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“MUSKETRY”

FOR THE
BATTALION

WITH
SPECIAL REFERENCE
TO THE

“Mark III, Ross Rifle”

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Musketry for the Battalion.

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PREFACE.

Musketry is one of the most interesting and one of the most important subjects which can be taught to Officers, N. C. O.'s and men. It is doubly interesting when the instruction is properly systematized and carried out in easy and progressive stages.

These pages have been written with the object of providing in a condensed form the knowledge which should be acquired by every N. C. O. and man on the establishment of an Overseas Battalion of the Canadian Expeditionary Forces, and is based upon the curriculum as laid down at the Canadian School of Musketry at Ottawa. In them an endeavor has been made to carry the recruit forward by easy and interesting stages through a course which, if followed in a thorough and painstaking manner, and sufficient practice given in rapid loading and unloading with dummy cartridges, and in rapid aiming and firing with Target Index Rods, should develop every N. C. O. and man on the establishment of an Overseas Battalion into a first class shot or marksman, before a single round of Service Ammunition is fired on the outdoor ranges with the Mark III. Ross Rifle.

The various stages through which the recruit should be carried are arranged as follows:—

1. Care of Arms.
2. Theory of Rifle Fire.
3. Aiming and Firing Instruction.
4. Visual Training and Judging Distance.
5. Fire Direction and Control.
6. Range Practices.

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Chapter I.

CARE OF ARMS

Care of Arms includes:—

- A. A description of the Mark III. Ross Rifle.
- B. Action of the mechanism.
- C. Care and cleaning.
- D. Small arms ammunition, Mark VI. and Mark VII.

Chapter I.—Continued
DESCRIPTION OF RIFLE.

The Mark III. Ross Rifle is 50½ inches long, and weighs 9½ lbs. It is a multiple loader rifle, with a straight pull bolt action, and fires the British S. A. .303 ammunition.

For descriptive purposes it is divided into four parts, as follows:—

1. **The Stock**, comprising all the wooden part seen except that part above the barrel which is called the hand-guard. It is in one piece of Italian walnut, hollowed out to receive the barrel, the mechanism, the oil bottle and pull-through.

2. **The Barrel**, which is 30½ inches long, is of forged steel, bored to .303 diameter, and then rifled with four grooves, having one spiral turn in 10 inches. The bore, including the rifling, is .311 diameter.

The barrel is screwed into the receiver at the breech by right hand machine threads, and held in position on the stock by the lower and upper bands.

3. **The Receiver**, as its name implies, receives and retains the three operating parts of the rifle, (1) the bolt, (2) the trigger action, and (3) the magazine. The Receiver comprises all that steel part of the rifle in rear of the barrel, and is secured to the stock by the front and rear receiver screws.

4. **The Bolt**—that portion of the mechanism which opens and closes the breech. It is divided into two main parts, the bolt and the bolt sleeve.

After the magazine has been loaded from a charger the bolt, on being pushed forward, pushes a cartridge ahead of it into the chamber, loading the rifle and cocking it, and (after the explosion of the cartridge) on being withdrawn brings the fired case with it until it reaches the ejector, when it is thrown out to the right.

To entirely remove the bolt from the Receiver, put down the bolt stop to the second (or horizontal) position, and withdraw the bolt to the rear.

To insert the bolt in the Receiver see that the lugs of the bolt head are in a horizontal position, the bolt stop in the second position, and that the grooves on the sides of the bolt sleeve fit into the guide rails of the Receiver

ACTION OF THE MECHANISM.

This should be explained in detail by first withdrawing the bolt and explaining its construction, and

Chapter I.—Continued

the names of its different parts, including the spirals on the bolt and bolt sleeve, the firing pin, cocking piece, extractor, ejector, the resisting shoulders of the receiver, the bolt unlocking pin, the sear and safety pawl of the trigger action.

LOADING ACTION.

After charging the magazine, on pushing forward the bolt it takes with it the uppermost cartridge in the magazine, pushing it clear of the Magazine Retainer Springs, the nose of the bullet being guided into the chamber of the Receiver by the bullet guide-way. When the cartridge has been pushed forward sufficiently its base rises up to the bolt head, against which it is tightly held by the claw of the Extractor, and when the lugs of the bolt head come opposite the resisting shoulders of the receiver the bolt unlocking pin comes in contact with the cam on the bolt head, turning the latter over sufficiently to release the locking spirals of the bolt sleeve, and the bent of the cocking piece at the same time engages with the nose of the sear. On further pushing forward the bolt sleeve, the bolt head revolves into the resisting shoulders by the action of the spirals on the bolt and bolt sleeve. The cocking piece, and with it the firing pin, is held back by the sear, thereby keeping the main spring compressed. The rifle is now cocked and ready for firing.

FIRING ACTION.

On taking up the first pressure on the trigger, equal to about two pounds, the first point of engagement on the trigger bears upon the sear, causing it to rotate, thus lowering the nose of the sear down the bent of the cocking piece.

On taking the second pressure on the trigger, equal to a further three pounds, the second point of engagement further rotates the sear, bringing its nose clear of the bent of the cocking piece, thus allowing it, and with it the firing pin, to fly forward under the action of the mainspring, the firing pin striking the cap of the cartridge and exploding it.

The rotation of the sear through the action of the trigger also raises the safety pawl behind the lugs on the bolt sleeve, thus preventing the sleeve or bolt being blown back so long as the trigger is held.

Chapter I.—Continued

UNLOADING ACTION.

On drawing back the bolt sleeve, the cocking piece and firing pin are brought back with it while the bolt remains forward, thus compressing the mainspring between the collar of the retreating firing pin and the mainspring retainer on the momentarily stationary bolt, but the spirals on the sleeve acting upon the spirals of the bolt cause it to rotate from left to right until the bolt lugs are clear of the resisting shoulders of the receiver, when the bolt head is free to come back out of the breech.

Since the lugs of the bolt head are cut to a screw pitch, this rotation of the bolt head causes it to recede very slightly, but enough to loosen the fired case and start it from the chamber, thus effecting primary extraction.

As the bolt head becomes unseated from the resisting shoulders, the short spirals of the bolt and sleeve engage and hold the bolt head extended from the sleeve against the pressure of the compressed mainspring. On further drawing back the bolt sleeve the bolt comes with it to the rear, bringing with it the fired case, which is still held fast to the bolt head by the claw of the extractor, until it reaches the ejector on the left of the receiver, which, passing through the slot in the bolt head, comes in contact with the rim of the fired case and kicks it out of the rifle to the right.

CARE AND CLEANING.

The rifle should never be used for any other purpose than that for which it is made, viz.: For shooting, for rifle exercises, and for bayonet fighting.

It should never be used for carrying weights

It should never be used for a seat or as a prop.

It should never be used as a hammer or for peg driving.

The muzzle should never be plugged, nor the browning removed, nor should any gritty or abrasive substance be used in cleaning. Never use the wire gauze on the pull-through except by permission of the company, platoon or section commander after his inspection.

Wear in the bore of a rifle is due to three causes, viz.:

1. The friction of the bullet.
2. Heat generated when the ammunition is fired.

Chapter I.—Continued

3. An excessive use of wire gauze on the pull-through.

When a rifle barrel is new the interior of the bore carries a high polish, and so long as this is retained it is a safeguard against rust and metallic fouling.

Rust is not fouling, but a result of fouling or carelessness in cleaning.

Fouling is of two kinds, Superficial and Internal.

Superficial Fouling is caused by the solid products of the explosion being deposited in the bore of the rifle, and may be removed by flannelette and the pull-through oiled and dried alternately.

Metallic Fouling or Nickelling is a Superficial fouling caused by a portion of the nickel jacket of the bullet adhering to the bore of the rifle in its passage through it.

In the Mark III. Ross Rifle its first appearance is usually near the muzzle at the foresight sleeve, and may be observed as small specks of white on the lands.

The soldier should not attempt to remove this himself, but should turn in the rifle to the Armourer, who will treat this with a chemical solution of nickel solvent.

Internal Fouling cannot be seen. It is caused by the forces of explosion driving the gases into the pores of the rifle. This kind of fouling can only be removed by the use of boiling water, which causes the steel of the barrel to expand, opening up the pores and allowing the imprisoned gases to escape.

The first application of the boiling water does not remove all the imprisoned gases, and these exude for a period of three days after firing, and cause sweating of the bore, which must be removed daily by a piece of dry flannelette until it comes through clean.

In Daily Cleaning wipe the outside of the rifle and the mechanism dry and clean and free from dust, and oil well with the Russian petroleum, which will be issued.

In Weekly Cleaning clean the bore of the rifle rag-clean, wipe off the outside and mechanism, and re-oil inside and out

Cleaning before Firing—Wipe out the bore perfectly dry, clean off all surplus oil from the mechan-

Chapter I—Continued

ism, especially the bolt head. Oil in the barrel causes erratic shooting.

Cleaning after Firing—After Wiping out the bore use boiling water whenever possible, pouring 2 or 3 quarts through the bore, using a proper funnel; thoroughly dry out and re-oil inside and out; wipe out the bore and re-oil it daily for three consecutive days after firing.

AMMUNITION.

Small Arms Ammunition, usually abbreviated to "S. A. A.," is of two kinds, known as Mark VI. and Mark VII. They are distinguishable by the shape of the bullet, Mark VI having a blunt nose and Mark VII. a pointed nose.

The weight, size and composition of each is given below for comparison:—

Bullet	Mark VI.	Mark VII.
Shape	Blunt nose.	Pointed nose.
Length and diameter	1.25 in., dia. .303, base .311.	1.28 in., dia. .303, base .311.
Weight	Bullet 215 grs. Cartridge 415 grs.	Bullet 174 grs. Cartridge 382 grs.
Composition	Solid lead core, with n'kel jacket	Alum. cap, lead core, n'kel jacket
Charge	31 grs. of cordite in 60 strands.	38 grs. of cordite in 40 tubes.
Muzzle Velocity	2,100 ft. per sec.	2,500 ft. per sec.
Rotation or Spin	2,500 revolutions per second.	3,000 revolutions per second.
Cartridge Case	Solid drawn brass	Solid drawn brass

The cap charge is the same for both, and is composed of Fulminate of Mercury, Flour of Sulphur and Meal Powder to form a paste

The cordite charge is composed of 58% nitroglycerine, 37% gun-cotton, and 5% glycerine, with a waxed cardboard wad to form a tight padding between the cordite and the bullet.

The base of the bullet is made .311 in diameter to fit the spiral grooves of the rifling, so that the bullet fits tightly into the bore and grooves of the rifle in its passage through the barrel.

Chapter I—Continued

The rifling imparting a spin to the bullet permits an elongated bullet to be used, the spin of the bullet keeping it in an horizontal position in its flight through the air, with its nose always pointed to the target, the elongated bullet having great weight in proportion to its surface exposed to air resistance.

Inspection of arms on parade is for the purpose of testing the cleanliness and condition of the rifle.

The following points will be looked for during a thorough inspection when taking over small arms:

1. That no part of the rifle and equipment is missing, by comparing it with the Indent.
2. Examine the exterior for damage to stock and browning.
3. Examine the interior of the bore and mechanism for rust, cuts, worn parts or abrasions.
4. Examine the exterior for absence of screws, defects, or damage to the foresight, rearsight, bolt stop and butt trap.
5. Test for the correct and easy working of the magazine platform, retainer springs, trigger, main-spring, firing pin, cocking piece, bolt sleeve, safety catch, extractor, ejector, and elevating and windage screws of rear sight.

Chapter II.

THEORY OF RIFLE FIRE

In discussing the Theory of Rifle Fire instructors should always remember that the most lasting impressions are conveyed to the mind through the eye, and blackboard diagrams should be used on every possible occasion in order to clearly demonstrate any point to be made.

As Musketry is not drill, and its aim is the development of will power, control of the muscles and coolness of nerve when under fire, every effort should be directed to make the soldier thoroughly familiar with the effectiveness of the weapon in his hands, practically and theoretically. He should be encouraged to ask questions, think for himself, and act upon his own initiative.

In teaching Musketry, instructors should,

Firstly—Explain.

Secondly—Demonstrate.

Thirdly—Have the soldier imitate, correcting faults.

Chapter II.—Continued

Lastly—Interrogate. Ask questions!

Not more than ten men should be allotted to each instructor, who will teach them individually and progressively, studying each man's build and temperament, making sure that each point is understood before proceeding to the next. Lectures or instruction in any one subject should not exceed 30 minutes.

Trajectory—Immediately the bullet leaves the muzzle of the rifle there are three forces acting upon it, as follows:—

1. The force of explosion driving it forward.
2. The force of gravity drawing it down to earth.
3. The resistance of the air impeding its progress.

These three forces combined cause the bullet to take a certain known path in its flight through the air, called the Trajectory

If the barrel of the rifle is held horizontally with the axis of the barrel pointed directly at a target 100 yards away, a Mark VI. bullet would drop $4\frac{1}{2}$ inches below the target.

At 200 yards the bullet would drop 20 inches below the target.

At 500 yards the bullet would drop 16 feet below the target.

At 1,000 yards the bullet would drop 144 feet below the target.

Giving Elevation means inclining the axis of the barrel as far above the target as the bullet would fall below it if the axis of the barrel was pointed directly at the target, so that if, using Mark VI. ammunition, the axis of the barrel must be pointing 20 inches, 16 feet and 144 feet above the target at 200, 500 and 1,000 yards respectively, in order to hit the target.

Sights are used on a rifle and are necessary in order to keep the target in view when the axis of the barrel is inclined to give the requisite elevation for the bullet to hit the target, and also to enable the firer to give the rifle exactly the desired elevation

In explaining the Theory of Rifle Fire and the Trajectory of the bullet, blackboard diagrams should be drawn to illustrate clearly why the bullet drops below the target when the axis of the barrel is directly in line with the target, and how elevation is given by depressing the butt instead of elevating the muzzle of the rifle, thereby keeping the target in view by the use of the sights.

Chapter II.—Continued

The rear sight attached to the Mark III. Ross Rifle contains three different and distinct sights, as follows:—

1. The Aperture Sight, which is used with the leaf raised; the aperture or peep is bored through the movable plate which is adjustable in height by the elevating screw and laterally by the windage screw behind the plate

2. The Battle Sight, which is used with the leaf down, is a fixed sight, not being movable in any direction. It is an aperture sight with the top cut away so that the target can be kept in view and a quick alignment made on it. It is adjusted for a point blank range at 600 yards when using Mark VII. ammunition. At shorter distances the aim must be taken below the target, conforming to the 600 yard trajectory, and wind allowance must be made by aiming off.

3. The Long Range Sight which forms the top portion of the leaf is an aperture sight, of which the top portion of the circle has been cut away. It gives approximately 60 minutes more elevation than the aperture sight in the plate. Using Mark VII. ammunition the following are approximately the variations between the aperture sight in the plate and the Long Range Sight:

With aperture sight set at 825 yards elevation, Long Range Sight gives 1,300 yards elevation.

With aperture sight set at 1,000 yards elevation, Long Range Sight gives 1,400 yards elevation.

With aperture sight set at 1,200 yards elevation, Long Range Sight gives 1,525 yards elevation.

NOTE.—The Long Range Sight should only be used for distances beyond the limit of elevation for the aperture sight.

On the front of the frame opposite the elevating screw of the sight are shown figures which represent hundreds of yards. Opposite the centre of each figure is a line cut in, and when the knife edge of the sliding plate touches the line in the centre of the figure the sight is then set for that particular range in hundreds of yards, but as there may be slight variations or errors in the adjustment of rifles and foresights, each individual rifle should be tested on the range separately and its error of range noted on the fine adjustment scale on the right hand side of the frame.

Chapter II.—Continued

"The Fine Adjustment Scale" on the right hand side of the frame is divided from zero to 9, each numeral representing 10 minutes of angle; thus the figure 2 means 20 minutes, and so on. Each of these divisions is again divided into five spaces, each of which represent two minutes of angle.

A Minute of Angle is the distance on the sight which it is necessary to adjust to make a difference of one inch on the target per 100 yards of range; that is to say, if the elevation was raised or lowered one division (two minutes) of the fine adjustment scale, it would correspondingly raise or lower the elevation on the target two inches at 100 yards, four inches at 200 yards, twelve inches at 600 yards, and so on. To make this adjustment correctly the line cut in on the centre of the slide is to be brought into line with the desired minute of elevation.

"The Vernier Scale," sometimes called the wind-age scale, works in a similar manner, and the adjustment of one minute on the scale means a corresponding lateral adjustment of one inch on the target per 100 yards of range, so that if shooting at the 500 yard range an adjustment of one minute on the scale would mean a corresponding lateral alteration of five inches on the target.

The scale on the sliding plate is divided into six spaces, and the fixed plate into five spaces, on each side of the aperture or zero mark. When the first division of the sliding plate is moved opposite the first division of the fixed plate this represents a movement of one minute of angle on the scale and a lateral movement of one inch per 100 yards of range on the target, and when the second and third divisions of the fixed and moving plates coincide two and three minutes of angle respectively are represented, and so on, a movement of five minutes bringing the larger divisions opposite to each other.

It must always be remembered that the aperture or peep is to be moved over to that side on which it is desired that the next shot shall go on the target, or, in other words, move the back sight into the wind.

Chapter III.

AIMING AND FIRING INSTRUCTION

The first lesson in Aiming Instruction should take the form of blackboard diagrams illustrating what the recruit will see when looking through the back sight and aiming at a bull's-eye target with

(a) open sights,

Chapter III.—Continued

(b) aperture sights,

(c) battle sights,

and demonstrating a full or correct sight, a half sight, and a fine sight, and the difference these will make on the result of a shot at different ranges, viz.: three inches per 100 yards with a half sight, and five inches per 100 yards with a fine sight when using Mark VI. ammunition; also explaining why it is easier for a recruit to maintain a correct aim with the aperture sight than that with the open sight.

Demonstrate the effect of canting the rifle and show why the shot will drop low and to the side on which the rifle is canted.

The rules for aiming are as follows:

1. To keep the backsight plumb.
2. To close the left eye.
3. To aim at six o'clock on the target, keeping the foresight centred and in the open sight level with the shoulders of the "V" or "U."
4. To restrain the breathing while pressing the trigger.

The common faults in aiming are:—

1. Taking too much or too little foresight in the "U" or "V" of the backsight
2. Inaccurate centering of the foresight in the back sight.
3. Canting the rifle.
4. Focussing the eye on the foresight instead of on the target.

After the principles of aiming are thoroughly understood by the recruit, he will be shown a correct aim by aligning a rifle supported by a tripod and sand bag on a bull's-eye target, afterwards displacing the rifle and having the recruit re-align it on the target, and correcting any faults which may be observed.

To test the proficiency of the recruit in aiming and to demonstrate the errors which arise from inaccurate and inconsistent aiming, the triangle of error will be employed.

The instructor will align a rifle, which is supported upon a tripod, on an aiming disc held by the marker against a piece of white paper 30 feet from the muzzle of the rifle.

After the recruit has been shown the instructor's aim, the point will be marked, the aiming disc removed, and the rifle left undisturbed. The marker

Chapter III.—Continued

will readjust the aiming disc to the directions of the recruit, who will reproduce the aim shown him by the instructor three times; these three points will be joined, forming a triangle of error, the sides of the triangle representing the inconsistency of aim and their relation to the original aim of the instructor showing accuracy of aim.

If the centre of the triangle is more than one-third of an inch from the instructor's aim, or any side of the triangle exceeds one-third of an inch, the recruit will be set back for further instruction.

Elementary Firing Instruction may be subdivided as follows:—

1. Trigger pressing from a rest.
2. Firing positions, demonstration and explanation.
3. Aiming positions from behind cover.
4. Snapping from a rest. (Aiming and pressing the trigger.)
5. Rapid loading and unloading, using dummy cartridges.
6. Rapid adjustment of sights.
7. Muscle exercises.

Before the recruit is permitted to practice snapping he will be taught the correct way of pressing the trigger, after the instructor is satisfied that he can move the trigger finger independently of the remainder of his hand or arm.

The double pull-off will be explained, and he will be taught to press the trigger evenly with a squeezing motion of the whole hand, avoiding any jerky movement, the first point of the forefinger being placed around the lower part of the trigger to increase the leverage.

His ability to press the trigger correctly will be tested by aligning a cocked rifle, resting on a sand bag, upon a mark, and have him press the trigger without disturbing the aim, and also by the use of the aiming disc held to the eye of the instructor.

Trigger pressing requires most careful individual instruction, during which the necessity for determination and strong personal effort will be impressed upon the mind of every recruit.

The correct firing positions will be taught for shooting from the standing, kneeling, sitting and prone positions, and instructors are referred to the points of the various positions noted and shown on

Chapter III.—Continued

Plates XIX. to XXXIII., Musketry Regulations, Part I., 1914. When these positions are being demonstrated the object and necessity for using the various positions will be pointed out, emphasizing the fact that the prone position is the normal position, and the one always to be used whenever possible. Special instruction should be given in aiming from the side and over cover to show how to make the best use of the rifle, at the same time giving the least possible exposure of the body of the firer.

Snapping practices will be carried out by squads taking aim at a target in the various firing positions and pressing the trigger, using dummy cartridges. Target Index Rods will also be used for this purpose when available.

In practising rapid loading and unloading with dummy cartridges, special precautions will be taken to ensure that neither ball or blank ammunition is taken to the parade ground. Instructors will personally examine all cartridges, rifles, pouches and bandoliers before loading takes place.

A few minutes daily should be given to rapid loading and unloading and rapid aim and firing.

The standard time for loading and unloading is six chargers in 60 seconds, and a recruit should be able to load and fire ten well-aimed shots in a minute charger loading.

Frequent practice should be carried out in the rapid adjustment of sights, using both the elevation given in yards and the fine adjustment scale, and also the Vernier or windage scale. The standard time for rapid adjustment of sights is four seconds.

To accustom the muscles to the strain of prolonged firing, muscle exercises as laid down in Section 54, Musketry Regulations, Part I., 1914, pages 105 and 106 will be carried out as frequently as possible, and combined with the teaching of the different firing positions.

In the advanced stages of aiming instruction, the eyesight must be gradually trained in aiming at figures or other service targets, and at the ground which might conceal an enemy.

Practice will be given in marking down an enemy, aiming off for wind and movement, and aiming up and down. Instructors are referred to pages 90 to 93 in Musketry Regulations, Part I., 1914.

As the force of gravity has its greatest effect

Chapter III.—Continued

when firing over level ground, less elevation is required when firing up or down hill. When a wind is blowing from behind the firer less elevation is required, and, vice versa, more elevation is required if the wind is blowing from the front. For side or cross winds the following allowances may be made when using Mark VI. ammunition:—

	500 yd.	1000 yd.	1500 yd.
Strength of wind	Range.	Range.	Range.
Gentle (10 miles per hour)....	2 ft.	9 ft.	18 ft.
Fresh (20 " " " ")....	4 ft.	18 ft.	36 ft.
Gale (30 " " " ")....	6 ft.	27 ft.	54 ft.

When using Mark VII ammunition these allowances may be reduced one-third.

For diagonally oblique winds these allowances may be reduced by one-half.

In aiming off for movement at ranges up to and including 500 yards, aim should be taken in front of the target, as follows:—

For a single man walking....	1 ft.	per 100 yds.	of range		
" " " doubling....	2 ft.	"	"	"	"
" horseman trotting....	3 ft.	"	"	"	"
" horseman galloping....	4 ft.	"	"	"	"

Aim should always be taken at the ground line at a moving or a stationary target, and at the front of a body of troops who are moving across the front to a flank.

Chapter IV

VISUAL TRAINING AND JUDGING DISTANCE

Visual training of soldiers and practice in judging distances can only be carried out successfully in the field.

The first lesson should be arranged to familiarize the men with the appearance of the human figure at ranges from 200 to 800 yards by stationing fatigue men at known distances and noting the outline of the human figure in the standing, kneeling and prone positions, noting the visibility of features, outline of shoulders, movement of legs and colour of clothes, etc, and comparing their appearance in relation to the height of the foresight and the bore of the rifle, and also by encouraging the powers of observation and keenness of vision by placing a known number of men in various positions and degrees of visibility dotted about within a radius of 300 yards, within

Chapter IV.—Continued

the field of vision, and having the recruits count them, the errors of the men being noted.

Tests in judging distances will be carried out by placing the recruits at some previously selected point and having each man estimate the distance to four separate objects in the landscape which will be pointed out, the actual distances having been previously ascertained by the instructor by the use of the Marindan Range Finder, or actual measurement, these distances not to be less than 200 yards or more than 1,400 yards. It is especially important that all men should be able to judge accurately distances up to 600 yards.

Four objects will be taken, two of them marked by fatigue men, who will fire blank ammunition giving off smoke to enable the men to estimate the distance by noting the time taken by the sound to travel after the smoke appears, explaining beforehand that if the men can count eleven beats correctly in three seconds, each beat between seeing the smoke and hearing the sound of the shot will represent a distance of 100 yards travelled by the sound, and will be a reliable check on the estimate of the distance.

Each man's estimate of the distance to each object should be taken down silently, and without prompting or coaching, and the percentage of error tabulated and filed so as to show the improvement after repeated practices.

In each practice of distance judging, local influences which may affect the apparent distance of the object will be explained to the men, and why the objects are likely to be under or over estimated. Instructors are referred to Paragraph 315, Section 67, page 125, Musketry Regulations, Part I., 1914 for this.

Aids to judging distance will also be explained, such as the lateral angle or jump of the eye, the foresight of the rifle, the barrel or bore of the rifle, and how distances may be estimated by making a maximum and a minimum estimate, and taking the mean, or by dividing the distance and estimating the half distance first.

Too much time should not be allowed for estimating after the position of the object is clearly seen; rough guesses should not be permitted, and every man should be able to give a substantial reason for arriving at his estimate.

Chapter IV.—Continued

Estimates should not be finer than a multiple of 50 yards.

Landscape targets are a very useful aid in teaching the recognition of targets, military vocabulary, and in explaining the meaning of military definitions.

If dummy figures drawn to the same scale are supplied with the targets, good practice may be obtained indoors in the development of quick and keen observation.

Training in observation and description may be carried out by having the squad of recruits study the landscape target for a few minutes, then turn their backs upon it and each man of the squad in turn give the description and position of some object he has noticed.

Landscape targets may also be employed very successfully in miniature range practices for shot grouping and collective fire if an outline target is placed directly above the coloured target with the aim taken on the coloured target and the elevation of the rifle raised so that the bullets strike the outline target above it.

Chapter V.

FIRE DIRECTION AND CONTROL

When recruits have profited sufficiently by the lessons of aiming and firing instruction, and the recognition of objects on landscape targets, they will be practised in moving in extended order as laid down in the Manual of Infantry Training. Targets of various kinds will be pointed out in the landscape at different ranges. Instructors will describe the targets in the most concise language possible, but so that there can be no misunderstanding as to the object referred to.

The clock method, and the clock and finger method will be used to describe targets which have no definite distinguishing mark, such as a fold in the ground or a small target which may be hidden from view or indecipherable without the aid of field glasses.

For definite targets in giving fire commands the following order will be followed:—

1. At (range) 500! (the word "yards" to be omitted.
2. At (object) The White House!
3. Rapid (or Deliberate) Fire!
4. Cease Fire! Unload!

Chapter V.—Continued

For indefinite targets:

1. At (range) 600!
2. The White House! Right! Four Fingers!
Four O'clock!
3. Five Rounds—Rapid (or Deliberate) Fire!
4. Cease Fire! Unload! (or Rest!)

The standing, kneeling or sitting positions will only be practised in conditions suitable to their employment.

Magazines will be emptied, springs eased, and the safety catch applied on all occasions except when actually firing, or when the commands "Rest" or "Cease Fire" is given without the command "Unload."

The importance of fire discipline must be fully explained to recruits showing that this demands the following qualities in the man:—

1. Strict attention to signals and orders of the Commander, combined with intelligent observation of the enemy.
2. Careful adjustment of the sights. Economy of ammunition and prompt cessation of fire when ordered, or when the target disappears.
3. Power to endure the enemy's fire when no reply is possible.
4. A cool and intelligent use of the rifle when the Commander can no longer exercise control.

In addition to the above, men must be trained according to the following rules:—

1. Never to fire except at a definite target.
2. To press the trigger only after a careful aim is taken, and to avoid wild shooting.
3. Not to sacrifice accuracy for speed in rapid firing.
4. To pass along fire orders carefully and accurately.
5. To make use of cover, first so as to make the best use of his rifle, and secondly, for concealment and protection, always keeping his eye on the enemy between shots.
6. To open fire smartly when ordered, watch the front, and remain alert and attentive to orders.
7. In individual fire on the defensive mark down the enemy, and open fire immediately they expose themselves.

In order that recruits may have an intelligent understanding of the necessity for controlled and

Chapter V.—Continued

collective fire, especially at the longer ranges, short lectures will be given with blackboard diagrams showing the dispersion of shots and shot groups made by expert marksmen, and the resulting cone of fire caused by these shots. The instructors are referred to Plates XII. to XIV., Musketry Regulations, Part I., 1914.

A full explanation of the cone of fire caused by a number of rifles fired at the same target to be given with blackboard diagrams showing the trajectory of the bullet at various ranges and its effect upon the dangerous space, beaten zone, and the zone of effective fire, and instructors are referred to Plate XVI., Musketry Regulations, Part I., 1914.

The height of the trajectories for Mark VII. ammunition are as follows, and the culminating point is approximately at 60 per cent. of the range:—

At 500 yds.	2.3 ft.	Culminating point at about	300 yds.
“ 600 “	3.8 “	“ “ “	350 “
“ 700 “	6.1 “	“ “ “	400 “
“ 800 “	8.9 “	“ “ “	500 “
“ 900 “	12.8 “	“ “ “	550 “
“ 1000 “	17.8 “	“ “ “	600 “

The zone of effective fire, which is the area of ground beaten by the best 75 per cent. of shots fired, with Mark VII. ammunition, may be taken as follows:—

At 500 yard range.....	300 yards deep and	7 feet wide
“ 1000 “ “	180 “ “ “	14 “ “
“ 1500 “ “	120 “ “ “	22 “ “

Blackboard illustrations should also be drawn to explain the contour of the ground in relation to fire effect, and how this increases or decreases the area of the zone of effective fire. Instructors are referred to Plate XVII., Musketry Regulations, Part I., 1914.

The importance of the correct estimation of ranges must be thoroughly understood, especially on rising ground at long ranges, owing to the rapidly decreasing area of the zone of effective fire.

The definition of “searching fire” should be clearly explained, and the difference between collective fire, individual fire, and controlled fire; why and where combined sights are necessary, and why combined sights should not be employed by bodies of less than two platoons.

Chapter V.—Continued

A thorough explanation by means of blackboard diagrams should be given of "dead ground," showing how this may be made use of in attack, and how it could be eliminated in defence by enfilade fire.

Organization of Fire is the duty of higher Commanders, comprises reconnaissance and the issuing of orders regarding frontages and objectives, securing the co-operation of fire, including supporting fire by artillery, infantry and machine guns; in this way providing for the combined and simultaneous action of the whole force

Chapter VI.

RANGE PRACTICES

After recruits have received preliminary training in Care of Arms, Elementary Theory of Rifle Fire, Aiming and Firing Instruction, and practice in rapid loading and unloading, they will be given practice in actual shooting on the 25 or 30 yard ranges with gallery practice ammunition.

This will render them familiar with the discharge of the rifle and improve their trigger release under easy conditions.

When an allowance of 60 rounds of gallery practice ammunition and 50 rounds of service ammunition per man is available, the following programme of range practice may be carried out to advantage under the proper range discipline.

A separate record of each man's practice to be taken, so that the improvement in his shooting may be noted; backward shots to be given further practice under the individual supervision of competent instructors, who are referred to pages 144 to 150, Musketry Regulations, Part I., 1914, for guidance.

Should a soldier make consistently poor shooting, the following four tests will be applied in order to find out the reason:—

1. Rifle to be tested by a reliable marksman.
2. Aim to be tested by the Triangle of Error method.
3. Trigger pressing, the let-off tested by aiming disc or sub target machine.
4. Eyesight tested and nervous condition examined by the medical officer.

Chapter VI.—Continued

Programme of Gallery Practice on 25 or 30 Yard Range.—60 rounds per man Available.

First Day—

- 5 rounds grouping, prone position, rifle rested.
- 5 " application, prone position, rifle rested.
- 5 " grouping, prone position, rifle rested.

Second Day—

- 5 rounds grouping, prone position, without rest for rifle.
- 5 " application, prone position, without rest for rifle.
- 5 " snapshooting, prone position, rifle rested, 6 secs. exposure.

Third Day—

- 5 rounds grouping, prone position, without rest for rifle.
- 5 " application, kneeling behind cover, rifle rested.
- 5 " rapid, prone position, without rest for rifle, 40 secs. allowed.

Fourth Day—

- 5 rounds application, kneeling behind cover, rifle rested.
- 5 " snapshooting, kneeling behind cover, rifle rested, 6 seconds exposure.
- 5 " rapid, prone position, without rest for rifle, 30 seconds allowed.

Total..... 60 rounds per man.

In these practices no sighting shots will be allowed, and the scoring for group shooting will be as follows:

25	points	for	five	shots	within	a	1-inch	circle.
20	"	"	"	"	"	"	2-inch	"
15	"	"	"	"	"	"	3-inch	"
10	"	"	"	"	"	"	4-inch	"

Recruits making a score of less than 15 will be given further practice.

Chapter VI.—Continued

In the application practices the scoring will be as follows:—

- 4 points for a Bulls Eye.
- 3 points for an Inner.
- 2 points for a Magpie.
- 1 point for an Outer.

In the snapshooting practice each hit will count 3 points.

Programme of Range Practices, Using Service Ammunition on the Outdoor Range—50 Rounds per Man Available.

First Day—

- 5 rounds grouping, prone position, 200 yards, rifle rested, 2nd class target.
- 5 " application, prone position, 200 yards, rifle rested, 2nd class target.
- 5 " grouping, prone position, 200 yards, rifle rested, 2nd class target.

Second Day—

- 5 rounds grouping, prone position, 200 yards, no rifle rest, 2nd class target.
- 5 " application, prone position, 200 yards, no rifle rest, 2nd class target.
- 5 " snapshooting, prone position, 200 yards, rifle rested, 3rd class target.

Third Day—

- 5 rounds application, prone position, 200 yards, no rifle rest, 3rd class target.
- 5 " application, prone position, 500 yards, rifle rested, 2nd class target.
- 5 " application, kneeling behind cover, 500 yards, rifle rested, 2nd class target.
- 5 " rapid, prone position, 500 yards, no rifle rest, 2nd class target.

Total..... 50 rounds per man.

Chapter VI.—Continued

The scoring for grouping practices in this programme will be as follows:—

25	points	for	five	shots	within	a	4-inch	circle.
20	"	"	"	"	"	"	8-inch	"
15	"	"	"	"	"	"	12-inch	"
10	"	"	four	shots	"	"	12-inch	ring and one wide shot.

In application practices:

Bulls Eye	score	4
Inners	"	3
Magpies	"	2
Outers	"	1

In snapshooting each shot on the target will count 3.

100 yard, 300 yard and 400 yard targets will substitute the 200 yard targets, if these ranges are available, and, when possible, figure targets will be used for all ranges after 200 yards, and silhouette targets for snapshooting.

RANGE DISCIPLINE

To minimize danger, strict discipline must be enforced by an officer at all range practices, as follows:—

1. The muzzles of all rifles at the Firing Point must be kept pointed towards the target.

2. No rifle to be loaded except on the word of command, and only when all men are in position at the firing point.

3. All magazines to be emptied on the command "Unload."

4. All unexpended ammunition to be collected before the men leave the Firing Point.

5. Absolute protection to be given to markers at all times.

6. All rifles to be inspected before the men leave the firing point.

7. "Cease Fire" to be given immediately if a marker becomes exposed or the danger signal is shown from the Butts.

8. Dummy cartridges never to be carried on to the Range.

APPENDIX I.

Progressive Half Hour Lessons.

Lesson No. 1—Care of Arms.

A short description of the Rifle, names of the different parts and their operation. Methods of loading, by magazine and single shot. The differences between the Mark II. and Mark III. "Ross" and between the Lee Enfield and the Ross Rifles. The operation of loading and unloading to be fully demonstrated with chargers of dummy cartridges.

Lesson No. 2—"Elementary Theory."

Describe the forces acting on a bullet. Show by a diagram on the blackboard the path of a bullet through the air and the drop of a bullet (force of gravity) at 100, 200, 500 and 1,000 yards. The reason for sights and a full explanation of the Mark III. Ross Aperture sight, including the battle sight and long range sight. Minutes of angle and the effect of its adjustment on the target at ranges from 100 to 1,000 yards. The squad to demonstrate their ability to adjust the elevating screw to any given range or minute of angle. (Vernier wind gauge scale omitted for a future lesson.)

Lesson No. 3—Care of Arms.

The general care of the rifle, purposes for which a rifle must not be used. The daily cleaning, description of cleaning materials. A practical demonstration of the use of the pull-through and gauze. Cleaning before and after firing. Parts to be specially attended to. Parts not to be polished. The three kinds of fouling and how to remove them and the necessity for keeping the rifle in a perfect condition for immediate use on Active Service.

Lesson No. 4—"Elementary Theory."

Aiming instruction. Show by a blackboard diagram the difference between a "Full" or correct sight, a "Half" sight and a "Fine" sight, and their effect on the strike of the bullet on the target at different ranges. The effect of canting the rifle. Common faults in aiming and their effect on the recruit's shooting. Demonstrate a correct aim by aligning a rifle, supported on a tripod, at a paper bull's eye target and see that each recruit understands it.

Lesson No. 5—Care of Arms.

Mechanism. The three operating parts of the rifle, bolt, trigger-action and magazine. A full description of the operation of each, emphasizing the necessity for keeping all the operating parts well oiled, clean and free from grit, especially on Active Service. A short description of Mark VII. and Mark VI. S. A. A., muzzle velocity and how the spin of the bullet, caused by the rifling, keeps the nose of the bullet pointed towards the target.

Lesson No. 6—Firing Positions.

The correct loading and firing positions for **Standing, Sitting, Kneeling and Prone DEMONSTRATED.**

Recruits to be arranged in a semi-circle around the Instructor, taking aim at his eye; the Instructor correcting faults of position and aim, and combining the preliminary muscle exercises with Aiming Instructions.

Lesson No. 7—Care of Arms.

Repetition of the description of the rifle, combined with catechism to test the knowledge of the recruits in Lesson No. 1.

Lesson No. 8—Aiming Instructions.

Demonstrate the correct method of trigger pressing and combine this with aiming, aligning the rifle on a bull's-eye target, making sure that the recruit can press the trigger correctly without disturbing the aim of the rifle.

Lesson No. 9—Care of Arms.

Daily and weekly cleaning and the general care of the rifle. Purposes for which a rifle should not be used. Catechism to test the knowledge of the recruits in Lesson No. 3.

Lesson No. 10—Aiming Instructions.

The standing load position in progressive stages. (1) Correct standing load position. (2) Aiming position. (3) Trigger pressing, each recruit taking aim at the Instructor's eye and snapping, combined with muscle exercises.

Lesson No. 11—Care of Arms.

Mechanism, the three operating parts of the rifle, emphasizing the parts which require careful attention and daily cleaning. Catechism to test the knowledge of the men in Lesson No. 5.

Lesson No. 12—Theory of Rifle Fire.

Catechism to test the knowledge of the men in Lesson No. 2. Three forces acting on the bullet during its flight. The effect of wind. The reason for the wind gauge, or Vernier scale, and a full explanation of its operation.

Lesson No. 13—Care of Arms.

A catechism to test the knowledge of the recruits on the general care of the rifle, the names of the different parts, the reason for using, and the necessity for the elevating and windage scales, explaining the minutes of angle and their effect, vertically and laterally.

Lesson No. 14—Firing Instruction.

Loading and unloading practice. Charger loading, and firing well aimed shots at a bulls-eye target from the prone position, each man to give the point of aim when the trigger is pressed.

Lesson No. 15—Care of Arms.

The composition of Mark VII. S. A. A. and defects which may occur in ammunition. The care of S.A.A. and what each man should do with his ammunition when disabled on the field. What to do in supposititious cases of a jam in the rifle, or defective mechanism, or ammunition during range practice or when on Active Service.

Lesson No. 16—Firing Instruction.

Muscle exercises. Charger loading and unloading. Firing practice at a bulls-eye target from the prone position, using dummy cartridges. Correcting faulty positions and seeing that the men declare their point of aim when pressing the trigger.

PROGRESSIVE HALF HOUR LESSONS

Advanced Stage

Immediately preceding each lesson a short catechism will be given on the work previously given which may have a bearing on these lessons.

Lesson No. 1—Advanced Aiming Instruction.

Explain clearly the method of using the battle sight on the Mark III. Ross Rifle. Explain by means of a trajectory curve why and where aim should be taken at all ranges between 200 and 600 yards, and showing the advantage of the battle sight in snap shooting. Give a short catechism on the effect of sight adjustments vertically and laterally, and a test on rapid adjustment of sights.

Lesson No. 2—Advanced Aiming Instruction.

Explain the necessity for aiming off for wind and movement, and why this is preferable to lateral windage adjustment. Write down on the blackboard the allowance to be made for 10, 20, and 30-mile winds, and also where aim should be taken for moving troops and horsemen, explaining that when firing at crossing targets aim will first be taken on the object, following it sideways, and then carried in advance of the target until the trigger is pressed.

Lesson No. 3—Theory of Rifle Fire.

Show by diagrams on the blackboard the dispersion of shots made by expert marksmen at the 200, 500, 800 and 1000-yard ranges, explaining that owing to imperfections of the rifle and ammunition and errors of the firer how difficult it is to make a dense group of shots without alteration of the sighting. Show also the resulting cone of fire with the nucleus, effective, and beaten zones, and a diagram showing trajectory, line of fire, line of sight, line of departure, culminating point, first catch, first graze, and dangerous space. Definitions.

Lesson No. 4—Theory of Rifle Fire.

Give, by the use of diagrams, full explanation of the cone of fire caused by a number of rifles being fired at the same target, and their effect upon the zone of effective fire at various ranges, showing the necessity for the use of controlled and collective fire. Illustrate also the height of trajectories of Mark VII. ammunition at ranges from 500 to 1000 yards, with the resulting dangerous space and area of zone of effective fire.

Lesson No. 5—Theory of Rifle Fire.

Show by diagrams the effect of ground contours or slopes on the dangerous space, and how the area of zone of effective fire is reduced by rising ground and increased by falling ground. Explain clearly the effect of grazing fire, what is a defiladed zone, and how necessary it is to have correct range estimation in order to ensure the greatest fire effect. Define searching fire, its use and object, and why combined sights are used.

Lesson No. 6—Theory of Rifle Fire.

Explain clearly by means of blackboard diagrams what is dead ground, how it may be made use of in attack, and how it may be eliminated in defence by enfilade fire. Show also how supporting or reserve troops may take advantage of the cover of reverse slopes from short range rifle fire, but which would be dangerous from long range rifle fire. Go over and explain clearly all the military definitions applicable to musketry.

APPENDIX II.

Tests of Elementary Training.

Range practices and more advanced training result only in wasted ammunition and time, unless the men have been thoroughly grounded in elementary work; therefore the following tests of efficiency should be applied and a record kept of the performance of each man for future reference, to ensure proficiency in each step before being carried on to the next in succession.

Oral Tests.

1. Care of Arms.
2. Elementary Theory of Rifle Fire and general knowledge.

Inspection Tests.

1. Firing Positions: the correct and natural adoptions.
2. Fire discipline and rapid execution of orders.

Standard Tests.

1. Eyesight. Recognition of an enemy in 30 second exposure.
2. Recognition of targets and aiming points.
3. Judging distance.
4. Rapid adjustment of sights; 5 seconds allowed.
5. Regulation aim, triangle of error.
6. Trigger pressing on sub-target machine.

7. Aiming off for wind or movement.
8. Rapidity of aim tested on sub-target machine in 4 seconds.
9. Rapid loading and unloading; six chargers in one minute.
10. Rapid firing; 10 well aimed shots in one minute.
11. Grouping practice on 25 or 30-yard ranges.

APPENDIX III.

Catechism on Care of Arms.

1. How many parts is the Ross Rifle divided into for descriptive purposes? Describe them.
2. Demonstrate the operation of charger loading.
3. Explain how the four parts of a Mark III. Ross Rifle are secured together.
4. Explain the construction, dimensions, bore and rifling of the barrel.
5. How is the barrel rifled? What is the object of rifling?
6. Describe exactly what happens when the bolt is closed after charging the magazine.
7. Describe exactly what happens when the trigger is pressed after the rifle is loaded.
8. Describe exactly what happens when the bolt is withdrawn after firing.
9. What would happen on closing the bolt if the bolt unlocking pin was missing from the rifle?
10. What would happen when the trigger was pressed if the bolt was not all the way home?
11. What would be likely to happen if the bolt was drawn back with the bolt stop in the second position?
12. What effect would the bolt stop in the third position have upon the loading of the magazine?
13. Commencing with the muzzle, name all the visible parts of the Mark III. Ross Rifle.
14. Name the parts of the Ross Rifle which may be dispensed with without making the rifle un-serviceable.
15. Name the various kinds of fouling, how they are caused, and the best means of removing them.
16. Name the four kinds of cleaning, and describe when and how they are carried out.
17. Can internal fouling be removed by the use of wire gauze on a pull through? If not, why not?

18. Is internal fouling likely to be caused by the use of blank ammunition? Give reasons for your answer.
19. Demonstrate the use of the pull through, and state the precautions to be taken in cleaning the rifle.
20. When should the wire gauze be used on the pull through? Give reasons.
21. What are the common causes of miss fires?
22. What is meant by a blow-back? How may these be caused?
23. Compare the Mark VI. and Mark VII. S. A. A. in size, shape, strength of charge, velocity and spin.
24. What are the three causes of wear in a rifle?
25. How could an excessive use of the wire gauze affect the course of a bullet through the air?
26. Is rust a species of fouling? If not, why not?
27. What is meant by the inspection of arms on parade?
28. Name the points to be looked for in an inspection when taking over arms and equipment.
29. How is the primary extraction of a fired case from the chamber of the rifle effected?
30. How could a fired case be extracted if the extractor was broken?
31. Name the purposes for which a rifle should not be used, and the parts of the rifle which should not be polished.
32. Explain and demonstrate the functions of the safety catch.
33. What would happen on pushing forward the bolt if the safety catch was at SAFE.

APPENDIX IV.

Catechism on the Theory of Rifle Fire and General Knowledge.

1. How many forces act upon a bullet in its flight? Name them and show their direction.
2. Explain by diagram the path of a bullet when the axis of the barrel is held in a horizontal position.
3. Define "giving elevation," and show by a diagram how this is carried out.
4. How high above the target should the axis of the barrel be pointed to allow a Mark VI. bullet to hit the target at 100, 200, 500 and 1000 yards?
4 1/2" 20" 16" 12 1/4"
5. Draw a trajectory diagram showing line of sight, line of departure, trajectory, line of fire, culminating point and dangerous space.
6. Why are sights used, and how would marksmanship be affected if sights were eliminated?
7. Explain what is meant by a "minute of angle," and how does this vary according to length of range?
8. What is the fine adjustment scale for, and how is it used?
9. Demonstrate the elevation adjustment necessary to correct a shot 30 inches low at the 500-yard range.
10. What is a "Vernier Scale," and how is it operated? Where is the Vernier Scale located on the Mark III. Ross Rifle?
11. Demonstrate the adjustment necessary to correct a shot 30 inches out at 9 o'clock when firing on the 500-yard range.
12. Demonstrate the adjustment necessary to correct a shot which is 24 inches to the right and 30 inches low when firing at the 600-yard range.
13. Explain the Battle Sight and the Long Range Sight of the Mark III. Ross Rifle, and when they are to be used.
14. Draw diagrams illustrating what is seen when looking through an open sight, an aperture sight, and a battle sight alligned on a bulls-eye target.
15. Which is the easiest aiming sight, the open or the aperture sight, and why?

16. Give the rules for aiming and describe the common faults for aiming.
17. Discuss the effect of canting the rifle, and demonstrate by diagram why a shot from a canted rifle drops low.
18. Show by diagram what is meant by a correct sight, a full sight, a half sight, and a fine sight.
19. What effect on the shot does a half sight and fine sight make when using Mark VI. S. A. A.?
20. What is the point blank range for the battle sight when using Mark VII. S. A. A. in the Mark III Ross Rifle?
21. Approximately, how much below the target should aim be taken at 200, 300, 400, and 500 yards when using the battle sight and Mark VII. S. A. A.?
22. What is meant by aiming off for wind and movement? When is this necessary?
23. Give the wind allowance at 500 yards for 10, 20, and 30-mile winds when using Mark VI. S. A. A.
24. How is elevation affected when (a) wind is from the front, and (b) when it blows from the rear?
25. Name the allowance which should be made when aiming at troops moving across the front of field of fire.
26. When is the greatest and the least elevation required, and why?
27. Why is it necessary to always aim at 6 o'clock on the target?
28. Define: Dead Ground, Searching Fire, Collective Fire, Individual Fire, Enfilade Fire.
29. Explain by diagram illustrations, Cone of Fire, Beaten Zone, Nucleus of Fire, Zone of Effective Fire, and Dangerous Zone.
30. What is the first principle to be observed in shooting from behind cover?