is possible for the

bracket head of the mounting to damage the fusee box. Both plates have openings in the rear end, which are partly closed by slides, in which the crank bearings move.

(14) The right slide carries the roller, collar, and split fixing pin; the left slide has a stud for holding the rear end of the fusee box.

(15) On the inside of both plates are cams, which control the path of the extractor. These cams have a step cut in each, on the rear sloping surface. These steps are for the purpose of preventing the lock going forward when the recoiling portions have not come back far enough to allow the extractor to drop. They are also the means of hanging the lock.

(16) The outside plates are connected at the rear end by the rear cross piece, which is hinged at the bottom by a screwed joint pin. This piece is fitted with handles of wood, inside which are steel cylinders for carrying oil; these are closed by milled heads fitted with brushes; firing lever with thumb piece; trigger bar lever; safety catch; safety catch piston and spring, which also actuates the trigger bar lever.

(17) The upper end of the rear cross piece is fixed in position by a T-shaped screwed pin, which passes through the side plates from left to right. The pin acts also as an axis pin for the trigger bar lever and a tool for stripping the lock and other parts of the gun. The trigger bar lever draws back the

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trigger bar by the action of a pawl on the firing lever, pressing forward its lower end.

(18) The two covers are both hinged on one joint pin attached to the outside plates just behind the feed block. The pin is secured by a check nut with a split keeper pin. The joint also forms a tie for the outside plates.

(19) The front cover is secured by a catch which must be turned up to open it. This catch, when down, is kept in position by a plunger and spring. There is also an extractor stop, inside, at the rear end of it. This, together with the stop on the lock casing, prevents the extractor from rising too high.

(20) On the top of the rear cover about ½ inch from the rear end of the breech casing is the tangent sight which is positioned by a piston and spring. The sight, when down, rests on a bridge, which is solid with the rear cover and strengthens it. The sight is " U " pattern.

(21) The tangent sight consists of stem, a plate graduated up to 2,900 yards, and slide. Running through the centre of the slide is a pinion, the teeth of which work in the rack on the stem. A *pawl* is secured to the pinion by a fixing pin. On the underside of one end of the pawl are teeth, which engage in the circular rack on the slide.

When the slide is at rest the stud on the inside of the milled head (nearest the slot for the slide spring) bears on the stud on the pawl immediately over the teeth, being actuated

by the slide spring, thus forcing the teeth into the circular rack. This keeps the slide stationary on the stem. On rotating the milled head, this stud is partly disengaged from the stud on the pawl, thus permitting a second stud on the milled head to press on one side of the V-shaped ramp at the other end of the pawl. This action releases the teeth sufficiently to permit the pawl being moved round the circular rack by the action of the stud bearing on one side of the V-shaped ramp on the pawl; this moves the slide along the stem. On releasing the milled head, the spring positions the cover, thus causing the stud on the pawl to become once more engaged with the stud on the milled head and force the teeth into the rack.

(22) The rear cover lock is actuated by a flat spring on the inside of the cover and has to be lifted to open.

(23) The rear cover and rear cross piece are grooved to fit over the edges of the breech casing, so that when the rear cross piece screwed fixing pin (which is T-shaped) is home and the cover locked, these, with the assistance of the screwed cover joint pin, keep the casing and cover rigid.

(24) The trigger bar slides inside the rear cover. It has a lug on the right, against which the trigger bar spring bears, and a projection on its rear end which engages the bent of the trigger bar lever.

(25) There are also two ramps fixed inside the cover which force the extractor down on

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recoil, and guides, which assist in keeping the lock down.

(26) *Muzzle attachment for ball firing.* A steel muzzle attachment for ball firing is provided to assist recoil. When the attachment is fitted on the gun, the gland replaces the packing gland. The muzzle cup is fixed to the barrel by the clamping screw, the body of which lies in a circular groove on the barrel, thus preventing the muzzle cup from being blown off the barrel should the clamping screw become loose. The outer casing is attached to the gland by an interrupted flange and spring keeper pin. The front cone screws into the front end of the outer casing, and, to protect its face from erosion, it is covered by a thin steel disc which, when badly eroded, can be replaced by a spare one. The gland and front cone have flanges which are grooved to receive the combination tool provided for assembling and stripping purposes.

Recoiling Portion.

(27) The recoiling portion (which is mounted inside the non-recoiling portion) consists of a barrel and two side plates, which carry the crank and lock.

(28) The barrel is browned and has a groove round it near the muzzle for the clamping screw of the muzzle attachment. At the breech end it is formed with a square block, which is provided with two studs (one at each side) called the barrel trunnions. By means of these trunnions the barrel is connected to the side plates.

(29) The front of the barrel block bears against the face of the barrel bearing in the barrel casing.

(30) The side plates are both bored to receive the barrel trunnions, and also guides, along which the flanges of the lock move. These guides have two interruptions on each side to enable the lock to be lifted out. In addition, each side plate has a bearing through which the crank passes, thus connecting the latter with the barrel; these bearings move in slots in the breech casing.

(31) Both side plates are fitted with side plate springs to ensure that the horns of the extractor do not drop below the solid cams during the backward movement of the lock when there are no cartridges on the extractor.

(32) The left side plate is prolonged to the front, and has a recess in which the bottom lever of the feed block engages.

(33) The crank is fitted with a connecting rod, which is free to rotate on the crank pin, and, outside the breech casing on the right, with a curved handle, the upper surface of which bears on the roller when the gun is firing. On the left it is fitted with a fusee to which is attached a chain of two links, by means of which it is connected to the fusee spring.

(34) The connecting rod is attached to the crank by means of an axis pin called the crank pin, and is arranged to take the lock by means of an interrupted flange, thereby connecting the crank and lock. It has an ad-

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justing nut and washers which enable its length to be increased. By this means it is ensured that a firm pressure is kept on the base of the cartridge at the moment of firing, thus preventing separations.

(35) On the left of the breech casing there is a strong spiral spring called the fusee-spring, the rear end of which is connected by the fusee chain and fusee with the crank; the fore-end is attached to the breech casing by means of the fusee spring box and adjusting screw, which passes through the front end of the fusee spring box, and through the nut at the front end of the spring.

(36) The fusee spring can be adjusted without removing the box, as the vice pin of the screw is loose. This screw is kept in position by two nibs which fall into recesses by the tension of the fusee spring. The fusee is attached to the crank by means of a stem and lugs, and is easily removed.

(37) The lock is attached to the connecting rod by the side lever head, and when in the firing position closes the breech. In this position it is held by the side levers, the crank (fixed in bearings in the side plates), and the connecting rod, which are all slightly below the horizontal, to prevent the breech being opened at the moment of firing. The lock has a reciprocating motion communicated to it by the rotation of the crank, and is kept in position during its backward and forward movements by means of flanges working along guides on the side plates, and by the guides underneath the rear cover.

(38) The lock casing has a piece riveted inside at the top of the front face, which acts as a guide for the lock spring when assembling the lock. On its underside it has flanges which work on the guides on the side plates. The lower of these flanges has interrupted portions to agree with those in the guides, and allow the lock to be removed from the gun.

(39) The extractor is attached to the front end of the lock by guide ribs, upon which it slides, and contains the gib.

(40) The projections on the gib, together with the cartridge grooves, form recesses which retain the cartridge in position.

(41) The extractor is moved upwards by means of the side and extractor levers. The upward and downward movements of the extractor are regulated by guide ribs and stops; the top and bottom stops form part of the lock casing; the bottom one regulates the drop of the extractor by limiting the travel of the extractor levers.

(42) The feed block, which fits under the front cover into a recess cut in the breech casing, is provided with a slide to which are attached two pawls with spring for the purpose of moving the cartridges from right to left. These pawls are made with finger pieces and can be pressed down together, releasing the pawls from the belt; the slide has a transverse motion given to it by means of two levers which are fitted together; the

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top lever has a stud which engages a slot in the slide, and on the bottom lever is a stud which engages in a recess in the left side plate; by this means the slide is connected with the recoiling portion. The feed block has also two stationary pawls which are connected by a finger piece, and which engage under the belt and prevent it slipping backwards during firing. The feed block is provided with guides fitted above and below in the cartridge way, which ensure the cartridges coming to the exact position where they can be gripped by the extractor; they are prevented from being pushed too far through to the left by means of the cartridge and bullet stops, which are inside the feed block.

(43) The gun is supplied with cartridges from a belt which passes from right to left through the feed block. This belt is formed by two pieces of webbing connected together by eyelets and brass strips of two lengths, the projecting strips showing how far the cartridges should be inserted; the belt is made thick at the edge next the bullets by being folded over a piece of cord, so that the cartridges may be kept parallel in passing through the feed block, and lie evenly in the ammunition belt boxes.

Action of Mechanism.

Loading.

44. To load the gun—(*a*) Pass the tag end of the belt through the feed block from the

right side; (*b*) then with the right hand pull the crank handle on to the roller; (*c*) with the left hand pull the belt straight through as far as it will go; (*d*) let go the crank handle; the first cartridge will then be gripped by the extractor. Repeat the above and, when this has been done, the first cartridge will be in the chamber, and another gripped by the upper part of the extractor. The gun is then ready for firing.

On raising the safety catch and pressing the thumb piece the gun will fire automatically until pressure is released. The lock will then be home, and the extractor will be found to be gripping (*a*) a live cartridge in the feed block and (*b*) a live cartridge in the chamber.

Unloading.

45. To unload the gun.—Pull the crank handle on to the roller twice in succession, (without pulling the belt), letting it fly forward to the check lever each time; press up the bottom pawls and remove the belt from the feed block—then release the lock spring.

Effect of the force of the explosion of the charge.

46. Suppose the gun to have just fired the first cartridge in the belt, the extractor will be gripping the second live cartridge in the feed block and the empty case, which has just been fired, in the chamber; the explosion will cause the recoiling portion to move backwards through a distance of about one inch, thereby extending the fusee spring.

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This backward movement is due partly to recoil and partly to the effect of the ball-firing attachment which acts as follows: The powder gases which escape from the muzzle after the exit of the bullet strike violently against the front cone and rebound on to the front face of the muzzle cup, driving it and the barrel, to which it is attached, backwards. The gases then escape into the air through the openings in the outer casing.

47. Action in the feed block. A recess in the prolongation on the left side plate actuates a stud on the bottom lever of the feed block. The bottom lever acts on the top lever, which moves the slide and the top pawls to the right, to engage behind the cartridge held in place by the bottom pawls.

48. Rotation of the Crank. The backward movement of recoil causes the tail of the crank handle to roll against the roller, thereby rotating the crank. The rotation of the crank draws back the lock and causes the fusee to wind the fusee chain, and thus further extend the fusee spring. The continued rolling of the crank handle against the roller assisted by the fusee spring forces the whole of the recoiling portions forward again, with the exception of the lock, which continues its backward movement for about another inch, and then goes slightly forward again. As the recoiling portions go forward, the recess in the prolongation of the left side plate actuates the stud on the bottom lever of the feed block. This

bottom lever acts on the top lever, which moves the slide and the top pawls to the left, the pawls thus bringing the third cartridge in the belt to a position against the cartridge and bullet stops, ready to be gripped by the extractor. The belt, as it moves to the left, slides over the bottom pawls, which are depressed as the cartridge passes over them, and rise behind the fourth cartridge, holding the belt in position and preventing it from sliding back after the second cartridge has been withdrawn by the extractor.

49. The Lock.—As the lock moves backwards the extractor withdraws the empty case from the chamber and a live cartridge from the belt in the feed block. The horns of the extractor move along the upper surface of the solid cams until the cartridge is clear of the belt. When the extractor arrives at the rear end of the cams it is forced down by the ramps in the cover, thus bringing the cartridge drawn from the feed block in line with the chamber, and causing the empty case drawn from the chamber to fall off the extractor. The live cartridge is prevented from slipping down the face of the extractor by the bottom projection of the gib. (If the empty case does not fall off when the extractor drops, it will be forced off by the seating for ejection on the bottom of the barrel casing when the extractor rises.)

50. Cocking Action.—The rotation of the crank gives an upward motion to the con-

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necting rod and side lever head, which latter, bearing on the tail of the tumbler, rotates it on its axis, and thus forces the firing pin to the rear. The long arm of the lock spring acts on the projection of the firing pin, while the short arm bears against the nose of the trigger; consequently the withdrawal of the firing pin compresses the lock spring by drawing the long arm towards the short arm. As the tumbler rotates, the nose of the trigger is forced by the short arm of the lock spring under the bent of the tumbler, and the continued motion of the tumbler forces the firing pin still further back, until the bent of the sear (which is actuated by the sear spring) is forced into the bent of the firing pin and retains it. The firing pin is thus prevented from flying forward.

51. Action of the fusee spring.—When the barrel is home the fusee spring unwinds the fusee chain from the fusee. This gives the crank a rotary motion, which is imparted to the connecting rod and the side lever head, causing the lock to continue the forward movement (*vide* para. 48) and place the live round in the chamber. The extractor is moved upwards by the side levers acting on the extractor levers. The bottom projection of the gib slides over the base of the live cartridge in the chamber and the top projection of the gib slides over the base of the cartridge which has been automatically moved up into position in the feed block. The firing

pin hole is thus brought opposite the cap.

As soon as the extractor reaches its highest position, the side plate springs engage in grooves in its sides to prevent the horns falling below and fouling the front end of the solid cams in the breech casing at the commencement of the backward movement, when (*a*) the side levers are released from the extractor levers; (*b*) the side or extractor levers are worn. This, however, can only occur when there are no cartridges on the face of the extractor.

The further downward movement of the connecting rod and side lever head causes the lock to be forced slightly further forward, and the breech is then closed. During this movement steps on the side levers travel over bents on the extractor levers.

52. Firing action.—(*a*) For the first shot. As the side lever head is brought slightly below the horizontal, it depresses the sear, thereby disengaging it from the firing pin, which then moves slightly forward until the bent of the tumbler engages the nose of the trigger. If the safety catch is raised and the thumb piece on the firing lever pressed, the pawl near the bottom of the firing lever pushes forward the bottom of the trigger bar lever. This, being pivoted in the centre, causes the top to come to the rear engaging a projection on the trigger bar and drawing it to the rear. As the trigger bar is drawn

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backwards the front end of the recess engages and draws back with it the tail of the trigger, thereby releasing the tumbler. The long arm of the lock spring then propels the firing pin on to the cap and the cartridge is exploded.

(*b*) For subsequent shots. The firer, by maintaining pressure on the thumb piece, holds back the trigger bar. Therefore, each time the lock goes forward the front end of recess holds back the tail of the trigger before the lock is quite home. By this means the nose of the trigger is prevented from engaging in the bent of the tumbler. When the lock is home, the side lever head depresses the sear, thus permitting the long arm of the lock spring to carry the firing pin on to the cap, and the charge is exploded.

53. The depression of the sear is so timed that the firing pin cannot be released until the lock is in the firing position.

54. On releasing the thumb piece, the short arm of the lock spring forces the nose of the trigger under the bent of the tumbler, so that when the sear is depressed, the nose of the trigger engages in the bent of the tumbler, and the firing pin is unable to go forward.

Connecting rod.

55. Test whether correct length with both locks as follows:

Take off fusee spring. Raise cover, turn crank handle back, and remove lock. Place

one of each of Nos. 1 and 2 washers on the outer face of the adjusting nut on connecting rod. Replace lock on connecting rod and let down into gun, retaining the lock in its rear position. The extractor being down, insert, through the opening in the underside of breech casing, the special armourer's machine gun dummy cartridge in bottom end of extractor over firing pin hole. Push the extractor right up to the upper stop, and, still retaining hold of the cartridge, see that the barrel is home; then turn crank handle over towards check lever, at the same time guiding the cartridge into the chamber. Push check lever back just clear of crank handle and let crank handle gently down towards rest. If the connecting rod is within limit for length, a check will be felt. If no pressure is required, it shows that the lock is not fully home (i.e. the connecting rod is not long enough and therefore outside the limit). If within limit, remove the washers. If outside the limit, washers must be fitted permanently to connecting rod.

No. 1 washer has one small hole. No. 2 washer has two small holes punched in the rim.

Instructions for fitting washers to connecting rod when required.

Take off fusee spring. Raise cover, turn crank handle back and remove lock. Turn the connecting rod back on to trigger bar lever; then with the combination tool unscrew and remove the adjusting nut from

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connecting rod. Place one of each of Nos. 1 and 2 washers on the shoulder of connecting rod, and screw the adjusting nut tightly home on to the washers.

Place one more of each of Nos. 1 and 2 washers on the outer face of adjusting nut, and test length of connecting rod.

Instructions for fitting spare discs for the ball-firing attachment.

The disc is placed in the front end of the outer casing and is pressed home and held in position by the front cone. Six spare discs are supplied. When one gets badly eroded it is removed by unscrewing the front cone, on which the disc may be found firmly fixed, cutting the front bevel of the disc across with a chisel and dividing sufficient metal up to provide a hold for the pliers. When assembling a new disc it may be necessary to lightly tap the front cone whilst screwing the disc home.

To Weigh and adjust Fusee Spring.

Take out the lock; place the loop of the spring balance over the knob of the crank handle, and, standing on the left side of the gun, press down the check lever with the left hand. Pull the spring balance vertically up, resting the right wrist on the breech casing. The reading indicated when the crank handle commences to move will be the weight of the

fusee spring. This weight should be between 7 and 9 lbs. If the spring is over, or not up to weight, adjust by means of the vice pin. Generally 6 clicks (3 revolutions) make a difference of about 1 lb. Adjust by ½ lbs. as a rule.

Turning the vice pin clockwise increases the weight, and vice versa.

The tension of the spring should always be kept as high as possible consistent with maintaining the normal rate of fire of 500 rounds per minute.

Repairs and Adjustments.

Stripping the gun. The gun is stripped in the following order, the gun being on the mounting.

(1) *Lock.* Clear the extractor by revolving the crank handle twice; raise the rear cover, pull the crank handle on to the roller; place finger between the extractor and stop, lift the lock, at the same time allowing the crank handle to move *slowly* forward until the lock is released from the side plates. Give the lock one-sixth of a turn in either direction and lift out.

(2) *Feed Block.* Release the front cover catch, raise the front cover, and lift out.

(3) *Fusee spring box.* With the right hand at the rear and left hand at the front, press the box forward until clear of the lugs and remove. Disconnect the fusee chain and

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remove the box and the spring. Care should be taken to throw no cross strain on the chain.

(4) *Fusee.* Turn the fusee to the rear until the lugs on the stem are free to be withdrawn.

(5) *Ball firing attachment.* Withdraw the split pin. Give the outer casing one-sixth turn and remove it. Unscrew the front cone. Loosen the clamping screw of the muzzle cup and revolve the cup till the clamping screw coincides with the flat on the barrel. Remove the muzzle cup. Unscrew and remove the gland.

(6) *Slides, right and left.* Raise the rear cover, unscrew the rear cross piece screwed fixing T-pin, and hinge down the rear cross piece. Pull out the slides.

(7) *Recoiling portion.* Draw the recoiling portion out to the rear. Disconnect the side plates from the barrel, removing the left one first. (For convenience only, the left side plate is removed first.) If necessary, by taking out the fixing pin, the crank handle can be driven off with a drift and hammer, but as a rule this should not be stripped.

(8) *Roller.* Remove split fixing pin, collar and roller.

(9) *Check lever.** Drive out keeper pin from underside, and take off check lever. To remove piston and spring, turn the piston by using a screwdriver in the slot until the lugs are free to be withdrawn, when the piston will be forced out by the pressure of the spring.

*These components are not to be stripped except by armourers, and then only when absolutely necessary.

(10) *Tangent sight.** Unscrew axis pin and force out. Remove tangent sight, piston and spring.

(11) *Cover lock.** Unscrew axis pin and force out. Remove cover lock and spring.

(12) *Trigger bar.** Remove spring and withdraw trigger bar.

(13) *Covers, front and rear.** Remove keeper pin and check nut; force out joint pin and take off covers.

(14) *Front cover catch.** To remove spring and plunger, force the plug forward with a screwdriver and give a quarter turn, when the piston will be forced out by the spring. Before removing the plunger, it must be turned so that the slots are free to pass the lugs in the catch.

(15) *Rear cross piece.** Remove keeper pin and check nut and force out joint pin. Lift out rear cross piece.

(16) *Foresight.** The position of the foresight should first be carefully marked. Using a drift and hammer, drive the foresight out of its dovetail seating through the opening in the right protecting wing.

(17) *Steam tube.** Up-end the gun so that it stands on the rear end of the breech casing. Remove the keeper screw and unscrew the steam tube.

(18) *Sliding shutter.** Press in the catch and force the shutter to the front until it is

*These components are not to be stripped except by armourers, and then only when absolutely necessary.

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against the stop, then press in the plunger with a No. 3 punch and force the shutter further to the front until it is free to be withdrawn from the breech casing.

(19) *To strip the lock.* (*a*) See that the lock is cocked; force out the side lever split pin and axis bush. Remove side levers and extractor levers, and slide the extractor from the face of the lock casing.

(*b*) Release the lock spring and push out the trigger and tumbler axis pins. (*c*) Remove trigger, tumbler, lock spring, firing pin and sear with spring. To strip the extractor, push out the gib spring cover and remove spring and gib.

(20) *Feed Block.** (*a*) Force out the split fixing pin of the top and bottom levers; drive out the bottom lever, and remove the top lever and slide. (*b*) Remove top pawls from the slide by pressing them down to clear the lugs, and outwards; remove top pawl spring. (*c*) Draw out the axis pin of the bottom pawls and remove bottom pawl spring and pawls.

(21) *Rear cross piece.** (*a*) Unscrew firing lever axis pin and remove firing lever. (*b*) Unscrew safety catch axis pin and remove safety catch, piston and spring. (*c*) Lift out trigger bar lever.

(22) *Tangent sight and spring.* (*a*) Remove top fixing screw of the graduated plate. (*b*) Run the slide off the stem. (*c*) Remove the

*These components are not to be stripped except by armourers, and then only when absolutely necessary.

fixing screw of the milled head and lift the latter off the slide. (*d*) Remove the fixing pin, pawl, and pinion, from the slide. (*e*) Place the milled head, face upwards, on a bench; then, with the small screwdriver applied to the rectangular nib on the slide spring, knock the latter down flush with the face, when it can be lifted out with the pliers.

Before assembling the gun all parts should be tried in their places separately to see that they work freely.

Assembling the gun. Reverse all the foregoing operations with the exception that the recoiling portions must be replaced before the packing and packing gland. When assembling the lock, care must be taken that the lock spring is replaced with the lock in the fired position, and when all the other parts are assembled. When assembling the rear cross piece see that the pawl of the firing lever engages with the trigger bar lever. When assembling the tangent sight, it will be found convenient to place the slide on the stem (axis end) before attaching the milled head; in this position the pinion is prevented from turning with the pawl when engaging the arms of the spring outside the lugs on the pawl.

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Position of crank handle and its indication.	Immediate Action.	Probable Cause.	Prevention of Recurrence.	Method of preparation for Instructional Purposes.
I. Indication. The lock is unable to come back far enough to allow the extractor to drop.	(i) Turn the crank handle on to the roller, pull the belt to the left front, and let go the crank handle. (ii) If after firing failure recurs, lighten fusee spring by 3 "clicks."	The extractor has not dropped. This may be due to: (a) Excessive friction, due to want of oil, grit, or tight pockets in the belt, or excessive packing in the cannelure or packing gland.	(a) Clean and oil working parts. Examine the belt, which should be dried, if damp, or if the stoppage is due to a new or stiff belt the pockets should be plugged. If due to excessive packing, examine, and repack cannelure or packing gland.	Perform half the loading motions; pull the crank handle slowly back until the horns of the extractor have engaged with the steps on the solid cams; pull the belt to the left front, and let go the crank handle. For range purposes: Increase the weight of the fusee spring.
		(b) Too heavy fusee spring.		
		(c) Partial loss of the force of the explosion due to: (i) worn barrel. (ii) Defective ammunition.	(c) The barrel should be examined at the first opportunity, and, if much worn in the lead, should be changed.	
II. Indication. The lock is unable to go fully home after recoil.	(i) Force the crank handle to the rear: open the rear cover and examine the cartridge on the face of the extractor. If a damaged cartridge or an undamaged cartridge with the front portion of a separated case adhering to it, clear the face of the extractor and reload. (ii) If the front portion of the separated case does not come out on the cartridge, clear the face of the extractor, replace the lock, keeping the crank handle on the roller. Take the clearing plug (seeing that the centre pin is back), and insert it into the chamber. Push the pin well home by allowing the lock to go forward. Then, keeping a firm pressure on the crank handle, give the clearing plug a rocking motion; withdraw the lock; lever back the handle of the clearing plug and withdraw it and reload.	(a) Damaged cartridge. The cartridge is unable to enter the chamber completely although it has commenced to do so. (b) Separated case. The front portion of the case causes an obstruction and prevents the next cartridge from going into the chamber.	(b) If a succession of separated cases occur the connecting rod must be long-turned.	(a) Bulge the leading dummy cartridge in the belt and load. For range purposes: Place a bulged *dummy* cartridge in the belt. (b) Perform half the loading motions. Open the rear cover, withdraw and lift up the lock. Place the front portion of a separated case over the front of the cartridge on the extractor. Replace the lock, close the rear cover, pull the belt, let the crank handle go slowly forward. For range purposes: File a cartridge about one inch from the base and insert in the belt. Care must be taken that the cartridge is not filed too far through as there is the danger of the bullet being left in the barrel.
III. Indication. The extractor is unable to rise to its highest position, although the lock is almost home. If the feed block slide is jammed there is a fault in feed, and the recoiling portions are not quite home.	(i) Strike the crank handle on to check lever by a glancing blow with the palm of the hand. (ii) If this fails, slightly raise the crank handle, pull the belt to the left front, let go the crank handle, and then strike it down on the check lever.	(i) Excessive friction. (ii) A cartridge is fed up slightly crossways or a long brass strip is bent.	(i) Clean and oil working parts. (ii) Carefully examine the belt.	(i) Perform the correct loading motions, except that when completing the loading the crank handle must be eased back gently until it touches the check lever. For Range purposes: Lighten the fusee spring. (ii) Perform half the loading motions. Pull the crank handle on to the roller. Open the rear cover; pull a cartridge half way into position in the feed block and hold it there. Let go the crank handle and close the cover. For Range purposes: Bend a long brass strip.

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Position of crank handle and its indication.	Immediate Action.	Probable Cause.	Prevention of Recurrence.	Method of preparation for Instructional Purposes.
	(iii) If (i) and (ii) fail, examine feed block slide; if jammed No. 1 pulls the crank handle on to the roller,* holds it there and unlocks the front cover. No. 2 opens the front cover and with the assistance of No. 1 raises the feed block sufficiently to allow the recoiling portions to go home. He releases the top and bottom pawls from the belt, which he withdraws until the top cartridge is clear of the feed block, and rectifies the belt or cartridges if necessary. He replaces the feed block, pushing the slide over to the left, and lowers the front cover. No. 1 locks the front cover, pulls the belt to the left front and releases the crank handle. NOTE.*—In order to do this, it may sometimes be necessary for No. 2 to open the front cover and force down the horns of the extractor.	(iii) (a) Badly filled belt or a belt with worn or loose pockets. The cartridges projecting unevenly from the belt prevent it entering or passing freely through the feed block. (iii) (b) Belt box not being in line with the feed block: the belt does not lead up correctly to the feed block and becomes jammed. NOTE.—The effect of a fault in feed is that the top pawls of the feed block slide, being engaged behind a cartridge in the belt, are held fast when some obstruction, such as sleeve prevents the belt from passing freely through the feed block. The recoiling portion being connected by the top and bottom levers to the slide is arrested and prevented from going home. The distance it is held back depends upon the point at which the obstruction asserts itself.	(iii) (a) Carefully examine belt, seeing that the cartridges are pushed well home	(iii) (a) Pull out the fourth cartridge in the belt about ¼ inch. Perform half the loading motions: pull the crank handle slowly back until the horns of the extractor have engaged with the steps on the solid cams. Draw the recoiling portions to the rear by forcing the knob of the crank handle forward, and pull to the rear at the same time pulling the belt to the left. Allow the recoiling portions to go forward. Bring the crank handle on to the roller and let go. For Range purposes. Fill a belt badly. (iii) (b) For Range purposes: Place the belt box at an angle to the feed block.
IV. Indication. That there has been no explosion, or if any, that there has been little or no recoil, the lock remaining in its forward position.	(iv) If the slide is free, No. 2 opens the front cover and forces the extractor down, while, *at the same time*, No. 1 pulls the crank handle on to the roller. No. 1 lifts up, clears, changes the lock, removes the cartridge in position in the feed block, and reloads. (a) Turn the crank handle on to the roller, pull the belt to the left front and let go the crank handle. (b) If this fails, place crank handle on to the roller twice, change the lock and reload.	(iv) (a) Damaged cartridge grooves. (b) Broken gib. (c) Broken gib spring. In these cases the cartridge is prevented from passing freely down the face of the extractor. (d) Thick-rimmed cartridge. (a) (i) Defective ammunition. (ii) No cartridge in the chamber. (b) (i) Broken or damaged firing pin. (ii) Broken lock spring.		(iv) Damage the rim of the second dummy cartridge in the belt. Proceed to load. NOTE.—As damage to the extractor has to be simulated by damaging a cartridge rim, this cartridge must be removed before reloading. For Range purposes: Damage the rim of a dummy cartridge and place it in the belt. (a) Load and press the thumb piece. For Range purposes: Place a dummy cartridge in the belt. (b) The effect of these will be simulated by placing two dummy cartridges in the belt.

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Army Orders No. 181 of 1913 is applicable to both Maxim and Vickers Guns:

"Handbooks (i). ·303-inch and ·303-inch converted Maxim Machine Guns. 1911. Para. 65 (iv). Add at end of sub-para:

"When the firing has been stopped as described above, hold the crank handle with the right hand, open the cover, press down the horns of the extractor, draw the lock back and, if there is a live cartridge on the face of the extractor, remove the feed block and belt, close the cover, and allow the lock to fly forward, when the live cartridge, which is on the face of the extractor, will be fired automatically. The lock can then be changed with safety. On no account should the lock be allowed to fly forward until the feed block has been removed and the cover shut.

"If, on drawing the lock back, it is found that there is no live cartridge on its face, the lock may be changed at once, and the necessity for removing the feed block, and the subsequent precautions will not arise."

THE ANNUAL TRAINING OF MACHINE-GUN SECTIONS.

SECTION 8, INFANTRY TRAINING, 1914.

1. The two non-commissioned officers and twelve privates shown in the establishment of a machine gun section will be trained as the battalion machine gun section. Two non-commissioned officers and twelve men in addition will be trained, as opportunity offers, as a reserve section to replace casualties.

2. A subaltern officer, other than the assistant adjutant, will be selected in each battalion to command and train the machine gun section, under the orders of the battalion commander. Should a brigade commander desire to train the machine guns of his brigade to act together, an officer, who is not the machine gun officer of one of the battalions of the brigade, may be selected to supervise the firing practice and to conduct the brigade training of machine gun sections.

3. Soldiers selected for duty with a machine gun section should possess, as far as possible, the following qualifications: good physique, good eyesight, calm temperament, fair education, and mechanical aptitude.

4. It is most important that men selected for the machine gun section should remain with it as long as possible in order that they may acquire a high standard of skill. Young soldiers of about a year's service are therefore the most suitable for selection. Officer, non-commissioned officers, and men of the machine gun section will fire the range practices prescribed for the rifle in the "Musketry Regulations, Part I" with one of the companies of the battalion. The classification of detachments will be determined by battalion commanders after the annual machine gun course. This paragraph applies also to special reserve battalions,

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whether the machine-gun sections belong to the battalion or are detailed for armament coast defence guns, except that machine gunners of such battalions will not be classified.

5. The elementary training, which may be carried out in the neighbourhood of barracks, will consist in instruction in the mechanism of the gun; in adjusting the tripod, mounting and dismounting the gun, and loading; in the drill and methods of laying, ranging, and firing; in packing and unpacking limbered wagons; in filling a belt quickly and correctly; in the use of the range finder; in semaphore signalling and in the signals for the observation and control of fire.

6. As soon as the men of a section are thoroughly conversant with the mechanism, and have qualified in the tests of elementary training for the machine gun (*see* page 194), their further training will be carried out, as far as possible, in open country away from barracks. During this training the sections should be practised in bringing the gun into action; in fire discipline; in fire control; in laying and ranging in every variety of country; in utilizing natural cover when advancing into action; and in constructing cover from both view and fire. The men should also be trained in range taking, judging distance, and in the use of field glasses.

7. When the section is proficient in these branches of training, the battalion commander will arrange for it to be trained with

one or more companies which have reached the more advanced stages of company training, in order that it may be practised in co-operating with other troops, and in dealing with such situations as would confront it in war.

DRILL OF THE MACHINE GUN SECTION.

Elementary Training.

Chapter VII. Infantry Training, 1914.

1. The elementary training of the machine gunner will be carried out as directed in pages 142-145.

He must be taught, at an early stage, to hold the gun so that sufficient pressure is applied to the handles to check its vibration without transferring the vibration to the mounting.

Machine guns vary considerably and such variations can only be counteracted by a thorough knowledge of the particular gun and by skilful holding. Whenever the gun is laid, the holding should be such as would be employed in actually firing service ammunition. This can only be judged by the man himself, but the habit of good holding is so important that this should be impressed upon the men.

2. An early opportunity should be taken to demonstrate with a few rounds of ball ammunition at 30 yards' range the necessity

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for correct holding. This may be done by a trained number firing a few rounds with different pressure on the handles.

3. During this elementary training, untrained numbers should attend on any occasion when firing is being carried out. They should also be present when the gun is stripped by the armourer.

Allocation of Duties.

The various duties to be carried out by the officer, non-commissioned officers and numbers of a section, are enumerated below.

It is important that all numbers should be interchangeable in order that casualties may be efficiently replaced in action. In allotting the various duties for active service, section officers should select the men who show a particular aptitude for each particular duty, and the next best should be those who would probably be most quickly available on service to replace a casualty. Table C, Range Takers' Tests, and Tests in Belt Filling, will assist in detailing the numbers, and for this purpose section officers will keep careful record of the characteristics and particular aptitude of each number. Nos. 1, 2 and 3 should be successively the best for laying and holding; Nos. 6 and 5 for range taking, and No. 4 for belt filling. In peace, the numbers should frequently change rounds as directed below.

The duty of keeping the gun firing under all circumstances when required should be a point of honour with machine gun detachments.

The Section Officer. To command his Section in accordance with his orders and the tactical situation; to select gun positions, give instructions to the sergeant regarding such positions, line of fire, and target; give instructions to range takers as to objects on which to range; call up guns and give necessary instructions to Nos. 1 under cover if possible; decide aiming mark, method of sighting, and fire; order the opening of fire; observe; order necessary alterations of point of aim or sighting; control fire generally; cease fire; withdraw; abandon guns temporarily or advance as circumstances dictate; watch the tactical situation; regulate the ammunition supply, and give general instructions regarding the movement of limbered wagons. If brigaded, repeat and pass orders of brigade machine gun officer, watch for signals, and act as he may direct. He should be particularly expert in observation of fire.

Sergeant. To supervise guns coming into action as the section officer may direct. Be conversant with the situation and instructions received by the section officer; at once assume command of the section in the event of the officer becoming a casualty or being tem-

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porarily absent; he must be thoroughly acquainted with the duties of a section officer as regards tactical handling and control of fire, and should be practised, in this respect, occasionally. He must be proficient in observation of fire and in handling the gun.

Corporal. He is generally responsible for the packing and contents of the limbered wagon. On the line of march he marches behind it, and works the brake as required. On the order to unpack he will lower the tail board, superintend the unpacking, and take command in the absence of the section officer and sergeant. He will see that Nos. 4 put their own rifles as well as those of Nos. 1, 2 and 3 in the wagon. He will have the spare parts box handy, supervise the ammunition supply and filling of belts; direct the limbered wagon as required; superintend the filling of sandbags, cutting of brushwood, and watch for signals from the section officer. He will be prepared to take the place of the sergeant should he become a casualty, and must therefore be thoroughly acquainted with the duties. He should occasionally act as sergeant during training. He must be particularly proficient in the use of the belt-filling machine and in filling belts by hand.

Gun Numbers.—In order that each man may be thoroughly trained in peace in the various duties connected with the gun, it is

suggested that a number of each detachment should be detailed on a weekly roster to clean and look after his detachment gun. He will personally clean the gun and be responsible that the mechanism is kept in thoroughly good working order. The duty number for the week will act as No. 1 for any tactical exercises or field days that may occur during his tour of duty. When relieved, he will become No. 2 for the next week, and so on in succession.

During Brigade and Divisional Training, Manœuvres, and Field Firing with ball ammunition, the section officer should vary the tours of duty so that, as far as possible, each man is afforded practice as No. 1 in each of these exercises. At any special or extra firing, the detachment should be allotted the duties they would be respectively detailed for on mobilization; any change of duties will be ordered in sufficient time to enable the new No. 1 to look over his gun and ensure that it is serviceable before leaving camp or barracks.

The following are the duties of the various numbers:

No. 1—Is the firer. He will personally clean and look after his gun; ensure that the mechanism is working smoothly. On going into action he will carry the tripod and place it in a suitable position, and assist No. 2 in mounting the gun. He repeats all orders received, observes his own

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fire, and makes necessary alterations of elevation and direction.

No. 2—Assists No. 1 at the gun, carries the gun into action, and mounts it with the assistance of No. 1. In action he will *watch for signals* from the section or brigade machine gun officer, *attend to the feeding of the gun*, and generally assist No. 1.

Nos. 3 and 4—Are ammunition carriers. No. 3 takes the first supply of ammunition to the gun, assisted by No. 4, and arranges that the spare parts wallet is brought up to the gun position. No. 4 takes ammunition from the limber to No. 3 as a further supply is required, and also the condenser complete and half-filled with water. No. 3 is responsible that the condenser reaches the gun position before there is any chance of the water boiling. No. 4 places his own rifle and those of Nos. 1, 2 and 3 in the limber.

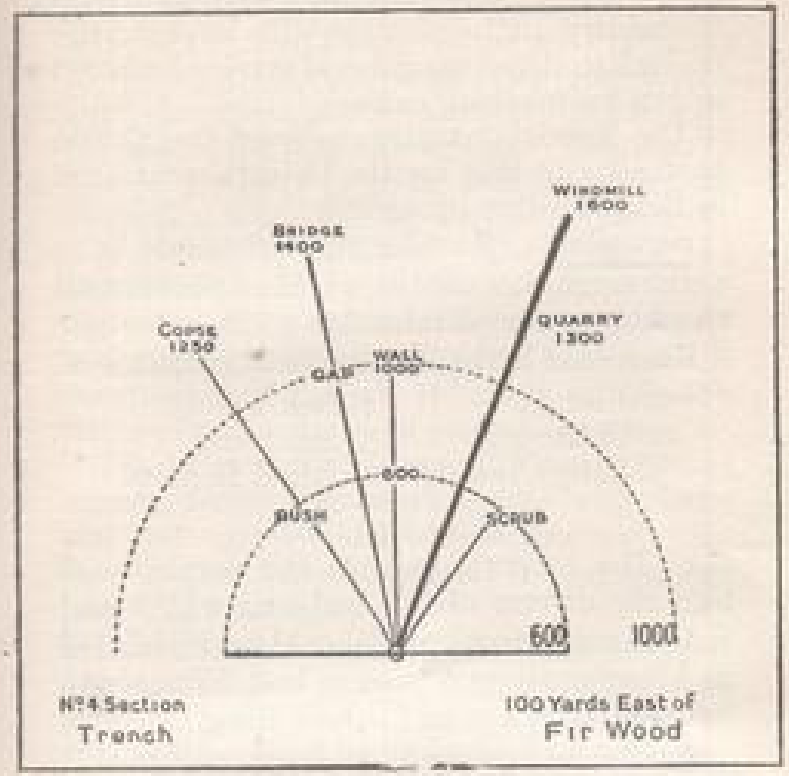
No. 5—Acts as scout. As ordered by the section officer.

One No. 6 is the range taker. He will take ranges and prepare range cards (see diagram).

The other No. 6 is a spare man and acts according to the orders he receives from his officer.

Drivers.—The transport drivers of the limbered wagon and Small Arms Ammunition cart should be frequently exercised

RANGE CARD (DEFENCE).



with the section, in order that they may thoroughly understand the necessity for taking advantage of ground to reduce visibility, and may learn to act on signals to move as required. They should also be taught to fill belts by hand and with the machine, and in addition should receive sufficient instruction in the duties of the gun numbers to enable them to replace casualties in an emergency.

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Regimental Transport Drivers—A certain proportion of the regimental transport drivers of cavalry and infantry will be specially trained to drive the general service limbered wagon for machine guns.

The special training referred to should be similar to that for the Drivers mentioned in the preceding paragraph.

Signalling.—Machine gunners should have a thorough knowledge of Semaphore, and should pass periodical tests.

Every man in the Section must be capable of:

1. Firing.
2. Observing.
3. Range Taking.
4. Belt Filling.
5. Signalling.
6. Small Repairs.

Belt Filling.

1. The corporal and all the numbers, as also the drivers of the limbered wagon and S.A. Ammunition cart, should be instructed and frequently practised in belt filling, both by hand as well as by the belt-filling machine.

2. *One man—loading by hand.* Sit on the ground with the right foot doubled under the left thigh, the left foot resting on the outer side and drawn towards the right knee.

Place the belt on the left knee, with the tag pointing to the right. Take hold of the first brass strip between the forefinger and thumb; then with the remaining fingers and ball of the thumb, hold the belt so that the pockets will remain open. Take 5 cartridges in the right hand, insert into pockets, taking care to avoid doubling over the thin edge of

webbing. Now place the belt on the knee, and placing the tips of the fingers on the front of the belt, finally adjust the cartridges by pushing them forward with the thumb until the points of the bullets are in line with the **ends** of the long brass strips. Continue to load and adjust in fives, and make a final inspection when placing the belt in the box.

3. *Belt-filling Machine.* (*See Plate* VII.) *Description.* The belt-filling machine is designed to place the cartridges expeditiously and evenly in the ammunition belts, and is constructed so that it may be readily clamped on to the most convenient place.

The chief parts are the bed plate, pocket opener, removable crank handle with fixing pin and chain, crank, connecting rod, cam bar, hopper, traversing gear, hinged loading tray, and hinged leg.

In the Mark I machine, the crank handle is not made removable; also the loading tray and leg are not made to fold in the centre.

Weight of machine, complete, with hopper, 19 lbs.

Weight of loading tray and leg, 4¾ lbs.

Instructions for use. The machine must be fixed so that the crank handle can be worked with the right hand. The loading tray and the leg should be unfolded. The leg should be made rigid by turning up the keeper plate on to the pin catch, and the loading tray secured to the left of the bed plate by means of the pin, which is attached by a chain to the former. Turn the steel guide

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plate on the bed plate outwards; see that the pocket opener is back far enough to clear the belt; place the belt behind the roller and into the belt guide, the edge of the belt to be touching the side of the guide, the projecting ends of the long brass strips to point away from the cartridge plunger and to pass under the steel guide. The pawl lies on top of the belt. Turn the steel guide plate into position again, and draw the belt through with the left hand until the first pocket is opposite the pocket opener. Fill the hopper with cartridges, and replenish as required. On revolving the crank handle, the pocket opener will enter the first pocket and open it; on continuing the motion, the pocket opener will be withdrawn, and the cartridge plunger will push the lowest cartridge from the column of cartridges into the pocket; the pawl will then feed the belt along and these motions will be repeated until the belt is filled.

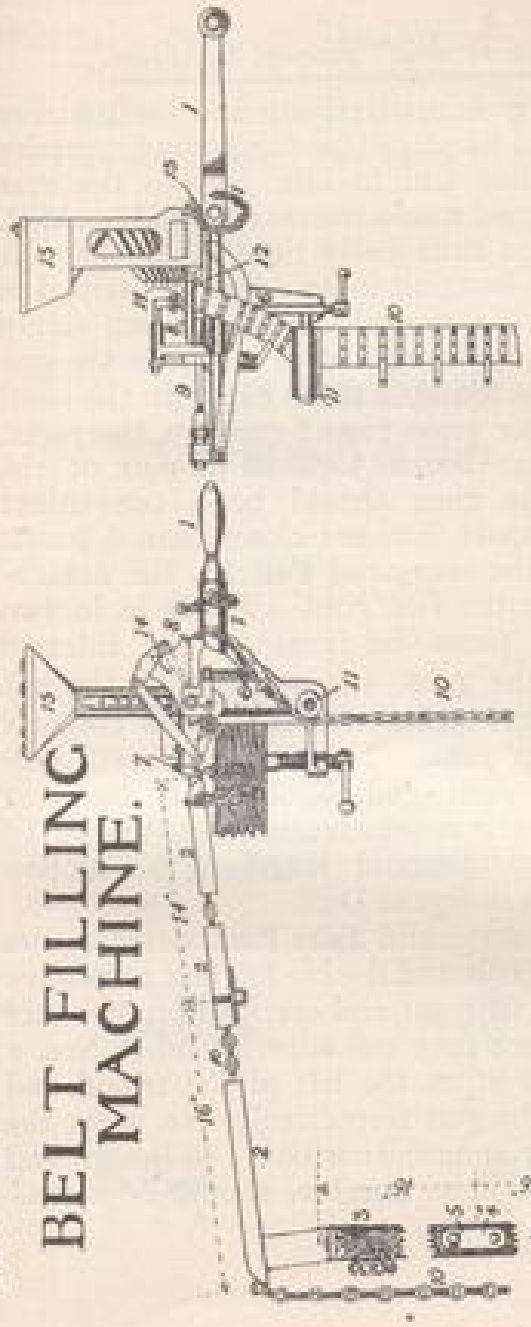
A light pressure should be kept on the belt with the left hand, until the weight of the filled portion of the belt is sufficient to assist the pawl. The angle of inclination of the loading tray is an important factor in this, and requires careful adjustment.

N.B.—Great care should be taken to see that the pocket opener enters the pocket each time, otherwise it may pierce and spoil the belt. On this account the crank handle should be held lightly and not turned too fast.

It is advisable to check the crank handle momentarily at the point where the pocket opener is about to enter a pocket.

Plate VII.

BELT FILLING MACHINE.



M2

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Section drill, without transport.

1. The guns, with tripods and ammunition boxes, will be placed on the ground, muzzles to the front and in line, legs to the rear straps lapped round the rear leg and buckled, and clamps sufficiently tight to prevent the legs from hanging loose when the tripod is lifted off the ground; the traversing clamp should be sufficiently loose to enable the gun to be deflected by a sharp tap with the hand on the rear cross piece; guns on the right, ammunition boxes 3 paces in rear of the guns. The guns should be a convenient distance apart, but not closer than 8 paces.

2. On the command **Fall In,** the detachments for the two guns will fall in in two ranks, 5 paces in front of the interval between the guns; the sergeant on the left of the front rank, covered by the corporal in the rear rank. The front rank will provide the right gun detachment, the rear rank the left gun detachment. (*See Plate* VIII.)

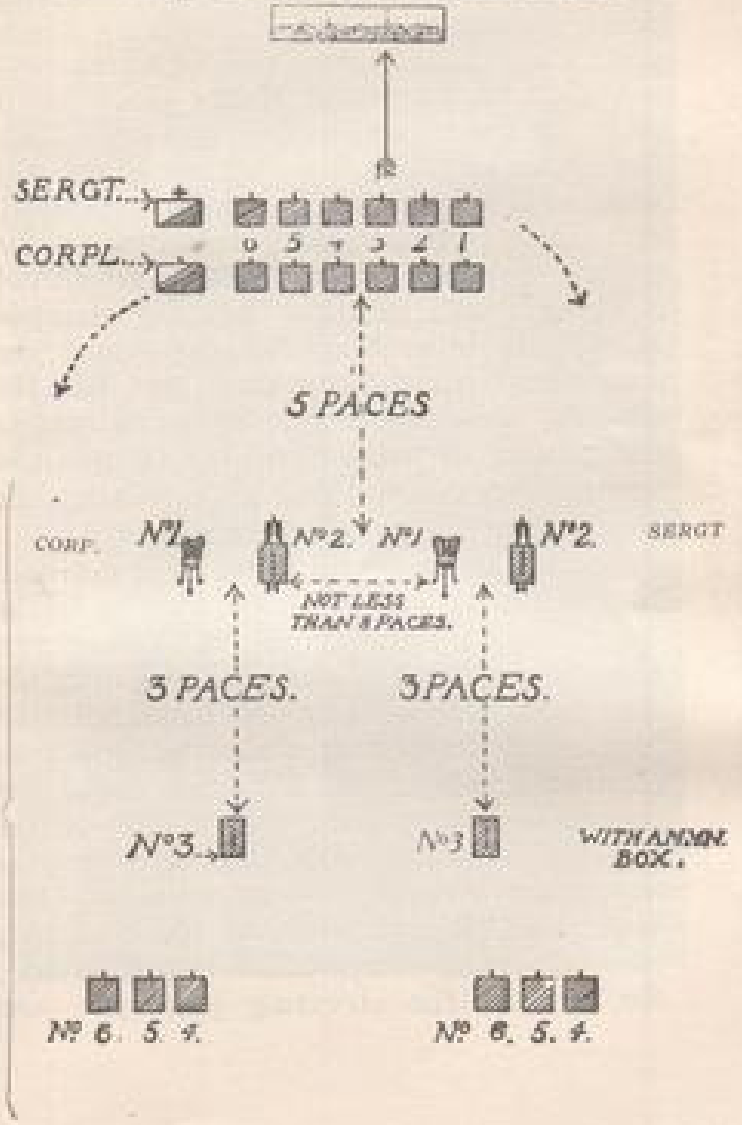
On the command **Number,** the section will act as in Squad Drill.

On the command **Take Post,** detachments turn outwards and double to their respective guns (the sergeant and corporal on the outer flank, where they can superintend). Nos. 1 and 2 fall in on the left of the tripod and right of the gun respectively, No. 3 on the left of the ammunition box. If the ground is suitable, these numbers should lie down.

Plate VIII.

POSITION OF GUNS, MOUNTINGS AND GUN NUMBERS AT COMMENCEMENT OF SECTION DRILL.

Landscape Target, 25 yards from Guns



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Nos. 4, 5 and 6 fall in, in single rank, in rear of No. 3. (*See Plate* VIII.)

3. A landscape target should be placed about 25 yards from the guns, and a point of aim indicated. The instructor having pointed out a spot—not more than 5 yards away, where each gun will be mounted—will give the command **Mount gun.** No. 1 picks up the tripod, having previously seen that both elevating screws are exposed the same distance, carries it to the spot ordered, and places it in position. In adjusting the tripod, he must ensure that the socket is upright, and that the legs are clamped tight. He must learn by experience the adjustment that suits him best for the position ordered and for the nature of the ground, so that he will not be cramped when firing and will not have to alter the tripod after the gun has been mounted.

As soon as the tripod is nearly in position, No. 2 picks up the gun and carries it to the right side of the tripod (with the Vickers gun first pressing back the shutter), holding the rear cross piece with the left hand, with the gun, muzzle to the rear, under the right arm. He then kneels on the left knee, facing the tripod, and, supporting the weight of the gun on the right knee, places it on the tripod, drives in and turns down the cross head joint pin, and removes the cork plug from the steam escape hole. (*See Plate* IX.) No. 1 fixes the elevating joint pin, and

Plate IX. MOUNTING THE GUN.

POINTS TO BE NOTED.

1. The method of supporting the gun on the right thigh by No. 2.
2. The assistance given by No. 1 in working the arm forward or backward while No. 2 drives in the crosshead joint pin.
3. It is no use No. 1 trying to insert the elevating joint pin until the crosshead pin is home.

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directs the gun towards the mark. Meanwhile, No. 2 kneels and places the ammunition box in position.

No. 2 should time his advance so as to reach the tripod at the moment its adjustment is completed.

When No. 3 sees the gun is nearly mounted, he carries the ammunition box forward and places it within reach of No. 2. The ammunition must be at hand directly No. 2 is ready for it. No. 3 then retires to a position not immediately in rear of the gun.

4. On the command **Load,** No. 1 at once raises the tangent sight, No. 2 passes the tag of the belt through the feed block. No. 1 turns the crank handle on to the buffer spring, (with Vickers gun pull crank handle on to the roller), pulls the belt to the left front as far as it will go and lets go the crank handle. He releases the strain on the belt, then turns the crank handle on to the buffer spring; he again pulls the belt to the left front and lets go the belt and crank handle. The gun is now loaded and ready to fire. Each motion should be distinct and clean.

Single Shot Loading. When it is desired to practice men in single shot loading, as required in practices 2 and 4, Table "C," the gunner should carry out the first half of the loading motions. Then, without touching the belt, turn the crank handle on to the buffer spring, and let go.

On the command (range), e.g., **900.** No. 1

repeats the order for his own gun, and adjusts the slide to the elevation required for the distance ordered.

On the command **"At"** (naming the aiming mark). No. 2 adjusts the traversing clamp if told to do so by No. 1, and No. 1 lays the gun, maintaining the same pressure on the handles while laying as he would when firing. No. 2 alters the position of the ammunition box if required.

5. When the gun is laid and the clamp adjusted as required, No. 1 raises the automatic safety catch with the forefinger and prepares to fire. When No. 1 is ready, No. 2 holds up his hand. When concealment is important the left hand held out behind No. 1 is the best means of indicating that No. 1 is ready to fire. As proficiency increases, the pause between naming the object and the range should be slight.

On the command **Fire,** No. 1 presses the double button, or thumb piece.

On the command **Cease Fire,** No. 1 releases the automatic safety catch, and remains steady.

6. Frequent instruction will be given in Traversing Fire. (See page 198.) The firer must first ensure that the traversing clamp is just sufficiently loose to enable the gun to be deflected by means of a sharp tap with the hand on the rear cross piece. Each man must learn by experience the exact degree of clamping he requires, and, before

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Plate X.

NORMAL POSITION WHEN FIRING ON LEVEL GROUND.

Note the method of "holding" with both elbows supported. This position should be regarded as the Normal one, and should be used until men are thoroughly experienced in firing. As proficiency increases, men may be allowed to modify their positions to suit themselves.

firing, he should ensure that the clamp is correctly adjusted to suit himself.

Traversing fire is applied by means of a series of groups fired at regular intervals within certain limits indicated by such figures on the target as may be ordered by the instructor.

The target will be the instructional machine gun target described on page 212.

The procedure for horizontal traversing is as follows:

The instructor having described the figures between which fire is to be directed, will order **Traversing Fire.** The firer will lay the gun on the flank figure named and press the button, then tap the gun approximately to the centre of the interval to the next figure, again press the button, then tap, and so on until the limit ordered has been reached. The firer should be taught to fire groups of about 8 rounds by maintaining pressure on the button for about one second at each group. By this method he learns to tap the gun with the necessary force in order to avoid firing more than one group at the same place, and also to avoid leaving gaps in the line he is traversing.

As proficiency increases, instruction should be given in diagonal traversing. In this case the target will be three bands, each with three figures, as for horizontal traversing. The bands will be joined so that each of the outer bands is in the same vertical

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plane as the centre band, and forms an angle of 120 degrees with it. In this case the firer is taught to combine the use of the elevating wheel with tapping for deflection. The same principles as for horizontal traversing apply for this diagonal traversing.

Instruction should be afforded in traversing from right to left, as well as from left to right.

During the instruction fire should be stopped at least twice in order to check the laying, and also to measure the distance traversed. By comparing the distance traversed with the number of groups fired, an estimate can be deduced as to the value of the traversing fire. For example: Traversing fire is ordered from the 1st to the 6th figure; fire is stopped after the 4th group. If the traverse has been correctly carried out, the gun should be laid on the interval between the 2nd and 3rd figures.

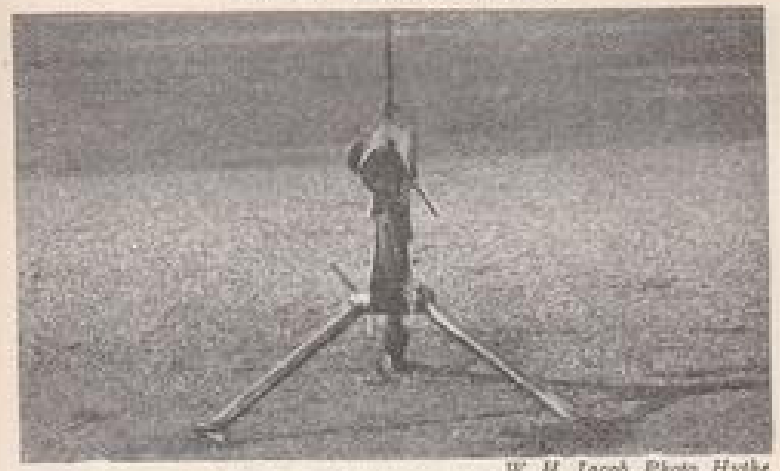
7. On the command **Unload,** No. 1 lowers the tangent sight, but not the slide, turns the crank handle twice in succession on to the buffer spring or roller, letting it fly back each time on to the check lever; then presses up the finger pieces on the bottom pawls, while No. 2 withdraws and repacks the belt in the box; this must be done correctly, and the lid closed and fastened; No. 1 clears the ejector tube and lock, and releases the lock spring by pressing the double button.

8. On the command **Dismount gun,** No. 1 removes the elevating joint pin, No. 2

Plate XI.

GUN CORRECTLY MOUNTED FOR FIRING.

FIG. I. FRONT VIEW.



W. H. Jacob, Photo, Hythe.

FIG. II. SIDE VIEW.

W. H. Jacob, Photo, Hythe.

POINTS TO BE NOTED.

1. Height of tripod suitable for average man to fire, sitting.
2. Legs firmly planted. Rear leg directly under the gun.
3. Crosshead upright.
4. Joint pins home and turned down.
5. Screws of elevating gear about equal.
6. Cork plug removed.

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Plate XII.

GUN INCORRECTLY MOUNTED FOR FIRING.

FIG. I. FRONT VIEW.

W. H. Jacob, Photo, Hythe.

FIG. II. SIDE VIEW.

W. H. Jacob, Photo, Hythe.

THE FOLLOWING POINTS SHOULD BE NOTED.

1. Tripod too high for the average man to fire, sitting.
2. Legs not firmly planted in the ground. Rear leg at an angle to the line of fire.
3. Crosshead leaning over and sights leaning.
4. Joint pin not turned down.
5. Small screw of elevating gear too short.
6. Cork plug not taken out.

replaces the cork plug, passes the ammunition box to No. 3, removes the gun as in mounting, and replaces it in its original position in rear (with Vickers gun first closing the shutter). No. 1 follows with the tripod. On reaching the original position, he sees that the joint pins are home and turned down, and then folds and clamps the legs.

SECTION DRILL BRIEFLY SUMMARIZED.

Words of Command.	*Duties, etc.*
"Fall in." *"Number."* *"Take Post."*	See Plate VIII. No. 1 Looks to screws of elevating gear.
	No. 1 Repeats all Orders.
"Mount Gun."	No. 1 Adjusts tripod, clamping legs tight. No. 2 Mounts gun, drives in cross-head pin and removes cork plug.
"Load."	Motions distinct and clear.
"At" (Elevation required).	No. 1 Repeats order for own gun, adjusts sight.
"At" (aiming mark).	No. 1 Lays gun. No. 2 Adjusts traversing clamp to suit No. 1, and when ready holds up his hand.
"Fire."	No. 1 Presses double button. Ranging-fire. Groups of 10 to 20 rounds. Rapid fire 30 to 50 rounds.
"Cease Fire."	No. 1 releases safety catch and remains steady.
	For Traversing Fire.
From—Figure To—Figure *"At" (Range).* *"Traversing Fire."*	No. 1 lays gun on flank figure named, presses button, then gives gun one tap, again presses button, then tap, and so on till limit is reached.
"Unload."	No. 1 Down sight with left hand. Turns crank handle twice over with right hand. Raises bottom pawls, clears ejector tube and lock, then presses double button. No. 2. Withdraws and repacks belt in box.
"Dismount Gun."	No. 2 Replaces cork plug, passes ammunition box back to No. 3 and removes gun. No. 1 Follows with tripod, sees joint pins home and turned down, folds and clamps legs.

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9. Instruction should be afforded in bringing the gun into action in the several positions of the tripod, and in various natures of ground. Firing up, down and along the side of steep hills should be practised. Practice should also be afforded in mounting the gun from the prone position, in firing from the lying position, and when kneeling on both knees, as well as when sitting. (*See Plates* XIII, XIV, XV.)

Drill with limbered wagons.

1. The detachment will be formed up in two ranks 6 paces from the rear of the wagon, facing outwards.

On the command or signal "**Action,**" the driver dismounts and stands to his horses. The sergeant and Nos. 5 and 6 double out to the section officer. The corporal lowers the tail board and superintends the unpacking. The remaining numbers ground arms on the word of command of the senior number and fall out to the wagon to perform the duties detailed on pages 146-152.

The corporal selects a suitable covered position for the limbered wagon, if necessary.

2. On the command or signal "**Dismount guns,**" the procedure for unpacking is reversed, and when completed, detachments fall in and take up arms by word of command.

Drill with pack transport.

Normally mules will be led by Nos. 1, 2, 3, 4, 7 and 8.

On the command "**Prepare for Action,**" Nos. 2, 3, 7 and 8 will link their mules to those immediately in front of them.

Nos. 7 and 8 will lead Nos. 1 and 4 mules. Nos. 1 and 2 will march on the tripod and gun sides respectively of No. 1 mule and loosen straps. Nos. 3 and 4 will march on either side of No. 2 mule.

On the command or signal **Action,** No. 1 will off-load the tripod and No. 2 the gun; No. 3 will off-load the leading ammunition animal.

The corporal will select a suitable covered position for the pack animals. The other duties of the various numbers are as on pages 146-152.

2. On the command or signal **Stand to,** Nos. 1, 2 and 3 will reverse the actions of off-loading. The detachment will then form up for marching.

Signals.

INFANTRY TRAINING, 1914 (SECTION 164).

1. In many cases observation will be impossible from the gun position, and it will be necessary for observers to signal results from a flank.

The following semaphore code is used in signalling the results of observation of fire:

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P = Plus: meaning fire observed at least 50 yards beyond target.
M = Minus: meaning fire observed at least 50 yards short of target.
T = Right: meaning fire observed to right of target.
L = Left: meaning fire observed to left of target.
C = Centre: meaning direction of fire correct.
U = Unobserved: meaning no observation obtained.
Q = Query: meaning fire observed, but its position uncertain.
R = Range: meaning range correct.

2. The signaller at the observation post should give the "call up" to show that the observers are ready. "P" and "M" may be repeated for multiples of 50 yards; thus "PP" would mean, "Fire observed at least 100 yards beyond target." Signals should be repeated from the gun position if this can be done without disclosing the position to the enemy.

3. On all occasions when guns are firing, the following signals should be used in controlling fire:

Signal for "Action."—Both arms fully extended, raised from the sides to a position in line with the shoulders and lowered again. This motion to be repeated until it is seen that the signal is being complied with. *Note.* A machine gun is said to be "*in Action*" when

it is mounted, loaded, and laid, not necessarily firing.

Signal for "Out of action."—Arm swung in a circular motion in front of the body.

By No. 2.
Hand up. = Gun ready to open fire.
By Controlling Officer.
Hand up. = Preparatory to opening fire.
Hand dropped. = Open fire.
Elbow close to the side, forearm waved horizontally. = Cease fire.

SUGGESTED SYSTEM OF ISSUING FIRE ORDERS FOR MACHINE GUNS.

There are four machine gun sections in an infantry brigade and three in a cavalry brigade. The machine gun sections of a Brigade may be used:

(*a*) *In sections* under the orders of the O.C. battalions.

(*b*) *Brigaded*, i.e., grouped under the control of the B.M.G.O., who takes the orders of the brigadier.

(*a*) will be the method employed when a battalion is acting independently when, the sections not being brigaded, no order for the machine guns is given by the brigadier; or, if already brigaded for the march, when the brigadier directs them to accompany their battalions.

(*b*) will be used when the brigadier con-

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siders it desirable. Frequently a combination of the two methods will be advisable (*vide* Infantry Training, 1914, Section 160).

The following notes are issued as a guide when giving fire orders either to a section or when guns are brigaded:

NOTES.

"A"

Section Fire Orders.

(1) Preliminary explanation:

(*a*) Guns may be used with either one or two elevations.

(*b*) Emphasize when guns would be used with one elevation (i.e., range obtained previously, by observation, range finding instruments, etc.) and draw attention to the object of combined sights, traversing and vertical searching fire.

(*c*) Gives rules *re* difference in elevation (i.e., up to 1,200 yards use 100 yards differences; over 1,200 yards use 50 yards differences with Mark VII ammunition).

(*d*) Minimum interval in the open between guns is 25 yards, based on the width of the area of ground struck by an effective shrapnel shell; it also depends on the ground and situation. (These points are brought out during tactical training.)

(*e*) Point out the position of the section officer. He would be normally on the left of the guns. Point out why he would be there, and explain when he would not, and what arrangements he would have to make if he is not there.

(*f*) Explain that in all orders it is always advisable to give the range first instead of the aiming mark. This enables the section or brigade machine gun officer to decide on his description of the aiming mark whilst the range is being passed down, and also avoids the necessity of the Nos. 1 having to take their eyes off the aiming mark (once it has been given them) for the purpose of adjusting their sights. Moreover, this method is more in conformity with rifle fire orders.

A pause must be made to enable the Nos. 1 to repeat, and if their guns are over or under-sighted, they put on the correct sighting elevation for their gun.

(*g*) The aiming mark is then given, with suitable pauses to enable the Nos. 1 to repeat. If necessary, the sergeant listens to one gun and the officer to the other.

The Nos. 1 should receive practice in looking along the sights of one gun, laid by the officer, and laying the other gun accordingly.

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(2) *When 50 or 100 yards differences are used.*

The elevation given by the section officer is for the left gun, and is not necessarily the sighting elevation for the estimated range.

(*a*) (Range and Differences). Pause until Nos. 1 repeat.
(Aiming Mark). Pause until Nos. 1 repeat.

(*b*) No. 1 of left gun says (e.g.) "1,000—100 yards differences."
No. 1 of right gun says "1,100—100 yards differences."

Note. If the guns are over or under-sighted, the Nos. 1 make the necessary allowances, *but* they call out the range as ordered for their guns, and *not* the sighting elevation.

(*c*) Guns are loaded and laid according to the above orders. As soon as the section officer sees the Nos. 2 hands up, he looks at the target through his glasses and, with his eyes on the target, gives the signal "open fire."

(3) *Traversing Fire.* Section officer wishes to traverse inwards. His orders would be:

(Range). Pause for Nos. 1 to repeat.
(Right and left limits of ground to be traversed). Pause for Nos. 1 to repeat.
(Inwards traversing).

Nos. 1 again repeat. Nos. 2 hold up their hand when ready, and section officer *signals* "open fire." Exactly the same method is employed when laying on the centre and traversing outwards.

(4) *Vertical Searching Fire.* One gun only available. Range obtained by judging distance. Officer gives out:

(Range). Pause for No. 1 to repeat.
(Aiming mark). Pause for No. 1 to repeat.
(To "Range" Vertical Searching). Pause for No. 1 to repeat.

Officer then gives signal to open fire as soon as No. 2's hand goes up.

(5) *Bracketing Fire.* Carried out in exactly the same way, except that two guns are used. Seldom necessary with Mark VII ammunition.

"B"

Fire orders for machine guns when brigaded.

The B.M.G.O. can issue his orders as follows:

I. When the guns are actually in action.
II. Before the guns come into action.

I.

When the guns are actually in action, the procedure to be adopted will depend on whether the B.M.G.O.'s voice can be heard or not.

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(*a*) *When the B.M.G.O.'s voice can be heard by all*, he will give orders direct to the Nos. 1 (*vide* Infantry Training, Section 164 (6), first lines).

(*b*) *When the B.M.G.O.'s voice cannot be heard* he will act as mentioned in Infantry Training, Section 162 (6), last six lines, e.g., he can

(1) Call up his section officers and issue orders *re* target (and range).

(2) Send these orders to the section officers by signal or orderlies.

The fire is controlled by signal from the B.M.G.O. either direct to the Nos. 2 or, when this is not possible, by means of observers who will be in view both of the B.M.G.O. and the Nos. 2 of their section, or (in exceptional cases) their section officer.

II.

If the B.M.G.O. issues orders before the guns come into action he should still control the fire as mentioned above. When, however, he details one or more sections for an independent task, the section officers of these sections are free to carry out the task and control the fire themselves.

(*a*) If "differences" "by sections" is ordered, the following will take place: B.M.G.O. gives out orders ("By sections, range, differences"), (pause for section officers to name the "number" of their section and the "range" for their section; they will not repeat the "differences") (aiming mark). Pause for section officers to repeat, e.g., No. 1 section officer says, "No. 1 section (range); both his Nos. 1 repeat to him, and so on; aiming mark, etc.

When the guns are ready, the Nos. 2 hold up their hands, and the section officers do likewise.

When B.M.G.O. sees all are ready he signals "open fire."

(*b*) If the section officers or orderlies come up to the B.M.G.O. for their orders, they will repeat the orders in turn before going back to their sections.

(*c*) *Traversing Fire.* Carried out in exactly the same way as if only one section was being employed.

In traversing with four or more guns two or more different aiming marks might be taken (e.g.) with four guns right, right centre, left centre and left, traversing "outwards" or "inwards" as ordered.

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EXAMPLES OF FIRE ORDERS FOR MACHINE GUNS.

1. Normal Fire Order Using One Elevation.

Range.—
Aiming Mark.—
Fire.—(Signalled.)
Cease Fire.—(Signalled.)
Changes in Elevation.—(*Up* or *down* 100) as required.

2. Combined Sights.

Range and Differences.—
Aiming Mark.—
Fire.—(Signalled.)
Cease Fire.—(Signalled.)
Changes in Elevation.—(Left Gun *up* 200) (Right Gun *down* 200) or more as required.

2 (a).

When Brigaded *within Voice Control* of B.M.G.O.

Fire orders are issued direct to the Nos. 1 as above.

When "Differences" "by Sections" are required.

Then the Fire Order will be as follows:

B.M.G.O.

(*a*) *By Sections.—Range.—Differences.*

(Pause for Section Officers to name the number of their Sections and the "Range" for their Sections; they do not repeat the "Differences.")

(*b*) *Aiming Mark.*
(*c*) *Fire.*

3. Traversing Fire.

Range.
Target.—(Naming Right and Left limits to be traversed.) "*Inwards Traversing.*"
Fire.—(Signalled.)

The same method is employed when laying on the centre, the Caution "Outwards Traversing" being given.

3 (a).

When Brigaded—under Voice Control—orders are issued as follows:

B.M.G.O.
Range.—
Limits of Traverse.—
Fire.—(Signalled.)

Section Officers repeat Limits to be traversed, and immediately issue orders respecting ground to be traversed by their own Sections, corresponding to their own positions.

4. Vertical Searching Fire.

Range.—
Aiming Mark.—
To "Range" Vertical Searching.—
Fire.—(Signalled.)

5. Bracketing Fire.

Ranges—Bracketing.—
Aiming Mark.—
Fire.—

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INSTRUCTIONS FOR THE MOUNTED DRILL OF MACHINE GUN SECTIONS OF MOUNTED UNITS.

(PROVISIONAL.)

THE SECTION.

1. Formations of a Section.

1. The formations of a section are:
   i. Line.
   ii. Column of route.

2. In *line*, the subsections, as shown in Figs. 1 and 2, are in line at twenty yards' interval, unless a different interval is specified. The section commander is two horse-lengths in front of the centre of the line.

3. In *column of route*, the subsections, as shown in Figs. 3 and 4, are in column at a distance of four yards. The section commander is half a horse-length in front of the centre of his section.

2. Line—Changes of Direction and Formation.

1. *Change of direction.*

The right subsection is the directing subsection. Changes of direction are made by wheeling or by forming column of route to the flank (Sec. **2**, 3), and then forming line (Sec. **3**, 2).

Line is formed to the rear by wheeling the subsections right about ("SUBSECTIONS ABOUT"), the guns still leading.

2. *Formation of column of route to the front.*

"FORM COLUMN OF ROUTE." The right subsection advances in column of route. The left subsection wheels half right, checking the pace as required, and wheels to the front when in rear of the leading section. Column of route may be formed from the left on the command "COLUMN OF ROUTE FROM THE LEFT."

3. *Formation of column of route to a flank.*

"COLUMN OF ROUTE TO THE RIGHT (LEFT)." Each subsection, forming column of route as it moves, wheels to the right (left); the subsection in rear checks its pace when necessary to obtain its proper distance from the leading subsection.

4. *Formation of column of route to the rear.*

Column of route to the rear is formed by wheeling the subsections about (para. 1), and then forming column of route as detailed in Sec. **2**, 2.

3. Column of Route—Changes of Direction and Formation.

1. *Change of direction.*

The direction can be changed by wheeling the head of the column, or, if a retirement

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is desired, by wheeling each subsection about.

2. *Formation of line to the front.*

"FORM LINE." The leading subsection advances, forming line as it moves. The subsection in rear by increasing its pace, wheeling half left at once, and half right when opposite its place in line, takes up its position when opposite its place in line on the left of the leading subsection at twenty yards interval.

If ordered to form line to the halt ("TO THE HALT FORM LINE"), the leading subsection will move forward a distance equal to its own length before halting, and the rear subsection will form on its left without increasing the pace.

If ordered to form line to the halt without advancing ("WITHOUT ADVANCING TO THE HALT FORM LINE"), the leading subsection halts and forms line, the rear subsection wheels to its left and moves to the flank until opposite its place in line; it then wheels to the front, halts, and forms line.

3. *To form line to the flank.*

"TO THE RIGHT (OR LEFT) FORM LINE." The leading subsection wheels at once to the right and forms line; the rear subsection wheels so as to be at an interval of 20 yards from the leading section, forms line, and

places itself in line with that section. As soon as line is formed, the right subsection directs.

In forming to the halt, the leading subsection having wheeled to the flank advances a distance equal to its own length before halting.

THE BRIGADE GROUP.

4. FORMATION OF A BRIGADE GROUP.

1. The formations of a group are:
   - i. Line.
   - ii. Column of sections.
   - iii. Column of route.

2. In *line*, the sections are in line at twenty yards interval, unless a different interval is specially ordered. The group commander is two horse-lengths in front of the centre section commander.

3. In *column of sections*, the sections, each in line, are in column at such a distance that when the sections are wheeled to a flank the group will be in line.

4. In *column of route*, the sections, each in column of route, are in column at a distance of four yards.

5. LINE—CHANGES OF DIRECTION AND FORMATION.

1. *Change of direction.*

The centre section is the directing section.

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A change of direction can be made either by shouldering the group or by wheeling the sections to the flank, and then forming line (*see* Sec. 6, 2).

Line is formed to the rear by wheeling the subsections about.

2. *Formation of column of sections.*

i. *To the front.*

"FORM COLUMN OF SECTIONS."	The centre section advances —followed by the left and right sections in succession —the two rear sections taking up their positions by making half wheels.

ii. *To the flank.*

"SECTIONS RIGHT (LEFT) WHEEL."	Each section wheels to its right.

3. *Formation of column of sections to the rear.*

Line is first formed to the rear by wheeling subsections about. Column of sections is then formed as described in para. 2, i.

4. *Formation of column of route.*

"FORM COLUMN OF ROUTE."	The centre section advances first in the required formation, and is followed in succession by the left and right sections

5. *Formation of column of route to a flank, or to the rear.*

"COLUMN OF ROUTE TO THE RIGHT (LEFT)."	Each subsection wheels to the right and follows the subsection in front as soon as it has got its proper distance.

Column of route to the rear is formed by forming column of route to the flank and then wheeling the head of the column.

6. Column of Sections—Changes of Direction and Formation.

1. *Change of direction.*

The direction of the march is changed by wheeling the head of the column ["HEAD RIGHT (OR LEFT) WHEEL"].

Column of sections to the rear is formed by wheeling subsections about.

2. *Formation of line to the front.*

"FORM LINE."	The centre section advances. The second and third sections, by increasing their pace and making half wheels, place themselves in line on the left and right respectively of the leading sections.

3. *Formation of line to a flank.*

"SECTIONS RIGHT (LEFT) WHEEL."	Each section wheels to the right (or left).

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4. *Formation of column of route.*

"FORM COLUMN OF ROUTE."	The right subsection of the leading section advances in column of route followed by the left subsection. The other sections cover and follow as it comes to their turn.

Column of route to the flank can be formed by advancing in column of route as described and then wheeling the head of the column to the flank.

7. Column of Route—Change of Formation.

1. *Formation of line to the front.*

Column of sections (Sec. 7, 3) is formed first and then group line (Sec. 6, 2).

2. *Formation of line to a flank.*

"TO THE RIGHT (OR LEFT) FORM LINE."	The leading section forms line to the right at once (Sec. 3, 3). The other sections form line to the right when opposite their places

in line.

3. *Formation of column of sections.*

"FORM COLUMN OF SECTIONS."	Each section forms line (Sec. 3, 2) and the rear sections then take their proper distances from the

sections in front.

4. *Formation of column of sections to a flank.*

"COLUMN OF SECTIONS TO THE RIGHT (LEFT)."	The leading section forms line to the right at once (Sec. 3, 3). The remaining sections move forward until they reach the ground

where the leading section wheeled; they then form line to the right, follow and cover.

MACHINE GUNS COMING INTO ACTION, SIGNALS, Etc.

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8. Section Coming into Action.

1.—i. *With wagons.*

"FOR ACTION FRONT (RIGHT OR LEFT) DISMOUNT."	The sergeant and Nos. 1, 2, 3, and 4 dismount and hand their horses over as follows:

The sergeant to the lead driver of one of the gun wagons; Nos. 1, 2, and 3 to the Nos. 7, and the Nos. 4 to the lead drivers of the ammunition wagons. Nos. 1 and 2 then take the guns into action as directed. If it is not necessary to move the wagons when the guns come into action, the corporal dismounts and hands his horse to the lead driver of the gun wagon not already holding the sergeant's horse, and Nos. 7 and the drivers also dismount.

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ii. *With pack.*

"FOR ACTION FRONT (RIGHT OR LEFT) DISMOUNT."

The sergeant and Nos. 1, 2, and 3 dismount and hand their horses over as follows: The sergeant and Nos. 1 to Nos. 7, Nos. 2 to the drivers of the gun pack horses, and Nos. 3 to the Nos. 4.

Nos. 1 and 2 then take the guns into action as directed, and Nos. 3 each off-load one of the ammunition animals.

If it is not necessary to move the horses when the guns come into action, the corporal dismounts and hands his horse to No. 7. The drivers and Nos. 4 and 7 also dismount.

2. One of the Nos. 5 will usually hold the section commander's and range-taker's horses when they dismount.

In peace, when there is not a second wagon available in a subsection, No. 4 on dismounting will hand his horse over to No. 7.

9. CHANGING FROM WAGONS TO PACK.

1. On the command "PACK SADDLES" all dismount, Nos. 1, 2, and 3 handing over their horses to No. 7, No. 4 to the wheel driver of the ammunition wagon.

2. The drivers of the gun wagon unhook the lead horses, move them forward two horse-lengths, and unharness them, placing the harness in rear.

No. 1 brings up the gun pack, gun carrier and gun, and No. 2 the tripod carrier, spare part box and water-bottle, placing them on the near side of the near horse. No. 3 brings up the ammunition pack and carriers, and the wheel drivers the ammunition boxes, placing them on the off-side of the off horse. The two horses are then saddled up and the harness is placed in the wagon by the man who has finished first.

3. The lead driver of the ammunition wagon unhooks the off lead horse, moves it up one horse-length in front of the near horse, and unharnesses it, placing the harness in rear.

No. 6 brings up the ammunition pack and carriers, placing them on the off-side of the horse; and No. 4 the ammunition boxes, placing them on each side of the horse. Nos. 4 and 6 saddle up while the lead driver places the harness in the wagon.

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10. SIGNALS.

SIGNAL.	MEANING.
1. The right or left hand, fist clenched, brought to the shoulder, elbow down; arm then extended in line with the shoulder pointing in the required direction; motion to be made twice.	"*Column of route.*" The direction in which column of route is required is indicated by the direction of the arm at the end of each motion.
2. "Troops right (left) wheel" (*see* "Cavalry Training"). 3. "*Form line*" (*see* "Cavalry Training").	Section, or sections, right (left) wheel. i. "*Form line.*"—When a group is in column of sections, or when a section is in column of route. ii. "*Form column of sections.*"—When a group is in column of route, or in line.
4. Same signal as "*form line*," except that the person making the signal faces the right (left), and points in that direction.	"*Line to the right (left).*"—When a section or group is in column of route.

FIG. 1.
SECTION IN LINE (WITH PACK).

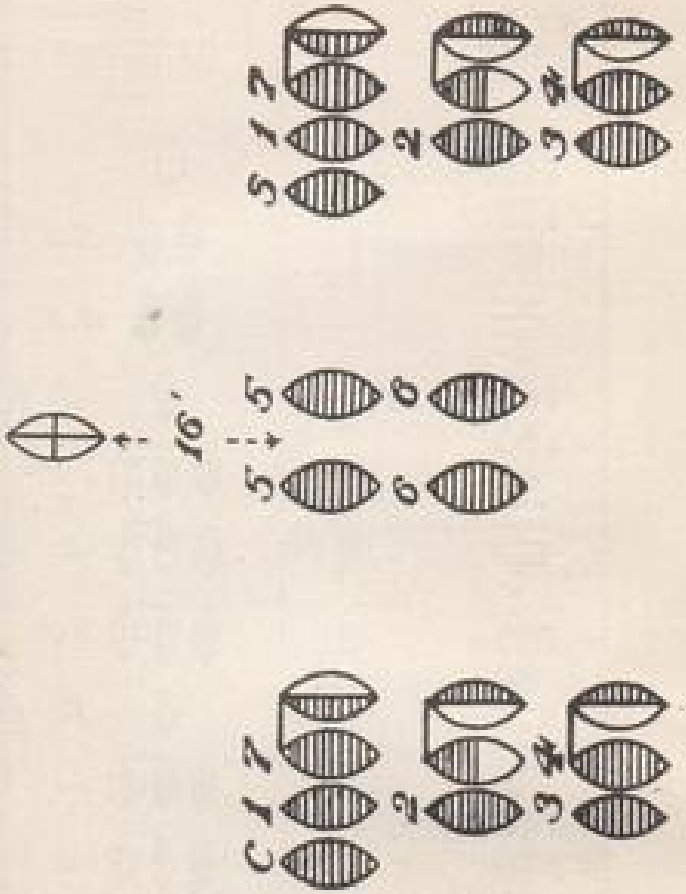

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Fig. 2.
SECTION IN COLUMN OF ROUTE
(With Wagons)

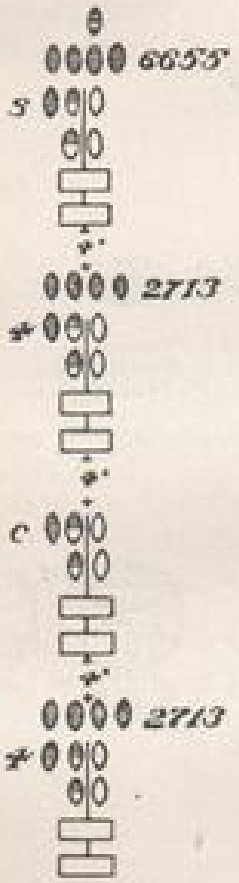
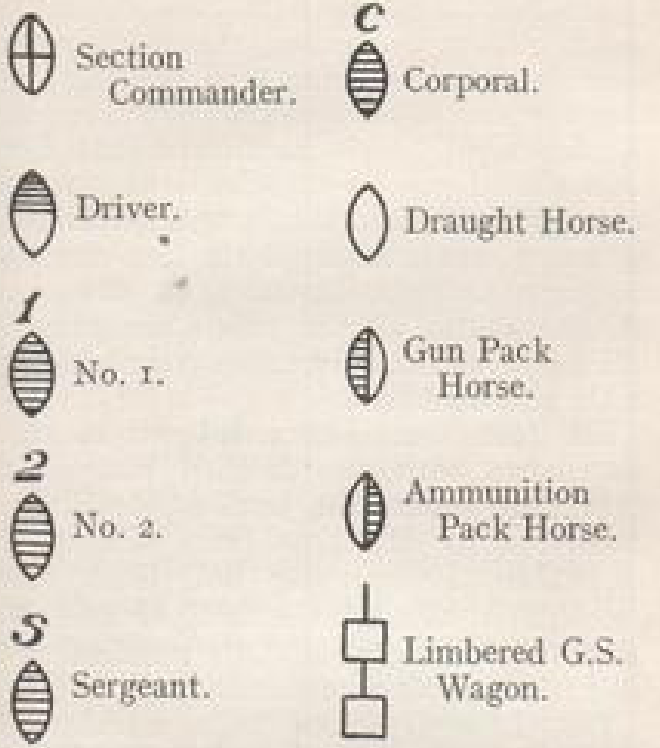


Fig. 3.
SECTION IN COLUMN OF ROUTE
(With Pack)

KEY TO FIGS. 1 TO 3



No. 1 is Firer.
No. 2 assists No. 1.
Nos. 3 and 4 are Ammunition Carriers.

No. 5. Scout.
No. 6. Range Taker.
No. 7. Horse Holder.

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TESTS OF ELEMENTARY TRAINING.

(PARA. 642 MUSKETRY REGS:)

The following tests have been devised to assist officers in testing the efficiency of their sections in elementary training, and also to ensure that no detail of such training is overlooked. It is important that these tests should not be considered as competitions against time, for although quickness is necessary, yet accuracy is the first essential. No man should, therefore, be passed as efficient unless all the points are properly fulfilled, even though he may complete them in the standard time.

The tests must be carried out in strict accordance with the detailed instructions given, for unless the smallest details are insisted upon, the time limit will not be applicable. In carrying out these tests, time can be saved if the first pair complete tests i. to v. consecutively; the remainder can be carried out as convenient.

The entire personnel of a machine-gun section, including, when possible, the drivers, should qualify in these tests, acting both as No. 1 and No. 2. This is necessary, for on service any member of a section may be required to replace a casualty at a moment's notice. In all tests No. 1 will repeat all orders received.

i. *To erect the tripod and mount the gun on the command "Mount Gun."*

The tripod, gun, and ammunition box to be laid on the ground, with Nos. 1 and 2 standing one on each side of them. The clamps of the tripod legs to be sufficiently tight to prevent them from falling loose when lifted; they must be close enough together to enable the tripod to be put into the hood; the strap to be buckled round the rear leg; traversing clamp tight. The position where the gun is to be mounted to be not more than 5 yards away.

Points to be observed.

Socket to be upright; all clamps tight; pins home and turned down; both elevating screws exposed the same distance; gun pointing to the front; cork plug withdrawn; Nos. 1 and 2, and an ammunition box, to be in position; tripod adjusted so that the gun is at a suitable height for No. 1 to lay and fire in a comfortable position without constraint. (With Vickers Gun, shutter must be open and "T" piece vertical.) *Standard time, 20 seconds.*

ii. *To load the gun on the command "Load."*

In continuation of i. Belt, with a few dummy rounds at the end, properly packed in the box, which will be closed and fastened.

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Points to be observed.

All loading motions to be quite distinct and correct; to be carried out without any slurring. *Standard time, 5 seconds.*

iii. *To adjust the sights and lay the gun on the completion of the command "At (Range).....(object)....."*

In continuation of ii. Gun loaded and ready to lay. Three objects will first be pointed out on a landscape target placed about 25 yards from the gun, but the No. 1 being tested will not know which will be given. Any range may be ordered so long as it will not be necessary to alter the slide by more than 500 yards up or down when the aiming mark is changed.

Points to be observed.

That the slide is adjusted and the gun laid with absolute accuracy. When checking the aim, "holding" pressure must be exerted on the handles; this may generally be done most conveniently by the instructor; but, should there be any question of different "holding," the No. 1 should hold the gun while the instructor checks the aim. No. 1 must be careful, however, that he does not exert lateral pressure when leaning to one side to clear the sights. *Standard time, 12 seconds,* from the range being ordered until No. 2 holds up his hand, indicating that No. 1 is ready to open fire.

iv. *To unload the gun on the command "Unload."*

In continuation of iii.

Points to be observed.

Tangent sight lowered, but without moving the slide; unloading motions to be quite distinct, without slurring; belt withdrawn, repacked correctly in the box with lid closed and fastened; lockspring released. *Standard time, 5 seconds.*

v. *To dismount the gun on the command "Dismount Gun."*

In continuation of iv. The gun will be dismounted, and, together with the tripod and ammunition box, will be placed in the same position as at the beginning of Test i. (Vickers Gun, shutter closed.)

Points to be observed.

All the points as at the beginning of Test i. and the cork plug replaced. *Standard time, 15 seconds.*

vi. *To bring the gun into action on the command "Range—object—action."*

This test combines i. to iii. It emphasizes the necessity for proficiency in all details

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required before a gun can open fire with effect. This test should, therefore, not be applied until proficiency has been attained in each of those that precede it. The numbers, gun, tripod and ammunition box will be as at the beginning of i.

Points to be observed.

All points as laid down for Tests i., ii. and iii, to be fulfilled. When No. 1 is ready to open fire, No. 2 will hold up his hand. *Standard time, 40 seconds,* from the range being ordered until No. 2 holds up his hand.

vii. *Horizontal Traversing. On the command "(limits of traverse)..... Traversing Fire."*

The target will be a horizontal line of figures, khaki on green, 3 inches high and 4 inches apart from centre to centre, placed at 25 yards from the gun. The gun will be laid on any figure that may be ordered, sights set at 500 yards. The test will comprise traversing from *right* to *left*, as well as from *left* to *right*. On the command "Traversing Fire," No. 1 will fire a group at the figure named, then traverse, so that the next group will be fired at the interval to the next figure; the subsequent groups will be fired at a figure and a space alternately. Each time a group is fired, pressure will be maintained on the double button for approximately 1 second, which is about the time required to fire a group of 5 to 10 rounds. The test will not be completed until the space included between 5 figures, including the first named and the fourth from it, has been traversed. In order to ensure that the traversing is satisfactory throughout, the order to cease fire will be given at least once during the traverse, but not before 5 groups have been fired, and the laying will be checked; this will be repeated when the limit of the traverse is reached.

Points to be observed.

That the traversing clamp is just sufficiently loose to enable the gun to be deflected by a sharp tap with the hand on the rear cross piece; when checking the laying, that the sights are laid approximately correctly; the object is to test the traversing by ascertaining if the strength of tap has been correctly estimated, and not accurate relaying; tapping backwards to obtain accuracy of aim will not be allowed. By counting the number of groups fired, the point of aim can be calculated, e.g., fire opened on the first figure and stopped after the 7th group has been fired; the gun should then be laid on the fourth figure. *Standard time, 3 seconds for each complete series,* i.e., a group and a completed traverse; e.g., in the example above, the time taken should

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have been 19 seconds, i.e., 6 complete series = 18 seconds; and a group = 1 second; total = 19 seconds.

viii. *Diagonal Traversing. On the command "(limits of traverse).....Traversing Fire."*

The target will be three lines of 3 figures as for vii. each joined at an angle of 120 degrees to the next.

The procedure will be as for vii. but in this test correct manipulation of the elevating wheel is included. Traversing will be from *right* to *left*, as well as from *left* to *right*.

Points to be observed.

As in Test vii. *Standard time, 4 seconds for each complete series,* as explained in Test vii.

ix. *Rectifying stoppages.*

The instructor will indicate the stoppage required by adjusting the crank handle of a spare gun, if available, or by holding a stick against a wall or target to exemplify the position of the crank handle which he wishes to illustrate. For example: Crank handle vertical; immediate action. The other positions of the crank handle can be similarly exemplified.

As an elementary test only, the "immediate action," *vide* Table of Stoppages, will be required, but as proficiency increases,

the remedy of stoppages may be more fully tested by introducing variations in accordance with the tabulated list of stoppages, 5th column, "Remedy in Detail"; e.g., after the "immediate action" in above example has been applied, keep the crank handle in the same position, telling No. 1 at the same time, "Gun still stops." No. 1 should lighten the fusee spring or put on the muzzle attachment. In all cases the "immediate action" must first be applied.

Points to be observed.

That the correct remedy is applied and completed; that all motions are correctly and clearly carried out; that the gun is relaid correctly after a remedy has been completed. *Standard time: The correct procedure to be begun within 3 seconds of the order "gun stops"* from the instructor.

x. *Belt filling.*

(*a*) A heap of 25 rounds of ball ammunition to be placed beside a man; these to be inserted in a belt. *Standard time, 1 minute.*

(*b*) As for (*a*), but 250 rounds to be inserted in a belt by one man. *Standard time, 12 minutes.*

Points to be observed.

Rounds to be placed anyhow in a heap and not arranged. Inspection of the belt on completion will show if it has been filled so as not to cause a fault in feed.

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Tests of Elementary Training.

Memory Table, Showing Commands, Times, etc.

No. of Test.	Nature of Test with Commands.	Standard Time.	Remarks.
I.	To Erect tripod and mount Gun. "Mount Gun."	20 sec.	Points—As on p. 195.
II.	To load the gun. "Load."	5 sec.	All motions distinct. No slurring.
III.	To adjust sights and lay gun. "At...(Range)...(Object)..."	12 sec.	From range being ordered until No. 2 holds up his hand.
IV.	To unload the gun. "Unload"	5 sec.	Motions distinct, belt correctly repacked, Lockspring released.
V.	To dismount the gun. "Dismount Gun."	15 sec.	All points as at beginning of Test I, and cork plug replaced.
VI.	To bring gun into action. (Range .... Object ...,) "Action,"	40 sec.	All points for Tests I, II and III to be fulfilled. Time taken until No. 2 holds up his hand.
VII.	Horizontal Traversing (Limits of Traverse). "Traversing Fire"	3 sec. for each complete series.	Points as on p 199.
VIII.	Diagonal Traversing (Limits of Traverse). Traversing Fire.	4 sec. for each series.	Points as in Test VII.
IX.	Rectifying Stoppages. "Gun Stops."	Correct procedure begun. 3 sec.	Correct remedy applied and gun relaid after remedy.
X.	Belt Filling.	1 min. 12 min.	25 rounds* 250 rounds.* *Placed in a heap—Pass thorough inspection when filled.

Plate XIII.

Position when Firing along a Steep Slope.

Fig. 1.

W. H. Jacob, Photo, Hythe

Fig. 2.

W. H. Jacob, Photo, Hythe.

POINTS TO BE NOTED.

1. The firer has adopted a position most suitable to the ground; and one that enables him to rest both elbows:

2. In Fig. 1 the tripod is incorrectly set up. The rear leg, being the longest, should be down the slope and should rest, if possible, on a firm basis, e.g. a tuft of grass (or other stop), as in Fig. 2, in order to obtain the greatest stability:

3. The crosshead in Fig. 1 is not upright.

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Plate XIV

Gun Firing from behind Slight Undulation.

Fig. 1. Front View.

W. H. Jacob, Photo, Hythe.

Fig. 2. Side View.

W. H. Jacob, Photo, Hythe.

Fig. 2 shows position of gun and Nos. 1 and 2.
The fence beyond the gun shows the slope of undulation.

Plate XV.

Firing on Level Ground. Tripod in Lowest Position.

W. H. Jacob, Photo, Hythe.

No. 1 is less sheltered and can "hold" the gun better than when lying on his chest.
The back of No. 1 may be supported by No. 2 turning on his right side and drawing up his knees.

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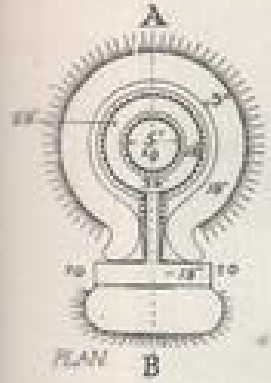
Cover and Entrenchments.

1. The use of cover must not be overlooked during training, for it is of great importance to machine guns, especially against artillery. Under some conditions, invisibility is of paramount importance; on other occasions, everything must give way to fire effect, and only by experience and practice at training can the relative importance of these be correctly gauged. Quick opening of fire and fire effect when required by the situation must never be sacrificed to reduction of loss by constructing cover.

2. Machine guns require but slight cover, and this can be quickly provided by digging in easy soil.

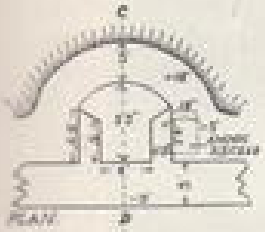
It may sometimes be advisable to construct cover on a gun position before guns actually reach it, and only when ready would the guns be moved forward.

Circular Machine Gun Pit.



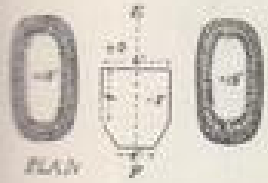
Section on AB.

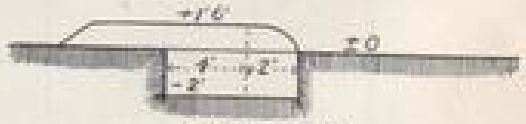
Machine Gun Recess in Trench.



Section on CD

Hasty Machine Gun Pit.





Section on EF.

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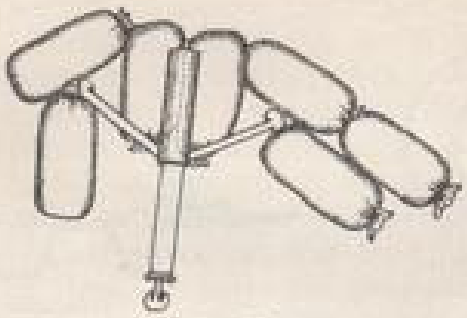
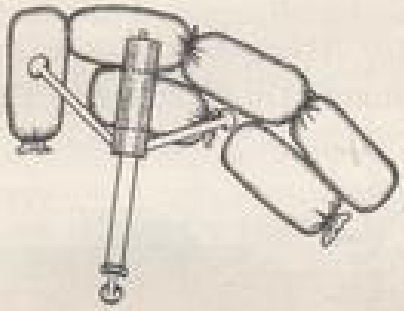
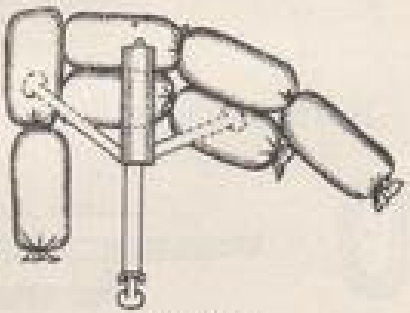
Hasty Sandbag Emplacement for Machine Gun.



Bottom Course.



Second Course.



Top Course.

Total, 20 bags.

Plate XVI.
Firing over Continuous Cover: Low Wall, Tree Trunk, etc.

W. H. Jacob, Photo, Hythe.

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Plate XVII.

Firing from a Circular Platform.

Fig. 1.

W. H. Jacob, Photo. Hythe.

Fig. 2.

W. H. Jacob, Photo, Hythe.

The value of this form of entrenchment is invisibility, all round traverse and good cover afforded for detachment.

Fig. 1 is the front view of the gun in action. No. 2 is invisible. The gun and No. 1 offer a very small mark.

Fig. 2. View from above, showing position of tripod, as low as consistent with good shooting.

Plate XVIII.

Section of Machine Guns Firing from Circular Platform.

W. H. Jacob, Photo, Hythe.

This form of entrenchment provides good cover for gun detachments, facilities for ammunition supply, and renders guns almost invisible at ranges beyond 800 yards.

Note.—The escape of steam when not using the condenser is liable to give the position away.

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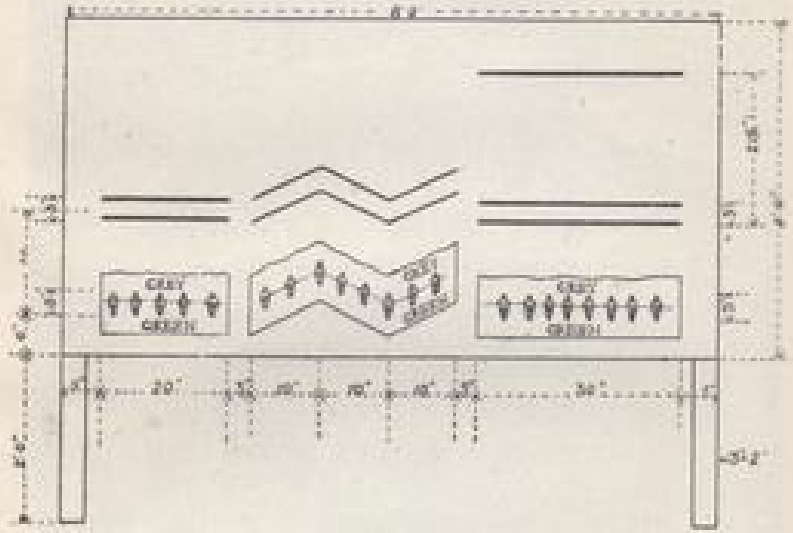
INSTRUCTIONAL TARGET FOR USE ON 25 YARDS' RANGES.

This target is of similar construction to a classification range target measuring 8 feet by 4 feet, with legs 2 feet long. The target

Plate XIX.



is faced with white paper. It is intended for use on a 30 yards' range or against the stop butt or earth bank of marker's gallery of a classification range. The target in each case must be placed 25 yards from the muzzle of the gun.

MACHINE GUN COURSE.

TABLE "C."

GENERAL INSTRUCTIONS.

1. Instructions have just been issued that the annexed General Machine Gun Course will, in future, be substituted for all machine gun courses previously authorized.

2. The course will be fired by officers, non-commissioned officers, and men of service machine gun sections belonging to the following units:—

New Armies.
Reserve Units.
Territorial Force Units.
Colonial Contingents.

3. Reserve machine gun sections will not fire the course, but detachments will be thoroughly instructed in mechanism, drill, etc.

4. No man who has already fired a complete course will carry out the General Machine Gun Course, and men who have commenced a course previously approved will complete it.

5. The following table shows the number of fully trained machine gunners who will

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fire the course, and must be maintained in Regiments or Battalions:—

Unit.	Officers.	Sergeants.	Corporals.	Privates.
New Armies (Infantry Battalions):—				
Service Section	1	2	1	24
Reserve Section*	1	2	1	24
Reserve Cavalry Regiments	1	1	1	24
Territorial Force:—				
Yeomanry Regiments	1	1	1	24
Infantry Battalions	1	1	2	24
3rd Line Depots	1	1	1	24
Special and Extra Reserve:—				
Infantry Battalions	1	1	1	24
2nd Reserve Infantry Battalions (supplying 3 Battalions)†	1	1	1	24
2nd Reserve Infantry Battalions (supplying 2 Battalions)†	1	1	1	18
2nd Reserve Infantry Battalions (supplying 1 Battalion)†	1	1	1	12
Colonial Contingents:—				
Cavalry Regiments	1	1	1	24
Infantry Battalions	1	2	1	24

* See paragraph 3.
† Until the 11 New Army goes overseas, 2nd Reserve Infantry Battalions will all be considered as supplying one Battalion for the purposes of this letter.

In draft-producing units the personnel of machine gunners will always be maintained, and as men are drafted others must at once take their place, who will fire the course as soon as they are considered fit to do so.

Commanding Officers must have a certain number of partly trained men always in readiness to take the place of machine gunners who are drafted out of the section.

6. *Ammunition.*—300 rounds per officer, non-commissioned officer and man of service machine gun sections.

New Armies, Reserve Units, Colonial Contingents	Mark VII.
Territorial Force Units	Mark VI.

Ammunition allotted to machine gun sections is not to be expended for rifle firing.

7. Machine gunners of New Army Battalions other than 2nd Reserve Battalions will not commence the course until authority is given to do so.

General Machine Gun Course.

Part I.

	Rounds allotted.
Practice 1.—Grouping	10
,, 2.—Single shot, traversing	10
,, 3.—Application	20
,, 4.—Vertical searching	20
,, 5.—(Omitted).	
Additional Practice.—Swinging traverse	30
Repetition	20
	110

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Part II.

(Range 400 yards for all practices except Practice 14.)

	Time Seconds.	Rounds allotted.
Practice 7.—Ranging . .	—	20
,, 8.—(Omitted.)		
,, *9.—Application .	20	30
,, *10.—Traversing .	50	60
,, 11.—(Omitted.)		
,, 12.—(Omitted.)		
,, 13.—Observation .	—	20
,, 14.—Fire at successive positions (range 600 yds. to 200 yds.)	—	40
Total . . .		170
Part I. . . .		110
Part II. . . .		170
Surplus for repetition of indifferent shots, to be pooled and used at the discretion of the Commanding Officer		20
Grand total . .		300

* Classification practices.

NOTES.

Part I.

1. *Additional Practice.*—For trench warfare, and against dense targets *at close range*, the "Swinging Traverse" has been found necessary. It in no way replaces the method of traversing by automatic tapping, which should still be considered the normal method. The swinging traverse is taught by teaching a man to traverse a machine gun instructional target evenly and smoothly in about 6 seconds.

Part II.

2. *Practice* 10.—It will be necessary to shorten the target, as 40 rounds less are allowed for in this practice. This will be done by using two 10-feet screens instead of three. Spaces will be 20 inches.

3. *Practice* 13.—(*a*) If a field firing range is not available, Practice 11 will be substituted for this practice.

(*b*) Observation should be taken by three parties, left, right, and centre, who should change round after each firer. Section officers should ascertain that each man has observed from each position.

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4. *Practice* 14.—10 rounds will be fired at each of the four distances laid down in Musketry Regulations. These rounds will be "spaced out" before commencing the practice, and the firer will proceed to the next range on completing his 10 rounds, whether he has secured a hit or not.

Classification.

5. Machine gunners will be classified upon the results which they obtain in Practices 9 and 10, General Machine Gun Course, as follows:—

To be classified as a "1st Class Gunner," 50 points.

To be classified as a "Qualified Gunner," 25 points.

Points will be allotted in the classification practices on the same basis of scoring as laid down in paragraph 647, Musketry Regulations, Part I, 1909 (reprint) 1914.

No man should begin firing with service ammunition until he has correctly passed the Tests of Elementary Training.

It is important that all the points to be observed before, during, and after firing are carefully carried out, in order to render them habitual to all machine gunners.

Part I is instructional, and since it is probably the first time a new machine gunner fires with service ammunition, careful and thorough instruction is necessary throughout the practices of Part I. The trained gunner must also regard these practices as instructional. The best value will be obtained by criticizing each practice while it is in progress, ceasing fire for the purpose, rather than by waiting until it is completed, when more ammunition will probably not be available with which to correct faults.

In these Practices the firer learns, as he gains experience, to understand thoroughly the peculiarities of his gun and its mounting, and to compensate for them by suitable holding. These points can seldom be learnt without careful instruction and explanation by the section officer.

In the Traversing Practice of Part I, no tapping backwards to correct faulty traversing will be allowed. In this Practice, a space exceeding 2 inches without a bullet mark indicates faulty traversing.

The sighting elevation to be used for the instructional machine gun target is 1,100 yards when using Mark VII ammunition. 800 yards with Mark VI. Aim taken at or in line with the feet of the figure should cause the bullets to strike in the centre of the band vertically above. Guns should, however, be

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harmonized before firing. As the accuracy of the first shot of each group fired by a machine gun is not reliable, a wide shot will generally be found when examining a group. Instructors should bear this in mind when criticizing the results of a practice or measuring the size of a group. In single shot traversing, therefore, the elevation may differ slightly from that required when firing groups.

In the Classification Practices of Part II, fire will be stopped as soon as the time limit is reached. No allowance will be made in these Practices for stoppages which are due to causes other than defects of the mechanism or breakages. The firer will be given time to look over the gun and the ammunition belt before each practice is begun.

Should the stoppage be due to a defect in the mechanism or to a breakage, sufficient time to remedy such stoppage will be allowed, or the practice will be repeated.

Points will be allotted in the Classification Practices (9, 10) as follows:

Practice 9.	Points.
75 per cent. of hits and over	35
60 " " less than 75 per cent.	30
45 " " " " 60 "	25
30 " " " " 45 "	15
15 " " " " 30 "	5
Less than 15 "	0

Practice 10. (Points)	
No spaces (greater than 20 inches)	45
Not exceeding 2 spaces	40
" " 4 "	30
" " 6 "	15
" " 8 "	5
" " 10 "	(exceeding 8 spaces = 0)
Exceeding 10 "	

Classification.

In order to be classified as a "1st Class" Gunner, 50 points must be obtained in the Classification Practices.

In order to be classified as a "Qualified" Gunner, 25 points must be obtained in the Classification Practices.

Those who obtain less than 25 points will be classified as "Inefficient," and should generally be replaced in the Machine Gun Section.

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TABLE C.

General Machine Gun Course for Service Machine.

Gun Sections of the New Armies, Reserve Units, Territorial Units, and Colonial Contingents.

Part I.—Instructional.

To be fired at a range of 25 yards. Target, Instructional Machine Gun Target, Plate 35, Musketry Instruction, Part II.

No.	Nature of Practice.	Rounds.	Method of Conducting and Object of Practice.
1	Grouping	10	*To teach the importance of the correct holding* required for the gun. During this practice the instructor should watch the firer so as to be able to criticize his method of holding and pressing the double button.
2	Single shot Traversing	10	*To teach accurate laying and automatic tapping.* Gun to be laid on the flank figure indicated by the instructor; fire a shot and tap alternately as in Section Drill (Traversing Fire). Shots should be approximately 2 inches apart. The result of each shot should be criticized. Single shot loading. It is useful to stop the practice a few times and criticize the firer's actions.
3	Application	20 (10 to each group)	*To teach correct laying and holding.* Two alternate figures to be indicated by the instructor. A group to be applied to the rectangle above each figure. The point of mean impact of each group should be within the rectangle above each figure respectively.
4	Vertical Searching	20	*To teach automatic manipulation of the elevating wheel.* Single shot loading. The gun to be laid on a figure with sights adjusted to 800 yards. Without altering the elevation of the gun, adjust the sights to 1,250 yards. Fire a shot, then elevate and fire, and continue elevating and firing alternately until the sights are again aligned on the original aiming mark. *Each shot should be approximately 2 inches vertically above the last.* Then traverse about 2 inches inwards and, without altering the elevation of the gun, adjust the sights to 800 yards and proceed as before, but depressing after each shot instead of elevating. When the sights are aligned between the figure originally laid upon and the next, the practice is completed, and each shot should be approximately 2 inches vertically below the last. The vertical interval of 2 inches at 25 yards is the horizontal equivalent to 60 yards at 1,000 yards range, or about the depth of the effective zone for the range.
5	Traversing (omitted)	(50)	Having learned to know the holding required for the gun in Practices 1 and 3, and Practice 2 having afforded practice in automatic tapping, *instruction is now given in practical traversing by groups of 5–6 rounds.* The ammunition should not be divided in groups of 5 rounds in the belt; the gunner learns to judge the size of groups for himself. Five figures to be indicated by the instructor. Gun to be traversed from *right to left.* Groups should be evenly distributed along the band above and between the figures indicated; there should be no space exceeding 2 inches without a bullet mark.
6	Swinging Traverse	30	See Notes, Part I.
	Repetition	20	
	Total rounds per man	110	

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TABLE "C." *Part II.—Classification Practices, 9, 10, only.*

No.	Nature of Practice	Target Screen (covered with Regulation brown paper).	Range (Yds.)	Rounds.	Time (secs.)	Remarks
7	Ranging	5' high 10' wide	400	20	—	In these practices each man has an opportunity of sighting his gun on the open range before firing the classification practices. Useful instruction in the practical method of ranging may be imparted in Practices 7 and 8. The quickest method is to fire a group, observing the strike; then elevate or depress *without touching the tangent sight.* Fire again, and turn elevating wheel until nucleus of fire falls on the target. Now the slide should be adjusted *without touching the wheel* and the sight shows the sighting required to hit the target.
8	(omitted)				—	
9	Application	"	400	30	20	
10	Traversing	5' high 20' wide	400	60	50	Gun to be traversed from *right to left.* The firer is required to traverse the target with the rounds allotted within the time limit without restrictions.
11	(omitted)					
12						Gun to be traversed from *left to right* under the same conditions as in Practice 10.
13	Observation	5' high 10' wide	400*	20	‡	Range known approximately. If it is probable that the firer can himself observe, he should apply his fire from such observation. The remainder of the section, except a No. 2 to assist the firer, should form two groups under the sergeant and corporal respectively. These groups should observe the fire by eye or with field glasses from the flanks. Each N.C.O. and man should note down the result of his observation of each group fired, and at the end of the practice put

* If a field firing range is not available Practice 11 will be substituted for this practice. See Notes, Part II.
‡ No limit, but at a rate of at least 250 rounds a minute.

						against each note of his observation the semaphore signal he would have sent had he been required to signal results. If the firer is unable to obtain observation himself, another No., not the No. 2 at the time, will control the fire from observation with field glasses, the remainder observing from a flank as described above. After each firer has completed the practice, the section officer will criticise the results of the observation as regards methods followed by firer and observers.
Practice 14	Fire from successive positions	25 iron falling plates on a frontage of 30 feet	600 to 200	40*		Ranges known approximately. Nos. 1, 2 and 3 will fall in with the gun, tripod and ammunition box, as for the 1st Test of Elementary Training, about 100 yards in rear of first fire position, which will be approximately 700 yards from the targets. The section officer will mark the first and subsequent fire positions, and, on his signal, the gun, etc., will be carried forward at a steady double, and fire opened without further orders. The gun will be carried dismounted, and the tripod legs will be closed and clamped until the fire position is reached. Fire will be continued at each position until a hit is obtained. Sights will not be adjusted until the new position is reached. *At alternate fire positions the firer will adopt the prone position when firing. The objects of this practice are to emphasize the lessons of elementary training as regards quick and correct mounting of the gun and quick opening of fire, and also to exemplify the principle of maintaining fire until effect is obtained.* It is often desirable to time the practice or a portion of it. If the section officer decides to do so, the time should be taken until a hit is obtained—not merely until fire is opened, because this encourages men to open fire without accurate laying. The advance to a fire position should not be a race between detachments if both are carrying out the practice simultaneously, nor against time.

* 10 Rounds will be fired at each of the four distances. These rounds will be "spaced out" before commencing the practice, and the firer will proceed to the next range on completing his 10 rounds, whether he has secured a hit or not.

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Amplified Notes on Part I, Table "C."

(Applicable both to the Maxim and Light Vickers Machine Guns.)

1. The whole of Part I is instructional, and no records need be kept, other than the number of rounds expended.

2. The section officer should invariably be present when Part I is being fired by his section.

3. Since Part I is instructional, no time limit is imposed.

4. The section officer may repeat any practice he thinks necessary. He can save ammunition by reducing the number of rounds fired in any practice by a trained machine gunner, who proves himself to be a thoroughly efficient firer.

5. In regiments and battalions, Part I should not be begun until men are thoroughly trained in Immediate Action and have passed the Tests of Elementary Training.

6. The traversing clamp should always be sticky.

7. General points regarding *Methods of Instruction*, except for "Swinging Traverse" practice.

(*a*) The instructor should generally watch the firer, order him to cease fire from time to time and examine the target from the gun position. Having made any necessary criticism the practice should be continued, and when it is finished, further criticism should be made *at* the target.

(*b*) It is important that a firer should be taught self-reliance in Part I and whenever the gun is fired. He should therefore be given the opportunity of carrying out the points before, during, and after firing, as well as of remedying any stoppages that may occur, without any assistance. Only when he has failed to carry out any of these points or has shown himself unable to deal with a stoppage should the instructor remind or assist him.

(*c*) No. 2 should invariably hold up his hand to indicate that No. 1 is ready to fire, and should await the order or signal of the instructor or superintending officer before telling No. 1 to open fire.

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8. *Points regarding Range Discipline.*

(*a*) Never allow anyone in front of the bracket until guns are reported clear by No. 1.

(*b*) Before going to the target, the lock of the Maxim gun to be on the rear cross piece. With the light Vickers gun, the lock to be raised above the guides.

(*c*) The ejector tube of the Maxim gun to be cleared for instructional purposes and extra safety before going to the target.

9. All points before, during, and after firing, must be carefully attended to, and no slackness must be allowed in any point of elementary training.

10. *Part I, Table "C."*

Practice I. Grouping 10 rounds. It should be remembered, when criticizing a group, that the first round is not reliable, because when it is fired, the barrel is not vibrating, and therefore it bears an inconstant relation to the remainder of the group; this, however, is not always noticeable.

This practice teaches and shows the following:

(*a*) The condition of the barrel and tripod.

(*b*) Any peculiarities of the mechanism.

(*c*) The holding required for the gun.

(*d*) The sighting of the gun.

(*e*) The adjustment of the fusee spring necessary to obtain the proper rate of fire.

Method of conducting the practice. The instructor watches the firer to see if he holds correctly and presses the double button (thumb piece) without pushing the gun forward or pulling it off the mark.

Criticism. The holding should be criticized both at the gun position and when at the target with reference to the group.

Practice II. Single shot traversing. Fired from right to left, from left to right, or both one after the other, at the discretion of the section officer and provided there is sufficient ammunition. Single shot loading must be explained.

Method of conducting and criticism. After 2 or 3 shots, stop the firing and examine the target from the gun position. Criticize the strength of tap with reference to the lateral interval between shots, but ignore elevation, because the practice is to teach tapping and not application.

Practice III. Application. *Method of conducting and criticism.* Watch the firer, but glance occasionally at the target and

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check the laying if considered necessary. There should be no unnecessary delay in loading, laying, and firing. Practice I should guide the firer as to the elevation. At the target, accurate laying and correct elevation should be points for criticism.

Practice IV. Vertical Searching. *Method of conducting and criticism.* Stop the firing after 2 or 3 shots and criticize before continuing the practice. The shots should show no marked lateral dispersion as this would probably be due to side pressure on the handles, perhaps caused by the firer keeping one hand on the wheel and pressing the double button (thumb piece) with the other.

**Practice V.* Horizontal traversing. Fire is applied from observation; the tangent sight may with advantage be lowered. The firer should stop firing when the end of the traverse ordered has been reached. Remind the firer that the method of altering the slide is too slow for practical service traversing, and that in Practice V he learnt the quicker method of using the wheel for slight corrections of elevation.

Criticism. Each group should be of the correct volume, i.e., of 5 or 6 shots. The firer should be discouraged from using the sights as he should, by this time, be able to tap automatically and correctly.

At the target, the following points should be discussed: (*a*) Good application, which includes the area of the group, the volume, and the correct elevation; (*b*) the spaces between groups.

**Practice VI.* Diagonal traversing. The instructor should note carefully that the wheel is not turned the wrong way when starting a new elevation.

* Omitted from General Machine Gun Course.

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POINTS WHICH SHOULD RECEIVE ATTENTION IN MACHINE GUN TRAINING.

1. Location of spare parts and spare parts boxes in action.

2. The proper numbers to carry out minor repairs.

3. See that necessary spare parts are always with the gun.

4. In certain cases, apply to the nearest detachment for necessary spare parts.

5. *Limbers.* Sufficient use to be made of them to get the guns forward from position to position. Otherwise the gun numbers, in the later stages of a fight, will be too exhausted to efficiently work the guns.

6. Ammunition supply.

7. The preliminary reconnaissance. Officers, sergeants, and range takers not to group at one spot.

8. Duties of the sergeant.

9. Range taker to have ideas of his own.

10. Oiling of guns during pauses in fighting.

11. Reserve supply of water and oil.

12. System of changing over Nos. not yet sufficiently practised.

13. Section officers must watch the movements of the troops with whom they are co-operating.

14. Rapidity in coming into action most essential.

15. *Condensers.* Attach to guns in sufficient time to prevent water boiling.

16. *Description Points.* For good results, to be as far away from gun positions as possible. Often too close.

17. *Opening of Fire.* To be simultaneous, to ensure surprise effect. Section officers must ensure that both Nos. 2 have their hands up before giving order.

18. *Ranging Fire.* Judge distance quickly and open fire simultaneously with one elevation.

19. *Bursts of Fire.* Must not be too small. Bursts of two or three rounds useless.

ADVANCED DRILL.

1. Section is supposed to have been thoroughly trained on the barrack square, i.e., Tests of Elementary Training passed, and thorough knowledge of mechanism.

2. The following stages of Advanced Drill are suggested as guides, with the object of ensuring that all the numbers are well trained in all the duties before they fire ball ammunition on the field firing area.

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When *time* is short Stages 1 and 2 should be combined and also Stages 3 and 4.

FIRST STAGE.

One gun, one ammunition box, belt with 50 dummy cartridges, Nos. 1, 2 and 3 only; remainder to watch and change rounds, including the sergeant and corporal, so that all are exercised. The instructor will previously select suitable positions for the gun, fulfilling the following requirements:

(a) Gun position on fairly level ground.
(b) Gun firing down a steep slope.
(c) Gun firing up a steep slope.
(d) Gun firing horizontally along a steep slope, both to the right and to the left.

Nos. 1, 2 and 3, with the gun, tripod, and ammunition box, will be in a position of readiness not more than 10 yards from the selected position. Having marked the position with a stick or stone, and having pointed it out to the numbers, the instructor will give a definite situation and objective; also the approximate range, e.g., the enemy has been seen collecting in that farm; lay on the gate, range 900. When the situation and objective are clearly understood, the instructor will give the order, "Action." Nos. 1 and 2 will then take the tripod and gun respectively, followed by No. 3, and will place the gun in action on the marked position.

The same procedure will be followed in each

of the four positions previously selected by the instructor.

In this stage, neither will the position of the limbered wagon nor the question of concealment in approaching the gun position be considered: but particular attention will be paid to the following points:

(1) Correct setting up of the tripod, suitably and firmly, to obviate the necessity for readjustment.

(2) Positions adopted by Nos. 1 and 2 so as to obtain the greatest fire effect while offering the least vulnerable target.

(3) Position of the ammunition box to ensure correct feeding.

(4) Position taken up by No. 3 so as to facilitate the supply of ammunition with the least exposure.

(5) That the gun is correctly "in action," i.e., loaded, sighted, and laid, in accordance with the requirements of the situation.

All details of elementary training to be observed, e.g., cross head upright, traversing clamp "sticky," cork plug out.

(6) That the gun is not fired, to emphasize the necessity which will frequently occur on service, of coming into action ready to seize any opportunity that may occur, but not to fire unless the situation demands it.

SECOND STAGE.

This stage will differ from the first stage only in the following respects:

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The position of readiness to be not closer than about 50 yards from the gun position.

Instead of indicating the exact position on which the tripod will be set up, the instructor will mark two points, about 20 yards apart, between which the gun will come into action. The frontages selected will exemplify the positions described in the first stage. Whenever possible, there should only be one small portion of the indicated frontage from which the objective can be seen when the gun is in action. By this means N.C.O's and men will obtain practice in selecting suitable gun positions to meet the particular requirements of the situation, and thus develop an eye for ground.

In this stage, attention will be paid to the following points:

(1) Use of ground to obtain the greatest concealment in approaching the gun position from the position of readiness. This should be kept in mind by the instructor when selecting the positions.

(2) Method of approach to the gun position as regards carrying the gun, tripod, and ammunition box. Concealment will be considered of greater importance than rapidity within reasonable limits.

(3) The six points already mentioned in the First Stage.

Observers should be sent out towards the direction of the objective to note visibility

in the approach, when the gun is being mounted and when in action.

THIRD STAGE.

In this stage the entire section is exercised on the same progressive system as detachments in the 1st and 2nd Stages. The actual position of each gun will be marked by the instructor in order to bring out the handling of the section with reference to the ground and the requirements of the situation. All the numbers will be exercised in their particular duties, and these will be changed so that each N.C.O. and man may have practice in each duty. The general situation must necessarily be somewhat amplified in order to employ scouts and range takers in a realistic manner, e.g., the enemy have been observed collecting in the copse on the left front of the infantry; the section is covering the left flank. The guns are to be prepared to engage the enemy should he issue from the copse; our left is not protected.

In this stage ranges will be actually taken. Whenever possible, the limbered wagon will be present, or its position will be imagined, and the corporal will be in charge. Supply of ammunition will be actually carried out, e.g., boxes brought from the position or supposed position of the wagon, and empty belts will be passed back to be refilled; if the wagon is present, the belt-filling machine should be in position for use.

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The points to be attended to in the 1st and 2nd Stages will be equally noted in this stage.

FOURTH STAGE.

When the first three stages have been thoroughly practised, the selection of positions and the various methods of fire suitable to particular situations will now be introduced. A situation should be carefully prepared so that, if possible, there is one particular position that is the most suitable to meet the tactical situation, while at the same time fulfilling as many of the requirements of a suitable Machine Gun position as possible. Again, the method of fire employed should be carefully criticized to ensure that the method most suitable to the occasion was employed, e.g., if the situation indicated traversing fire, perhaps to cover movement, concentrated fire at a particular point would obviously be inapplicable.

Opportunities should be taken during this stage for selecting and reconnoitring positions in defence. It may be assumed that the Machine Gun sections are held in reserve, and areas should be allotted within which positions should be reconnoitred. Some of the points to be criticized in such reconnaissance would be:

(1) The exact gun positions.
(2) The best way to the positions.
(3) Ranges.

(4) Control and observation post.
(5) That all information has been noted in such a manner as to be easily understood by an officer who has never seen the ground

Again, perhaps an outpost situation may be given; lay guns by day to cover certain approaches at night.

In each case guns should actually come into action on the positions selected.

N.C. Officers should be practised in directing the fire in accordance with the prepared situation.

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CHARACTERISTICS OF THE MACHINE GUN.

1. A thorough knowledge of the characteristics of the machine gun is essential, for upon those characteristics is based the tactical employment of the gun.

2. The characteristics, and their effect on the tactical employment of the machine gun, are as follows:

I. Fixed Platform.

Three important conclusions follow from this characteristic:

(1) The personal factor is reduced. (2) The reduction of the personal factor, combined with the fixed platform, result in the close grouping of machine gun fire. (3) Suitable for night firing.

From these conclusions the following deductions may be drawn regarding their effect on tactical employment:

(1) By reducing the personal factor, approximately the same results can be obtained in war as in peace. This also renders the machine gun particularly valuable in the crisis of a fight.

(2) The close grouping of fire causes a very restricted area of ground to be beaten; this is less than half the area beaten by rifle fire,

The following table gives a useful indication of the cones formed by the bullets at various ranges in their flight. The cone of bullets would actually take the form of an ellipse, but for convenience only the longest, i.e., the vertical diameter, is given:

Range (Yds)	Vertical diameter of: 75% Cone. Mark VI.	75% Cone. Mark VII.	100% Cone. Mark VI.	100% Cone. Mark VII.	The height of the centre of the cone above the ground at each range is slightly more than the height given for the rifle in M.R., Pt. I; this is owing to the inclination of the line of sight due to the muzzle of the gun being 20 inches above the ground.
300	—	3′ 0″	—	6′ 6″	
500	3′ 5″	5′ 0″	8′ 0″	10′ 10″	
700	—	7′ 0″	—	15′ 2″	
800	—	8′ 0″	—	17′ 4″	
1,000	8′ 0″	10′ 0″	20′ 0″	—	
1,500	15′ 0″	15′ 0″	39′ 0″	—	
2,000	24′ 0″	—	70′ 0″	—	
	75% Cone. Horizontal diameter.				
500	4′ 0″	2′ 6″			
1,000	8′ 0″	5′ 0″			
1,500	13′ 0″	10′ 0″			

This close grouping, and therefore highly concentrated fire, is particularly suitable for surprise effect, and in addition not only facilitates observation of fire, but renders such observation reliable.

Another advantage of close grouping is the safety with which fire can be directed, under certain limitations, over the heads of other troops to support their advance or increase the volume of fire.

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There is, however, another aspect which is actually a disadvantage, for, owing to the close grouping of the fire, narrow or widely scattered objects, such as a machine gun or extended infantry, offer unsuitable target; while, unless the range can be accurately ascertained, or the target has considerable depth, effect can only be ensured by the employment of several guns and by skilful fire direction.

(3) Lines of fire can be prepared by day for firing at night.

II. Rapid Production and Application of Large Volume of Accurate Fire.

When the gun is loaded and laid, fire can be opened instantaneously at any moment. This is particularly valuable on outpost, or for night firing, for the gun can command any required locality for any length of time, and the double button only requires to be pressed to produce and apply a large volume of accurate fire at the moment it is required.

As regards the indication of the point of aim, greater accuracy is ensured than is the case with an equivalent volume produced by rifle fire, because with the machine gun the point of aim has only to be recognized by one man, or it will frequently be possible for the machine gun officer to lay the gun himself, or for the firer to take the point of aim from another gun already laid.

III. Narrow Front and Shallow Depth from which a Large Volume of Fire can be Delivered.

A machine gun occupies the same frontage as two men with rifles. If the normal rate of machine gun fire is taken as 300 rounds a minute, and the average rate of rifle fire at 12 rounds a minute, it is apparent that the volume produced by the machine gun is more than 12 times that of two men armed with rifles. This indicates the value of the machine gun in cramped localities where it is not possible to deploy a number of rifles, such as villages, roads, or defiles. Also as a flank defence to enfilade hedges, walls, or obstacles.

These characteristics, while enabling the gun to take advantage of small or isolated cover, also renders it not only difficult to locate, but difficult to range upon as, with so small and isolated a target, great accuracy in ranging is essential.

IV. All-Round Traverse.

The chief value of the all-round traverse lies in the facility with which the gun can be turned in any direction without moving the tripod, and with the minimum of movement or exposure. This facility, combined with the characteristic of narrow frontage and shallow depth, enables the machine gun to at once engage an enemy advancing from an unexpected direction without increasing its vulnerability to enfilade fire. This power of

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all-round traverse indicates action on a flank or in a detached post, as particularly suited to the machine gun. It also renders the gun a useful auxiliary to rifle fire in engaging an enveloping attack by mounted or other troops.

V. Invulnerability.

Only two men are required to serve the gun, but they must be well trained. The gun cannot be easily put out of action provided there are sufficient trained men to replace casualties.

VI. Mobility.

A machine gun with tripod mounting can be taken wherever a man on foot can go; the gun can thus be employed to closely support infantry in any nature of country, and in close country will often take the place of artillery, when the ranging power and mobility of this arm can no longer be used for close support. By mounting a few men on the limbered wagons, the guns can be rapidly moved from place to place to meet unexpected or critical situations. For this purpose, machine guns may often be retained as a mobile reserve of fire under the hand of the commander, particularly in defence.

VII. Accidental Cessation of Fire.

Consisting as it does of delicate mechanism, the fact must be accepted that the machine gun will stop firing from time to time and will thus fail to meet the requirements of

the situation. Such cessations of fire may be due to want of care—which is avoidable; or due to mechanical causes—which are unavoidable and liable to occur in any piece of mechanism. Both can be overcome by careful training of the detachment; in the former case by care and examination of gun and ammunition; in the latter, by skill in remedying the cause of cessation. In addition, a large expenditure of ammunition, of which the gun is capable, brings a considerable strain on the mechanism, and this, combined with the probability of accidental cessations of fire, renders the gun *unsuited to prolonged firing*. Fire should therefore be reserved for *suitable targets*, having due regard to the tactical requirements, and for *decisive action*.

VIII. Noise of Firing, and Steam.

The peculiar noise of the automatic firing attracts attention towards the gun, and, when steam is given off owing to the water in the barrel casing boiling, the position of the gun can be readily located. This indicates skilful use of cover in order to conceal the gun position, and the reconnaissance of alternative positions.

3. The above characteristics may be briefly summed up as follows:

THE MACHINE GUN IS A WEAPON OF OPPORTUNITY, PARTICULARLY ADAPTED FOR SURPRISE EFFECT BUT NOT FOR SUSTAINED FIRE ACTION.

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Methods of Illustrating the Cones of Fire from Machine Guns.

Trajectory discs showing 75% and 100% cones of Maxim gun with Mark VII ammunition.

The discs can be made of wood or of canvas on an iron frame. They should be made with a strap round the pole so that the discs can be moved up or down the pole and fixed at the heights given by means of a pin through the centre of the disc. The scantling for the pole varies from 1 inch square for the smallest disc to 3 inches by 2 inches for the largest. The larger discs require rope guys for use in a wind. The discs are made elliptical in shape.

The muzzle of the gun is taken as 20 inches above ground.

1. 75 % *cone ellipses.*

	100	200	300	400	500	600	700*	800*
Vertical axis ...	1' 0"	2' 0"	3' 0"	4' 0"	5' 0"	6' 0"	7' 0"	8' 0"
Horizontal axis	6"	1' 0"	1' 6"	2' 0"	2' 6"	3' 0"	3' 6"	4' 0"
Probable course of lowest shot of 100 % cone below centre of disc.	1' 1"	2' 2"	3' 3"	4' 4"	5' 5"	6' 6"	7' 7"	8' 8"

* To be hinged along horizontal axis.

The following cones may also be of use:

	1,000 Yards.		1,500 Yards.	
	Vertical	Horizontal	Vertical	Horizontal
75% ...	10' 0"	5' 0"	15' 0"	10' 0"
100% ...	25' 0"	15' 0"	40' 0"	30' 0"

II. Range.	Height of centres of discs above ground.		
	700 yds. trajec.	800 yds. trajec.	900 yds. trajec.
(Yards)	ft. ins.	ft. ins.	ft. ins.
100	3 5	4 3	5 0
200	5 9	6 11	8 8
300	6 7	8 11	11 1
400	6 10	9 8	12 11
500	6 0	9 6	13 7
600	3 10	8 0	13 0
700	—	5 1	10 8
800	—	—	6 6

III. Heights of Trajectories of German S bullet and of Mark VII bullet above line of sight.

Range—800 yards.	*Mark VII.* ft. ins.	*German.* ft. ins.
At 100 yards	2 9	2 5
„ 200 „	5 8	4 2
„ 300 „	7 10	5 6
„ 400 „	8 10	6 4
„ 500 „	8 11	6 4
„ 600 „	7 7	5 6
„ 700 „	4 10	3 4

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FIRE DIRECTION.

1. The general principles of rifle fire explained in Musketry Regulations, Chapter 3, apply to machine guns, though they require to be modified in detail. Machine gun fire should be regarded as a special form of collective fire.

2. Owing to the barrel of the machine gun being supported in a different manner to that of the rifle, and consequently the jump being different, the trajectory tables require slight modification, though those given in the Musketry Regulations for the rifle are sufficiently correct for practical use.

3. The dispersion in area of machine gun fire is less than half that of rifle fire under peace conditions.

4. Owing to the closeness of grouping and rapidity of fire, observation is facilitated; furthermore, as wild shots do not occur, one of the main causes of error in observing rifle fire is eliminated; if any shots are observed, it is safe to conclude that the remainder are *vertically* close to those observed. The machine gun groups are easily distinguished from rifle fire by the even, successive, and continuous character of the hits; consequently up to the limit of easy observation (800 yards) in favourable ground, the fact that ranges are unknown will not affect machine guns to the same extent as rifles, as correct observation will probably be obtained at once.

5. The guiding principle of machine gun fire, which is based upon the characteristics of the weapon, is that the fire is produced and applied in groups. The number of rounds comprising a group varies within certain limits, according to the requirements of the situation.

6. The following methods will be used:

(*a*) *Ranging Fire.* The bursts of fire will be limited to from 10 *to* 20 *rounds*. The object of this method is to obtain observation and so correct any errors in sighting. Under favourable conditions for observation, such as dry earth, sand, etc., a burst of 10 rounds should be sufficient to give observation. Under less favourable conditions, up to 20 rounds in a burst may be necessary. It should be noted that, considering the close grouping of the fire, unless observation is obtained with bursts of 20 rounds, *it is unlikely that observation will be obtained with larger bursts.*

(*b*) *Rapid Fire.* This is used when the greatest volume of fire is required. It is produced and applied by means of a series of long groups of 30 to 50 rounds. The firer pauses momentarily between each group to ensure that the sights are correctly aligned, and continues until ordered to cease, or until he considers it necessary to do so. Rapid fire will be used (1) when the sighting elevation has been successfully obtained by rang-

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ing fire; (2) when surprise effect is required; (3) with combined sights.

(*c*) *Traversing Fire.* This method of distributing fire laterally is employed against a linear target and is applied by means of a series of small groups with the object of covering as wide a front as possible with only sufficient volume to ensure effect. In this case a group should consist of from 5 to 10 rounds only, because against a linear target greater volume will not produce greater effect.

Up to 1,000 yards, experiments show that machine guns firing 250 rounds in one minute can distribute annihilating fire (i.e. without any lateral gaps greater than 1′ 6″ between shots) over 25 yards of front. This will form the basis of calculations as to whether any particular line is sufficiently dense to repay the expenditure on it as regards material effect, and apart from any tactical necessity there may be to engage it. This is also the basis for calculating the number of guns required to defend any frontage, or to engage any target in a given time.

Machine guns can engage lines to greater advantage from an oblique direction, as the spaces between figures are closed up the further to a flank the gun position may be. At an angle of 45 deg., experiments show that increase in effect of at least 30 per cent may be expected.

Swinging Traverse. For trench warfare, and against dense targets *at close range*, the

"Swinging Traverse" has been found necessary. It in no way replaces the method of traversing by automatic tapping, which should still be considered the normal method.

(*d*) Single, deliberate shots are of no value for ranging, as, owing to the gun then being perfectly steady, these shots bear no relation to the subsequent rapid grouping. The same generally applies to the first shot of every group.

7. From the foregoing paragraphs it will be seen that fire direction may be divided into two main headings:

(i) Allowance for error of day.

(ii) Allowance for error in ranging by artificial dispersion in depth.

8. *Allowance for error of day* is dealt with in Musketry Regulations, Chapter III, Sections 28–30.

9. *Allowance for error in ranging by artificial dispersion in depth.* Owing to probable errors in ranging, difficulty in estimating the error of the day at long ranges, and to the close grouping of the machine gun, it becomes necessary to increase the depth of the beaten zone to give assurance of obtaining fire effect. The amount by which the beaten zone has to be increased depends on (i) the permissible error in ranging, and (ii) the probable error in ranging.

As regards (i) it will be clear from the diagram below that if we make an error in ranging which is greater than half the depth of the effective zone, the target will

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not be included in this zone, and fire will be ineffective. For example, if the correct range to the target is 1,000 yards, but is estimated to be 965 yards, the furthest shots of the effective zone (with Mark VI ammunition) will theoretically just strike the target (Diagram A). If the range were estimated at 950 yards, the furthest shots would strike 15 yards short of the target.

DIAGRAM A.

It is clear, therefore, that the permissible error for ranges of and beyond 1,000 yards with Mark VI ammunition is as follows:

1,000 yards		35 yards.
1,500	,,	30 ,,
2,000	,,	25 ,,

As regards (ii), the probable error depends on the means we have at our disposal for obtaining the range. These may be divided into three heads, and the probable error with each is as follows:

(*a*) Direct ranging with Range Finding instruments, 5 %.

(*b*) Judging distance by eye, 15 %.

(*c*) Judging distance by eye with assistance of key ranges, 10 %.

From this it is seen that if the range to a target is given by each of the above means to be 1,000 yards, the probable error will be, with: (*a*) 50 yards; (*b*) 150 yards; (*c*) 100 yards: and in each case it may be either over or under the estimated range.

Considering both the permissible and the probable error together, it is seen that in practically all cases it is necessary to considerably increase the depth of the effective zone to ensure fire effect.

To effect this, the following methods can be adopted:

(*a*) Combined sights.
(*b*) Bracketing.
(*c*) Vertical searching.

10. *Combined sights.* When two or more guns are working together, the depth of the effective zone can be increased by ordering different elevations to be used by each gun, while each uses the same aiming mark. By this means, while the effective zone is increased, the density of fire is considerably reduced. The extreme difference between the sighting which will ensure that no gaps are left between the cones of the different guns is the depth of the effective zone for the range. If, therefore, when firing at 1,000 yards with Mark VI ammunition, one gun fires with elevation 1,035, and the other with 965, the cones will theoretically just join at the 1,000 yards point (Diagram B). The density of the fire

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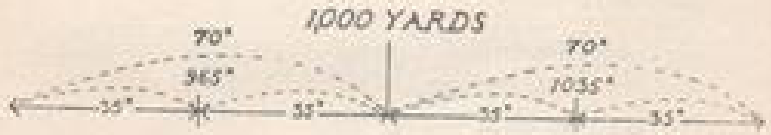
will be very much less, however, between 990 and 1,010 yards than at 965 and 1,035, at which ranges the nuclei of the different cones will fall, and in order to give an even density to the combined effective zone, it is necessary to make the two cones slightly overlap. The greatest difference that can be allowed between guns is therefore only 50 yards (Diagram C).

DIAGRAM B.

Estimated Range.



Reduced Density of combined cone over 20 yds.

DIAGRAM C.

Overlap of 2 Cones at 20 yards.

The difference of sighting used depends on the number of guns available and also the probable error in ranging. In order to find the depth of the combined effective zone, the following method is useful:

Multiply the number of guns available less 1, by the difference in sighting used, and

add the effective zone of one gun, e.g., To find the depth of combined effective zone at 1,000 yards when four guns are available and 50 yards' difference used:

$$(4-1) \times 50 + 70 = 220 \text{ yards.}$$

Since the greater the concentration of fire the greater will the effect of fire be; therefore combined sights should not be used—or with small differences only—if accurate observation of the strike of the bullets can be obtained, unless surprise is required.

Infantry Training, Section 163, 2, and Cavalry Training, Section 236, deal with the use of combined sights when Mark VI ammunition is in use. The principles therein mentioned require some modification when Mark VII ammunition is used, otherwise there will be a considerable waste both of power and of effect.

The respective depths of the effective zones may be taken as being:

Range (yards).	Mark VI (yards).	Mark VII (yards).
500	150	220
600	134	204
700	118	188
800	102	172
1,000	70	140
1,200	66	112
1,500	60	70

From this it is apparent that, allowing an error of 10 per cent. in ascertaining the range, the flatness of trajectory within 800 yards will ensure the target being included

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in the effective zone. Therefore with Mark VII ammunition, combined sights should not be used within 800 yards.

The Table on page 258 shows how dependent successful fire action is upon the degree of accuracy with which the range to the target is obtained. It therefore appears necessary to allow greater latitude to machine gun commanders when using Mark VII ammunition than is contemplated in the existing regulations.

For example, referring to the attached table, if a commander knows that his range finder is reliable, and that his range taker is efficient, he could count on an error not exceeding 5 per cent.; if, then, the range was given as 1,000 yards, he could safely use one elevation and not be obliged to resort to combined sights to secure effect. If, however, he had to judge the range, or appraised his range finder or range taker as only reliable within 10 per cent., he should use two guns differing by 100 yards in elevation.

If, again, owing to light, or other unfavourable conditions, the commander considered his estimate of the range to be only within 15 per cent., he would require three guns differing by 100 yards. He would probably not open fire with two guns, as success would be exceedingly doubtful, unless required to do so by the exigencies of the situation.

It may be stated for general guidance

that when using Mark VII ammunition, combined sights differing by 100 yards should be used beyond 800 yards and up to 1,200 yards inclusive; beyond 1,200 yards the difference in sighting should not exceed 50 yards between guns. As will be seen from the attached table, if this guiding principle is followed successful fire action can be relied upon. Under certain conditions, however, as explained above, a machine gun commander should use his judgment in modifying the application of this principle in accordance with the facilities that may be available for accurate ranging, and thus gain the tactical end in view with less expenditure of ammunition and less exposure of guns and personnel.

Another question which should be left to the judgment of the machine gun commander occurs when sections are brigaded. In such a case differences of elevation may be given either to each gun or to each section. This will depend on the tactical situation. For example, if three sections are co-operating and the commander judges that ranging can be relied upon to give an error not exceeding 10 per cent., and the range is given as 1,200 yards, he could either order each section to use the same elevation and the difference between sections to be 100 yards or he could order three guns each to take an elevation differing by 100 yards.

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TABLE SHOWING THE EFFECT OF COMBINED SIGHTS, AND ILLUSTRATING THE SAVING OF FIRE POWER AS ACCURACY IN RANGING INCREASES:

Range in Yards.	Depth of Effective Zone in yards.	Mark of Ammunition.	Error in Ranging.	Consequent Depth to be searched in yards.	Using Combined Sights.			
					Minimum Number of Guns Required.	Difference in Sighting Elevation in yards.	Depth Searched in yards.	Distance over which Cones Overlap.
1,000	140	VII	5%	100	Combined sights not required.			
			10%	200	* 2	100	240	40
					* 2	50	190	90
	70	VI	15%	300	* 3	100	390	40
			5%	100	* 2	50	220	20
					† 2	100	Space between conts.	
			10%	200	† 4	50	220	
1,500	112	VII	5%	120	* 2	100	212	12
					* 2	50	162	62
			10%	240	* 3	100	312	
			15%	360	† 4	100	412	
	56	VI	5%	120	† 2	50	Space between conts.	
					† 3	100	216	16
					† 3	50	220	
1,500	70	VII	5%	150	† 2	100	Space between conts.	
					† 2	50	170	20
			10%	300	* 3	100	320	
			15%	450	* 3	50	420	
	60	VI	5%	150	† 3	100	160	
			20%	300	† 3	50	310	
			15%	450	* 5	50	410	

* In these cases another gun would be required, as the depth is insufficient for assurance of effect with number of guns given.

† In these cases 100 yards' difference of elevation between guns is too much, for a space would be left between the cones within which the target might be, and would consequently be struck only by the few bullets outside the 75 %; i.e., the effective zone.

The former would be used against a very favourable target, which required a large volume; the latter when the volume produced by three guns would meet the tactical requirements, in which case one section and one gun would be held in reserve. This would be in accordance with the principles laid down in Infantry Training, Section 162, 12.

12. *Control of guns when using combined sights.* In order to obviate the need of long fire orders, it is only necessary for machine gun officers to give out the lowest range to be used. This will always be taken by the left hand gun of the section or battery as the case may be. The No. 1 of that gun will pass to the No. 1 of the gun on his right the range he *himself* is using and the differences ordered. This No. 1 in his turn will pass on his range to the gun on his right, and so on down the line. In addition, the directing officer must state the difference in sighting between guns to be used, which will also be passed down by Nos. 1.

When the target to be engaged is a narrow one, and all guns are using the same aiming mark, it will be generally impossible for the firers to observe their own particular cone of fire as distinct from the whole combined cone. Under these circumstances no alteration in sighting is permissible except under the orders of the directing officer.

Combined sights should be discontinued when the cone of fire of any one gun can be

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accurately observed, one sighting elevation being given to all guns according to observation.

In cases, however, in which the target to be engaged is a broad one, different points of aim, corresponding to their own position in section or battery, can be given to each gun or section, and in this case each firer should endeavour to correct his elevation from observation of the bullet strike. In addition, traversing fire from the flanks inwards should be ordered, and converging cones of fire will be obtained, producing greater moral and material effect.

If, after fire has been opened, the directing officer wishes to alter the sighting used in accordance with his observation, or for other reasons, the quickest method is to bring the elevation of his left hand gun above that of the right hand gun, or vice versa, according as to whether he wishes to increase or decrease the elevation originally used. For example:

With two guns, using combined sights at 1,000 yards with Mark VI ammunition, the original elevations would probably be 975 and 1,025 yards. In order to increase the elevation of these combined sights by 50 yards, he would give the order, "Left Gun up 100." This would then leave the guns firing with, left gun 1,075, right gun 1,025 yards. The amount necessary to bring the highest or lowest gun's elevation the correct amount below or above the remaining guns respectively, is to multiply the difference in sighting between guns by the number of guns used, e.g., 4 guns, 50 yards difference; amount necessary, 200 yards.

If the directing officer is directing the fire from the opposite flank to that of the gun or guns whose elevation he wishes to alter, it may be necessary to cease fire momentarily for his order to be received, after which he will immediately give the signal to continue. This will in many cases not be necessary when he is on the same flank.

13. *Bracketing.* When only a section is available, and it is found that sufficient assurance of fire effect is not given by the normal method of combined sights, bracketing should be used. The method in which it is carried out is as follows:

The range is estimated by eye alone, or in conjunction with key ranges; the probable error is then determined, and also the limits between which it is found necessary to search with fire in order to ensure fire effect. If, for example, the range is estimated by eye to be 1,000 yards, it is probable that the target is somewhere between 1,150 and 850, or if with the aid of key ranges, between 1,100 and 900. These elevations (when using Mark VI ammunition) are allotted to the right and left guns respectively, who fire a burst, then work *inwards* by altering their respective elevations by 50 yards at a

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time, eventually passing each other. If, during the fire, observation of the bullet strike can be obtained, fire should immediately be ordered with the correct elevation. When using Mark VII ammunition, however, this method would not be necessary at 1,000 yards with a 10 per cent. error, as combined sights would ensure the necessary amount of ground being swept. The elevations with above mark of ammunition when using Bracketing Fire will be altered by a 100 yards instead of 50s. This method is rather slow and expends a large amount of ammunition, but the moral effect will be considerable, as the enemy will have to pass through the zone of fire of one or other of the guns. Should the nature of the target render it advisable, traversing fire can be used in conjunction with bracketing.

14. *Vertical Searching.* The principles of Vertical Searching are taught in Part I, Table "C."

It is a useful method when one gun is available to engage a target in enfilade, or whenever the target is of greater depth than the beaten zone of the cone.

It requires much skill on the part of the firer to avoid gaps between the bursts, which should be of a volume suitable to the density of the target engaged. Alterations of elevations are made by the turn of the elevating wheel, and not by the tangent sight, as is the case in bracketing fire.

The range to the nearest point of the target is taken, sights adjusted, and gun laid on that point. Sights are then set for the furthest point of the target to be engaged. This will then throw the line of sight short of the aiming point. A burst is then fired, elevating wheel is then turned sufficiently to cause the next burst to strike beyond the first, but not so far as to allow a gap or defiladed zone between the two bursts.

This process is continued until the line of sight is again brought on to the aiming mark. The whole length between the near and far end of the target will then have been swept.

If the target is broader than the breadth of the normal cone of fire for that range, the gun should then be slightly traversed and process reversed. The slide will in this case be brought back again to the distance of the near point of target; the line of sight will then be above aiming mark, and the elevating wheel will be turned until the line of sight is again on the aiming mark.

15. In the following paras., dealing with overhead, indirect, and night fire, are exemplified the application of the methods of fire referred to in para. 7, to particular tactical situations. These examples must be studied and practised in peace, as skilful preparation and direction are necessary if adequate results are to be obtained on service.

16. *Overhead Fire.* Owing to the fixed platform and close grouping of machine gun fire, this method may be used with safety, under limited conditions.

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The state of the barrel, the condition of the tripod, and the nature of the ground on which it is erected, the visibility of the target, accuracy of aim, holding of the gun, and the probable errors in ranging, are all factors which increase the difficulty and risk of employing overhead fire, and necessitate a reasonable margin of safety.

The flat trajectory necessarily restricts overhead fire at the closer ranges if the gun position, friendly troops and the enemy are on the same plane, while at long ranges the dispersion of the cone of fire and difficulty of ranging makes it dangerous.

Overhead fire, therefore, might normally be employed under the following conditions:

(*a*) Only "from" or "at" a commanding position, or across a valley; but *not* when the gun, friendly troops and target are on the same plane.

(*b*) The range to the target must be obtained accurately, that is, within 5 per cent. of error.

(*c*) If the range is 1,000 yards or under and the angles of sight to the target and friendly troops contain an angle of not less than 30 minutes.

If the range is between 1,000 and 1,500 yards, the angle must not be less than 60 minutes.

These angles allow for a large margin of safety at the shorter, and a sufficient margin at the longer, ranges.

If the range is over 1,500 yards overhead fire should not be used.

The safety angles mentioned above may be obtained:

(*a*) From prismatic field glasses graticuled for Mark VII ammunition, in which case the distance between the zero line and 600 yards graticules gives an angle of 32 minutes, and that between the zero line and 1,000 yards an angle of 63 minutes.

(*b*) By the card and string method. Attach a piece of string of any convenient length —but the longer the better and not less than 24 inches—to a card.

If the string is 27 inches long the angles required, viz., 30 and 60 minutes, are equivalent to the distance between lines drawn on the card ·23-inch and ·47-inch apart respectively.

By holding the card, on which these lines are drawn, vertically and 27 inches from the eye the spaces between the lines will give the required safety angles, e.g.:

In this diagram the range to the enemy is between 1,000 yards and 1,500 yards,

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consequently the safety angle of 60 minutes is taken. It is therefore safe to fire over the supported troops until they reach A.

When the conditions outlined in the preceding paragraphs are very marked, no difficulty in deciding when to cease fire is to be anticipated. As these conditions become less marked, there will be a difficulty in deciding when the limitations of overhead fire are reached. In such cases as these, when the command of the gun position is not clearly marked, the machine gun commander should not only act as explained in the last paragraph, but should also frequently place the lower line of the card or graticule, according to the range, on the *heads* of the friendly troops, and should cease fire as soon as the upper line touches the enemy's position.

17. *Indirect Fire.* Owing to the fixed mounting of the machine gun, indirect fire can be used to cover areas of ground, sweep roads, etc. Apart from the fact that fire direction is facilitated when firing unexposed to aimed rifle fire, the advantage of being concealed from the enemy's artillery must not be overlooked.

By means of graticules cut across the focal plane of a pair of prismatic field glasses, indirect fire can be as commonly used and as quickly applied as ordinary direct fire.

These graticules represent the angles of elevation for the Maxim gun. The topmost

graticule represents zero, and the lines below every hundred yards from 200 yards. (See diagram M.)

Proceed as follows:

(1) Obtain the range to the target.

(2) Move to a flank or slightly forward and observe the target through field glasses, so that the graticule representing the range to the target falls across the target, *vide* Diagram M, e.g., 900 yards to target, and then see which line cuts a suitable aiming mark above the target which can be seen from the gun position, e.g., house 500 yards graticule. The range corresponding to that line, namely, 500 yards, is the tangent elevation at which to open fire, using the house as an aiming mark, if it is required to strike the target. By this method very great accuracy can be obtained, and indirect fire opened as easily and quickly as direct.

This method becomes inaccurate when the eye of the officer using the graticuled glasses is more than about 6 feet above the gun.

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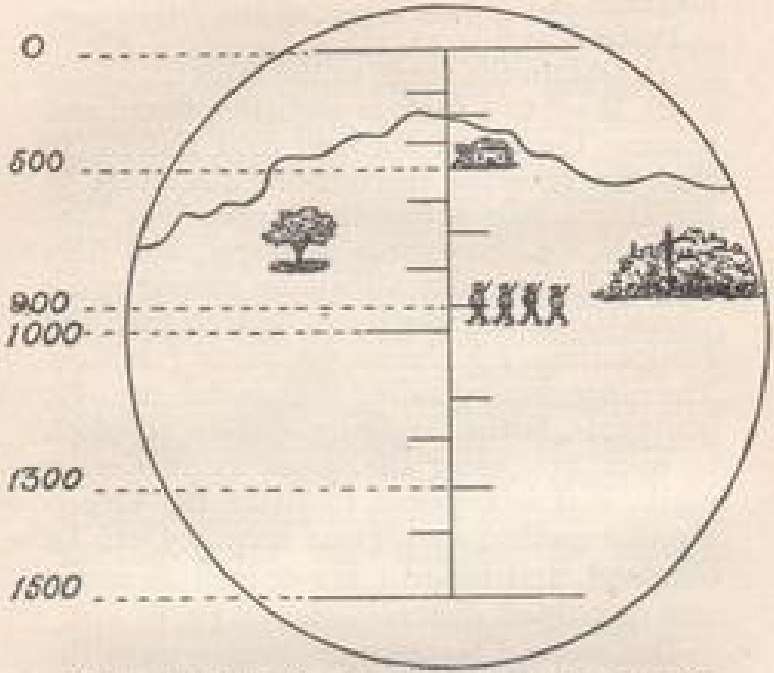
Diagram M. Illustrating the use of graticuled glasses.



The angles of elevation may be put in graticule form on a visiting card, but it must be understood that such methods are less accurate than graticules cut on field glasses. The graticule card enclosed in the pocket of this book has been used with striking success in the hands of experts. A notch was cut in a stick which was held to the shoulder to ensure the card being exactly 18 inches from the eye.

18. *Night Firing.*—If the gun position is not exposed to the enemy's fire, the gun, if

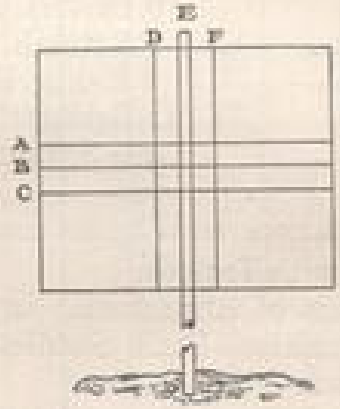
not otherwise required, can be mounted and laid by day, and left till night.

A stick is placed in the ground 10 yards in front of the gun in a direct line with the target.

At *night* this stick is replaced by a lamp, and the sight altered (but not the gun) until the sights are aligned on the lamp. This ensures accurate re-laying should the gun shake off during firing.

In order to align the sights on a light, it is necessary that a beam 9 inches broad at 10 yards be used. Diagram P shows the form of front for the lamp, which allows of searching within definite limits by means of auxiliary aiming marks.

DIAGRAM P.



Bands A, B, C, D, F are $\frac{1}{2}$ inch wide.

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The tangent sight slide should be adjusted so that the line of sight is directed at the intersection of the lines B E. The lines A C are respectively 1 inch above and below line B; if the lantern is placed 10 yards away from the gun, these lines will give a difference of angle of 10 minutes from the normal line B. The amount that 10 minutes represents in range can be calculated from the tables of elevation. The firer can be ordered to concentrate by firing with the original laying or to search within definite limits by varying his aim from line A to line C.

Deflection can also be ordered by means of the lines D and F, which are 2½ inches from the centre line, giving therefore a deflection of about 2 feet per 100 yards.

WAR ESTABLISHMENTS OF NEW ARMIES, 1915.

4 Guns.
1 Subaltern.
2 Sergeants.
1 Corporal.
24 Privates.
6 Drivers.
1 Batman.
1 Riding Horse.
12 Draught Horses.
4 G.S. Limbered Wagons.

The G.S. Limbered Wagons contain:—

4 Guns with Tripods.
7,000 Rounds of Ammunition in Belts, and
4 Ammunition Pack Saddles for lead horses.

1 Pickaxe, 1 Shovel and 1 Billhook are carried with each Machine Gun Tripod as part of its equipment. 60 Sandbags per Infantry Battalion are carried for use with Machine Guns.

AMMUNITION SUPPLY.

Approximate No. of Rounds provided in the Field for each Machine Gun.

For each Machine Gun of —	With Units.		Total with Units.	With Brigade Ammunition Column.	Ammunition Park.	With Divisional Ammunition Column.	Lines of Communication.	Total Rounds *Per Gun* in Front of Advanced Depôt.
	On Wagon in Belts.	Regimental Reserve.						
Cavalry or Mounted Infantry	3,500	16,000	19,500	10,500	6,000	—	14,000	49,500
Infantry	3,500	8,000	11,500	5,000	6,000	5,000	14,000	41,500

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Application of Principles to the Organization and Tactical Handling of Infantry Machine Guns.

Infantry Training, 1914. (Section 161.)

1. Machine guns are organized in sections, which form an integral part of the battalions to which they belong. But as circumstances may make it advisable to employ several sections together, a brigade commander may, if he so desires, detach two or more machine gun sections temporarily from their battalions and place them under the brigade machine gun officer (see page 282) for employment as a unit of the brigade.

2. When employed by sections with their battalions, machine guns are usually better able to take advantage of fleeting opportunities to support infantry closely, and are more easily concealed both on the move and in action than when brigaded.

On the other hand, a single section of these guns cannot be relied upon to obtain results proportionate to the expenditure of ammunition when first opening fire, at distances beyond about 1,200 yards. Further, it is rarely possible to arrange that sections acting independently shall co-operate effectively with each other.

Machine Guns Brigaded.

3. By employing several sections under the control of one commander, a brigade commander is able to keep a powerful reserve of fire in hand to be used for any special purpose, the probability of obtaining good effect at ranges beyond 1,200 yards is increased, and it is easier to ensure that the fire is directed on the objective desired by the brigade commander.

4. The disadvantages of brigading machine guns are:

(i) That the difficulties of concealment are increased.

(ii) That at shorter ranges than 1,000 yards the control of more than one section usually becomes difficult, more especially in attack.

(iii) That the positions suitable for a number of sections in attack are often difficult to find at effective and close ranges, and that the combined movement of a number of sections is only possible under such conditions when the ground is very favourable.

5. It will, therefore, usually depend upon the general situation and upon the ground whether the machine guns should be placed under the control of the brigade machine gun officer, or left with the battalions to which they belong.

Position of Machine Guns in Attack.

6. In attack, when the facilities for con-

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cealment and control at effective range are good, good results may be obtained by unity of command, and, by a timely concentration of fire, machine guns may be an important factor in the struggle for superiority of fire.

When control and concealment are difficult, or when the brigade is extended over a wide front, it will usually be better to leave guns with their units.

It will often be advisable to employ both methods and to leave their machine guns with the battalions which are first extended, while those of reserve battalions are placed under the command of the brigade machine gun officer.

7. Machine guns should rarely attempt to move forward with attacking infantry beyond a certain point. When they have gained a position from which they can effectively support their infantry in the struggle for fire superiority and in the assault, they should only be moved for good and sufficient reasons. The difficulties of ranging and of concealment on the move usually outweigh the advantages of decreasing the range.

8. Machine guns will usually find opportunities for employment in the attack, in assisting the advance of their infantry by means of covering fire, in protecting attacking infantry against counter-attack or against cavalry, in covering an exposed flank, in assisting the infantry in the fire fight, in preparing for the assault by sudden bursts of fire against the objective of the attack, and in assisting to secure localities seized during the advance. After a successful assault machine guns should reach the captured position as soon as possible, in order to pursue the enemy with fire and cover the reorganization of their infantry.

Use of Machine Guns in Defence.

9. In defence machine guns permanently allotted to the defensive line may lose their mobility, and can rarely be used as a reserve of fire for special purposes, since it is not possible to foresee the action of the enemy when allotting them to their positions. For these reasons it should be exceptional to employ more than a limited number of guns with the firing line in a defensive position.

When so employed, machine guns may be used either dispersed, or brigaded to command approaches, defiles, exits from woods, etc., and to bring fire to bear upon the ground in front of weak parts of the position.

10. When retained as part of a local reserve, machine guns retain their mobility and are therefore available to meet any unexpected situation, or to support local counter-attacks closely.

In order to make full use of the guns.

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alternative positions should be allotted to sections. These positions should be thoroughly reconnoitred and all necessary arrangements made for rapid occupation and quick opening of fire.

These arrangements should include: Previous preparation of cover, information as to the shortest route to the various positions, preparation of range cards, and selection of the most suitable position from which to control and observe fire.

Distance between Guns.

11. Owing to the liability of the mechanism to interruption, the guns of a section should rarely be employed beyond supporting distance of one another; when sections are acting independently, and good cover is not available the guns should usually be not less than 25 yards apart, the average width of the area of ground struck by the bullets of an effective shrapnel.

12. As a general principle no more guns should fire than are necessary to meet the tactical requirements, the remainder being placed in concealed position ready to open fire on a favourable opportunity, or held in positions of readiness under cover, according to circumstances. It is, however, of the first importance that sufficient fire effect to attain the object in view should be produced.

Initiative of Commanders.

13. A machine gun commander should be given definite orders by the commander of the body of troops to which he belongs, as to what is required of him, but he should be allowed as much freedom of action as possible in carrying out these orders, and should be kept informed of all changes and developments of the situation which may affect his action. Initiative and enterprise are essential to the effective handling of machine guns.

14. Machine guns will usually be sufficiently protected by the dispositions of the troops with whom they are acting. Should a machine gun commander find himself in an exposed position, he should apply to the nearest infantry commander for a suitable escort if necessary.

Employment of Spare Numbers.

15. When a machine gun is in action only those numbers required to work the gun should be with it. Spare numbers, when not employed as range takers, ground scouts, ammunition carriers, or on similar duties, should be under cover in the vicinity. Groups of men close to machine guns do not facilitate the working of the gun, are apt to disclose its position and make a vulnerable target.

The limbered wagons will be unpacked in

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positions where they are screened from the enemy's fire and observation.

The commander of the machine gun section will arrange for the selection of a covered position for his small arm ammunition cart, as close to his guns as possible.

Choice of Fire Positions.

Infantry Training, 1914 (Section 161).

Reconnaissance.

1. Surprise and concealment being very important factors in the employment of machine guns, their effective use depends upon the skill with which they have been brought into action.

Reconnaissance is therefore of special importance. The brigade machine gun officer if the guns are brigaded, the section officer if they are not, accompanied by range takers and orderlies, should usually be well in advance of his guns, where he can observe the action of the body of infantry with which he is co-operating. He should carefully reconnoitre suitable fire positions and make all preparations for bringing his guns rapidly into action. Alternative positions to which the guns may be moved to meet changes in the situation or to avoid artillery fire should always be selected.

Similar reconnaissances should be carried

out, whenever possible, before changing position.

Choice of Position.

2. The choice of a fire position must depend upon the tactical requirements of the situation and upon the object in view; for example, it must depend upon whether it is desired to use covering, enfilade, or flanking fire, or to act by surprise.

A commanding position is favourable for the development of covering fire, while for other purposes the gun should be sighted as low as is compatible with obtaining the necessary field of fire.

Points in Good Machine Gun Position.

3. A clear field of fire, facilities for observation, a covered approach, concealment and cover for the guns and their detachments, and facilities for ammunition supply are advantages to be looked for in a good fire position, but one position will rarely unite them all. As a general principle, when the situation calls for effective fire, fire effect must not be sacrificed to obtain concealment.

In arranging for the concealment of the guns, it is important to consider the background. The neighbourhood of landmarks and the tops of prominent features should be avoided.

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General Principles of Fire Control.

Selection of Targets.

1. The general considerations which govern the selection of a target for machine guns are —its tactical importance, its range and its vulnerability.

2. Machine guns should rarely open fire except:

(i) To facilitate movement of their own infantry.

(ii) To prevent or delay movement of the enemy.

(iii) Against a favourable target.

As soon as a machine gun opens fire its presence is disclosed, its subsequent appearance will then be watched for, and it loses to a great extent the advantage of surprise. Fire should therefore not be opened without good reason.

Effective Range for Machine Guns.

Again, fire should be not opened at ranges beyond 1,200 yards, unless a particularly favourable target offers, or a number of guns can be employed. Between 1,200 and 800 yards good effect may be anticipated from machine gun fire, and within 800 yards the greatest possible effect should be developed. If the firer can himself obtain observation,

the effect of machine gun fire is appreciably increased.

3. Except under special circumstances, as, for example, when the tactical situation demands the opening of fire irrespective of the probability of obtaining material results in hits, machine guns should open fire only upon targets which are sufficiently large and dense to promise an adequate return for the ammunition expended. Thin lines of infantry in extended order are not a suitable target.

If there is no satisfactory indication of effect, and no special justification for firing at long range exists, it will usually be better to withdraw from action and to seek other opportunities for effective intervention.

Action against Artillery.

4. Machine guns should seldom engage artillery with direct fire beyond close rifle range, for in such circumstances superiority of fire will always rest with the artillery if the machine guns are located. Within close rifle range machine guns, if concealed, should inflict considerable loss on artillery.

5. To sum up, fire should only be opened when probable results will justify it, and the tactical situation demands it. When opened, fire should be maintained so long as there is a reasonable chance of gaining the object

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for which it was opened. The method and volume of fire must be determined by the tactical situation, the object in view, the nature of the target, the nature of the ground, and the characteristics of the gun.

If these results are to be attained, fire must be skilfully controlled and directed by machine gun commanders.

Control by Brigade Machine Gun Officer.

6. When two or more sections are brigaded, they will act as a unit under the command of the brigade machine gun officer, who will direct the fire as regards range, point of aim, method of fire, the opening and cessation of fire, if the conditions are favourable, i.e., if the sections can be brought into action in such a way that the orders of the brigade machine gun officer can be heard clearly by all concerned.

If the conditions are not favourable, the orders for fire direction will be limited to indicating the objective by signal or message, and to ordering the opening and cessation of fire, all other details being left to the section officers. The latter method is to be regarded as exceptional, but it may be used on occasion to bring converging fire to bear upon the enemy.

High training in semaphore and in the correct passing of orders is essential.

Further reference should be made to:

FIELD SERVICE REGULATIONS, Part I, Operations, 1909.

INFANTRY TRAINING, 1914.

MUSKETRY REGULATIONS, Part I. Reprint, 1912.

THE "KINGSWAY" SERVICE SERIES.

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DETAILS (incomplete) OF MACHINE GUNS USED BY VARIOUS POWERS.

Country.	Name of gun and weight in lbs.	How cooled.	Mounting and weight in lbs.	How loaded.	Maximum fire per min.	How Transported.	Organization, etc.
Austria ...	Schwarzlose (R) 58	Water Jacket	Tripod 40	Belt of 250 rds	375	Pack	Sec. 2 guns Infy, 4 guns Mountain troops and Cav. About 1 gun per 600 rifles.
Belgium ...	Maxim (R)	Water Jacket	Tripod on carr.		600	Draught (Dogs)	
Brazil ...	Maxim (R) Nordenfeldt (R)	Water Jacket	Tripod	Belt of 250 rds	600	Pack	Sect. 3 guns.
Bulgaria	Maxim (R) 35	Water Jacket	Sledge with detachable wheels.	Belt of 250 rds	600		Section 2 guns peace, 4 war.
China ...	Maxim (R)						16 companies: 9 guns.
France ...	Hotchkiss (G) 53. Model 1907 (G) 52	Both air cooled Radiators	Cav. tripod on wheeled carr. Inf. tripod 73	Flat charger of 24 rounds	600	Cav. draught Infy. Pack	4 per Inf. Rgt. 2 per Chasseur Bn. 2 per Cav. Bde. Being increased to 2 per Battn and Cav. Rgt.
Germany	Maxim (R) Infy, 40; Cav. 58	Water Jacket	Sledge, Infy 53; Cav. 110	Belt of 250 rds	600	Draught	Det. or Coy, 6. Also Armoured motor cars 6 guns per Bde = 1 gun per 1,000 rifles.

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Gt. Britain	Maxim (R) 58 Vickers (R) 27	Water Jacket	Tripod 48	Belt of 250 rds	600	(a) Limbered carr. (b) Pack	Section 2 guns.
Greece ...	Maxim (R)	Water Jacket		Belt of 250 rds	600		4 Batteries: 24 guns
Holland	Schwarzlose (R) 44	Water Jacket	Sledge forming bitripod, 77	Belt of 250 rds		Limbered wagon	Det. (mtd) peace 4 guns. Co. (dismtd) war 8 guns.
Italy ...	Perino (R) 48 Maxim (R)	Water Jacket Water Jacket	Tripod 44	Hopper fed with flat chgrs of 50 rounds	450	Pack	Section 2 guns.
Japan ...	38th Year (G) 70	Air Cooled Radiators	Tripod 30	Flat charger of 30 rounds	600	Pack	Battery 4 guns Cav. 6 guns Infy.
Montenegro	Maxim						12 guns, possessed.
Norway ...	Hotchkiss (G)						Detmt, 4 guns.
Portugal	Maxim (R)	Water Jacket	Wheeled carriage	Belt of 250 rds	600	Draught	2 secs each 4 guns with each of six Rifle Battalions.
Roumania	Maxim (R)	Water Jacket	Sledge	Belt of 250 rds	600	Draught	6 per regiment.
Russia	Maxim (R) 63 Vickers (R) 27	Water Jacket	Wheeled carriage with trail 483, or tripod, 45 lbs	Belt of 250 rds	600	Infy. pack, replacing draught. Cav. draught	Det. 8-gun, 4-gun, 2-gun wheeled equipt and 4-gun pack equipt
Servia ...	Maxim (R)	Water Jacket					Infy and Cav. Rgt 2 in peace, 4 in war. Eventually 2 per battalion of 1st Bat.

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DETAILS (incomplete) OF MACHINE GUNS USED BY VARIOUS POWERS.

Country.	Name of Gun and weight in lbs.	How cooled.	Mounting and weight in lbs.	How loaded.	Maximum fire per min.	How Transported.	Organization, etc.
Spain	Maxim (R) Hotchkiss (G)	Water Jacket Air Cooled Radiator				Pack	1 group, 2 sects = 4 guns (Maxim). 5 groups, 10 sects = 20 guns (H'kiss). Maxim Sect. has water mule.
Sweden ...	Hotchkiss (G)	Air Cooled		Flat chgrs of 30	600		3 guns per Sqdn.
Switzerland	Maxim (R)	Water Jacket	Tripod and Refl. (porter's cradle) carriage	Belt of 250 rds	600	(a) Pack; (b) cradle on man's back	Company 6-8 guns. Groups 3 companies.
Turkey ...	Maxim (R) 40 Hotchkiss (G) 83	Water Jacket Air Cooled Radiator	German sledge 53 lbs	Belt of 250 rds Flat chargers of 30 rds	600	Draught	Company 4 guns.
U.S.A. ...	Maxim (R) 58	Water Jacket	Tripod	Belt of 250 rds	600	Pack	Platoon 2 guns.

Remarks: (R) = Recoil-operated. (G) = Gas-operated. The weight for water-jacketed guns does not include the weight of water, which is from 7 to 9 lbs.
In Germany the sledge mounting is transported on a wheeled carriage which carries 2 guns and sledges.
Belgium possesses 40 Hotchkiss for mobile defence of fortresses.
In Switzerland the company is sub-divided into sections with 2 or 4 guns.
France also uses Hotchkiss Portative.
Japan also uses Rexer.
Russia has 6 Rexers per Cav. Rgt also (now being discarded for 2 Maxims. Rexers only used for advanced patrols).
Denmark, 4 Rexers (on saddle) per Sqdn of Hrs. Also a motor cycle section armed with Rexers.
Sweden, 2 Rexers per section in the Infantry.
Norway } Use Rexers for Cavalry.
China }
Uruguay uses Rexer for Infantry and Cavalry.
U.S.A. uses Hotchkiss Portative under the name of Benet-Mercié.
The Lewis Gun (G) is now under trial in Great Britain and U.S.A., especially for Aircraft

THE LEWIS AUTOMATIC MACHINE GUN.

SPECIAL FEATURES.

Simplicity.—The attainment of ultimate simplicity has been successfully studied in every detail of the gun design. No part of the mechanism is complicated or hard for even the untrained layman to understand.

Few Parts.—There are only sixty-two parts in the gun proper, exclusive of the accessories which are not part of the gun. The parts cannot be wrongly assembled, and when in place require no adjustment.

Cooling System.—The method of cooling employed in this gun is as simple in principle as it is effective in practice. No moving parts are employed. Closely fitting the steel barrel is a cylindrical jacket of aluminium having deeply cut longitudinal grooves throughout its length and circumference. Over this aluminium jacket there is a thin tubular steel casing, the muzzle end of which extends at reduced diameter beyond the end of the jacket and barrel. The jacket and tubular casing, together with the barrel mouthpiece, constitute the entire cooling system. The specially shaped barrel mouthpiece screwed to the end of the barrel serves the double purpose of firmly securing the radiator in place and of so directing the powder blast at each discharge as to greatly increase the "ejector action" of this blast in

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sucking cool air from in rear through the longitudinal grooves (air passages) of the radiator. The tubular steel casing serves to confine the blast of cool air within the course of the air passages and hence in contact with the aluminium of the radiator. The high specific heat, the great heat conductivity, and the low specific gravity of aluminium, combined with an exceedingly simple and durable construction, thus produce a cooling system for the gun that is at once practical and efficient, without rendering it too heavy or bulky for general field service. No extra barrel is carried on the firing line, *and water is never needed for cooling purposes.*

Velocity.—Another useful effect incident to the cooling system is the increase of velocity, due to prolonging the gas pressure upon the bullet after the latter has left the muzzle. This increase of muzzle velocity is more than sufficient to compensate for the loss of the slight amount of gas energy required to operate the gun mechanism, and it is found in practice that the gun gives a slightly greater velocity to the bullet than can be obtained from the same length of barrel in a shoulder arm firing the same ammunition.

Recoil Checking.—There is almost no noticeable recoil when the gun is fired. This is due to the fact that the design found to give best results for air cooling also proves effective in practice in reducing the recoil,

GUN COMPLETE, WITH MAGAZINE AND LIGHT FOLDING FIELD MOUNT.

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through the friction of the powder blast on the inner walls of the barrel mouthpiece and tubular casing.

Mounting the Gun.—The very small amount of free recoil makes the problem of mounting the gun a very easy one. A heavily built man can do accurate shooting from the shoulder without a mount of any kind. The gun may be fired in any position from any sort of improvised mount. The ejection being to the side does not interfere with placing the gun as close to the ground as may be desired. For general use in the field a light portable form of support, such as is illustrated in the frontispiece, is recommended, but to meet any special condition of service, such, for instance, as arise in the arming of aeroplanes or dirigibles, a special form of mount is recommended. Any existing type of machine gun mount can be adapted to the Lewis gun.

Buttstocks.—To meet special conditions or individual preference two forms of buttstock are supplied with the gun. The long "rifle" stock is recommended for general field use, while the short "spade grip" stock is especially useful when firing from an aeroplane or whenever it is desired to reduce the over-all length of the gun.

Moving Parts.—The number and weight of the moving parts has been reduced to an approximate minimum, thus reducing the amount of live gas needed for operation, and

GUN COMPLETE, WITH MAGAZINE AND RIFLE BUTTSTOCK

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effecting a material saving of wear and shock to those parts.

Durability.—Exhaustive endurance trials have made it possible to select for each part the material and design calculated to give the maximum length of useful service.

Gas Regulation.—The special form of gas regulator employed permits the use of a fixed port opening for the gas, and obviates the necessity for constant hand regulation of the gas supply during long-continued rapid fire.

Balanced Magazine Feed.—The feed system is entirely positive in any position of the gun. The cartridges are fed to the gun in action from a rotating drum magazine, which is given a positive step-by-step movement by the reciprocating breech mechanism. As each step of the movement is completed the magazine is securely locked in position by the stop and rebound pawls, thus preventing overthrow when operating at high speeds. Throughout the feeding operation the cartridge is securely held and accurately guided. The cartridges are arranged radially in the magazine in two parallel layers, thus giving a compact balanced distribution about the axis of rotation, independent of the number of cartridges contained in the magazine at any moment. Vibration of the gun during fire is reduced to a minimum, and there is no variable disturbance of aim in action as the plane and direction of fire are changed and the magazine is emptied.

Portability.—The gun complete weighs but 25¼ pounds, and forms a light load for one man. The outside of the gun is smooth, and there are no small projecting parts liable to damage during transportation. The gun may be withdrawn from its leather case and put into action almost instantly.

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LEWIS AUTOMATIC MACHINE GUN.
GAS-OPERATED. AIR-COOLED.
Model 1915.

Operation.—The gun is operated automatically by trapping a small portion of the live powder gases before the bullet leaves the muzzle, and causing this portion of gas to impinge against the head of a free moving piston, which is thus driven back against the force of a spring, and is returned by this spirng when the force of the gases is spent. The motion of the piston is utilized to unlock the breech bolt, feed in a new cartridge, relock the breech bolt, and fire.

To Put Gun into Action.—When a loaded magazine is dropped into place over the magazine post, and the charging handle pulled to the rear as far as it will go and then released, the gun is put into action by a pull on the trigger, and continues to fire until the finger pressure on the trigger is released or until the magazine is empty.

Single Shots.—When the trigger is pulled once and very quickly released a single shot is fired, and this may be repeated at will until the magazine is empty.

Semi-Automatic Fire.—Within the limits of the magazine capacity the gun continues to fire so long as the trigger is held back, and stops firing whenever the trigger is released.

It follows, therefore, that the operator may at will fire shots either singly, or in groups of two, three, four, or of any number up to the full magazine capacity of forty-seven cartridges.

Full Automatic Fire.—Continued pressure on the trigger results in full automatic fire which need be interrupted only by the four second intervals required to replace emptied magazines by loaded ones.

DESCRIPTION OF GUN PARTS.

In the following description the Reference Numbers used correspond throughout with those of the Nomenclature and Plates.

The parts of the Lewis Machine Gun may conveniently be considered under the following four headings:

I. Barrel Group.
II. Receiver Group.
III. Working Parts.
IV. Buttstock.

I. Barrel Group.

Barrel.—The barrel (76) is round in section, and tapers towards the muzzle, where it is threaded to receive the barrel mouthpiece (89). The chamber end of the barrel is also threaded to permit its being screwed into the receiver (26). On the underside, near the muzzle, the barrel is pierced by the gas port (*a*).

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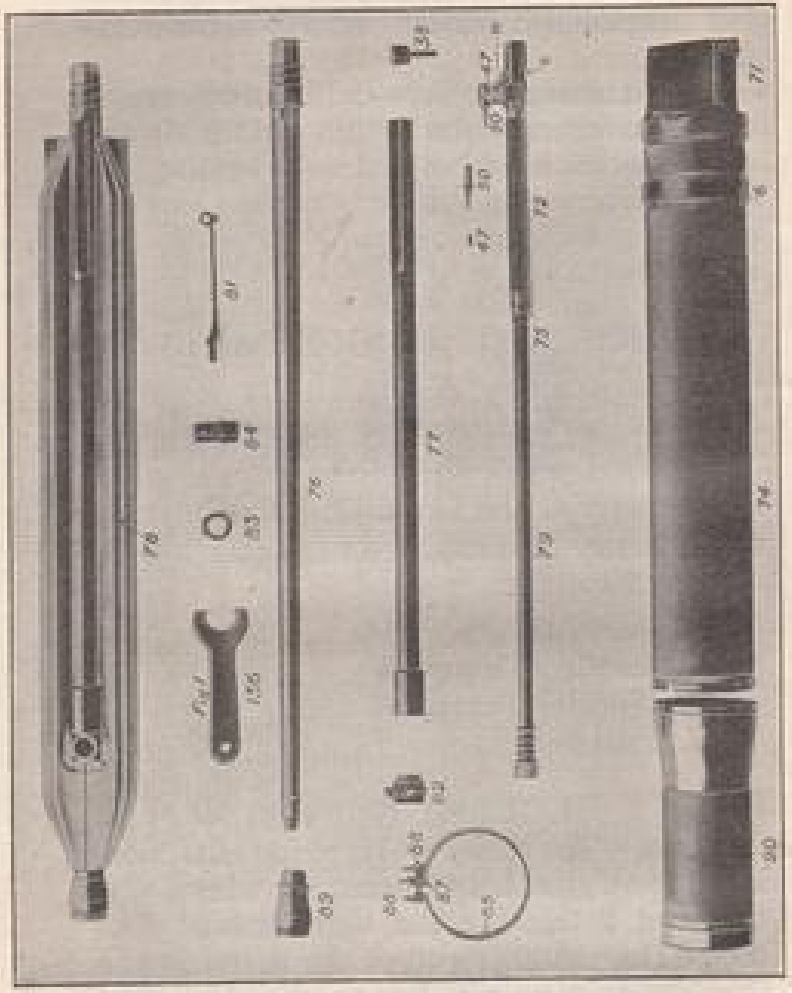

GUN PARTS: BARREL GROUP AND OPERATING ROD.

Barrel Mouthpiece.—The barrel mouthpiece (89) is a tubular nut of special shape, screwed on to the muzzle end of the barrel (76) by means of a left-handed thread. It serves to hold in place the aluminium radiator (78), and acts also to direct the powder gases in such a manner as to aid the cooling and to check the recoil.

Radiator.—The radiator (78) is of aluminium. It fits closely over the barrel (76), and is itself enclosed in the radiator casing (71, 74, 90).

Radiator Casing.—The steel radiator casing consists of three parts: front (90), rear (74) and rear locking piece (71). The front (90) is tubular, extending beyond the muzzle of the barrel (76), and serving to aid the circulation of the cooling air. The rear (74) is cylindrical, it is permanently assembled to the rear locking piece (71), which on top is a flat platform serving to guide the magazine, and at the bottom is the link between the barrel and receiver group. The radiator casing rear (74) carries the rear mounting band (*b*).

Clamp Ring.—The two parts of the radiator casing are assembled by means of the clamp ring (85) which carries on top the front sight (86), with its clamp ring positioning screw (87), and is held together by the clamp ring screw (88). The clamp ring (85) serves also as the front mounting band.

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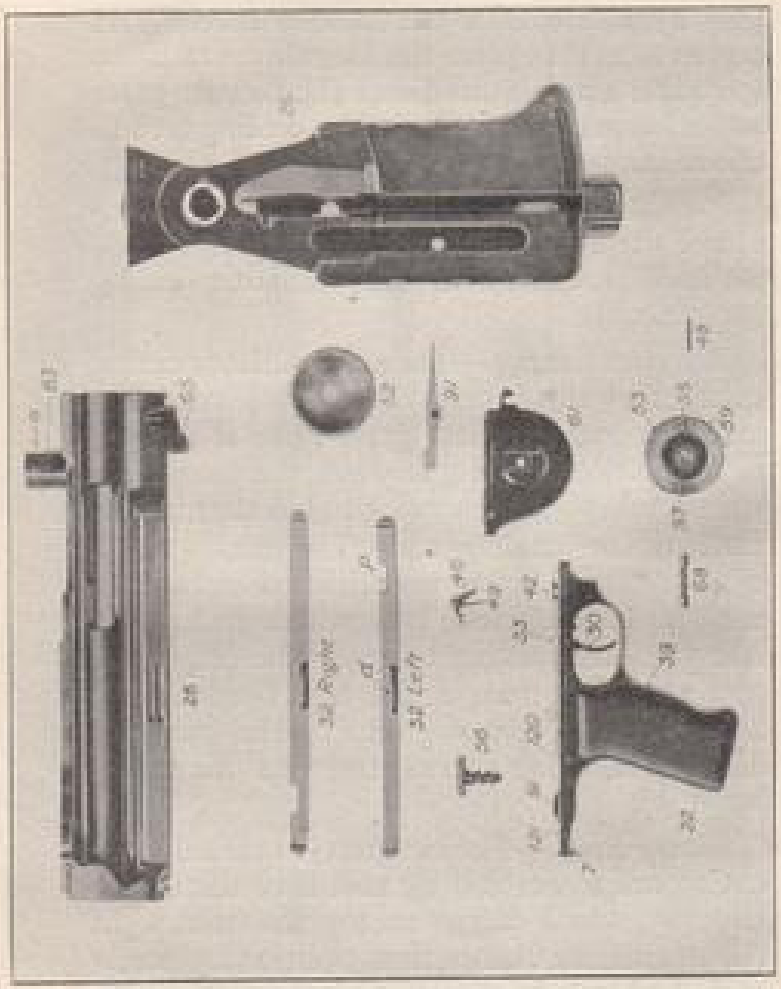

GUN PARTS: RECEIVER GROUP, MAINSPRING, AND TRIGGER MECHANISM.

Gas Fittings.—Fitting into a recess in the under side of the radiator (78), and enclosed by the radiator casing, is the gas cylinder (77).

The forward end of the gas cylinder (77) is screwed into the gas chamber (82), which in turn is screwed into the gas chamber band (83), which fits over the barrel (76) at the point where the barrel is pierced by the gas port (*a*).

Also screwed into the gas chamber (82) is the gas regulator cup (84), which may be turned by means of the gas regulator key (81).

The foregoing parts, when assembled, complete the barrel group.

II. RECEIVER GROUP.

Receiver.—The receiver (26) is pierced transversely throughout its length by two parallel bores, connected for the greater part of the distance by the cut through which the operating post (*m*) moves. The upper bore forms the bearing surface for the bolt (37) and the lower bore guides and supports the operating rod (47, 50, 72, 75 and 79).

The top of the receiver (26) is pierced to form a channel for the feed operating stud (31), and also by the feed-way slot through which the cartridges are fed down from the magazine.

A recess in the top of the receiver (26) forms the seat for the ejector (21), which operates through two small slots (*h* and *i*) cut into the left-hand side of the bolt bore.

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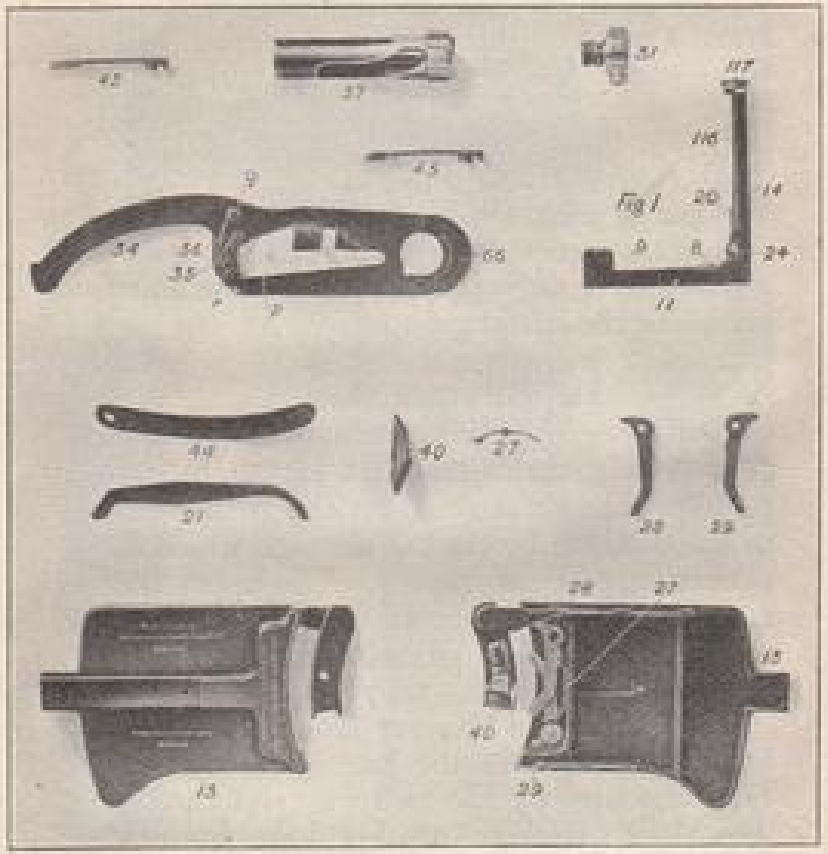
GUN PARTS: FEED MECHANISM, BOLT, EXTRACTORS AND EJECTOR.



On top of the receiver (26) is the magazine post (*u*).

The ejector opening (*c*) is on the right-hand side, and lower down on each side are cut the slots through which the charging handle (38) moves.

Guard.—The guard (39) and guard side pieces (22) carry the trigger mechanism, and serve as a grip for the gunner's hand.

Feed Cover.—The feed cover (13) fits over the top of the receiver (26), and serves as a housing for the feed mechanism.

Gear Casing.—The gear casing (61) contains the mainspring mechanism. A hook at the front end, fitting over the gear case hinge pin (65) serves to attach the gear casing to the receiver.

III. WORKING PARTS.

Operating Rod.—The operating rod is an assembled piece composed of the piston (79), the rack (72) and the striker (50). The sear notch (*e*) is cut into the bottom plane surface of the rack (72) near the rear end. The striker (50) is carried by the top projecting lug (*m*) of the rack (72), called the operating post, to which the striker (50) is secured by the striker fixing pin (47). The rack (72) and the piston (79) are loosely connected together by the piston connecting pin (75).

Bolt.—The bolt (37) is cylindrical in form.

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It is provided with four resistance lugs (*g*) at the rear end to sustain the shock of discharge, and is threaded internally to receive the feed operating stud (31). The cam slot cut through the under side of the bolt (37) takes the operating post (*m*) of the rack (72) when in firing position. The two extractors (45) are carried in longitudinal recesses cut into the outer surface of the bolt. The front end of the bolt is recessed to form a seat for the cartridge case, and the wall of this recess is slotted to take the front end of the ejector (21) and to permit the free ejection of the empty cartridge case.

Feed Operating Stud.—The feed operating stud (31) is threaded to fit into the rear end of the bolt (37). It has four guiding lugs corresponding in form and position to the resistance lugs (*g*) of the bolt. The top one of these guiding lugs, by engaging with the feed operating arm (34), actuates the feed mechanism.

Feed Operating Arm.—The feed operating arm (34) fits over and pivots around the magazine post (*u*) on top of the receiver (26). It is secured in place by the feed operating arm latch (66). The curved finger-like extension of the arm has in its under-side a deeply cut groove, which, in action, engages with the top lug of the feed operating stud (31). The main surface of the arm is pierced by the feed-way slot (*p*), through which, in

feeding, the cartridges pass from the magazine into the chamber.

The feed pawl (35), the feed pawl stud (*r*), the feed pawl spring (36), the feed pawl spring stud (*q*), and the feed pawl stop are all mounted upon the feed operating arm (34).

Stop and Rebound Pawls.—The stop pawl (28) and the rebound pawl (29) are fitted into place over studs inside the feed cover (13), where they work against the magazine pawls spring (27).

Mainspring.—The mainspring (55) fits inside the mainspring casing (53), which is enclosed in the gear (52); and both are enclosed in the gear casing (61). One end of the coiled mainspring (55) is located by the mainspring rivets (59), the other end by the mainspring collet (57), which is secured by the collet pin (56).

It will be noted that the gear (52) engages inside the gear casing (61) with the ratchet gear stop (46), which is held in place by the gear stop pin (48), and is actuated by the gear stop spring (49).

Trigger Mechanism.—The trigger (30), enclosed in the guard (39) and secured by the trigger pin (33), is in mesh with the sear (91) and the sear spring box (42), which latter encloses the sear spring (41).

Charging Handle.—The charging handle (38) engages with the operating rod through

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a slot cut in the rack (72). It works through a narrow longitudinal slot cut through the side of the receiver (26). The charging handle may be inserted and used from either the right or left-hand side as preferred.

Safety.—The safety (32) is a narrow sliding strip of steel which serves both as a safety and as a dust cover for the longitudinal slot through which the charging handle moves. A projection (*d*) serves as a thumb-hold for the operator, and when the slide is snapped up a notch (*f*) engages with the charging handle (38) when the latter is in the ready-to-feed position, and the safety is "on."

IV. Buttstock.

The "rifle" and "spade grip" are alternative forms of buttstock.

Rifle Buttstock.—These parts consist of the buttplate (1), two buttplate screws (2), the butt (3), the butt tang screw (4), and the butt tang (5). Together they form a single assembled piece which should never be stripped.

Spade Grip Buttstock.—This piece consists of the hand grip (92), the oil well (93) with its oil well cap (94) and oil brush (95), and the spade grip butt tang (96).

General Note.

It will be noted that the receiver group is secured to the barrel group by the receiver

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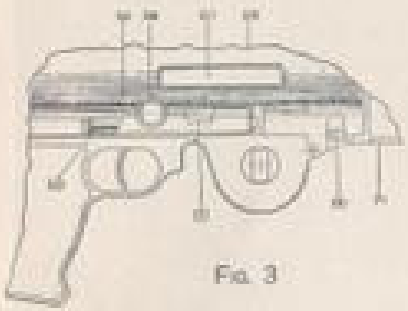

Fig. 3

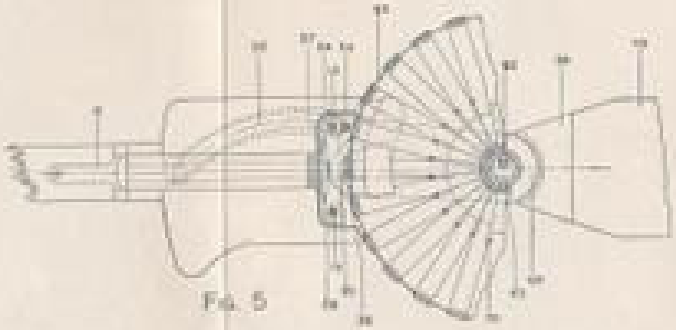

Fig. 5

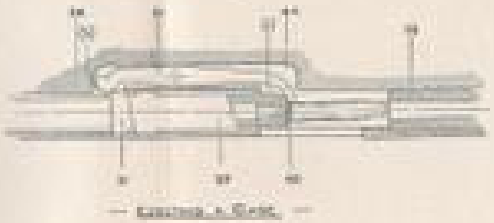

Fig. 4

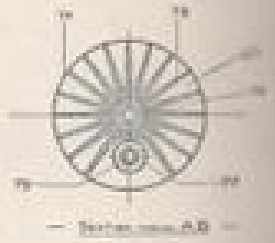

Fig. 2

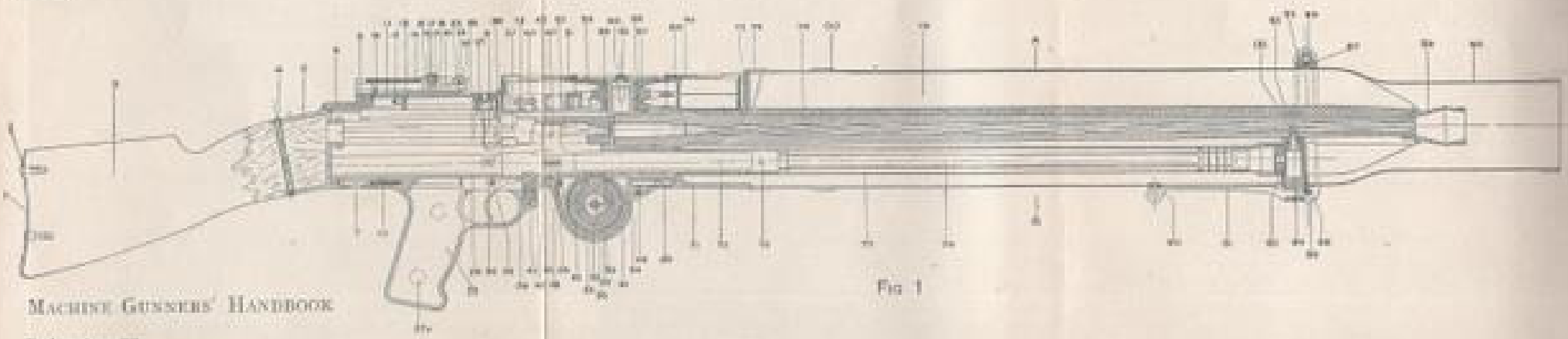

Fig. 1

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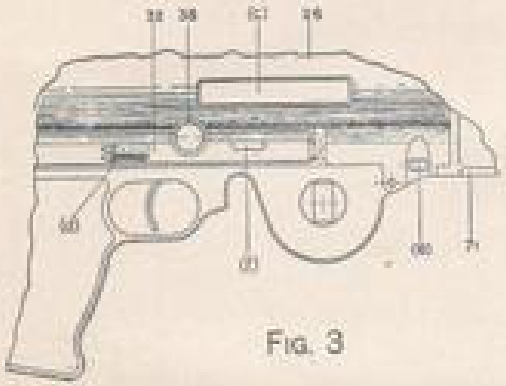
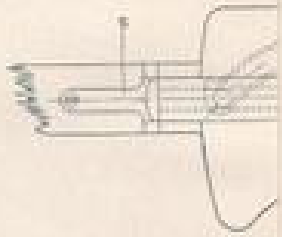
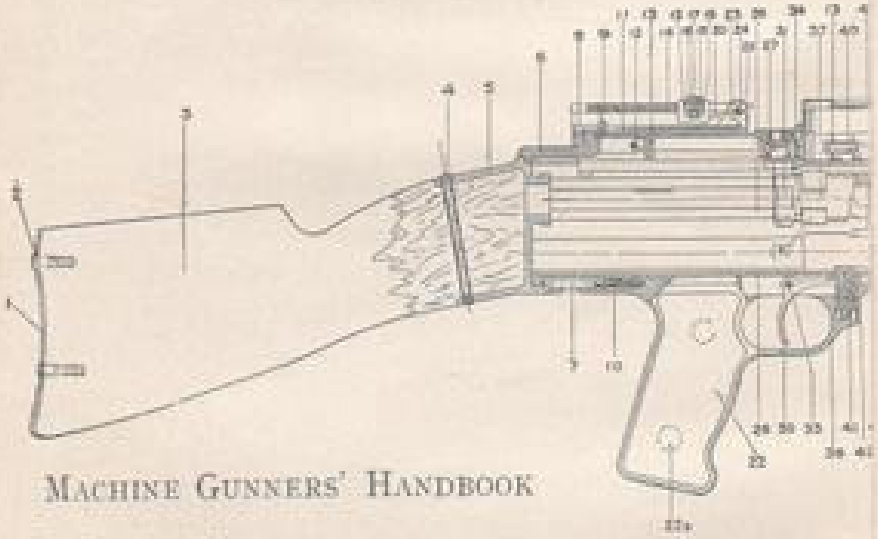


Fig. 3





lock pin (68). The line of connection then runs through the gear casing (61) to the front end of the guard (39); through the guard to the butt latch (7) seated in a recess in its rear end. When the buttstock is latched into place behind the receiver (26) the entire gun is securely assembled.

DESCRIPTION OF THE MAGAZINE.

The magazine from which cartridges are fed into the gun consists of the magazine pan (43), to which the cartridge spacer ring (51), carrying the interior separators (70), is fastened by means of the spacer ring rivets (69). The wall of the magazine pan (43) is provided with corrugations which serve on the inside of the pan to space and retain the bases of the cartridges, and on the outside of the pan to engage with the feed pawl (35), stop pawl (28), and rebound pawl (29). The magazine pan (43) revolves around the magazine centre (58), to which it is held by the magazine top plate (67), with its magazine top plate rivets (54).

In action, the magazine centre (58) fits on top of the receiver (26) over the magazine post (*u*), and the centre key (63).

The magazine latch (62) fits under the magazine top plate (67), where it works against the magazine latch spring (60) and engages under a projection on the inside of the magazine post (*u*), and also in notches

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cut in the cartridge spacer ring (51) and magazine pan (43).

Action of the Gun.

Starting with the gun in the "ready-to-feed" position, as shown in Plate 1, when the trigger (30) is pulled and held back the action is as follows:

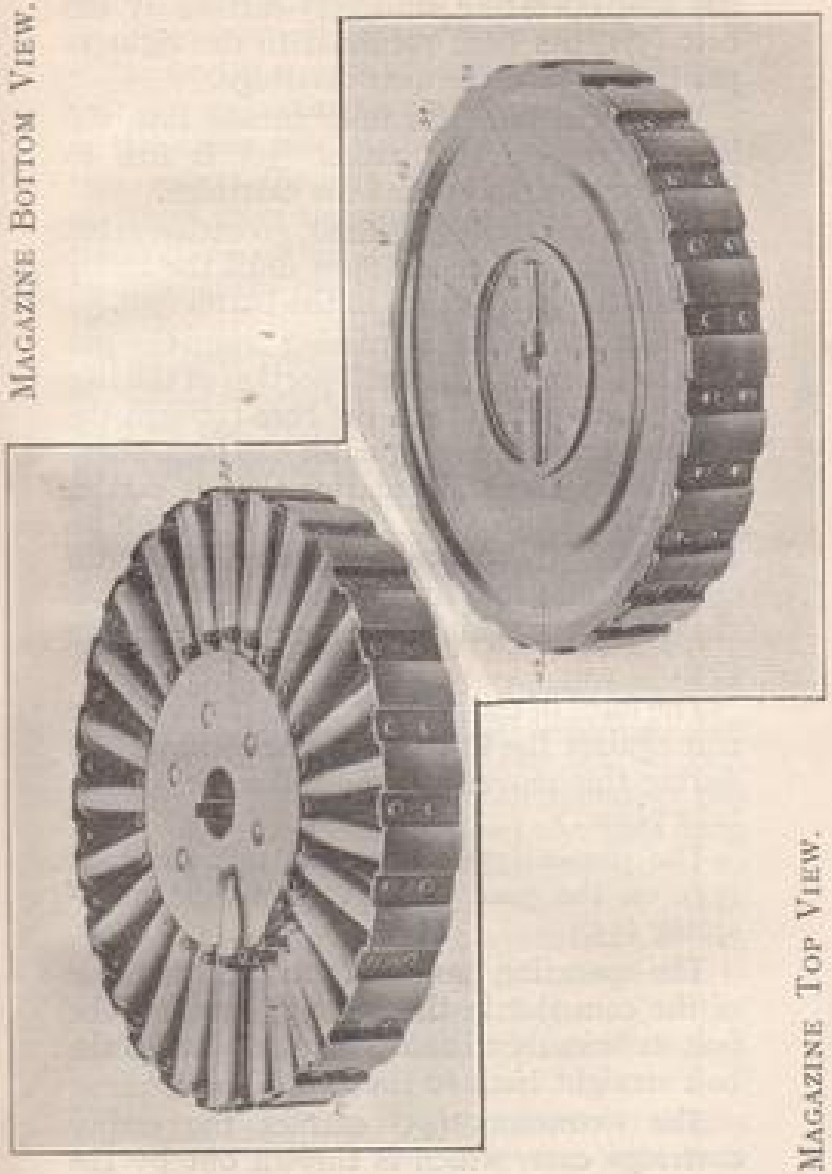
Actuated by the force of the mainspring (55) acting through the gear (52) and the rack (72), the operating rod moves forward, carrying with it the bolt (37).

As it moves forward the front top edge of the bolt (37), striking the lower edge of the rim of the cartridge resting in position in the feedway, drives the cartridge forward and downward into the chamber.

At the end of the forward movement the resistance lugs (*g*) on the rear end of the bolt (37) emerge from their guide slots into the space in the receiver (26) known as the locking recess. The bolt (37) is now free to turn and lock, which movement is accomplished by the action of the operating post (*m*) against the shoulder of the cam slot in the bolt. As the bolt closes behind the cartridge in the chamber the extractors (45) take their grip upon the rim of the cartridge case.

During the forward movement of the bolt and operating rod, the magazine has been held by the rebound pawl (29), and has not moved.

The feed operating arm (34), actuated by



Magazine Bottom View.

Magazine Top View.

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the feed operating stud (31) carried by the bolt (37), has been returned to the right in position to take the next cartridge.

When the bolt has fully turned into the locked position the striker (50) is free to drive forward and prime the cartridge.

When the cartridge is fired, no action takes place in the gun mechanism until the bullet reaches the gas port (*a*) in the barrel (76).

While the bullet is passing from the gas port to the muzzle, a small portion of the live powder gas enters from the bore through the gas port into the gas regulator cup (84), where it deposits any solid matter that it carries with it. The clean gas expands through an aperture in the gas regulator cup (84) and a corresponding aperture in the wall of the gas chamber (82), against the head of the piston (79).

The force of the gas drives the piston to the rear against the force of the mainspring, and during this movement the following actions take place:

The piston (79), acting through the rack (72), on the gear (52), winds up the mainspring (55).

The operating post (*m*), acting on the side of the cam slot in the bolt (37), rotates the bolt sufficiently to unlock it, then carries the bolt straight back to the rear.

The extractors (45) extract the empty cartridge case, which is thrown out by the

ejector (21), actuated by the feed operating stud (31) striking against its rear end.

The feed operating stud (31), carried by the bolt (37) and acting on the sides of the channel in the under side of the feed operating arm (34), moves the arm to the left, carrying a cartridge from the magazine under the cartridge guide spring (40) and into the feeding position in the feedway on top of the receiver (26).

The feed pawl (35), carried by the feed operating arm (34) and acting on the outside wall of the magazine pan (43), carries the magazine through a partial revolution sufficient to bring the next cartridge in position. The magazine is held in its new position by the stop pawl (28) and the rebound pawl (29), and does not move during the forward movement of the other parts.

The foregoing operations are all completed by the impulse given to the piston by the direct action of the gas. The last of this impulse is expended when the operating rod and bolt come to rest against the butt tang (5) at the extreme end of their movement to the rear. The forward movement then begins, and the cycle of operations is repeated for each shot until the magazine is empty, when the parts stop at the end of the forward movement, with the bolt locked behind the empty chamber.

During the firing, if at any time the trigger is released before the magazine has been

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emptied, the gun stops at the beginning of the forward stroke, in the "ready-to-feed" position. In this position the action is open and the chamber empty, but firing is resumed on pulling the trigger.

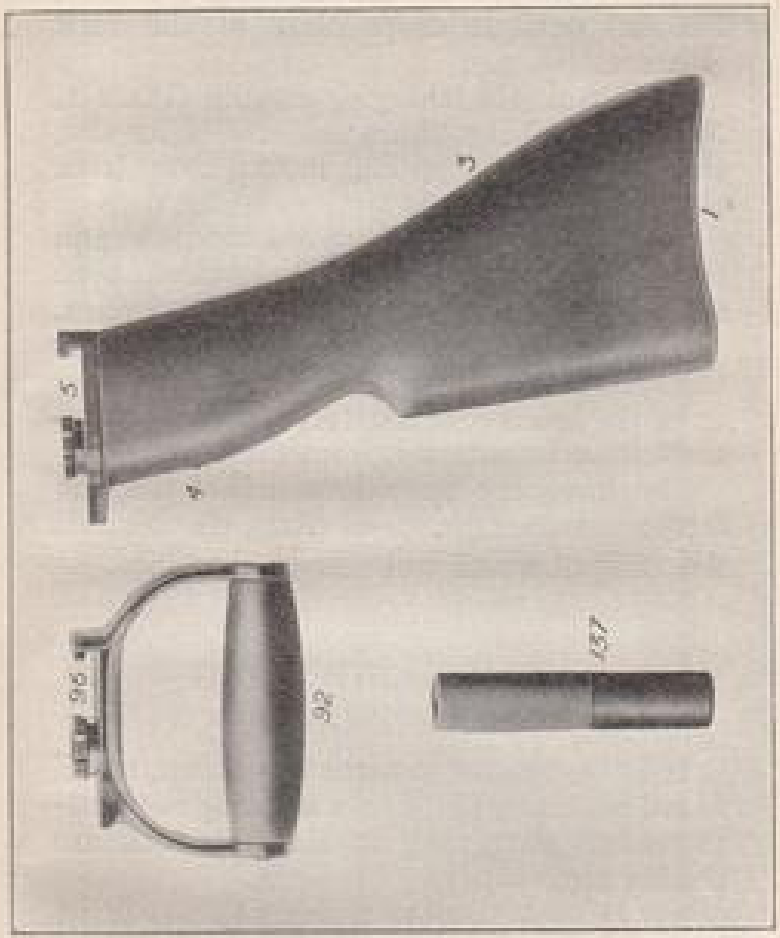
To Strip and Assemble the Gun.

Although the gun may be taken apart starting with the mechanism in any position, it is best whenever practicable to see that the magazine is removed, the chamber empty, and the charging handle at the extreme forward end of its stroke, before commencing to disassemble. If this procedure is followed there will be no need to readjust the mainspring tension or to make any other adjustment when the gun is reassembled.

Stripping.

To disassemble the gun, insert the point of a bullet into the slot leading to the butt latch (Plate 1, No. 7) and push forward against the force of the butt latch spring. At the same time twist the buttstock (Plate 1, No. 3) up and to the left, then remove by withdrawing it to the rear. This removes the buttstock group (Plate 6, Nos. 1, 2, 3, 4, 5), which should not be further disassembled.

Next hold back the trigger (Plate 1, No. 30), and pull back the guard (Plate 1, No. 39) until clear of the receiver (Plate 1, No. 26).



Accessories: Buttstocks and Magazine Filling Handle.

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This removes the guard, which contains the trigger mechanism and butt latch.

Pull down on the gear casing (Plate 1, No. 61) until it drops clear of the rack (Plate 2, No. 72).

Pull back the charging handle (Plate 1, No. 38) until it reaches the end of its slot, then withdraw by pulling it out away from the receiver.

Withdraw the operating rod complete and the bolt complete by pulling them both together to the rear until clear of the receiver.

With the point of a bullet push back on the receiver lock pin (Plate 1, No. 68), then twist the receiver (Plate 1, No. 26) up and to the left and unscrew it from the barrel.

The foregoing operations divide the gun into convenient groups of parts, the detailed stripping of which will now be described.

DETAILED STRIPPING.

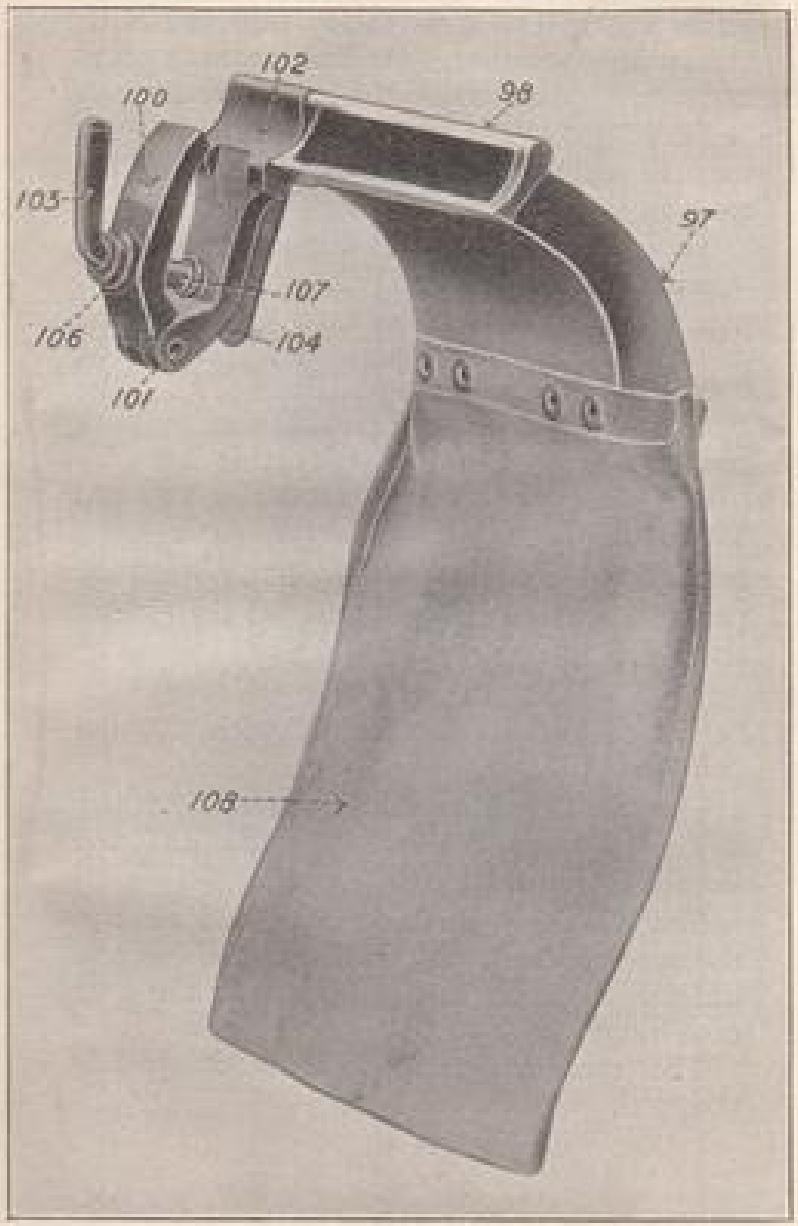
Buttstock Group.

It is best never to strip this group, but if found necessary the screws securing the butt-plate and butt tang to the buttstock are readily removed.

Receiver Group.

See that the feed operating arm (34) is pushed to the right, then pull back and remove the feed cover (13).

ACCESSORIES: SHELL DEFLECTOR COMPLETE.



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Feed Cover.—From the feed cover the stop pawl (28), rebound pawl (29), and cartridge guide spring (40) are readily removed with the point of a bullet. On Plate 4 these parts are seen in place inside the feed cover.

Back Sight.—The back sight (Plate 4, Fig. 1) may be stripped from the feed cover by removing the bed spring screw (111).

Feed Operating Arm.—Remove the feed operating arm complete (Plate 4, Nos. 34, 35, 36, 66) by pushing forward on the feed operating arm latch (66), and then lifting clear of the magazine post (Plate 3, *u*). The feed pawl (35) and feed pawl spring (36) are removed from the feed operating arm by lifting them clear of the studs (*r*) and (*q*). The latch (66) should not be removed.

Ejector.—(Plate 4, Nos. 44, 21). With the point of a bullet lift and pull out the ejector cover (44) and the ejector (21).

Safety.—The safeties (Plate 3, No. 32) may be prised out of the receiver with a bullet point.

The gear case hinge pin (65) and the centre key (63) are permanently assembled and should not be removed.

Gear Casing.—Push forward and remove the receiver lock pin (Plate 3, No. 68) and unhook the gear casing (61) from the gear case hinge pin (65).

The receiver group is now completely stripped.

ACCESSORIES: AEROPLANE MOUNTING COMPLETE.

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Mainspring Group.

To strip completely the parts (Plate 3, Nos. 61, 46, 56, 52, 57, 53, 55, 49, 48, 59) found assembled in the gear casing (61), raise the gear stop (46) with the point of a bullet, and allow the mainspring to unwind.

Gear.—Then unscrew the collet pin (56) and shake out the gear (52).

Mainspring.—Pushing with a bullet through the gear against the mainspring collet (57) forces out the mainspring casing (53) from which the mainspring (55), with its locating rivets (59) and the mainspring collet (57) may also be removed by the use of a bullet.

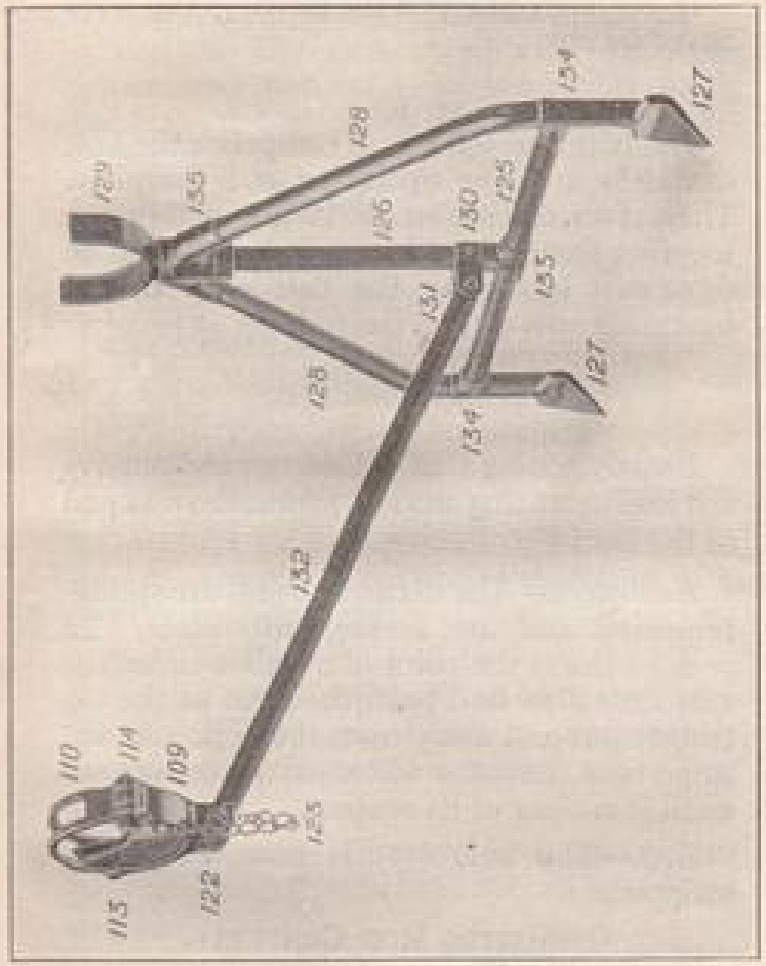
Gear Stop.—The gear stop (46) and gear stop spring (49) should not be stripped, but in case of necessity they may be removed by driving out the gear stop pin (48).

Guard Group.

The assembled guard (Plate 3, Nos. 33, 120, 30, 91, 42, 41, 121, 7, 10) contains the trigger mechanism and the butt latch. To strip this group, punch out the trigger pin (33) and the sear pin (120).

Trigger.—Pull back on the trigger (30) and lift it out.

Sear.—Remove the sear (91), sear spring box (42) and sear spring (41).



Accessories: Light Folding Field Mount Complete.

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Butt Latch.—Punch out the butt latch pin (121) and remove the butt latch (7) and butt latch spring (10).

In ordinary practice the guard group need never be stripped.

Bolt and Rod Group.

The bolt and rod group comprises the bolt complete and the operating rod complete. These two assembled parts are withdrawn together from the receiver, and may then be separated by lifting the bolt clear of the operating post (*m*) on the rod.

Bolt Complete.

(Plate 4, Nos. 31, 45, 37.)

Feed Operating Stud.—Unscrew and remove the feed operating stud (31) from the rear end of the bolt.

Extractors.—The extractors (45) are spring-tempered and are sprung into place. To remove insert the point of a bullet under the extractor claw and push the head of the extractor out and away from the bolt. At the same time draw the whole extractor forward until it is clear of its seating.

Bolt.—The bolt (37) is now completely stripped.

Operating Rod Complete.

(Plate 2, Nos. 79, 75, 72, 50, 47.)

This assembled piece is ordinarily never stripped.

Piston.—The piston connecting pin (75) is riveted in place but may readily be punched out in case it is desired to remove the piston (79).

Striker.—The striker (50) may be withdrawn after punching out the striker fixing pin (47).

Barrel Group.

(Plate 2, Nos. 81, 84, 88, 85, 86, 87, 90, 74, 71, 77, 89, 82, 76, 78, 83).

Gas Regulator.—Lift out the gas regulator key (81), then unscrew and remove the gas regulator cup (84).

Clamp Ring.—Using the gas regulator key as a tool unscrew the clamp ring screw (88) and remove the clamp ring (85) which carries the front sight (86) and the clamp ring positioning screw (87).

Radiator Casing.—Pull forward the radiator casing front (90), and pull back the radiator casing rear (74) which is permanently assembled to the radiator casing rear locking piece (71).

Gas Cylinder.—Unscrew and remove the gas cylinder (77), using the operating rod as a wrench.

Gas Chamber.—Unscrew the gas chamber (82), using, if necessary, the barrel mouthpiece wrench (Plate 2, Fig. 1).

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Barrel Mouthpiece.—Unscrew the barrel mouthpiece (89), remembering that the thread on this piece is left-handed.

Barrel.—Drive out the barrel (76) from the radiator (78). (This operation may conveniently be accomplished before removing the barrel mouthpiece, by unscrewing the latter part way and then allowing the barrel and radiator to drop from a height of two or three feet on to a solid piece of wood, striking on the front end of the barrel mouthpiece. The weight of the radiator dropping from this height will usually loosen the barrel sufficiently so that it can be simply withdrawn by hand from the radiator, after the mouthpiece has been removed.)

Gas Chamber Band.—Lift out the gas chamber band (83) from its recess in the radiator.

The stripping of the barrel group is now complete.

Assembling.

By reversing the operations just given for stripping the assembling of the gun is readily and quickly carried out. The following points, however, should be noted:

1. Be sure that the gas chamber band (83) is correctly inserted into its place in the radiator before the barrel (76) is pushed home, and that the barrel is turned so that the gas port (*a*) is at the bottom.

2. In replacing the bolt and operating rod the cam slot in the bolt (37) is slipped over the striker (50), and the feed operating stud (31) is screwed into the bolt as far as it will go.

3. After inserting the bolt, rod, and charging handle (38), the charging handle is then carried forward to the extreme end of its stroke before the gear casing (61) is swung up into place and the rack engaged.

4. The mainspring is wound up by engaging the rack and gear, disengaging the guard, and pulling back on the charging handle until the required tension is obtained. The gear is then disengaged, the charging handle moved completely forward, the gear re-engaged, and the guard pushed home.

5. To reduce the tension of the mainspring proceed as follows:

Remove the Buttstock.

Disengage both Guard and Gear.

Move the Charging Handle part way back.

Re-engage the Gear and Guard.

Replace the Buttstock.

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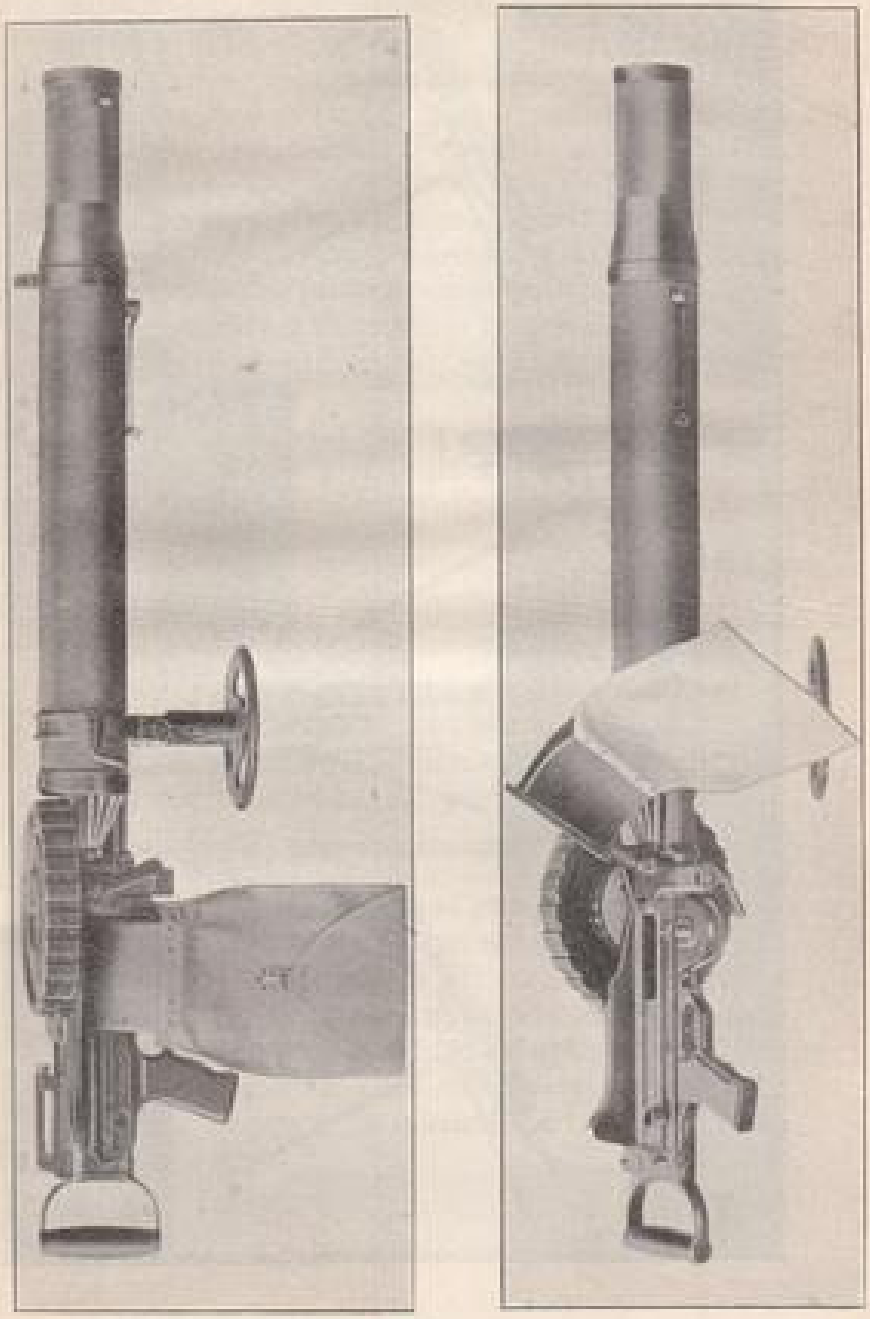
MAINSPRING TENSION.

The ideal condition exists when the strength of the mainspring exactly balances the opposing force of the gas striking the piston head. When this condition is realized all parts of the gun are subjected to a minimum of shock and wear. The attainment of the exact point of balance is of no practical importance, for the gun will operate satisfactorily over a wide range on either side of this point. Besides, the exact point is subject to constant slight fluctuations, due to the variable frictions caused by oil or lack of oil, and the accumulation or removal of foreign matter within the mechanism. But a little attention paid by the gunner toward getting an approximate balance between gas and spring will be well repaid in increased reliability of action and longer life of the gun parts.

For a given setting of the gas regulator to low limit for the working tension of the main spring is the point at which misfires occur. The high limit is reached when the force of the gas is no longer sufficient to drive back the mechanism far enough to feed the succeeding cartridge. The gun will operate on any spring tension between these limits.

At the approximate point of balance the bolt and rod barely touch the butt tang at the rear end of their stroke. Below this point the butt tang is being hammered with unnecessary force, and above it the action of the gun is faster than normal.

GUN COMPLETE AS MOUNTED ON AEROPLANE.



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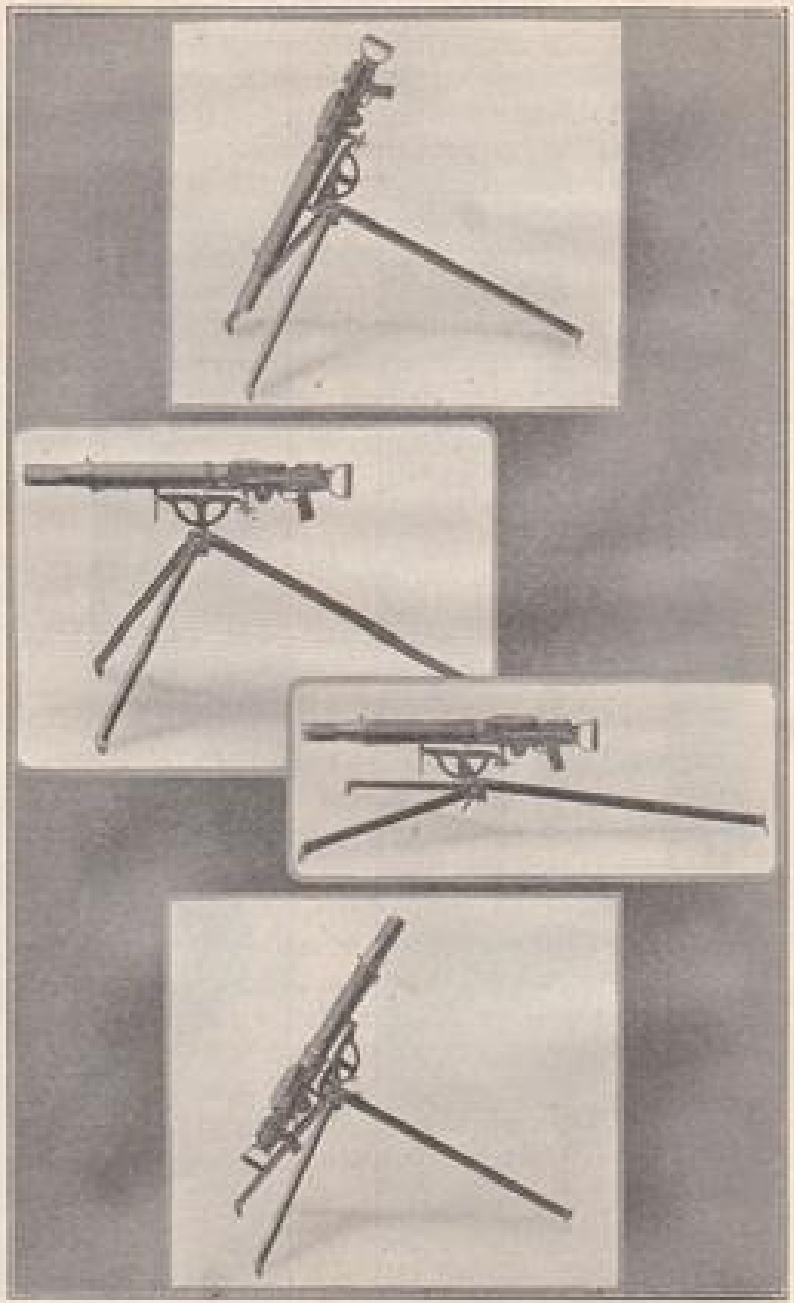
VARIOUS POSITIONS ON NEW TRIPOD FIELD MOUNT.



As already pointed out, conditions inside the gun may vary the point of balance, hence it is sometimes advisable to increase the spring tension in order to overcome some added friction or prevent misfiring; or to slow down the rate of fire by slightly decreasing the tension.

An average working tension for the mainspring is between twelve and fourteen pounds, as measured by holding back the trigger and pulling back on the charging handle with a small spring balance such as is supplied with the gun.

GENERAL NOTE.

Before Firing.—See to it that the bore is clear, that the working parts are properly lubricated with good mineral oil and move freely, and that the tension of the main spring is sufficient to avoid misfires.

After Firing.—See that the gun is immediately unloaded, and that the bore, working parts, and bearing surfaces are carefully examined, cleaned, and properly lubricated as soon as possible.

It is especially important to oil the piston head and the inside of the gas cylinder; and to remove oil, and replace the gas regulator cup.

Burrs found raised on any working part should be removed, and any roughening on a bearing surface should be smoothed down with fine emery or an oilstone.

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NOMENCLATURE.

List of Parts in Gun.
(Alphabetical Order.)

Ref. No.	*Name of Part.*
76.	Barrel.
89.	Barrel Mouthpiece.
37.	Bolt.
7.	Butt Latch.
121.	Butt Latch Pin.
10.	Butt Latch Spring.
1.	Butt Plate.
2.	Butt Plate Screws (2).
3.	Buttstock.
5.	Butt Tang.
4.	Butt Tang Screw.
40.	Cartridge Guide Spring.
63.	Centre Key.
38.	Charging Handle.
85.	Clamp Ring.
87.	Clamp Ring Positioning Screw.
88.	Clamp Ring Screw.
56.	Collet Pin.
21.	Ejector.
44.	Ejector Cover.
45.	Extractors (2).
13.	Feed Cover.
34.	Feed Operating Arm.
66.	Feed Operating Arm Latch.
31.	Feed Operating Stud.
35.	Feed Pawl.
36.	Feed Pawl Spring.

86.	Front Sight.
82.	Gas Chamber.
83.	Gas Chamber Band.
77.	Gas Cylinder.
84.	Gas Regulator Cup.
81.	Gas Regulator Key.
52.	Gear.
65.	Gear Case Hinge Pin.
61.	Gear Casing.
46.	Gear Stop.
48.	Gear Stop Pin.
49.	Gear Stop Spring.
39.	Guard.
22.	Guard Side Pieces (2).
27.	Magazine Pawls Spring.
55.	Mainspring.
53.	Mainspring Casing.
57.	Mainspring Collet.
59.	Mainspring Rivets (2).
79.	Piston.
75.	Piston Connecting Pin.
72.	Rack.
78.	Radiator.
90.	Radiator Casing Front.
74.	Radiator Casing Rear.
71.	Radiator Casing Rear, Locking Piece.
29.	Rebound Pawl.
26.	Receiver.
68.	Receiver Lock Pin.
32.	Safety (right and left).
91.	Sear.
120.	Sear Pin.
41.	Sear Spring.

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42. Sear Spring Box.
28. Stop Pawl.
50. Striker.
47. Striker Fixing Pin.
30. Trigger.
33. Trigger Pin.

LEWIS MACHINE GUN ACCESSORIES AND THEIR PARTS.

The Magazine.—The Magazine (Plate 5) is an assembled unit composed of the following parts:

51. Cartridge Spacer Ring.
70. Interior Separators (25).
58. Magazine Centre.
62. Magazine Latch.
60. Magazine Latch Spring.
43. Magazine Pan.
67. Magazine Top Plate.
54. Magazine Top Plate Rivets (6).
69. Spacer Ring Rivets (5).

Rifle Buttstock.—The Rifle Buttstock (Plate 6) is a single assembled piece composed of:

1. Butt Plate.
2. Butt Plate Screws (2).
3. Buttstock.
4. Butt Tang Screw.
5. Butt Tang.

Spade Grip Buttstock.—The Spade Grip Buttstock (Plate 6) is used when preferred to the Rifle Buttstock. It is composed of the following parts:

92. Hand Grip.
95. Oil Brush.
93. Oil Well.
94. Oil Well Cap.
96. Spade Grip Butt Tang.

Shell Deflector.—The Shell Deflector (Plate 7) is an attachment for controlling the ejection of the empty cartridge cases. It is very readily and quickly attached, and when in position can be instantly swung back out of the way so that the inside of the gun may be examined or any part of the mechanism reached. Plate 10 shows the deflector attached and ready to catch each cartridge ejected. The lower view shows the deflector swung back out of the way. The component parts of the Shell Deflector complete are as follows:

97. Deflector.
98. Deflector Arm.
99. Deflector Arm Joint Pin.
102. Deflector Bracket.
103. Deflector Clamp Screw.
107. Deflector Clamp Screw Stop Nut.
106. Deflector Clamp Screw Washer.
100. Deflector Clip.
101. Deflector Clip Joint Pin.

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104. Deflector Latch.
105. Deflector Latch Screw.
108. Shell Catcher Bag.

Back Sight.—The Back Sight, a side view of which is shown on Plate 4, Fig. 1, is normally left in position on top of the Feed Cover (13), where it is secured by the upper prolongation of the Butt Tang (4 or 96) and by the Back Sight Bed Spring Screw (9). The Back Sight complete is an assembled unit composed of the following parts:

24. Back Sight Axis Pin.
23. Back Sight Axis Pin Washer.
11. Back Sight Bed.
8. Back Sight Bed Spring.
9. Back Sight Bed Spring Screw.
116. Back Sight Elevating Screw.
117. Back Sight Elevating Screw Head.
118. Back Sight Elevating Screw Head Pin.
119. Back Sight Elevating Screw Head Spring.
14. Back Sight Leaf.
20. Back Sight Slide.

Mounting Yoke.—The Mounting Yoke (see Frontispiece and Plates 8, 9 and 10) is the device adopted to secure the gun on any desired form of mounting. The Yoke complete is composed of the following parts:

109. Mounting Yoke.

111. Mounting Yoke Bronze Pillar.
123. Mounting Yoke Chain.
110. Mounting Yoke Clamp.
113. Mounting Yoke Clamp Hinge Pin.
114. Mounting Yoke Clamp Pin.
115. Mounting Yoke Clamp Key.
122. Mounting Yoke Pillar Hinge Pin.
112. Mounting Yoke Pillar Screw.

Aeroplane Mounting Standard.—This is a single gunmetal casting. (Plate 8, No. 124.)

124. Mounting Standard.

Light Folding Field Mount.—This is a three-and-a-half pound folding mount adapted for general use with infantry and cavalry in the field. The mount is surprisingly rigid, and permits of very accurate shooting. Both front and rear mounting yokes, connected through the centre post and rear brace, are pivoted about the axis of the centre post, so that the gun is always free to traverse. The gun is also free to turn within the yokes, so that the sights may always be kept vertical no matter what the position of the feet. When the mount is attached, it is often convenient to use the rear brace as a handle for carrying the gun. The assembled mount complete has the following component parts:

125. Light Field Mount Bottom Cross-brace.
126. Light Field Mount Centre Post.
127. Light Field Mount Feet (2).

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128. Light Field Mount Front Legs (2).
129. Light Field Mount Front Yoke.
130. Light Field Mount Knuckle Joint.
131. Light Field Mount Knuckle Joint Pin.
132. Light Field Mount Rear Brace.
133. Light Field Mount T Joint, centre.
134. Light Field Mount T Joint, side (2).
135. Light Field Mount Top Lug.

Also 1 Mounting Yoke complete.

COMPLETE NUMERICAL LIST OF PARTS IN LEWIS MACHINE GUN AND ACCESSORIES.

In order of the Reference Numbers used throughout in the Text and Illustrations.

Ref. No.	*Name of Part.*
1.	Butt Plate.
2.	Butt Plate Screws (2).
3.	Buttstock.
4.	Butt Tang Screw.
5.	Butt Tang.
7.	Butt Latch.
8.	Back Sight Bed Spring.
9.	Back Sight Bed Spring Screw.
10.	Butt Latch Spring.
11.	Back Sight Bed.

Ref. No.	*Name of Part.*
13.	Feed Cover.
14.	Back Sight Leaf.
20.	Back Sight Slide.
21.	Ejector.
22.	Guard Side Pieces (2).
23.	Back Sight Axis Pin Washer.
24.	Back Sight Axis Pin.
26.	Receiver.
27.	Magazine Pawls Spring.
28.	Stop Pawl.
29.	Rebound Pawl.
30.	Trigger.
31.	Feed Operating Stud.
32.	Safety (right and left).
33.	Trigger Pin.
34.	Feed Operating Arm.
35.	Feed Pawl.
36.	Feed Pawl Spring.
37.	Bolt.
38.	Charging Handle.
39.	Guard.
40.	Cartridge Guide Spring.
41.	Sear Spring.
42.	Sear Spring Box.
43.	Magazine Pan.
44.	Ejector Cover.
45.	Extractors (2).
46.	Gear Stop.
47.	Striker Fixing Pin.
48.	Gear Stop Pin.
49.	Gear Stop Spring.

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Ref. No.	*Name of Part.*
50.	Striker.
51.	Cartridge Spacer Ring.
52.	Gear.
53.	Mainspring Casing.
54.	Magazine Top Plate Rivets (6).
55.	Mainspring.
56.	Collet Pin.
57.	Mainspring Collet.
58.	Magazine Centre.
59.	Mainspring Rivets (2).
60.	Magazine Latch Spring.
61.	Gear Casing.
62.	Magazine Latch.
63.	Centre Key.
65.	Gear Case Hinge Pin.
66.	Feed Operating Arm Latch.
67.	Magazine Top Plate.
68.	Receiver Lock Pin.
69.	Spacer Ring Rivets (5).
70.	Interior Separators (25).
71.	Radiator Casing Rear, Locking Piece.
72.	Rack.
74.	Radiator Casing Rear.
75.	Piston Connecting Pin.
76.	Barrel.
77.	Gas Cylinder.
78.	Radiator.
79.	Piston.
80.	Regulator Key Stud.
81.	Gas Regulator Key.
82.	Gas Chamber.

Ref. No.	*Name of Part.*
83.	Gas Chamber Band.
84.	Gas Regulator Cup.
85.	Clamp Ring.
86.	Front Sight.
87.	Clamp Ring Positioning Screw.
88.	Clamp Ring Screw.
89.	Barrel Mouthpiece.
90.	Radiator Casing Front.
91.	Sear (Rear).
92.	Hand Grip.
93.	Oil Well.
94.	Oil Well Cap.
95.	Oil Brush.
96.	Spade Grip Butt Tang.
97.	Deflector.
98.	Deflector Arm.
99.	Deflector Arm Joint Pin.
100.	Deflector Clip.
101.	Deflector Clip Joint Pin.
102.	Deflector Bracket.
103.	Deflector Clamp Screw.
104.	Deflector Latch.
105.	Deflector Latch Screw.
106.	Deflector Clamp Screw Washer.
107.	Deflector Clamp Screw Stop Nut.
108.	Shell Catcher Bag.
109.	Mounting Yoke.
110.	Mounting Yoke Clamp.
111.	Mounting Yoke Bronze Pillar.
112.	Mounting Yoke Pillar Screw.
113.	Mounting Yoke Clamp Hinge Pin.

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Ref. No.	*Name of Part.*
114.	Mounting Yoke Clamp Pin.
115.	Mounting Yoke Clamp Key.
116.	Back Sight Elevating Screw.
117.	Back Sight Elevating Screw Head.
118.	Back Sight Elevating Screw Head Pin.
119.	Back Sight Elevating Screw Head Spring.
120.	Sear Pin.
121.	Butt Latch Pin.
122.	Mounting Yoke Pillar Hinge Pin.
123.	Mounting Yoke Chain.
124.	Mounting Standard.
125.	Light Field Mount Bottom Crossbrace.
126.	Light Field Mount Centre Post.
127.	Light Field Mount Feet (2).
128.	Light Field Mount Front Legs (2).
129.	Light Field Mount Front Yoke.
130.	Light Field Mount Knuckle Joint.
131.	Light Field Mount Knuckle Joint Pin.
132.	Light Field Mount Rear Brace.
133.	Light Field Mount T Joint, Centre.
134.	Light Field Mount T Joint, Side (2).
135.	Light Field Mount Top Lug.
136.	Barrel Mouthpiece Spanner.
137.	Magazine Filling Handle.

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