

Figure 15

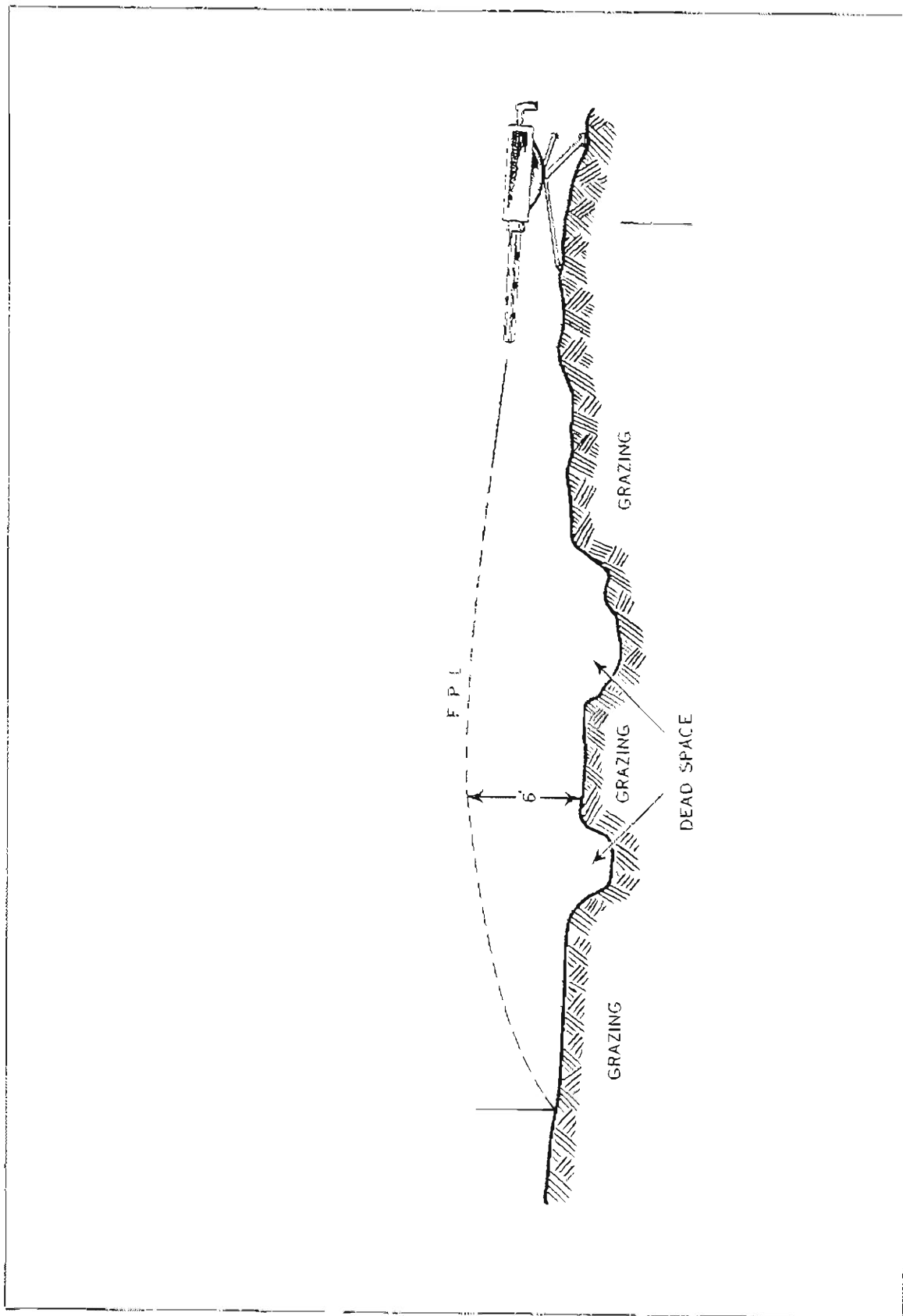


Figure 16

(1) Setting up your FPL's so that they protect not only your front, but also that of an adjacent unit. This can be done by causing your flank guns to cross fire with those on the adjacent flank.

(2) Co-ordinate interior guns so that their FPL's cross. This not only will permit laying down of crossed bands of grazing fire, but also will insure covering the front in case one gun is knocked out (fig. 17).

64. RANGE CARDS.--Range cards will be prepared every time a gun is placed in position. During training the cards will be critiqued carefully.

b. When the tactical situation permits, estimated ranges should be confirmed by firing on the final protective line and selected terrain features.

c. Range cards for machine gun positions may have 500-yard range line to facilitate plotting terrain features.

d. Data pertaining to the aiming box and other night firing aids should always be entered on the card.

e. For sample range card see fig. 18.

65. KNOWN DISTANCE (1000-INCH) FIRING.--a. Training in 1000-inch firing with the caliber .30 machine gun is adequate preparation for field range firing with both the caliber .30 and caliber .50 guns.

b. The 1000-inch machine gun target (pp. 98, FM 23-50) tests the gunner's ability to deliver all four types of fire classed with respect to the gun, each of which should be associated with battlefield targets (fig. 19):

(1) Fixed (fig. 20).

(2) Traversing (fig. 21).

(3) Searching (fig. 20).

(4) Combination searching and traversing (fig. 21).

66. ADVANCE ORGANIZATION FOR 1000-INCH FIRING.--a. General sequence of firing.--Break this down into phases which will lead firing from the simple to the complex. Plan to stress accuracy first, then speed. Remember that during the early instruction the gunner is trained to get good shot groups, regardless of where they hit on the target; later he is trained to put the groups on a designated part of the target. 1000-inch firing culminates in firing complete targets for record.

b. Maintenance of the range.--Provide for continuous loading of ammunition belts, replacing and pasting of targets, and racking and inspection of brass.

c. Behind-the-line instruction.--Behind-the-line instruction

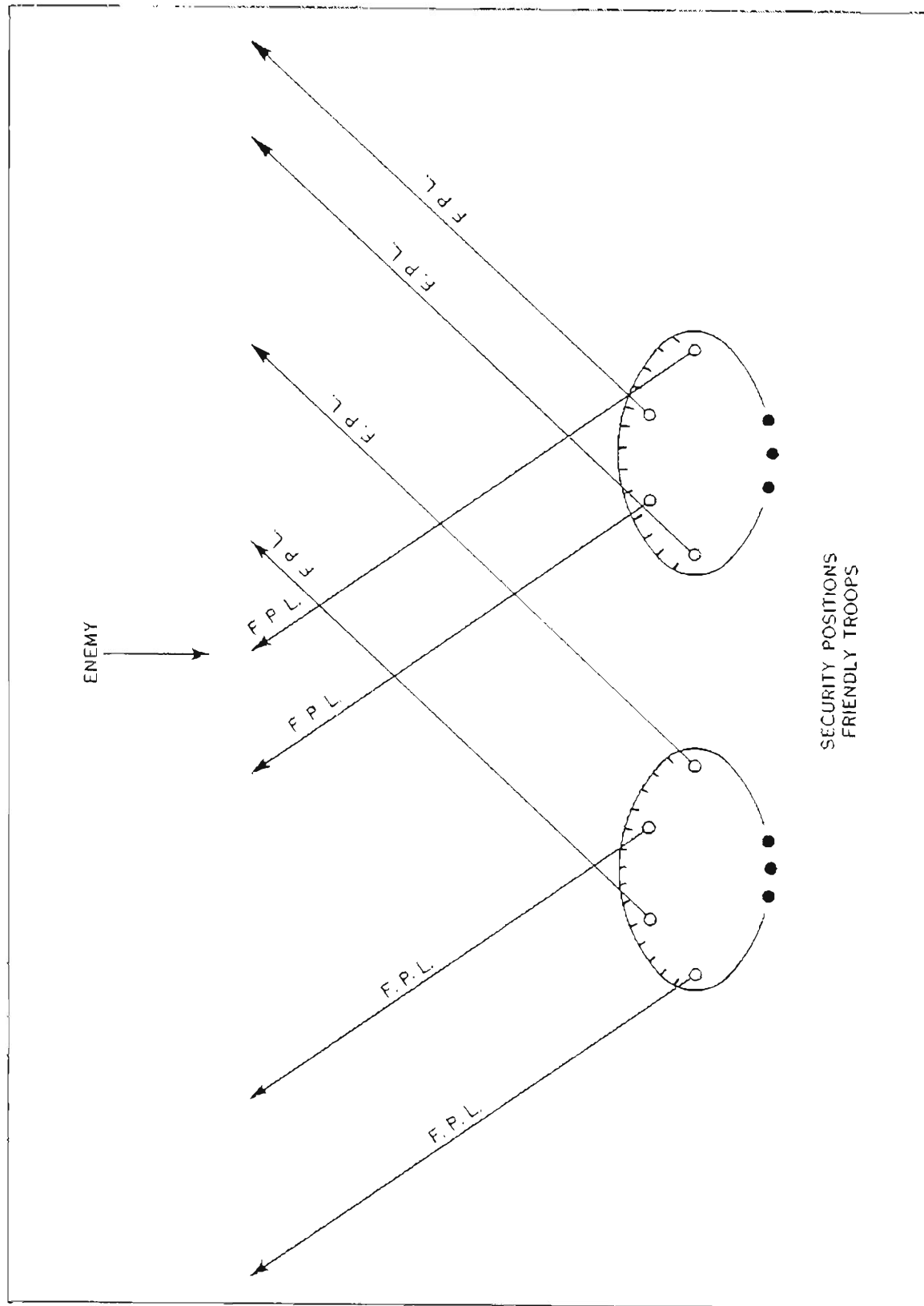


Figure 17

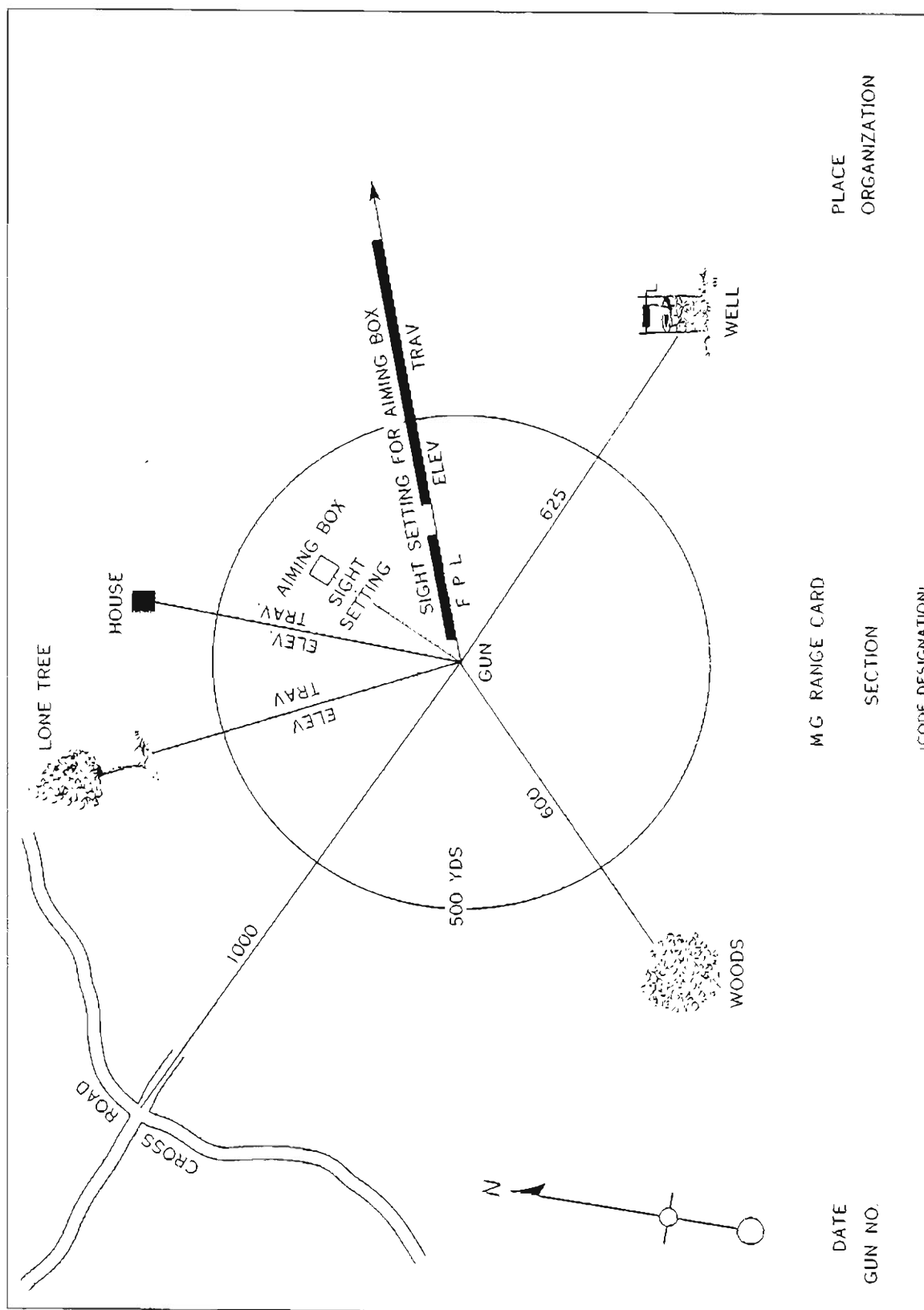


Figure 18

1000" MACHINE GUN TARGET (CONVENTIONAL TARGET IN RECTANGLES)



Figure 19

CLASSES OF MACHINE GUN FIRE WITH RESPECT TO THE GUN

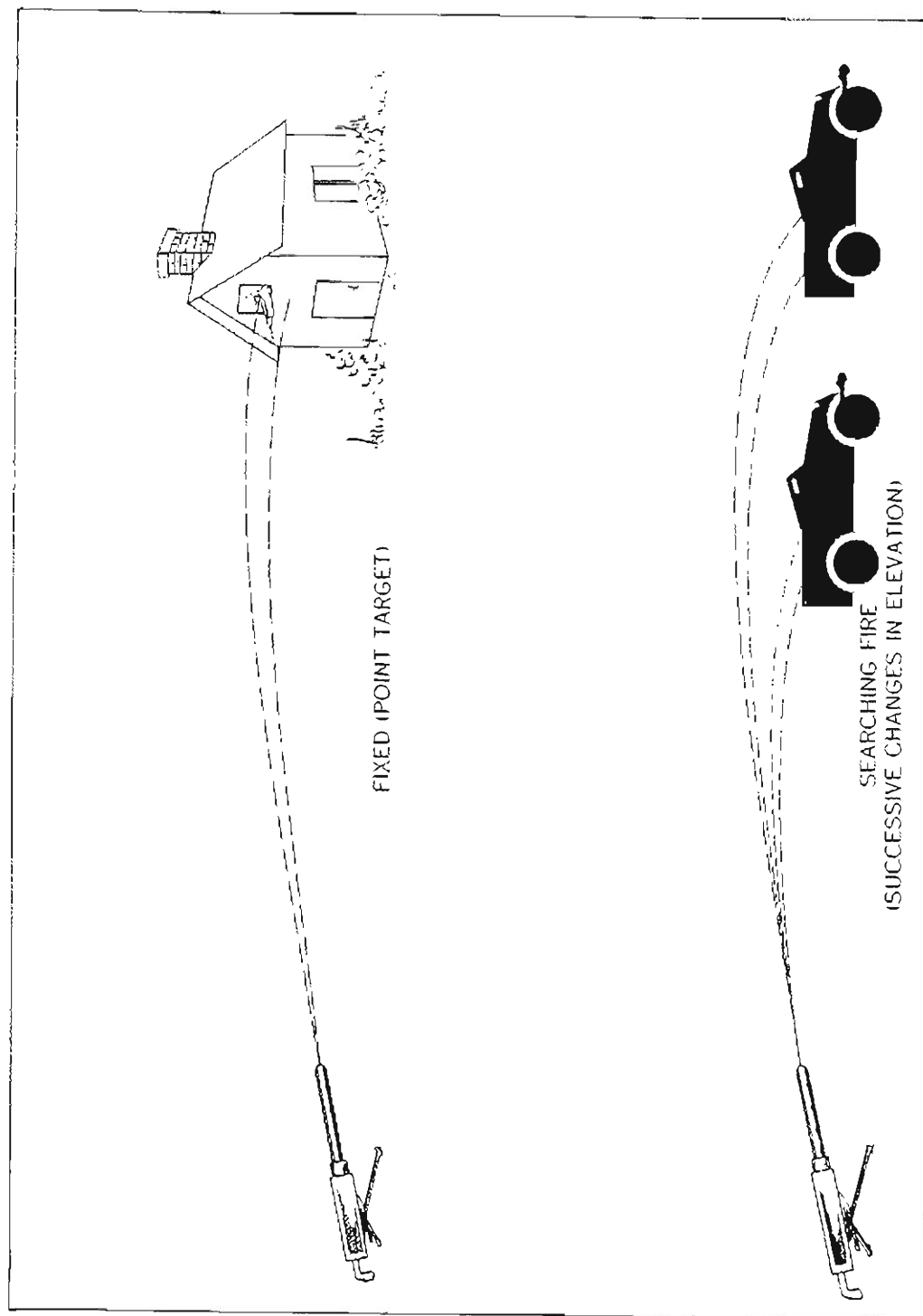


Figure 20

during 1000-inch firing should be limited to dry runs and systematic reviews of preparatory marksmanship. This is the gunner's first period of firing, the one during which the objective is uniform gun-pointing. All training on the 1000-inch range should point toward this end.

d. Each gun crew should work as a team under the supervision of its regularly assigned leaders. It should use its own gun and equipment in order to "get the feel" of it, and above all to acquire a keen sense of responsibility for it. The crew should come to the range with a complete set of equipment, including spare parts for the performance of normal maintenance.

67. CONDUCT OF THE 1000-INCH RANGE--a. Govern procedure by the following sequences:

(1) The first step is to check the gunner's ability to shoot good shot groups with the correct sight picture. Do not hesitate to send a man back to the dry line for additional instruction.

(2) Targeting the guns (see par. 73, FM 23-50). The gunner must be proficient in obtaining good shot groups before this step is taken up.

(3) The aim now is to shoot good shot groups where the gun is aimed, that is, in the target squares. Conduct as much dry firing as time permits; keep the firing slow, at first, allowing each gunner ample time to finish the target; seek speed gradually and never at the expense of accuracy.

(4) The final step comes when the gunner is ready to fire a complete target. This is a comprehensive test of all his marksmanship training, and every point of it should be carefully and constructively covered in critiques.

68. CRITIQUES.--a. To obtain the maximum value from 1000-inch firing, every target should be critiqued as soon as it is completed. In addition, coaches must be checked to see that they are correcting the gunner's mistakes as he fires. The coach should watch the gunner, not the target!

b. Failure to get a good shot group will usually be caused by one of the following:

(1) Failure to take the correct sight picture:

- (a) Front sight blade too high or too low in peep sight.
- (b) Front sight blade to the left or right of the center of the peep.
- (c) Bull's-eye right or left of front sight blade.
- (d) Bull's-eye too high or too low with respect to front sight blade.

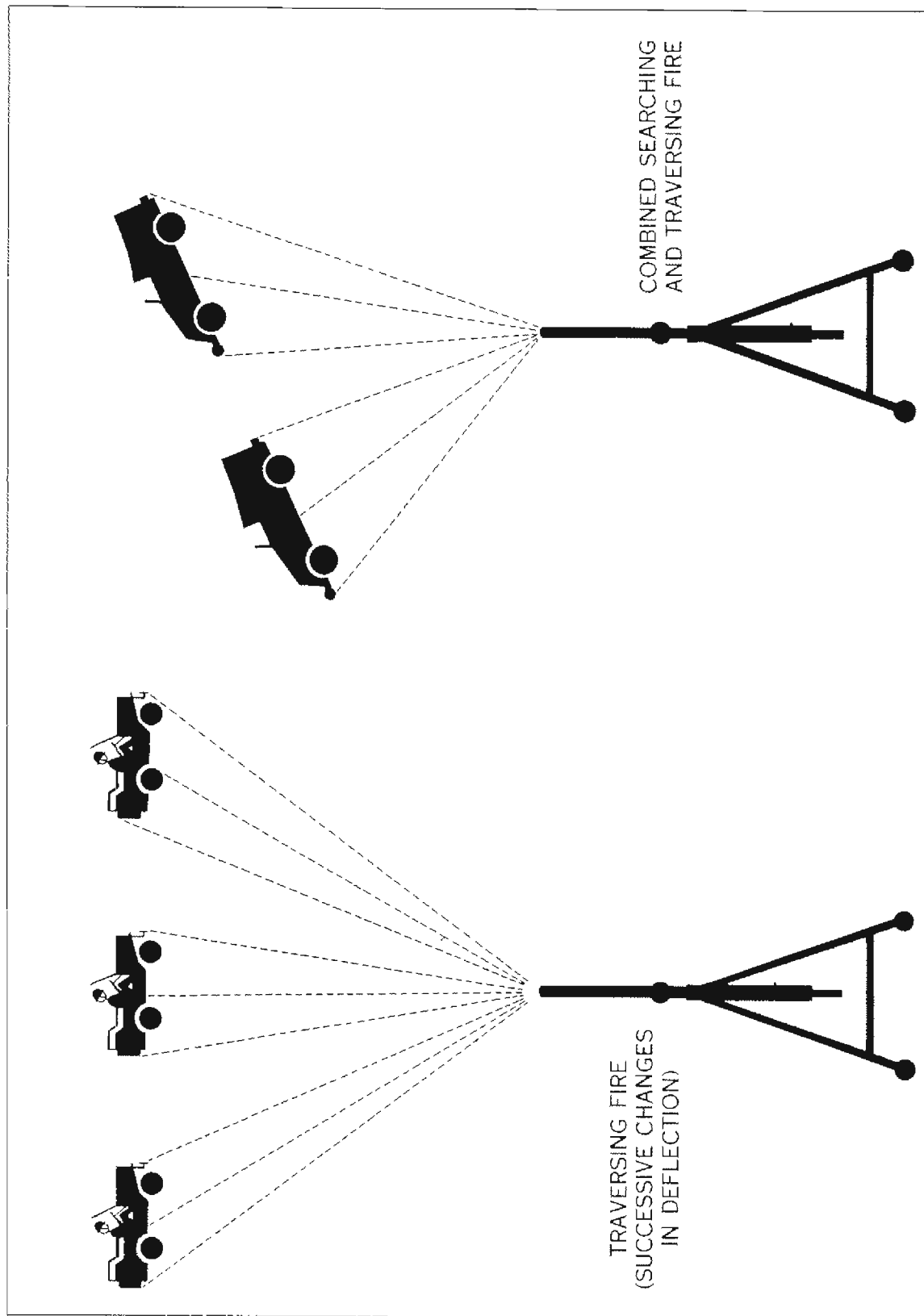


Figure 21

(2) Improper gunner's position:

(a) Not directly behind gun.

(b) Eye too far from the sight.

(c) Left hand not kept on elevating mechanism with thumb on traversing clamp.

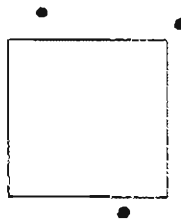
(3) Canting of the gun.

(4) Loose front sight or front barrel bearing (muzzle plug).

(5) Failure to set off proper windage or range (if gun is zeroed).

c. The following paragraph contains some typical results of faulty firing and suggested critiques.

69. EXAMPLES OF CRITIQUES.--a. The gun is not targeted; Pvt. Jones, attempting to get a shot group, produces the following:



"You have spread your shots all around the target. If you'd been firing at a Jap vehicle, it would keep right on coming or else take cover--in any case, you would have given away your position. Several things could have caused you to get a group like that. The front sight or front barrel bearing may have been loose; but since you checked both before firing, it is evident that they were not responsible. Another possibility is that you failed to take the correct sight picture each time you fired. Lay the gun on the aiming paster and let me check it. Lay on the aiming paster again and I'll check it. Fine; now let's do it one more time. There's the answer, Jones. You took a different sight picture each time. The last time, for example, you have the front sight blade too low in the peep, and the bull isn't centered on top of the front sight blade. Hop back to the dry line and have the sergeant check your sight picture on the sighting bar and the gun."

b. Pvt. Smith's target looks like this:



"Notice that your shots are spread vertically, but that there is very little lateral dispersion. If your target had been a German machine gun nest, your shots would have gone over or short--fair warning for the crew to get out of there. Your lateral centering of the front sight and the bull was obviously ok. Lay the gun on the aiming paster and let's see what's wrong. Let's try checking again; just once more will do the trick. Just what we would expect: I can see about three inches of white between the top of the blade and the bull; in other words, your front sight blade was too low in the peep. Now I'm going to set up the correct sight picture and I want you to tell me what you see."

"Sir, the front sight is right up in the bull, almost covering it."

"That proves you're putting the front sight too low in the peep. And that means your check is too low on the grip, which in turn gets your eye too low behind the peep sight. Raise your head now until the bull rests right on top of the front sight. Got it?"

"Yes, sir."

"Good. Now, don't move."

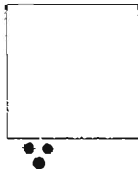
Place your hand in front of the front sight, so that Jones cannot see the target. Tell him: "What you see now is the correct position of the front sight blade in the peep. Can you remember it?"

"I think so, sir."

"I think so, too, so I'm going to let you fire three more shots. But if you don't get a good group this time, it's back to the dry line for a little more work on the sighting bar. Go to it."

c. The gun has been targeted, so the object this time is twofold: To get a good shot group and to get the group in the scoring square. Pvt.

Jackson comes up with this:



"You have a good shot group, Jackson, which indicates you are taking just about the same sight picture every time, but not the correct sight picture. There are three ways of accounting for the location of your group. Let's take them up one by one. First, you may have set off the wrong range on the rear sight...No, that's all right. Next, you may have taken an incorrect sight picture. Lay the gun on the square you were firing at and let me have a look at it. . .What do I see, Jackson? I see a line of white between the front sight blade and the bull. You've centered the sight blade in the peep all right, but you haven't got the bull right on top of the front sight. Now, I'm going to set off the correct sight picture. Here, take a look at it--careful, don't move the gun! Got it? Good. Well, I'm convinced we've spotted the trouble, but you're probably thinking of that third possibility--that the gun isn't targeted. Let's test it. Without moving the gun, I'll just tap off a shot. Here goes... Where's the strike, Jackson?"

"Dead center, sir."

"Satisfied, Jackson?"

"Yes, sir."

"I think you'll find that in 99 out of 100 cases like this the fault lies with the gunner and not the gun. Think you've got the correct sight picture now?...Good. Carry on."

(For officer in charge of range)

70. CHECK LIST 1000" RANGE.--a. Equipment:

(1) Each gun crew should have a cleaning rod, oil can, ammunition box, and spare parts.

b. Gun position (emplacement):

(1) Be sure gun is centered on target (enables gunner to traverse entire target by means of only the traversing handwheel).

(2) Dig the trail spades into the ground and be sure the tripod is level, not canted.

c. Check for proper functioning of gun and mount:

- (1) Run a dry patch through the bore before firing.
- (2) Check headspace each time a new order or gunner fires.
- (3) See that pintle bolt, pintle latch, front barrel bearing, and muzzle plug are properly secured.
- (4) See that excessive play doesn't exist between the elevating mechanism and the gun.

d. Gunner's position:

- (1) Gunner directly behind gun, legs well spread, toes out.
- (2) Elbows on ground, left hand on elevating handwheel, thumb on traversing clamp and right hand on stock.
- (3) Body well forward, cheek against grip.
- (4) Common faults:
 - (a) Gunner's body not directly behind gun, but off to the left.
 - (b) Using the right hand to both elevate and fire the gun.
 - (c) Failure of gunner to get well forward on gun, therefore, not placing cheek on grip.

e. Firing:

- (1) Check for shot groups constantly. Every target must be critiqued. If a gunner is obviously shooting poorly, he should be stopped immediately and his faults pointed out and corrected by coach or instructor.
- (2) Common faults:
 - (a) Failure to take correct sight picture.
 - (b) Failure to fire single shots properly.
 - (c) Failure to set off the exact range on the rear sight.

f. Targeting:

- (1) Do not allow any man to proceed with zeroing until he can get a satisfactory shot group.
- (2) Check to see that the guns are properly zeroed with the least possible number of rounds.

(3) The confirming shots in the zeroing should actually hit the paster or crow's nest.

g. General:

(1) See that safety precautions are observed.

(2) See that ~~ammunition~~ ammunition is not wasted; if a gunner consistently fires without making a good shot group after several critiques, he should be sent to the rear area for more instruction on preparatory marksmanship.

(3) During cleaning, check each gun. Improperly cleaned guns should be sent back for more cleaning.

71. GUN DRILL.--a. The principles cited in par. 11 apply.

b. For drills for machine guns of both calibers, see the appropriate field manuals. These will require slight modifications for use in TD units. Since few men are exclusively designated as machine gunners in TD's, all should be proficient in placing both types of machine guns in action; drivers especially should be prepared to perform the duties of both gunner and assistant gunner.

72. FIELD RANGE FIRING.--a. Field range firing is the intermediate step between known distance firing and combat firing. For the first time the gunnery team now fires at targets, both stationary and moving, at unknown ranges.

b. Field range firing is conducted under conditions affording the maximum of control and the minimum of distraction to the gunner. Therefore, to be prepared for the next step, the gunner must be introduced to the selection and occupation of gun positions, camouflage, range cards, and other elements of combat firing. This is accomplished by behind-the-line instruction, which also should include gun drill and a review of marksmanship.

c. The sequence of this instruction is:

(1) Direct fire (stationary targets only).

(2) Simple indirect fire.

(3) Firing at moving targets.

(4) Night firing.

73. DIRECT FIRE.--a. Direct fire is fire delivered by a gunner when he can see the target through the sights.

b. The object of direct fire training is to make the gunner proficient in the application of marksmanship, including range estimation, accurate delivery of initial burst, and adjustment of fire. He bases his adjustment on observation of the strike or tracer and accomplishes it by

relaying with a new sight setting, or by simple manipulation of the gun on the tripod. The targets used are at varying ranges up to 1500 yards, to afford practise in long-range observation.

74. SIMPLE INDIRECT FIRE.--a. Sometimes because of tall grass or weeds the gunner cannot see the target through the sights. Fire delivered on a target that cannot be seen by the gunner is called indirect fire.

b. In such cases, the gun is laid as follows:

(1) For direction.--Kneel or stand behind the gun and sight along the top of the receiver and barrel jacket to the target.

(2) For elevation.--Kneel or stand at the right or left rear of the gun and lay it in a horizontal position by estimation.

c. The assistant gunner stands or kneels near the gun and, as the gunner fires a string or burst, observes the strike or tracer and gives the necessary commands for adjustment.

75. ADJUSTMENT OF FIRE.--a. The data required for the adjustment may be computed by the following simple rules:

(1) With the horizontal mil scale in the field glasses, measure the horizontal angle in mils from the center of impact (or strike) to the target, and command RIGHT (LEFT) so much.

(2) With the vertical mil scale, measure the vertical angle in mils from the center of impact (or strike) to the target.

(3) Estimate the distance, in hundreds of yards, from the center of impact (or strike) to the target.

(4) To the reading obtained in (2) add:

(a) 2 mils for each hundred yards of the estimate in (3), up to a point 1000 yards from the gun.

(b) 4 mils for each hundred yards beyond.

(c) These figures apply to cal. .30 M2 ammunition only.

(5) Command: UP (DOWN) the number of mils obtained in (4).

b. The same rule applies to caliber .50 MG fire, substituting 1 mil and 2 mils for the 2 mils and 4 mils per hundred yards given in (4) above.

c. These rules may often be used to adjust fire on a target beyond the burnout point of tracer and when observation of strike is not possible due to the terrain. For example, to adjust on a target at a range of 1200 yards with caliber .30 machine gun and due to tall grass or wet ground near the target the strike is not visible, proceed as follows:

(1) Adjust on a point at any convenient range by tracer or observation of strike.

(2) Shift to the desired target by the rules given in (1) to (5) above.

d. For small adjustments when observation is possible a faster method is to increase or decrease the elevation, firing a string after each change, and "roll" the strike into the target.

76. FIRING AT MOVING TARGETS.--a. This type of fire introduces two new factors, tracking and leading.

b. Tracking consists of maintaining the correct alinement of the sights on a moving target. Rules for tracking:

(1) Pick up the target from the rear and swing out to estimated leads.

(2) Gain the proper elevation as you move on the target.

(3) Continue traversing while firing.

(4) If you get ahead of the target, don't stop--just slow up.

c. Leading consists of pointing the gun far enough ahead of a moving target to cause the bullet and the target to arrive at the same point at the same time. Lead tables may be found in the field manuals.

77. NIGHT FIRING.--a. Training in night firing is important because of the increasing incidence of night operations in modern warfare and because the technique of night firing applies equally to combat in fog, smoke, and similar conditions of poor visibility.

b. The principal combat uses of night firing are to permit the placing of accurate fire by night on bridges, road junctions, and other critical points and to protect bivouac areas by covering likely avenues of approach.

c. Preparations for night firing should be made by daylight whenever possible.

d. The subject is treated under the following headings:

(1) Laying the gun.

(2) Recording the information.

(3) Aiming devices.

78. LAYING THE GUN.--a. In placing the gun in position be sure:

(1) The tripod legs are on firm ground.

- (2) The gun is level.
- (3) All clamps are tight.

b. The most accurate data is obtainable of course only by actually firing on the target. The steps are as follows:

- (1) Register on the target.
- (2) Record the information, as prescribed in par. 64 and fig. 18.

c. Sometimes, for tactical or other reasons, firing on the target in advance will not be possible. The best that can be done under such circumstances is to:

- (1) Estimate the range and set it off in the sight.
- (2) Lay the gun on the target.
- (3) Record the information.

79. RECORDING THE INFORMATION.--a. General.--(1) The gunner must be thoroughly familiar with the operation of the traversing and elevating mechanisms (fig. 22).

- (2) All readings are in mils.
- (3) The information will be recorded immediately on range cards.

b. Reading deflection.--(1) Note that each division on the traversing bar consists of 5 mils.

- (2) Always take the number on the left side of the traversing slide.
- (3) When the traversing slide is left of zero, the deflection is right and is recorded as such, because the muzzle points to the right; similarly, when the slide is right of zero, the deflection is left.

c. Reading elevation.--(1) Look at the brass scale in the upper screw, and take the number that appears just above the lowest line visible on the screw.

- (2) Read the number pointed to by the indicator on the hand-wheel.
- (3) The figures are read in the above order. Thus the reading shown in fig. 22 would be: Minus 150 dash 16. The complete information appearing in fig. 22 would be: Right 190; minus 150 dash 16.

80. AIMING DEVICES.--Two difficulties are apparent in connection

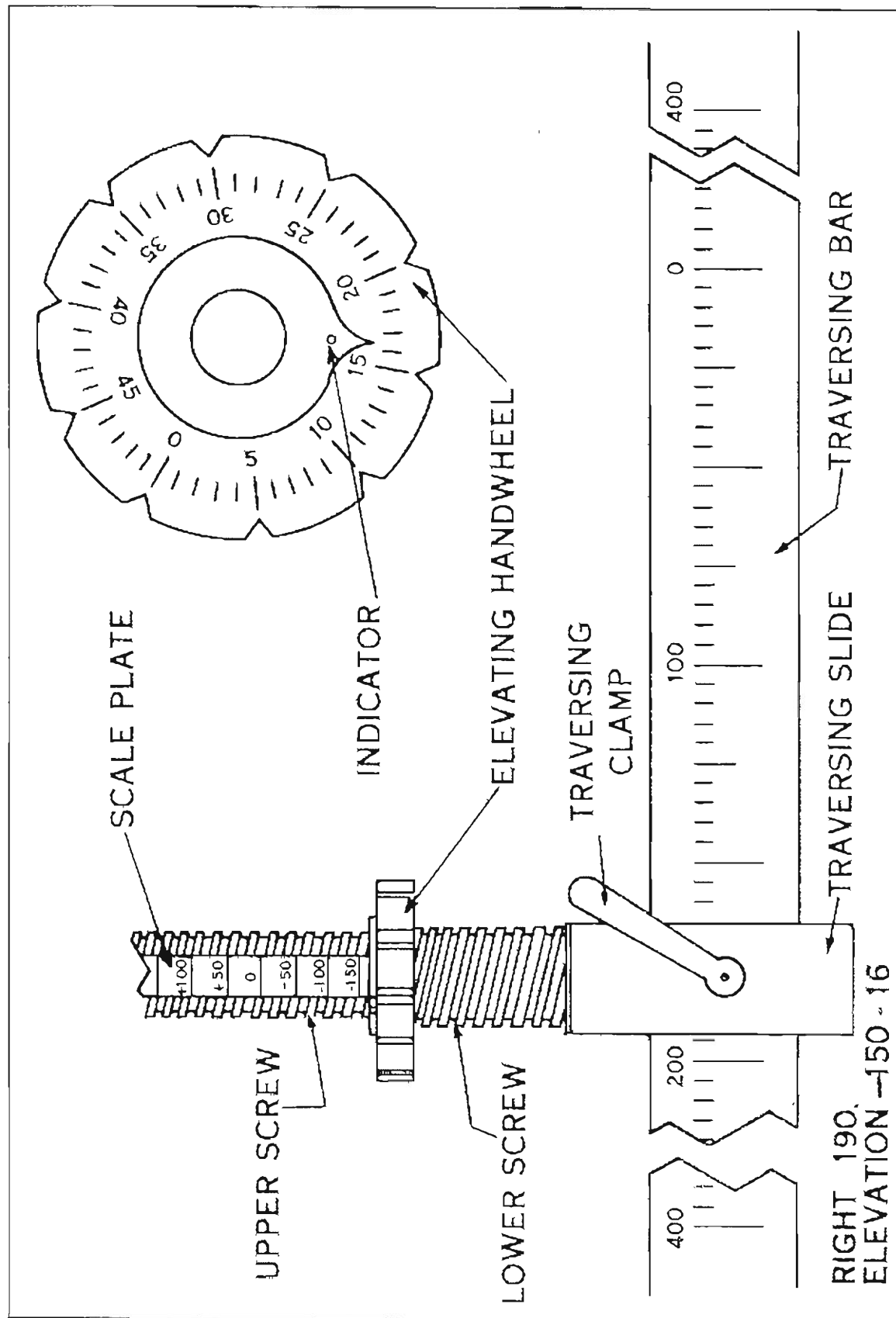


Figure 22

with night firing. First, how can the gunner be sure the gun is in exactly the same position when he is ready to fire it, that it was when he recorded the data hours earlier? Second, setting off the information on the elevating and traversing mechanisms by night requires use of a flashlight or some other means of illumination which might disclose the gun position to the enemy. Both drawbacks may be overcome by the use of the night aiming box and the "stick method."

81. NIGHT AIMING BOX.--a. This device serves the function of an aiming stake adapted for night use. It consists of a tin can or similar container with a slit cut in it and a flashlight or other source of light placed inside.

b. The box is set up about 20 yards in front of the gun, slightly to one side and below the muzzle, and in such a position that no light is visible from the enemy's direction.

c. After the gun has been laid on the target and the information recorded, the gunner refers his rear sight to the slit in the box without moving the gun, and records the sight reading on his range card. On his return to the gun position at night, he lays the gun on the target by setting off the recorded data on the traversing and elevating mechanisms. Then he sets the rear sight at the reading marked on his range card and sights through it (fig. 23).

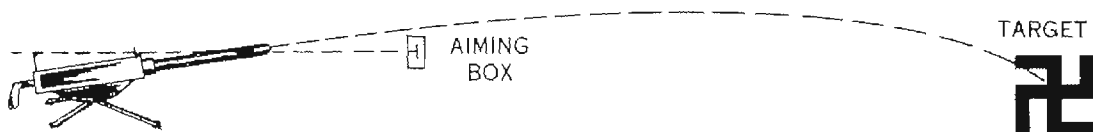


Figure 23

d. If the sight is still laid on the aiming light, the gunner knows the gun and tripod have not been moved.

e. If the sight is not lined up with the aiming box, the gunner aligns the two by manipulating the gun without changing the sight reading. This of course changes the deflection and elevation readings. The difference between the original readings and the new ones must be applied to the information recorded for all targets. The difference corresponds to the distance the gun has moved; it will usually be only a few mils.

82. USE OF STICKS.--a. Besides obviating the use of lights, the "stick method" of setting off information is rapid and accurate.

b. After the gun has been registered on a target, the gunner cuts a stick that exactly fits between the traversing slide and either tripod leg, and a shorter stick that fits in the same way between the

elevating handwheel and the top of the traversing slide. On his return to the gun at night, the gunner merely fits each stick into place.

c. Information for any number of targets may be "recorded" by sticks. The gunner may make a set of sticks for each target, or may use just one pair, notching them in a different place for each target.

d. Note that the stick method does not serve as a check on whether or not the tripod has been moved. Use of both the night aiming box and sticks will give the maximum possible accuracy consistent with complete absence of light visible from the enemy's position.

83. ILLUMINATION BY USE OF TRACER.--a. A very rapid and simple method of engaging targets at night when no predetermined data are available is to fire one gun as a "lead gun," using tracer ammunition and by the light of the tracer illuminate the target. The "lead gun" merely searches the area until the target is found. Other guns then fire and adjust by simple indirect methods until they are on the target. This method requires the use of some tracer in all guns in order to allow them to adjust. The "lead gun" should fire straight tracer, if available, to give maximum illumination of the target. This is particularly applicable to caliber .50 machine guns due to the brightness of the tracer and its long burning range as compared to caliber .30.

b. One disadvantage of this method is the use of tracer which, at night, very definitely gives away the machine gun's position.

84. COMBAT FIRING.--a. The general nature of combat firing is covered in par. 16.

b. The principal feature which requires specific application to machine guns is the selection and occupation of gun positions.

85. SELECTION OF POSITIONS.--a. A good position will:

(1) Enable the gunner to observe and engage targets within his sector of fire, that is, provide an adequate field of fire with a minimum of dead space.

(2) Afford cover from flat trajectory fire.

(3) Afford concealment from ground and air observation.

(4) Afford covered and concealed routes for ammunition, supply, and communication.

b. Few positions will fulfill all four requirements. The most important one is that there shall be a field of fire adequate to accomplish the mission. The other three will be sacrificed for that one, if necessary.

86. EMBLEMMENTS.—The assumption that soldiers will "dig in fast enough the first time they are fired on" is erroneous. The leader who

slights the training of his men in the combat importance and combat use of entrenching tools is inviting heavy losses in battle.

87. TD ANTIAIRCRAFT GUNNERY.--a. There are no antiaircraft sections as such in the TD battalions; the mission is entrusted to caliber .30 and caliber .50 machine guns mounted in the battalion's organic vehicles. These weapons, when manned by well-trained gunners, are capable of damaging or destroying low-flying enemy planes. At the very least, effective AA fire will divert enemy pilots from their course or keep them at an ineffective distance.

b. The maximum effective range for AA fire is 1,000 yards for the caliber .50 machine gun and 600 yards for the caliber .30 machine gun. When placing AA machine guns in position, never separate them by distances greater than their effective range.

c. Because of the high speed of modern aircraft and the difficulty of observing fire and estimating distance against the background of the sky, AA fire requires the maximum firing time and the maximum volume of fire on every attacking plane.

d. Enemy planes generally will attack with the sun at their backs. Enemy planes are frequently used to divert attention; attack planes then come in to load or strafe, catching the gunners by surprise.

e. The enemy uses low-flying planes just to draw fire, so that our troops will disclose their position. AA gunners must open fire only when attacked or observed, and then fire at the plane only on its incoming course.

f. In firing at aerial targets, the gunner uses individual tracer control. This means that he adjusts fire on the target by observing the tracer stream at the range of the target; at this point, the nose of the plane appears to be riding the tracer. Beginners usually observe the tracer stream where it appears to curve back toward the plane; at this point, the stream appears to be ahead of and over the target. Tracer appearing in front of the plane will divert the attention of the pilot from accurate bombing and strafing.

88. PRELIMINARY MARKSMANSHIP.--a. AA marksmanship is the basic step in training the gunner to employ his weapon against air targets successfully in combat. Training is based on the principle that the gunner under stress of combat conditions will follow subconsciously the methods instilled in him by precombat instructions and practise.

b. The fundamentals of marksmanship include mechanical skill in manipulation of the gun and mount, accurate delivery of initial burst, and adjustment of fire by observation of the tracer stream.

c. Each man should know and practise every position of the gun squad in combat vehicles, on pedestal mounts, ground mounts, and the positions for firing from the hip.

d. For position drill have each gun squad take position on its assigned gun and mount. Rotate the members of the squad until every man knows the positions.

e. For advanced drill require speed but never at the expense of precision.

f. For firing on the range have the gun squads go into action "on the double," take their correct positions, and fire at air targets. This gives the gun squads practise in team work.

89. ESTIMATING LEADS.--a. Until the gunners are experienced in estimating leads a good method is to begin tracking the target while it is still beyond effective range, taking a lead of about 10 target lengths. The gunner should continue the easy swing of the gun with this lead until details of the plane, such as wheels, rudder, wing struts, or tail wheel, become visible. Fire should then be opened, as the target will be within effective range.

b. It is better to take too much lead than too little, as it is easier to adjust fire when the tracer stream is ahead of the target, and there is a greater possibility of obtaining hits on the more vulnerable forward part of the plane. A plane may fly into a cone of fire ahead of it but it will never back into one that's behind.

90. MOUNTS.--a. The following is a list of the mounts used in the TD battalions which can be used for AA fire:

- (1) M2 ground mount for .30 cal. machine gun.
- (2) M31 pedestal mount for .30 cal. machine gun (in 1/4-ton vehicle).
- (3) M3 ground mount for .50 cal. machine gun.
- (4) M32 ring mount for .50 cal. machine gun (in 2½ and 1½-ton vehicles).
- (5) M21 skate mount for either .30 cal. or .50 cal. machine gun (in scout cars and half-tracks).

91. POSITIONS AND DUTIES OF MEMBERS OF AA GUN SQUADS (COMMON TO ALL TYPES OF MOUNTS).--a. Position of AA gunner when firing .30 cal. machine gun.

- (1) Eyes 2 to 9 inches above the receiver of the gun.
- (2) Body directly behind gun, leaning into it.
- (3) Stock of gun held against body.
- (4) Right hand on grip and trigger, left hand on top of buffer tube.

b. Ass't gunner.--(1) Ass't gunner kneels or crouches on left side of gun.

(2) Feeds ammunition belt into gun.

(3) Helps gunner clear stoppages.

c. Gun commander (safety man for training only, as most TD AA machine guns have 2-man crews).--(1) Stands or kneels in rear of gunner.

(2) Has command of gun squad.

(3) Stops gunner from firing out of safety limits.

d. AA gunner when firing .50 cal. machine gun.--(1) Eyes 18 to 20 inches above the receiver of the gun.

(2) Body directly behind gun and leaning into it.

(3) Spade grips of gun held against body.

(4) Hands on spade grips and trigger.

e. Ass't gunner and safety man same as for cal. .30.

92. POSITIONS AND DUTIES OF AA GUN SQUAD USING M2 GROUND MOUNT.--a. Gunner: same as in paragraph 91a, plus the following:

The gunner kneels behind the gun on his right knee and places his left foot on the spade of the left tripod leg.

b. Ass't gunner: same position as in par. 91b, but add the following: The ass't gunner kneels on his right knee facing the left side of the gun and places the front leg of the tripod on his left knee, "breaking" the tripod over his knee and holding the front tripod leg firmly down with his left hand. He feeds the belt into the gun with his right hand.

c. Gun commander: (or safety man for training only) same position as in paragraph 91c.

93. POSITIONS OF AA GUN SQUAD USING M3 GROUND MOUNT.--a. Gunner: same as position for .50 cal. AA gunner in paragraph 91d except that he kneels behind the gun on his right knee.

b. ASS'T GUNNER AND SAFETY MAN: same as in paragraph 91e.

94. POSITION OF AA GUN SQUAD USING M31 PEDESTAL MOUNT.--a. Gunner: Same position as in par. 91c for .30 cal. AA gunner, but add the following: The gunner stands in the vehicle, right hand on grip, left hand on top of stock of gun, elbows into his side and leans slightly into gun. The gunner obtains elevation and depression by bending or straightening his knees.

b. Ass't gunner and safety man same as in par. 91b and c.

95. POSITION OF AA GUN SQUAD FIRING CAL. .30 MACHINE GUN FROM HIP.--a. Gunner: The gunner spreads his legs about 10 to 24 inches apart. His body is bent slightly forward, knees bent. The pistol grip is placed against the meaty portion of the right thigh, the right hand on the grip, right forefinger on the trigger. The left hand grasps the barrel jacket just forward of the receiver and is bent at the elbow in order to move more rapidly. For firing, the gunner fires a short burst (3 to 5 rounds) in order to feel the recoil and thus set his body accordingly. Thereafter it is advisable for a burst not to exceed 50 rounds.

b. Ass't gunner: Same position as in paragraph 91b.

96. COMBAT PROCEDURE FOR HIP FIRING: Two-man gun squad--gunner, ass't gunner.--a. Gunner's position as above, (par. 91a).

b. Ass't gunner is charged with applying immediate action. He stands on the left of and facing the gun. With his left hand he directs the feed of the gun, holding his right hand ready to apply immediate action. In immediate action the ass't gunner places his right arm across the top of the receiver and over the gunner's arm to operate the bolt.

97. POSITION OF AA GUN SQUAD USING M32 SKATE AND RING MOUNT.--One-man gun squad. The ass't driver is the gunner. He stands on the seat, releases the lock on the skate, and swings the gun in the desired direction. He changes elevation by bending or straightening his knees. Large changes in traverse are obtained by rolling the skate around the mount. The gunner keeps his head as near 18 to 20 inches above the receiver as possible when firing at air targets.

98. HOW TO TRAIN AA GUNNERS.--a. GENERAL.--The firing of automatic weapons against aircraft requires the highest degree of training. To insure accurate fire with a minimum of lost time and to obtain perfect coordination between members of the gun squad, all personnel must be familiar with their own duties and those of the other members of the gun squad.

b. Training is accomplished by the gun squad working as a group, with each member functioning in the several positions in succession.

99. TRAINING OF PERSONNEL.--a. The training of personnel is divided into three phases: preliminary training, individual firing, and group firing.

b. All personnel receive training during the first and second phases. During the third phase, that of group firing, particular attention is given to the training of the selected gunners.

100. PRELIMINARY TRAINING.--All personnel are trained thoroughly during the preliminary training phase. This training includes all instruction which can be given, prior to actual firing, on the care, operation, and manipulation of the gun and mount; the loading, handling, and inspection

of ammunition, and gun pointing, estimation of leads, and fire adjustment.

101. TD AA GUNNER'S TEST TO BE GIVEN AFTER PRELIMINARY TRAINING.--a.
Question: At what maximum range do TD .50 cal. antiaircraft guns open fire?

Answer: Tracer burnout range (approx. 1600 yds.).

b. Question: When firing a .30 cal. machine gun at aerial targets from the M31 (pedestal mount), what should be the location of the gunner's eyes? _____

Answer: 2 to 9 inches above the receiver of the gun.

c. Question: Caliber .30 machine gun fire is effective against aircraft at a maximum range of? _____

Answer: 600 yards.

d. Question: In AA firing, what portion of the tracer stream should be observed? _____

Answer: Only that part at the range of the target.

e. Question: Caliber .50 machine gun fire is effective against aircraft at a maximum range of? _____

Answer: 1000 yards.

f. Question: At what maximum range do TD cal. .30 antiaircraft weapons open fire? _____

Answer: Tracer burnout range, (approx. 800 yds.).

g. Question: When firing .30 cal. machine gun at aerial targets from ground mount M2 or M3, the best position for the gunner is? _____

Answer: Kneeling.

h. Question: When firing a cal. .50 machine gun at aerial targets, where should the gunner's eyes be? _____

Answer: at least 20 inches above receiver of gun.

i. Practical test: Assume the correct position of an AA gunner on your assigned gun and mount.

102. CRITIQUE OF AN AA PROBLEM.--The following is a typical critique of an AA problem in which the gunner is firing all around the target. The instructor has just stopped the gunner (whose name is Jones), and the following conversation takes place.

INSTRUCTOR: "Jones, I watched you when you went up to the gun to

fire. You checked your gun and mount and started firing with the correct position of a gunner, but for some reason you had too much dispersion. By that I mean you had some tracers too high above the target, then some tracers too low, and some way off to the side of the target. Now Jones, that can be caused by any one of three things: first, not holding the spade grips well into your body; second, trying to control your gun with your arms only; and third, not leaning well into the gun. Now when you were firing I noticed that you did not lean into the gun. What is your reason for not doing this?"

JONES: "I thought that the gun would hurt my belly if I did that."

INSTRUCTOR: "Jones, now look, in position drill we taught you to hold the spade grips to your body and lean into the gun. You will not hurt yourself by doing this. We don't want you to get hurt."

JONES: "Why can't I just use my arms?"

INSTRUCTOR: "That is the reason I stopped you when you were firing. Tracers all over the sky. When you were using your arms only to control the gun, didn't the recoil of the gun jerk your arms and make your eyes roll around in your head? You didn't even know where you were firing! Is that right?"

JONES: "Well, the gun did make my arms jerk a little."

INSTRUCTOR: "That is what caused you to fire all over the sky. You have to lean into the gun and control the gun by keeping the spade grips well into your body. In combat the Jap and German fliers can always tell green gunners when they fire all over the sky, and then in they come to bomb you and your outfit. Now go back to your gun and fire and keep in your mind what we have just talked about."

NOTE: The biggest error in tracer adjustment is OVER manipulation. Correction in elevation should be gradual rather than by quick movements.

103. A GUIDE FOR AA RANGE PROCEDURE.--a. To have an orderly procedure on the AA range the following is suggested. Form the platoons into firing orders, three men to a gun squad. The third man of the gun squad is a safety man. The firing line may consist of vehicles with the various types of mounts in the unit firing. The .30 cal. and .50 cal. gunners fire at gliders, balloons, rocket targets, and radio target planes. Have all men rotate and fire on the different mounts so that all will be familiar with them. On the firing line have a place for hip firing with the .30 cal. machine guns.

b. To add battle conditioning to the range work the following range set-up may be used: place the vehicles of the .50 cal. firing line from 30 to 50 yards behind the .30 cal. firing line. The ideal situation is with the .50 cal. line slightly higher than the .30 cal. firing line. To insure safety for the gunners of the front line, depression stops must be installed on the .50 cal. cradles. The object of the stops is to prevent firing into the .30 cal. line. Operate the two firing lines con-

currently. The .30 cal. gunners fire at gliders, ground targets, balloons, and/or the radio aerial target plane from the front line, while the gunners on the .50 cal. line fire over their heads at balloons, the rocket target, and/or the R.A.T. plane.

104. TRAINING AIDS.--a. ROCKET TARGET M2 AND PROJECTOR:--See Training Manual 4-236.

b. RADIO AERIAL TARGET PLANE (OQ-2A) (R.A.T.):--See training circular #96 dated Dec. 1, 1942.

c. BALLOONS:--These are used to teach the gunners the use of a free gun. They are released at ranges of 300 to 500 yards. The balloons and gas are articles of ordnance issue.

d. GLIDERS:--These gliders are made of balsa wood and so constructed that the wings are folded along the fuselage by means of hinges. When the glider is launched the wings remain folded until it reaches its maximum height. At that time the wings snap into place by means of rubber bands. The gliders are launched into the air by a rubber band on a stick, similar to a sling shot. These gliders may stay in the air as long as one to three minutes. As they are launched approximately 100 yards in front of the firing line, they should be used for .30 cal. fire only. They may be used for caliber .50 firing but one caliber .50 hit ruins the glider, whereas they may be re-used after being hit by caliber .30 fire.

105. HASTY TRAINING.--When time and limited ammunition allowances preclude training in the method just described (adjustment of tracer by individual gunners), a simple and effective defensive method of AA fire consists of placing a fixed curtain of fire well ahead of attacking planes. This will tend to drive them up, away from the position, and decrease the accuracy of their bombing. Reports from combat zones indicate that pilots will not fly into such a screen, particularly of caliber .50 fire.



SECTION IV

DESTROYERS

106. PURPOSE AND SCOPE.--a. The purpose of this section is to provide unit commanders, platoon commanders, and section leaders with a step-by-step outline of the gunnery of the destroyer weapons.

b. The detailed discussion and explanations in this section deal only with marksmanship and gunnery for tank destroyers proper. Information on associated arms is available in the preceding sections of this manual and in the appropriate field manuals listed in the appendix.

c. Selection of the material, which was drawn from many sources, was governed by the primary aim of enabling troop leaders to train gunners and teams to the peak of combat efficiency. Information available in War Department manuals has purposely been omitted.

d. The material in this section is presented in the following sequence:

- (1) General subjects applicable to all destroyers.
- (2) Outline of destroyer gunnery training.
- (3) Direct fire.
- (4) Indirect fire.

107. TYPES OF DESTROYERS.--a. Lightest and most vulnerable of the destroyers is the 37-mm. gun, M3 mounted on the motor carriage, M6 (Fargo). For details, see FM 23-70 and Manual TDS 105-12.

b. Newest of the light destroyers is the 37-mm. gun, M5 on motor carriage, M8. See TDS 105-12 and TM 9-743.

c. Oldest and the lightest of the heavy destroyers is the 75-mm. gun, M1897A4 on motor carriage, M3. See TDS 105-11, Weapons Department.

d. One of the newer destroyers is the 3" gun, M5 on towed mount, M1. For details, see TM 9-322.

e. Largest of the destroyers is the 3" gun, M7 on motor carriage, M10. This destroyer weighs approximately 32 tons.

f. Newest of the heavy destroyers is the hard-hitting 76-mm. gun on motor carriage, T70. Weight, approximately 18 tons.

All of the above destroyers will be considered in this section.

108. MARKSMANSHIP.--a. The following appears elsewhere in this manual but is intentionally repeated: marksmanship is the basic step in training the gunner to employ his weapon successfully in combat.

109. FUNDAMENTALS OF MARKSMANSHIP.--To become a good gunner, a soldier must be thoroughly trained in the following fundamentals of marksmanship:

- a. Accurate delivery of the initial round.
- b. Mechanical skill in manipulating the gun.
- c. Adjustment of fire by:
 - (1) Observation of strike.
 - (2) Observation of flight of tracer.
 - (3) Frequent re-laying of gun during firing.
- d. Speed in combining the above three elements in delivering fire.

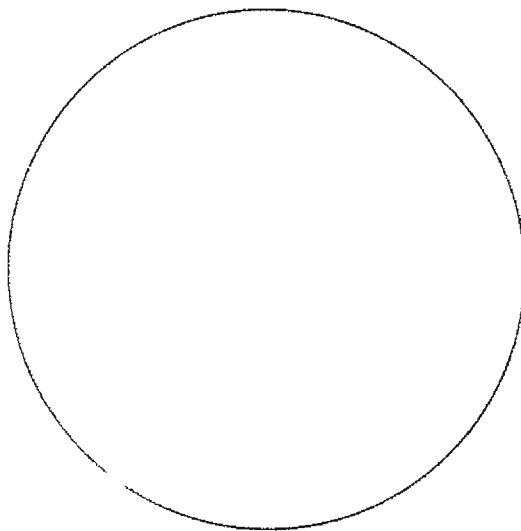
110. STEPS IN MARKSMANSHIP.--To develop efficient TD gunners, the following training steps in preliminary marksmanship are necessary:

- a. Building up of sight reticles.
- b. Laying for range.
- c. Laying for leads.
- d. Laying for range and leads.
- e. Fire orders.
- f. Use of the gunner trainer.
- g. Technique of tracking.
- h. Boresighting.
- i. Range cards.
- j. Ammunition.
- k. Service of the piece.
- l. Firing.

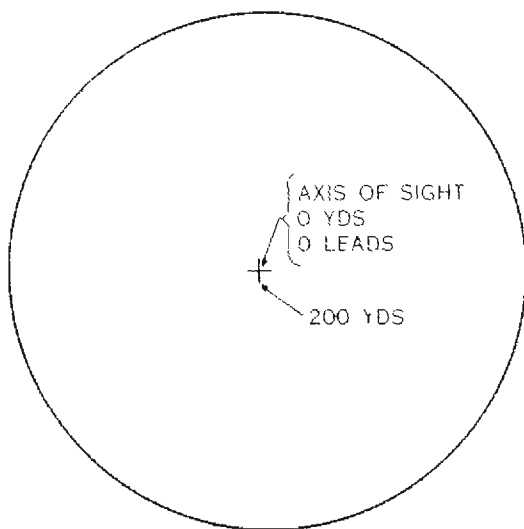
111. BUILDING UP OF SIGHT RETICLES.--a. To acquaint the soldier with the sight he will use on the destroyer, the sight is built up step by step by means of range and lead graduations cut from cardboard and pinned to a white background representing the field of view of the sight.

b. Steps in the building up of the reticle of the telescope sight for the 76-mm. gun on motor carriage, T70 are given in the next subparagraph. This reticle, when produced in quantity, will be the standard for all destroyers. That is, instead of having a "circle-dot" reticle in some destroyer sights, a "grid" type in others (like the M33), etc., the reticle illustrated in the building-up procedure below will be used for all destroyers; when a gunner is proficient in the use of one destroyer sight, he will know them all.

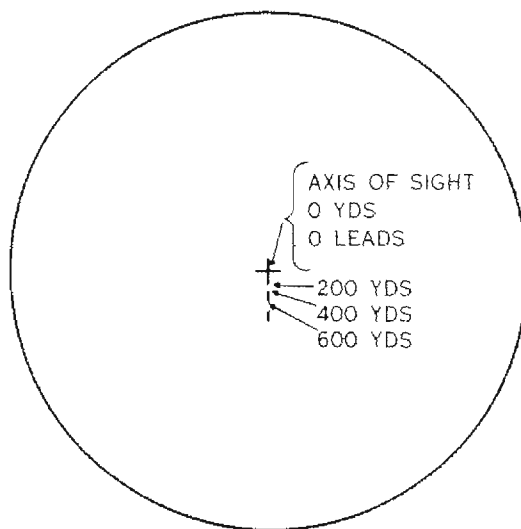
c. The reticle of the 76-mm. gun sight is built up as follows:



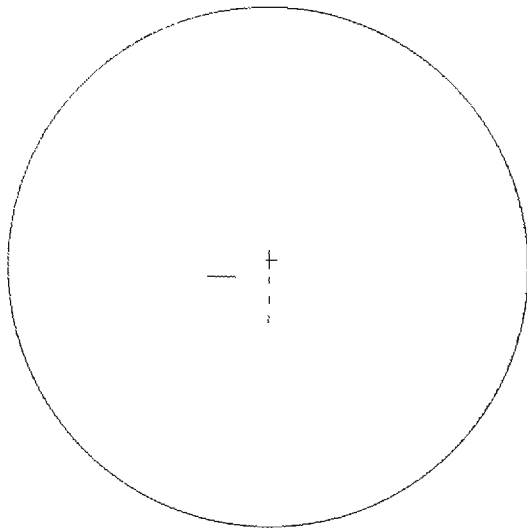
- (1) Large circle represents circumference of sight; add dot to establish center of sight.



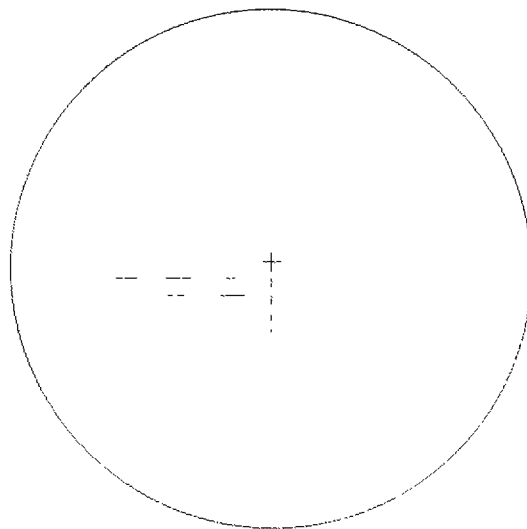
- (2) Add top tick to definitely establish vertical axis of sight and 0-200 yd. range tick. Add top range line to establish horizontal axis of sight. Top range line is 10 mils wide (5 mils on either side of vertical axis).



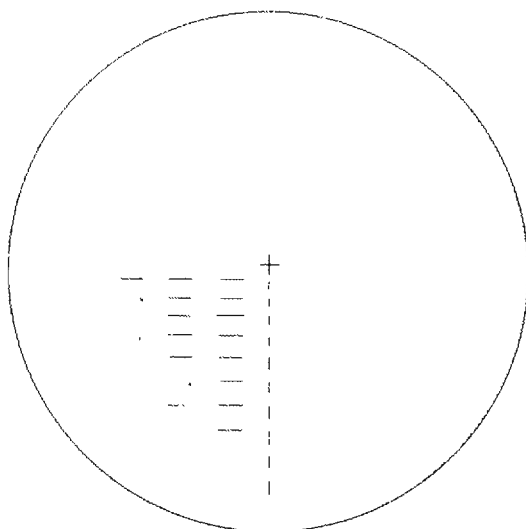
- (3) Add 400-600 yd. tick, then 600-1000 yd. tick, and so on, until 3800-yd. tick is positioned. Each range tick represents 200 yards, and each interval between ticks is also "200 yards long."



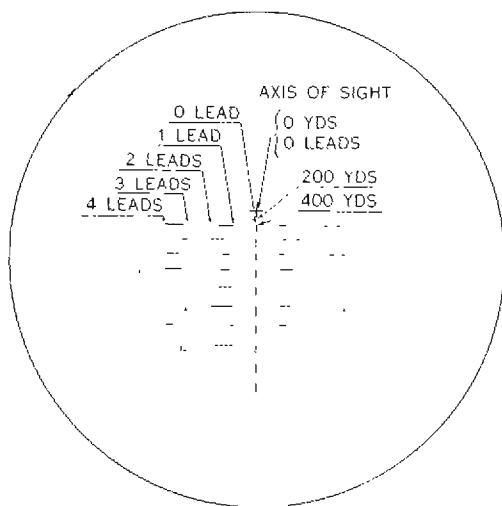
- (4) Place first left lead line in position, at the 400 yd. graduation.



- (5) Add second and third lead lines on left side of vertical axis; continue this until the left side is complete.

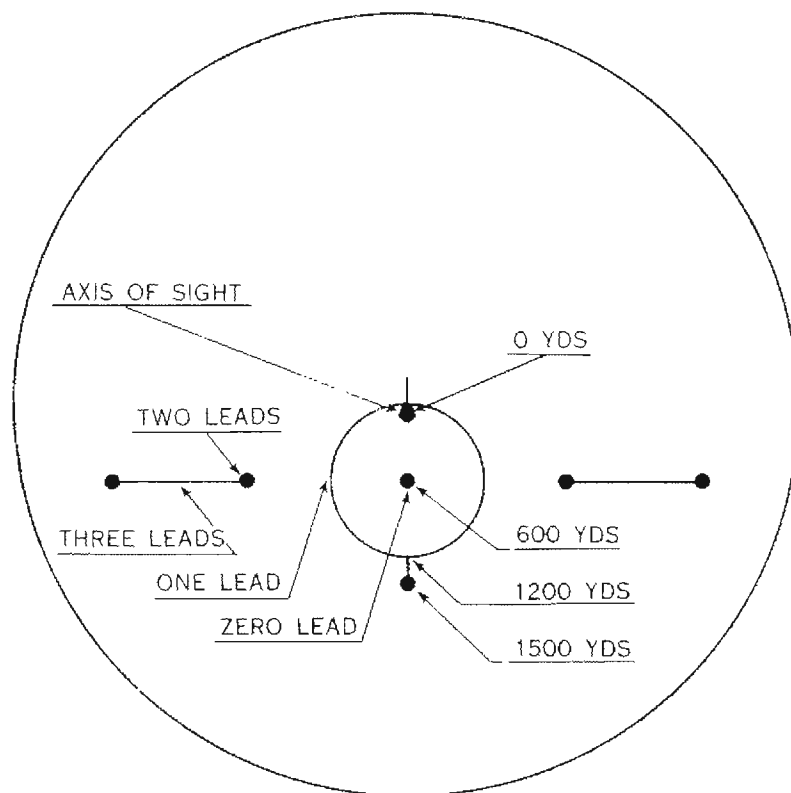


- (6) After all lead lines and numerals designating the various ranges have been placed, the left side of the reticle will appear as shown.

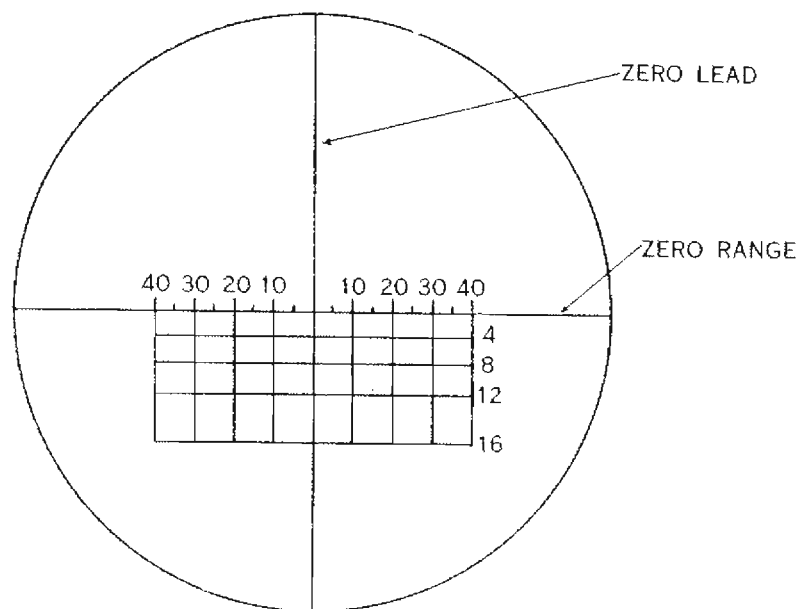


(7) Add right lead lines, completing the reticle.

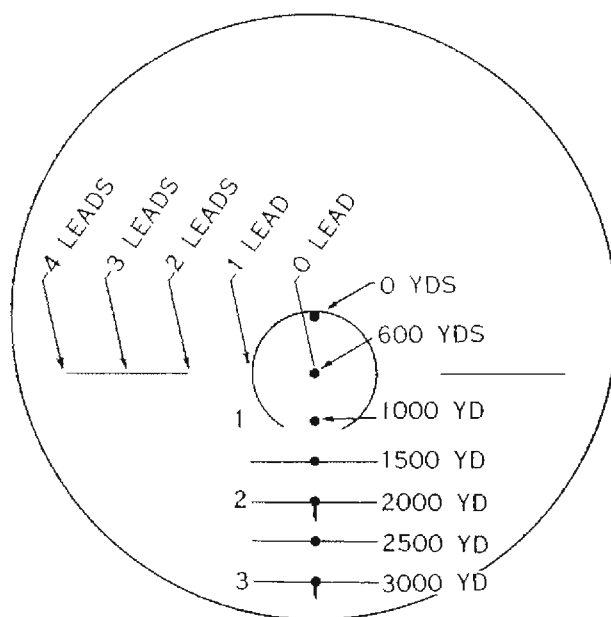
d. Telescopic sight. M6 for 37-mm. gun, M3: 1-power (no magnification):



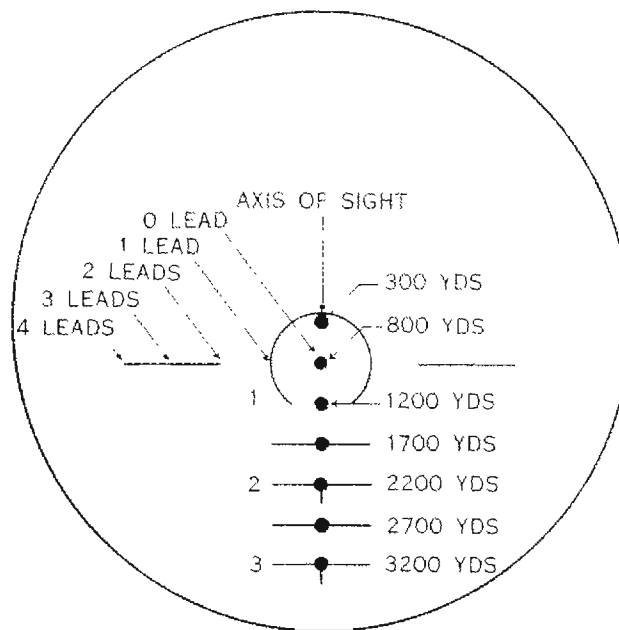
e. Telescopic sight, M33 for 75-mm. Gun. The M33 is also a 1-power sight. It has a field of view of 11° . This reticle is graduated for shell, HE Mark I.



f. Telescope sight, M51 for 3" gun M7 on motor carriage, M10. The telescope M51 is a 3-power sight, with a $12^{\circ} 19'$ field of view. The reticle is graduated for shot APC - M62.



g. Telescopic sight, M41 for 3" AT gun M1: The telescope M41 is a 3-power sight, graduated for shot APC-M62.



h. To summarize, the steps in building up any sight reticle are:

(1) Pin the zero range, zero lead, dot or line (as in the case of the M33 sight) on the chart to establish the axis of the telescope sight.

(2) Establish the range graduations of the sight by fastening the range lines to the chart. Explain range graduation as it is placed on the chart.

(3) After the sight has been built up for range, complete it by placing the lead lines on the chart.

i. After the demonstration, have all personnel draw a picture of the telescopic sight reticle under the supervision of their squad, section, and platoon leaders, labeling all ranges and leads.

112. LAYING FOR RANGE.--a. All sights used for direct laying are calibrated for certain types of ammunition. When the gun has been properly boresighted and a particular range dot or graduation placed on the target, the tube will be elevated to an angle above line of site which will cause the projectile to strike the target.

b. To train gunners to aim at stationary targets and to use the range graduations on the sight being employed, have them pin a tank silhouette (to represent the target) in the correct place on the built-up sight reticle, corresponding to a range announced by the platoon leader

113. LAYING FOR LEADS.--a. Unit of measure.--For all moving target

firing with destroyers a 5-mil lead has been taken as the unit of measure. Therefore "one lead" actually equals 5 mils, "two leads" equals 10 mils, and so forth. To afford the gunner a scale for applying these leads, the telescope reticle is provided with a horizontal scale graduated in 5-mil units.

b. Angular lead is the only type used when firing with a telescopic sight (fig. 24).

(1) The muzzle velocity of 37-mm. APC is 2900 f/s or 966 yds. per sec. At this speed the projectile will travel 900 yds. in .93 seconds. In that time a target 900 yds. away moving 30 mph will move 40.92 ft. or 13.64 yds. Therefore, at the instant of firing the bore of the gun must be laid on a point 13.64 yds. ahead of the center of mass of the target in order that the projectile and target meet. This distance, by the mil formula:

$$\frac{W}{R} = \frac{13.64}{.9}$$

is 15.1 or approximately 15 mils (3 leads). Thus if the projectile moved at 2900 f/s for the entire 900 yards, it would hit the center of mass of the tank (point of aim). Actually the projectile slows down during flight so that it requires slightly more than .93 seconds to move the 900 yards. Hence the tank moves slightly more than 40.92 feet and the projectile actually strikes the hull of the tank in rear of the center of mass rather than the center of mass itself.

The angle at which the target is moving will govern the amount of lead to be taken. The angular speed of the target across the field of view of the gunner will determine the amount of lead to be set on the sight. For example, a tank may be moving towards a destroyer position very fast at an angle, yet to the gun commander the speed of the tank across his field of view appears to be SLOW. (fig. 25) The gun commander will give in his initial fire order (to engage this tank) the amount of lead estimated from the "apparent" speed of the tank across his field of view and not from its "vehicular" speed. The most obvious example would be the case of a tank moving directly toward the gun at 60 mph. Here no horizontal lead would be taken because the angular speed of the target across the gunner's field of view would be zero. That is, the gun would not have to traverse to track the target.

(2) The greater the range, the greater the linear distance by which the target is led. But the angular lead remains the same. Example: By the mil formula, when you give a lead of 5 mils to a target 500 yards away, you are leading the center of mass of the target by 2 1/2 yards; when the target is 1000 yards away, the same angular lead (5 mils) will mean you are leading the center of mass of the target by 5 yards (linear lead).

(3) Use of angular leads compensates for the difference in time of flight of projectile at various ranges; therefore, range is not considered in the lead table.

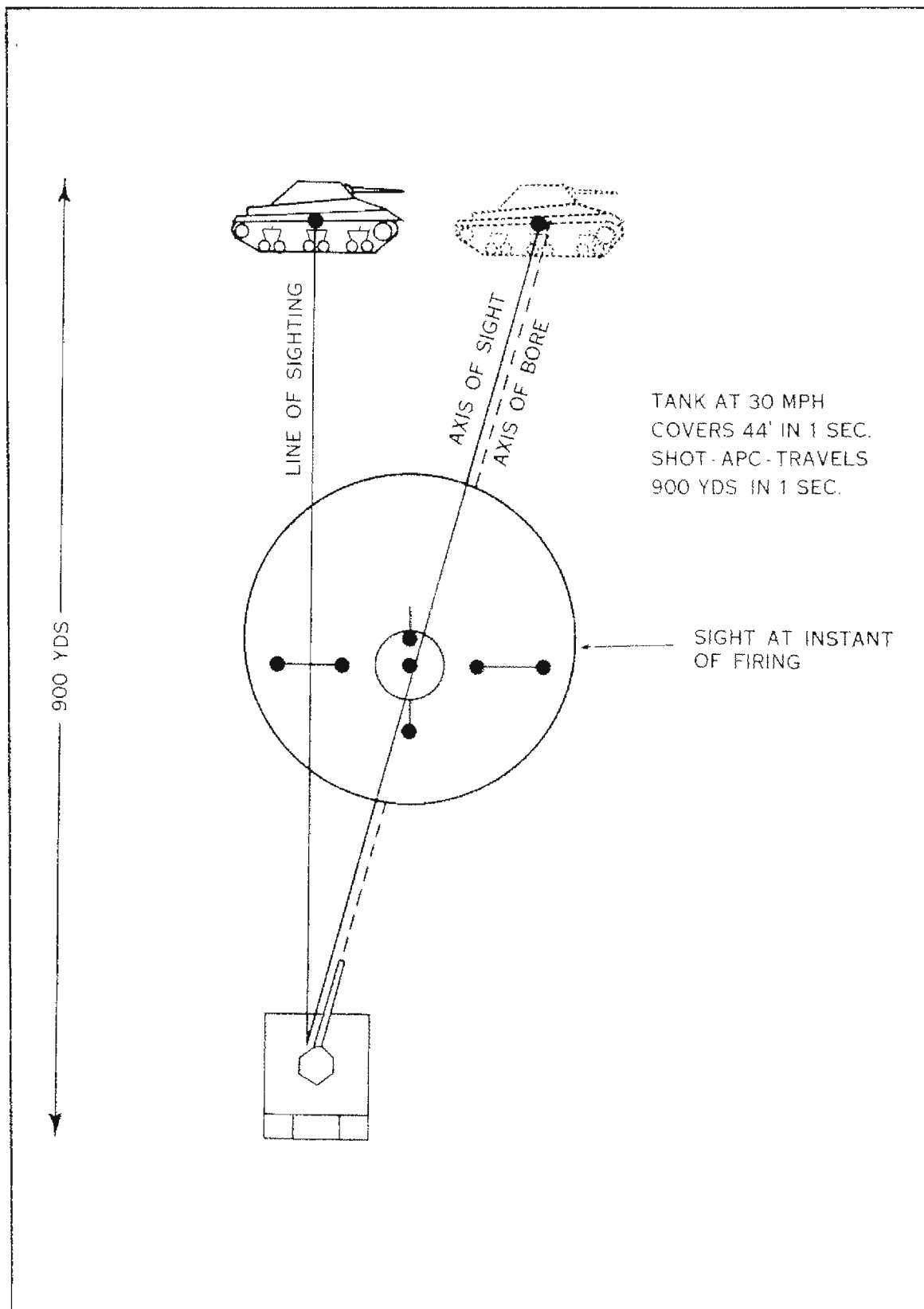
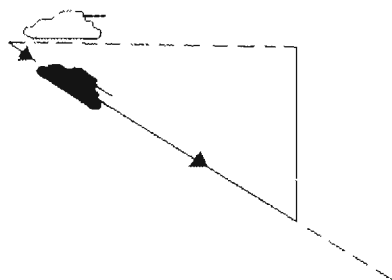


Figure 24



The "apparent" speed of tank across field of view of destroyer commander determines amount of leads to engage this target. Tank appears to be moving "slow" to the destroyer commander.

Enemy tank approaching a destroyer position at a high rate of speed (vehicular).



Destroyer Position

Figure 25

c. Lead Table.

	M51) M41) M6)	Telescopic sights	M33 sight
<u>TARGET SPEED</u>		<u>LEAD</u>	<u>LEAD</u>
SLOW (0 - 10 mph)		0 or 1	0 - 1
MEDIUM (10 - 20 mph)		2	1 - 3
FAST (20 - 30 mph)		3	3 - 5
VERY FAST (30 - 40 mph)		4	Over 5

d. Aiming with leads.--To teach the gunner how to apply the lead graduations when engaging a moving target, have him place a tank silhouette on the built-up sight reticle at the correct place for leads announced by the platoon leader. Make sure he knows that the vertical axis of the sight must always be ahead of the center of mass of the target.

e. SPEED ESTIMATION.--a. Importance. Accuracy in determining the speed of a moving target is important for the effective use of the lead table. Leads are necessary for moving targets to cause the projectile and target to arrive simultaneously at the same point. Speeds of moving targets should be estimated as slow (below 10 mph), medium (10 to 20 mph), fast (20 to 30 mph), and very fast (above 30 mph) according to how fast they appear to move across (or perpendicular to) the field of view of the gun commander. For example, a tank may be approaching a destroyer at an oblique angle, traveling at 30 mph. To the gun commander the tank appears to be moving only 15 - 20 mph across his field of view. The number of leads he will use to engage this target will be only 2 leads and not 4. It is important to remember that since angular leads are used, speed alone will determine the number of leads to use in engaging a moving target.

114. LAYING FOR RANGE AND LEADS.--a. The aiming point for stationary targets is the center of mass (fig. 26).

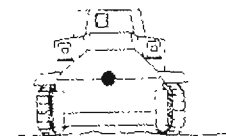


Figure 26

b. Aiming Point for Moving Targets.--The aiming point for moving targets is also the center of mass of the target (fig. 27). The vertical axis of the sight must always be ahead of the center of mass of the target.

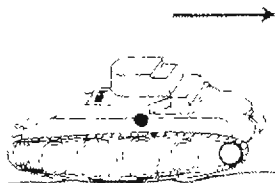


Figure 27

In laying for range and leads on a stationary target, the gunner places his zero lead line and the range announced in the fire order on the center of mass. In laying for range and leads on a moving target, he places the proper range graduation on the target, then traverses the gun in such a manner that the vertical axis of zero lead line will be ahead of the center of mass of the target by the announced number of leads.

c. In laying for range on a moving target which is coming directly toward the destroyer position, the gun commander will estimate the range to the target and make allowance for its movement by issuing the initial fire order with a range less than that estimated. If the target is moving directly away from the destroyer position, he will make allowance for that by giving a range greater than the range he estimated. In either case, the gunner sets off the range announced.

115. FIRE ORDERS.--a. Fire orders are orders issued by the gun commander to bring fire on a target. There are two kinds:

(1) Initial fire orders--those issued to get the first shot on the way.

(2) Subsequent fire orders--those issued to correct or adjust the fire.

b. Elements of initial fire orders:

(1) Type of ammunition--given only when ammunition other than armor-piercing (AP or APC) is desired. If AP or APC is desired, this element of the order is omitted. Ranges to be used for ammunition other than armor-piercing must be posted in a conspicuous place on the gun.

(2) Target Description--LEADING TANK, REAR TANK, TANK WITH FLAG, etc.

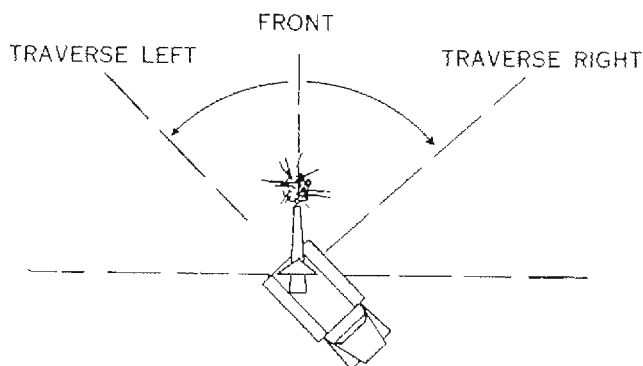


Figure 28

(3) Range--400, 600, 1200. Range is always given to the nearest 100 yards. 400 is announced as "Four hundred," 1000, as "One thousand," 1200, as "One two hundred," 2900, as "Two nine hundred," etc.

(4) Direction to traverse: (where applicable)--TRAVERSE RIGHT or TRAVERSE LEFT. (Fig. 28)

(5) Stopping traverse--Given to assist the gunner to get the target in his sight. As the gun tube nears the target, gun commander commands: STEADY-Y-Y-Y, as a warning, and when the gun is on the target, he calls, ON. The gunner now has the target in his field of view. When the gunner sees the target he says "check". The destroyer commander then announces the lead

(6) Lead--ONE LEAD, TWO LEADS, ZERO LEAD, etc. Announcement of the lead element is considered the command to fire unless a fire control command follows the lead command

(7) Fire control --AT MY COMMAND, AT MY SIGNAL, etc. Used only when the gun commander wishes to control the fire.

c. Examples of initial fire orders--(1) HE, LEADING TANK, 600, TRAVERSE RIGHT, STEADY.....ON, 2 LEADS, AT MY COMMAND.

(2) LAST TANK, 500, TRAVERSE LEFT, STEADY.....ON, ONE LEAD.

d. Subsequent fire orders.--(1) After the first round, the usual procedure is for the gun commander to sense the shots, leaving the necessary corrections up to the gunner. (For terms used in sensing see fig. 29. However, the gun commander will announce a new range or lead at any time he believes the circumstances warrant it.

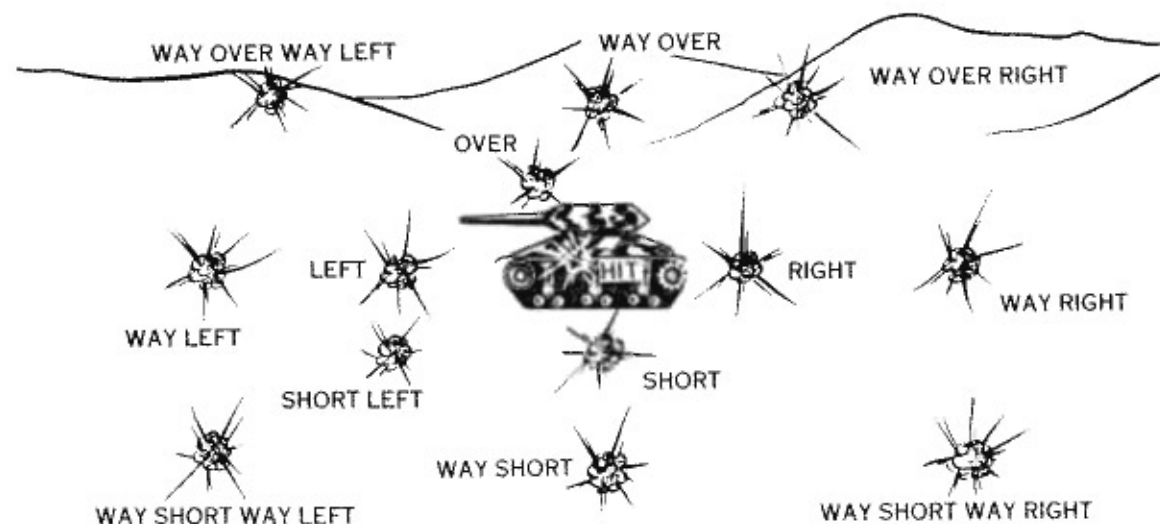


Figure 29

(2) The gunner's action in response to the destroyer commander's sensing is as follows:

When the destroyer commander senses the

shot as:

Gunner will:

OVER

Decrease the range setting by one half a range graduation.

SHORT

Increase the range setting by one half a range graduation.

RIGHT

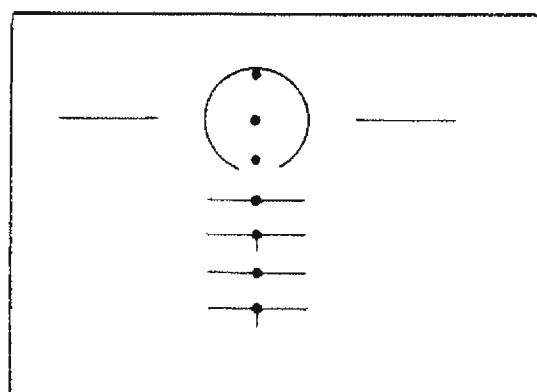
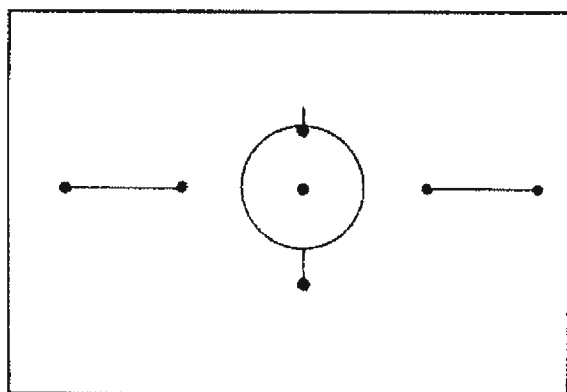
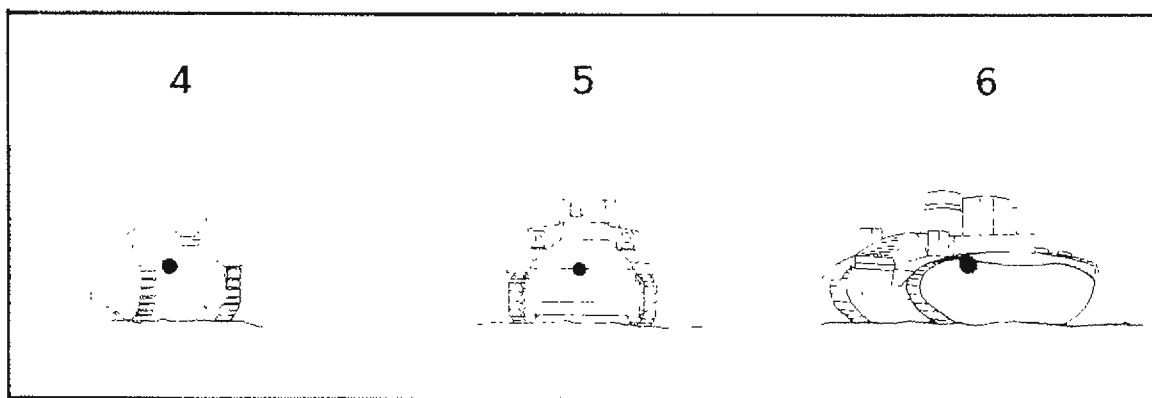
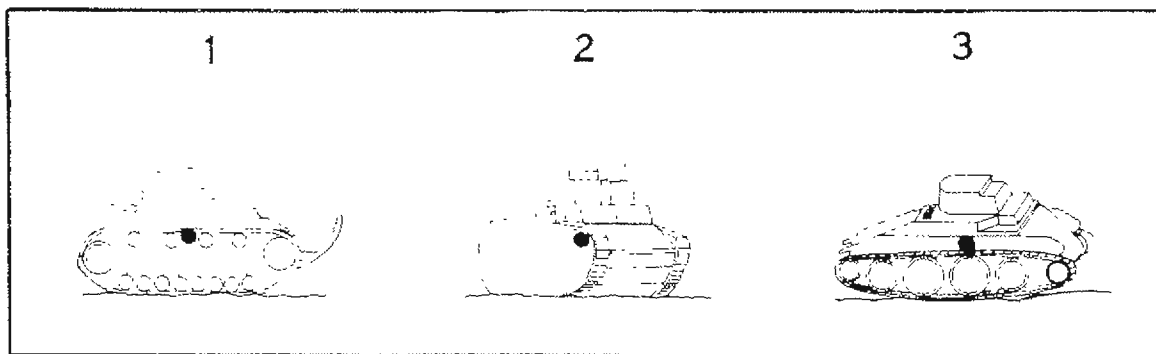
Increase or decrease his lead by $1/2$ lead.

LEFT

Increase or decrease his lead by $1/2$ lead.

NOTE: When the term "way" is placed in front of the above sensings the gunner will increase or decrease his range or leads by one full range or lead graduation. Example: Gunner lays on target tracking from left to right with a range setting and a lead setting. First shot is sensed as "way short" and "way left," he will increase his range by one range graduation and increase his lead by one full lead. For uniformity, range sensings are given first, then deflection sensing. Example: WAY OVER, RIGHT; not, RIGHT, WAY OVER.

116. THE GUNNER TRAINER.--Construction of the gunner trainer.--The gunner trainer is a homemade device which can be made from material on hand. Exposed bleached X-ray film, old car curtain windows, tracing cloth, or any other pliable transparent material may be used to make the movable reticle. Cut the material approximately 4" x 6" and paint or draw the reticle on the transparent material. India ink or any good black paint will do. Black enamel may chip with use.

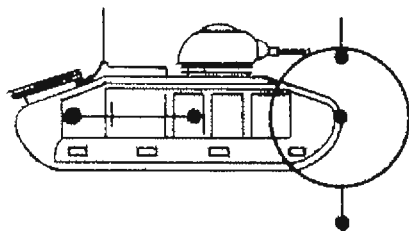


This plate of tanks and the reticle described above are the components of the gunner trainer.

The instructor, after explaining the aiming point, fire orders, and the range and lead theory, trains his class in sighting and adjustment of sights on the target. He gives an initial fire order. Each gunner places the reticle on the designated tank with the proper sight picture. The instructor then checks the trainer. When all gunners have the correct sight picture, a subsequent fire order is given. The change in sight picture is then made by each gunner and is checked by the instructor. Short but frequent periods spent with the gunner trainer will be a large factor in training gunners in the use of the sight. The reticles may be made for any sight. Examples of use:

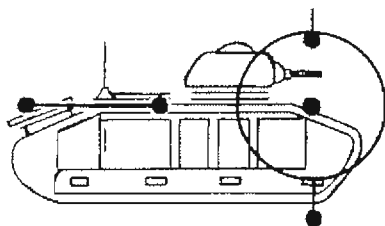
Initial fire order

TANK
600
TRAVERSE RIGHT (LEFT)
STEADY....ON 2 LEADS



Subsequent fire order

SHORT, RIGHT



Raises range $\frac{1}{2}$ range graduation
Goes left $\frac{1}{2}$ lead graduation

In the above figures the reticle of the M6 telescopic sight is drawn in india ink on transparent material. (Old X-ray films, glass, tracing cloth, etc.) The tank is one of a plate of tanks painted in black on strong cardboard or plywood.

117. TECHNIQUE OF TRACKING.--a. Tracking consists of the smooth traversing and elevating or depressing of the gun so that the proper point of the sight reticle is kept on the correct aiming point of the target.

b. The correct procedure in tracking can be learned only through constant practise on the part of the gunner.--(1) From the initial fire order determine and locate in the sight reticle the point which is to be placed on the aiming point of the target.

(2) Traverse smoothly through the target from rear to front, gaining proper elevation as you swing through to the proper lead.

(3) Slow down your tracking as you swing through the target so that when you reach the proper lead and elevation you will be traversing at a speed which will enable you to maintain the proper point in the reticle on the aiming point (center of mass) of the target.

(4) When you have the proper sight picture, fire, and keep on tracking smoothly while firing. This last is very important, as failure to do this will always put the round behind the target.

(5) If you get ahead of the target slow down on your tracking gradually until the target catches up.

(6) If you get behind the target speed up gradually until you catch up with the target.

(7) Adjust the next shot on the basis of the subsequent fire order.

c. Common faults to be avoided in tracking.--(1) Moving ahead of the target, stopping, and waiting for the target to catch up.

(2) Moving ahead intentionally and waiting for a quick shot.

(3) Stopping elevating and traversing (tracking) when firing.

(4) Jerking the traversing handwheel when firing.

d. Methods of instruction in tracking.--(1) There are many ways to teach tracking. The following methods of instruction have been used successfully.

(a) Gunner tracks a target moving at a regular speed over a smooth course, maintaining certain lead line on the aiming point of the target.

(b) Gunner then tracks a moving target, placing a certain

range and lead on the aiming point of the target.

(c) As the gunner becomes proficient in tracking on a smooth course, move the target to a course where the gunner will have to elevate and depress the gun to maintain a correct sight picture.

(d) At intervals through the process of teaching the gunner to track, have the target stopped and the gun commander or platoon leader check the sight picture.

(e) The use of training aids will aid in training gunners to track.

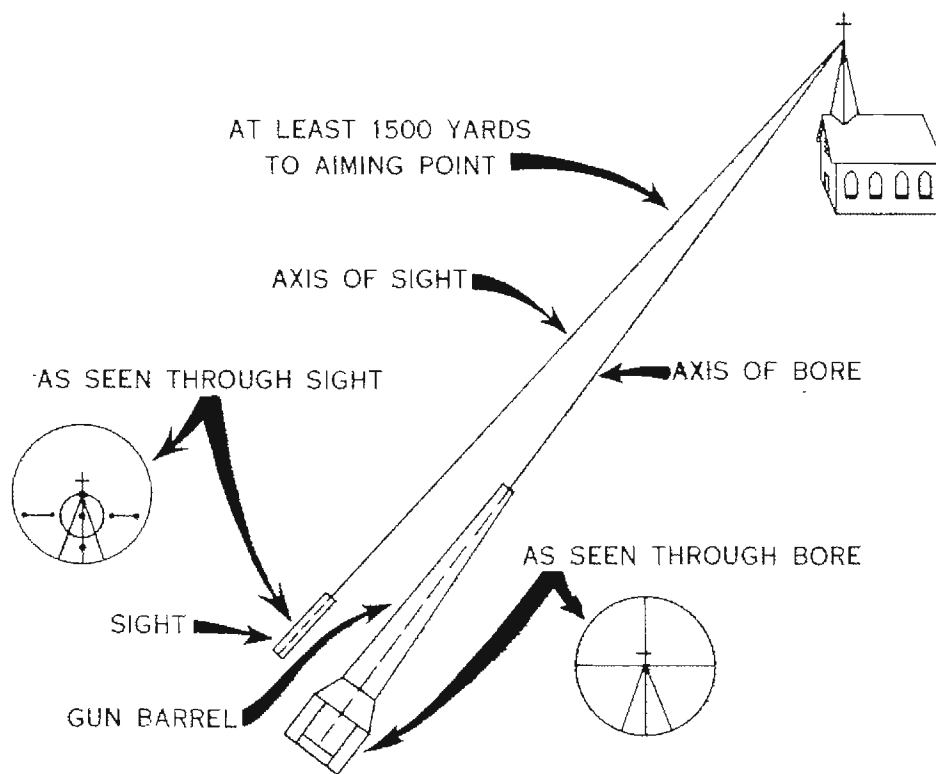
One satisfactory aid operates as follows:

Two men walk in column at a slow pace, carrying between them a board on which is painted a black tank silhouette about 10" long. The man acting as gunner walks in the same direction, carrying a piece of transparent material (glass, tracing cloth, x-ray film in a frame, etc.) about 20" x 30" in size, on which is painted the reticle of the sight being studied. The platoon leader gives a fire order. The acting gunner, carrying the large sight reticle, increases his pace so as to overtake the tank silhouette and hold the reticle against it as he moves. He moves the reticle forward until he has the correct sight picture to carry out the fire order and then keeps it correct as he walks by holding the reticle and tank silhouette, carrying out the fire order. The entire platoon watches the operation and is able to see any errors made by the gunner as he gets his sight picture. The use of this device should follow immediately after the operation of pinning tank silhouettes to a stationary reticle.

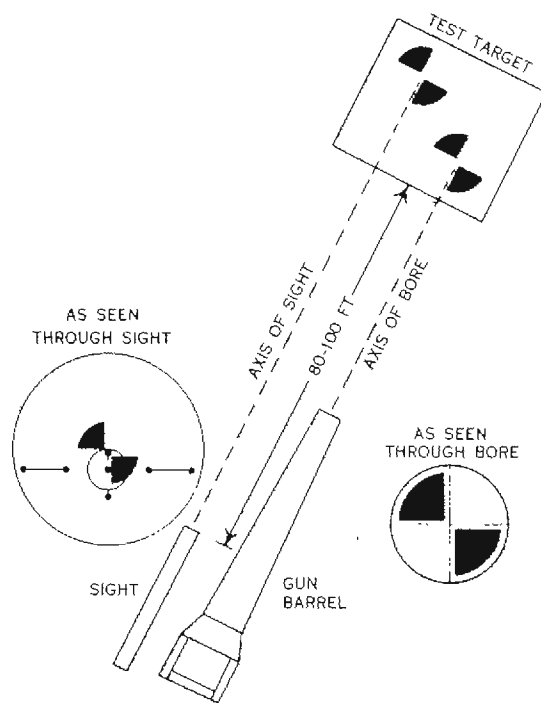
(2) Muzzle writing is another excellent aid. In this method the gunner is required to follow a pattern with his sight and reproduce that pattern on a black board or chart placed in front of the muzzle. A marking device is fitted to the muzzle of the gun. There are many ways of doing this. A plug in the muzzle holding a pencil or piece of chalk can be used. In FM 17-12 an excellent method is described. Muzzle writing will improve the gunner's stability of manipulation of the gun controls. It can be used where a shooting range or tracking area is not available. As gunners become more and more proficient, the pattern which they are required to follow may be made more complex.

The "gunner trainer" has been described in a previous paragraph

118. BORESIGHTING.--a. Boresighting consists of adjusting the sight of a destroyer so that the axis of the sight is parallel to the axis of the bore of the gun. When boresighting is accomplished by the distant aiming point method, described below, the above definition is not theoretically correct, as the two axes do intersect at the aiming point. For all practical purposes, however, due to the long range to the point of intersection, the axes may be considered parallel. In no case should the aiming point used be at a shorter range than that at which the gun is to



Boresighting--Distant Aiming Point
Figure 30



Boresighting--Test Target Method
Figure 31

be fired.

b. There are two principal methods of boresighting.--(1) Distant aiming point method. This is the more practical method. The procedure is as follows (fig. 30).

(a) Place the destroyer on ground as level as possible. But whether in the park, on the range, or in combat, and whether the wheels can be leveled or not, boresight!

(b) Remove those parts of the firing mechanism necessary to leave open the firing pin well for use as a rear sight.

(c) Place crosshairs on the muzzle so that they intersect at the exact center of the bore.

(d) Pick out as an aiming point a clearly defined object at least 1500 yards from the gun.

(e) Using the firing pin well or hole as a rear sight and the crosshairs on the muzzle as a front sight, aline the axis of the bore on the distant object.

(f) Without moving the gun tube, aline the sight so that the intersection of the zero range line and the zero lead line is laid exactly on the same spot as the aiming point that the axis of the bore is laid on. When this is done, the gun is boresighted.

(2) Test target method. The procedure is as follows (fig. 31):

(a) Place the destroyer on ground as level as possible. In any case, boresight!

(b) Carefully install the breech and muzzle boresights.

(c) Level the tube with a level or gunner's quadrant, or by inspection if no instrument is available.

(d) Suspend test target at same level as gun tube.

(e) Test target should be 80 to 100 feet from the gun. It should be perpendicular to the gun tube.

(f) Look through breech end of tube and without moving tube, have a man aline the right intersection of test target so the horizontal and vertical lines of intersection coincide with horizontal and vertical lines of muzzle boresight.

(g) Without moving the tube, place the axis of the sight on the right intersection of test target.

(h) When this has been done accurately the gun is boresighted.

119. BORESIGHTING EXPEDIENTS.--There are many expedients that can be made by the gun crew that will aid in boresighting the piece. An expended round can be fitted with crosshairs. Drive the primer out and the shell can be used to boresight without getting out of the destroyer. The short distance from the base of the shell to the base of the crosshairs in its front end makes the accuracy of this method doubtful. A hasty boresight can be made by centering an object in the bore and then laying the sight on that object. This method, however, is not desirable due to its inaccuracy (see also par. 124c).

120. WHEN TO BORESIGHT.--A gunner should always keep his gun boresighted. Whenever he has the opportunity he should boresight. During lulls in battle, after a road march, at halts on the march, and many other times a short stop will enable the gunner to check the boresight of his weapon. If the first round is to count, the adjustment of sight must be correct.

121. BORESIGHTING SPECIFIC WEAPONS.--Since the boresighting of the destroyers is not covered in War Department field manuals and since the accuracy of all firing is directly dependent upon this adjustment, the detailed procedure for boresighting each weapon is included in the following paragraphs.

122. BORESIGHTING 37-mm. GUN, M3 ON MOTOR CARRIAGE, M6.--See FM 23-70. Though this is the manual for the towed gun, the procedure is identical.

123. BORESIGHTING 37-mm. GUN, M5 ON MOTOR CARRIAGE, M8 --See FM 23-80. Though this FM is written for the 37-mm. gun mounted in tanks, the boresighting procedure is identical.

124. BORESIGHTING THE 75-mm. 1897A4 ON MOTOR CARRIAGE, M3A1.--a. Distant aiming point method.

(1) When used.

(a) When suitable objects on terrain are present.

(b) During lulls in firing, or before firing.

(2) Equipment.

(a) Breech boresight--brass disk which fits into bore at the breech.

(b) Muzzle boresight--black linen thread and web belt.

(3) Procedure.

(a) Pick out clearly defined object at least 1500 yards from destroyer, and choose definite part of this object, preferably a corner, as aiming point.

(b) Using boresights, or suitable substitutes (see c below)

aline tube on the distant object. Note carefully exact point on the object on which tube is alined.

(c) Check sight to see if intersection of zero range and lead lines are on the same point.

(d) If crosshairs do not coincide, adjust as follows:

1. To aline zero range line, loosen bracket-locking bolts on sight mount. Tap mount forward or back until zero range is on proper part of aiming point. Tighten bracket-locking bolts; re-check tube.

2. To aline zero lead line, loosen telescope holder locking bolt. Turn eccentric until zero lead line is on proper part of aiming point. Tighten telescope holder locking bolt; re-check sight and tube.

b. Test target method.

(1) When used.

(a) Periodically in garrison or bivouac, for accurate adjustments.

(b) In action, when distant aiming points are not available and time is not important.

(2) Equipment.

(a) Breech and muzzle boresights.

(b) Any object with comparatively flat vertical surface, such as side of another destroyer.

(c) Chalk or substitute.

(3) Procedure.

(a) Place destroyer on level ground about 80 to 100 feet from flat surface selected.

(b) Draw a straight horizontal line on selected surface; intersect it with two vertical lines 16 7/16 inches apart (fig. 32).

(c) Aline tube so that horizontal portion of muzzle bore-sight coincides with horizontal line, and vertical portion of muzzle bore-sight coincides with right-hand vertical line.

(d) Proceed as in distant aiming point method, adjusting zero lead line on left-hand vertical line and zero range line on single horizontal line.

c. Expedients.--(1) For muzzle boresight: thread from waste,