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Tank Destroyer Center

Camp Hood, Texas

TANK DESTROYER GUNNERY

Prepared by the Tank Destroyer School
under the direction of the Commanding General
Tank Destroyer Center

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FOREWORD

Without proficiency in firing, tank destroyers are as nothing--a burden to their friends in anticipation of becoming a token to the enemy.

Leadership must be engendered by developing responsibility on the part of the officers and noncommissioned officers. Squads and sections must be trained as a team--a team which will carry on under conditions that entail not only shortage of equipment but shortage of men. Substitutes are rarely available to the squad in the last stages of battle. Everything must be done to discover our mistakes before entering battle. Mistakes made in maneuvers and on the drill field are not repeated in battle, if our leaders know their business.

The foundation on which effective tank destroyer organization is built must be efficient gun crews. Unless we have efficient gun crews, every other bit of training is wasted.

TANK DESTROYER GUNNERY

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TANK DESTROYER GUNNERY

SECTION I

GENERAL

1. PURPOSE AND SCOPE.--a. The purpose of this manual is:

(1) To provide unit commanders and gunnery instructors with a step-by-step outline for training in the gunnery of all TD weapons, including small arms.

(2) To emphasize the application of all marksmanship to battle conditions.

(3) To bring out the points which should be emphasized and carefully checked by instructors in all phases of gunnery instruction.

(4) To point out training aids and specific methods of instruction which will assist in preparing gunners for combat.

b. In general, it includes material which is not covered in War Department field manuals.

c. Plan.

(1) This manual is divided into four sections:

(a) General.

(b) Individual Weapons.

(c) Machine Guns.

(d) Destroyers.

(2) The general section contains material applicable to all weapons. The other sections contain primarily material pertaining to the weapons concerned. However, repetition has sometimes been used for emphasis.

2. REFERENCES.--a. Gunnery training in all weapons must be preceded by thorough instruction in mechanical training, and care and cleaning.

b. Not only the preliminary instruction referred to above, but

also qualification courses and other material essential to gunnery training proper have purposely been omitted, since they are covered in War Department field manuals.

c. FM's supplementing this manual are listed in the appendix. A complete list of all FM's published may be found in FM 21-6.

3. BASIC TRAINING PRINCIPLES.--The following points will be cited, illustrated and intentionally repeated; they should be instinctive with unit commanders and gunnery instructors:

a. Be thorough.--Training must leave no mistakes to be discovered on the battlefield. In training, getting a second chance is an element of instruction; in combat, it's a miracle.

b. Make explanations complete.--Tell the soldier the why of what he is doing. If he knows the reason for it, he'll do it better. Explain the battle value of every step in training.

c. Make training cumulative.--Review every step before, during, and after moving on to the next step. Drive home old principles with a new approach.

d. Maintain strict discipline.--Under the stress of combat only the well disciplined gunner will automatically apply the habits of good marksmanship. Require this discipline in every exercise. Make all exercises brief and follow each one with a short rest period.

e. Preserve the team.--Conduct instruction by existing units--squads, sections, platoons--each working under its regularly assigned leader. This requires the least amount of "organizing" since it makes use of organizations already in existence. It fosters the competitive spirit in all groups and a sense of responsibility in their leaders. Above all, it trains as a team--from the very beginning--each of the small units which will fight as a team in combat.

f. Stress battle application.--Training is rehearsal for battle; make it a dress rehearsal. Don't merely explain the relation of the 1000-inch range to the battlefield; make the "crow's nest" target a Jap sniper and the searching target a column of German troops.

g. Critique every exercise.--(1) Critiques should be held at frequent intervals in all exercises.

(2) A good critique is one which gives constructive criticism on a few major errors. To be of value, it must follow immediately after a short exercise and be succeeded at once by a similar exercise in which the gunner, with the critique fresh in his mind, has an opportunity to apply the lessons he has learned.

(3) A good critique must be specific. It must emphasize not many corrections but one or two specific things which the gunner must do "next time" to correct his errors. For example, to tell a destroyer

gunner that he was behind the target on his last round is not sufficient. He must be told that he was behind because he stopped tracking when he gave the command FIRE, or that the ordered lead was insufficient. He can then return to the gun with a definite solution to his problem. It gives him one thing which he must try above all else to correct when he fires the next round.

Examples of critiques are presented in the sections of the manual devoted to the various weapons.

h. Use every minute.--Training time is a scarce commodity and you can't requisition any more. Every man should be learning something new or practising and reviewing subjects already covered during every working minute. Don't say: "Keep busy, you men back here." Use PLANNED behind-the-line instruction, give it as a mission to the regular leaders of squads, sections, and platoons, and see that it is carried out.

4. PHASES OF INSTRUCTION.--All gunnery instruction is divided into two phases:

(1) Individual instruction phase.

(2) Team instruction phase.

5. INDIVIDUAL INSTRUCTION PHASE.--a. Individual instruction must be thorough and complete, because it is the foundation on which team instruction is built. No amount of top-notch training in the second phase can weld a fighting team out of poorly trained individuals.

b. The steps in individual instruction are:

(1) Preparatory marksmanship.

(2) Duties of crew members.

(3) Known distance firing.

(4) Behind-the-line instruction.

6. PREPARATORY MARKSMANSHIP.--The purpose of preparatory marksmanship training is to teach the soldier the essentials of good shooting and to develop fixed and correct shooting habits before he undertakes range practise. Any gunner who fails in his first firing exercise should be returned at once to the basic exercises of preparatory marksmanship before he is allowed to continue.

7. DUTIES OF CREW MEMBERS.--a. This step covers gun drill for machine guns and service of the piece for destroyers.

b. It obviously merges with the team phase of instruction, but the accent at this stage is on perfecting each member in his individual duties.

c. Regardless of the team aspect of this training, it must precede known distance firing so that the members can efficiently perform loading, reduction of stoppages, and other firing duties.

d. Training in the coach-and-pupil method for instruction in individual weapons is stressed in this step. In this case the coach and pupil form a team like the members of a machine gun crew.

8. KNOWN DISTANCE FIRING.—This step consists of qualification courses for individual weapons and 1000-inch firing for others. The procedure to be followed and courses to be fired are as laid down in AR 775-10 and appropriate FM's.

9. 1000-INCH FIRING.--a. The specific place of 1000-inch firing in training on machine guns and destroyers will be found in Sections III and IV respectively. The points in this paragraph apply generally.

b. The purpose of 1000-inch firing during the individual instruction phase of training is threefold:

(1) To teach the gunner to manipulate the weapon and at the same time stimulate interest by actual firing.

(2) To allow the gunner and the gun commander to see a picture of the errors made, since a permanent record of each round is made on the target.

(3) Above all, to teach uniform gun-pointing, which is the foundation of good gunnery.

c. 1000-inch firing should be accomplished in two phases:

(1) In order to detect and correct errors in the uniformity of his gun-pointing, the gunner should be required to "shoot for a group" regardless of where that group may be on the target. During this stage the gunner gets training in uniform gun-pointing with no other requirement to confuse him. This is the individual instruction phase.

(2) The second phase is the team instruction phase.--When the gunner has proved his ability to shoot a good group he is then taught to adjust while firing. In this step, corrections or sensings are given by the gun commander and the gunner is required to adjust as he continues to fire. This step will be taken up in detail in the team instruction phase.

d. 1000-inch firing is extremely important in that it affords a graphic, incontestable record of the gunner's firing. In the field, when firing at a moving target, a round may be sensed as "over" or "way over" but the gunner has only a fleeting glimpse of what he has done. On the 1000-inch range every round is permanently recorded.

10. BEHIND-THE-LINE INSTRUCTION.--a. The object of this step is threefold:

(1) To put to constructive use every minute of every man's working time.

(2) To drive home the application to battle of what is being done on the firing line.

(3) To review work already covered, since "practise makes perfect."

b. During the individual instruction phase, behind-the-line work will consist mainly of systematic reviews of points already covered, since the goal of this phase is to teach the individual gunner to shoot.

c. Battle application should be stressed concurrently with each point reviewed. For reasons of control and avoiding distractions that would hamper the soldier's learning the fundamentals of marksmanship, the organization and general atmosphere of the range are necessarily remote from combat conditions. To counteract this bad habit-forming influence, behind-the-line instruction should, for example:

(1) Show how conventional targets are connected with the battlefield.

(2) Demonstrate a good combat position for every firing line position. NO RIFLEMAN SHOULD EVER LEAVE A FIRING POINT WITHOUT TAKING A GOOD POSITION THAT MIGHT BE OCCUPIED IN BATTLE.

(3) Continuously remind the soldier of the effects of fatigue, full equipment, ammunition supply, water and camouflage discipline, and other combat conditions purposely kept out of this stage of his training.

d. Behind-the-line instruction is admirably suited to explaining the too often neglected WHY of what the soldier is preparing to do, or has just done. Why have a sight reticle? Why did that colonel whose outfit knocked out so many German tanks in North Africa say: "Boresight to beat hell, and don't let the men try to target at 1000 yards. . ."? Why "sweep through" a target when you're tracking it? Why learn how to fire from the sitting position when the prone position is so much steadier and more comfortable and presents a smaller target to the enemy?

Appropriate subjects for backline instruction are listed in the sections on the weapons.

11. TEAM INSTRUCTION PHASE.--a. Building teams is the goal of training, because men will fight as teams; all preceding training has been leading up to this phase.

b. Preserve the team.--Keep a squad intact even if it means an extra order on the firing line. The following are only a few of the ways in which this will increase battle efficiency:

(1) <u>It promotes co-ordination</u>. Any team--even if it is only two men--will instinctively build up its own standing operating procedure

--the best kind because the best remembered. Gunner Smith and Assistant Gunner Jones know each other's working habits; they make a nod of the head or a raised finger do the work of a dozen words; in trying to shoot better than Gunner Johnson and Assistant Gunner Jackson, they eliminate faulty techniques and waste motions; and every time Smith tells Jones: "Get on the ball with that new belt!" he may not know it but he's using one of the most valuable of all instructional methods--the critique.

(2) It develops leaders. A leader must know his men; let him learn to know them by working with them continuously. The best squad leader you have won't take the pains with men from another platoon that he will with his own: he wouldn't if he could, because he hasn't a personal interest in them; he couldn't if he would, because he doesn't know the lazy ones from the workers or the keen ones from the dumb ones. No amount of training will erase the individual differences among men; a leader who stays with his men will learn those differences and make his men work for the team by proper assignment of personnel to missions.

(3) It fosters competition. A squad that maintains its identity throughout training develops a pride of organization. When you hear a man say, "Our crew can shoot rings around any other one in the outfit," the training is paying dividends. No soldier can speak of "our crew" if he goes on the firing line with a different group of men every day.

c. The "preserve the team" idea is going to be knocked out in battle, because there are going to be casualties. Prepare your teams for battle by making them function at part strength. Simulate casualties by having one man fall out, and make the team carry on without him. Rotate the team so that every member will be able to perform the other's duties.

d. The steps in team instruction are:

(1) Gun drill.

(2) 1000-inch firing.

(3) Field range firing.

(4) Combat firing.

(5) Behind-the-line instruction.

12. GUN DRILL.--a. Steps and specific suggestions for gun drill for the machine guns and service of the piece for destroyers are covered in Sections III and IV respectively.

b. The object of gun drill is to develop an efficient, smooth working team and a sense of discipline that will impel the team to operate under stress of battle.

c. Precision in the most minute detail is the first objective. Inaccuracies permitted in training will multiply in battle. All gun drill

is given at attention.

d. The development of speed must be gradual and always subordinate to accuracy. It is obtained by constant practise and the elimination of lost motion. After reasonable proficiency is obtained, stop-watch competitions may be used to stimulate interest; but again, the greater stress must be on accuracy.

e. Periods of this type of training should be short. For the first period, when the duties of the individuals are explained for the first time and the team is put through its paces in painstaking "slow motion," two hours may be permissible. Subsequent gun drill periods, however, should never last more than an hour.

f. This training must be continuous through all phases of instruction. It should be a part of the daily routine.

g. Make this drill complete; include fire orders and the use of sights, interphone systems, and all other equipment. During the team instruction phase the preparation of range cards should be habitual at every period of gun drill.

h. Accuracy of fire is dependent upon correct sight adjustment. Sights should be adjusted before each period; destroyer sights should be boresighted. This forms, early in training, the habit of boresighting at every opportunity.

i. Crew members should be rotated frequently in every period of gun drill, so that every man knows every job in the crew. This not only allows each man to perform his own duties more intelligently, but prepares him to take over anybody's job when casualties occur in combat.

13. 1000-INCH FIRING (TEAM INSTRUCTION PHASE).--The purpose of 1000-inch firing during the team instruction phase is:

a. To teach the gunner to adjust his properly aimed fire in accordance with the fire orders of the gun commander.

b. To give the gun commander instruction in rapid and accurate sensing and the issuance of fire orders.

c. To start the development of the <u>team</u> (gun crew).

14. FIELD RANGE FIRING.--a. The term "field range firing" is a convenient substitute for the longer term "long-range observation and adjustment practise" used in field manuals.

b. The purpose of field range firing is to teach the soldier the adjustment of fire by observation of strike and by the observation of the flight of tracer bullets.

c. Field range firing is the intermediate step between known distance firing and combat firing. The only feature it has in common

with combat is that it involves the same long ranges; everything else characteristic of battle is eliminated so that:

(1) The soldier can concentrate without distraction on the problems presented by this advanced step and work them out under the most favorable conditions.

(2) The personnel conducting training can maintain control and, through close-interval arrangement of the guns and familiarity with the target area, provide instruction of maximum effectiveness.

d. The artificiality of the setup, which is necessary for the two reasons just cited, demands an antidote. This is furnished by well planned behind-the-line instruction which emphasizes battle application.

e. During field range firing the soldier is introduced to range cards and must be impressed from the very beginning with their vital importance in all training and combat from this point on.

15. RANGE CARDS.—a. A range card is a diagramatic or panoramic sketch of a given sector showing the gun position, the direction of magnetic north, fields of fire, and ranges to prominent terrain features.

b. The purpose of range cards is to enable gun crews to deliver fire promptly on likely targets in any situation.

c. In view of the nature of modern combat, range cards should cover all fields of fire, regardless of the supposed direction of enemy targets. Base your range cards, even in training, on all-round fields of fire.

d. Be sure range cards are legible, and avoid overloading them with detail. They must convey information quickly to even the slowest member of the gun crew.

e. A range card will be prepared for each gun immediately upon occupation of a position. This allows the gun commander, assisted by the other members of the crew, to determine ranges to prominent terrain features at a time when it can be accomplished with the least amount of distraction. In some cases, these ranges may be determined by a study of a map or aerial photos, by the speedometer reading of a vehicle, or at least by a deliberate estimate. When a target does appear in the area, a quick and accurate determination of the range may then be made by referring to the nearest point shown on the card.

f. Such a card may be made on a message blank or other piece of paper, or it may be drawn in chalk or pencil on the gun shield of the destroyer.

g. When a range card is prepared, the ranges shown will often be estimates. As soon as the gun actually <u>fires</u> at a point shown on the card, a corrected (adjusted) range will obviously be obtained. This corrected range will immediately be recorded on the range card. For

instructional purposes, during training, the original estimate should be left on the card, crossed out, and the corrected range written in, thus allowing instructors to ascertain by inspection that the directive is being carried out. The gun commander will have to get the corrected information from the gunner, who is the only person who really knows the range actually used for firing the last round at the target.

16. COMBAT FIRING.—a. In combat firing, gunnery teams combine for the first time and apply all they have learned in marksmanship, gun drill, field firing, and tactics. It is their advanced course in gunnery; they take their final examination on the battlefield.

b. A TD platoon is given a mission. From the time it nears its firing position until the mission is accomplished, everything that platoon does is included in the term "combat firing."

c. These things are covered throughout the manual—in this section generally, and in the others where the operation varies with the weapon. All that can be done here is to list the elements of combat firing. In the following list, note how many were first introduced to the team during behind-the-line instruction. At that stage it was little more than an introduction; selection and occupation of positions, for instance, was sketched in its broad outlines; in combat firing it becomes three-dimensional—something to perform.

(1) Selection of firing and cover positions, and alternate and supplementary positions.

(2) Selection of routes of approach and withdrawal. Withdrawal may be necessary for maneuver. Often it may be impossible to maneuver to the front and in order to maneuver to the flanks suitable routes must be chosen in advance.

(3) Preparation for firing, including preparation of range cards; keeping the cards up-to-date by use of information obtained by firing; digging of slit trenches; camouflage; digging in the destroyer, if ordered; obtaining information for night firing, etc.

(4) Firing, including fire orders; communication between destroyers, between platoon commanders and destroyers, etc.; fire control; fire distribution; gun drill or service of the piece, etc.

(5) Security against ground and air attack; positions for machine guns and security weapons.

(6) Movement from one position to another.

d. To hit the target with the least expenditure of time and ammunition is the primary goal of gunnery training. This is assured by the perfecting of the team, or gun crew, which is developed during combat firing. For this reason, gun drill and service of the piece must be carried on continually—and continually supervised. Pep drills should be held at irregular, unannounced intervals to insure maintenance of strict

discipline and instantaneous obedience to orders.

e. It is during combat firing that units will develop their standing operating procedures. The best SOP's are those that best fit the qualities of the men in the unit and therefore develop with the least conscious effort.

f. Combat firing must spread the team spirit--between men, gun crews, sections, and so on up. Whenever the training situation permits there should be co-ordination between adjacent units in matters like range card data, communications, dovetailing of final protective lines, and terrain information.

17. BEHIND-THE-LINE INSTRUCTION (TEAM PHASE).--a. The twofold object of this instruction is the same as for the individual phase (see par. 9a).

b. Always plan behind-the-line instruction in advance. In planning it, keep these points in mind:

(1) The cumulative nature of training. Review material covered during the individual instruction phase.

(2) Preservation of the team. Instruction behind the line, like that on the firing line, must be carried on with existing organizations under their regular leaders. Again work by squad, section, and platoon.

c. Behind-the-line instruction during the team phase should include the following subjects (the list is merely a guide, and by no means exhaustive):

(1) Selection of the proper ammunition to accomplish the mission, and the effect of the proper use of correct ammunition on various types of targets.

(2) How shorts kick up dust and obscure the target; why, therefore, extreme care must be taken to avoid getting shorts at short ranges; the advantages of shorts for ricochet burst with delay fuze against personnel in foxholes; and the advantage of shorts to assist in adjustment at long ranges.

(3) Engaging tanks from rear to front, in the manner of Sergeant York's technique against a flight of wild turkeys.

(4) How to distribute the fire of the gun, section, and platoon on various types of targets.

(5) Boresighting and the importance of checking the aim frequently by this method. If it is SOP for your unit to boresight at every halt of more than 10 minutes (and it's a good SOP item), drive that home during behind-the-line instruction by firing the question: "What do we do every time we halt for more than 10 minutes?" until the answer, "Boresight!" comes back like an echo.

(6) Practise in the quick and accurate setting of sight pictures by the use of issue and improvised trainers. This is essentially a step in individual instruction; make it a team affair by using the coach-and-pupil method. Let the members of the team check each other, then you check them.

(7) Continuous review of all elements of marksmanship to instil in every individual and team the absolute necessity of making the first round count.

(8) Review of technique of fire.

(9) Use of the lensatic compass and the use and adjustment of field glasses, sights, and other fire control instruments.

(10) Preparation and use of range cards.

(11) The selection of good gun positions.

(12) The application to the battlefield of every subject taught.

18. CRITIQUES.—a. The value of critiques has been cited; it cannot be overstressed.

b. Every critique should be:

(1) On-the-spot. Make corrections while the error is still clear in the mind of both the soldier and the instructor. If a rifleman gets misses with his first three rounds, every subsequent round he fires will be wasted unless he is stopped then and there and his mistakes corrected.

(2) Specific. Don't tell a gunner: "You're not tracking properly." Tell him: "You got ahead of your target that time. That happens to the best of gunners—but you stopped tracking to let the target catch up. You should have slowed down but kept tracking. Here's why...." The above is only a small part of a critique, isolated to illustrate a point. Make your critiques specific throughout. Some examples of specific critiques are given in subparagraph c below and in the sections on weapons.

(3) Applied to the battlefield. Make the soldier realise what the mistake he made would have meant in combat. He knows the enemy will both take cover and fire back, but he's likely to forget it during range practise. Don't let him.

(4) Concise. Don't overload your critiques. If a gunner does five or six things wrong all at once, pick the two or three that are the most important and straighten him out on them first. Trying to correct everything at once will confuse him.

c. The following procedure or a similar procedure should govern methods of critiquing all firing instruction:

(1) The instructor, who should normally be the platoon leader or gun commander, observes the man or men firing, at the same time noting the strike of the projectile or the penetration of the bullet and the grouping of the projectiles on or near the target. The maximum instruction can be obtained from ammunition expended by having a suitable number of men witness each firing from positions near the gun. On the completion of a run or a limited number of shots, the instructor stops the firing and critiques the problem. The firing may have been for one of two purposes: either for accuracy in laying, in the case of the targets on the 1000-inch range with skeleton lead figures; or for the destruction of an enemy tank, for example.

(2) The critique is an analysis of the firing entered into for the purpose of emphasizing the correct as well as the incorrect procedure with which the fire was conducted. For example, a critique of a rifleman firing in a prone position might well be somewhat along the following lines (to be addressed to the assembled squad):

"Had that target been a man he would have been hit twice, which was Jones' purpose, but he was missed three times before being hit, so possibly he might have moved and certainly he would have fired back. Look at Jones' nose. He got that by putting his thumb across the stock. I did not caution him about it because I wanted to impress on him and on all of you the importance of not doing it. Remember the second round he fired was a miss, and it was probably due to the fact that he flinched, having hit himself on the nose on the first shot. I then cautioned him about taking in a full breath and letting it out, and squeezing the trigger so that he would not know when the shot was going off, and keeping his thumb away from his nose, and he got a hit and another one immediately thereafter. So you see, his problem brought out three principles: (1) Don't hit yourself in the nose with your thumb; (2) take a full breath and let a little out in order to be steady; (3) squeeze the trigger so that you will not know when the gun is going off, and therefore will not flinch. Has anybody any comments?"

Private Smith speaks up and says: "Where did you aim? The gun commander describes where the man should aim for that particular type of fighting and that particular target.

The instructor then questions the group: "Assuming that Jones was firing from wheat field stubble, Private Smith, would he fire from a prone, kneeling, or standing position? Suppose Jones was firing from a field of standing wheat, Private Johnson, what firing position would he assume? Suppose he was firing from a ditch nearly shoulder high, Private Wilson, what firing position would he assume?"

(3) In another example, four rounds of sub-caliber ammunition have been fired from a tank destroyer at a moving target, moving from left to right. The first round was short and threw dust all over the target; the second and third were way to the left; and the fourth round hit the target. The critique by the instructor would be about as follows:

"The object in firing was to stop the tank. It was accomplished. However, what tank would continue to move in the same direction without firing at you or without changing its direction? Your first round obscured the target and it would have given the enemy an opportunity to move to a cover position and possibly take you under fire. The second and third were fine as to range, but I noted definitely that the gunner did not follow through, although he apparently had the right lead. Consequently these rounds were behind the target. The gun commander, realizing this, gave him an additional false lead and the last round was a hit. At short ranges, care should be taken to avoid getting shorts, as the resulting dust obscures the target. The first round must be a hit! And we must remember to follow through. It took about one minute thirty seconds to get that hit. Put yourself in the enemy's position. Would you have interfered with this gun's fire by machine gun or other fire? Would you have taken cover? You see, failure to follow through did not permit a hit until too late in the day if we were fighting the Germans, because they are good soldiers."

(4) In every instance the instructor should emphasize the battlefield application of all technical and tactical training.

19. CRITIQUE TRAINING.—a. All personnel undergoing gunnery training will be instructed and given practise in critiquing. Warn your group that every man is subject to be called on at any time to analyze performances in all phases of instruction. Then "critique the critique."

b. Giving a constructive critique, one that will improve the individual and the group and further battle efficiency, is an accomplishment that comes only with experience and constant practise. However, even beginners can be grounded in the elements of critiquing. A suggested plan of training follows:

(1) Explain what a critique is and what it should do, as outlined in par. 18.

(2) Give a critique yourself, starting from the beginning; that is, with the execution of a firing problem or some other step in training. If the state of your group's training seems to warrant it, slip in one or two "boners." Then have the group criticize your critique; if they miss the mistakes you purposely made, be sure you point them out.

(3) Teach critiquing from the point of view of cause and effect. Point out that every shot that doesn't hit the target is due to at least one faulty technique--perhaps several--on the part of the gunner or someone else on the team. Show how the target corresponds to the direct evidence confronting a detective when he visits the scene of a crime. Make the reading of targets an exercise in deduction, in working back from the effect to the cause.

(4) Note the similarity between the malfunction or stoppages of a gun and the poor shooting by a gunner. Demonstrate that a scattered shot group has a cause, or several possible causes, just as surely as a failure to fire has. On the basis of this similarity, work up a table

as a guide for both yourself and your group. The following table is a partial one; it can be developed by the addition of actual examples found on the range:

Effect	Possible Causes
Stationary Target	
Complete miss (firing carbine at 300 yards).	1. Failure to take the correct sight picture. 2. Flinching. 3. Closing the eyes. 4. Jerking the trigger.
	1. Incorrect sight picture caused by: a. Ignorance of correct sight picture. b. Faulty position.
Failure to get a shot group (firing caliber .30 rifle at 200 yards).	2. Flinching. 3. Closing the eyes. 4. Jerking the trigger. 5. Failure to hold the breath. 6. Unsteadiness due to incorrect position.
Shots scattered in a vertical line (firing pistol, slow fire, at Target L; range, 25 yards).	1. Failure to aline front sight, rear sight, and bull's-eye horizontally. 2. Failure to hold the breath. 3. Incorrect position, allowing arm to sag.
Good shot group, but not in target (firing caliber .30 machine gun at 1000 inches).	1. Gun not targeted. 2. Incorrect sight picture (apparently consistently the wrong picture).

Effect	Possible Causes
(continued)	
Moving Target	
Good shot group; correct for range, but behind target (firing subcaliber, U. S. rifle, caliber .22, in 37-mm. gun, at 1000 inches).	1. Not enough lead. 2. Failure to keep tracking while firing.
	1. Uneven tracking. 2. Failure to slow down or speed up gradually when ahead of or behind target.
Shots good for range, but right or left of target (firing 75-mm. service ammunition at 800 yards).	3. Failure to keep tracking while firing on certain rounds. 4. Failure to swing through to proper lead at the start. 5. Failure to keep tracking when ahead of target. 6. Failure to use the same lead for each round fired.

20. FIRE CONTROL INSTRUMENTS.--The field glass, M3 and the lensatic compass are covered in this section. The gunner's quadrant, various sight and other fire control instruments are covered in the sections on weapons.

21. FIELD GLASSES.--a. Description: The field glass used in the army is a 6-power glass. That is, it magnifies the object viewed six times, or makes it look six times as large as with the naked eye. With the 6-power field glass an object 600 yards distant appears as it would to the naked eye at a distance of only 100 yards.

It is made up of two telescopes, each with an eyepiece. Around the base of each eyepiece is a scale called the "diopter scale" with its zero in the center. Note that on one side of the zero, or center mark, the readings are marked plus, on the other, minus. The zero graduation represents the minus setting for a normal eye.

The two telescopes are fastened together by a hinged joint which permits adjustment for interpupillary (inter-eye) distance. On one end of the hinge is a scale called the "eye distance scale." The reading of this scale shows the distance in millimeters between the centers of the eyepieces.

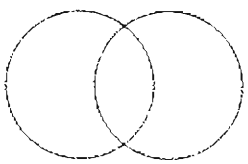
b. Operation.--(1) Neck strap: When the glass is out of the case the neck strap should always be worn around the neck. This keeps the glass always in a convenient position for use and eliminates the possibility of breakage by dropping.

(2) Method of holding: Holding the glass in both hands with the fingers bent over the top of, and grasping the two telescopes. The bent thumbs should extend upward beside the eyepieces, the edges of the thumbs held against the bony structures of the head at the outside corners of the eyes. This position of the thumbs serves two purposes. First, it excludes the light which would otherwise shine into the corners of the eyes behind the eyepieces and reduce the visibility through the glass. Second, it steadies the glass, allowing the eyepieces to be held correctly alined with the eyes without pressure against the eyes. When possible it is best to use a rest for the glass or to rest the elbows on some solid object while observing.

c. Adjustment.--(1) Interpupillary distance: To adjust the glass so the eyepieces are the same distance apart as the pupils of the observer's eye:

(a) Open the hinged joint until the telescopes are spread apart to the maximum distance.

(b) Point the glass at the sky and look through the eyepieces. KEEP YOUR EYES FOCUSED ON THE SKY! You will now see what appears to be two overlapping circles made by the two telescopes like this:



(c) Close the hinged joint slowly until the two circles merge into one and the field of view appears to be one clearly defined circle.

(d) Note the reading on the eye distance scale on the end of the hinged joint and MEMORIZE IT.

(2) Focus of the eyepiece.--(a) Look through the glasses, both eyes open, at an object about 500 yards away.

(b) Place the hand over one telescope, still keeping both eyes open, and screw the eyepiece of the other telescope in or out until the object becomes clear and sharply defined.

(c) Repeat the operation for the other eye.

(d) Note and MEMORIZE the reading on the diopter scale of each eyepiece. The object at which the observer looks while making this adjustment should be one such as a bush or tree with leaves and small branches to allow a check on the "sharpness" of the adjustment. If the glass is directed toward a smooth, regular object, such as the flat side of a building while adjusting the focus, a less accurate adjustment will result. The flat surface contains less detail to be brought out by the magnifying power of the properly focused telescope.

(3) Memorizing the eye distance scale and diopter scale readings eliminates the necessity of going through the adjustment procedure each time the glass is used. This saves time which may save your life in battle by allowing you to see an enemy before he sees you.

d. Reticle.--(1) The left telescope is fitted with a reticle which contains both horizontal and vertical mil scales.

(2) Several types of reticles are now in use in issue glasses. The following are two of these types:

(See fig. 26, page 49, FM 23-55.)

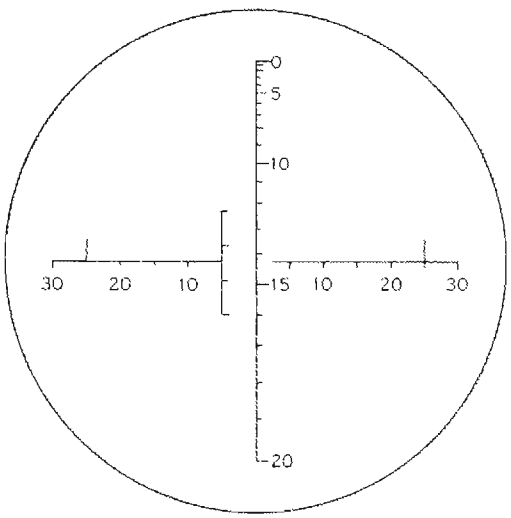


Figure 1

In addition to the mil scales some reticles contain a stadia scale or inverted sight leaf (see fig. 1). This scale may be distinguished from the mil scales by the fact that its graduations are not equally spaced. Those near the top are closest together, the distance between them gradually increasing toward the bottom of the scale. This scale, when present, should be disregarded, as it is used only for firing certain small arms when using an auxiliary aiming point. Its use is not particularly applicable to the type of firing done in TD's. Some glasses of recent manufacture are made without the inverted sight leaf in the

(See fig. 27, page 50, FM 23-55.)

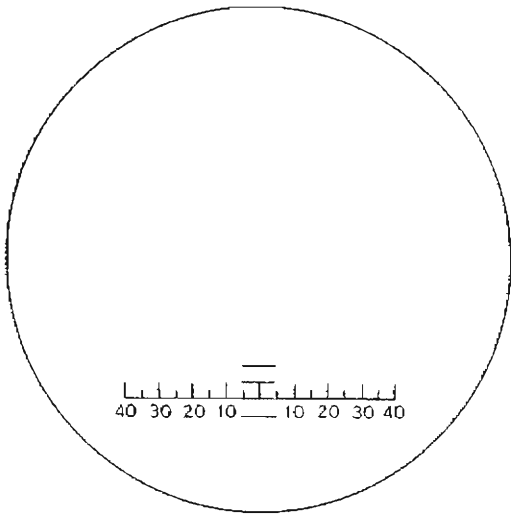


Figure 2

reticle (see fig. 2).

The mil scales, whether horizontal or vertical, may easily be identified by the fact that the graduations are all equally spaced. On most horizontal mil scales the 10-mil graduations are numbered 1, 2, 3, etc., left and right of the center representing 10, 20, 30, etc., mils. The zero is omitted to save cluttering up the field of vision.

The vertical mil scales are graduated with unnumbered 5-mil graduations. This may be checked by comparison with the marked graduations on the horizontal scale. Thus if the unmarked graduations on the vertical mil scale are half as far apart as the 10-mil marked graduations of the horizontal scale the vertical scale graduations are 5 mils.

a. Use.—(1) The mil scales are used for measuring small horizontal or vertical angles. Their use may be compared to the use of a yardstick in the measurement of linear distance. By looking through the glass and superimposing the horizontal scale on any two objects the angle between these objects may be read in mils. In the same manner the vertical mil scales may be used to measure the angle between two objects one of which is above the other as viewed by the observer.

(2) The glass is also used for observation of distant objects since its magnifying power brings out much more detail than can be seen with the naked eye. This magnifying power is a material assistance in range estimation and adjustment of fire, as it clearly brings out ground forms which cannot be seen with the naked eye.

(3) The observer's depth perception is greatly enhanced by the use of the glass. This fact may be clearly brought out by the following exercise. Pick out a ridge at a range of 600 to 1200 yards with some object such as a tree a hundred to a hundred and fifty yards in the rear

of the crest with its top just showing above the crest. With the naked eye the tree top will look like a bush on top of the ridge, but with the glass the depth will be obvious and the tree top will appear to be where it actually is, some distance beyond the crest. Thus in estimating ranges, valleys, the bottoms of which are not visible to the observer, may be picked up with the glass and a clearer estimate of their actual width may be made. For an accurate estimate the terrain between observer and target should always be studied with glasses.

(4) By measuring with the mil scale the angular width or height of objects of known size, the range to the object may be rapidly and quite accurately determined by use of the mil formula. For example, if the length of an enemy tank is known to the six yards and the observer measures its angular length as three mils by using the mil scale in the glass, the range to the tank is

$$\frac{1000\ W}{M} = \frac{6 \times 1000}{3} = 2000 \text{ yds.}$$

The same rule is, of course, applicable to vertical measurements. Thus it is evident that by dividing the known length of an object in yards by the angular length of the object (in mils) as read from the mil scale in the field glasses and multiplying the result by 1000, the range to the object is determined.

(5) When using the glass for adjustment of fire it should be held in readiness below the eyes and the round observed with the naked eye until its general location is known. The glass should then be quickly placed to the eye for careful observation. This eliminates the possibility of losing the round by its failure to strike close enough to the target to come within the field of vision of the glass. When firing at stationary targets this is normally necessary only for the first round or first burst, since the location of succeeding rounds will normally come well within the field of vision. In any case the glass should not be held to the eyes constantly, as this tires the eyes. For observation of a round whose approximate location is known, place the glass to the eyes after the gun has fired and keep it in position only long enough to make the sensing.

f. Care.--(1) The issue field glass is a rugged instrument but should not be abused by rough handling.

(2) Care should be taken not to scratch the lenses.

(3) Always dry the glass carefully before replacing it in the case.

g. "Musts" for the use of field glasses:

(1) Keep neck strap around neck when glass is out of case.

(2) Focus eyes on sky while adjusting interpupillary distance.

(3) Keep both eyes open when adjusting focus.

(4) Memorize interpupillary distance and diopter scale readings.

(5) Cover corners of eyes with bent thumbs to exclude light and steady glass while observing.

(6) Hold eyepieces lightly to eyes while observing.

(7) For observation of fire observe first round with naked eye and then quickly place glass to eyes for final sensing.

22. LENSATIC COMPASS.--a. General.--A compass is a magnetic instrument which is used to measure the angle a given line makes with magnetic North. This angle is called the magnetic azimuth of the line. It is based on the principle that a specially treated piece of iron will point magnetic North and South if allowed to swing freely on a pivot, and kept well away from other iron bodies or from electrical equipment.

b. Description of the lensatic compass.--(1) The lensatic compass consists of:

(a) Case.

(b) Compass dial, pivoted to swing inside the case.

(c) Rear sight leaf and lens, hinged to the rear of the case.

(d) Top cover and front sight, hinged to the front of the case.

(2) The case is a plastic round box, with a glass cover over the compass dial. In the side of the case is a damping plunger, which stops the motion of the compass dial when pressed. A luminous index for reading the scale of the dial is inside the case below the top cover.

(3) The compass dial is a circular card, pivoted at the center, and mounted inside the case. It may be seen through the glass cover. It is graduated with two scales, the outer of which is divided into units of 20 mils each. These divisions are numbered at every even hundred mils; for example, (0), 4, 6, etc., to 60, 62, and (0) which represents 6400 mils. This dial is fastened to the magnetic needle, which will always come to rest with the same end pointing to magnetic North if allowed to swing freely on the pivot. Over the end of the needle which points to magnetic North is the zero (0) of the compass card. The 1600 mil division is East; the 3200 mil division is South; and the 4800 mil division is West on the compass dial. Note that the reading increases as we move clockwise from North.

(4) The rear sight leaf is slotted at the top to form the rear sight. Below the slot is a lens, through which the compass dial is read. When the rear sight leaf is laid down on the glass cover, the compass dial is lifted off the pivot to prevent any swinging and jiggling

which would damage the delicate bearing. A brass ring is mounted on the same hinge as the rear sight leaf but swings under the case.

(5) The front sight is a wire held in the center of a slot in the top cover. Above this wire sight is a notch which forms on alternate front sight. Luminous dots at each end of the wire sight mark the front sight when using the compass at night.

c. Use.--(1) To measure the magnetic azimuth of a line, place yourself on the line and pick out some point on the ground as far distant as possible which is also on the line. Hold the compass on a level surface of a fixed support, or hold it at eye level with the thumb or forefinger through the brass ring and the other fingers supporting the compass and holding it steady. Move the rear sight leaf until the figures on the compass dial can be seen most distinctly through the lens. The magnetic azimuth of a line is the angle measured clockwise from magnetic North to the line. This angle is also referred to as the "compass" of the line. Line up the front and rear sights with the point selected on the ground and let the compass dial come to rest, using the damping plunger to stop excessive swinging. When the dial is at rest and the front and rear sights are in line with the point selected, the azimuth in mils may be read on the mil-graduated scale opposite the luminous index inside the case. Care must be taken to hold the compass steady and level while the azimuth is being read.

(2) To find a line which has a given azimuth, hold the compass as before, allowing the compass dial to come to rest and turning the case and sights until the luminous index is opposite the desired azimuth on the scale. Look through the front and rear sights and pick out some distant point on the ground which is in line with these sights. A line through the compass and the point picked on the ground has the desired azimuth.

(3) Never attempt to measure a bearing or azimuth while carrying iron or steel objects on the person, or while within 60 yards of guns, vehicles, or other steel equipment, as the presence of iron will cause the compass to give incorrect readings.

d. Care.--The compass should always be carried with the rear sight leaf and the top cover closed down on top of the case, and the compass in the canvas carrying case. Keep the compass clean, but do not attempt to lubricate it. If malfunctions develop, the compass should be turned in for repairs. Keep it well away from high-power electrical equipment, such as strong radio transmitters, transformers, etc., or the needle will lose its magnetic qualtities.

23. THE MIL RELATION.--a. If the nickel were the smallest coin we had, the monetary system would be inadequate every time someone wanted to buy a one-cent stamp. That's why we have pennies.

b. Similarly, the degree system is inadequate for gunnery. For example, if we were firing at a tank 1000 yards away and moved the gun tube one degree to the right or left, the next round would land about 18 yards from the first. In other words, the degree is too large a unit--

it's the nickel of the angle-measurement system.

c. But breaking up the degree--say, into tenths--would lead to all kinds of trouble, and using the standard subdivisions--minutes and seconds--would be worse. That's why we have "mils." Mils are the pennies of the system.

d. A mil (abbreviated m) is 1/6400th of a circle. (There's a reason, but it's no more important than the reason why there are 360 degrees in a circle--or 100 cents in a dollar.) Since there are 6400 mils in a circle, there are 3200 mils in a half circle, 1600 in a right angle, 800 in a 45-degree angle, and so on. If we start at North for instance, and move clockwise, East is 1600 mils, South is 3200, and West is 4800 (see fig. 3).

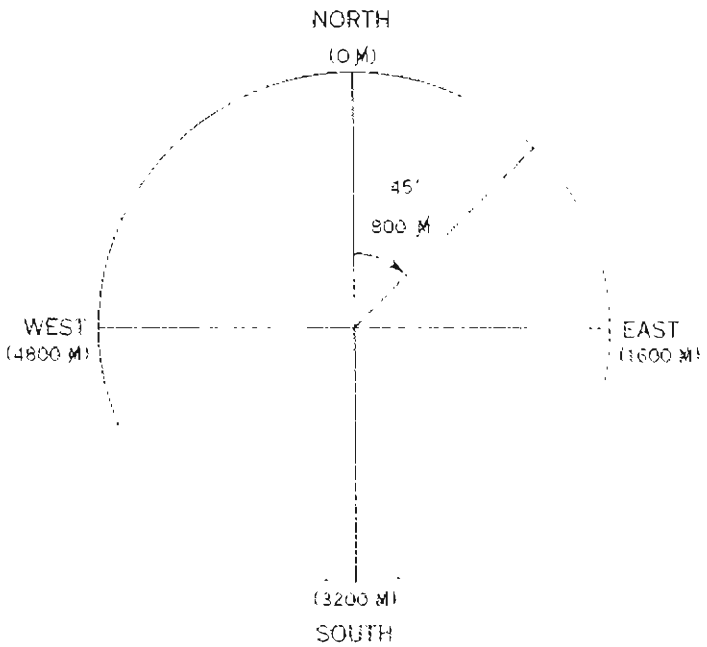


Figure 3

e. Besides being 1/6400th of a circle, a mil is also the angle subtended by one yard at a range of 1000 yards. Here's what "subtended" means: Let's go back to the gun and the tank mentioned above. At the given range (1000 yards), if we moved the tube of the gun just enough to put the second round one yard to the right or left of the first one, we would have moved the tube one mil. The one-mil angle on the gun is said to be "subtended" by the one yard out there at the tank.

f. The relationship between the one mil, the one yard, and the 1000 yards is called the mil relation. If we let M stand for the number of mils in the angle, W for the width (in yards) and R for the range (in thousands of yards), we can write a formula like this: W/RM. Remember it by the word WORM (W Over RM). This formula is good only for angles of 400 mils or less.

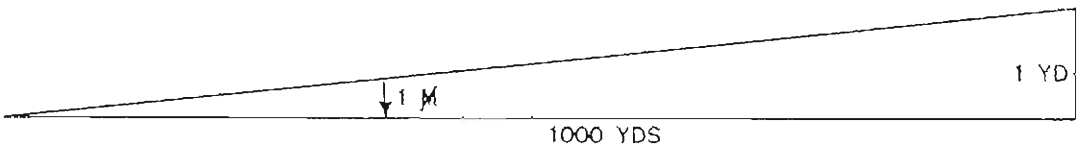


Figure 4

g. With the formula you can find the one element any time you know the other two simply by striking out the one you want to know. Thus, if you want to know the angle, strike out the M in the formula and W/R is left. Examples:

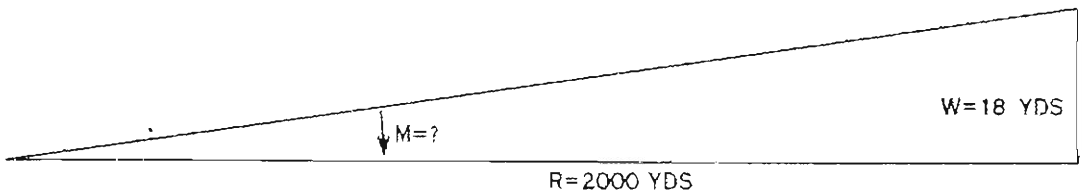


Figure 5

(1) What is the size of the angle subtended by 18 yards at a range of 2000 yards? Striking out the M leaves W/R. In this case, W equals 18 and R equals 2 (not 2000; R stands for number of thousands of yards of range). Substituting, we get 18/2, or 9M.

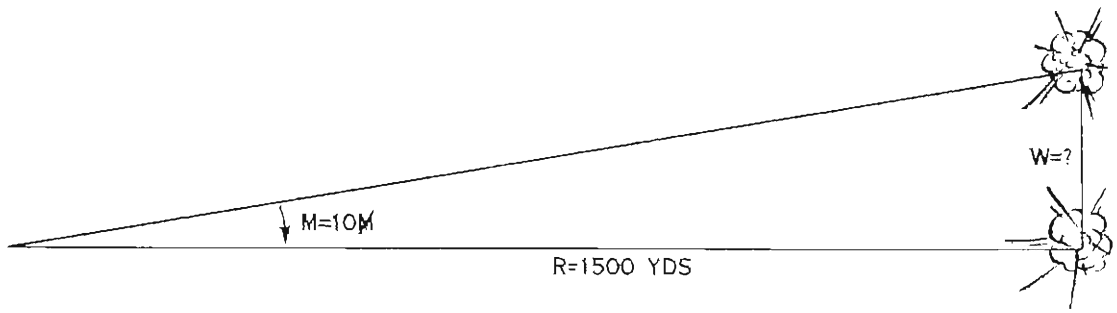


Figure 6

(2) At a range of 1500 yards, how far will a 10-mil change in deflection move a shell-burst? Here we want to know W. Striking out the W in the formula leaves RM (which means R times M). Substituting, we get 1.5 x 10, or 15 yards.

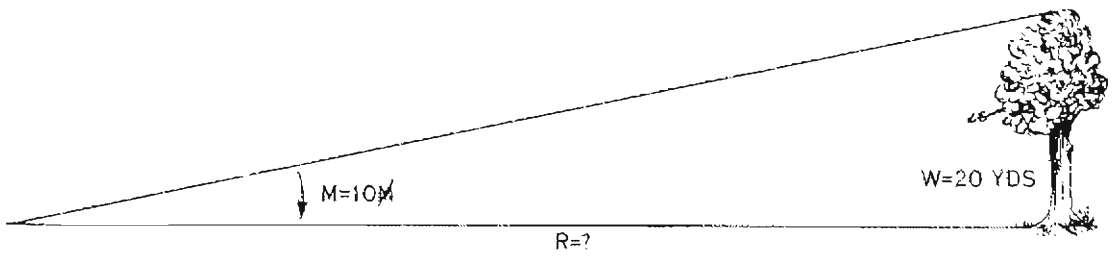


Figure 7

(3) How far away is a 60-foot tree that measures 10 mils on the vertical mil scale in your field glasses? This time we are solving for the range. Striking out R in the formula leaves W/M. Changing the 60 feet to yards and substituting, we get 20/10 or 2. Since R is the range in thousands of yards, the tree is 2000 yards away. Note that the width and range must always be in the same units of linear measure before substituting in the formula. If W is in feet R should be in thousands of feet, or if W is in inches R should be in thousands of inches.

24. TECHNIQUE OF FIRE.--a. The technique of fire of any weapon includes the methods used and the factors involved in the delivery of effective fire upon a target.

b. The principal elements in technique of fire are:--(1) Characteristics of fire.

(2) Determination of initial data.

(3) Fire orders.

(4) Conduct of fire.

c. The characteristics of fire, classes of fire, and target designation, though covered from the standpoint of machine guns, are amply described in the FM's on the caliber .30 machine guns. The most complete of these discussions will be found in FM 23-55. The principles involved in this study are applicable to all weapons and will not be discussed further at this point.

d. Range determination.--(1) In battle, ranges are seldom known in advance, so the effectiveness of fire depends in large measure on the accuracy of range determination.

(2) The methods used are:

(a) Estimation by eye.

(b) Firing the gun.

(c) Obtaining data from other units.

(d) Use of map.

(e) Use of instruments.

(3) Range estimation by eye is the most important method because it is the one most used in combat. When used, the average of the estimates of all available trained personnel is the range to use. Bear in mind, however, that when time and the tactical situation permit, every available means of determination should be employed, one checking against the other. The commander's ingenuity will often afford him more methods of determination than the field manual. Distances may be paced off, measured with the odometer of a vehicle, or determined by use of the field glass and mil relation. In any case when two or more means are available all should be used. The goal is always to make the first round count.

e. Leads.—In order to eliminate the possibility of confusion in the use of leads the reason for the use of each type should be explained. The simplest method is the use of angular leads since for all practical purposes the same amount of lead will be used regardless of the range to the target. Thus when angular leads are used only one variable is involved, the speed of the target. Hence only one estimate is made, which allows only one possibility of error. Were it possible, this method would be used for moving target firing with all weapons. This is possible, however, only with the telescopic sight and hence the method is limited to the destroyers. For this type of firing 5 mils are taken as one lead.

With the small arms, which are equipped with iron sights, there is no mechanical means of obtaining angular leads. For this reason, and this reason only, target length leads are employed, one lead being the apparent length of the target at the range at which it is located. This method of firing requires the determination of two factors, i.e., range to the target, and target speed. Since both of these factors must normally be estimated, the probability of error from this standpoint alone is twice as great as with the angular lead.

f. Estimation of target speeds.--(1) In firing on a moving target, speed estimation enters the picture in getting the initial shot or burst on the target. In view of the importance of making the first round count, speed estimation is a vital part of the gunner's training.

(2) To become proficient in estimating speeds constant practise is necessary.

(3) Overestimation is better than underestimation. The target may run into fire that is ahead of it, but will never run into fire

that is behind.

(4) To learn speed estimation gunners must be taken to the range and required to practise on actual vehicles. Training must embrace every possible factor affecting estimation. Some of these are:

(a) Range.

(b) Type and size of vehicle.

(c) Visibility—dusk, sunlight, rain, fog, dust, etc.

(d) Direction of vehicle—angle of its path with respect to observer.

(e) Length of time vehicle is visible--intermittently hidden by terrain, appearing only at brief intervals, etc.

(5) Be sure the vehicles used for instruction are driven at the speeds you prescribe. Do not tell your group the speeds in advance; tell them after they have made their estimation.

(6) Work to the end of making every man estimation-conscious. When they practise it on their own time on non-military traffic, your training is succeeding.

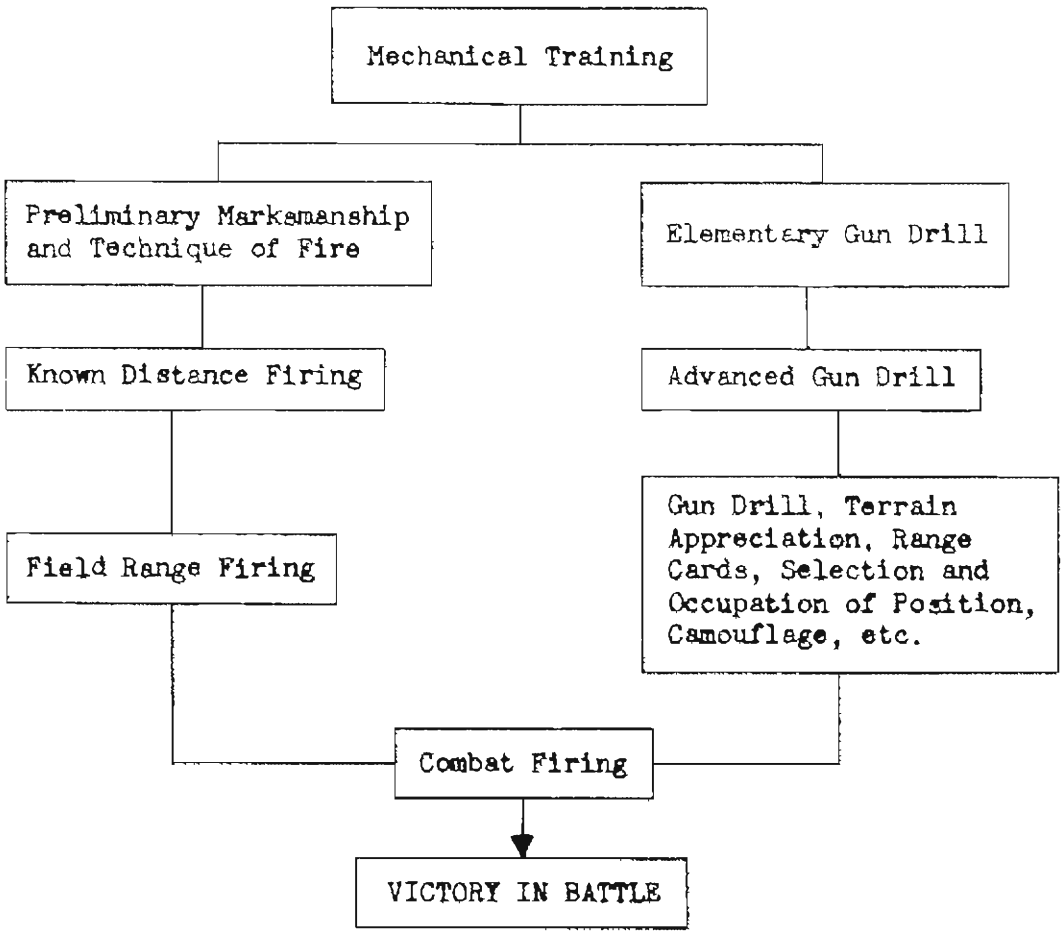
(7) No attempt should be made to estimate speeds to the exact mile per hour. By so doing we would ask the impossible and thereby defeat our purpose. Let it suffice to make the estimate as "slow" (0 to 10 mph), "medium" (10 to 20 mph), "fast" (20 to 30 mph) and "very fast" (over 30 mph).

g. Indirect laying.--Since the methods used for indirect fire vary with the type of weapon employed, a discussion of this subject will be included in the sections on the weapons.

h. Fire orders and conduct of fire.--These subjects will be included under each of the weapons sections to which they are particularly applicable.

25. SUMMARY.—The goal of all training is victory on the field of battle. Where each phase of gunnery training fits into the march toward that goal is suggested by the following diagram:

GUNNERY TRAINING



SECTION II

INDIVIDUAL WEAPONS

26. PRELIMINARY.--a. The purpose of preliminary marksmanship is to teach the soldier the correct gunnery techniques before he takes up range firing. In combat "just about right" will not kill the Jap.

b. The rifleman must develop correct habits in his training, since it is easier to form a good habit than it is to break a bad one. For example, it is easier to make a marksman out of a soldier who has never fired the rifle than one who has fired and formed the habit of "jerking" the trigger.

27. PREPARATORY EXERCISES.-- The six preparatory exercises in marksmanship are taught in the order listed below. What is learned in each exercise must be practiced in each succeeding one. Short time gaps should be provided between phases of instruction to keep the soldier from becoming stale and to enable him to digest what has been covered.

a. Sighting and aiming.

b. Positions.

c. Trigger squeeze.

d. Rapid fire.

e. Sight adjustment.

f. Examination.

28. SIGHTING AND AIMING.--a. To hit the bull's-eye, the soldier must know exactly what he should see when he looks through the rear sight of his rifle. The rear sight, front sight and bull's-eye must be lined up in a certain way, to produce a bull's-eye hit. There is only one correct sight picture; every other picture is wrong.

b. Demonstrate the correct sight picture on a chart or blackboard. Show the relationship between the front sight and the rear sight first. When the group understands that--and not before--show the place of the bull's-eye in the correct sight picture.

c. The next step is the use of the sighting bar. Make sure the slowest man in your group understands the relationship of every part of the device to the corresponding part of the rifle and the target. Point out that the bull must not be placed on the bar until after the front

sight blade is centered in the peep.

d. When the soldier is proficient in the use of the sighting bar, he progresses to the next step in sighting and aiming--triangulation. The ability of the gunner to take exactly the same sight picture each time can be determined in this exercise by checking the size of the "shot group." This exercise also gives the gunner his first look at the target through the sights of a rifle. Always have the sights cleaned and blackened before starting this exercise. Check each gunner's sight picture carefully during the making of his first triangle (shot group), either by using an aiming device or by having him lay the gun on the bull and then checking the sight picture by getting down behind the gun. Conduct triangulation exercises first at close range (50 feet): as the gunner becomes proficient at that range, increase the range.

29. POSITIONS.--a. General.--(1) After sighting and aiming, the soldier is ready for position exercises. Steadiness is of prime importance; it depends on the correct position and the proper method of adjusting the sling and holding the breath. Sling adjustment and breath control are taught prior to the positions proper.

(2) In all position practise, the gunner should have a target at which to aim, so as to combine practise in sighting and aiming with the learning of correct position.

(3) The basic--and steadiest--position is prone. The sitting position affords less stability than the prone and kneeling still less; standing is the most difficult of all positions from which to shoot accurately. However, each position has its peculiar value and by constant practise of the correct procedure, the gap from prone to standing can be bridged.

(4) Regardless of the position being used, train your men to aline themselves with the target by glancing through the sights, then to close both eyes for a moment. If the rifle seems to be pointing to the right or left of the bull's-eye, the position of the entire body is shifted until the gun is pointed at the bull's-eye. Then it is not necessary to HOLD it on the point of aim.

(5) In all positions, keeping the left elbow directly under the gun is an important factor in good marksmanship. The gun merely rests in the "V" formed by the thumb and the fingers of the left hand; it is not gripped.

b. Prone Position.--(1) The prone position is the easiest of all positions to shoot from. In battle it offers the smallest target to the enemy. This is the basic position; until it is mastered, the soldier must not be allowed to proceed to the next.

(2) From the very beginning, the soldier must be taught to press his cheek firmly to the stock and in the same position for each shot. "Checking" the piece in the same manner for each shot enables the rifleman to "line up" on the target quickly from any position, and he soon forms the

habit of looking through the rear sight instead of at it. If the face is held in the same position on the stock every time, the eye automatically centers itself in the peep sight and the shooter gives his undivided attention to placing the front sight in the correct place on the target. Too many beginners look at the rear sight; this makes the target and the front sight merely a blurr. Pressing the check against the stock, and allowing the face to move to the rear with the rifle, also reduces the shock of recoil. Reducing shock reduces flinching.

c. Sitting Position.--(1) In the sitting position, the knees should be no farther apart than the feet. Keep in mind that the soldier forms a tripod with his feet and buttocks, and that he bends forward from the hips in order to keep the weight forward. The weight from the elbows is not borne by the knees but is transmitted from the upper arms to the legs. If the knees are too far apart, the shooter will sway from side to side. The advantage of the sitting position over the prone is that it is quickly assumed, is almost as steady as the prone, and permits firing from weeds or very low walls at targets that cannot be seen from the prone position. In the prone position the shooter's eye is only about 12 inches above the ground, while in the sitting position it is about 24 or 25.

d. Kneeling position.--(1) In rapid advances where the soldier desires to get quickly into and out of a position, the kneeling position is especially good. It permits seeing over higher obstacles than the sitting position, can be assumed very quickly, and does not require use of the hand when the soldier gets to his feet. The kneeling position enables the soldier to lunge or shoot in case of emergency.

(2) In the kneeling position a common error is for the shooter to place his left foot in too close to the other two points of the "tripod," which causes the body to sway. The shooter's weight should be as evenly distributed as possible. If the rifle bobs up and down while it is being aimed, have the man slide his left hand outward or inward until a position is found that will reduce the movement to a minimum. The point of the left elbow is a few inches forward of the left kneecap.

e. Standing position.--(1) The standing position is the hardest of all to learn, but is essential to firing over obstacles and from behind walls or other forms of high protection.

(2) The beginner usually makes the mistake of standing as if he expected someone to push him over. Check to see that his feet are placed just far enough apart for steadiness. To place a man in the correct position, have him assume an easy standing position, raise his right arm over his head, and flex the arm muscles. Hand him the rifle and see that he fixes it firmly against his shoulder with his left hand. Then have him lower his right hand, leaving the elbow in position, and grasp the gun at the small of the stock, increasing the pressure of the stock against the shoulder. This action keeps the right elbow at the proper height, forming a pocket at the shoulder for the butt of the rifle. The rifle should merely rest in the left hand. Take care at this point to see that the soldier does not lean either backward or forward.

30. POSITIONS FOR THE THOMPSON SUBMACHINE GUN.--a. General.--The positions for firing the submachine gun are very similiar to those for the rifle, except that the firer keeps his hips and shoulders as squarely toward the target as possible. The gun is not pulled into the shoulder; most of the weight of the gun is supported in the right hand. The right shoulder is rolled forward to compensate for the thrust of the gun during firing. Failure to do this will cause the gun to rise badly at automatic fire.

b. Prone.--The most difficult part of assuming this position correctly is keeping the body pointed toward the target and the backbone straight, since there is a natural tendency for the firer to lie at an angle to the target. If the man firing the gun has short arms he may have difficulty in reaching the foregrip due to the position of the magazine. It is possible to support the muzzle of the gun by placing the left hand around the magazine and supporting the gun on the circle of the hand formed by the thumb and forefinger.

c. Sitting.--The sitting position is used for firing from partial concealment or cover such as in tall grass or behind logs, or rocks. It is fairly steady. It is fundamentally the same as the sitting position for the rifle but care must be taken that the shoulders and hips are in the proper position. The right shoulder must be rolled forward into the piece to prevent its rising at automatic fire. Note that when the firer is in the sitting position, the magazine does not interfere with his left arm.

d. Kneeling.--The kneeling position, somewhat less stable than the sitting, is used under similar conditions. It is the same as the rifle position except for the position of the shoulders.

e. Standing.--The standing position differs considerably from the one for riflemen. A good way to instruct the soldier in taking this position is first to have him face the target and assume the position of raise arms. Then have him take a short step forward with his left foot, bend the left knee slightly, bend the body slightly forward at the waist, throwing the weight of the body onto the left foot. The right foot is kept in a position most comfortable to the firer. Next have the man bring the gun up to his shoulder, roll the shoulder into the butt of the gun, and aim at the target. If this position is correctly assumed, the left hand may be removed from the foregrip and the gun will remain pointed at the target. The piece must merely rest lightly in the left hand. Correct the soldier's tendency to "fight" the gun during firing. With the correct handling, when the trigger is released the gun will come to rest in the palm of the left hand after the firing of bursts.

31. FIRING THE SUBMACHINE GUN.--Instruction should always begin with the soldier firing single-shot. As the training progresses, work up to short bursts (two or three shots), then to 10-round bursts. This training must be progressive.

32. TRIGGER SQUEEZE.--a. Even if the soldier performs correctly all of the other operations of firing, failure to squeeze the trigger will keep him from becoming a good shot. Trigger squeeze is the most important

single factor in small arms marksmanship.

b. In preliminary practise without ammunition, the beginner usually blinks his eyes when the striker snaps. This habit must be eradicated before he is allowed to fire a loaded rifle. One of the principal methods by which the rifleman detects his errors is by noting the point of aim at the instant of firing.

c. To squeeze the trigger after the slack is taken up, the firer exerts a steadily increasing pressure in such a manner that he cannot know the exact instant the gun will go off. One method of insuring this is to require the firer to squeeze the stock first, then squeeze with the whole hand to include the index finger on the trigger. If the shooter is squeezing the stock with any finger the fingernail turns white near the end. This test allows the coach to determine whether or not his instructions are being carried out.

d. Squeeze the trigger and the shot is controlled; jerk the trigger and the shot is lost.

e. Prior to actual firing practice, it is extremely difficult to determine whether the soldier is squeezing the trigger properly. Even in dry runs, however, it is possible to check his breathing. If his back moves, or if any "see-sawing" of the rifle muzzle is noticeable, he is not holding his breath during the trigger squeeze.

33. RAPID FIRE.--Rapid fire does not mean firing so rapidly that the aim is slighted or that the trigger is jerked. It is a smooth, unhurried but rapid delivery of aimed fire.

34. GUNNER'S TEST.--An examination should be held at the end of each preparatory exercise to test the soldier's fitness to proceed to the next. This will obviate the compounding of bad habits. No shooter should be allowed to proceed to the second exercise in marksmanship until he has mastered the first.

35. KNOWN DISTANCE FIRING.--a. General--(1) In organizing the firing line, the pit detail and the range in general, work by squad, section, and platoon, each leader instructing his own unit.

(2) In the early phases of known distance firing, stress the making of good shot groups, not scores.

(3) The first shots are always fired from the prone position, because it is not only the easiest and steadiest of all the positions, but also the one on which all the others are based.

(4) Never allow a man to keep firing in any position when it is evident he is not improving. Move him back one step in the training sequence; for example, from the sitting position back to prone or from prone back to the sighting bar and triangulation exercises.

b. Caliber .22 firing.--(1) The caliber .22 rifle is recommended

for the first stage of firing because it is convenient, economical, and holds the beginner's interest. What is learned on this weapon is directly applicable to the caliber .30 rifle and carbine.

(2) Start practise at a range of 50 feet, then move to 100 and finally 200 yards. Excellent training at 200 yards in all positions can be had with this weapon.

c. Caliber .30 firing.--(1) When the soldier is graduated to the larger rifle, watch his trigger squeeze particularly. Correct the tendency to flinch, blink the eyes, and jerk the trigger, which may not have been present in caliber .22 firing.

(2) A slight bruising of the shoulder is not unusual the first few times the caliber .30 rifle is fired. However, persistent complaints indicate the soldier is not holding the rifle properly against his shoulder.

(3) Accommodate the ammunition allowance per man to the progress each one is making. The per capita allowance is fixed by regulations, but there is nothing to forbid you from cutting down the quota for the rapidly advancing rifleman in favor of the one who needs more practise to keep up. In training troops the goal is not a lot of experts and a lot of "Bolos." The goal is rather to make an efficient fighting team where every man is better than satisfactory.

36. CRITIQUES.--a. General.--Any deficiency noted on the firing line is related, directly or indirectly, to faulty trigger squeeze, improper positions, an incorrect sight picture, or breathing while firing.

b. Examples.--(1) To a man who consistently scatters his shots all over the target: "Jones, your failure to get a shot group indicates you are jerking the trigger instead of squeezing it. I'm going to give you a new clip of eight rounds; two of the eight will be dummies. Now, grip the rifle with your right hand, but don't apply any pressure on the trigger yet. That's the idea. You see how white your thumbnail is? Now I know you're squeezing the stock. Continue the pressure with your entire hand and now squeeze with your trigger finger as well. No, you're still jerking! Grip the rifle again and squeeze until your fingernails and knuckles are white. Here, I'll put my hand over yours this time and squeeze along with you. See how I apply that steady pressure? Load up and try a round....There you are--a bull's eye!"

(2) To a man whose position is incorrect: "Bradley, look how your shots are scattered over the target. I checked your sight picture a while back and it was ok. You're squeezing and breathing properly, but that kneeling position of yours is bad. See how having your left foot too close to your body throws your weight to the rear? Push your left foot forward now and lean farther forward from the hips. Now get your left elbow directly beneath the gun. Notice how the gun stops wobbling? Squeeze off a shot and see what happens . . . A four at 6 o'clock. I think you're on the right track. Now, let's get a good group."

(3) To a man with a good shot group--outside the bull's eye:

"Your shot group is excellent, Smith, but let's get it out of the 4 ring and into the bull. If that bull's-eye was a Jap's head you would have missed him. Your gun has been zeroed, so it's probably your sight picture that's at fault. Here, take this sighting bar and show me the sight picture you've been using . . . Just as I thought. The bull's-eye is perfect with respect to the front sight, but look at the front sight itself--it's quite a bit too far up in the peep. Go back to the dry line and have your squad leader check you up on the sight picture."

(4) To a man whose shots form an almost straight vertical line: "Looks like breathing trouble, Black. Get in position and fire a shot for me. There it is--the muzzle of your gun is going up and down like a see-saw. I can see your back moving, too. Now, take a deep breath, let some of it out and then cut it off in your throat . . ."

37. ADVANCED FIRING.--a. Training in individual weapons proceeds from known distance firing to combat problems.

b. Advanced training should develop the ability to: give fire orders from covered positions; use cover and concealment in moving from one firing position to another; select good firing positions; deliver group fire on point targets; exercise strict fire control; and engage surprise targets and distribute fire so as to get the maximum effectiveness from the ammunition used.

Section III

MACHINE GUNS

38. GENERAL.--a. This section applies to the caliber .30 and caliber .50 machine guns. However, repetition of general gunnery principles has been used where it seemed necessary.

b. Subject matter in this section is taken up in the following sequence:

(1) Preliminary marksmanship.

(2) Technique of fire.

(3) Known distance firing.

(4) Gun drill.

(5) Field Range Firing (including simple indirect methods and night firing).

(6) Combat firing.

(7) Antiaircraft fire.

39. MARKSMANSHIP.--a. Marksmanship is the basic step in training the gunner to employ his weapon successfully in combat. Training is based on the principle that the gunner, under stress of combat, will follow subconsciously the methods instilled in him by pre-combat instruction and practise.

40. PREPARATORY EXERCISES.--The gunner's first step in learning the fundamentals of marksmanship is to learn to handle the gun. This step is taught by preparatory exercises which will develop fixed and correct habits of marksmanship before the gunner begins range practise. Instruction should be thorough. The gunner must be required to master each exercise before going on to the next. Remember, "Good shots are made on the dry line, not on the range."

41. CORRECT SIGHT PICTURE ON THE GUN.--a. Do not omit this step even though your men may have had a good foundation in rifle marksmanship. Treat previous instruction as an aid, not a substitute.

b. Have each gunner lay the gun on an aiming paster and check him for these common errors:

(1) Failure to center the front sight blade horizontally; that is, the front sight is too low in the peep.

(2) Failure to center the bull directly on top of the front sight blade; in other words, taking a line of white.

c. If during triangulation exercises, or even after he has started actually firing, the soldier fails to center the front sight blade in the peep, recheck him on the sighting bar. If this does not correct his errors, proceed as follows:

(1) Set off the correct sight picture on the gun. (Fig. 8)

(2) Have the soldier get behind the gun again, but place your hand in front of the front sight so that he cannot see the target.

(3) Tell him to center the front sight in the peep.

(4) Raise your hand quickly and ask the soldier if the bull is directly on top of the front sight. In most cases he will find that the front sight is up into the bull, or even above it. This is definite proof that he is not centering the front sight horizontally in the peep sight.

(5) Next, have the soldier raise or lower his cheek until the bull is in the upper half of the peep sight and resting directly on the front sight blade.

(6) Caution him not to change his position; place your hand in front of the front sight again, and tell him that the front sight blade is now centered in the peep. Make sure he recognizes what this looks like.

(7) Turn the gun off in elevation and have the soldier lay on the bull with the correct sight picture. If he still takes an incorrect sight picture, repeat steps (1) to (6). A few minutes spent here with patience and understanding will save time and ammunition on the range and will improve the gunnery of the whole team.

42. TRIANGULATION EXERCISES.--a. Check the gunner's sight picture frequently; he can take an incorrect sight picture and still get a good shot group.

b. If the gunner does not get a good shot group, make him repeat the exercise until he does; be sure to check his sight picture before each repetition.

c. Inability to satisfactorily perform an exercise often indicates improper or incomplete instruction in an earlier one. If the gunner can't do the second exercise with reasonable facility, recheck him on the first. This same principle applies to all his marksmanship training. If he has difficulty with simple firing exercises, put him back on preparatory marksmanship to detect his deficiencies. If the more difficult firing exercises are too hard for him, return to the simpler ones. His train-

THE CORRECT SIGHT PICTURE

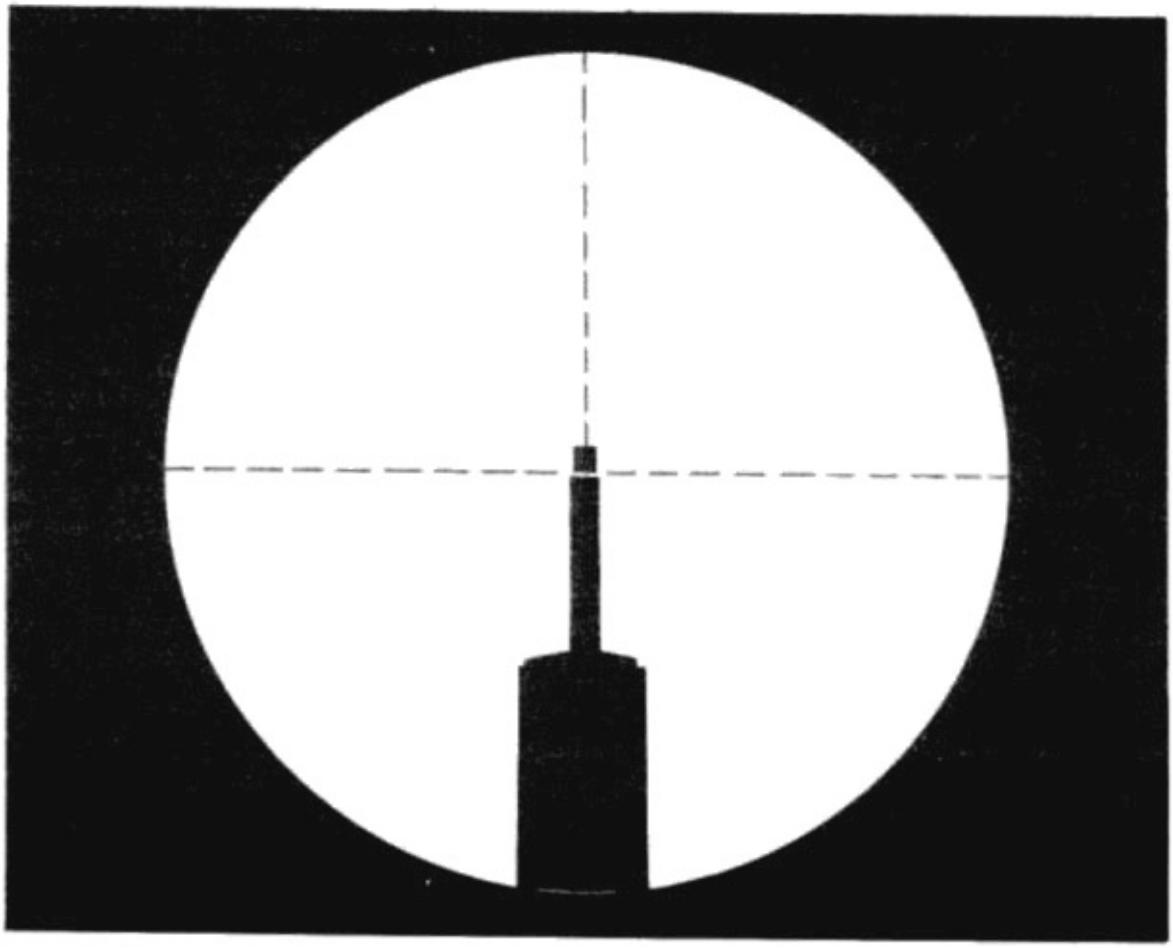


Figure 8

ing must be progressive. Never require him to perform an exercise which is beyond his ability.

43. METHODS OF FIRING.—a. Single-shot (caliber .30 MG)—(1) Tap off each shot by striking the trigger with the right hand, between the knuckle and the second joint of the forefinger; the fingers of the hand are extended and joined. (Fig. 9) This method is used when you want positive single-shot action in precision fire, such as in zeroing the gun on the 1000-inch range or firing at a fixed target where extreme accuracy is desired.

(2) Squeeze off each shot by grasping the stock and extending the forefinger to the trigger; holding the trigger in the first joint of the finger will give the greatest degree of control. Release the trigger immediately; avoid "leaning in it." (Fig. 10) This type of single-shot firing is used against moving vehicles because tapping off is impossible during tracking.

b. Single-shot (caliber .50 MG).--(1) Grasp the right spade grip with the first two fingers of the right hand, the other fingers allowed to curl loosely around the grip.

(2) With the thumb stiff, on the trigger, back of the hand facing as nearly straight up as possible without releasing the grip, take up the slack in the trigger.

(3) By flexing the wrist downward, apply a quick pressure to the trigger with the stiff thumb. This pressure is applied and released so quickly that it is almost a "bump."

c. Burst (caliber .30 MG).—This consists of firing more than one shot each time the trigger is pulled; in other words, automatic fire. It is used against aircraft and laying down fire on a final protective line. It may also be used to advantage to cover an area target. Firing by bursts should not be employed at long ranges with the LMG as the resulting dispersion makes this type of fire ineffective and unnecessarily overheats a gun that was not intended for such a high rate of fire.

44. SIGHT SETTING AND AIMING.—a. Battlefield targets appear suddenly and at all ranges. The purpose of this exercise is to train the gunner to be able to engage targets accurately and rapidly at any range.

b. With the rear sight down and a range of 500 set off, give an order such as RANGE 800, PASTER, NUMBER, COMMENCE FIRING. The gunner immediately sets off the announced range and lays the gun on the target. (This is a dry-run exercise; see par. 72, FM-23-50). Check the gunner for both accuracy and technique. For advance practise, have the gun placed in a combat position; use terrain features as targets. Gunners should be able to set off the range and lay on the target in 10 seconds; train to cut down the time, but not at the expense of accuracy.

45. MANIPULATION.--a. Manipulation exercises are described in the field manuals on machine guns.

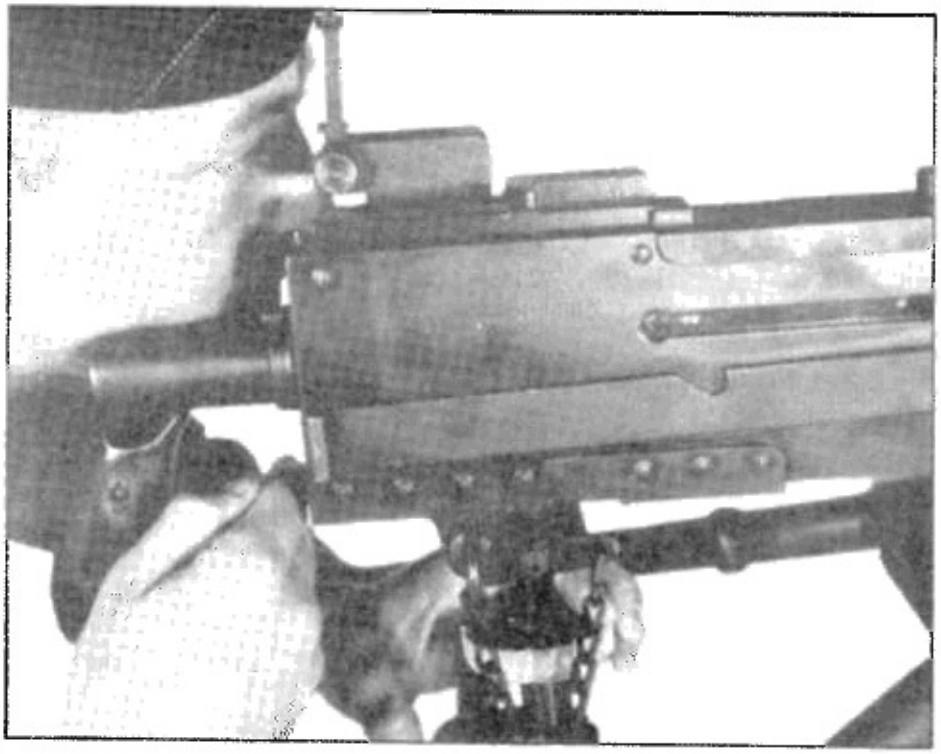


Figure 9

Figure 10

b. Explain and demonstrate the "thumb rule," RIGHT IS UP, UP IS RIGHT.

(1) With the left hand on the elevating handwheel, turn the thumb to the right, and the muzzle moves up. RIGHT IS UP.

(2) With the left hand on the traversing handwheel, turn the thumb up, and the muzzle moves to the right. UP IS RIGHT.

Note: A variant of the above rule is PUSH UP, PULL DOWN; PUSH RIGHT, PULL LEFT. Use one rule or the other; using both will confuse the gunner.

46. CENTERING THE GUN ON THE 1000-INCH TARGET.--a. Before attempting to manipulate the machine gun to cover the entire target, the gunner should center the gun on the target. Failure to do this will cost much time through necessity of adjusting the traversing mechanism.

b. Center the gun as follows:

(1) Clasp the traversing clasp at zero on the traversing bar, with zero to the left of the slide.

(2) Center the traversing handwheel by turning it all the way to one side, then backing off 30 mils; count the clicks, or read the 30 mils on the micrometer scale.

(3) Looking through the sight, move the trail legs of the mount so that the line of aim is on the searching target.

(4) Dig or pound the shoes of the tripod into the ground until the tripod is level.

47. TARGETING THE GUN.--a. Targeting the gun consists of alining the sights so that you will hit where you aim; that is, so adjusting the sights that the point of aim and the point of strike of the bullet coincide at the target. A gun must be targeted every time the barrel is changed; it should be checked frequently. This is very important since in this stage of training the gun should be so perfectly prepared that any error on the target must without doubt be the fault of the gunner.

b. Before any targeting, check the gun and tripod to see that:

(1) The clamping screw, bracket screw, and locking screw on the front sight are tight.

(2) The headspace adjustment is correct.

(3) The gun's pintle bolt is tight, but not tight enough to bind.

(4) Oil has been removed from the barrel with a clean, dry patch.

(5) The gun is centered on the target, the tripod is level and its shoes pounded into the ground securely. (See FM 23-50.)

(6) All bolts and nuts of tripod are tight.

48. TECHNIQUE OF FIRE.--The general subject of technique of fire, applying to all weapons, is covered in the first section of this manual as well as appropriate FM's. Here the subject is treated in its specific application to machine guns, under the following headings:

a. Characteristics of machine guns.

b. Trajectories.

c. Methods of firing.

d. Beaten zone.

e. Fire orders.

49. CHARACTERISTICS OF MACHINE GUNS.--a. General.—The machine gun is capable of delivering a great number of aimed shots within a short period of time.

b. Principal targets:

(1) Caliber .30 personnel: turret and vision slits of tanks, to force them to "button up."

(2) Caliber .50 light materiel such as "thin-skinned" vehicles, aircraft, and personnel; invaluable against antitank gun crews in the open.

50. TRAJECTORIES.--A knowledge of trajectories is important in the selection of gun positions, clearing masks, and delivering overhead fire. Night firing with tracer, with men observing from the flanks, is an effective training method to show the shape of the trajectory when firing at various ranges.

51. METHODS OF FIRING.--a. Rapid single-shot is generally preferable to bursts because it conserves ammunition, is more accurate, and does not disclose the gun position so readily. It is the normal method of firing both the caliber .30 and caliber .50 MG's. Long strings, rapid single-shot assist materially in observation of strike at long ranges. Long strings are better for the purpose than long bursts as they are more accurate and the strike is therefore more concentrated and easier to see.

b. The number of shots to be fired in a short burst depends on such factors as the nature of the target, steadiness of the mount, ammunition supply, the condition of the gun, and the range to the target. The shorter the range the longer may be the burst without loss of effectiveness. Firing bursts causes the gun to jump or "search" considerably, with resultant waste of ammunition. This is particularly so when the tripod

stands on extremely hard (such as frozen or rocky) ground.

c. Firing in long bursts is the normal method against aircraft.

d. In training, stress continuously the problem of ammunition supply, which indicates the necessity of conserving ammunition. Remind your men that 100 rounds of caliber .50 ammunition weighs 30 pounds--and can be fired away in about 15 seconds.

52. BEATEN ZONE.--Use simple sketches to illustrate the general shape of the beaten zone. A good gunner should know that the long axis of the beaten zone is in the direction of range, that the length is about 150 yards at a range of 500 yards and 50 yards at a range of 1500 and that for all practical purposes it is about 2 yards wide at all ranges.

53. FIRE ORDERS.--a. Purpose.--The purpose of a fire order is to give the leader a means of laying fire from the weapons of his unit on the right target, at the proper time, in the necessary amount, with the most effective distribution, in the least amount of time. This can be done by oral orders or hand signals. For hand signals see FM 22-5, pars. 292-323.

b. Delivery.--Make sequence, clarity, and brevity your guides in giving fire orders. Be as brief as clarity permits, and remember that a fire order poorly given will be executed in just that way.

c. Execution.--Supervise and correct constantly; place accuracy before speed. Train gunners to repeat all orders given. Make your gunners proficient in executing hand signals as well as oral orders.

54. TARGET SELECTION.--Selection involves the choosing both of remunerative targets and of the proper weapon and ammunition. Don't use caliber .50 guns on personnel when caliber .30 guns will do the job. Don't waste caliber .30 against light armor when you have .50 ammunition on hand. Suggested training methods:

a. Fire both .30 and .50 ammunition--ball, tracer and AP--on various thicknesses of armor at selected ranges and show the effects of each.

b. When making a motor march, point out typical targets and ask your gunners which gun and ammunition should be employed. Critique their answers.

55. DIRECTION.--Drill the gunner in the intelligent use of reference points. Practise indicating target direction by the clock system--12 o'clock for front, 3 o'clock for right, etc., in combination with FRONT, LEFT FRONT and so on. For example LEFT FRONT, TEN O'CLOCK.

56. FIRE DISTRIBUTION.--Proper fire distribution will save more ammunition and kill more of the enemy more quickly than any other single element of a fire order. (Figs. 11 and 12)

57. FIRE CONTROL.--a. Overhead fire.--A frequently overlooked point

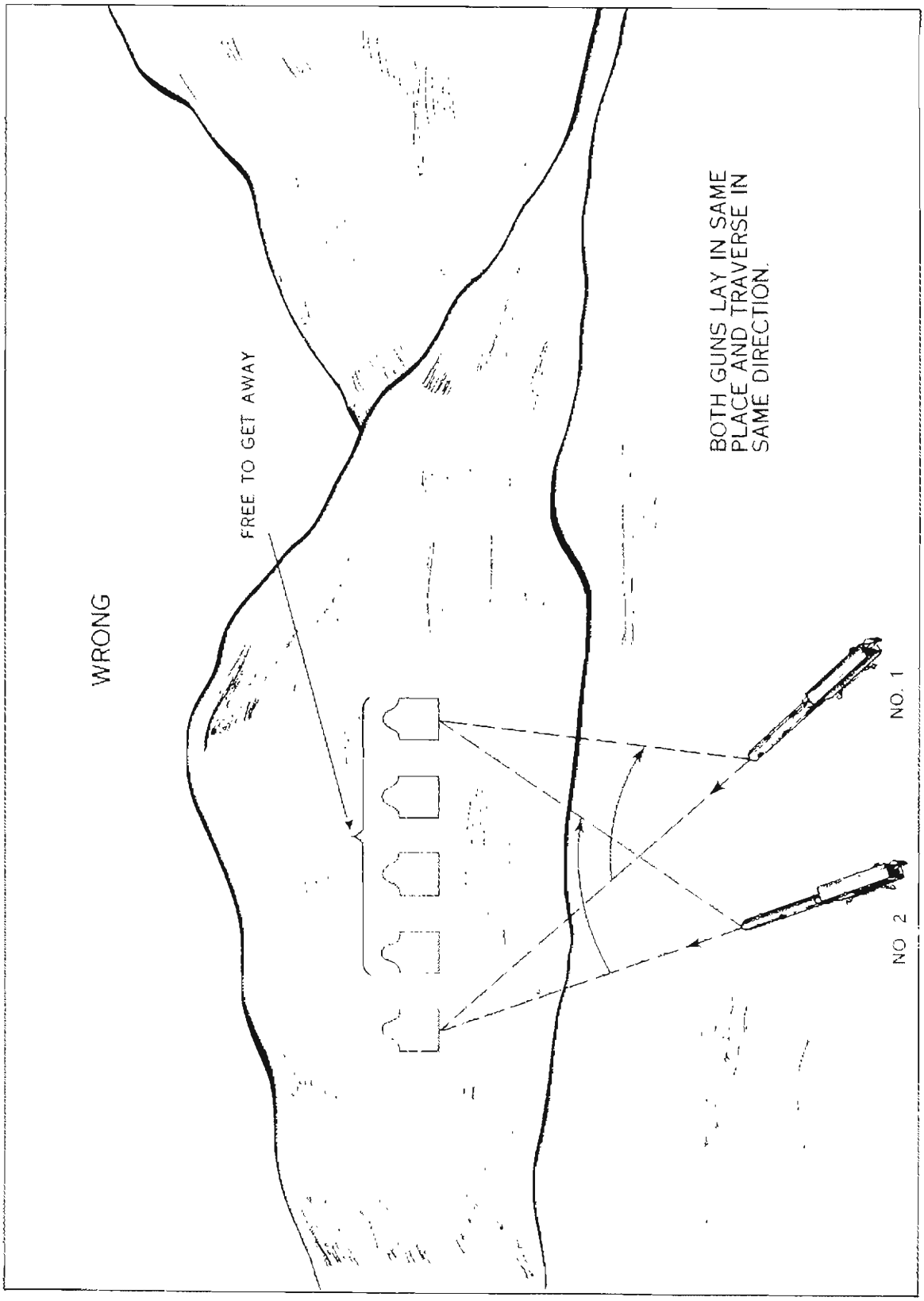

WRONG
FREE TO GET AWAY
BOTH GUNS LAY IN SAME PLACE AND TRAVERSE IN SAME DIRECTION.
NO. 1
NO. 2

Figure 11

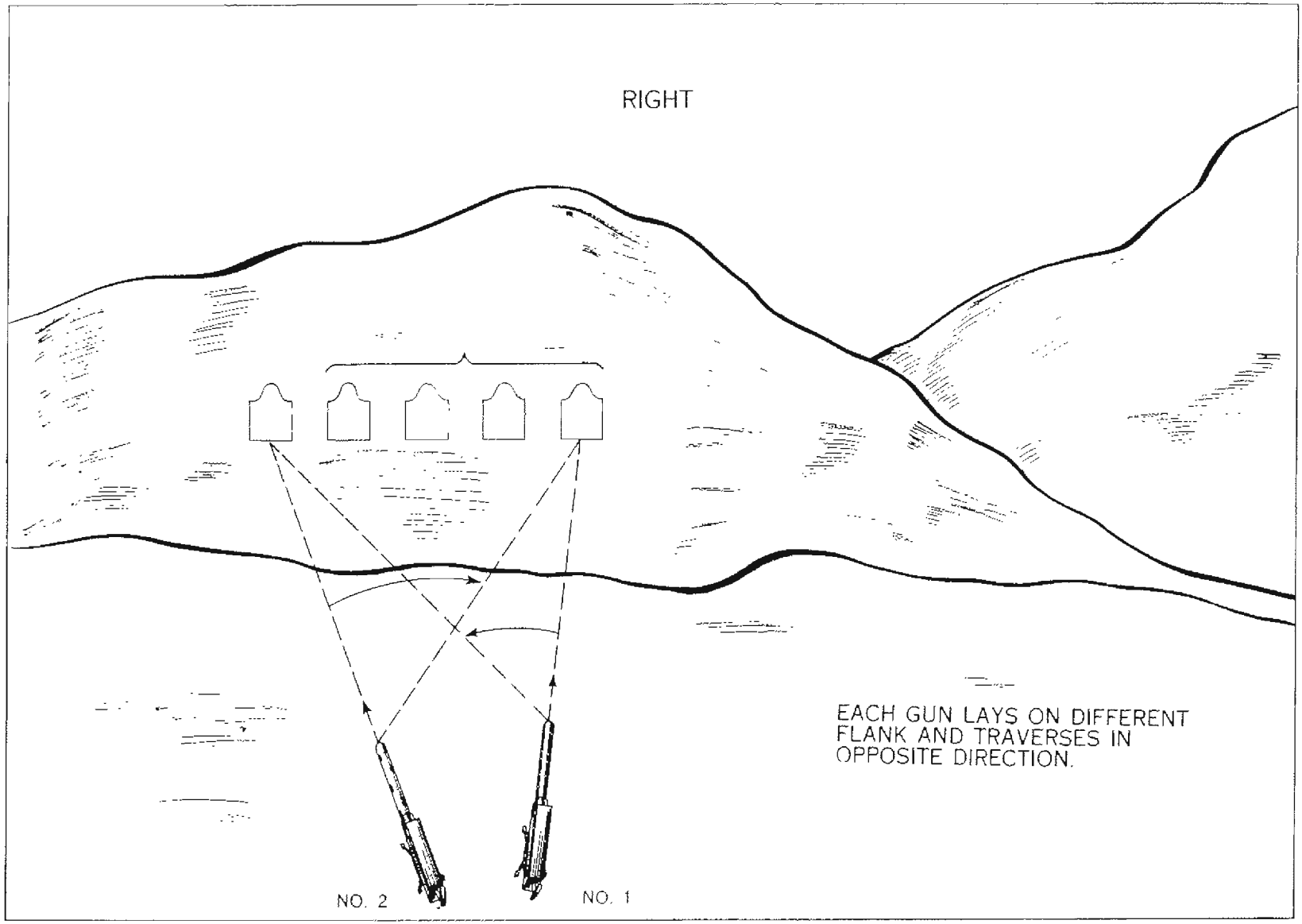

RIGHT
EACH GUN LAYS ON DIFFERENT FLANK AND TRAVERSES IN OPPOSITE DIRECTION.
NO. 2
NO. 1

Figure 12

is the time required for delivery of overhead fire from the time the order is given. Leaders must train their gunners in application of the gunner's rule (see par. 127, FM 23-50) during training, in order to have a guide in combat.

b. Rate of fire.--Gunners acquire the ability to adjust their rates of fire only through actual practise. Enhance the value of this practise by stressing the factor of ammunition supply in combat. Show how the rate of fire varies with the mission, such as firing harassing actions, firing on an attacking force, and firing down a final protective line.

c. Time of opening fire.--The importance of the gunner's not opening fire until told to do so may be demonstrated by a simple exercise with blank ammunition.

(1) Have an "enemy" patrol, simulating battle conditions, approach the gun emplacements.

(2) By prearranged signal, have one gunner (who has been told the exact position of the advancing patrol) open fire prematurely.

(3) Let the other gunners, not having been given a fire order, attempt to deliver accurate fire on the patrol before it disperses and takes cover, still a threat to the gun position.

(4) Repeat the exercise, this time making sure that all guns have received complete fire orders and open fire simultaneously. The lesson is effectively put across, blank ammunition notwithstanding.

d. Commands to commence and cease firing.--Stress hand signals (pars. 292-323, FM 22-5) as a means of ordering commencement and cessation of fire, as this method is too often neglected in favor of the more common oral orders. Emphasize the importance of ceasing fire at the proper time as a means of conserving ammunition.

58. FINAL PROTECTIVE LINES.--a. A final protective line is a fixed band of grazing machine gun fire (Fig. 13) laid on the predetermined point at a range of 750 yards or less through which the enemy will be forced to pass in order to make the final assault on your position (Fig. 14).

b. This subject is covered in the following order:

(1) Use.

(2) Influence of terrain.

(3) Dead space.

(4) Laying on final protective lines.

(5) Recording FPL data on range cards.

CLASSES OF MACHINE GUN FIRE
WITH RESPECT TO THE GROUND.

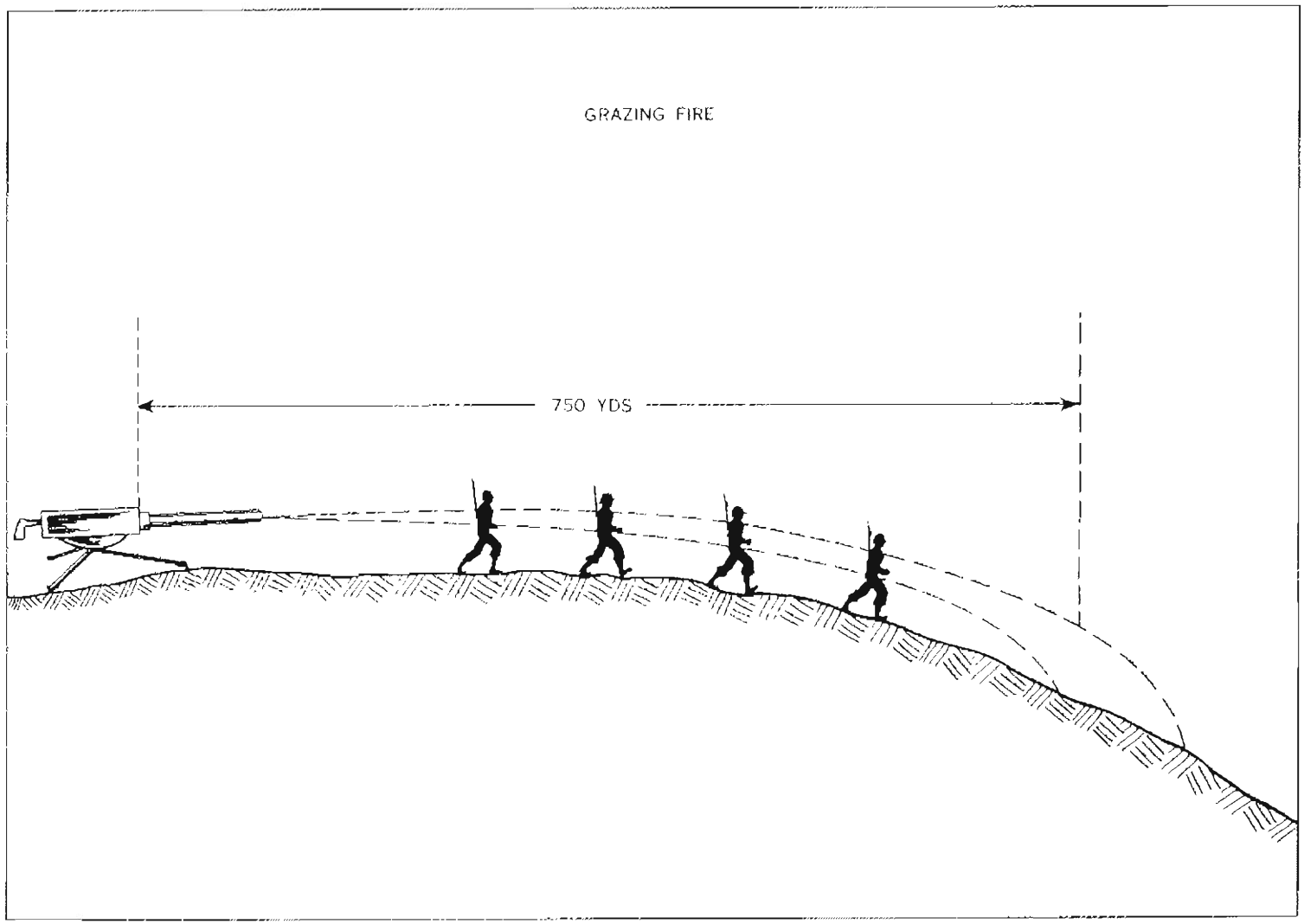


Figure 13

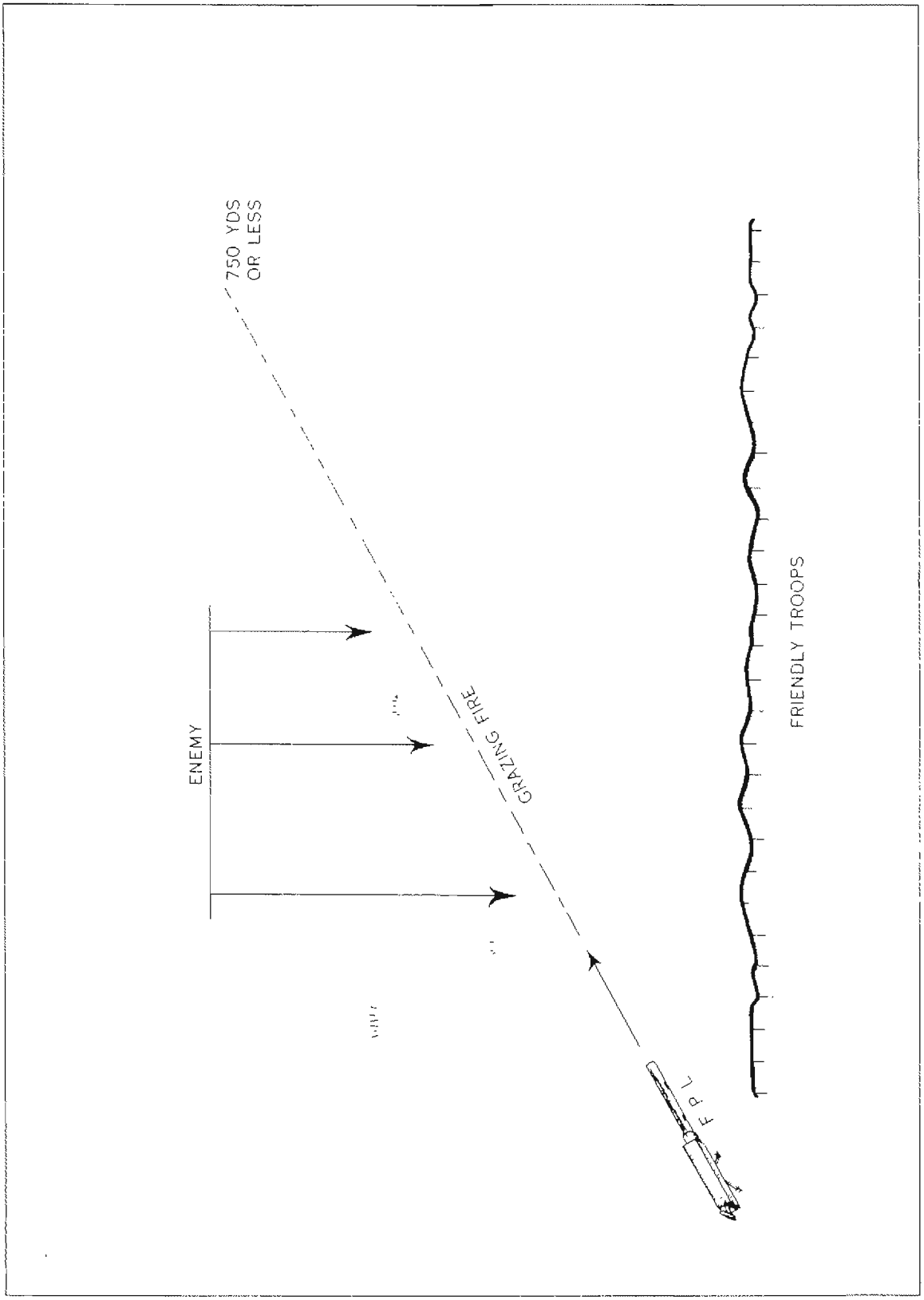


Figure 14

(6) Co-ordination of FPL with other guns or adjacent units.

59. USE.--A jittery gunner who opens fire when nothing but a squad nears it wastes ammunition and gives the enemy information that might cost the position. Final protective lines will be fired when the enemy makes his final assault on your position (fig. 15).

60. INFLUENCE OF TERRAIN ON THE FPL.--a. In selecting a point in which to register his gun to establish an FPL, the gun commander must analyze the terrain, because:

(1) The terrain must be flat or have a uniform slope to permit delivery of grazing fire.

(2) The maximum range for grazing fire is 750 yards.

b. The importance of terrain appreciation may be driven home by an exercise like this:

(1) Take your men to the combat range during daylight hours and have them place a gun in position.

(2) Set up a tactical situation and have the men select their own final protective lines.

(3) Fire tracer and let the men see grazing fire; place silhouette targets at various ranges to test the effectiveness of the fire on the selected FPL's.

(4) Point out errors; have your men select other positions and other FPL's which correct their previous mistakes in terrain analysis.

61. DEAD SPACE.--a. In combat it will be the rule rather than the exception that one or more ravines or similar depressions at an angle to the proposed FPL will produce dead space; that is, areas where the fire will not be grazing and where the enemy can take cover (fig. 16). The location of such spaces must be noted on the range card, so that the leader can have them covered by other small arms fire.

62. RECORDING FPL DATA ON RANGE CARDS.--Check range cards for the following points:

(1) FPL is indicated by a much heavier line than those marking other lines of fire--except where the FPL crosses dead space.

(2) FPL is identified by its initials.

(3) Deflection and elevation readings are recorded on the FPL in the same manner as on other lines of fire.

63. CO-ORDINATION OF FPL's.--a. When the tactical situation permits, increase the effectiveness of machine gun fire by: