

THE "KINGSWAY" SERVICE SERIES

THE  
Machine Gunners'  
Handbook

Including the  
Vickers, Maxim, Lewis, and Colt  
Automatic Machine  
Guns



Arranged by  
Lieut. J. BOSTOCK, R.O., Yorkshire L.I.  
(Machine Gun Corps)

NINTH



EDITION

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THIS AND SERVICE SET

Caution

THE  
MACHINE GUNNER'S  
RANGE & TRAJECTORY CARD WITH  
ANGLES OF ELEVATION, Etc., FOR  
MARK VI AMMUNITION.

Range Yards.	Approximate Angles of Elevation.		Rise in Minutes.	Culminating Point of Tra- jectory in Feet.
	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	22	15	17½
1,000	1	38	15	23½
1,100	1	53	10	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	140
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.]

# 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.
100		8½	2	0	5	5	6	5
200	1	3½	3	0	8	6	10	6
300	2	0	5	0	10	2	13	4
400	2	8½	6	6	10	7	14	8
500	3	6	8	0	9	4	14	2
600	4	0	10	0	5	11	12	1
700	4	6	12	0	—	—	7	6
800	5	6	14	0	—	—	—	—
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	"

[SEE OVER

MEASUREMENTS OF THE 75% CONE—  
— MARK VII AMMUNITION. —

Range.	Vertical Diameter.	Horizontal Diameter.	Depth of I. B. Zone.
500	5 ft.	2½ ft.	220 yds.
800	8 ft.	4 ft.	172 yds.
1000	10 ft.	5 ft.	140 yds.
1200	12 ft.	7 ft.	112 yds.
1500	15 ft.	10 ft.	70 yds.

## MARK VII AMMUNITION.

Angles of Elevation.	Angle of Descent.	Culminating Point.	Trajectory Discs.		Lowest shot 100% Cone below Centre of Disc.	Height of Centre of Disc above ground.		
			Vert.	Hor.		700 yds.	800 yds.	900 yds.
100 yds	12' 5"		11"	8"	1' 1"	3' 5"	4' 3"	5' 0"
200 "	15'		1' 10"	1' 0"	2' 2"	5' 8"	7' 2"	8' 11"
300 "	18' 5"		2' 9"	1' 8"	3' 3"	6' 9"	9' 1"	11' 4"
400 "	22' 6"	1 in 300	3' 8"	2' 0"	4' 4"	8' 11"	9' 10"	13' 2"
500 "	27'	1 in 180	4' 8"	2' 6"	5' 5"	5' 11"	9' 8"	13' 9"
600 "	32' 5"	1 in 120	5' 8"	3' 0"	6' 8"	3' 10"	8' 2"	13' 2"
700 "	38' 5"	1 in 90	6' 1ft.	3' 8"	7' 7"	—	5' 1"	10' 10"
800 "	46'	1 in 67	8' 9ft.	4' 0"	8' 8"	—	—	8' 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	108ft.					
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' 6"
At 400 ..	8' 8"
At 500 ..	8' 0"
At 600 ..	7' 6"
At 700 ..	4' 8"

75% Zones: 500 yds	220 yds	1,000 yds	140 yds	1,500	70 yds
	24'		5'		10'

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## INTRODUCTORY.

With the issue of an Official Text Book, "Machine Gun Training," it is no longer necessary to give a detailed description of the various machine guns, pack saddlery, spare parts and equipment. Opportunity has, therefore, been taken to revise these Notes with a view to showing common-sense methods of applying the instructions given in "Machine Gun Training," which is the authority for all things pertaining to machine guns.

These notes show, in some measure, the system followed at the Headquarters of the Machine Gun Corps, in giving effect to the instructions laid down in the Official Text Book on Machine Guns.

The continued popularity of this little handbook necessitates the issue of a Ninth Edition.

Jan., 1916.

J. B.

## ESSENTIALS FOR MACHINE GUN INSTRUCTORS.

## 1. Study of Official Text Books.

This is the first essential for all machine gun instructors, and is of particular importance at this moment because of the publication of an Official Text Book on Machine Gun Training, giving a detailed description of the various machine guns in use, and the correct sequence of instruction to be followed.

*It is hoped that these Notes may be of some assistance to instructors. Having first studied the official book to see **What to Teach**, a perusal of these Notes will help instructors **How to Teach**, and also stimulate interest in this branch of training.*

## 2. Qualities of Machine Gun Instructors.

Non-Commissioned Officers taking up the duties of a machine gun instructor should strive to cultivate the following good qualities, a combination of which go to form the ideal instructor :--

- (a) Enthusiasm for machine gunnery.
- (b) Cheerful temperament.
- (c) Good physique.
- (d) Will power and determination.
- (e) Mechanical turn of mind.
- (f) Initiative and resource.

Enthusiasm is contagious. When the instructor is enthusiastic those under instruc-

tion soon learn their work. A cheerful temperament is especially necessary, because there is much hard work to be done in a Machine Gun Company, by night as well as by day. A mechanical turn of mind is not acquired easily. Some may possess no mechanical ability on joining the Company, but constant study of the working parts of the various guns and frequent handling will establish the requisite knowledge and confidence.

The other qualities speak for themselves.

### 3. Manner.

The first point an instructor should study, when imparting instruction, is his manner. He requires great patience, and should cultivate a *quiet, convincing manner*. To do this he must have a thorough knowledge of his work, making sure that he can explain the reason for everything he strives to teach. He must be insistent without bullying, above all things avoid sarcasm and slang terms, and encourage men to ask questions. In a similar manner the men's temperaments differ, and need careful study by the instructor.

### 4. Application of Instruction.

In the elementary work those under instruction should be assembled in a semi-circle around the gun, seated as convenient. The instructor explains carefully and concisely

each point dealt with during the lesson, drawing each man's attention by touching or moving the gun parts as required.

Demonstration of some part of the work by the instructor, or by one of the gunners, will often revive interest which is on the wane owing to long explanations.

Each stage must be thoroughly understood before proceeding to the next. Frequent interrogation will show when the instructor should go on.

### 5. Gunners to "handle" the Gun Parts.

Even in the early lessons the gunners should be given frequent practice in removing and replacing the lock, feed block, fusee spring box, etc. This gives confidence and facilitates quickness in handling the gun. This facility is only gained by constant practice. Therefore it is suggested that at every lesson on Description or Mechanism each gunner should be ordered to remove and replace several parts of the gun, or to weigh and adjust the fusee spring, under the eye of the instructor. By this means correct methods will be inculcated and damage to gun parts prevented.

### 6. Instructional Kit.

When teaching Mechanism, Stoppages, Drill, etc., it is most important that the instructor has on parade a number of dummy cartridges, prepared dummies, separated cart-

ridge cases, a brass lock, clearing plug, and all the necessary appliances to correctly illustrate points arising during instruction.

### 7. The Value of Personal Effort.

The most successful instructors are those who are able to induce men to eradicate their own faults by personal effort. This is the principle of standardising elementary machine gun training. The men are shown how to mount the gun, tap automatically, etc. on the parade ground or in the drill hall, and also told the standard of efficiency they are expected to reach, then encouraged by personal interest and effort to attain the necessary standard during leisure hours.

This is the best form of teaching and should always be employed.

## SYLLABUS OF TRAINING FOR A MACHINE GUN COMPANY.

(MINIMUM TIME ALLOTTED--SIX WEEKS.)

The following syllabus is given to emphasise the necessity for a carefully thought out programme before instruction commences, in order that no detail in training may be overlooked, and also to enable Section Officers and N.C.O.'s to prepare for the subjects to be dealt with on the following day.

The programme given is not an exhaustive one, and should be taken as a guide only. Particular attention is drawn to the following points :

### 1. Training of Officers and N.C.O.'s.

When the Company is engaged at Physical Training, or other similar periods, opportunity should be taken to carry out further training of Section Officers and N.C.O.'s. This training should include :

- (a) Practice in fire orders.
- (b) Map reading.
- (c) Reports, and direction of field messages.
- (d) Use of angle of sight instruments, methods of indirect, overhead, and night firing.

(e) Tactical schemes and fire problems, worked from the map.

It is important that Section Officers should parade daily under the Company Commander, for discussion of the next day's work, to ensure uniformity of training throughout the Company.

## 2. Training of Scouts.

A Special course of instruction is necessary to teach the duties of Scouts. This must be framed to suit machine gun requirements. The following brief summary is suggested :

(a) Map reading, conventional signs, contours, compass, etc.

(b) All methods of finding and keeping direction.

(c) Choice of machine gun positions, lecture, and practice.

(d) Reconnaissance, use of ground and cover.

(e) Points in reporting on position for attack or defence.

(f) Signalling, all methods, particularly Semaphore and Buzzer.

(g) Positions for observing fire, and signalling back results.

(h) Reports and field messages.

(i) Making rough sketches of trenches.

## 3. Night Work.

Attention is drawn to this subject because of its increasing importance. A considerable amount of training is required before gunners are able to quickly bring the gun into action ; to clear stoppages, or effect repairs, during hours of darkness. Instruction should therefore be given in these subjects when possible at night.

# SYLLABUS OF TRAINING.

(SIX WEEKS.)

## FIRST WEEK.

Time.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
7.15-7.45 a.m.	Squad drill	Squad drill	Rifle exercise	Squad drill	Rifle exercise	Barrack room inspection and pay.
9-9.45 a.m.	Physical training	Physical training	Physical training	Physical training	Physical training	Physical training
10-10.15 a.m.	General Description	Mechanism	Mechanism	Lecture. Indication and recognition	Practice in indication and recognition on landscape targets	Lecture. Allocation of duties
10.45-11.30 a.m.	Mechanism	General description	Visual training	Landscape targets, indication and recognition	Visual training	Immediate action position, Snapped position.
11.30-12.30 a.m.	Aiming, reason for rules, correct sight, etc.	Gun drill	Gun drill	Gun drill	Gun drill	Gun drill

Time.	Lecture. Objects, etc., and methods of instruction	Lecture. Visual training	J.D.	Mechanism	Mechanism	12.30-6. Cleaning of guns, tripods and transit.
3-3.45 p.m.	Ranging. Importance and methods. Elementary J.D.	Aiming with "cut & holding"	Detailed description, gun stripped	J.D.	Immediate action, first position	—
3.45-4.30 p.m.	Daily cleaning and stripping	Daily cleaning and stripping	Daily cleaning and stripping	Daily cleaning and stripping	Daily cleaning and stripping	—
5.30-6.20 p.m.	Lecture to N.C.O.'s. Discipline, etc.	—	Belt-filling	N.C.O.'s practice in indication	Packing of spare parts' box	—
Night work p.m.	—	—	—	—	—	—

# SYLLABUS OF TRAINING—continued.

## SECOND WEEK.

Time.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
7.15-7.45 a.m.	Squad drill	Rifle exercises	Kit inspection	Squad drill	Rifle exercise	Barrack room inspection and pay
9-9.45 a.m.	Physical training	Physical training	Physical training	Physical training	Physical training	Physical training
10-10.45 a.m.	Lecture "Error of the Day"	Lecture. Fire Orders	Lecture. Definitions, e.g., Trajectory, Cone of fire, etc.	Lecture. Commanded sights	Lecture. Bracketing fire	Lecture. Vehicle scorching
10.45-11.30 a.m.	J.D.	Immediate action. First and second positions	Visual training: individual instruction in automatic tapping	Landscape targets. Fire Orders	Immediate action. Fourth Position	Fire Orders. Open country
11.30-12.30 a.m.	Mechanism	Mechanism	Gun drill	Gun drill	Indication and recognition. Open country	Mechanism

Time.	Gun drill	Landscaping targets. Obedience to fire orders	Landscaping targets. Obedience to fire orders	Immediate action, first, second, and third positions	Gun drill	11.30-1
3-3.45 p.m.	Landscape targets, indication and recognition	Immediate action, third position	Immediate action, third position	Visual training	Fire Orders. Open country	Cleaning of guns, tripods, transport
3.45-4.30 p.m.	Immediate action, second position	Gun drill	J.D. Forward and lateral	Mechanism	J.D. Forward and lateral	
5.30-6.30 p.m.	Note. Gun to be cleaned every day by Nos. 1 and 2 between 5.30-6.30 p.m. from second week onwards	Belt-filling	Advanced stripping, repairs	N.C.O.'s practice in "combined sights"	N.C.O.'s practice in fire orders	
Night work p.m.						

# SYLLABUS OF TRAINING—continued.

## THIRD WEEK.

Time.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
7:15-7:45 a.m.	Squad drill	Rifle Exercises	Kit inspection	Squad drill	Rifle Exercises	Track, route inspection and pay
9-9:45 a.m.	Physical training	Physical training	Physical training	Physical training	Physical training	Physical training
10-10:45 a.m.	Lecture. Indirect fire	Lecture. Overhead fire	Lecture. Night firing	Lecture. Range Cards. Defence	Lecture. Range Cards. Attack	Lecture. Characteristics
10:45-11:30 a.m.	Open country. Complete fire	Demonstration. Overhead fire	Mechanism	Practice in making range cards.	Practice in making range cards. Attack	Practice in laying out for indirect fire
11:30-12:30 a.m.	Open country. Indirect fire	Gun. Drill or firing with min. attachment	J.D.	Tests of elementary training	Tests of E.C.	Tests in knowledge of mechanism
2-3 p.m.	Demonstration in indirect fire	Open country. Indirect fire for Monday	Demonstration laying gun for night firing	Open country. Indirect fire and control. Service conditions	Tests and competition in J.D.	12:30-1 Clearing of guns, tripod, transport

5-9:45 a.m.	Gun. Drill or firing with min. attachment	Stoppages	Gun drill or firing with min. attachment	Open country. Indirect fire orders and control. Service conditions	Made preparations necessary for Night firing on a particular point	—
5:45-1:30 p.m.	Stoppages	Automatic turn and tap	Signals for fire control	Automatic turn and tap for backwards	—	—
5:30-6:30 p.m.	N.C.O.'s, map and compass methods of indirect fire	—	Packing of spare parts, box	N.C.O.'s practice in fire orders	—	—
Night work P.m.	—	—	—	—	Test accuracy of gun laying preparations	—



# SYLLABUS OF TRAINING—continued.

## FOURTH WEEK.

Time.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
7:15-7:45 a.m.	Squad drill	Rifle exercises	Kit inspection	Squad drill	Rifle exercises	Barrack room inspection and pay
9-9:45 a.m.	Physical training	Physical training		Physical training	Lecture. Emplacements	Physical training
10-10:45 a.m.	Lecture. Range discipline, points before and during firing, etc.	Range cards		Lecture. Trench warfare, defence		Lecture. Packing and movement of limbered wagons
10:45-11:30 a.m.	Advanced drill, elementary stage	Immediate action and belt filling (change over)		Occupation of positions—changing to alternative positions. Fire control practice	Digging emplacements on lines	Practice in packing limbered wagon
11:30-12:30 a.m.		Lecture. Selection and occupation of gun positions	Thirty yards Range—			Use of periscopes with indication and recognition

Time.	Range cards	Conducted preliminary reconnoissance.	Part I. C.	Lay out of trench line	Worked out on trenches	Lecture. Cleaning of tools, etc.
3-3:45 p.m.	Signals for fire control and observation	Occupation of positions as previously selected during reconnoissance		Drill		N.C.O.'s presence in preliminary reconnoissance and selection of gun positions
3:45-4:30 p.m.	Mechanics			Immediate action and belt filling		
4:30-6:30 p.m.						
Night work p.m.						

*Note.*—During the second, third, and fourth weeks, special instruction will be given to Range Finders, Scouts, Drivers, etc., under the Company Commander's arrangements.

# SYLLABUS OF TRAINING—continued.

## FIFTH WEEK.

Time.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
7:15-7:45 a.m.	Squad drill	Belt filling	Belt filling	Kit inspection	Packing of hampered wagons	Barack inspection and tidy
9-9:45 a.m.	Digging Complete Emplacements	Classification Routes, Part II, "C."	Part II, "C." and fire Direction Practices	Physical training with guns, tripods, etc. Lecture. Battle Actions	Lecture. "Going on Service"	Tactical Submarine Open Regt. Squad Action
10-10:45 a.m.					Bombing practice and tactical use of bombs	
11:15-11:30 a.m.				Pomping, throwing practice	Firing gun from parapet without mounting	
11:30-12:30 p.m.				Quick mounting, etc., in trenches	Lecture. Battle actions	

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2-3 p.m.	Practice in over trenches ; (2) Firing guns quickly into action (3) Care of guns and ammunition in trenches					
3-3:45 p.m.				Tactical exercise—Advanced guard Action		
3:45-4:30 p.m.						
5:30-6:30 p.m.					Practice in taking over trenches at night. "Manning" them with guns and practice in fire control	
Night work p.m.				Digging and improving emplacements		

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# SYLLABUS OF TRAINING—continued.

## SIXTH WEEK.

Time.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
7-15-7-45 a.m.	Pushing forward wagons	—	Belt filling for cement-straips and field telegraphs on field-planting trenches	Afternoon training in trenching all night from the trenches upon another line is made at dawn. The gunners should feed in all phases of attack for trench warfare, special attention to bombing	—	Barroll, room inspection and pay
9-30-11 a.m.	Constructing various types of cover.	Tactical Exercise, attack and advance in trench warfare with infantry	—	—	Tactical exercise in combination with officer troops, or as an alternative, de- trenching against gas attacks; fitting of gas helmets practised	Bombing practice in trench storming; formation of troops and machine guns
10-10-11 a.m.	—	—	—	—	—	—
10-45-11-30 a.m.	—	—	—	—	—	—
11-30-12-30 a.m.	—	—	—	—	—	—
2-3 p.m.	Bombing trench stammine	—	—	—	—	—
3-5-45 p.m.	—	—	—	—	—	—
3-45-4-30 p.m.	—	—	—	—	—	—

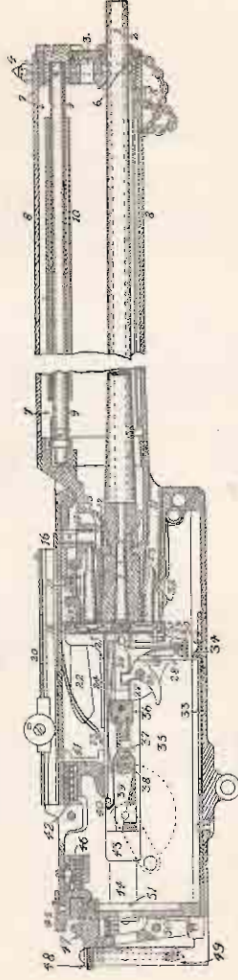
8-30-10 p.m.

Night work 10 p.m.

Repeating drill during night work

Repeating drill during night work

.303-INCH MAXIM MAGAZINE RIFLE CHAMBER MACHINE GUN.  
LONGITUDINAL SECTION SHOWING GUN READY FOR FIRING.



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.

LIST OF PARTS AS SHOWN IN PLATE I.

17. Feed Block Slide.
18. Upper Extractor Stop.
19. Extractor.
20. Tangent Sight.
21. Gilb Spring.
22. Side Cam.
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 Gaining.
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.

**MAXIM GUN.****General Description.**

(For detailed description of the gun, equipment and mountings, see "Machine Gun Training.")

**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 action of mechanism.

It is a waste of time and energy to teach the *names* of the parts only. These will be referred to so often during subsequent instruction, that they gradually take root in the brain of the beginner. It is also useless to talk too much about parts of the gun which cannot be seen at the moment. Such parts are dealt with when the gun is stripped.

**System of Instruction.**

*Name.*—Maxim Machine Gun, 303 inch.

*Weight.*—Sixty pounds.

*The gun is worked by two forces:*—

1. The force of explosion.
2. The fusee spring.

*The gun is divided into two portions.*—

1. The recoiling portions.
2. The non-recoiling portions.

NOTE.—Explain the non-recoiling portions first.

The *non-recoiling* portions consist of :

1. The barrel casing.
2. The breech casing.

Remove the recoiling portions to prevent confusion while explaining the non-recoiling portions in detail. Go slowly.

**NON-RECOILING PORTIONS.****The Barrel Casing.**

(a) Explain its use, and show the openings and plugs.

(b) Discuss the water-supply.

(c) How applied and retained in the barrel casing.

(d) The steam tube, steam escape hole, and condenser.

(e) Rate of evaporation and orders for replenishing water.

(f) Foresight, Pattern, and method of adjustment laterally.

**The Breech Casing.**

*Consists of :*

1. Two outside plates.
2. Bottom plate.
3. Rear cross piece.
4. Cover.

Explain briefly the function of each part in the following order :

### Outside of Breech Casing.

#### Right Side Plate.

1. Buffer spring.
2. Resistance piece.
3. Check lever.
4. Slide.

#### Left Side Plate.

1. Studs for fusee spring box.
2. Slide.
3. Fusee spring box—how retained.
4. Fusee spring—how adjusted and connected with recoiling and non-recoiling portions.
5. Studs for shoulder piece.

#### Rear Cross Piece.

1. Handles, the use of, and how secured. To be screwed tight and always kept full of oil.
2. The safety catch. Show automatic action.
3. The firing lever and double button.
4. Connection with trigger bar.
5. Use of shutter.

#### The Bottom Plate.

Bracket for elevating joint pin.

#### The Cover.

1. Tangent sight.
2. Stem.
3. Plate and graduations.
4. Slide and how adjusted.
5. Battle sight, its use.
6. Cover lock.

### Inside of Breech Casing.

#### The Cover.

1. Springs, show use with a lock.
2. Gun metal block.
3. Piston and spring which actuate tangent sight.
4. Piston and spring which actuate cover lock.

#### The Side Plates.

1. Cams, illustrate use with lock.
2. Rests which support the side plates.

#### Bottom Plate.

1. Studs which control the trigger bar.
2. Trigger bar, with projection and knuckle joint.

### The Feed Block.

1. Its use and how fitted.
2. Slide, levers, and stud connection with the recoiling portions.

3. Use of top and bottom pawls, with action of springs.
4. Band roller, lugs, and cartridge way.
5. Steel guides.
6. Cartridge and bullet stops.

#### Ammunition Belt.

1. How gun is fed.
2. Use of projecting strips.
3. Show thick edge near bullets to keep cartridges parallel.
4. How packed in box. Filling explained later.
5. Metal and web belts compared.

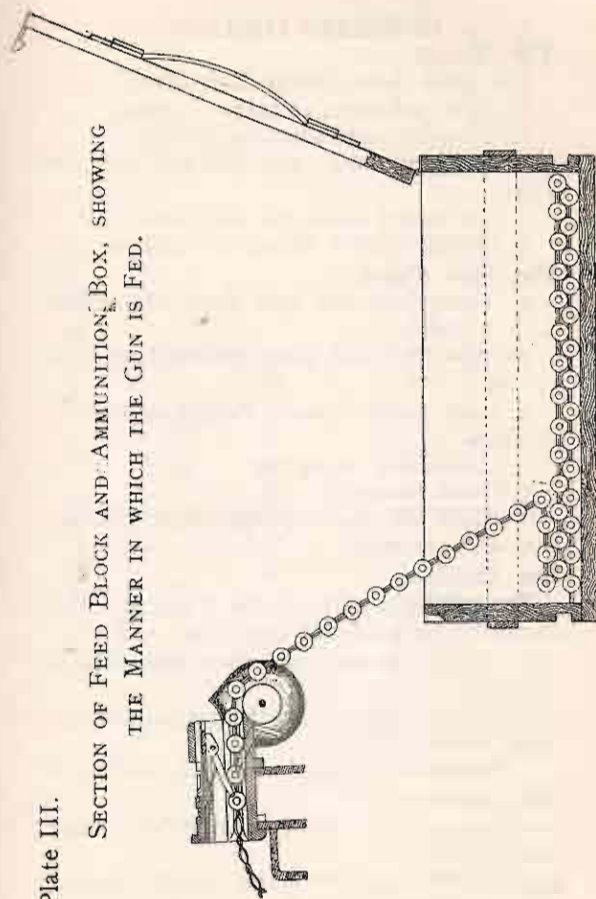


Plate III.

SECTION OF FEED BLOCK AND AMMUNITION BOX, SHOWING  
THE MANNER IN WHICH THE GUN IS FED.

## RECOILING PORTIONS.

### The Barrel.

Use spare barrel during description.

1. Draw attention to copper coating.
2. Cannelure and asbestos packing.
3. The gun-metal valve—its use and how fitted.
4. The barrel block and trunnions.
5. Chamber, bore, rifling and calibre.

### The Side Plates.

1. Take them out and show connection with barrel.
2. Show left side plate prolongation and recess.
3. Lock guides—places flanges of lock in position.
4. Connecting rod spring.
5. Crank bearings.
6. Right side plate spring—show connection with extractor.

### The Crank.

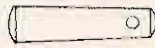
The principal parts of the crank are best shown by removing the side plates.

1. The connecting rod—show how lock is connected.
2. How divided for lengthening purposes—show washers.
3. Show how crank pin connects the rod to the crank.
4. Crank shaft—show fitting of crank handle and fusee.
5. Explain uses of crank handle, curved arm, knob, etc.

Plate II.

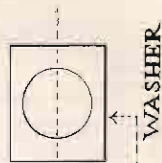
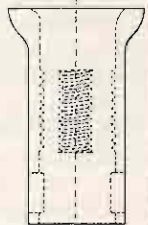
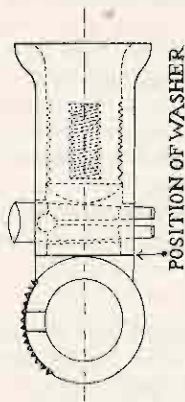


SPRING  
COTTER



SOLID  
COTTER

ADJUSTABLE CONNECTING ROD, MARK II.





### The Lock.

#### Outside.

1. Show interrupted screw fitting with connecting rod.
2. Screwed head connection with side levers.
3. Movement of extractor levers imparted by side levers.
4. Regulation of extractor by guide ribs and stops.
5. Keeper bracket. Explain this when lock is stripped.
6. The extractor with—
  - (a) Horns, cartridge grooves, firing pin hole, gib projections, and extractor spring. (Dummy cartridges should be used to illustrate.)
  - (b) Recess for side plate spring.
7. Flanges and neck. Show how this fits under gun-metal block.

#### Inside.

The brass lock (a stripped lock for preference) should be used to show inside parts.

1. Show sear with tail, bent, and spring.
2. Firing pin connection with sear, tumbler and lockspring recesses.
3. Tumbler: tail, axis pin, bent, and head. Show working with firing pin.
4. Trigger: nose, fitting bent of tumbler; tail, and connection with trigger bar.
5. Lockspring: positions of long and short arms shown and axis pin.

### 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.

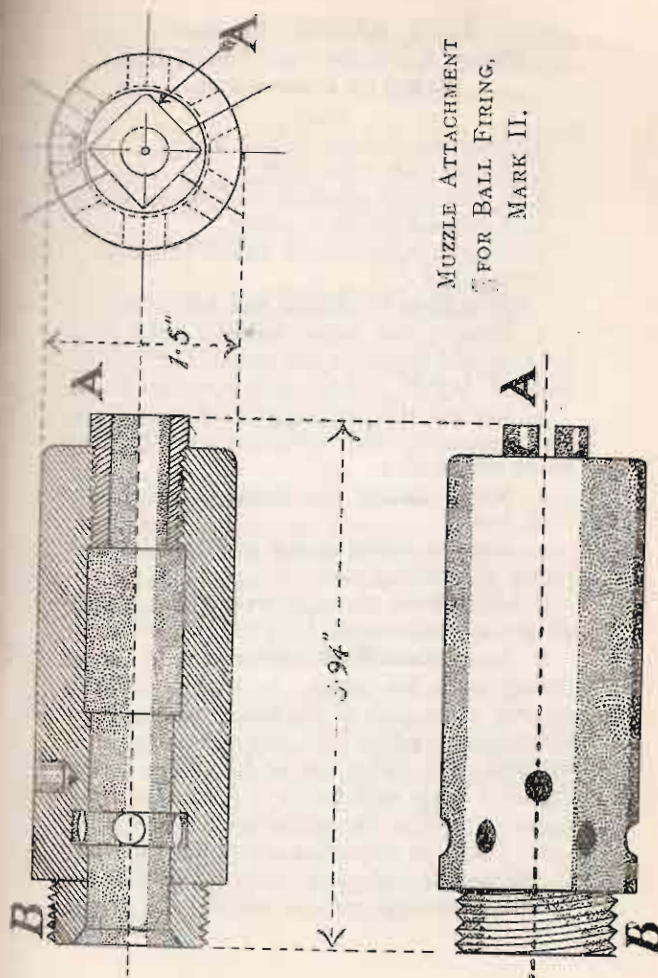
(iv) When the attachment is taken into use to overcome a defect in the working of the gun, the fusee spring, if already lowered,

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  $2\frac{1}{2}$ – $3\frac{1}{2}$  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.



**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 upperside of the block.
2. Remove the packing gland from the gun and assemble the gland, screwing hard home with tool 1.
3. Screw muzzle cup 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 into outer casing 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, screwing hard home with tool 1 or 3, and assemble adjusting nut on the adjusting screw.
7. Turn the adjusting screw lightly home to the muzzle cup, care being taken that the recoiling portions are not forced back. Then,

noting its position by the uppermost number marked on the flats at the outer end, unscrew 64 revolutions and tighten adjusting nut.

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.

### SUMMARISED SEQUENCE OF INSTRUCTION IN THE ACTION OF MECHANISM.

(For detailed Action of Mechanism, see "Machine Gun Training.")

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

- |  |                       |
|--|-----------------------|
| 1. How to load the gun.  |                       |
| 2. Show how to fire.   |                       |
| 3. How to unload the gun.  |                       |
| 4. Action on recoil.   |                       |
| 5. First action in the feed block.                               | } Backward movement   |
| 6. Rotation of the crank.  |                       |
| 7. Backward movement of the lock.                                | } Recoiling Portions. |
| 8. Cocking action.   |                       |
| 9. Action of fusee spring.                                       |                       |
| 10. Second action in feed block.                                 | } Forward movement    |
| 11. Rotation of crank.   |                       |
| 12. Forward movement of the lock.                                | } Recoiling Portions. |
| 13. Firing action: (a) For first shot; (b) for subsequent shots. |                       |
| 14. Action inside lock when double button is released.           |                       |

#### Method of Teaching Action of Mechanism.

Demonstration is the most powerful aid to instruction when teaching mechanism of any kind. Men learn through the eye rather than

the ear. Every opportunity should, therefore, be taken to demonstrate while explaining, and show each motion as it would actually take place.

Again, one would emphasise the necessity of *going slowly*. The quick instructor (and especially the one who suddenly produces all the inside parts of the lock with two taps of a hammer) leaves those under instruction bewildered and discouraged, and they return to quarters as men leave a first-class sleight-of-hand entertainment.

#### 1. Loading.

Show how to load, explaining that the crank handle is first moved to—

(a) Draw the extractor from the face of the feed block and thus allow the first cartridge to be drawn into position.

(b) To cause the extractor to fall, ready to grip the first cartridge.

(c) To cock the lock.

As each motion is performed draw attention to the correct method and show the actual result.

#### 2. To Fire the Gun.

Explain and demonstrate that—

(a) On raising the safety catch and pressing the double button the gun fires automatically.

(b) On releasing the double button the gun stops firing with two live rounds on the face of the extractor.

### 3. Unloading.

(a) Open the cover and show what happens to the cartridge each time the crank handle is turned over.

(b) Explain why the bottom pawls must be depressed.

(c) Draw attention to the necessity of always releasing the lock spring after unloading.

### 4. Action on Recoil.

Remove the fusee spring box and, by pushing on the muzzle, demonstrate the effect of the explosion upon the recoiling portions and the first extension of the fusee spring. Some instructors show this effectively by holding the fusee spring box open to the squad, with spring attached to chain, while one of the men under instruction pushes back the muzzle.

### 5. First Action in the Feed Block.

See that the recoiling portions are fully home and remove the fusee spring box, if on. Now direct attention to the slide of the feed block and push back the muzzle. Next remove the feed block, or use the spare one, to show exactly what happened to the levers and top pawls. This point may be clearly illustrated

with a belt and dummies placed over the barrel casing, the first two fingers of the right hand taking the place of the top pawls.

### 6. Rotation of the Crank.

Force home the recoiling portions and direct attention to the curved arm of the crank handle and resistance piece. Pushing slowly on the muzzle will clearly illustrate how the crank first obtains its rotary motion. Then turn the gun round so that the fusee spring and chain can be observed, and (holding the box open with spring and chain attached) repeat the motion of pushing the muzzle, to show how the rotation of the crank also winds the chain round the fusee and further extends the fusee spring.

### 7. Backward Movement of the Lock.

Open the cover and show—

(a) The horns of the extractor riding on the cams, thus keeping the extractor up until the cartridge is clear of the feed block.

(b) Explain how the live round and empty case are prevented from slipping down the face of the extractor during this backward movement.

(c) Show the action of the cover springs. Partially close the cover to do this.

(d) Show how the gun-metal block keeps the lock in position when the flanges are clear of the guides.

### 8. The Cocking Action.

The brass lock or spare parts should be used to demonstrate this.

The position of the instructor, and also the method of holding the brass lock (when used), are of special importance.

It is useful to repeat this a number of times, then to ask questions while cocking the action with the lock in the gun.

Some men are very slow in picking up this part of the mechanism, but, having once learned, such men, as a rule, never forget. Thus the patience and perseverance of the instructor is rewarded.

### 9. Action of the Fusee Spring.

See that the recoiling portions are fully back, and that the top pawls are behind one cartridge only. Holding the fusee spring box partially open on the left side of the breech casing, push forward the crank shaft with the right hand, and show how the fusee spring carries the recoiling portions forward when the force of recoil is expended.

### 10. Second Action in the Feed Block.

Remove the fusee spring box and draw back the recoiling portions fully. Open the cover, and remove the cartridge from the face of the feed block if one is already fed up, owing to previous manipulation. Direct attention to the slide and face of the feed

block, and slowly push the recoiling portions forward. This motion should be repeated with the feed block in and out of the gun, to bring out the action of the levers, the top and bottom pawls, the use of the steel guides, bullet and cartridge stops, etc.

### 11. Rotation of the Crank.

With the recoiling portions forward, lock back, and fusee chain wound round the fusee, open the cover and partially open the fusee spring box to show—

(a) How the rebound of the crank handle from the buffer spring assists the fusee spring to unwind the fusee chain.

(b) How the chain unwinding, rotates the crank and forces the lock forward.

### 12. Forward Movement of the Lock.

Put on the fusee spring box, and, slowly turning the crank handle, show—

(a) The entrance of the live round and empty case respectively into the chamber and ejector tube.

(b) How the side levers acting upon the extractor levers cause the extractor to rise (use a spare lock to show this action).

(c) Show (with spare lock and empty case) the action of the extractor spring, and the parting of the case from the cartridge grooves.

(d) How the gib projections pass over the round in the chamber and fresh cartridge in the belt respectively.

(e) The action of the side plate spring.

### 13. The Firing Action.

(a) *For the First Shot.*

With a brass lock show how (when the lock goes home) the screwed head rises slightly above the horizontal and disengages the sear from the firing pin.

Repeat this action with the gun, moving the crank handle slowly.

Draw attention to the fact that now it is only necessary to release the nose of the trigger from the bent of the tumbler to fire the first shot. Illustrate this with the brass lock, pointing out the action of the lock spring. Then repeat by pressing the double button.

*In teaching the firing action for first and subsequent shots, it is useful to have the rear cross piece and trigger bar out of the gun.*

(b) *For Subsequent Shots.*

Demonstrate with the brass lock, and explain that single shots are fired by means of the trigger, and rapid fire by means of the sear. Show also that another function of the sear is to hold back the firing pin until the lock is in the firing position.

It is most important that every gunner should understand this "timing" principle

of the sear and firing pin, because on taking into use a strange lock, the sear "timing" should be tested immediately, and if necessary adjusted.

### 14. Action Inside Lock when Double Button is Released.

(a) With the rear cross piece and trigger bar on a bench or table, show how the trigger bar moves slightly forward on releasing pressure from the double button.

(b) With the brass lock show the action of the short arm of the lock spring, forcing the nose of the trigger under the bent of the tumbler.

(c) Demonstrate the action of the screwed head lifting the sear, and the bent of tumbler coming into contact with the nose of the trigger, so stopping the gun from firing.

## 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.

**1. 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  $\frac{1}{2}$  turn to the left and lift off. Lift the feed block out.

**2. 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.

**3. 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.

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

**5. 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.

**6. 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.

**7. 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.

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

**9. Steam Tube and Packing Gland.**—Up-end 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.

**10. 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.

### 11. 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 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.

#### To Assemble the Lock.

(a) Replace the extractor and bottom stop.

(b) Insert firing pin, with extractor up.

(c) Replace the tumbler and axis pin.

(d) Replace the trigger and axis pin.

(e) Replace the extractor levers.

(f) Replace the keeper bracket.

(g) Replace the lock spring, forcing the long arm into the recess in the firing pin.

(h) Holding the thumb against the trigger, force a drift between the lock spring and the

extractor. This will bring the recess in the spring opposite that in the keeper bracket.

(j) Insert lock spring axis pin.

(k) Holding the lock up to the light, insert the sear, taking care not to push it beyond the holes which receive the axis pin.

### 12. 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.

### 13. 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.

### 14. 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.

#### 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 cannellure of the barrel, pressing it together with a thin piece of wood, or the point of a turnscrew or knife, until the cannellure 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.

## 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

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.

### 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.

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

#### 5. Tumbler.

- (a) Drive out tumbler axis pin.
- (b) Pull trigger back slightly.
- (c) Remove tumbler.

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

**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  $2\frac{1}{4}$  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

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.

### 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 . . . . .	$\frac{1}{2}$ lb.
Flannelette, Mark II . . . . .	11 yards.
Old linen . . . . .	3 lbs.
Mineral oil, burning . . . . .	$\frac{1}{2}$ pint.
Russian petroleum for lubricating . . . . .	8 pints.
Spirits of turpentine . . . . .	1 pint.
Soap, yellow . . . . .	4 bars.

#### 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 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. Take out the elevating joint pin and depress the muzzle. 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.*



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.*

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

(For Maxim and Vickers Guns.)

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.

### I. 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.

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. With Maxim guns 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. (Maxim Gun.)

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 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 dif-

ference 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.)

To Weigh and adjust Fusee Spring.

(Vickers Gun.)

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  $\frac{1}{2}$  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.

(d) Examine Barrel, etc., and clean Bore.

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, and that screwed heads are tight; 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.

#### Points to be Attended to During Firing.

##### (a) Watch Water Supply.

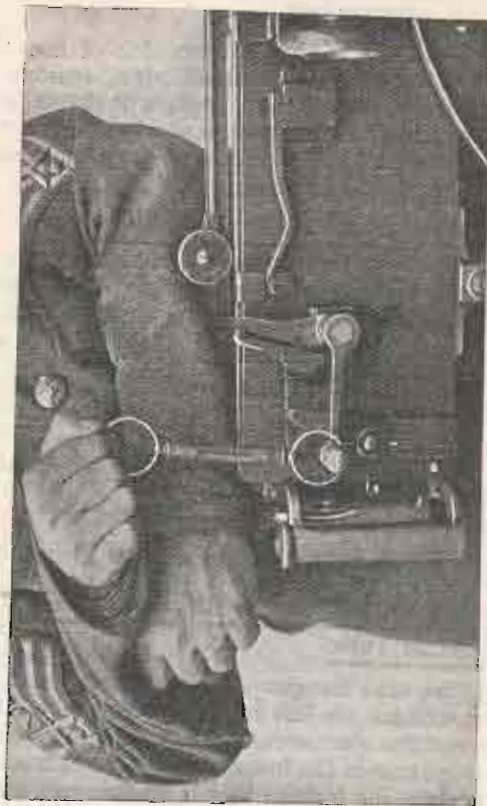
See that a sufficient supply of water is kept in the barrel casing, so that the barrel is never uncovered.

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  $1\frac{1}{2}$  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.

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 emphasizing. Note the support given to the right arm.

(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. Take steps to replenish oil and water if necessary.

(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.

(e) Belts Refilled.

See that the belts are refilled without delay.

(f) Clamps.

See that clamps of tripod legs do not work loose.

**Points to be Attended to After Firing.**(a) Unload and (with Maxim) 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 Quarters.

On return to quarters 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. The boiling water method of cleaning the bore should be applied when possible.

ABBREVIATED MEMORY TABLE OF			
POINTS TO BE ATTENDED TO BEFORE, DURING, AND AFTER FIRING.			
	<i>Before Firing.</i>	<i>During Firing.</i>	<i>After Firing.</i>
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, etc.	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 Quarters.
7	Examine belts.		
8	Action when water is Frozen		

## STOPPAGES.

### Stoppages in the Automatic Action of the Gun During Firing.

Every opportunity should be taken to thoroughly clean guns. On service, where guns have been properly looked after, stoppages, due to faulty mechanism, have been very rare.

The most common troubles have been :—

(a) **Faults in feed due to—**

- (i) Badly filled belts.
- (ii) Wet and dirty belts.
- (iii) Pockets becoming loose.

(b) **Bulged barrels, due to—**

Getting mud into muzzle of gun when mounting, dismounting, or crawling with gun, etc.

Great care should be taken to prevent this.

(c) **Broken—**

- (i) Lock springs, due mainly to leaving spring compressed.

(ii) Muzzle cups, in Vickers, due to their being too tightly screwed up.

(iii) Condenser tubes. Overcome by issue of new pattern tubes.

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 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.

### Method of Instruction.

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 relaying 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.

1. The probable causes of stoppages should never be discussed during immediate action instruction.

The instructor demonstrates the particular immediate action he is about to teach. He should emphasise the necessity for scrupulous accuracy in every detail, and for crisp and clean handling of the gun parts to ensure that no fresh stoppage occurs due to clumsy manipulation on the part of the gunner.

2. The gunner is then told exactly what is required of him immediately he receives the order, "Gun stops."

(a) Correct immediate action. (Assisted sometimes by No. 2.)

(b) Gun relayed on mark.

(c) Fire reopened.

Each is of equal importance. The instructor should always check the aim and watch the tendency to simply jerk the thumb piece forward and release it again, when reopening fire. This is a common fault in immediate action training.

3. The gunner takes up the sitting position behind the gun with head turned aside, while the instructor sets up the required stoppage and taps the gun off the mark. The element of surprise is an essential feature in this part of the training, the instructor therefore covers the crank handle with cap or handkerchief, and smartly gives the order, "Gun stops," at the same time uncovering the crank handle.

There should be no delay between the time when the stoppage is set up and the order "Gun stops," otherwise the surprise element is lacking and the training almost valueless.


4. It is often argued that when the cause of a stoppage is obvious to the gunner, as in the case of a bad fault in feed, it is unnecessary to go through the preceding immediate actions for that particular stoppage. This idea is erroneous, because on service the gun is not always firing with sufficient light to see what is the cause of stoppage. We should therefore train our men to go through all the motions laid down; this will enable them to get the gun firing again by night or by day.

5. When men are proficient in immediate action by day, the remainder of the training should be carried out in darkness.

6. A smart instructor who gives a few minutes' demonstration of the various immediate actions before his squad daily, will stimulate interest and rouse the competitive spirit more than is possible by hours of talking.


### Immediate Action.

#### FIRST POSITION.

Position of Crank Handle.	Method of Preparation by the Instructor.	Immediate Action performed by the Gunner on the Order, "Gun Stops."
<p>First.</p> 	<p>(1) Raise the lock and place an empty case between the projections of the gib.            (2) Half load.            (3) Raise crank handle to a vertical position and pull a cartridge into position in the feed block.            (4) Tap gun off the mark.</p>	<p>(1) Turn crank handle on to the buffer spring, pull the belt to the left front, let go crank handle, relay, and open fire.            (2) If failure recurs, lighten fusee spring by three turns.</p>

## Immediate Action—continued.


SECOND POSITION.

Position of Crank Handle.		Method of Preparation by the Instructor.	Immediate Action performed by the Gunner on the Order, "Gun Stops."
Second.		<p>(1) Damaged cartridge: Budge 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, and tap gun off the mark.</p> <p>(2) Separated case: 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. A cartridge should be pulled into position in the feed block. Tap gun off the mark.</p>	<p>(1) Force the crank handle forward, and at the same time open the cover with the left hand.</p> <p>(2) Clear the face of the extractor. If necessary call for the clearing plug from No. 2, and clear the obstruction in the chamber.</p> <p>(3) Reload, relay and open fire.</p>

NOTE.—When it is desired to make the gunner use the clearing plug, return the lock slowly, and see that the separation is not gripped by the cartridge entering the chamber.

## Immediate Action—continued.

(THIRD POSITION.)

Position of Crank Handle.		Method of Preparation by the Instructor.	Immediate Action performed by the Gunner on the Order, "Gun Stops."
Third.		<p>(1) Simulating weak fusee spring or excessive friction: 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. Tap gun off mark.</p> <p>(2) Slight crossfeed: Perform half the loading motions. Place the crank handle on to the buffer springs in to position in the feed block, and holding it there, close the cover, and let the crank handle go slowly back.</p> <p>(3) Bad fault in feed: Pull out the fourth cartridge in the belt about <math>\frac{1}{2}</math> in. 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 an</p>	<p>(1) Lift the crank handle slightly, pull the belt to the left front and strike the crank handle down on the check lever, relay, and open fire. (If failure recurs strengthen the fusee spring by three turns.)</p> <p>(2) If (1) fails, 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, if necessary, No. 2 forces down the horns of the extractor with the clearing plug in position. No. 1 closes the cover and pulls the top cartridge of a fresh belt into position and lets go the crank handle. Then relays and opens fire. (3) If the slide is free, No. 1 opens the cover, No. 2 forces down the horns of the extractor, No. 1 clears the face of the</p>

## Immediate Action—continued.

### THIRD POSITION—continued.

Position of Crank Handle.	Method of Preparation by the Instructor.	Immediate Action performed by the Gunner on the Order, "Gun Stops."
	<p>empty case over the firing pin hole. Replace the lock, shut the cover, and let go the crank handle. Tap the gun off the mark.</p> <p>(4) Simulating damaged cartridge grooves, etc.; Damage the rim of the second dummy cartridge in the belt and proceed to load. Tap gun off the mark.</p>	<p>extractor, and changes the lock. No 2. removes the cartridge in position in the feed block and No. 1 reloads, relays, and opens fire.</p>

*NOTE.—As damage to the extractor has to be simulated by damaging a cartridge rim, this cartridge must be removed before reloading.*

### (FOURTH POSITION.)

Fourth:

Load, and press the double button.  
Tap gun off mark.

To simulate a broken firing-pin. Call out, "Gun will not fire," immediately 1st immediate action is completed.




## 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.
<p><b>FIRST:</b></p> <p><i>Indication.</i> The lock is unable to catch back for the extractor to drop.</p>	<p>(1) Turn the crank handle on to the buffer spring, pull the belt to the left front and let go crank handle.</p> <p>(2) If failure recurs, lighten fuse spring by three turns.</p> <p><i>NOTE.—If the continued lightening of the fuse spring results in the crank handle stopping in the third position, take muzzle attachment into use and put fuse spring back to normal weight.</i></p>	<p>The extractor has not dropped. This may be due to—</p> <p>(a) Too heavy fuse spring.</p> <p>(b) Excessive friction, or tight pockets in the belt, or excessive packing in camature or packing gland.</p> <p>(c) Insufficient energy of recoil due to deteriorated ammunition or worn barrel.</p>	<p>(1) 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 camature or packing gland.</p> <p>(c) The barrel should be examined at the first opportunity, and if much worn in the lead should be changed.</p>	<p>(1) Raise the lock and place an empty case between the projections of the gib. Half load, raise the crank handle to a practical position, and put in the cartridge into position in the feed block. When actually firing this can be simulated by increasing the weight of the fuse spring.</p>

*NOTE.—In the above cases the energy of recoil is insufficient to overcome the strength of the fuse 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 cases 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 in the feed block, prevents the lock from going forward again.*



### Third Position of Crank Handle.

Position of Crank Handle and its Indication.	Immediate Action.	Probable Cause.	Prevention of Recurrence.	Method of Preparation for Instructional Purposes.
<p><b>TIPED:</b></p>  <p>The tractor is unable to rise to its highest position. If the feed slide is jammed there is a fault in the feed.</p>	<p>(r) 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. If failure recurs, strengthen the fusee spring by 3 turns.</p>	<p>(r) (a) Too light fusee spring. (b) Excessive friction. (c) A cartridge fed up slightly crossways, or a long brass strip is bent.</p>	<p>(r) (b) Clean and oil working parts. (r) Carefully examine the belt.</p>	<p>(r) Perform the correct loading motions, except that when connecting the loading the crank handle must be eased back gently until it is in the third position. For range purposes:— Lighten the fusee spring.</p>
<p><b>NOTE—If the continued slipping of the fusee spring results in the crank handle stopping in the first position, change the lock, putting the fusee spring back to normal; if failure recurs take muzzle attachment into use.</b></p>				

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<p>(r) A. If (r) fails to 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 No. 1 places the crank handle on the buffer spring. As soon as the spare feed block is in position, No. 1</p>	<p>(r) A (r) fills belt, or a belt with worn cartridges projecting unevenly from the belt prevent it entering or passing freely through the feed block.</p> <p>(r) A (s) Belt horn not being in line with the feed block; the belt does not lead up correctly to the feed block and becomes jammed.</p>	<p>(r) A (r) Carefully examine the new belt.</p> <p>(r) A (s) See that the new belt box is in line.</p>	<p>(r) A (r) Pull out the fourth cartridge in the belt about <math>\frac{1}{2}</math> 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 an empty case over the firing pin hole. Replace the lock, shut the cover, and let go the crank handle.</p> <p>For range purposes:—</p>
<p>ridge half way into position in the feed block, and, holding it there, close the cover and let the crank handle go slowly back.</p> <p>For range purposes:— Bend a long brass strip.</p>			


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### Third Position of Crank Handle—continued.

Position of Crank Handle and Its Indication.	Immediate Action.	Probable Cause.	Prevention of Recurrence.	Method of Preparation for Instructional Purposes.
Closes the cover and pulls the top cartridge of a fresh belt into position, and lets go the crank handle.	(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. No. 2 removes the cartridge in position in the feed block and No. 1 reloads.	NOTE.—The effect of a fault in lead is that the top parts being engaged behind a cartridge in the belt, are held fast when some obstruction, such as about, prevents the belt from passing freely through the feed block. The receding 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.		Fill a belt badly. (iii) A. (2) For range purposes.—Place the belt box at an angle to the feed block.
		(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 second dummy cartridge in the belt, and proceed to load.

(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.
<p><b>FOURTH:</b></p>  <p>That there has been no explosion, or if any, that there has been little or no recoil, the lock remaining in its forward position.</p>	<p>(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.</p>	<p>(a) (1) No cartridge in the chamber.                  (2) Defective ammunition.                  (b) (1) Broken or damaged firing pin.                  (2) Broken lock spring.</p>		<p>(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.</p>

**NOTE.**—Worn or damaged side or extractor levers, may result in the extractor being unable to rise, or if the side levers are bent, 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



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.



**VICKERS MACHINE GUN.****General Description.**

(For detailed description of the gun, equipment, and mountings, see "Machine Gun Training.")

**Method of Imparting Instruction.**

*Name.*—Vickers Light Machine Gun, '303 inch.

*Weight.*—28½ lbs., including muzzle attachment. 38½ lbs., with barrel casing full of water.

(Guns of recent manufacture are a few pounds heavier, owing to slight alterations.)

**The Gun is Worked by Two Forces:—**

1. The force of explosion.
2. The fusee spring.

**The Gun is Divided into Two Portions:—**

1. The recoiling portion.
2. The non-recoiling portion.

*Note.*—The non-recoiling portion, being easy to see and to understand, will be explained first.

**Non-Recoiling Portion.**

The *non-recoiling* portion consists of:—

1. The barrel casing.
2. The breech casing.

Remove the recoiling portions to prevent confusion while explaining the non-recoiling portion in detail.

**The Barrel Casing.**

(a) Explain its use, and why corrugated. Show the openings and plugs.

(b) Discuss the water supply.

(c) How applied and retained in the barrel casing.

(d) The steam tube, steam escape hole, and condenser.

(e) Rate of evaporation and orders for replenishing water.

(f) Foresight. Pattern and method of adjustment laterally; also how protected from damage.

(g) Remove the muzzle attachment and briefly explain the parts.

The interior of the barrel casing should be explained when the gun is stripped.

**The Breech Casing.**

*This consists of:*

1. Two side plates.
2. Bottom plate.
3. Two covers, front and rear.
4. Rear cross piece.

Explain briefly the function of each part in the following order:

**Outside of Barrel Casing.****Right Side Plate.**

1. The check lever. Demonstrate its use.
2. Roller and slide.

Left Side Plate.

1. Front cover catch.
2. The studs which hold front end of fusee spring box.
3. The elevating stop.
4. Slide and stud for fusee spring box.
5. Fusee spring. How connected to the recoiling portion, and method of adjustment. Use of the vice pin, etc.

Bottom Plate.

1. Sliding shutter. Its object. When to be open and when closed, etc.
2. Elevating bracket. Show connection with mounting and method of securing by means of feather way.
3. Cross head bracket. Show method connecting cross head joint pin.
4. Seating for ejection. Invert gun and show ejection of empty case.

Rear Cross Piece.

1. Handles, use of. How filled with oil, Emphasisc necessity of screwing up tight, and keeping full of oil.
2. The safety catch. Show automatic action.
3. Thumb piece, firing lever, and pawl.
4. Trigger bar lever. Show connection with pawl and trigger bar.
5. T-shaped screw. Remove and explain its uses.

6. Show how rear cross piece is hinged to outside plates.

Front Cover.

1. Explain working of the catch.
2. Open cover and show the extractor stop.
3. Point out the hinge pin securing front and rear covers.

Rear Cover.

1. Cover lock and spring.
2. Tangent sight stem, how actuated by piston and spring.
3. Plate and graduations.
4. Slide and how adjusted.
5. Battle sight. Its use and advantages explained.
6. Column on which the stem rests when down.

Inside of Breech Casing.Rear Cover.

1. Show how rigidity is secured by rear cover and rear cross piece grooves.
2. Trigger bar. Show action of spring, and point out the recess for the trigger, and also the projection by which connection is secured with the trigger bar lever.
3. Lock guides. Show use with lock.
4. Ramps. Show use with lock.

**The Side Plates.**

1. Cams. Show with lock how these control extractor.
2. Cam steps. Explain and demonstrate uses.
3. Rests which support the recoiling portion.
4. The barrel way, or sleeve, through which the barrel passes into the barrel casing.

**The Feed Block.**

1. Its use, and how fitted and secured in the gun.
2. Levers. Explain action, and show stud connection with recoiling portions.
3. Slide and top pawls. Show spring and finger pieces.
4. Bottom pawls. Explain use, and show spring and finger piece.
5. The cartridge way, with guides. Show use of guides with a dummy cartridge.
6. Cartridge and bullet stops. Show use of these with belt and dummies.

*Note.*—It is convenient to explain the use of ammunition belts at this period of the instruction.

**Ammunition Belts.**

1. Explain how gun is fed.
2. Use of projecting strips.

3. Show thick edge near bullets to keep cartridges parallel.

4. How packed in box. Filling explained later.

5. Metal and web belts compared.

(See method of feeding the gun on Plate III page 27).

**RECOILING PORTION.**

The recoiling portion consists of :

1. The barrel.
2. Two side plates.
3. The lock.
4. The crank.

**The Barrel.**

Use the spare barrel during description.

1. Show the groove near muzzle. Explain its use. Emphasising the correct method of attaching the muzzle cup, and strength required.

2. The cannellure near breech end. Its use and importance, correct packing.

3. The barrel block and trunnions.

4. Correct method of inserting barrel after repacking, etc.

5. Chamber, bore, rifling, and calibre.

*NOTE.*—Explain importance of safeguarding both inside and outside of barrel from rust.

**The Side Plates.**

1. Remove and show connection with barrel.
2. Show left side plate prolongation and its connection with the feed block.
3. Side plate springs. Explain action.
4. Guides for lock flanges. Explain reason for the interruptions.
5. Crank bearings. Show how these support recoiling portions and move in the slots in breech casing.

**The Crank.**

The principal parts of the crank are best shown by removing the side plates.

1. The connecting rod. Show how lock is secured by the interrupted flange.
2. The adjusting nut. Briefly explain object.
3. Show how the crank pin connects the rod to the crank.
4. The crank shaft. Show fitting of crank handle and fusee.
5. Explain briefly various uses of crank handle—*e.g.*, loading, unloading, indicator during stoppages, weighing fusee spring, curved tail, etc.

**The Lock—Outside.**

1. Show connection to crank by interruptions inside side lever head.

2. Trace the side levers from the side lever head, and show :—
3. How the upward movement of the extractor is imparted by the side and extractor levers.
4. Show how the upward and downward movements of the extractor are regulated by guide ribs and stops.
5. Explain the parts of the extractor, commencing with the horns and working downwards. Demonstrate, when necessary, with a good dummy cartridge.
6. Show the lock flanges, and explain the interrupted portions.

**Inside the Lock.**

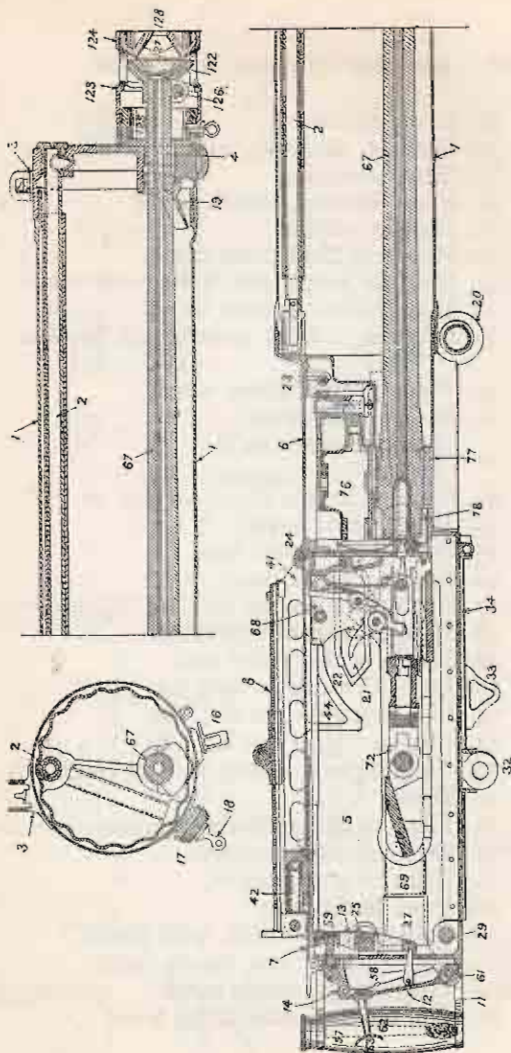
Strip the lock, and lay out the parts on a bench in correct relationship, while explaining.

1. Show the sear, with tail, bent, spring, and claw.
2. Firing pin. With bent, tumbler head recess, axis bush recess, and lock spring projection.
3. The tumbler. With tail, axis pin, bent, and head.
4. The trigger. With its nose fitting bent of tumbler, axis pin, and tail.
5. Lockspring. Show position of long and short arms, also piece riveted inside lock which acts as a guide for the lock spring when assembling.
6. Show back of the extractor, and position of stops.

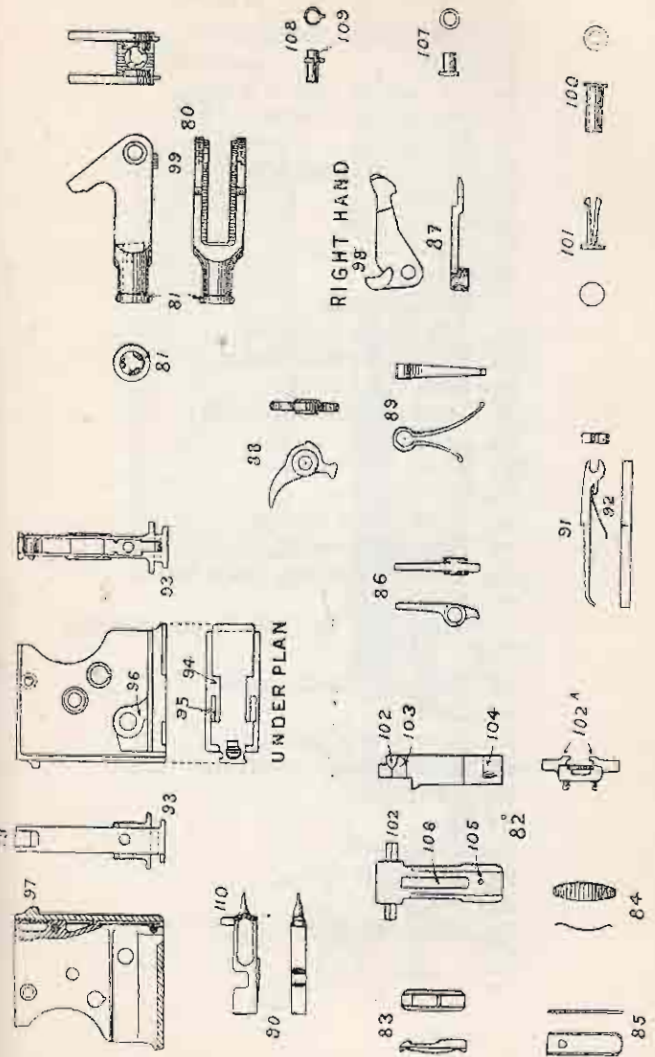
**303-inch Vickers Gun.***Explanation of Plates.*

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.

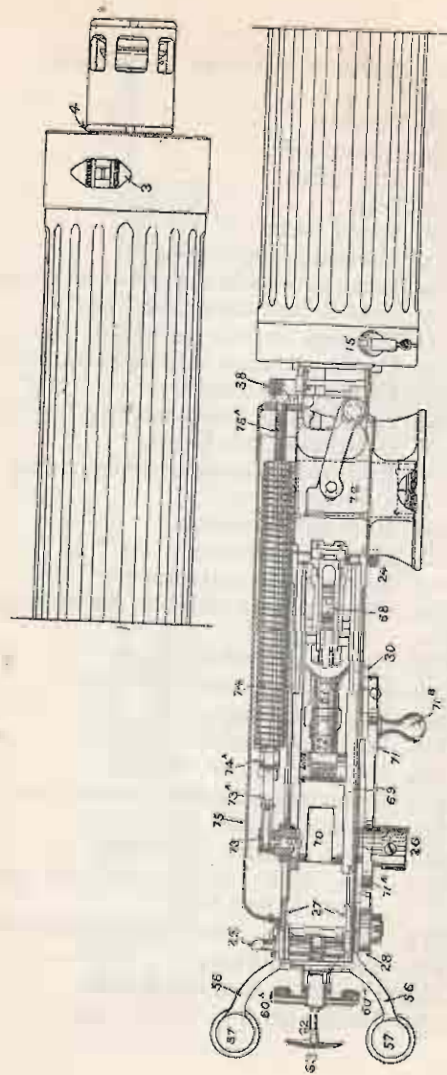


31. Lever, check.
32. Bracket, elevating joint.
33. Stop, mounting.
34. Plate bottom, breech casing.
35. Shutter, sliding.
36. Hooks of front cover catch.
37. Hole for keeper pin, front cover catch.
38. Lever of catch, front cover.
39. Grooves in front cover catch to clear "36."
40. Plunger, front cover 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.



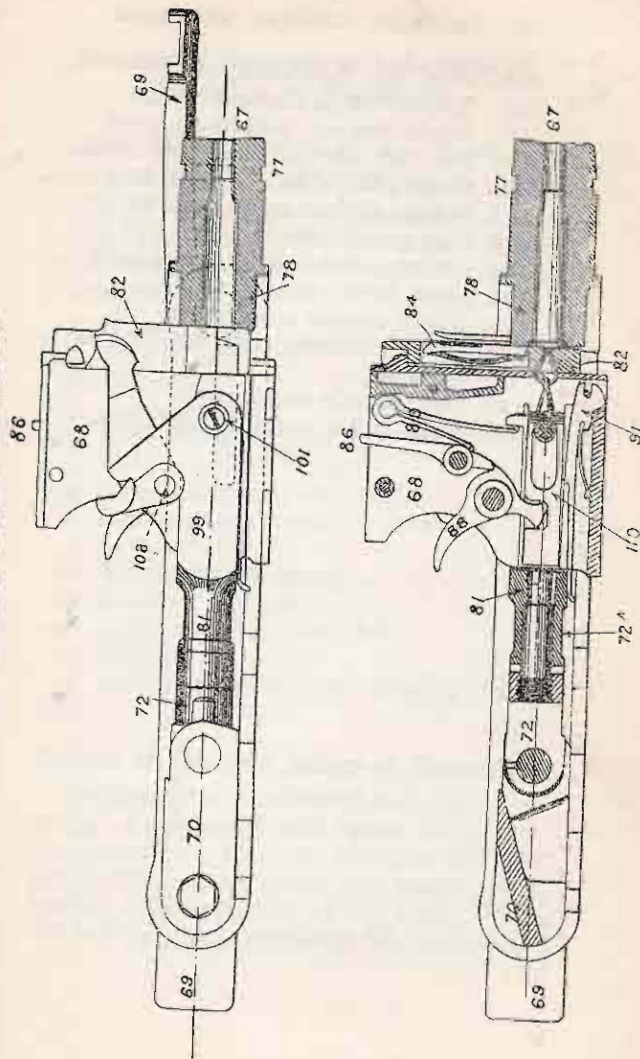


- 62. Thumbpiece, firing lever.
- 63. Ditto.
- 64. Pin, keeper, check lever.
- 65. Piston, check lever.  
Spring, " "
- 66. Recess in check lever for " 65."
- 67. Barrel.
- 68. Casing, lock.
- 69. Plate, side, right.
- 70. Crank.
- 71. Handle crank.
- 71a. Tail of crank handle.
- 71b. Knob of crank handle.
- 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.



- 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."

THE LOCK IN FIRING POSITION.



- 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.

**Summarised Sequence of Instruction in the Action of Mechanism.**

*(For detailed action of mechanism, see "Machine Gun Training.")*

Having thoroughly studied the detailed action of mechanism, the instructor will find it useful, for teaching purposes, to memorise it briefly as follows :

1. How to load.
2. How to fire.
3. Unloading.
4. Action on recoil.
5. First action in feed block.
6. Rotation of the crank.
7. Second action in feed block.
8. Backward movement of the lock.
9. Cocking action.
10. Action of fusee spring.
11. Rotation of crank.
12. Firing action for first shot.
13. Rapid fire.
14. Action inside lock on releasing thumb piece.

**Method of Teaching Action of Mechanism.**

The instructor is reminded of the Notes on p. 36. Particularly with regard to *frequent demonstration*. This is undoubtedly the greatest aid an instructor can employ when dealing with mechanism of any kind. When the look in a man's eye shows that he does not

understand, it is useless wasting more words for the moment. Simply demonstrate the particular motion several times until light dawns.

We would also remind the instructor of the words in the official Machine Gun book regarding the teaching of mechanism—viz., "That each stage must be thoroughly understood before proceeding to the next."

### 1. Loading.

Pass the tag end of the belt into the feed block from the right side. Now pause to explain the reasons for each of the motions as they are performed.

(a) Open the rear cover and show that the crank handle must first be pulled on to the roller, for three reasons—viz. :

1. To draw back the lock to allow a free passage for the first cartridge into the feed block.

2. To make the extractor fall so that it will grip the cartridge when the lock goes home.

3. To compress the lock spring.

(b) As you take hold of the belt, emphasise the necessity for pulling *straight* through the feed block as far as it will go.

(c) The crank handle is released to allow the lock to go forward and the extractor to grip the first cartridge in the belt.

(d) Explain that the motions must be repeated in order that the extractor may carry the round from the feed block to the chamber, and a second cartridge to be drawn into the feed block to be gripped as the extractor rises, so ensuring automatic feeding.

### 2. To Fire the Gun.

Explain briefly as you demonstrate :

(a) That on raising the safety catch and pressing the thumb piece the gun fires automatically.

(b) On releasing the thumb piece, the gun stops firing, with two live rounds on the face of the extractor.

NOTE.—The details of the above actions should not be explained at this stage.

### 3. Unloading.

(a) Open the rear cover and show what happens to the cartridge each time the crank handle is turned over.

(b) Explain why the bottom pawls must be depressed, before the belt can be withdrawn.

(c) Draw attention to the necessity of always releasing the lock spring after unloading.

### 4. Action on Recoil.

Remove the outer casing of the muzzle attachment, and disconnect the fusee spring

box from the studs, so that the box may be held open in the left hand, with the spring connected to the chain. Now cause one of the men under instruction to slowly push back the muzzle, to demonstrate the effect of the explosion upon the recoiling portions, particularly the first extension of the fusee spring.

#### 5. First Action in the Feed Block.

Remove the fusee spring box and see that the recoiling portions are fully home. Now direct attention to the slide of the feed block, and push back the muzzle. Next remove the feed block, or use the spare one, to show exactly what happened to the levers and top pawls, using a single cartridge. This point may be illustrated with a belt and dummy cartridges placed over the barrel casing, the first two fingers of the right hand being used to represent the top pawls.

#### 6. Rotation of the Crank.

Force home the recoiling portions. Turn the muzzle to the left, and direct attention to the tail of the crank handle bearing against the roller. Slowly push back the muzzle. This will clearly illustrate how the crank first obtains its rotary motion, and the lock is withdrawn. Now turn the gun round so that the fusee spring and chain can be observed, and (holding the box open with spring and chain attached) repeat the motion

of pushing back the muzzle to show how the rotation of the crank also winds the links of the chain round the fusee, and further extends the fusee spring.

#### 7. Second Action in the Feed Block.

Show how the continued rolling of the crank handle on the roller (assisted by the pressure of the fusee spring) forces the side plates forward and so moves the feed block slide to the left. This motion should be repeated with the feed block in and out of the gun, to bring out the action of the levers; the top and bottom pawls; the use of the cartridge guides; and the bullet and cartridge stops.

#### 8. Backward Movement of the Lock.

Open the rear cover and show:

(a) The horns of the extractor riding on the cams, thus keeping the extractor up until the cartridge is drawn clear of the belt.

(b) Explain how the live round is prevented from slipping down the face of the extractor.

(c) Partially close the cover and show the action of the ramps.

(d) Show how the lock is controlled during the backward movement.

#### 9. The Cocking Action.

Hold the brass lock in such a position that all under instruction can see the movements while explaining and demonstrating.

It is useful to repeat this action several times, then to ask questions while cocking the action with the lock in the gun.

Some men are very slow in picking up this part of the mechanism. But having once learned, such men, as a rule, never forget. Thus the patience and perseverance of the instructor is rewarded.

### 10. Action of the Fusee Spring.

Hold the fusee spring box partially open, and show how the tension on the fusee spring carries the crank and plates forward, and also rotates the crank.

### 11. Rotation of Crank.

(a) Replace the fusee spring box. Open the rear cover, and show how the rotation of the crank causes the lock to continue its forward movement, placing the live round in the chamber. Explain what becomes of the empty case.

(b) Show how the extractor is moved upwards by the side levers acting upon the extractor levers. (Use a spare lock to show this action.)

(c) Show with a spare lock and dummy cartridges, how the projections of the gib slide over the base of the cartridges in the chamber and feed block.

(d) Show how the side plate springs engage in the grooves on the outside of the extractor. Show this *without* dummy cartridges, to

emphasise that the side plate springs are only useful when there are no cartridges on the face of the extractor.

(e) Show how the steps on the side levers travel over the bents on the extractor levers as the lock is forced farther forward and the breech finally closed.

### 12. Firing Action for First Shot.

With a brass lock show how the crank, on passing below the horizontal, forces the tail of the sear downwards. Explain resulting action of the lock spring. Draw attention to the fact that now it is only necessary to release the nose of the trigger from the bent of the tumbler to fire the first shot. Illustrate this with the brass lock, pointing out the action of the lock spring. Repeat this action by pressing the thumb piece, bringing out the connections between the firing lever, pawl, trigger bar lever, trigger bar recess, and projection.

### 13. Rapid Fire.

Using the brass lock, explain that single shots are fired by means of the trigger, and rapid fire by means of the sear. Show also that it is the function of the sear to hold back the firing pin until the lock is in the firing position.

It is most important that every gunner should thoroughly understand this "timing" principle of the sear and firing pin, because

on taking into use a strange lock, the sear "timing" should be tested by the gunner immediately, and if necessary, adjusted.

#### 14. Action Inside the Lock on Releasing the Thumb Piece.

(a) Release pressure from the thumb piece. Explain that the trigger bar has now returned to its original position, and is therefore unable to engage the tail of the trigger as the lock moves forward.

(b) Show with a brass lock the action of the short arm of the lock spring, forcing the nose of the trigger under the bent of the tumbler.

(c) Demonstrate the action of the side lever head depressing the sear, and the bent of the tumbler immediately engaging the nose of the trigger, so stopping the gun from firing.

#### Repairs and Adjustments.

(See notes on "Instructional Stripping," page 44.)

**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 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.

**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.

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

**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 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.

(b) Force out the side lever split pin and axis brush.

(c) Remove side levers and extractor levers.

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



(d) Slide the extractor from the face of the lock casing.

(e) Release the lock spring and push out the trigger and tumbler axis pins.

(f) Remove trigger, tumbler, lock spring, firing pin and sear with spring.

(g) To strip the extractor, push out the gib spring cover and remove spring and gib.

## 20. To Assemble the lock.

(a) Insert the sear.

(b) Insert the firing pin with bent next to the sear.

(c) Replace the tumbler and axis pin.

(d) Replace the trigger and axis pin.

(e) Press back the firing pin and slide on extractor.

(f) Replace extractor levers.

(g) Replace side levers.

(h) Replace bush and split pin.

(i) Rest the lock on a bench (base downwards) and press down the side lever head and tumbler, at the same time holding back the tail of the trigger. This places the inside parts in correct position to receive the lock spring.

(k) Force in the lock spring, the long arm to be nearest the extractor.

## 21. 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 the bottom pawl spring and pawls.

## 22. 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.

## 23. Tangent sight and spring.

(a) Remove 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 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.

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

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.

#### Connecting rod.

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 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.

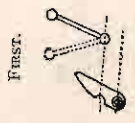
The disc is placed in the front end of the outer casing and is pressed home and held in position by the front cone. Six spare discs are supplied. When one gets badly eroded it is removed by unscrewing the front cone, on which the disc may be found firmly fixed, cutting the front bevel of the disc across 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.

*For notes on cleaning and points to be attended to before firing, etc., see p. 64.*

### VICKERS GUN. Stoppages.


For Notes on Method of Instruction in Stoppages see page 77.  
Immediate Action.

FIRST POSITION.

Position of Crank Handle.	Method of Preparation by the Instructor.	Immediate Action performed by the Gunner on the Order, "Gun Stops."
<p>First.</p> 	<p>(1) Perform half the loading motions. (2) Pull the crank handle slowly back until the horns of the extractor have engaged with the steps on the solid cams. (3) Pull the belt to the left front and let go the crank handle. (4) Tap the gun off the mark.</p>	<p>(1) Turn the crank handle on to the roller, pull the belt to the left front, and let go the crank handle. (2) Relay. (3) Open fire.</p> <p>If after firing failure recurs, tighten fusee spring by 3 "clicks."</p>


## Immediate Action—continued.

### SECOND POSITION.

<p style="text-align: center;">Position of Crank Handle.</p> <p style="text-align: center;">SECOND.</p> 	<p style="text-align: center;">Method of Preparation by the Instructor.</p> <p>(1) Simulating a damaged cartridge: in the belt and load. (b) Tap the gun off the mark.</p> <p>(2) Simulating a separation. (a) Perform half the loading motions. Open the rear cover, withdraw and lift up the lock. (b) Place the front portion of a separated case over the bullet of the cartridge on the extractor. (c) Replace the lock, close the rear cover, pull the belt, let the crank handle go slowly forward. (d) Tap the gun off the mark.</p> <p><i>Note.</i>—When it is desired to make the gunner use the clearing plug. Return the lock very slowly, and draw lock back to see that the neck of the case is left in the chamber.</p>	<p style="text-align: center;">Immediate Action performed by the Gunner on the order, "Gun Stops."</p> <p>(1) (a) (i) Force the crank handle to the rear; open the rear cover and examine the cartridge on the face of the extractor. (ii) 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. (iii) Relay. (iv) Open fire. (b) If the front portion of the separated case does not come out on the cartridge, clear the face of the extractor. (c) Replace the lock, keeping the crank handle on the roller. (d) 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. (iii) Relay. (iv) Open fire.</p>
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## Immediate Action—continued.

### THIRD POSITION.

<p style="text-align: center;">Position of Crank Handle.</p> <p style="text-align: center;">THIRD.</p> 	<p style="text-align: center;">Method of Preparation by the Instructor.</p> <p>(1) To simulate excessive friction: except the correct loading motions, the crank handle must be eased back gradually until it touches the check lever. (b) Tap gun off mark.</p> <p>(2) Slight cross feed: (a) 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 the crank handle go slowly home, then tap it down for firmness and close the cover. (b) Tap gun off mark.</p> <p>(3) Simulating bad fault in feed: (a) Pull out the fourth cartridge in the belt about half inch. (b) Perform half the loading motions.</p>	<p style="text-align: center;">Immediate Action performed by the Gunner on the order, "Gun Stops."</p> <p>(1) 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.</p> <p>(2) Relay and open fire. If (1) fails examine feed block slide; if jammed No. 1 pulls the crank handle on to the roller, No. 2 opens the front cover and, by the assistance of No. 1 raises the feed block sufficiently to allow the receding portions to go home. He releases the top portions pawls from the belt, which he withdraws until the top cartridge is clear of the feed block, and rectifies the belt or cartridges if</p> <p><i>Note.</i>—In order to do this, it may sometimes be necessary for No. 2 to open the front cover and force down the handle of the extractor.</p>
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## Immediate Action—continued.

### Third Position—continued.

Position of Crank Handle.	Method of Preparation by the Instructor.	Immediate action performed by the Gunner on the order "Gun Stops."
Position of Crank Handle.	<p>(c) Pull the crank handle slowly back until the horns of the extractor have engaged with the steps on the solid cams.</p> <p>(d) Draw the recoiling portions to the rear by forcing the knob of the crank handle forward, and tail to the rear at the same time pulling the belt to the left.</p> <p>(e) Allow the recoiling portions to go forward. Bring the crank handle on to the roller and let go.</p> <p>(f) Tap gun off mark.</p> <p>(g) Stimulating damaged cartridge grooves, etc.:</p> <p>(a) Damage the rim of the second dummy cartridge in the belt.</p> <p>(b) Proceed to load.</p> <p>(c) Tap gun off mark.</p> <p>Note.—As damage to the extractor has to be simulated by damaging a cartridge rim, this cartridge must be removed before reloading.</p>	<p>Relays. 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.</p> <p>Relays. Opens fire.</p> <p>(2) (b) (i) If the slide is free, No. 2 opens the front cover and forces the extractor down, while, <i>at the same time</i>, No. 2 pulls the crank handle on to the roller. No. 1 lifts up, clears, changes the lock, No. 2 removes the cartridge in position in the feed block, and No. 1 reloads.</p> <p>Relays. Opens fire.</p>



## Immediate Action—continued.

### Fourth Position.

Position of Crank Handle.	Method of Preparation by the Instructor.	Immediate Action performed by the Gunner on the order, "Gun Stops."
Fourth. 	<p>(1) To simulate a miss fire:</p> <p>(a) Load and press the thumb piece.</p> <p>(b) Tap gun off mark.</p> <p>(2) To simulate a broken firing pin: call out, "Gun will not fire," as soon as the gunner completes his first "Immediate action."</p>	<p>Relays. Opens fire.</p> <p>(2) (b) (i) Turn the crank handle on to the roller, pull the belt to the left front and let go the crank handle.</p> <p>(2) Relay.</p> <p>(3) Open fire.</p> <p>If gun fails to fire, place crank handle on to the roller twice, change the lock and reload.</p> <p>Relay. Open fire.</p>



## STOPPAGES.

### VICKERS LIGHT MACHINE GUN.

Position of crank handle and its indication.	Immediate Action.	Probable Cause.	Prevention of Recurrences.	Method of preparation for Instructional Purposes.
<p><b>I.</b> Indication. The lock is unable to go back far enough to allow the extractor to drop.</p> 	<p>(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 springs by 3 "clicks."</p>	<p>The extractor has not dropped. This may be due to: (a) Excessive friction, due to want of oil, grit, or light packing in the belt, or excessive packing in the cam-belt or packing gland. (b) Too heavy fusee spring. (c) Partial loss of the force of the explosion due to: (i) Worn barrel. (ii) Defective ammunition.</p>	<p>(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 cam-belt or packing gland. (c) The barrel should be examined at the first opportunity, and, if much worn in the lead, should be changed.</p>	<p>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.</p>
<p><b>II.</b> Indication. The lock is unable to go fully home after recoil.</p> 	<p>(f) Force the crank handle to the rear; open the 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 ex-</p>	<p>(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</p>	<p>(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</p>	<p>(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</p>

<p>tractor 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 forward, allowing the lock to firm pressure on the crank handle, give the clearing plug a rocking motion; withdraw the lock; let back the handle of the clearing plug and withdraw it and reload. (iii) Strike the crank handle on to check lever by a glancing blow with the palm of the hand.</p>	<p>from going into the chamber, lengthened.</p>	<p>(i) Clean and oil working parts. (ii) Carefully examine the belt.</p>	<p>portion of a separated case over the bullet 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: Place 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.</p>	<p>(a) 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. (b) Perform half the loading motions. Pull the crank handle on to the roller. Open the rear cover; pull a cartridge that way into position; the feed block and hold it there. Let go the crank handle and close the cover. For Range purposes: Bend a long brass strip.</p>
<p><b>III.</b> 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.</p>	<p>(i) 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.</p>	<p>(i) A cartridge is fed up slightly crossways or a long brass strip is bent.</p>	<p>(a) If a succession of separated cases occurs the connecting rod must be</p>	<p>(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 that way into position; the feed block and hold it there. Let go the crank handle and close the cover. For Range purposes: Bend a long brass strip.</p>

STOPPAGES—VICKERS' LIGHT MACHINE GUN—continued

Position of crank handle and its indication.	Immediate Action.	Probable Cause.	Prevention of Recurrence.	Method of preparation for Instructional Purposes.
<p>III.</p> 	<p>(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 looks the front cover, pulls the belt to the left front and releases the crank handle.</p>	<p>(iii) (a) Badly fitted 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.</p>	<p>(iii) (a) Carefully examine belt seeing that the cartridges are pushed well home.</p>	<p>(iii) (a) Pull out the fourth cartridge in the belt about <math>\frac{1}{2}</math> 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 cauls. Draw the recoiling portions to the rear by forcing the knob of the crank handle forward, and fail 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.</p> <p>For Range purposes: Fill a belt badly.</p>
<p>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.</p>		<p>(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.</p> <p>Note.—The effect of a fault in the 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</p>		<p>(iii) (b) For Range purposes: Place the belt box at an angle to the feed block.</p>
	<p>(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, No. 2 removes the cartridge in position in the feed block, and No. 1 reloads.</p>	<p>(iv) (a) Damaged cartridge grooves. (b) Broken pin. (c) Broken gib spring.</p> <p>In these cases the cartridge is prevented from passing freely down the face of the extractor.</p> <p>(d) Thick-rimmed cartridge.</p>		<p>(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 three dummy cartridges in the belt.</p>
<p>IV.</p> 	<p>(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.</p>	<p>(v) (a) Defective ammunition. (ii) No cartridge in the chamber.</p> <p>(i) Broken or damaged firing pin. (ii) Broken lock spring.</p>		<p>(v) (a) Defective ammunition. (ii) No cartridge in the chamber.</p> <p>(i) Broken or damaged firing pin. (ii) Broken lock spring.</p>

**Allocation of Duties.***(Vickers and Maxim.)*

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 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. 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 temporarily 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 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.

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 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.

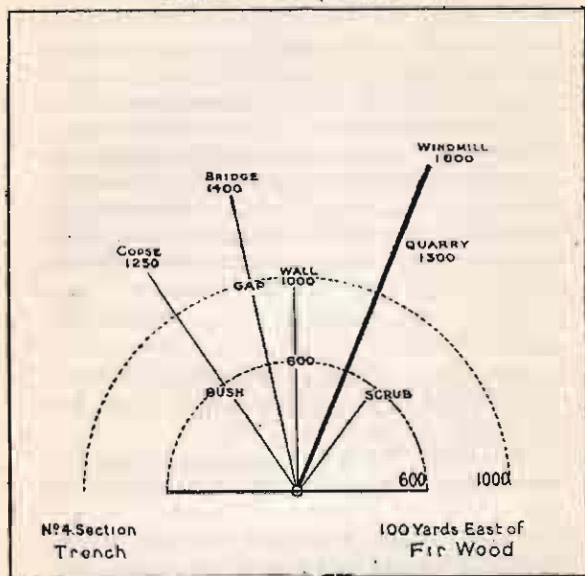
No. 5—Acts as scout. As ordered by the section officer.

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 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.

## RANGE CARD (DEFENCE).



*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 must be capable of :

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

A knowledge of mining is also of great value to machine gunners.

**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 a few 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.

The same method should be followed when filling metal belts, the neck of the cartridge case being pressed home against the front clips.

### 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.

*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 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

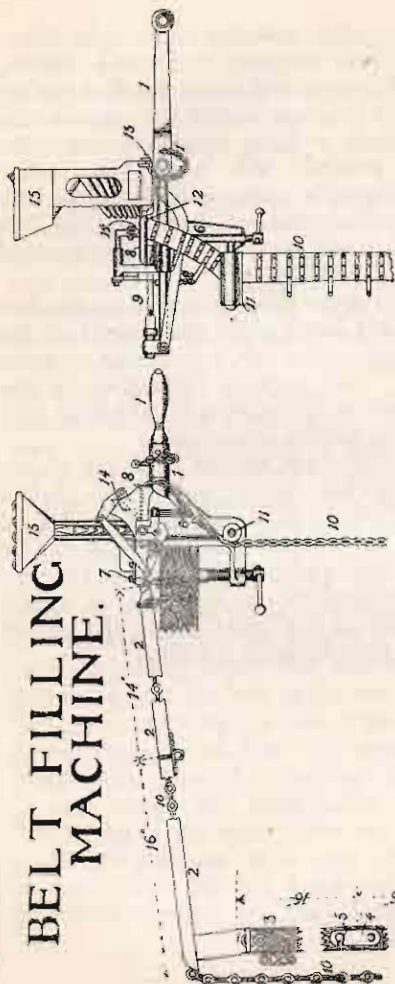
the hopper with cartridges, and replenish as required. On revolving the crank handle, the pocket opener will enter the first pocket and open it; on continuing the motion, the pocket opener will be withdrawn, and the cartridge plunger will push the lowest cartridge from the column of cartridges into the 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.

# BELT FILLING MACHINE.



1. Removable Crank Handle with Fixing Pin and Chain.
2. Hinged Loading Tray
3. Hinged Leg.
4. Keeper Plate.

5. Pin, Catch.
6. Red Plate.
7. Pin, Joint, Bracket.
8. Plate, Guide.
9. Pocket Opener

10. Belt.
11. Belt Roller
12. Belt Guide.
13. Cartridge Plunges.
14. Pawl.
15. Hopper.

## 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 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.)

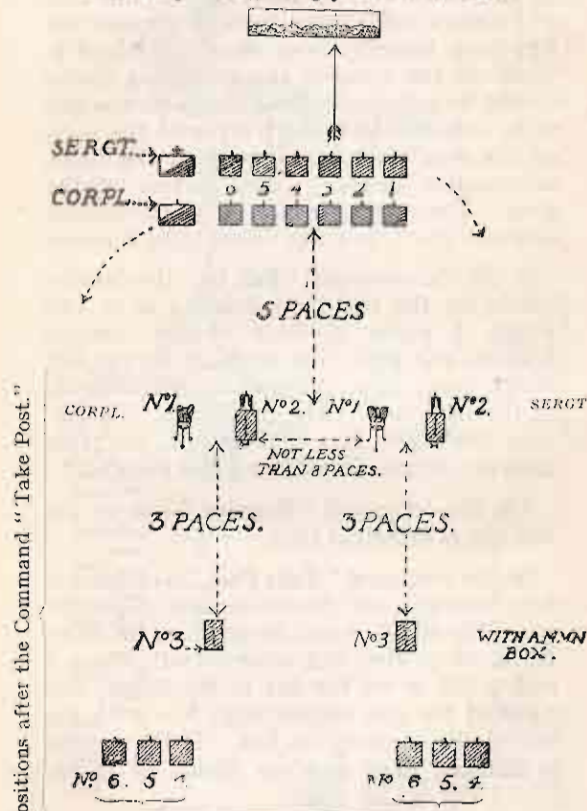
On the command "**Number,**" the section will act as in Squad Drill.

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



Positions after the Command "Take Post."

Nos. 1, 2, and 3 at once examine the tripod, gun, and ammunition belt respectively. Nos. 2 and 3 reporting when correct to No. 1.

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

Posted according to orders of Section Officer.



## 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 gun 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.

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 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.

When the instructor criticises the mounting of a gun on the Mark IV. Tripod, his criticism should follow a definite sequence so that no point is overlooked. For example:

## (a) Tripod.

- Legs.
- Clamps.
- Socket.
- Pins.
- Elevating gear.

## (b) Gun.

- Direction of muzzle.
- Cork plug.
- Shutter.
- Approximately level.

(c) *Box.*

Up and in line.

(d) *No. 2.*

No undue exposure.

Reasonable position.

(e) *No. 1.*

Correct holding.

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 practise 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. When laying, the aiming eye should be about six inches behind the rear cross piece. 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.

### Horizontal Traversing.

6. Frequent instruction will be given in Traversing Fire. 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

Plate X.  
NORMAL POSITION WHEN BATTLE SIGHT IS NOT IN USE.



Note the method of "holing" with both elbows supported. This position should be regarded as the normal one, and should be used until men are thoroughly experienced in firing.

experience the exact degree of clamping he requires, and, before 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 184.

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.

### Diagonal 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 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.

#### Swinging Traversing.

The method is employed against dense targets at close range.

It in no way replaces the method of traversing by automatic tapping.

The Swinging Traverse is taught by teaching a man to traverse a machine gun instructional target evenly and smoothly in about 6 seconds.

The importance of the socket being perfectly upright should be emphasised.

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 and cross head joint pins, No. 2 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.

9. On the commands "**Range—Aiming Mark—Action,**" the gun will be mounted, loaded, and laid as described in the previous paragraphs, No. 2 raising his hand to indicate when the gun is ready for firing.

On the command, or signal—"**Out of Action**"—the gun is at once unloaded and drawn back, by means of the rear leg, under

cover, or to the original position, then dismounted in the usual way.

The practice of getting up to carry back the gun, etc., should be checked.

10. 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 150-151.

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

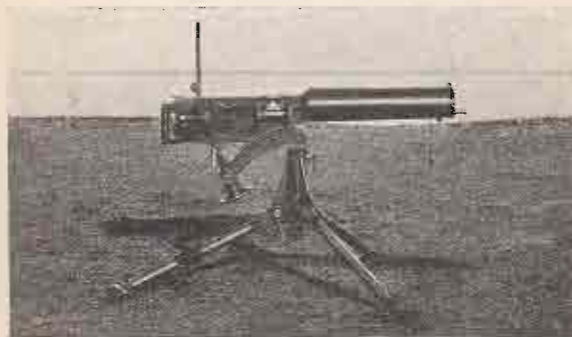
#### Plate XI.

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. Socket upright.
4. Joint pins home and turned down.
5. Screws of elevating gear about equal.
6. Cork plug removed.

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. Socket 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.

Section Drill Briefly Summarized.

Words of Command.	Duties, etc.
"Fall in."	} See Plate VIII. No. 1 Looks to screws of elevating gear, etc. No. 2, gun. No. 3, belt.
"Number."	
"Take Post."	
<i>No. 2 Repeats all Orders.</i>	
"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.
<i>For Traversing Fire.</i>	
From—Figure	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. 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.
To—Figure	
"At" (Range).	
"Traversing Fire."	
"Unload."	No. 2. Withdraws and repacks belt in box. 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.
"Dismount Gun."	Gun mounted, loaded, and laid on aiming mark, but not fired. Gun unloaded and drawn back under cover—then dismounted.
Range Target.	
"Action."	
"Out of Action."	

reversed, and when completed, detachments fall in and take up arms by word of command.

### 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:

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.

### EXAMPLES OF FIRE ORDERS FOR MACHINE GUNS.

#### I. NORMAL FIRE ORDER

*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

M.G.C.C.

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

When "Differences" "by Sections" are required.

Then the Fire Order may be as follows:

M.G.C.C.

(a) *By Sections or Sub-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:

M.G.C.C.

*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.*—

**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.*

- (a) Socket to be upright.
- (b) All clamps tight.
- (c) Pins home and turned down.
- (d) Both elevating screws exposed the same distance.
- (e) Gun pointing to the front.
- (f) Cork Plug withdrawn.
- (g) Nos. 1 and 2, and an ammunition box, to be in position.
- (h) 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.

*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.*

(a) Tangent sight lowered, but without moving the slide.

(b) Unloading motions to be quite distinct, without slurring.

(c) Belt withdrawn, repacked correctly in the box with lid closed and fastened.

(d) 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 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 "Action" 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. 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 re-laying; tapping backwards to obtain accu-

racy 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 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. 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 re-laid 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.

## 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. 169.
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. 172.
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.	Correct remedy applied and gun re-laid after remedy.
X.	Belt Filling.	3 sec. 1 min. 12 min.	25 rounds* 250 rounds.* *Placed in a heap— Pass thorough inspection when filled.

**COVER AND ENTRENCHMENTS.**

For Plates and dimensions of M.G. Emplacements see "Machine Gun Training."

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.

## 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.**

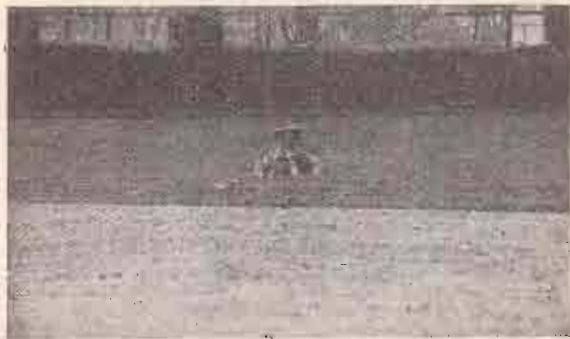
1. The firer has adopted a position most suitable to the ground; and one that enables him to rest both elbows.

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.

GUN FIRING FROM BEHIND SLIGHT  
UNDULATION.

FIG. 1. FRONT VIEW.



*W. H. Jacob, Photo Hythe.*

FIG. 2. SIDE VIEW.



*W. H. Jacob, Photo, Hythe.*

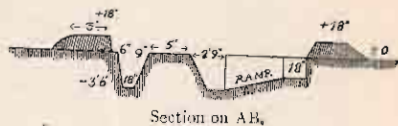
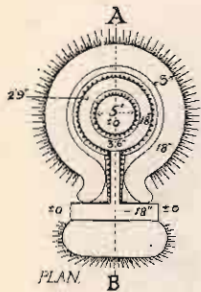
Fig. 2 shows position of gun and Nos. 1 and 2:  
The fence beyond the gun shows the slope of undulation.

Plate XV.  
FIRING ON LEVEL GROUND. TRIPOD IN LOWEST POSITION.

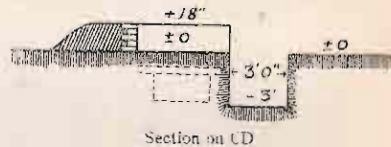
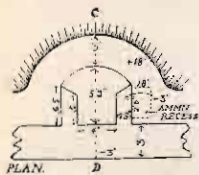


*W. H. Jacob, Photo, Hythe.*  
No. 1 is less strained and can "hold" the gun better than when lying on his chest.  
The back of No. 1 may be supported by No. 2 turning on his right side and drawing up his knees.

CIRCULAR MACHINE GUN PIT.



MACHINE GUN RECESS IN TRENCH.



HASTY MACHINE GUN PIT.

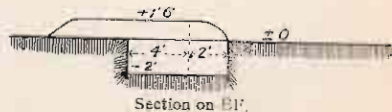


Plate XVI. FIRING OVER CONTIGUOUS COVER: LOW WALL, TREE TRUNK, ETC.



W. H. Jacob, Photo Historic.

## 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 condensers is liable to give the position away.

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	<i>To teach the importance of the correct holding required for the gun.</i> During this practice the instructor should watch the fire so as to be able to criticize his method of holding and pressing the double button.
2	Single shot Traversing	10	<i>To teach accurate laying and automatic tapping.</i> 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	2% (10 to each group)	<i>To teach correct laying and holding.</i> 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.

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4	Vertical Sighting	20	
5	Traversing (omitted)	50	
6	Swinging Traverse	30	
Repetition		20	
Total rounds per man		110	

*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 marks. *Each shot should be approximately 2 inches vertically above the last.* Then traverse eight 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.

Having learned to know the holding required for the gun in Practices 1 and 3, and Practice 2 having afforded practice in automatic tapping, *the instruction is now given in practical traversing by groups of 5-6 rounds.* The instructor should not be divided in groups of 5 rounds in the belt; the ampler 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.

See Notes, Part I.

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TABLE "C." Part II.—Classification Practices, 9, 10, only.

No.	Nature of Practice	Target Screen (covered with brown paper)	Range (Yds.)	Rounds	Time (secs.)	Remarks
7	Ranging	3' high 10' wide	400	20	—	In these practices each man has an opportunity of sighting his gun on the open range before bringing the classification practices. Use the 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 faintest 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 aim shows the sighting required to hit the target.
8	(omitted)					
9	Application		400	30	30	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.
10	Traversing	3' high 20' wide	400	60	50	
11	(omitted)					
12						
13	Observation	3' high 10' wide	400	50	1	Gun to be traversed from left to right under the same conditions as in Practice 10. 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 fixed 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 from the semaphore signal he would mark and then be 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 round completed the practice, the section officer will criticize the results of the observation as regards methods followed by firer and observers.

Range known approximately. Nos. 1, 2 and 3 will fall in with the aim, 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 target. The section officer will mark the first and subsequent fire positions, and, on his signal, the gun, etc. will be carried toward a steady double, and fire opened without further delay. 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 such position until a hit is obtained. Shots 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 the gun, and to exemplify the principle of maintaining fire until effect is obtained. It is often desirable to time the practice on 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 firing 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.

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
	<hr/>
	110
	<hr/>

## 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
		<hr/>
Total . . . . .		170

\* Classification practices.

	Rounds allotted.
Part I. . . . .	110
Part II. . . . .	170
	<hr/>
Surplus for repetition of indifferent shots, to be pooled and used at the discretion of the Commanding Officer . . . . .	20
	<hr/>
Grand total . . . . .	300
	<hr/>



## 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-foot 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.

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 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.

## 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.

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

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.

\* Omitted from General Machine Gun Course.

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.

## ADVANCED DRILL

1. The Company 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.

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 re-adjustment.
- (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:

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.

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.



## 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.

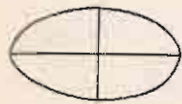
(2) The close grouping of fire causes a very restricted area of ground to be beaten; this is less than half the area beaten by rifle fire

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:

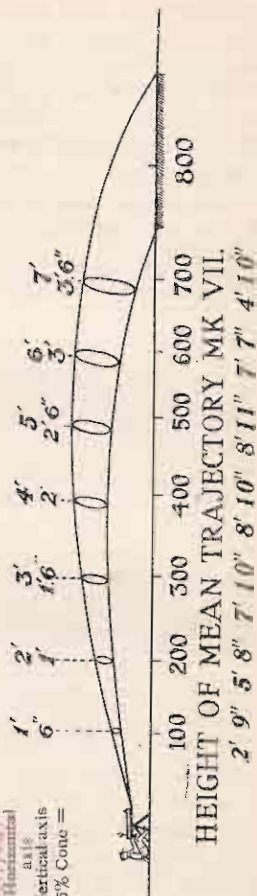
Range (Yds)	Vertical diameter of:				The height of the centre of the cone above the ground at each range is slightly more than the height given for the rifle in M.K. Pt. I; this is owing to the inclination of the line of sight due to the muzzle of the gun being 20 inches above the ground.
	75% Cone.		100% Cone.		
	Mark VI.	Mark VII.	Mark VI.	Mark VII.	
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"	36' 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.

ILLUSTRATING THE VERTICAL AND  
HORIZONTAL DIAMETER OF THE  
CONE.

Horizontal  
axis  
Vertical axis  
75% Cone =



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

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 closely to 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.

#### 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:

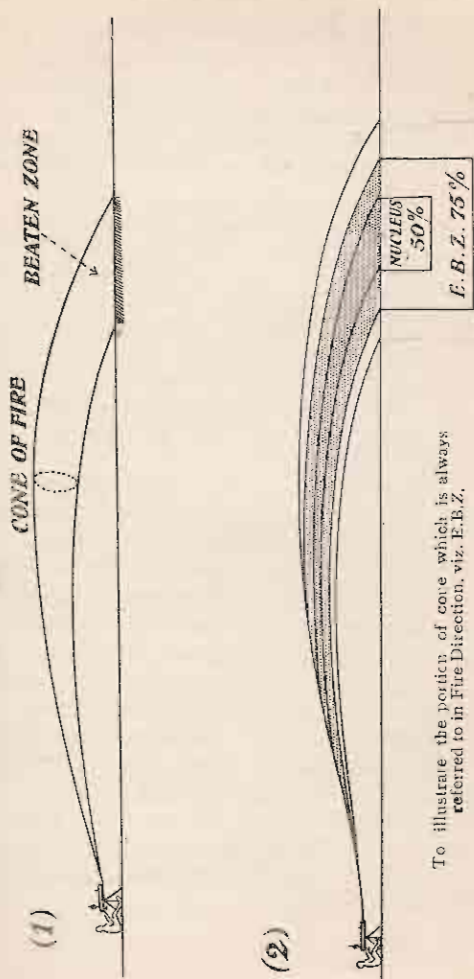
	1,000 Yards.		1,400 Yards.	
	Vertical	Horizontal	Vertical	Horizontal
75% ...	10' 0"	5' 0"	15' 0"	10' 0"
100% ...	25' 0"	15' 0"	40' 0"	30' 0"

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 0	6 11	8 6
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.	German.
	ft. ins.	ft. ins.
At 100 yards ... ..	2 9	2 3
" 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

ILLUSTRATING CONES OF FIRE.



To illustrate the position of cone which is always referred to in Fire Direction, viz. E.B.Z.

**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

ranging 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, i.e. :—**

- (1) Judging the effect of atmosphere on the elevation required.
- (2) Judging the effect of wind on the flight of the bullet.

These may be briefly tabulated as follows :

Barometer : Pressure of Air.

Thermometer : Density of Air.

Wind : Front and Rear.

Light : Difficulty or ease in focusing on "Dull or bright day."

It will be noted that these influences affect the bullet in a vertical sense, and for simplicity may be again tabulated as follows:—

**ERROR OF THE DAY.**

## ELEVATION TABLE.

<u>More.</u>	<u>Less.</u>
Dry.	Wet.
Cold.	Hot.
Head Wind.	Rear Wind.
Bright.	Dull.

Allowances necessary:—

Ranges.	Influences.	Allowances.
Below 1,000 yards.	For 1 Influence. .. 2 or more, acting together.	Nil. 50 yards.
Between 1,000 and 1,500 yds.	For 1 Influence. .. 2 or more.	50 yards. 100 ..
Beyond 1,500 yds.	For 1 Influence. .. 2 or more.	100 yards. 150 ..

So far we have dealt only with those weather conditions which affect the bullet in a vertical sense. We will now consider how the bullet may be affected in a *horizontal* manner.

**FOR SIDE WINDS.**

The Wind Table given in Para. 638 M.R. should be thoroughly learned by all Section Officers.

This is necessary so that commanders may estimate the strength of the wind blowing, and convert it to some measurement which can be understood by the gunners.

The Wind Table referred to is as follows:—

**WIND TABLE.**

	Mild.	Fresh.	Strong.
	10 M.P.H.	20 M.P.H.	30 M.P.H.
For Right Angle winds allow—			
At 500	2	4	6 feet.
At 1,000	3	6	9 yards.
At 1,500	6	12	18 yards.
At 2,000	12	24	36 yards.
At 2,500	24	48	72 yards.

For oblique winds allow half the above.

When issuing deflection orders for narrow-fronted targets, an auxiliary aiming mark should be given when possible. To order the gunner to aim off in target widths is the next best method. Orders to aim off in feet or yards should be avoided.

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 diagrams opposite that if we make an error in ranging which is greater than half the depth of the effective zone, the target will 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 930 yards, the furthest shots of the effective zone (with Mark VII ammunition) will theoretically just strike the target (Diagram B). If the range were estimated at 1,070 yards, the nearest shots of the cone would strike just short of the target (Diagram C).

It is clear, therefore, that the permissible error for ranges of and beyond 1,000 yards with Mark VII ammunition is as follows:

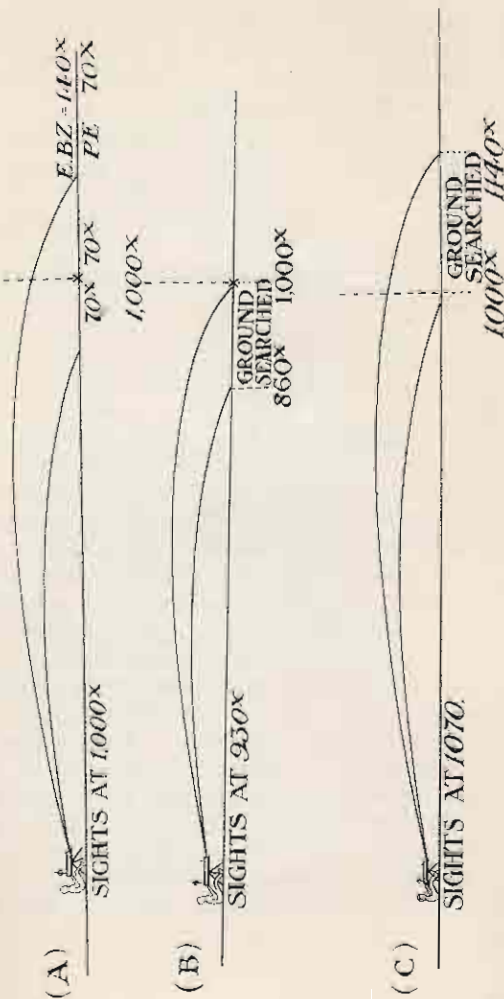
1,000 yards	70 yards.
1,200 "	56 "
1,500 "	35 "

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:

- Direct ranging with Range Finding instruments, 5%.
- Judging distance by eye, 15%.
- 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 ILLUSTRATE PERMISSIBLE ERROR IN RANGING.



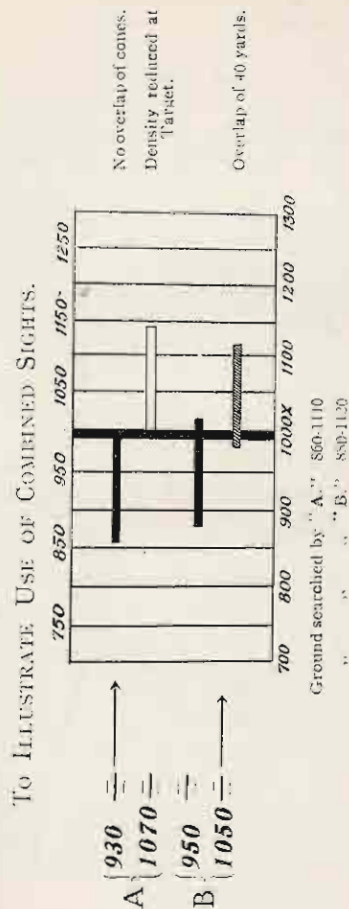
to be 1,000 yards, the probable error will be, with: (a) 50 yards; (b) 150 yards; (c) 100 yards; and in each case it may be either over or under the estimated range.

Considering both the permissible and the probable error together, it is seen that in practically all cases it is necessary considerably to increase the depth of the effective zone to ensure fire effect.

To effect this, the following methods can be adopted:

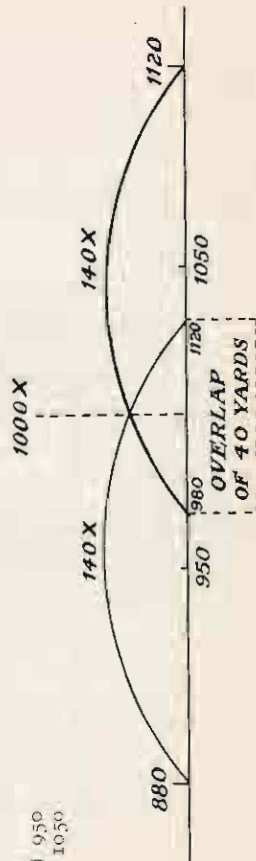
- (a) Combined sights.
- (b) Bracketing.
- (c) Vertical searching.

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 VII ammunition, one gun fires with elevation 930, and the other with 1,070, the cones will theoretically just join at the 1,000 yards point (see diagram). The density of the fire will be very much less, however, between



## ILLUSTRATING GROUND SEARCHED BY TWO GUNS USING COMBINED SIGHTS.

Sighting used—

(a) 930  
1070(b) 950  
1050

990 and 1,010 yards than at 930 and 1,070, 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 100 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 1,200 yards when four guns are available and 50 yards' difference used:

$$(4-1) \times 50 + 112 = 262 \text{ yards.}$$

Another method is to divide the ground to be searched by the differences in elevation allowed. For example:—

If 300 yards of ground is to be searched at 1,000 yards range, where the differences of sighting should not exceed 100 yards, we should divide 300 by 100. This gives 3 as the number of guns to be used.

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.

When a belt of ammunition is fired, the depth of ground searched by the 75 per cent. cone 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 in the effective zone. Therefore with Mark VII ammunition, combined sights should not be used within 800 yards.

The Table on page 232 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 table on p. 232, 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.

Illustrating the point that 100 yards differences will give overlap of cones up to 1,200 yards only.

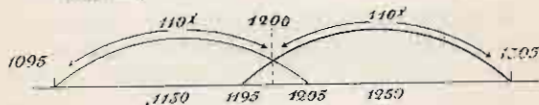
Range 1200—10% Error =  $\pm 120^*$

Ground to be searched  $\frac{1320}{1080}$

Two guns only available.

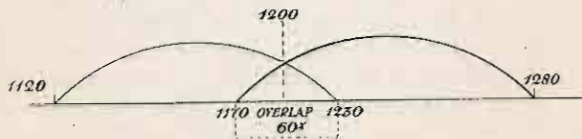
Sighting elevation ordered 1150—100 yards difference.

Result—(i)



Range 1200—5% Error. Sighting elevations ordered, 1175—50 yards differences.

(ii)



Range 1500—10% error. Target may be between 1350 and 1650  
If 1450 and 1550 is ordered, result may be as follows:—



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.

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.

TABLE SHOWING THE EFFECT OF COMBINED SIGHTS, AND ILLUSTRATING THE SAVING OF FIRE POWER AS ACCURACY IN RANGING INCREASES.

Using Combined Sights.						
Range in Yards.	Depth of Effective Zone in yards.	Mark of Ammunition.	Error in Ranging.	Consequent Depth to be searched in yards.	Minimum Number of Guns Required.	Distance over which Cones Overlap.
1,000	140	VII	5%	100	2	40
			10%	200	*2	50
	70	VI	15%	300	3	40
			5%	100	2	50
1,200	112	VII	10%	200	4	20
			5%	100	2	50
	66	VI	15%	300	4	Space between cones.
			5%	120	†2	116
1,500	70	VII	5%	130	3	16
			10%	300	†	220
	60	VI	15%	450	6	Space between cones.
			5%	150	3	170
			10%	300	3	20
			15%	450	8	
			5%	150	3	
			15%	300	6	
			5%	450	8	

\* 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.

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.

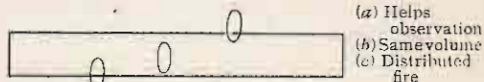
Combined sights should be discontinued when the cone of fire of any one gun can be accurately observed, one sighting elevation being given to all guns according to observation.

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

TO ILLUSTRATE QUESTION OF DIFFERENT POINTS OF AIM ON LINEAR TARGETS.

(iv)



Sighting ordered  
800 = 100 x diff.  
Changes of elevation,  
left gun up  
400

|||    |||    |||    |||  
800   900   1,000   1,100

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 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 50<sup>s</sup>. 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, or aim may be taken at any suitable mark in the area of ground to be searched. 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.

In cases where the ground rises at a fairly steep angle. In such cases the cones would not reach the further limit unless an extra 100 or 200 yards is added to the range of the further limit.

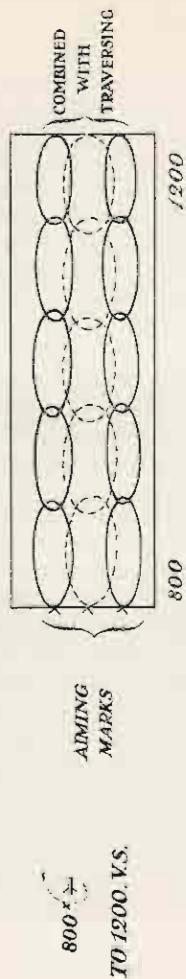
(a) VERTICAL SEARCHING. AT COMMENCEMENT OF PRACTICE.



(b) VERTICAL SEARCHING. ON REACHING FURTHER LIMIT.



## VERTICAL SEARCHING. ENGAGING A TARGET IN ENFLADE.



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 skillful 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.

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.

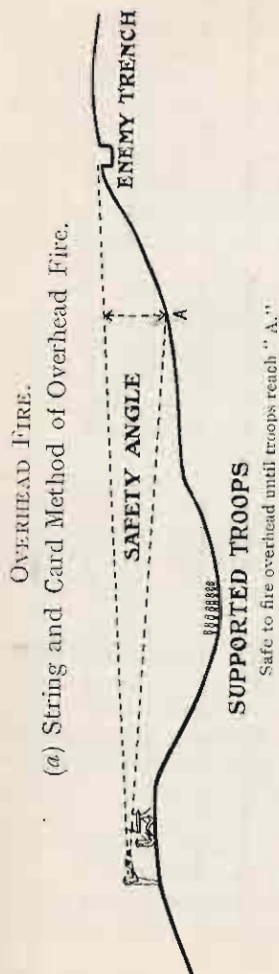
These angles allow for a large margin of safety at the shorter, and a sufficient margin at the longer, ranges.

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.

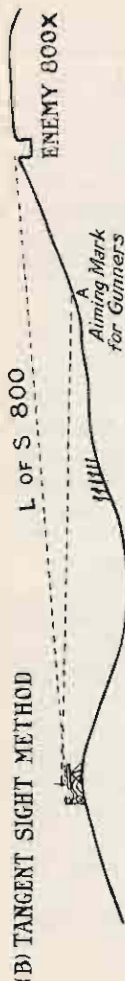
(b) By the card and string method. Attach a piece of string of any convenient length—but the longer the better and not less than 24 inches—to a card.



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, 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.

#### TANGENT SIGHT METHOD.

The gun is first laid on the target with sights adjusted for correct distance. Then raise the slide, *without touching the elevating wheel*, according to the following rules:—

- (i) If range is under 900 yards raise slide 400.
- (ii) If range is 900 yards or over raise slide 250 (see diagram).

This method has its advantages and disadvantages. In one sense it is against the principles of machine gun training that the gunner should constantly look along the sights while firing. But the advantages far outweigh the disadvantages. Having marked down carefully the spot on which the sights are now aligned for the purpose of relaying, the gunner is trained to take the heads of the advancing infantry as his aiming mark, once they come into his line of sight. As the advance continues his aim is kept on their heads by turning the elevating wheel. By this means covering fire is maintained until the friendly troops reach the enemy's position. The cones of fire pass over the heads of friendly troops with a uniform margin of safety at each advance, and search ground in rear of the defended position possibly occupied by supports and reserves.

Purely as a matter of interest, and also to show that a liberal margin of safety is allowed in the angles of 30 and 60 minutes referred to, the following explanation is given, showing how the angles are obtained.

#### How the Safety Angles for Overhead Fire are Obtained.

- (1) The factors which must be considered, and a suitable allowance made for each, viz.:
  - t. Vertical dispersion of lower half of 100 per cent. cone at each range.

2. The probable errors to be expected in ranging.

3. Other factors such as bad laying, incorrect holding, etc.

*The vertical dispersion of the lower half of the 100 per cent. cone is as follows:—*

At 500 yards	...	...	5' 5"
At 800 yards	...	...	8' 8"
At 1,000 yards	...	...	12' 6"
At 1,500 yards	...	...	20' 0"

This vertical dispersion expressed in angles by means of formula

$$D \text{ (Degrees)} = \frac{V.I. \text{ (Vertical dispersion in feet)} \times 19.1}{H.E. \text{ (distance from gun to target in yds.)}}$$

is as follows:—

At 500 yards	...	...	12' 5"
At 800 yards	...	...	12' 42"
At 1,000 yards	...	...	14' 33"
At 1,500 yards	...	...	15' 28"

*The probable errors to be expected in ranging may be taken as follows:—*

Using accurate rangefinder and efficient rangetaker	...	...	5 per cent.
<i>Allowance for remaining factors,</i>			
bad holding, etc., etc....	...	...	10 per cent.

Total percentage of range ... 15 per cent.

This 15 per cent. at 500 yards range is 75 yards.

This 15 per cent. at 800 yards range is 120 yards.

This 15 per cent. at 1,000 yards range is 150 yards.

This 15 per cent. at 1,500 yards range is 225 yards.

In other words the lowest bullet of the 100 per cent. cone may strike as follows:—

Firing at 500 yards, bullet may strike at 425 yards.

Firing at 800 yards, bullet may strike at 680 yards.

Firing at 1,000 yards, bullet may strike at 850 yards.

Firing at 1,500 yards, bullet may strike at 1,275 yards.

This 15 per cent. error expressed in angles will be the difference between the angles of tangent elevation for the ammunition in use.

Thus with Mark VII ammunition:—

500 yards tangent elevation	...	27' 0"
425 yards tangent elevation	...	23' 75"
Difference	...	3' 25"
800 yards tangent elevation	...	46' 0"
680 yards tangent elevation	...	38' 0"
Difference	...	8' 0"
1,000 yards tangent elevation	...	63' 5"
850 yards tangent elevation	...	50' 0"
Difference	...	13' 5"
1,500 yards tangent elevation	...	135' 0"
1,275 yards tangent elevation	...	100' 0"
Difference	...	35' 0"

If we now add the vertical dispersion of the lower half of the 100 per cent. cone expressed in angles, to the error 15 per cent. also expressed in angles, it will give the safety angle for each of these ranges.

500 yards	12.5	plus	3.25'	...	15.30'
800 yards	12.42	plus	8.0'	...	20.42'
1,000 yards	14.33	plus	13.5'	...	27.38'
1,500 yards	15.28	plus	35.0'	...	50.28'

From the foregoing it will be seen that there is a different safety angle for each range. As it would unnecessarily complicate our card, and possibly lead to the wrong lines being used, we only use two angles, taking the angles at 1,000 and 1,500 yards, and calling them 30' and 60' respectively.

#### 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.

Any of the following methods may be selected in accordance with a particular situation:—

(a) By the use of aiming posts and quadrant elevation. This method is slow and is only applicable when time is available, perhaps sometimes in defence. It is valuable for training purposes as exemplifying the principles underlying all methods of indirect fire.

(b) Map and Compass.

(c) Graticules.

*Method (a).*—The procedure to obtain direction will be as follows:—

The gun position, having been approxi-

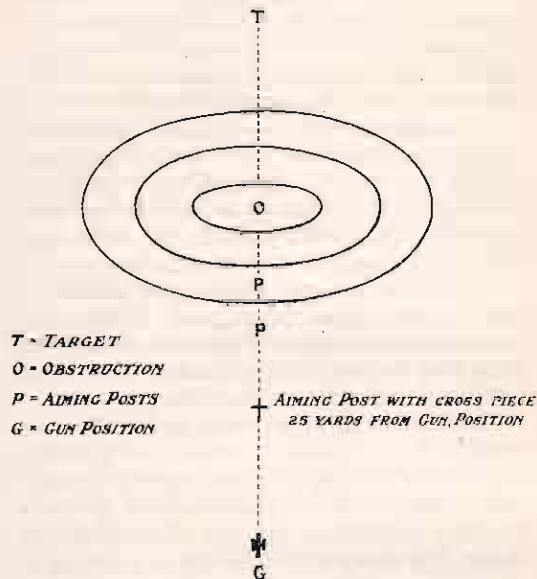
mately selected, Nos. 4 and 5 advance with three aiming posts until the target is visible. Two aiming posts are then planted about 25 yards apart in such a manner that the prolongation of a line joining the posts would coincide with the line of fire required. If these two posts are not visible to the firer, a third is planted in an accurate alignment with the first two, and the furthest is then withdrawn, and, if necessary, is used to continue the alignment towards the gun position. This is continued as necessary until two posts are visible to the firer.

If sufficiently high ground is available in rear of the gun position to allow of both the target and gun position being seen, the aiming posts can be placed in alignment by a gun number dressing them from this position.

This method is very quick, and avoids the possibility of errors in direction being made, when it might otherwise be necessary to work back a long distance with the first method. As these conditions are not often likely to obtain, the first method should be constantly practised until the numbers can work with absolute accuracy and speed.

The nearest post to the gun should be placed 25 yards away, and should be fitted with a crossbar, divided into 6-inch rectangles (Diagram E). The gun is then placed exactly in line with the two posts, and will thus be directed on to the required point on the target. If, however, it is desired to deflect the cone of fire to allow either for wind, or to

## ILLUSTRATING INDIRECT FIRE BY THE USE OF AIMING POSTS AND QUADRANT ELEVATION.



T = TARGET

O = OBSTRUCTION

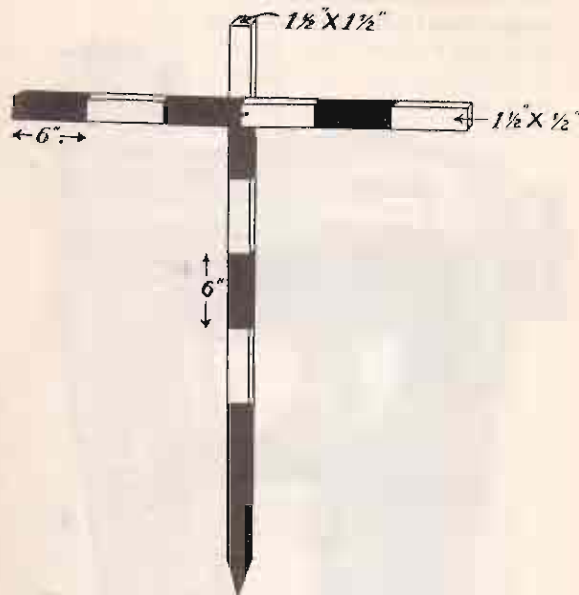
P = AIMING POSTS

G = GUN POSITION

correct from observation after fire has been opened, the firer can be ordered to aim off one division right or left. This is equivalent to allowing 6 inches at 25 yards or 2 feet per 100 yards of range. Limits for traversing can also be given on the crossbar.

If two or more guns are firing, a separate series of aiming posts must be laid out for each gun, and lateral dispersion can be arranged by giving different deflection to the guns.

DIAGRAM E.

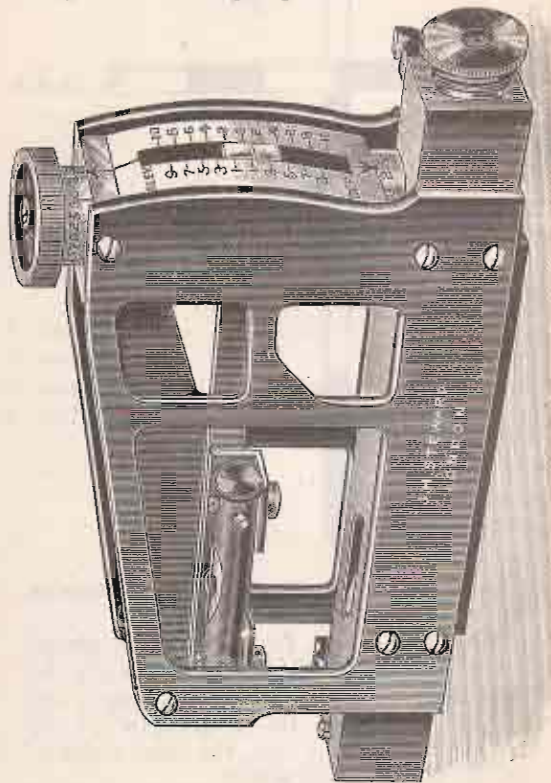


The procedure to obtain the correct elevation will be as follows:—

While the aiming posts are being placed in position, the range takers obtain (1) the range from the obstruction to the target, and (2) the range from the obstruction to the gun position. From this, the total range to the target can be calculated.

By means of an "angle of sight" instrument, such as the Abney level, or the official pattern shown on next page, the machine gun

officer must obtain the angles of elevation or depression from the obstruction to the target and to the gun position.



### To Take an Angle of Sight.

Adopt the prone or sitting position for steadiness. Focus the instrument like a

telescope. Holding the instrument firmly with the left hand, lay the horizontal line on the target. Now turn the micrometer head with the fingers and thumb of the right hand until the bubble is centrally opposite the horizontal line. Read the angle now recorded on the degree and minute scale.

From these the angle of sight to the target can be obtained. For example:—(see Diagram F) the machine gun officer and range takers observe from O (the top of the obstruction) that the angle to T is 1 degree, and the angle to G is - 3 degrees, that the range to T is 1,000 yards, and to G is 400 yards. The range from G to T is therefore 1,400 yards approximately.

The following formula is then applied:—

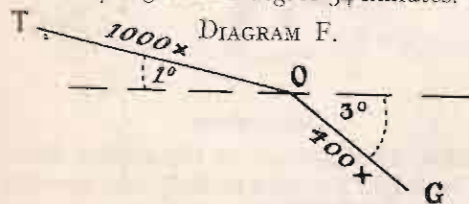
$$\text{Angle to target} = \frac{E \times OT - E^1 \times OG}{GT}$$

Where E = angle from O to T in degrees

E<sup>1</sup> = angle from O to G in degrees,

and we find that the angle from G to T is:—

$$\frac{1 \times 1000 - (-3 \times 400)}{1400} = \frac{1000 + 1200}{1400} = \frac{2200}{1400} \\ = 1\frac{1}{2} \text{ degrees} = 1 \text{ degree } 34 \text{ minutes.}$$



From the tables of elevation it is found that the angle of elevation for 1,400 yards is 1 degree 57 minutes; to this must be added the angle of sight to target as found above, 1 degree 34 minutes. Total to be put on gun = 3 degrees 31 minutes.



DIAGRAM G.

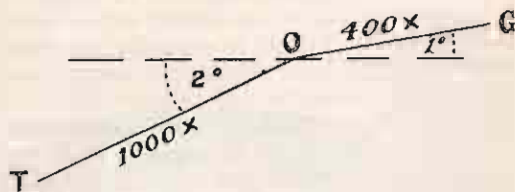


DIAGRAM H.

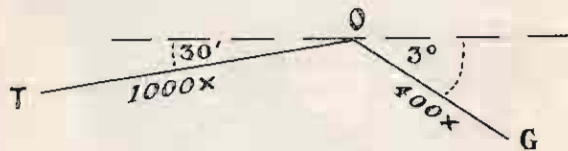
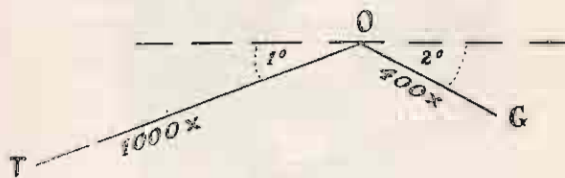


DIAGRAM K.

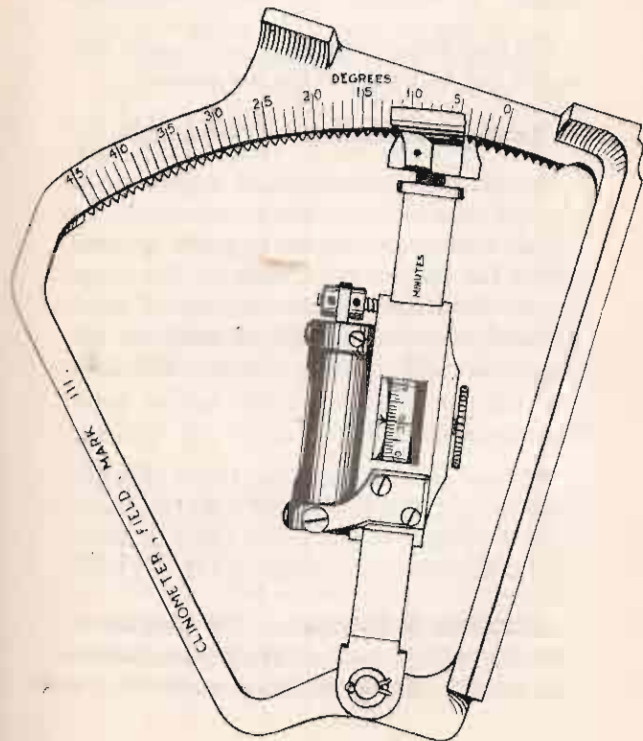


### Clinometers.

Below, two patterns of clinometers officially issued for use with artillery and machine guns are illustrated.

The Mark III pattern is easily read and rapidly set.

The quadrant angle required for the gun is put on the clinometer, which is then placed on the breech casing exactly in the same place for each reading, the gunner maintaining his "holding" throughout.



Diagrams G, H, K afford further examples. If the formula is applied it will be found that the angle in G is  $-1$  degree 43 minutes, and K is  $-9$  minutes, and must in both cases be deducted from the angle for the range; in H the angle is  $+30$  minutes, and must be added.

The calculated angle to be used is now put on the gun by means of the instrument.

#### Lowest Shot Clearing the Obstruction.

It must next be ascertained if the cone of fire will clear the top of the obstruction. To do this without altering the laying of the gun, adjust the tangent sight slide for the range to the *obstruction*; if then the line of sight is found to pass over the obstruction, the cone of fire will also pass over it. If it does not, the gun must be moved farther away from the obstruction.

Without altering the laying of the gun, the tangent sight slide is adjusted until the line of sight is directed to the lowest point of intersection between the crossbar and aiming post,

**Alterations in Elevation.** The position of the slide will probably have no relation to the range. Since the graduations of the

tangent sight vary with the range, it will not be possible to make alterations in sighting by 50 or 100 yards in the usual way, but, as the ratchet is uniform, alterations can be accurately made by clicks of the ratchet. For practical purposes it can be remembered that the number of clicks required in order to elevate the gun by 100 yards is the same as the number of hundreds of yards in the range. Thus, to move the slide from 1,200 to 1,300 yards requires 13 clicks, from 1,500 to 1,600 yards, 16 clicks, etc. Example:—Range being 1,400 yards, and shots are observed 50 yards short. Directing officer gives the signal for "Cease Fire" and gives the order "Up 7." The Nos. 1 then move their slides up 7 clicks, *relay the guns on the original aiming mark*, and on the signal from the officer, continue firing.

*Method (b).*—Indirect fire by Map and Compass.

With the introduction of a 'dial plate' for machine gun mountings, this method has been simplified enormously. It is, however, very desirable that all machine gun Company Commanders should exercise section officers in selecting gun positions from the map, both for indirect fire, and for the production of

oblique *bands* of machine gun fire, to search all ground between the first line trenches. This latter point should receive greater attention in future training, having regard to the enormous power possessed by well-placed machine guns for covering areas of ground with flat trajectories up to 600 yards range. In the past too much stress has been laid upon *depths of beaten zones*, and too little attention given to *Trajectories*.

#### METHOD.

Having allotted a task to section officers from the map, time should be given to consider details and decide on action to be taken, then, after discussion on the various methods employed, the work should be checked by the M.G.C.C. on the actual ground.

The procedure suggested to section officers is as follows:—

#### FIRST OBTAIN DIRECTION TO THE TARGET.

(a) If no dial plate is available for the mounting.

Having set the map, take a bearing of the target from the gun position, then, with the compass on or in rear of the gun position, mark an object suitable for use as an auxiliary aiming point, on the same bearing.

Where no natural aiming mark comes on the bearing, one of the aiming posts may be used, placed 25 yards in front of the gun, as

when using the aiming post method described in the preceding pages.

The gun is now laid on the auxiliary aiming mark, the correct alignment being maintained by adjusting the slide on the tangent sight to a suitable range, so that a line drawn from the gunner's eye, through the sights, will reach the desired point on the aiming mark.

(b) With dial plate on mounting.

Mark off the position for the gun on the map, and also the direction of some prominent object from the gun position. Measure the angle between the reference point and the target. When the gun is placed in position, the *direction* may be obtained readily, and with absolute accuracy. First lay the gun on the reference point, and, having read the dial, add or subtract the number of degrees measured on the map from reference point to target. Set the gun to this reading on the dial, and it will be directed on to the target.

#### NEXT OBTAIN THE NECESSARY ANGLE OF ELEVATION.

Measure the distance on the map from the gun position to the target, and note the difference (if any) in altitude. Then apply the usual H.E.—V.I. formula—

$$\frac{\text{Difference in Altitude in feet} \times 19.1}{\text{Range in yards.}}$$

This gives the vertical interval between gun and target in degrees.

Now add (or deduct) the amount given from the above formula to the angle of tangent elevation. The result will be the correct angle to be put on the gun.

For example—

The range to a target is found to be 1,000 yards, and the target is 30 feet *below* the gun position.

$$\begin{aligned} -\frac{30 \times 20}{1000} &= -\frac{3}{100} \text{ of a degree. } \frac{3}{100} \times 60 \\ &= -36 \text{ minutes.} \end{aligned}$$

The angle of tangent elevation for 1,000 yards (given in the elevation table) =  $1^{\circ} 3'$ . I must now deduct 36 minutes from  $1^{\circ} 3'$  which gives 27 minutes to put on the gun by means of the Abney level.

When the target is *above* the gun position the plus sign is used.

Many kinds of formula may be used, but the usual topographical formula is given as being one of common knowledge.

NOTE.—Before opening fire the section officer must ensure that the lowest bullets of the cone will clear the obstruction.

The flat trajectory of Mark VII ammunition places considerable restrictions on the use of indirect fire at ranges under 1,200 yards. A little study of the probable course of the lowest bullet in the cone will show section officers the limitations imposed by varying heights of obstructions over which it is desired to fire.

*Method (c). Graticule Method.*—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.

### ILLUSTRATING THE USE OF GRATICULED GLASSES.

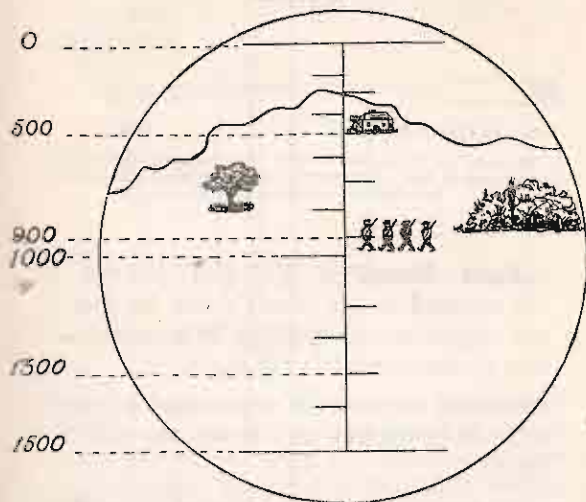
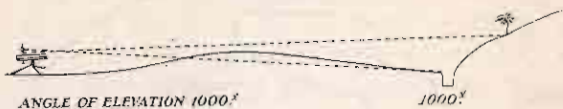


DIAGRAM M.

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.

### ILLUSTRATING INDIRECT FIRE BY GRATICULE METHOD.



ANGLE OF ELEVATION 1000'

1000'

The upper line shows line of sight when sights are lowered and aim taken at tree. The angle of elevation originally given by the elevating wheel is still on the gun.

**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.

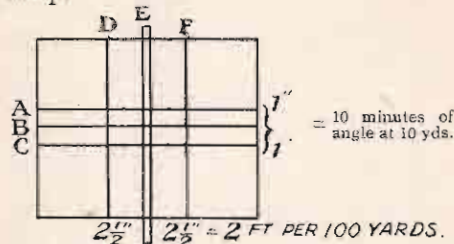
A stick is placed in the ground 10 yards in front of the gun in a direct line with the target.

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.

### NIGHT FIRING BOX.

Lines on face of box for *Searching* and *Traversing*, lit up with electric torch or siege lamp.



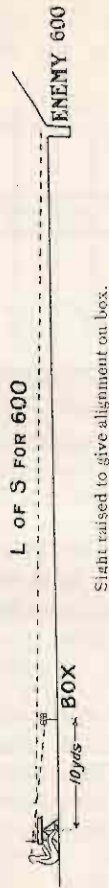
Bands A, B, C, D, F are  $\frac{1}{2}$  inch wide.  
DIAGRAM P.

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 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  $2\frac{1}{2}$  inches from the centre line, giving therefore a deflection of about 2 feet per 100 yards.

## NIGHT FIRING.

(a) Night Firing with Box.



Sight raised to give alignment on box.

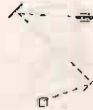
IMPROVED METHODS OF FIRING FROM TRENCHES BY NIGHT—THE GUN HAVING FIRST BEEN LAID ON THE TARGET BY DAY.

(a) Night Firing from Trench with Box and Mirrors.

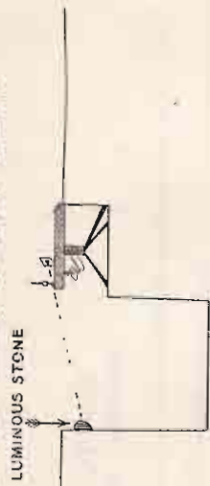
To illustrate fixing of 3 posts and box in position, measured by cord 10 yds. in length, passing from tripod to box.



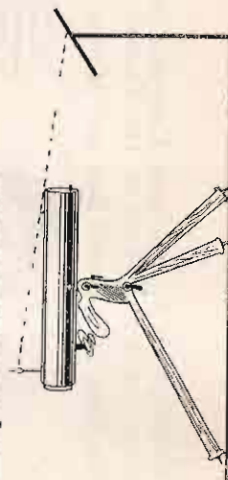
(b) No. 1 post removed and Mirrors Adjusted.



Illustrating Mirror and Luminous Stone Method.



(c) Illustrating Mirror placed in front of Gun.



Mirror may be used from side of gun reflecting the box placed in rear of trench.

### RANGE TABLE FOR FIRING AGAINST AEROPLANES WITH MACHINE GUNS.

This range table gives a guide as to the allowance which should be made when firing with a machine gun against aeroplanes.

The table is drawn up to meet the case of an aeroplane flying 70 miles an hour. It should be remembered that machines vary in speed and size, and that a wind affects the speed of an aeroplane more than the flight of a bullet.

Range along line of sight.	Allowances in front of lengths.	Elevation on back sight at following angles of elevation.			
		20°	40°	60°	80°
yards.		yards.	yards.	yards.	yards.
200	1	200	150	100	50
400	2	400	300	300	100
500	3	600	550	400	200
800	5	800	700	550	300
1000	7	1000	900	700	400
1200	9	1200	1050	850	450
1400	12	1400	1250	1050	600
1600	15	1550	1450	1200	700
1800	18	1750	1650	1350	800
2000	22	1950	1800	1500	950
2200	26	2150	2000	1650	1050
2400	31	2350	2200	1850	1150
2600	37	2550	2350	2000	1250
2800	44	2750	2550	2200	1400

Machine gun tactical training is fully dealt with in the official text-book *Machine Gun Training*.



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) 38	Water Jacket	Tripod 40	Belt of 250 rds	375	Pack	Sec. 2 guns Infy, 1 guns Mountain troops and Cav. About 1 gun per 600 rifles.
Belgium ...	Maxim (R)	Water Jacket	Tripod on cart.		600	Draught (Dogs)	
Brazil ...	Maxim (R) Nonconduit (R)	Water Jacket	Tripod	Belt of 250 rds	600	Pack	Sec. 3 guns.
Bulgaria	Maxim (R) 35	Water Jacket	Sledge with detachable wheels.	Belt of 250 rds	600		Section, 2 guns Section, 4 war. 16 companies: 9 guns.
China ...	Maxim (R)						
France ...	Hotchkiss (G) 53. Model 1907 (G) 52	Both Air Cooled Radia-tors	Cav. tripod on wheeled cart. 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 in-creased to 2 per Battn and Cav. Rgt.
Germany	Maxim (R) Infy, 40; Cav. 48	Water Jacket	Sledge, Infy 33; 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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Country	Maximum (R) 58 Vickers (R) 27	Water Jacket	Tripod 45	Belt of 250 rds	600	(a) Limbered carr. (b) Pack	Section 4 guns.
Greece ...	Maxim (R)	Water Jacket		Belt of 250 rds	600		4 Batteries: 24 guns
Holland	Schwarzlose (R) 44	Water Jacket	Sledge forming tetrapod, 77	Belt of 250 rds		Limbered wagon	Det. (incl) peace 4 guns. Co. (dismt'd) war 8 guns.
Italy ...	Perino (R) 48 Maxim (R)	Water Jacket Water Jacket	Tripod 44	Hopper fed with flat chrgs of 30 rounds	450	Pack	Section 2 guns.
Japan ...	38th Year (G) 70 Maxim	Air Cooled Radiators	Tripod 30	Flat charger of 30 rounds	600	Pack	Battery 4 guns Cav. 6 guns Infy.
Montenegro	Hotchkiss (G)						12 guns, possessed.
Norway ...	Maxim (R)	Water Jacket	Wheeled carriage 485, or tripod, 45 lbs	Belt of 250 rds	600	Draught	Detmt, 4 guns.
Portugal	Maxim (R)	Water Jacket	Sledge	Belt of 250 rds	600	Draught	2 secs each 4 guns with each of six Rifle Battalions.
Roumania	Maxim (R)	Water Jacket	Wheeled carriage with trail 485, or tripod, 45 lbs	Belt of 250 rds	600	Draught	6 per regiment.
Russia	Maxim (R) 69 Vickers (R) 27	Water Jacket					Det. 8-gun, 4-gun, 2-gun wheeled equip and 4-gun pack equip
Serbia ...	Maxim (R)	Water Jacket					Infy and Cav. Rgt 2 in peace, 4 in war. Eventually 2 per bat-talion 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.	Muzzling 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 secs = 4 guns (Maxim) 5 = 20 groups, 10 secs = 20 guns (Hotchkiss). Maxim Sect. has water mule.
Sweden ...	Hotchkiss (G)	Air Cooled		Flat chgrs of 30	600		3 guns per Sqdm.
Switzerland	Maxim (R)	Water Jacket	Tripod and Ref (porter's cradle)	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. Regt 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.

Uruguay uses Rexer for Infantry and Cavalry.

U.S.A. uses Hotchkiss Portative under the name of Benet Merici.

The Lewis Gun is now under trial in Great Britain.

## THE LEWIS MACHINE GUN.

Manufacturers' Notes.

### 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

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.

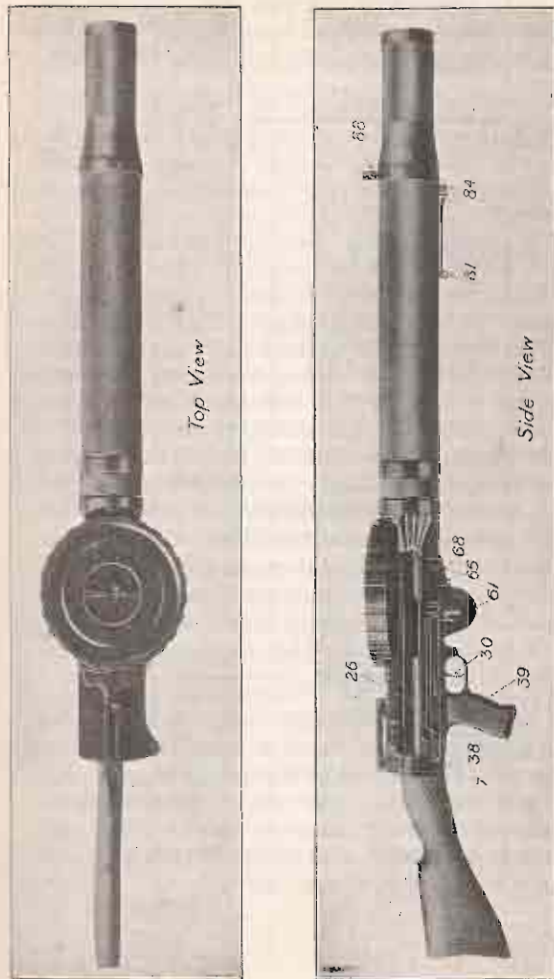
through the friction of the powder blast on the inner walls of the barrel mouthpiece and tubular casing.

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.

Moving Parts.—The number and weight of the moving parts have been reduced to an approximate minimum, thus reducing the amount of live gas needed for operation, and 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



GUN COMPLETE, WITH MAGAZINE AND RIFLE BUTTSTOCK

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 25½ 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.

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 spring 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.

### LEWIS MACHINE GUN.

*Method of imparting instruction.*

#### GENERAL DESCRIPTION.

*Name.*—Lewis Machine Gnn. .303. Air cooled and gas operated.

*Weight.*—25 lbs.

*The gun is worked by two forces :—*

1. The force of the explosion.
2. The return spring.

*NOTE.*—Do not talk too much about things that cannot be seen, wait for these until the gun is stripped.

*The Gun is divided into two portions :—*

1. The stationary portions.
2. The moving portions.

The *stationary* portions consist of :—

- (a) The barrel group ;
- (b) The body group.

(a) The barrel group consists of :—

- i. The *barrel* (the spare barrel should be shown, in order to avoid withdrawing the barrel from the radiator).

Calibre .303, with a right-handed twist to the rifling.

It is threaded at the front end to take the *barrel mouthpiece* which has a left-handed

thread, to prevent it being detached from the barrel during firing.

A *gas vent* is bored in it 4 inches from the muzzle, to allow the gas to pass into the gas chamber.

A square thread is cut at the rear end for attachment to the *body*.

A *stud* is placed in front of the square thread to fit in a slot in the radiator, and align it with the barrel.

ii. The *radiator* is of aluminium, and has projecting flanges and is split longitudinally, and sprung on to the barrel.

It assists in dissipating the heat of the barrel.

A *recess* for the gas chamber is provided at the forward end, and a *flat* which corresponds with one on the *radiator casing* is made at the rear end to assist in alignment to allow for rotation of magazine.

iii. The *radiator casing* consists of front and rear portions and is connected by the *clamp ring*.

The rear portion has a hole cut in it to allow the entrance of the *gas regulator*.

A *flat* is provided at the rear end to correspond with the flat on the radiator, and the rear face is drilled to admit the barrel and gas cylinder, and also the *body locking pin*.

The front portion is tapered and extends beyond the barrel mouthpiece.

On both portions are recesses to take the stud on the clamp ring.

The clamp ring is turned up at both ends to form fore sight protectors, and the inner portion on the right side forms the fore sight block and is dovetailed to receive the fore sight. It is held in position by a screw.

iv. The gas chamber is connected to the barrel by a band which fits round the barrel, and at the forward end fits into a recess in the barrel, which is cut round the gas vent.

It is drilled and tapped to receive the gas cylinder and gas regulator, and has wings which the stripping spanner grips when screwing it up.

v. The gas regulator screws into the gas chamber and has two holes, either of which can be placed opposite the hole in the rear face of the gas chamber.

It is operated and held in position by means of the gas regulator key, for which a recess is cut in the gas regulator.

The key is sprung in and out of a hole in the rear radiator casing by means of a loop large enough to take the point of a bullet.

vi. The gas cylinder is tapped at the front end to screw on to the gas chamber, and is shaped at the rear end to admit the rack on the piston.

(b) The body group consists of:—

i. The body is tapped to screw on to the barrel, and is drilled to take the locking pin,

and a groove is cut through which the pin is operated when stripping the gun.

Bottom.—Underneath the body is a pin on to which the pinion casing, hooks and openings are cut to allow the pinion, plunger and sear to enter.

Guide grooves are also made to take the pistol grip, and the catch on the butt stock.

Sides.—Openings are cut on either side of the body in which the eocking handle shank can travel as required, and a sliding plate with a recess and a thumb piece is provided for safety purposes.

On the right side of the body is the ejection slot.

Top.—The body carries on top the magazine post, which is hollowed and coned to actuate the magazine when placed in position.

A key is placed on the exterior to prevent the centre block of the magazine from rotating.

The top of the body is slotted throughout the greater part of its length, the front part of the slot taking the form of a cartridge, while in the rear portion fits the boss on the feed arm actuating stud.

The ejector seating lies on the left of the slot, and is closed by a spring cover, and a hole is drilled in the body into which the stud on the centre of the ejector fits.

A groove is cut at the rear end of the body

in which the stud on the tail of the feed arm runs.

Interrupted projections are provided to lock the body cover.

Interior.—Inside the body are drilled the bolt way, and the piston rod channel.

The bolt way has four grooves placed in the form of a cross, which admit the lugs on the bolt, and on the feed arm actuating stud.

Recesses are provided at the forward end of the bolt way in which the lugs on the rear end of the bolt lie, when the bolt is closed.

Slots are cut in the interior of the bolt way to allow the ends of the ejector to project alternately into the bolt way.

The piston rod channel is flat-bottomed to take the rack.

ii. The body cover fits on top of the body.

The projecting tongue at the front end has underneath it a seating for the cartridge guide spring.

Under the body cover are the axis studs for the stop and rebound pawls.

Projections to engage with the projections on the body are provided at the sides.

Fixed to top of the body cover by a screw is the back sight bed.

The tangent sight leaf is hinged to it, and held in position by a spring.

The tangent sight is of the aperture pattern, and is actuated by an elevating screw which

is operated by a milled head with a rib and spring.

The cartridge guide spring is held in position by an undercut recess, and has a stud which fits in a hole in the tongue.

The two ends of the spring are turned over, and the left hand end lies over the right, and controls it.

The stop and rebound pawls pivot on the studs, the right pawl lying above the left pawl, the head of which is enlarged to bring it on a level with the under side of the cover.

A flat spring lies behind the pawls, and a stud on its back fits in the rib behind it.

Part of the left of the spring is turned over to embrace the pawl.

iii. The pinion casing is shaped to contain the pinion and spring.

At the front end is the hook which engages it to the body, and at the rear end is the pinion pawl, a rib on one arm of which engages in the pinion and is kept in action by a spring which bears against the back of the arm.

The other arm of the pawl projects from the casing and is lifted by the trigger guard as the latter is slid into position, thus disengaging the rib from the pinion.

The casing is drilled to take the tension screw.

iv. The trigger guard and pistol grip consist



of a frame which is channelled to contain the plunger, trigger and sear.

It extends to form the trigger guard and pistol grip.

Guide grooves to connect it with the body are left on the sides.

At the forward end is a recess for the pinion pawl.

The plunger is a cover for the trigger spring and is slotted to take the front end of the trigger.

The sear and trigger are both pivoted on axis pins and the jaw on the rear end of the trigger controls the sear.

At the rear end is the butt catch with a spiral spring.

v. The butt has on the front face the butt cap. Projections are provided for attaching it to the body, and a recess into which the tooth on the butt catch fits.

It acts as a stop for the bolt and piston, and also locks the component parts of the body group.

The moving portions consist of :—

i. The piston rod, which is in two parts and joined by a pin, to compensate for any slight want of alignment between cylinder and body.

The head is cupped, grooved and ringed, and the rings tend to make a gastight joint,

and scrape away any fouling which accumulates.

Under the rear portion of the piston is a rack, and behind the rack is the bent which engages with the nose of the sear.

On top is the striker post, which is drilled for the striker, and is secured by a fixing pin.

A slot for the cocking handle is cut in the rear end.

ii. The bolt has on the face a rim to support the base of the cartridge.

Gaps are cut for the extractors which lie in recesses cut in the surface of the bolt.

The extractors are flat springs with a hook on the head to engage with the rim of the cartridge, and a stud which fits in a recess in the bolt and takes the pull of extraction.

Grooves are cut in the slot into which the tail of the extractor is sprung, and these tend to keep it pressed inwards.

A slot cut in the rim allows the ejector to enter.

A cammed slot is cut inside the bolt in which the striker post travels.

Four lugs at the rear end take the shock of discharge, and the rear face is tapped to take the feed arm actuating stud.

iii. The feed arm actuating stud screws into the rear of the bolt, has lugs which work in the guideways, and prevent it from turning,

and a *boss* which travels in the long slot in the body and actuates the *feed arm*.

iv. The *feed arm* has an axis hole which passes over the magazine post, and a recess to clear the key on the post, when stripping.

A hinged *latch* secures the feed arm to the post.

A slot is cut to allow the cartridge to pass from the magazine to the body, and a raised *stop* holds the cartridge in position during the movement of the feed arm.

Behind this are the *axis*, *stop* and *spring retaining studs* for the *feed arm pawl*.

The *pawl* has a hole for the axis stud and a slot in which the spring lies, while underneath is a recess for the stop stud and a stud for the *loop* on the spring.

The tail of the feed arm is grooved underneath to receive the boss on the feed arm actuating stud, and the *tail* is curved.

At the end of the tail is a *stud* which works in the shallow groove in the body.

v. The *pinion* is bored to admit the tension screw, and has an *internal recess* to correspond with a *projection* on the spring casing, to lock the two parts.

The *spring drum* has a *hub* which is tapped for the tension screw and is slotted to take one end of the *return spring*, which is coiled inside the spring casing and attached to it by two studs.

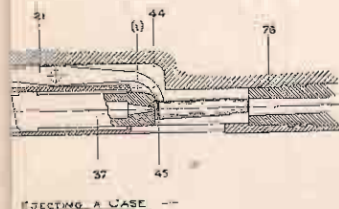


FIG. 4

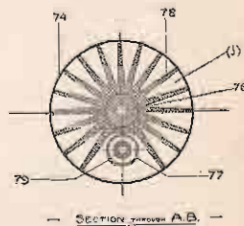
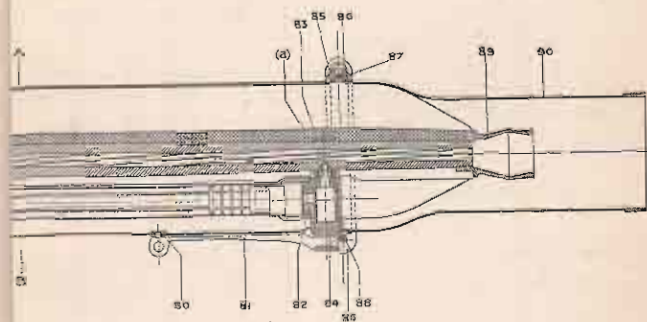


FIG. 2



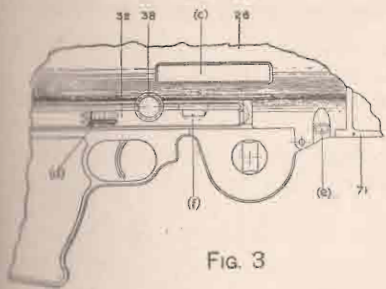


FIG. 3

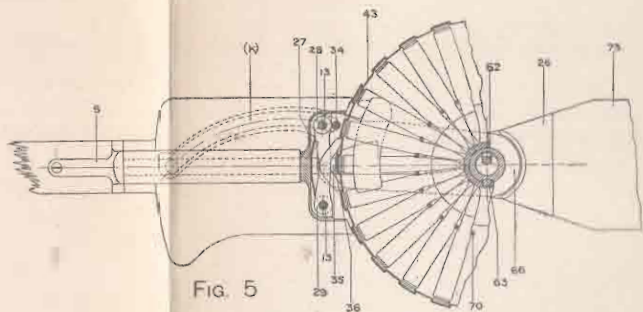


FIG. 5

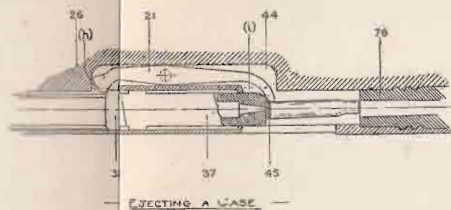


FIG. 4

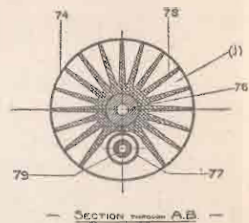


FIG. 2

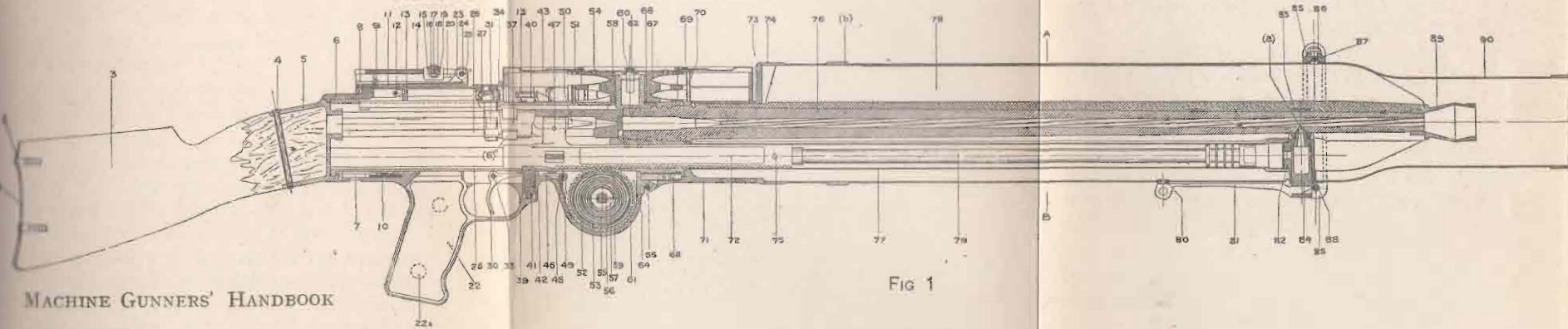


FIG. 1

vi. The *magazine* is a circular *pan* with *rectangular indentations* on the rim, inside which are riveted plates to hold the base of the cartridge.

A *ring* carrying 25 *pegs* is riveted over a hole which is cut out of the centre of the pan.

The pegs and indentations hold the cartridges in position, and force them round when the pan is rotated.

Twenty-five recesses for the nib on the magazine catch are provided inside the ring and pan.

A *steel disc* covers the central hole with a channel in it for the *magazine catch and spring*.

A *thumbpiece* is cut in the centre of it.

A *hook* is formed on the bottom of it with a sloping head to engage below the cone on the magazine post.

A *spiral spring* lies in the channel and keeps the nib pressed into one of the recesses in the ring and pan.

A *centre block* with a spiral channel, in which the bullet ends of the cartridges lie, is riveted to the centre disc, and keeps the magazine catch in position in the channel.

In the centre is the hole for the magazine post, and a keyway is cut to fit the key on the magazine post.

The magazine catch locks the centre block to the pan, and prevents it from rotating when not in position.

The *cartridge guide spring* is held in position by an undercut recess, and has a stud which fits in a hole in the tongue.

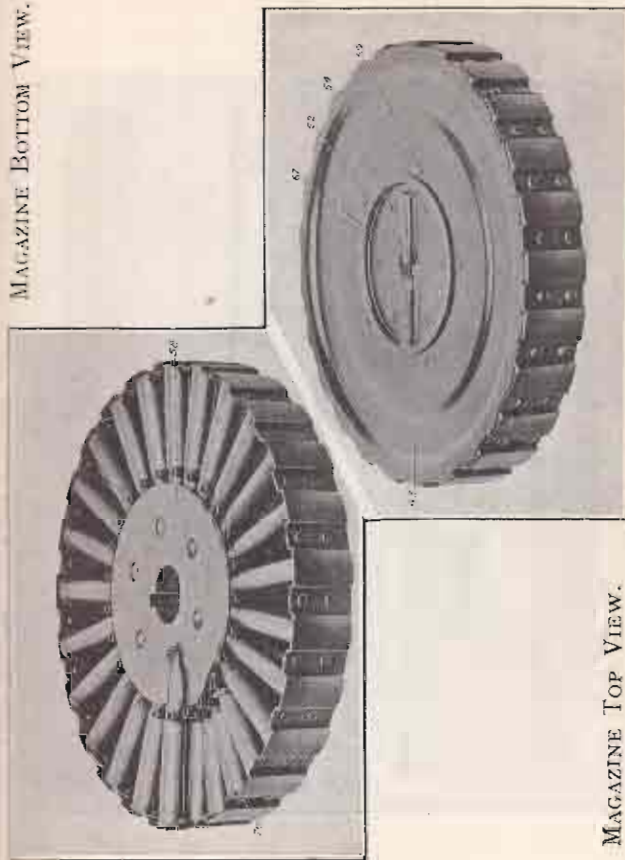
The two ends of the spring are turned over, and the left-hand end lies over the right, and controls it.

The *stop and rebound pawls* pivot on the studs, the right pawl lying above the left pawl, the head of which is enlarged to bring it on a level with the under side of the cover.

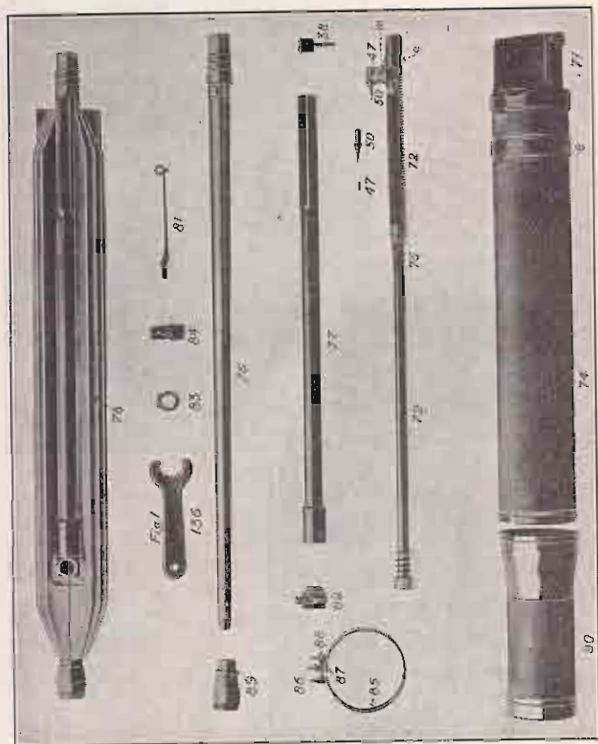
A flat spring lies behind the pawls, and a stud on its back fits in the rib behind it.

Part of the left of the spring is turned over to embrace the pawl.

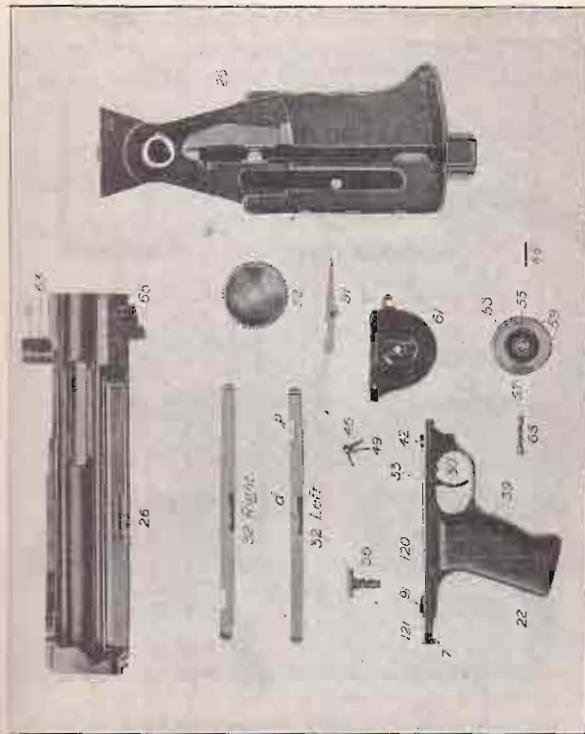
MAGAZINE BOTTOM VIEW.



MAGAZINE TOP VIEW.

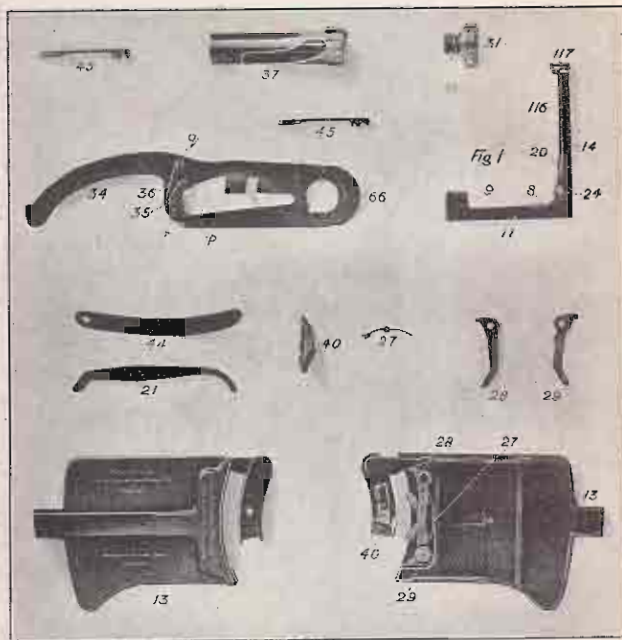


GUN PARTS: BARREL GROUP AND OPERATING ROD.



GUN PARTS: RECEIVER GROUP, MAINSPRING, AND TRIGGER MECHANISM.

## GUN PARTS: FEED MECHANISM, BOLT, EXTRACTORS AND EJECTOR.



## MECHANISM.

### SEQUENCE OF INSTRUCTION.

1. How to load.
2. How to fire.
3. Action of the explosion on the moving portions and in cooling gun.
4. Action of the return spring.

*During the teaching of mechanism, practice should be given in the following subjects :—*

1. Removing the bolt.
2. Removing the magazine.
3. Changing cartridge guide spring.
4. Replacing any of the pawls and springs.

### MECHANISM.

1. Show how to put on the magazine and load.

*Note.*—Show each action as it takes place. Dummies should also be used.

The magazine should be removed after the first cartridge has dropped, to show the action clearly.

### Load and Explain.

2. That (a) on pressing the trigger, the gun fires. (b) On releasing the trigger the gun stops in a fully cocked position, with a live round under the cartridge guide spring.

3. When the powder gases expand through the gas vent into the gas chamber, and pass through the hole in the gas regulator,

(a) The piston is forced back, and the rack on its under side, working in the pinion, winds

up the return spring and the bent passes over the nose of the sear.

(b) The striker post bearing against the cammed slot in the bolt (after the first  $1\frac{1}{2}$  inches of travel) rotates the bolt and frees the lugs from the recesses in the body, and the rear part of it then bears against the cammed slot, forcing the bolt further back, till piston and bolt reach the butt cap.

(c) The bolt by means of the extractors withdraws an empty case from the chamber, and in its backward travel pushes the tail of the ejector out of the boltway, the head swinging into the boltway and ejecting the empty case.

(d) The boss on the feed arm actuating stud carries the feed arm over to the left, and the feed pawl, which is bearing against a projection on the magazine, carries the pan round with it.

(e) A cartridge is forced down the slope of the centre block, and when the bullet end falls clear of lip on to the cartridge opening in the feed arm, the tongue on the body ensuring that the cartridge drops.

It is carried to the left by the indentations and separating pegs of the magazine, and forced under the cartridge guide spring.

The stop on the left side of the feed arm controls it in this position.

(f) The spring stud on the feed arm moving to the left releases the stop pawl, which is pushed forward by its own spring, and

engages in the indentations on the magazine and prevents it rotating too far, while the rebound pawl is pressed back, as the magazine moves to the left, and then comes forward again.

4. (a) *Pressing the trigger* disengages the bent from the sear, and the unwinding of the return spring actuates the rack, and forces piston forward.

(b) *The striker post*, being unable to rotate the bolt owing to the lugs being in the guide grooves, carries the bolt forward.

(c) The face of the *bolt* in its forward movement meets the cartridge and pushes it into the chamber, the cartridge stop controlling it during movement. The front of the bolt pushes the head of the ejector out of the boltway, and the tail swings in. The extractors spring over the rim of the cartridge as it goes into the chamber. When the bolt is fully forward the lugs are clear of the grooves.

(d) *The feed arm actuating stud* is carried forward with the bolt, and the boss carries the feed arm over to the right; the feed arm pawl passing over a projection on the magazine and engaging behind it, while the spring stud presses the stop pawl out of the path of the magazine, the rebound pawl preventing the magazine from slipping back.

(e) *The striker post* rotates the bolt and locks the lugs in the recesses in the boltway, and the striker, passing through the face of



the bolt, strikes the cap and explodes the charge.

5. (a) If the trigger is instantaneously released after pressing it, single—or at times two—shots will be fired according to the rapidity with which the sear rises and engages with the bent.

(b) If pressure is maintained, the gun will continue firing until the magazine is empty.

### Stripping.

#### 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 main-spring tension or to make any other adjustment when the gun is reassembled.

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). 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 buttplate 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).

*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 (III).

*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.

### MAINSRING 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).

*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 month piece wrench (Plate 2, Fig. 1).

**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.

## MAINSRING 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.

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 mainspring 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.

## STOPPAGES.

## EXPLANATORY NOTES.

I.—I. It should be taught in drill that when the gun stops with the cocking handle in forward position the firer immediately tries to rotate the magazine in the feeding direction to find out whether it is empty.

The gun has been known to stop with C.H. *nearly* forward and to carry on suddenly after a pause of about one second. This is probably due to friction causing the bolt to be slow in rotating.

The slight pause in trying to rotate the magazine would allow for this.

2. (a) A *weak* S. and R. pawl spring would allow magazine to be dragged back one space each time by the feed pawl.

(b) A *broken* S. and R. pawl spring would allow the stop pawl to drop slightly from its position and obstruct the feed pawl, thus preventing C.H. from being drawn back more than about two or three inches.

II.—I. (a) If a *badly* bulged round were drawn under the C.G. spring it might cause a fault in feed—No. IV position.

This would be discovered during the carrying out of the Immediate Action, and might necessitate the removal of the body cover.

2. A Maxim or Vickers gun clearing plug can be used. This necessitates removal of the body from the barrel. The use of the clearing plug may be shown during instruction in mechanism.

Separated cases are not likely to occur frequently, and only if the bolt is much worn and does not close the breech securely.

III.—(a, b) Hard extraction may be due to abnormal expansion of a cartridge in exploding, or to dirt or fouling in chamber. The extra force exerted in extracting the case from the chamber (or in overcoming friction of any kind) may prevent the piston-rod from completing its backward travel. The bolt moves back far enough to eject the empty case, but not far enough to engage behind the next live round which is being drawn into position. The bullet of this round has *dipped* during the rotation of the magazine, and bearing against the *lip* of the *centre block*, prevents the magazine and feed arm from going back to their original position.

This can very easily be demonstrated with dummy cartridges.

IV.—(a) The point of bullet may have dipped, allowing bolt to catch against the under side of case, *or* bullet may have risen and caught against front end of cartridge-opening. A fault in feed may occur on rare occasions with a perfectly sound cartridge guide spring, owing to the spring not having had time to act properly.

(b) Faulty extraction might possibly be caused by brass filings (scraped off cartridges by the extractors) getting into the extractor seatings, but this should seldom occur if these are cleaned out periodically.

If the empty case cannot be removed from chamber with the point of another bullet or with a small screwdriver, a cleaning rod must be used.

(c) On pulling back C.H. live round will probably drop into bolt-way.

## GENERAL.

If on releasing the trigger the gun does not stop firing, the cause will probably prove to be dirt or excessive oil under the plunger, preventing it from rising and thus holding the sear down.

The effect of a too weak or strong return spring is to cause a more rapid rate of fire and excessive wear and tear to the gun.

A good normal weight is 13 or 14 lbs.

## STOPPAGES.

Position of C.H.	Immediate Action.	Probable Cause.	Remedy or Recurrence
I. In forward position.	<p>1. If magazine cannot be rotated in feeding direction pull back C.H. and press trigger.</p> <p>2. (a) If gun will not fire or (b) If C.H. cannot be moved back more than two or three inches, remove magazine and examine for:</p>	<p>1. (a) Empty space in magazine. (b) Missfire due to defective ammunition.</p> <p>2. (a) Worn or broken feed pawl or spring. Worn or broken striker. Weak pawls—springs. (b) Broken pawls—springs.</p>	
II. Just in front of trigger.	<p>1. Pull back C.H. sharply, seeing that live round is ejected. Examine round ejected, and if it is <i>bulged</i>, or if front portion separated, cause is due to too strong firing case's and undamaged live round is ejected, use clearing plug.</p> <p>2. If only undamaged live round is ejected,</p>	<p>1. (a) Bulged cartridge. (b) Separated case.</p> <p>2. Separated case.</p>	Change bolt.
III. Immediately over ledge on safety catch.	<p>Pull back C.H. and continue firing. If stoppage occurs again turn large hole in gas regulator to rear and oil all working parts.</p>	<p>(a) Hard extraction. (b) Friction in gas cylinder or working parts of gun.</p>	Clean the breech, cylinder and piston head, also remove gas regulation and fire one shot to clean out gas port.
IV. Behind ledge on safety catch.	<p>Pull back C.H. and raise safety catch. Remove magazine. Push back live round into position under cartridge guide spring and (a) <i>If chamber is empty</i>: Continue firing. If stoppage occurs again with chamber empty change cartridge guide spring. (b) <i>If empty case left in chamber</i>: Remove it through ejection opening and change bolt. (c) <i>If empty case still gripped by extractors</i>: Examine for broken ejector.</p>	<p>(a) Fault in feed, due to breakage, weakness, or faulty action of C.G. spring. (b) Broken extractors or dirt under extractors. (c) Broken ejector.</p>	Clean extractor seatings.



COLT AUTOMATIC GUN MOUNTED  
ON TRIPOD. CARTRIDGE BOX  
ATTACHED (*Left Side*).



COLT AUTOMATIC GUN  
MOUNTED ON TRIPOD, SHOWING  
BELT PASSING OUT (*Right Side*).

## COLT AUTOMATIC GUN.

### I.

#### GENERAL DESCRIPTION.

*Name*.—Colt Automatic Gun '303.

Air-cooled and gas operated.

*Weight*.—35 lbs.

The gun is worked by *two forces* :—

1. Force of the explosion.
2. The retracting mechanism.

The gun is divided into *two parts* :—

1. Stationary portions.
2. Moving portions.

1. THE STATIONARY PORTIONS consist of :—

- (a) The barrel group.
- (b) Breech casing group.
- (c) Handle.

(a) The Barrel group consists of :—

1. *Barrel*. Calibre '303. Right-handed rifling. 28 inches in length. External diameter at breech  $1\frac{1}{2}$  inches, tapering to  $\frac{7}{8}$  inch at muzzle. It is corrugated to assist radiation.

At muzzle end it carries the fore sight and protector. On the underside is a slot to take the combination wrench.

The gas vent hole has diameters of  $\frac{7}{1000}$  inch and  $\frac{1}{16}$  inch.

The barrel lock slot is cut in the corrugated portion, and helps to lock and align the barrel.

It is threaded at the rear end to screw into the receiver, and has a slot in rear for the



entrance of the extractor. A mark is cut on the barrel which coincides with one on the receiver to ensure alignment.

2. The Gas Cylinder is fitted below the barrel over the gas vent hole by a split band and adjustable clamp, which prevents the escape of gas. It is bored to accommodate the piston. It has two projections, which fit into recesses in the gas lever, and also carries the barrel lock.

3. The Gas Lever Bracket carries a band which fits round the barrel and is drilled to receive the side plate screw. The fork of the bracket is drilled to receive the gas lever bracket pin, and is recessed to receive the studs on the retracting spring tubes.

(B) Breech Casing Group.

1. The Left Side Plate is:—

Bored at either end to receive side plate screws;

Bored in the centre for the gun pin; bored for the bolt pin;

Fitted on the inside with a retaining pin for the retracting spring tubes;

Grooved along the centre to allow the slide pin to travel, and along the bottom to admit the locking tongues on the bottom plate;

Provided with a stud at the rear end, which fits into a recess in the body.

On the outside of the plate is fitted the cocking attachment, which has an arm to operate the gas lever; the attachment is

worked by hand by means of a Bowden cable and two gears.

A slot is provided for insertion of the loaded belt, at the front end of which, inside, is the bullet guide.

2. The Right Side Plate, in addition to items common to both plates, carries on the outside the throw-off button, and is provided with an inspection slot.

A small hole is bored for the insertion of the handle lock in order to remove the bolt pin.

On the inside are recesses for the safety catch and handle lock.

In front of the belt slot is fitted the feed throw-off, the feed lever, and the ratchet lever with pawl and spring.

3. The Bottom Plate has, underneath, the hook for attachment to the adapter.

On the inside it is slotted at the fore end to allow the gas lever to travel, and is recessed to take the ratchet lever. The belt feed wheel and shaft are fitted between two standards and are controlled by a dog and spring.

The rear standard forms a support to the receiver and acts also as a cartridge stop. It has on its rear face an angular projection, which depresses the cartridge extractor.

Further to the rear is the platform, which serves as support for the receiver and controls the movement of the carrier.

Near the rear end is the carrier stop, which controls the vertical movement of the carrier.

It is joined to the side plates by two tongues, and to the receiver by an upright with two shoulders, which, supporting the receiver, is slotted to allow the withdrawal of the bolt, and the insertion of the trigger and sear, and is drilled for the side-plate screw.

4. *The Receiver* is shaped from a solid steel block, and carries on the top a leaf back sight with aperture and open sights.

On the left side are :—

Recess for the trip and holes for the trip pins.

Carrier pin hole.

Bolt pin hole.

Recess for the side-plate stud.

Hole bored for the side-plate screw.

On the right side are (in addition to items common) :—

Ejection slot.

Inspection slot.

Safety catch slot.

Safety catch and handle lock stops.

Handle lock hole.

Inside, the receiver is :—

(a) Tapped to take the barrel screw.

(b) Bored and slotted for the passage of the bolt and slide, and at the rear end for the passage of the handle.

(c) Cut away to allow the hammer to travel and provided with sloped resistance shoulders

against which the bolt bears when locked in the firing position.

Screwed to the receiver is the belt guide, a block  $2\frac{1}{2}$  inches long, provided with two screw holes and a positioning pin, which fits into a recess in the receiver. It is made to conform with the shape of the belt, and is slotted to take the tongue of the slide.

The chamber guide, cartridge guide and ejector are all dovetailed into the upper part of the body, and the air tube is fixed in a groove there.

5. *The Safety Catch* is a small crank with a milled thumb-piece, which, when placed in the "safe" position bears against the face of the hammer and prevents the hammer from flying forward even if the trigger is pressed.

(c) *Handle.*

This is pistol-shaped, and is bored to take the hammer and hammer spring.

The trigger and sear, attached to the lower part of the handle by a pin, are held by a spring in a groove in the forward part of the hammer and retain it in position.

2. THE MOVING PORTIONS are :—

- (a) Gas lever.
- (b) Gas lever connection.
- (c) Retracting connection.
- (d) Retractors.
- (e) Slide.
- (f) Carrier.
- (g) Trip.

- (h) Bolt.  
(i) Hammer.

(a) Gas Lever, is of solid steel, with a slotted arm, and is hollowed to receive the piston, which is attached to it by a pin and split pin.

It has the gas lever pin on the right for operating the lever by hand, and a stud on the left, against which the arm on the cocking attachment bears. It is attached to the bracket fork by the bracket pin, and the gas lever connection is hinged to it at the centre.

(b) The Gas Lever connection is about 10 inches long, and is bored at each end for connection to the gas lever and the slide.

(c) The Retracting Connection lies under the barrel, and is connected by a long and short link to the gas lever, and by a T head to the retractor followers.

(d) The Retracting Springs consist of right and left tubes, fitted with springs, followers and screws. A stud is fitted to the forward end of each tube, to fit into the recesses in the bracket.

(e) The Slide is 12 inches long, and is joined to the gas lever connection by the slide pin.

A lug is placed at the front end for this purpose, slotted to receive the connection, and drilled to take the slide pin.

Two projections are placed on the right side to actuate the feed lever, and at the rear end

the cartridge extractor, which is held up by a spiral spring, is pivoted on a pin.

It is grooved through the greater part of its length to allow the carrier to travel, and has a tongue to prevent the cartridge from slipping back. On the right of the groove is the cartridge guide.

A hollow is cut in the rear, in which the carrier dog works.

It is grooved on the left side to take the stud on the trip.

A deep slot, in which the lug on the bolt lies, is cut in the rear lug, which is also drilled to take the bolt pin.

(f) The Carrier is slotted to allow the cartridge extractor to travel, and has on it a dog, which is actuated by a plunger and spring. It is attached to the receiver by the carrier pin.

(g) The Trip is a flat piece of steel about 6 inches long fitted with three studs, of which the forward stud moves in a groove on the slide, whilst the middle one acts as a pivot, and the rear one depresses the sear, when the slide reaches its forward position.

(h) The Bolt has on the left side a lug which guides the bolt to the chamber, and also supports the base of the cartridge.

The left side is cut away to allow the bolt to clear the ejector.

On the right side is the extractor with spring and pin.

The lug on the fore end of the bolt acts as a guide in conveying the cartridge from the carrier to the chamber.

The lug at the rear end has a kidney-shaped slot, in which the bolt pin works, and the small lug at the extreme rear compresses the hammer spring.

The bolt is drilled throughout its length to take the firing pin and spring. The firing pin is held in position by a stop pin, which lies in a curved recess in the firing pin.

(i) *The Hammer* is grooved to take the sear and trigger and is actuated by a strong spiral spring.

## II.

### Mechanism.

With gun on tripod, using dummies :—

#### 1. How to Load :—

Pass tag of belt through gun from left to right, giving belt a sharp upward and forward tug to the right, placing the live round on the belt feed wheel.

Pull the cocking attachment sharply to rear, thus through the slide withdrawing the live round from the belt on the belt feed wheel.

Release cocking attachment.

The cartridge is now placed in the breech ready for firing.

#### 2. How to Fire.

(a) On pressing the trigger the gun fires.

(b) When the pressure is released the gun stops in a fully loaded state (*i.e.*, live round in breech and one in belt on belt feed wheel).

NOTE.—Work the gas lever and note the action on the retracting springs and the slide.

#### 3. How to Unload.

Now remove the barrel so as to see more clearly the moving portions, and note that when the gun is fired no action takes place in the mechanism until the bullet has passed the gas vent hole. Then a portion of the powder gases, entering the vent hole, expands in the gas cylinder on the piston, *forcing the gas lever downwards and backwards*.

Motion of the gas lever :—

(1) Through the gas lever connection : *drives back the slide and the bolt.*

(2) Through the retracting connection : *compresses the retracting springs.*

When the action of the gases is expended, the gas lever being fully back, the retracting springs come into play, and (1) carry the gas lever back to its original position, and (2) the gas lever through its connection brings back the slide and the bolt.

Action when first shot is fired as explained

*Slide is driven back* : in its backward movement it—

(1) Withdraws, by means of the cartridge extractor, the live round from belt and places it on the carrier.

(2) Carries back, by means of front lug, on right side, the feed lever which works the ratchet lever and causes the pawl to engage behind tooth of belt feed wheel (ready to feed up the next cartridge on return of slide).

(3) Carries back the bolt which :—

(a) Extracts the cartridge from the chamber.

(b) Ejects it through ejection slot.

(c) Cocks the hammer by means of rear lug on bolt pressing back the hammer into the handle, where it is engaged by the sear.

NOTE.—When the different actions governed by the slide are thoroughly understood, the gun should be stripped, and, by placing certain portions together, each action can be clearly seen.

Retracting springs now come into play, and through the gas lever *the slide is brought forward.*

In its forward movement the slide—

(1) Raises the carrier so that the cartridge is placed opposite the breech.

(2) Draws forward feed lever by means of the rear lug on the right side, thus turning belt feed wheel and feeding the next cartridge into position.

(3) Carries the bolt with it, placing the cartridge in the chamber and locking the bolt in the receiver.

(4) Raises front end of trip by means of the shoulder of the groove on left side, thus depressing the sear and firing the cartridge.

### III.

#### Stripping.

Attach gun to mounting.

To remove the barrel :—

1. Pull back the cocking attachment and fix it in hook.

2. Draw down the barrel lock.

3. Release the gas clamp.

4. Unscrew the barrel, by means of the combination wrench, and remove.

To re-assemble :—

1. Screw in the barrel.

2. Replace the barrel lock.

3. Tighten the gas clamp.

4. Release the cocking attachment, and press trigger.

To strip the gun :—

1. Remove handle lock and handle.

(The gun may be cocked in order to get out handle with hammer and hammer spring complete.)

Then place gun on its right side on two ammunition boxes or blocks of wood.

2. Side-plate screws.

3. Remove left side plate.

4. Remove trip.

Turn the gun over.

5. Right side plate.

6. Safety catch.

Turn gun on to barrel.

7. Remove slide pin.

8. Bottom plate.

9. Retracting springs.
10. Bracket pin, gas lever, and connections.  
Push the slide back :
11. Push out from right to left (a) bolt pin,  
(b) carrier pin.
12. Remove carrier.
13. Bolt.
14. Unscrew and remove belt guide.
15. Withdraw slide.
16. Release barrel lock and gas clamp, and
17. Remove the barrel, and slide off the  
gas cylinder and bracket from the barrel.

To re-assemble the gun :—

1. Replace gas cylinder and bracket on the  
barrel.
2. Screw barrel to the receiver (see that  
marks on barrel and receiver are aligned).  
Rest the gun on barrel.
3. Barrel lock.
4. Insert slide, and push it to the rear.
5. Replace belt guide and screws.
6. Bolt and bolt pin.  
Push slide forward :
7. Carrier and carrier pin.
8. Gas lever and connections.
9. Bracket pin.
10. Retracting springs (insert at an angle  
of 45°, with screws in tubes away from the  
barrel).
11. Bottom plate.  
Push slide back ; lay gun on left side :
12. Safety catch.

13. Right side plate (see that feed lever is  
between the lugs on the slide).  
Turn gun on its right side :
14. Trip.  
Now test slide mechanism.
15. Slide pin (insert either by pulling slide  
forward, or by drawing down the gas lever).
16. Left side plate and side plate screws.  
(Front side plate screw inserted first.)
17. Handle and handle lock.  
Test the working of the gun by pulling back  
the cocking attachment, letting it go, and  
pressing the trigger.

To remove the bolt :—

1. Pull back cocking attachment, and hook  
back.
2. Remove handle lock and handle.
3. Push out bolt pin to the left (take up  
some of the tension by pulling back cocking  
attachment a little farther. The bolt pin  
need not be pushed entirely out of the  
receiver).
4. Remove bolt.

To re-assemble :—

1. Bolt.
2. Bolt pin.
3. Release cocking attachment.
4. Handle, and handle lock.
5. Press trigger.

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