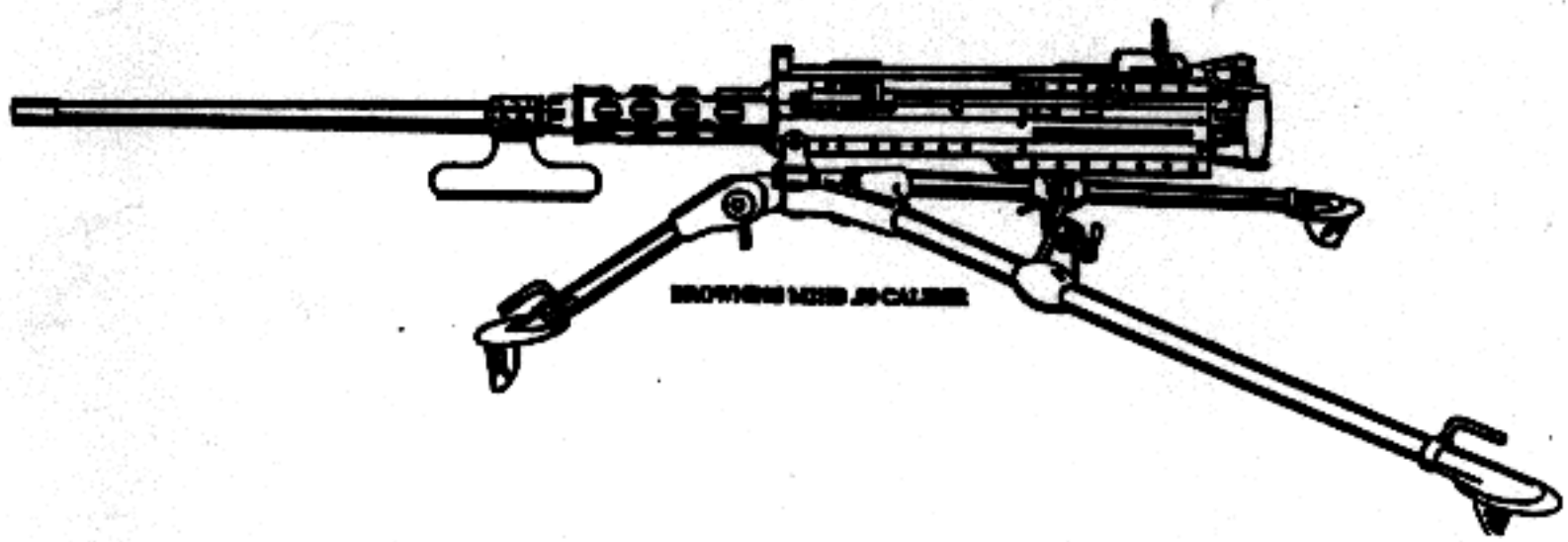
FIELD MANUAL

BROWNING MACHINEGUN CALIBER .50 HB, M2



HEADQUARTERS, DEPARTMENT OF THE ARMY

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FIELD MANUAL
No. 23–65

HEADQUARTERS
DEPARTMENT OF THE ARMY
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BROWNING MACHINEGUN CALIBER .50 HB, M2

* This manual supersedes FM 23–65, 5 December 1958, including all changes.

PART ONE
MECHANICAL TRAINING AND CREW TRAINING

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Purpose and Scope

a. This manual is a guide for training on the Browning machinegun, caliber .50 HB, M2. It provides a sound and detailed basis for the conduct of training, to include mechanical and crew training, techniques of fire, employment, and layout and operation of machinegun ranges and courses of fire. Information in this manual is presented in a logical sequence from the basic to the more complex phases of instruction. All instruction can be given either on the range or in the vicinity (concurrent training stations).

b. The material contained herein is applicable without modification to nuclear and conventional warfare.

c. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications) and forwarded direct to the Commandant, US Army Infantry School, Fort Benning, Georgia 31905.

2. Roles of the Machinegun

a. The machinegun supports the infantryman in both the attack and defense. It provides the rifleman with the heavy volume of close, accurate, and continuous fire necessary to accomplish his mission in the attack. The long range, close defensive, and final protective fires delivered by this gun form an integral part of the unit's defensive fires.

b. The caliber .50 machinegun is also used to:

(1) Provide protection for motor movements, vehicle parks, and train bivouacs.

(2) Defend against low-flying hostile aircraft.

(3) Destroy lightly armored vehicles.

(4) Reconnaissance by fire on suspected enemy positions.

Section II. DESCRIPTION

3. Principles of Operation

The Browning machinegun, caliber .50 HB, M2, is a belt-fed, recoil-operated, air-cooled, crew-operated machinegun. The gun is capable of single-shot, as well as automatic fire (fig 1).

a. Belt Feed. By repositioning some of the component parts, the gun is capable of alternate feed (ammunition can be fed into the weapon from the right or the left side of the receiver); however, the infantry uses only left side feed. A disintegrating metallic link belt is used in feeding.

b. Recoil Operation. The force for recoil operation is furnished by expanding powder gases which are controlled by various springs, cams, and levers.

c. Air Cooling. Maximum surface of the barrel and receiver are exposed to permit air cooling. Perforations in the barrel support allow air to circulate around the breach end of the barrel and help in cooling the parts. The heavy barrel is used to retard early overheating.

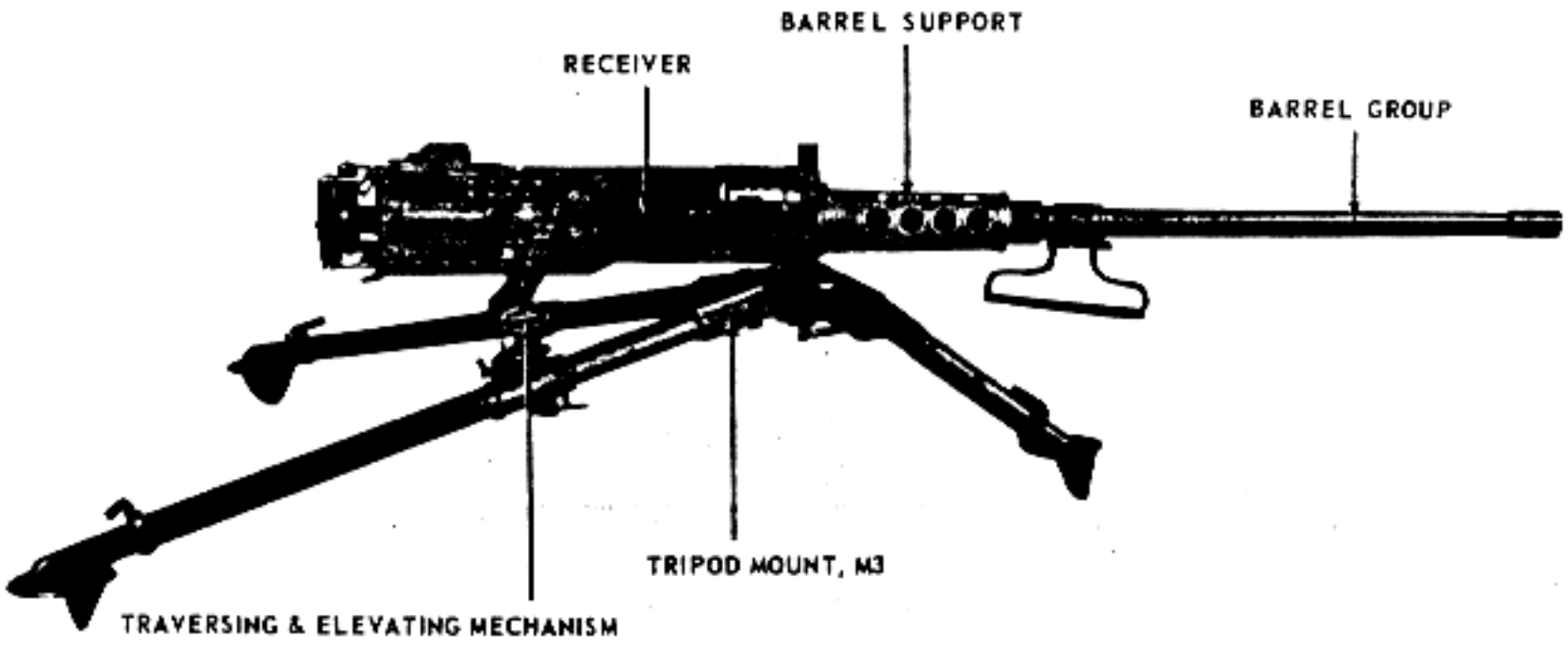


Figure 1. Browning machinegun, cal .50 HB, M2 on tripod mount, M3.

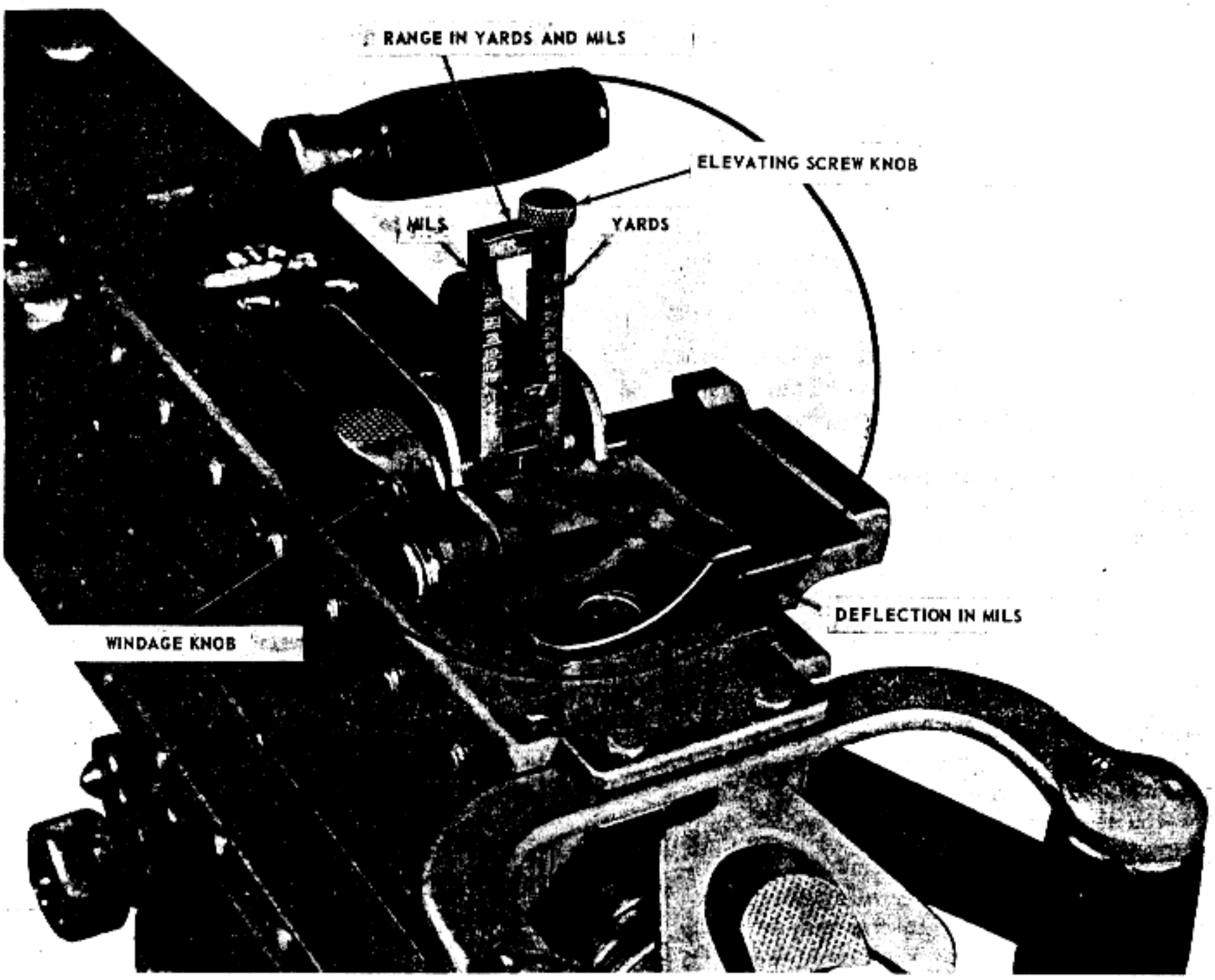


Figure 2. Leaf type rear sight.

4. Sights

The gun has a leaf-type rear sight, graduated in both yards and mils for ranges from 100 to 2,600 yards, and from 0 to 62 mils. A windage knob permits deflection changes of 5 mils right or left of center (fig 2). The front sight is a semi-fixed blade type with cover (fig 3).

5. General Data

Weight of receiver group	60 lb.
Weight of barrel	24 lb. (approx.)
Weight of tripod mount M3 (w/traversing and elevating mechanism and pintle w/bolt)	44 lb.
Total weight of gun, complete, on tripod mount, M3	128 lb. (approx.)
Maximum range (M2 ball)	6,800 meters (approx.)
Maximum effective range	1,830 meters
Rates of fire:	
Sustained	40 rd. or less per min.
Rapid	40 rd. or more per min.
Cyclic rate of fire	450–550 rd. per min.
Muzzle velocity (M2 ball)	3,050 ft per sec (2,080 mph)
Length of gun, overall	65 in. (approx.)
Length of barrel	45 in.

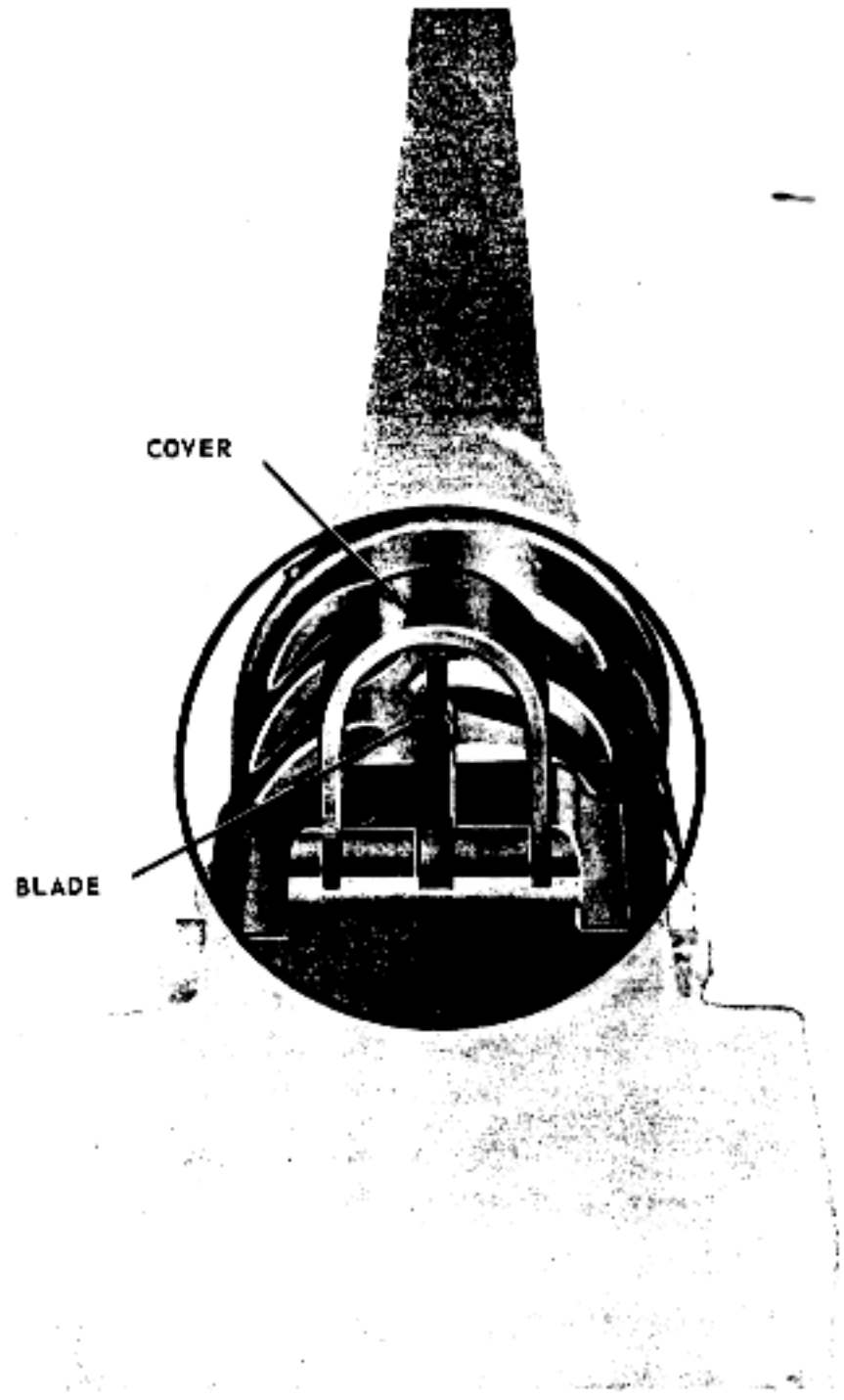


Figure 3. Front sight, cover, and blade.

CHAPTER 2

DISASSEMBLY AND ASSEMBLY

Section I. INTRODUCTION

6. General

a. Types of Disassembly and Assembly. The two classifications of disassembly and assembly are:

(1) *General disassembly and assembly.* Removing and replacing major groups and assemblies of the gun.

(2) *Detailed disassembly and assembly.* Removing and replacing all component parts of each major group and assembly.

b. Changing Parts. When time is critical and a major group or assembly is available, a broken part can be replaced by substituting a complete group or assembly containing the part. When a major group or assembly within the receiver is replaced, headspace and timing must be set.

Section II. GENERAL DISASSEMBLY

7. Procedure

General disassembly consists of removing the major groups and assemblies for inspection or cleaning.

a. Clearing the Gun. Before disassembly can be conducted, the gun must be cleared as prescribed in paragraph 15.

b. Barrel group. Turn the cover latch and raise the cover group (fig 4). Grasp the retracting slide handle with the right hand, *palm up,* and pull the recoiling parts to the rear until the lug on the barrel locking spring alines with the ⅝-inch hole in the right sideplate of the receiver (just below the feedway exit). The barrel can be turned only when the lug is alined with the ⅝-inch hole. Place the smallest loop of a caliber .50 link, or suitable spacer, between the trunnion block and the barrel extension (fig 5 and 6). This holds the barrel locking spring lug alined with the ⅝-inch hole in the right sideplate. Unscrew the barrel from the receiver (fig 7). Be careful not to damage the threads or barrel locking notches when setting the barrel down. Pull back slightly on the retracting slide handle and remove the link or spacer from the receiver.

c. Backplate Group. Insure that the bolt latch release is in the up position, free of the bolt latch release lock. If it is not, push down on the bolt latch release and turn the buffer tube sleeve to the right to free it (fig 8). *The bolt must be forward before the backplate is removed.* If the bolt is to the rear, push down on the bolt latch release allowing the bolt to go forward.

***Caution.* Care must be taken to prevent the bolt from slamming forward with the barrel removed.**

Use the retracting slide handle to ease the bolt forward after the bolt latch is released. The backplate latch lock and latch are below the buffer tube. Pull out on the lock and up on the latch; remove the backplate by lifting it straight up (fig 9).

d. Driving Spring Rod Assembly. The inner and outer driving springs and driving spring rod are located inside the receiver next to the right sideplate (fig 10). Push in on the head of the driving spring rod and push to the left to remove the driving spring rod retaining pin from its seat in the right sideplate. Pull the driving spring assembly to the rear and out of the receiver.

***Caution.* Never attempt to cock the gun while the backplate is off and the driving spring assembly is in place. If the backplate is off and the driving spring assembly is compressed, the retaining pin on the driving spring rod can slip from its seat in the sideplate and could cause serious injuries to anyone behind the gun.**

e. Bolt Stud. Grasp the retracting slide handle and give it a quick jerk, freeing the bolt from the barrel extension. Aline the shoulder on the bolt stud with the clearance hole in the bolt slot on the rght sideplate, and remove the bolt stud (fig 11).

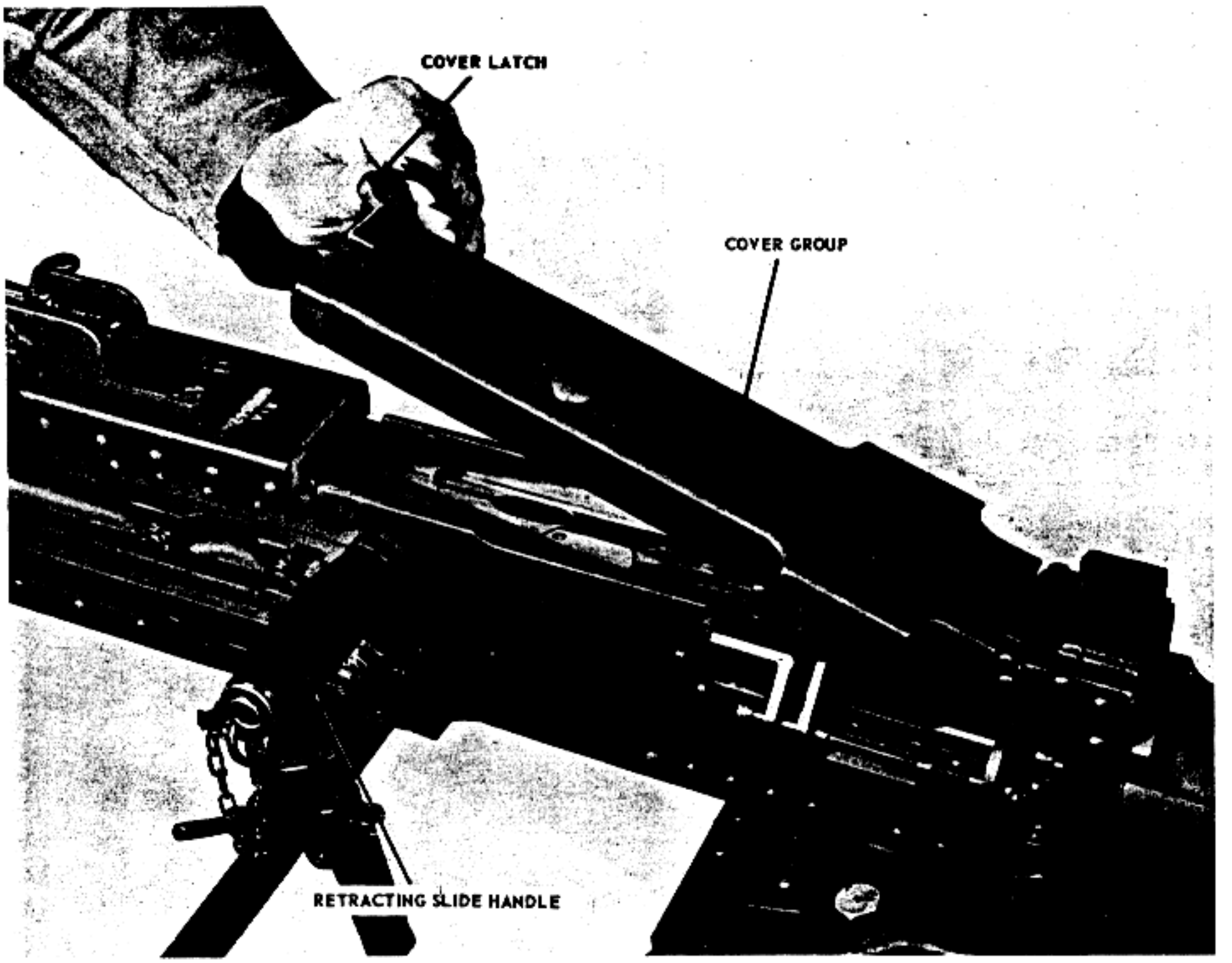


Figure 4. Raising the cover.

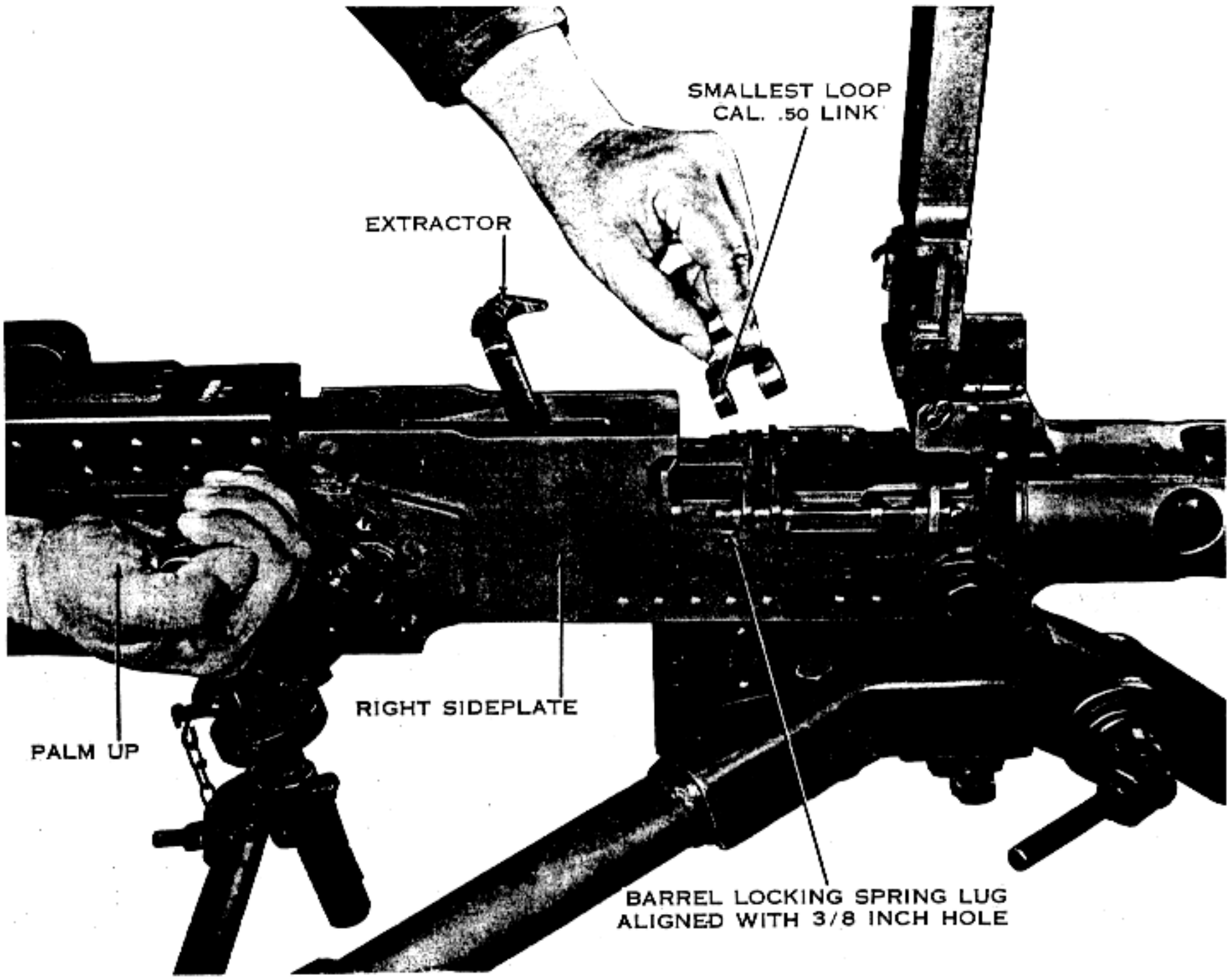


Figure 5. Alining the lug on the barrel locking spring with the ⅜-inch hole in the right side plate.

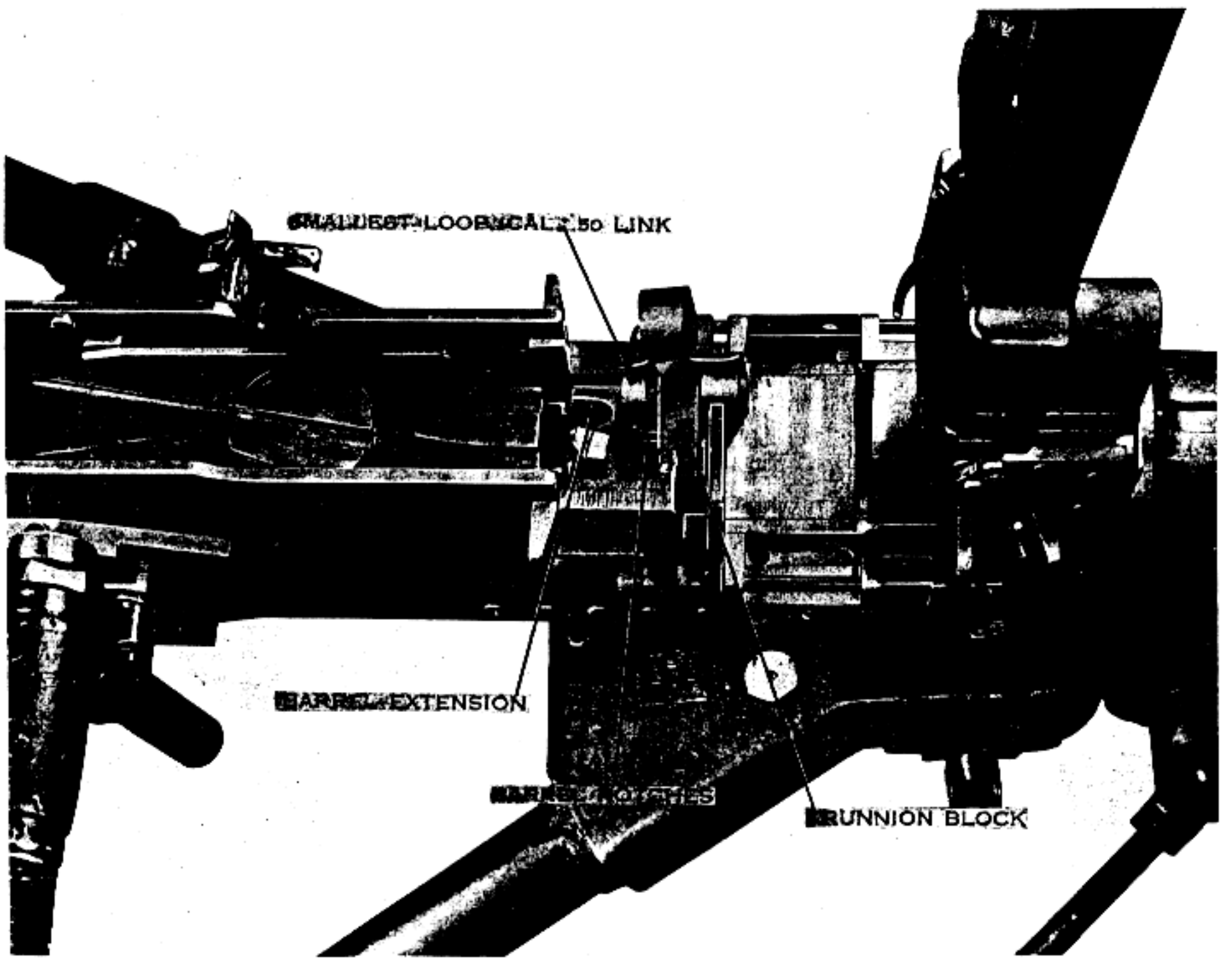


Figure 6. The smallest loop of the cal .50 link is used in alining the barrel locking spring lug with the ⅜-inch hole in the right sideplate.

Figure 7. Removing the barrel.

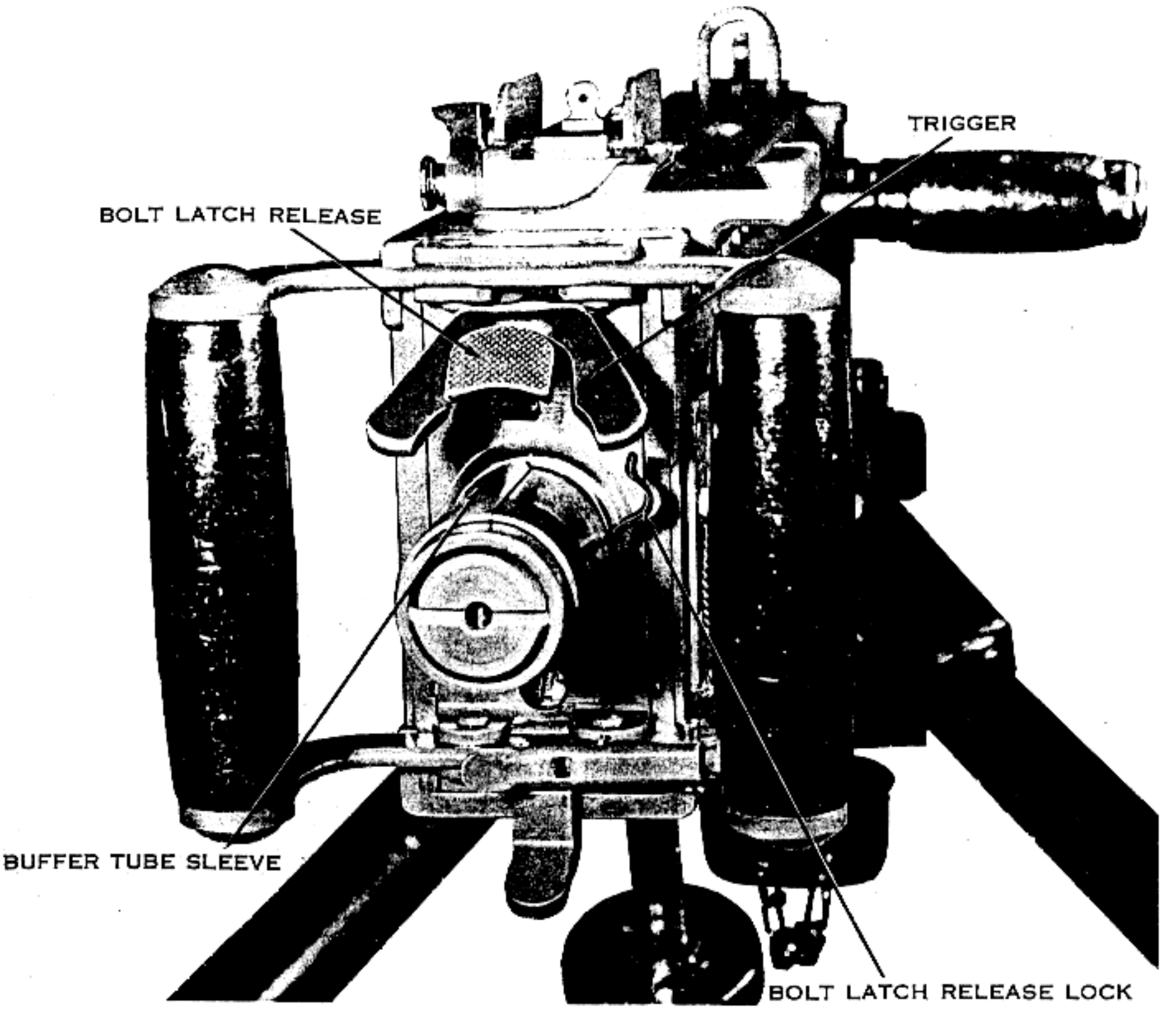


Figure 8. Bolt latch release free of the bolt latch release lock.

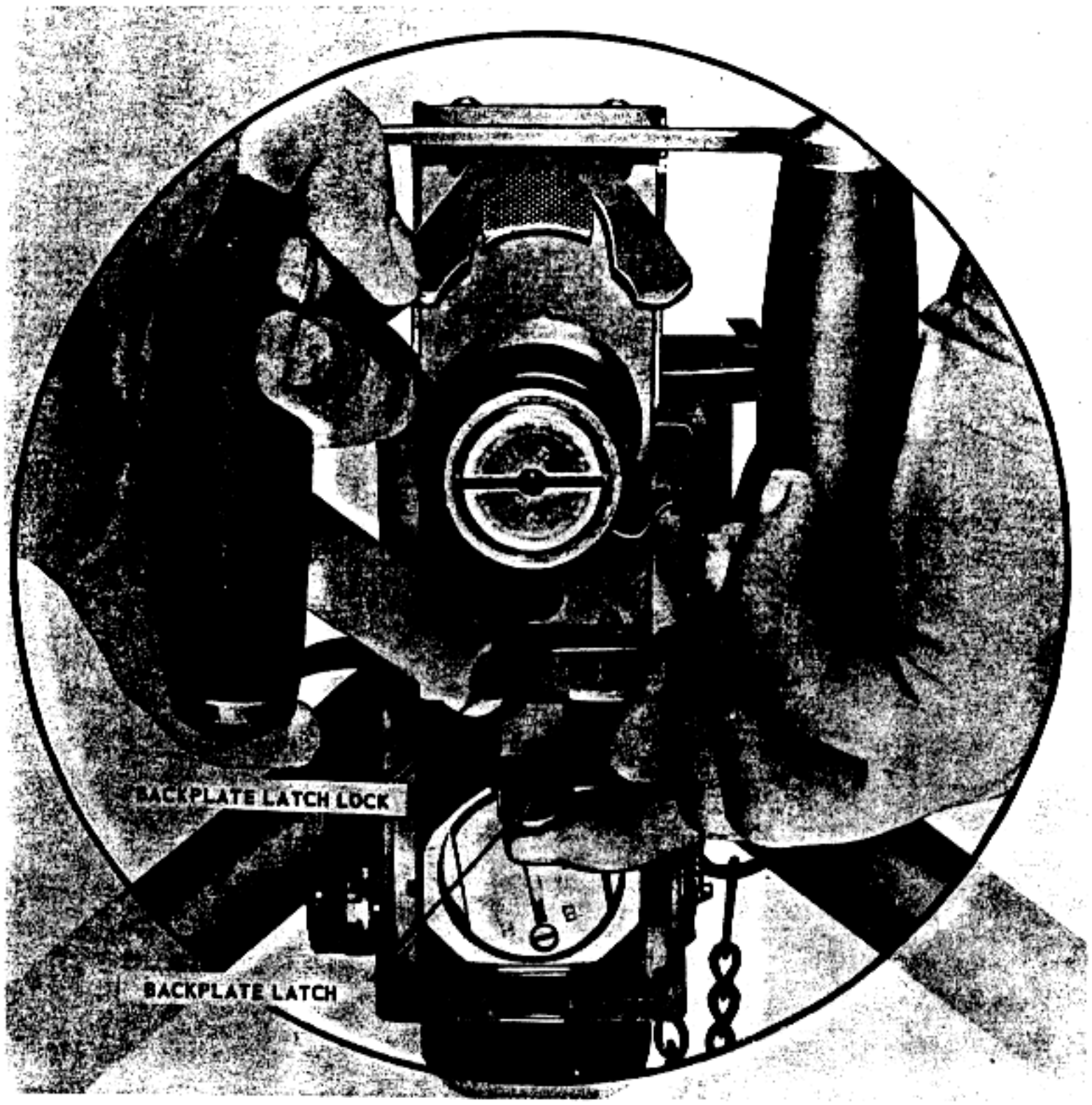


Figure 9. Removing the backplate.

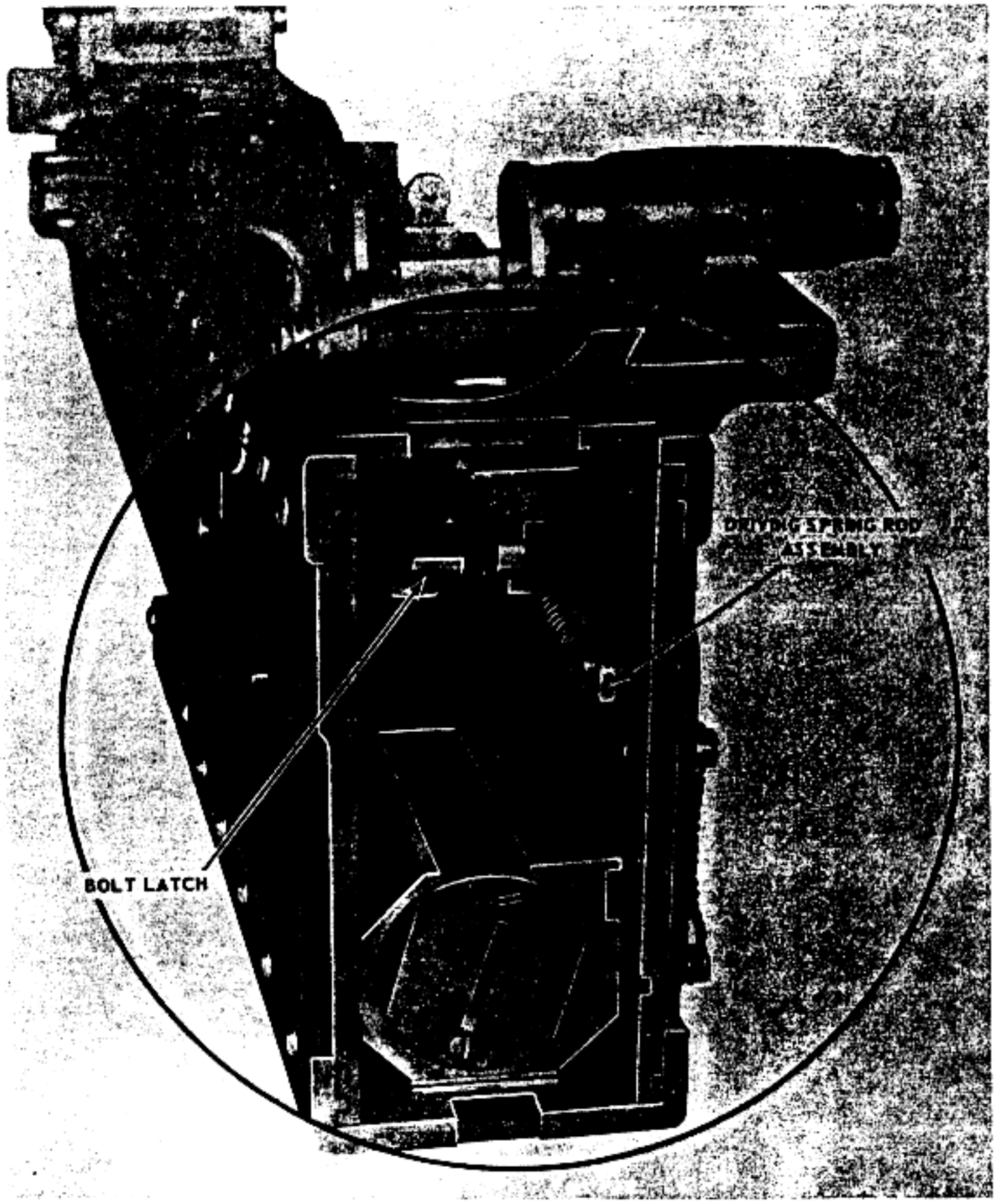


Figure 10. Driving spring rod assembly.

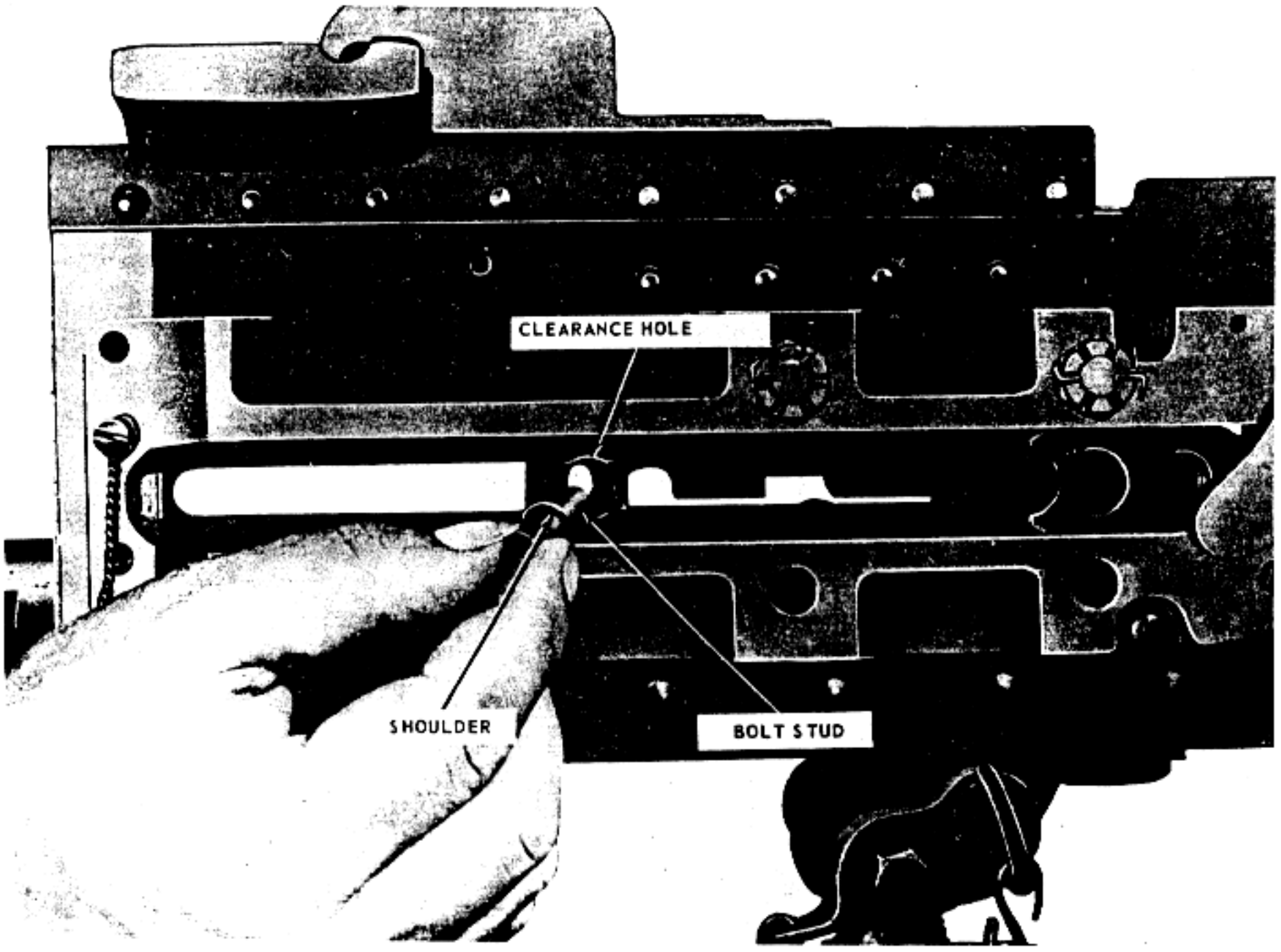


Figure 11. Removing the bolt stud.

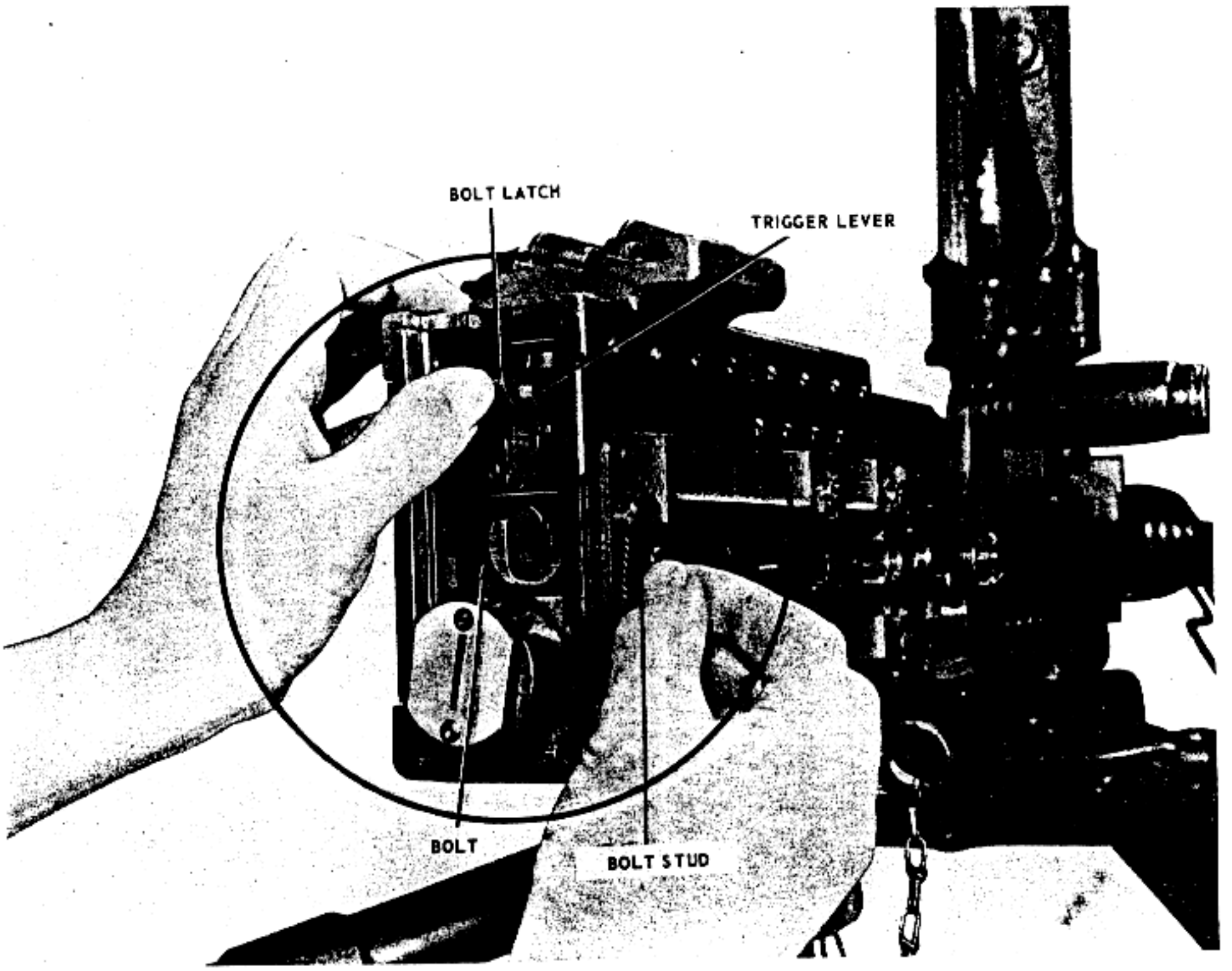


Figure 12. Freeing the bolt.

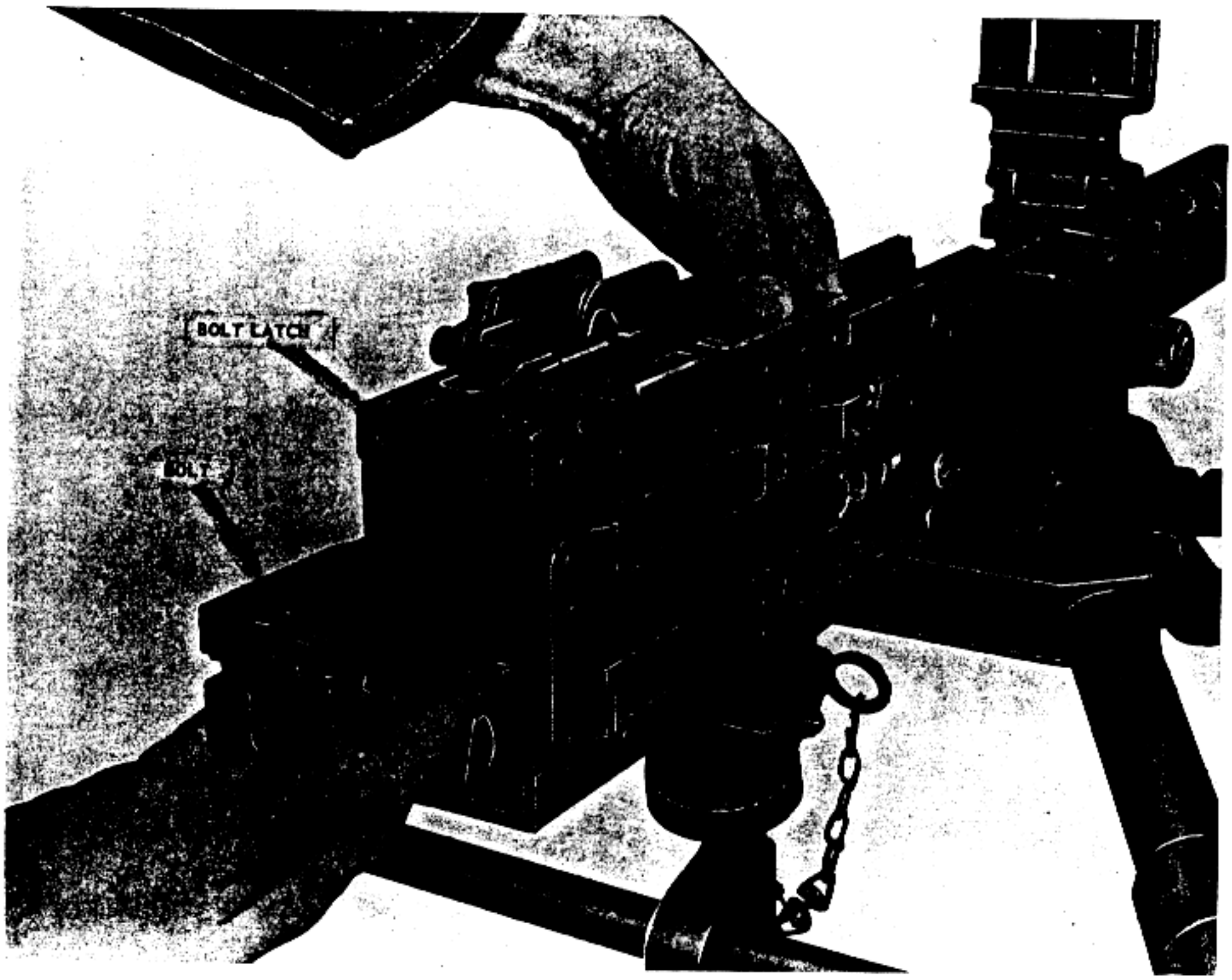


Figure 13. Removing the bolt from the receiver.

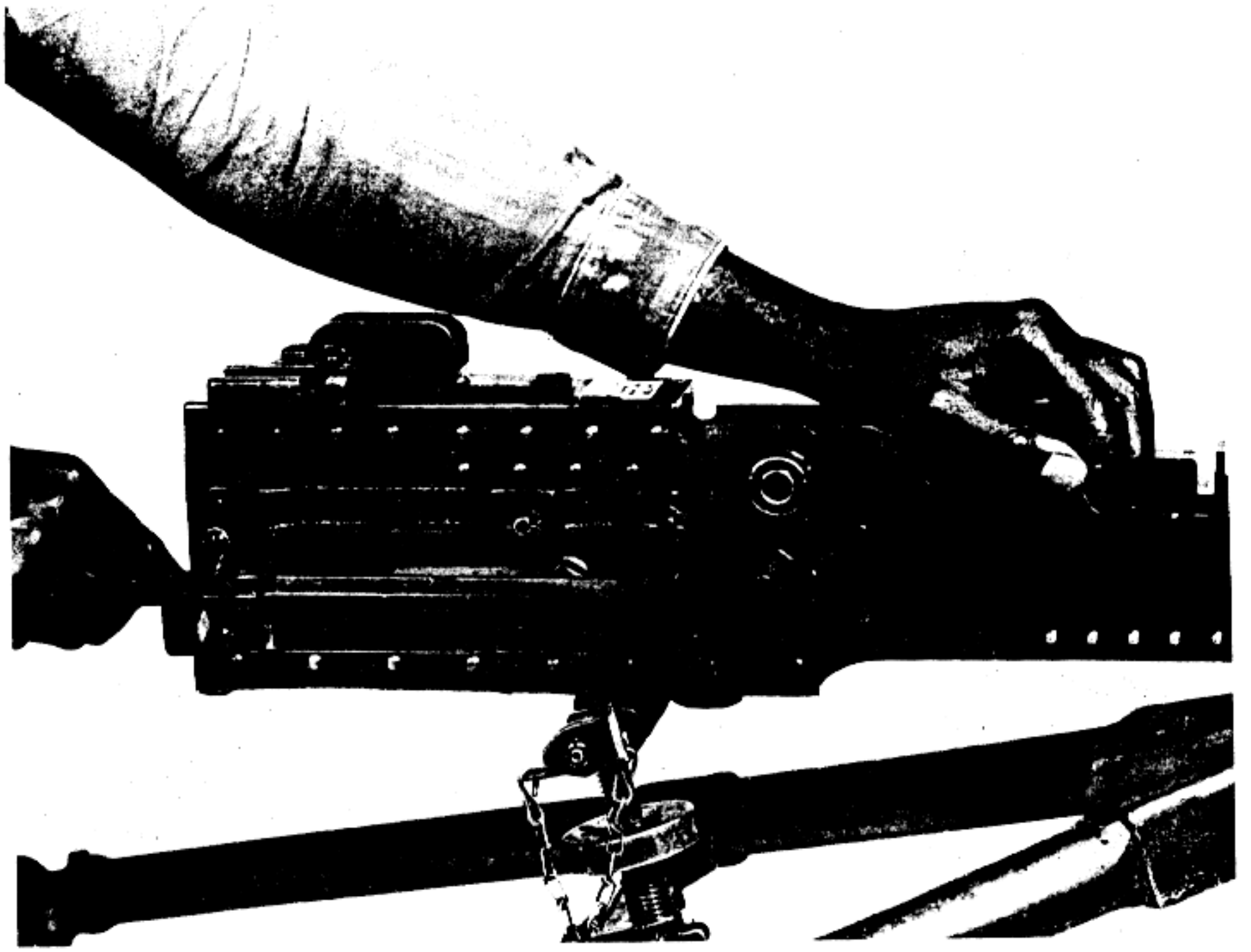


Figure 14. Removing barrel buffer group and barrel extension group.

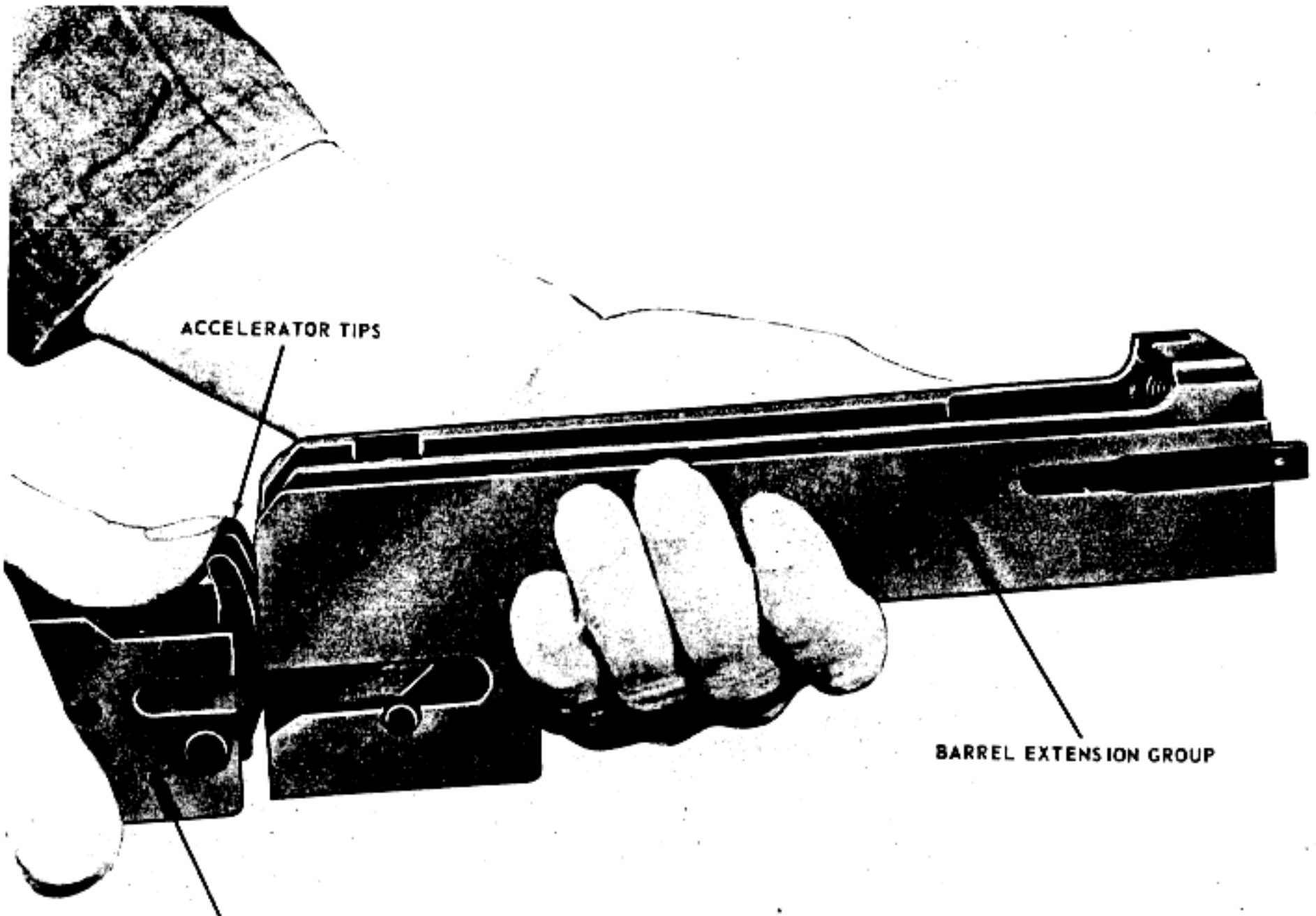


Figure 15. Separating the groups.

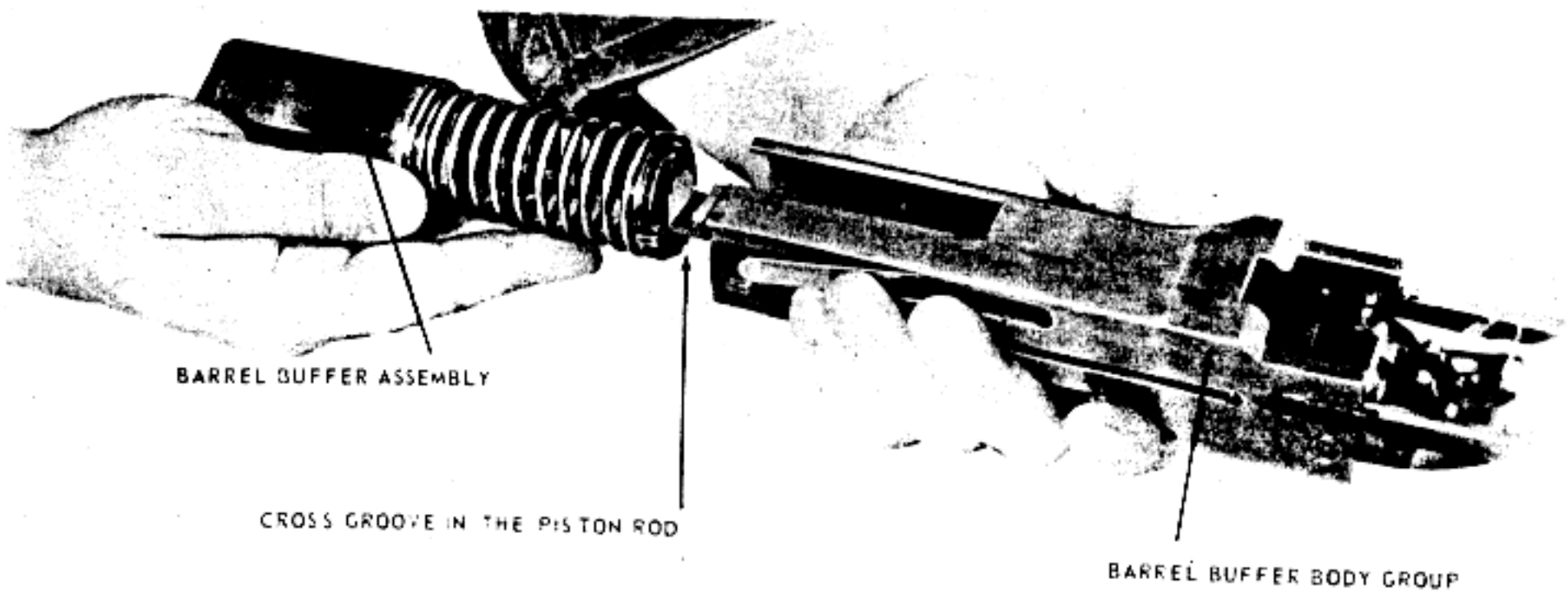


Figure 16. Separating the barrel buffer assembly from the barrel buffer body group.

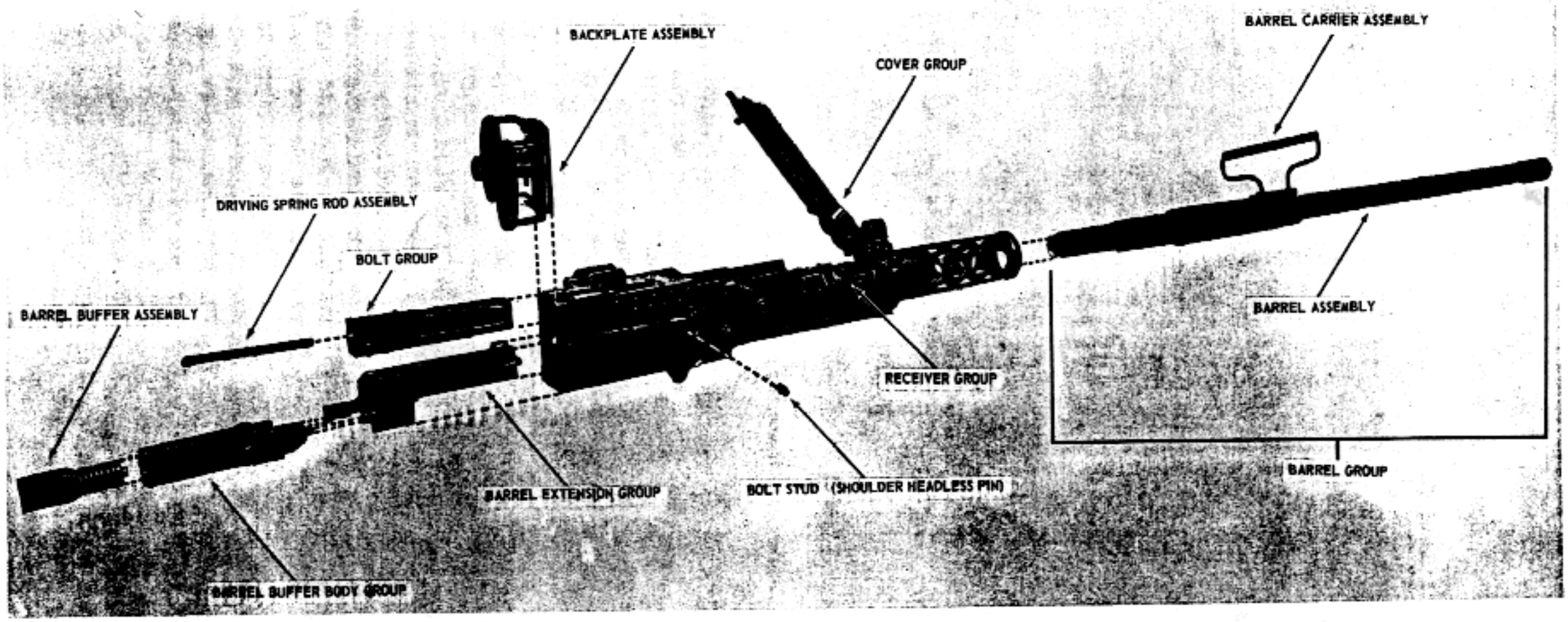


Figure 17. Major groups.

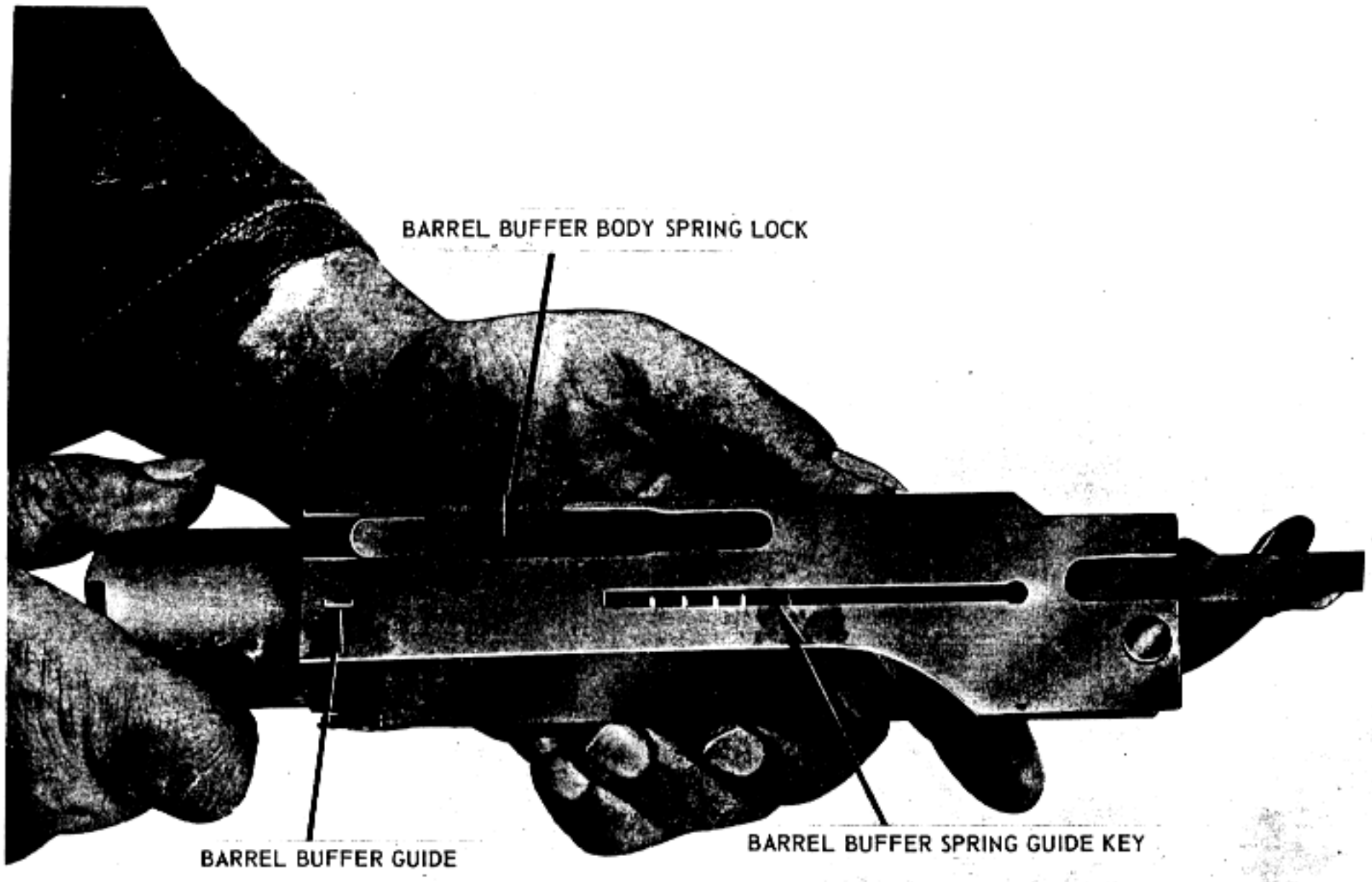


Figure 18. Removing the barrel buffer assembly.

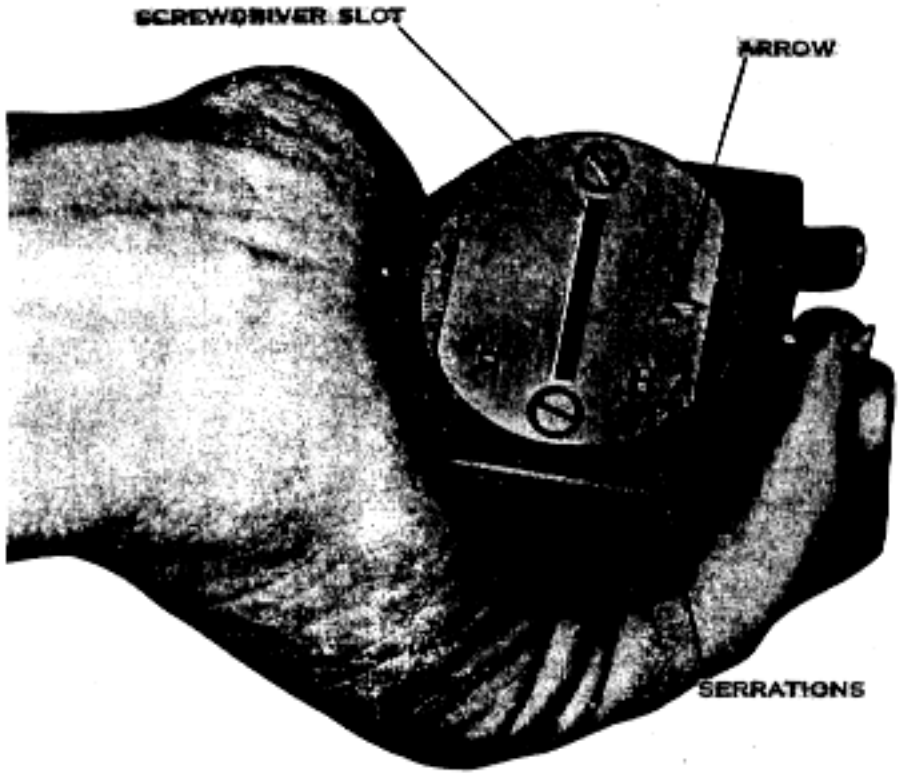


Figure 19. Replacing the barrel buffer assembly.

Note. If the bolt is accidentally moved all the way to the rear, the bolt latch will engage in the bolt latch notches in the top of the bolt. If this occurs, raise the bolt latch (left of the trigger lever) and push the bolt forward to aline the bolt stud with clearance hole (fig 12).

f. Bolt Group. After freeing the bolt, slide it to the rear and out of receiver (fig 13). Place the bolt down on its right side (with the extractor arm up), so that the extractor will not fall from the bolt.

g. Barrel Buffer Group and Barrel Extension Group. Insert the drift of a combination tool, or other pointed instrument, through the hole in the lower rear corner of the right sideplate. Push in on the barrel buffer body lock. At the same time, place one hand in the receiver and push the barrel extension group and barrel buffer group to the rear (fig 14). Remove the barrel buffer group and barrel extension group from the receiver. Separate the two groups by pushing forward on the tips of the accelerator (fig 15).

h. Barrel Buffer Assembly. Pull the barrel buffer assembly from the rear of the barrel buffer body group. The barrel buffer assembly will not be disassembled (fig 16). This completes general disassembly (fig 17).

8. Procedure

To assemble the gun, replace the groups and assemblies (in reverse order of removal in disassembly).

a. Barrel Buffer Assembly and Barrel Buffer Body Group. Replace the barrel buffer assembly in the barrel buffer body group, with the key on the spring guide to the right. This key must fit in its slot in the right side of the barrel buffer body. Turn the barrel buffer tube until the screwdriver slot (in the rear of the tube) is vertical, the arrow pointing to the right. The stud on the tube lock will now engage the serrations in the barrel buffer tube, to keep the tube from turning. Push the barrel buffer assembly fully forward (fig 18 and 19).

b. Barrel Buffer Group and Barrel Extension Group. To join the two groups together, hold the barrel buffer group in the right hand, with the index finger supporting the accelerator. Join the notch on the shank of the barrel extension group with the cross-groove in the piston rod of the barrel buffer assembly. At the same time, aline the breech lock depressors with their guideways in the sides of the barrel extension, insuring that the tips of the accelerator are against the rear end of the barrel extension (claws against the shank) (fig 20). Push the groups together. As the accelerator rotates to the rear, press down on its tips to insure positive locking of groups. Place the groups in the receiver, and push them forward until the barrel buffer body spring lock snaps into position. When the parts are properly locked in place, the barrel buffer tube should protrude about 1⅛-inches from the rear of the barrel buffer body group.

c. Bolt. Place the bolt in the receiver, with the top of the cocking lever forward and the extractor down (fig 21). Push the bolt forward into the receiver. As the front end of the bolt approaches the tips of the accelerator, look in the sideplate of the receiver, press down on the rear end of the bolt to insure the front end of the bolt clears the

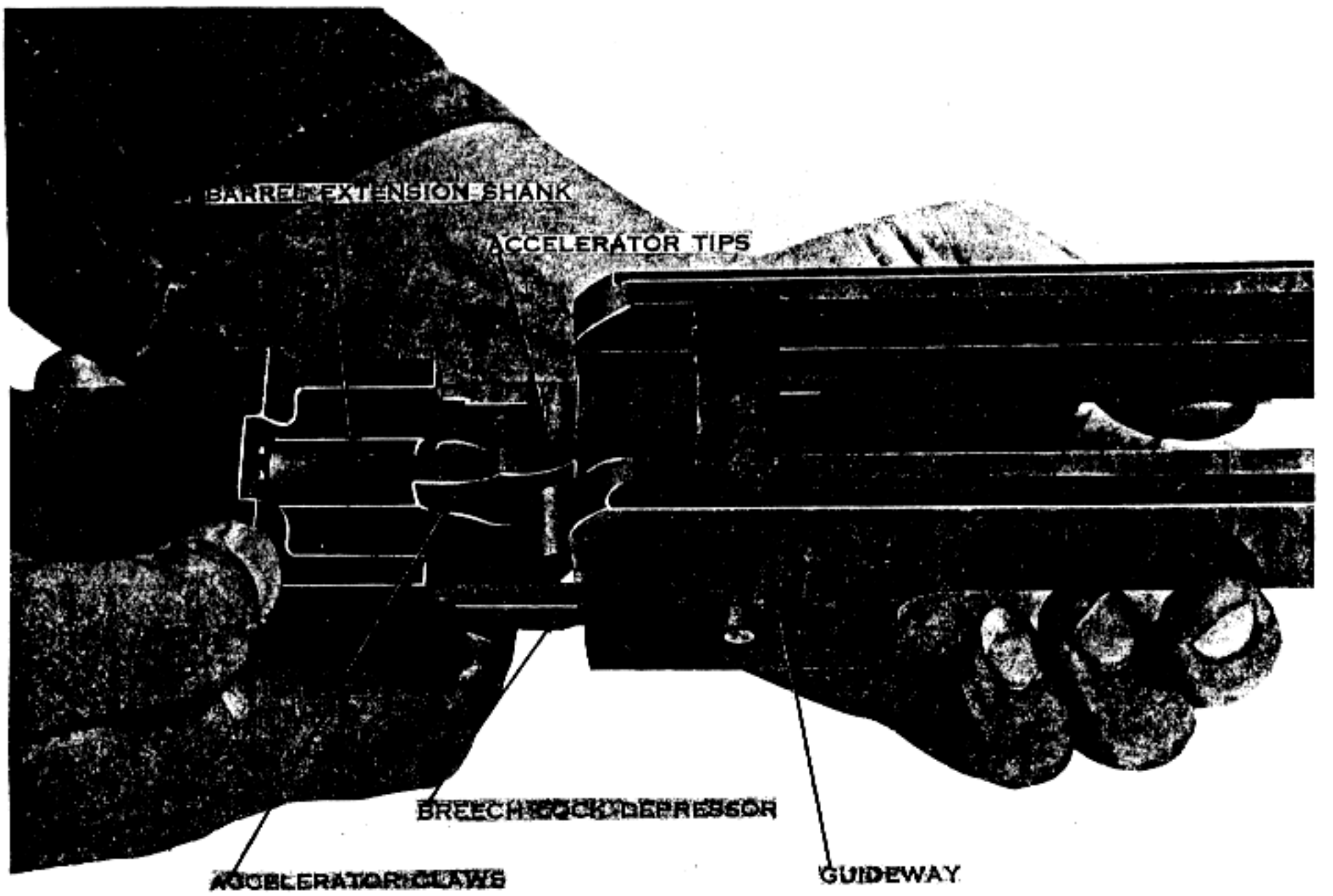


Figure 20. Joining the barrel extension group and barrel buffer group.

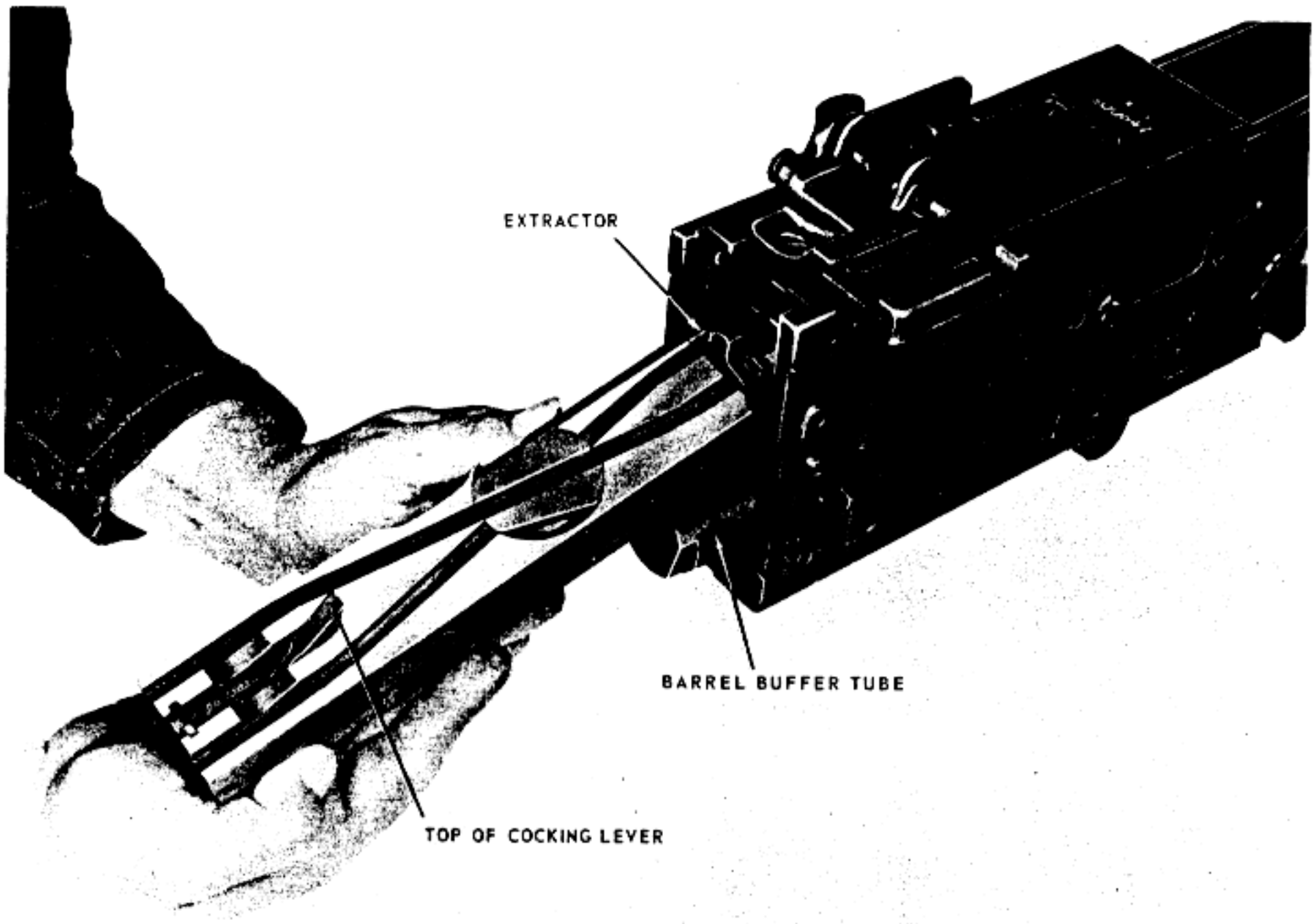


Figure 21. Replacing the bolt.

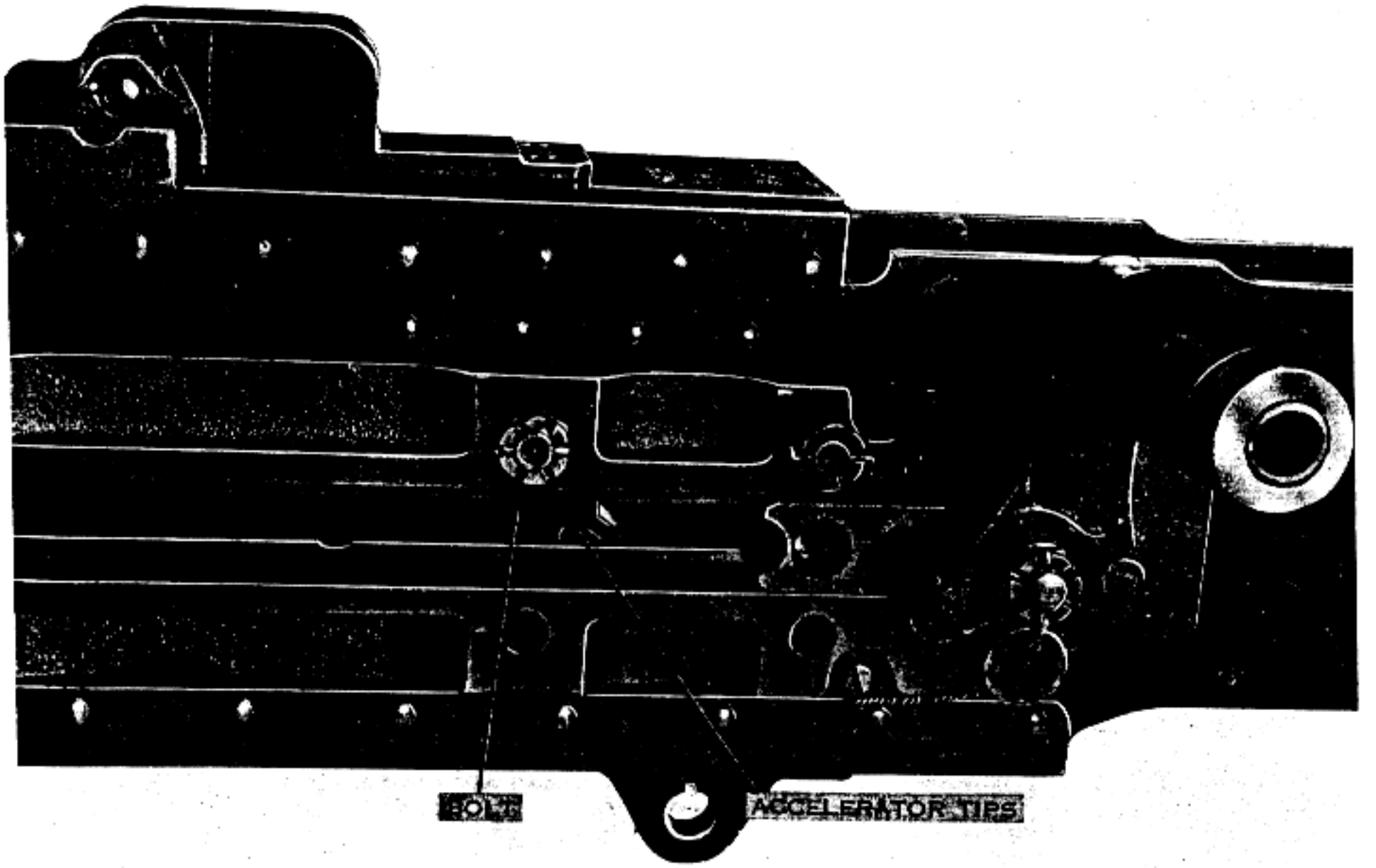


Figure 22. Bolt clearing the accelerator tips.

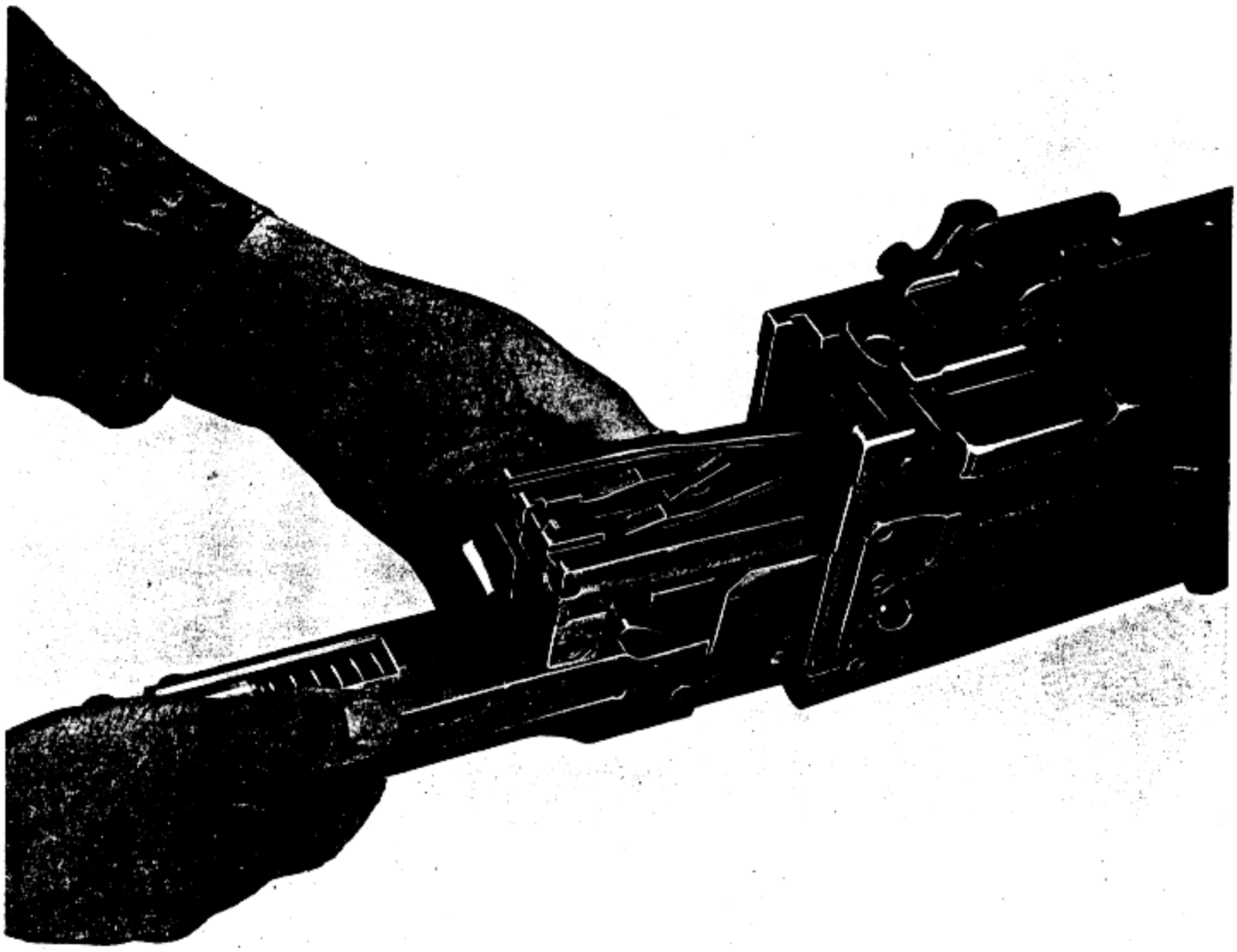


Figure 23. Returning the barrel extension, barrel buffer, and bolt groups together.

Figure 24. Replacing the backplate group.

accelerator tips (fig 22). Raise the rear of the bolt and continue to push the bolt forward until the bolt latch engages the notches in the top of the receiver.

Note. The barrel extension, barrel buffer, and bolt groups may be assembled and returned to the receiver together (fig 23).

d. Bolt Stud. Aline the stud hole in the bolt with the clearance hole and replace the bolt stud, insuring that the shoulder of the stud is inside the sideplate.

e. Driving Spring Group. Press up on the bolt latch and push the bolt all the way forward by pushing on the bolt stud only. Place the end of the driving spring rod in its hole in the rear of the bolt, and push forward on the driving spring group and the barrel buffer tube. Press in and to the right on the head of the driving spring rod and place the retaining pin in its seat in the right sideplate.

Note. At this time, the barrel buffer tube should be completely inside the receiver. If not, the barrel buffer body spring is not properly seated.

f. Backplate Group. Hold the backplate with the latch down and the trigger up; place the backplate guides in their guideways. Hold out on the latch lock and tap the backplate into position until the latch snaps into place (fig 24). Release the latch lock, and pull up on the backplate group to insure it is firmly seated.

g. Barrel. Pull the retracting slide handle to the rear until the lug on the barrel locking spring is visible through the ⅝-inch hole in the right sideplate. Place the smallest loop of a caliber .50 link, or suitable spacer, between the trunnion block and the barrel extension. Screw the barrel all the way into the barrel extension; then unscrew the barrel two notches. Remove the link and close the cover. This completes general assembly.

Section IV. DETAILED DISASSEMBLY AND ASSEMBLY

9. General

To replace damaged or broken parts within major groups or assemblies, a knowledge of detailed disassembly and assembly is required. Detailed disassembly and assembly involves the bolt, barrel buffer, barrel extension, cover, receiver, and backplate groups.

a. Bolt Group (fig 25).

(1) *Disassembly.*

(*a*) *Extractor.* Rotate the extractor upward, and remove it from the bolt, freeing the bolt switch. The ejector and ejector spring are not disassembled from the extractor (fig 26).

(*b*) *Bolt switch and bolt switch stud.* Lift out the bolt switch and pull out the bolt switch stud (fig 27). On some models, the bolt switch stud may be staked, so that it cannot be removed.

(*c*) *Cocking lever pin and cocking lever.* Rotate the top of the cocking lever toward the rear of the bolt and remove the cocking lever pin. Lift out the cocking lever. NOTE: The rounded nose of the cocking lever is down and to the rear of the bolt (fig 28).

(*d*) *Sear stop and pin.*

Note. Before removing the sear stop and pin, (on some models, the accelerator stop and lock) press down on the top of the sear to release the firing pin.

Use the thin end of the cocking lever to pry the sear stop (accelerator stop lock) out of its groove in the bolt, and into the center recess (fig 29 and 30). Turn the bolt over and drift the sear stop pin free from engagement with the firing pin spring (shake out the accelerator stop lock) (fig 31 and 32). Turn the bolt over and lift the sear stop and pin from the bolt (drift out the accelerator stop) (fig 33 and 34). If the pin does not come out freely, place the thin end of the cocking lever under the sear stop, against the pin, and pry it out of the bolt.

(*e*) *Sear slide.* Press down on the sear and withdraw the sear slide. Withdraw the square end first (fig 35).

(*f*) *Sear and sear spring.* To prevent loss of the sear spring, insert the thin end of the cocking lever between the coils of the sear spring. Lift out the sear and remove the sear spring. Leave the spring on the cocking lever (fig 36).

(*g*) *Firing pin extension assembly and firing pin.* Raise the front end of the bolt and allow the firing pin extension assembly and firing pin to fall into your hand (fig 37). Separate the firing pin from its extension. This completes detailed disassembly of the bolt (fig 38 and 39).

(2) *Assembly*

(*a*) *Firing pin and extension assembly.* Engage the rear end of the firing pin in its seating groove in the front end of the firing pin extension assembly. Insert the firing pin and extension assembly in the bolt, striker first, sear notch down (fig 40). Push the extension assembly into the bolt, and tilt the front end down until the striker

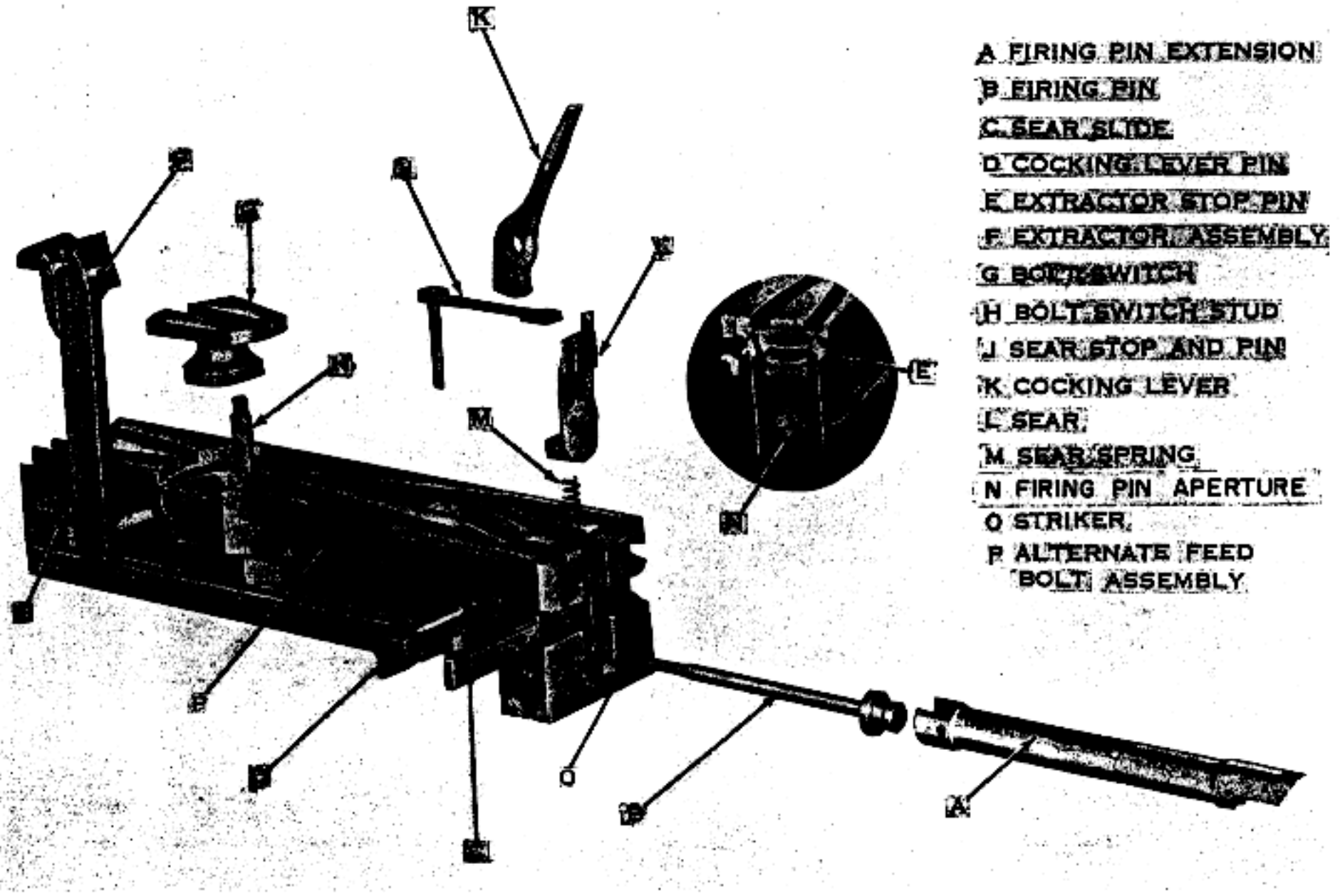


Figure 25. Bolt group, exploded view.

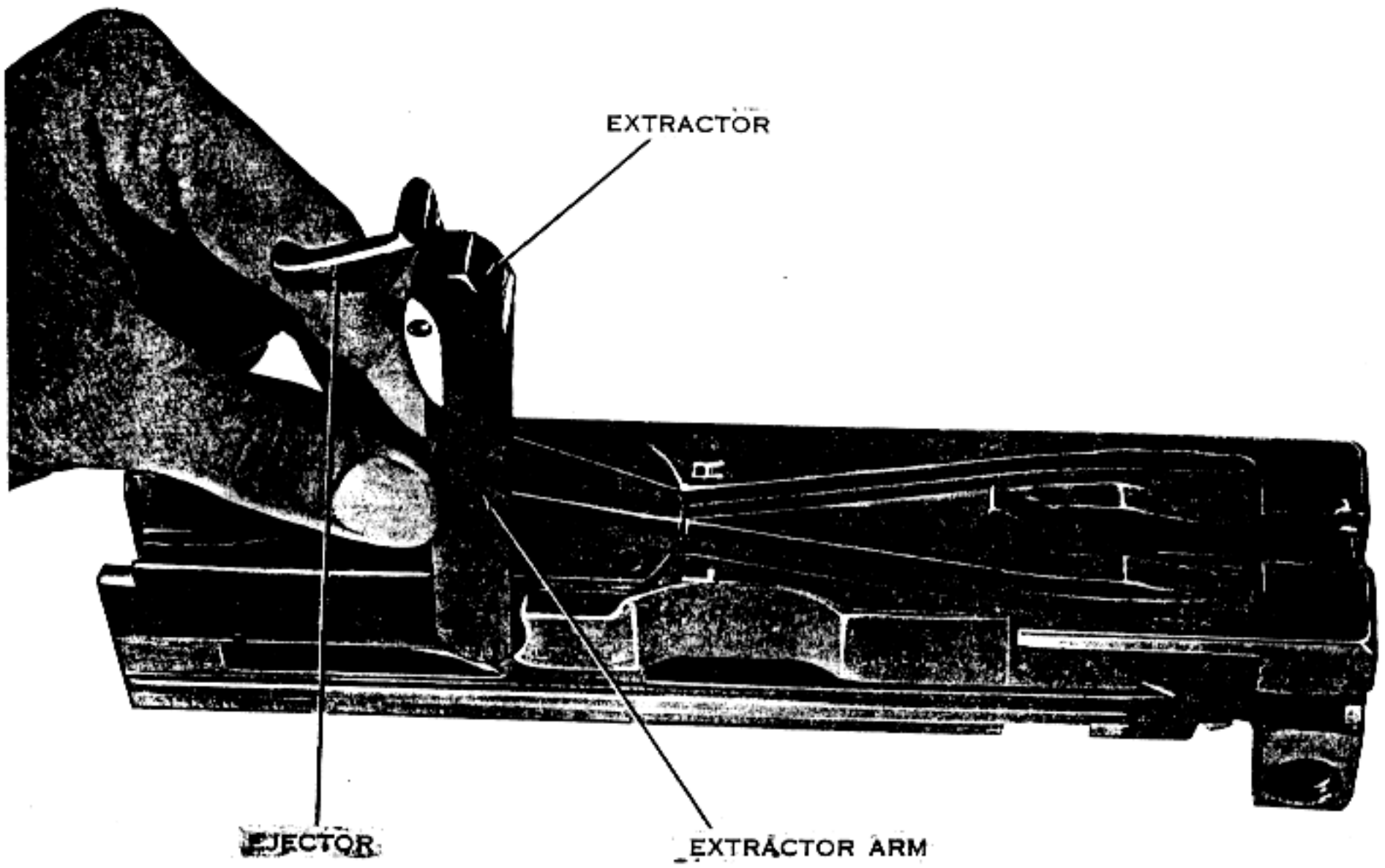


Figure 26. Removing the extractor.

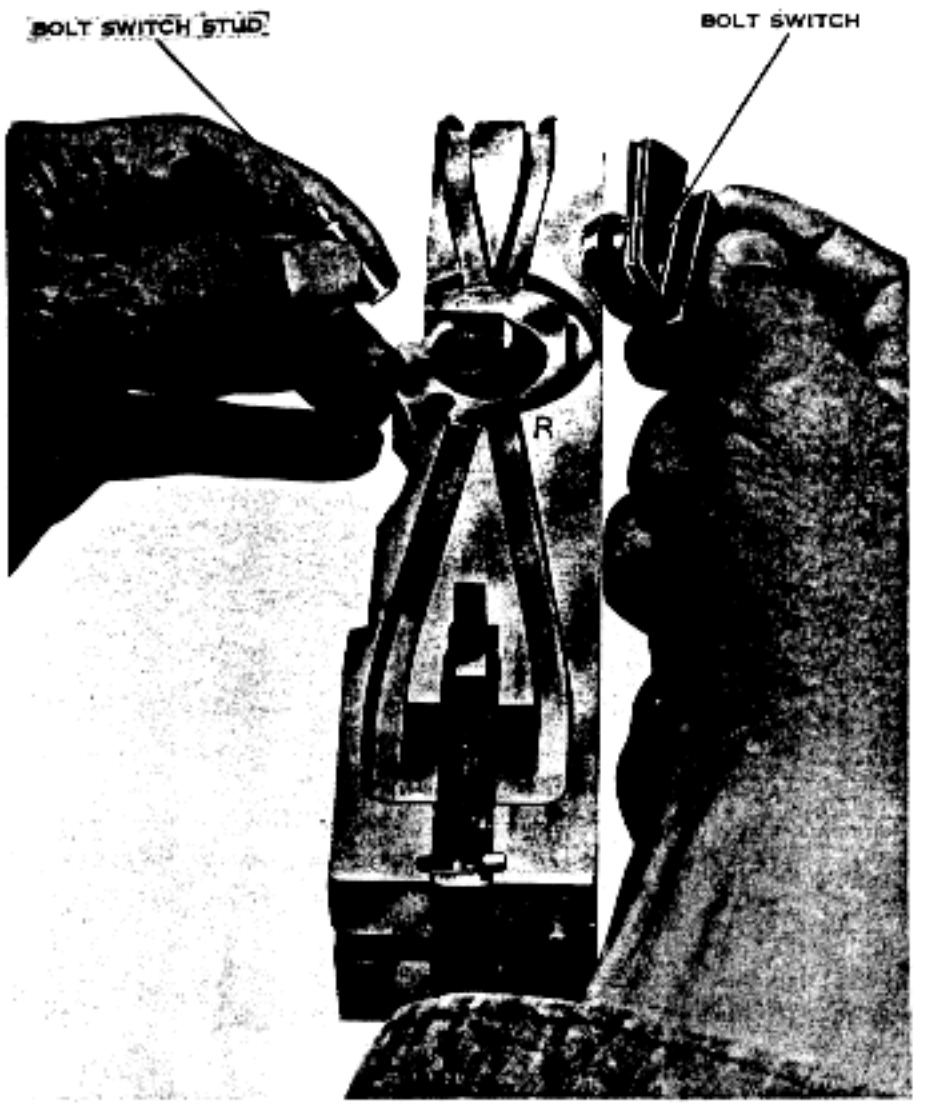


Figure 27. Removing the bolt switch and bolt switch stud.

protrudes through its aperture in the face of the bolt.

(*b*) *Sear spring and sear.* With the sear spring still wedged on the cocking lever, replace the spring, and insert the sear in its slot—stud up, and notch to the front. Make sure the sear spring is properly seated in its recess in the bolt, and the bottom of the sear (fig 36).

(*c*) *Sear slide.* Press down on the sear and replace the sear slide in its guideways. The slide may be inserted from either side, unless the gun is to be fired by the sideplate trigger. In that case. the square end must be to the left (fig 35).

(*d*) *Sear pin and stop.* Replace the sear stop and pin (accelerator stop and lock). Press down on the head of the pin (base of the accelerator stop) to force it in place (fig 41); swing the sear stop into its groove in the bolt.

(*e*) *Cocking lever and pin.* Replace the cocking lever. the rounded nose down and to the rear; the top of the cocking lever to the rear. Replace the cocking lever pin from the left side of the bolt. To test for correct assembly, cock the firing pin by rotating the top of the cocking lever toward the front of the bolt; then rotate it to the rear and depress the sear. This should release the firing pin.

(*f*) *Bolt switch stud and bolt switch.* Replace the bolt switch stud with the small end up. Place the bolt switch over the bolt switch stud, so that the groove marked "L" is continuous from the left-hand feed (fig 42). (The wider portion of the bolt switch will be to the front.)

(*g*) *Extractor.* With the extractor arm vertical, replace the extractor stud in the extractor pivot hole of the bolt. Rotate the extractor forward; insure that the collar is engaged in its slot in the bolt (fig 43).

b. Barrel Buffer Body Group (Fig 44).

(1) *Disassembly.*

(*a*) *Barrel buffer tube lock assembly.* Turn the barrel buffer body group upside down. Pry up on the barrel buffer tube lock latch, to disengage the latch before moving the lock body to the rear. Pry up the latch end of the assembly, so that the lug will clear the barrel buffer body. At the same time, press down on the front of the lock body to keep it from springing out. Turn the accelerator back to push the barrel buffer tube lock assembly out of its slot (fig 45 and 46).

(*b*) *Barrel buffer body spring lock.* In most cases, the barrel buffer body spring lock is staked and will not be removed.

(*c*) *Accelerator pin and accelerator.* Drift the accelerator pin out and remove the accelerator. This completes detailed disassembly of the barrel buffer body group.

(2) *Assembly.*

(*a*) *Accelerator and accelerator pin.* Replace the accelerator with the tips up and the claws to the rear. Replace the accelerator pin so that the ends are flush with the sides of the barrel buffer body group.

(*b*) *Barrel buffer tube lock assembly.* Turn the barrel buffer body upside down. Hold the assembly against the barrel buffer body, lug down. With the thumb of one hand, press the forward winged part into the circular opening in the slot. With the other hand, raise the rear of the assembly enough to lift the lug over the buffer body. Push the assembly forward until the rear winged part (barrel buffer tube lock latch) snaps into the circular opening in the slot (fig 47). This completes assembly of the barrel buffer body group.

c. Barrel Extension Group.

(1) *Disassembly (fig 48 and 49).*

(*a*) *Breech lockpin and breech lock.* Drift the lockpin out and remove the breech lock from the bottom of the barrel extension group. The top of the breech lock may have a wide, single-beveled edge, or a double-beveled edge. In earlier models, the top may be flat (fig 50); the newer models

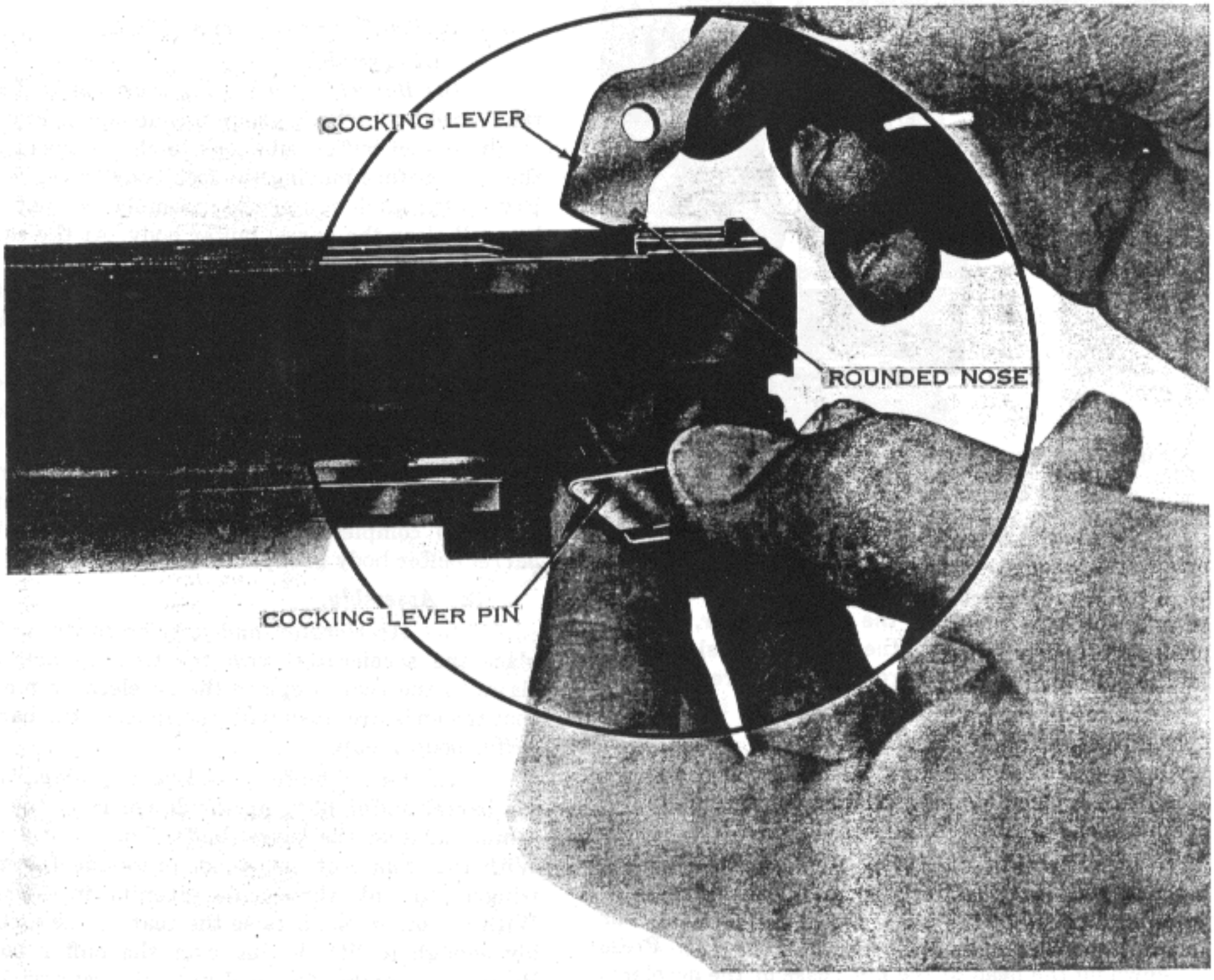


Figure 28. Removing the cocking lever and cocking lever pin.

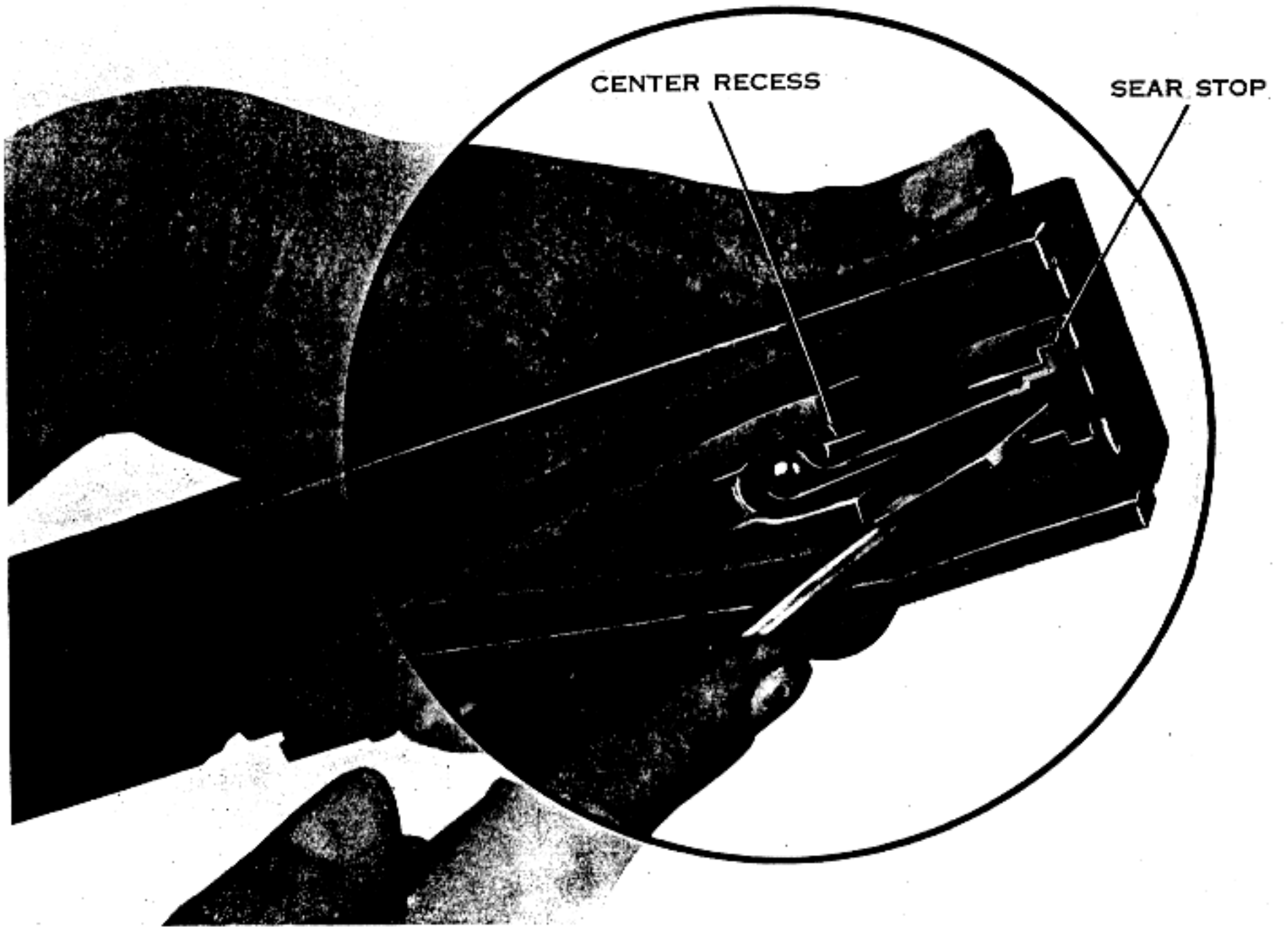


Figure 29. Prying the sear stop into its center recess.

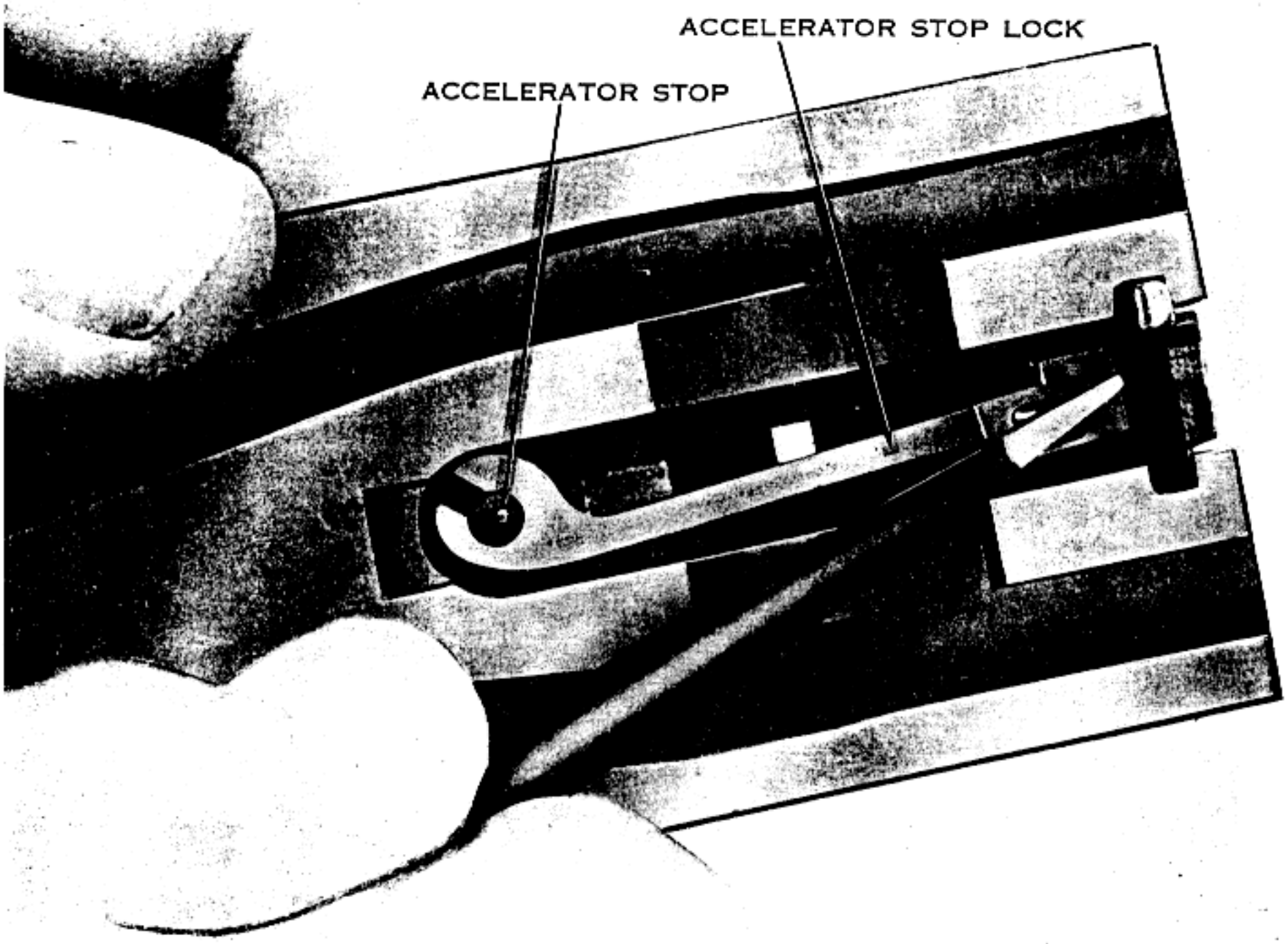


Figure 30. Prying the accelerator stop lock into the center recess.

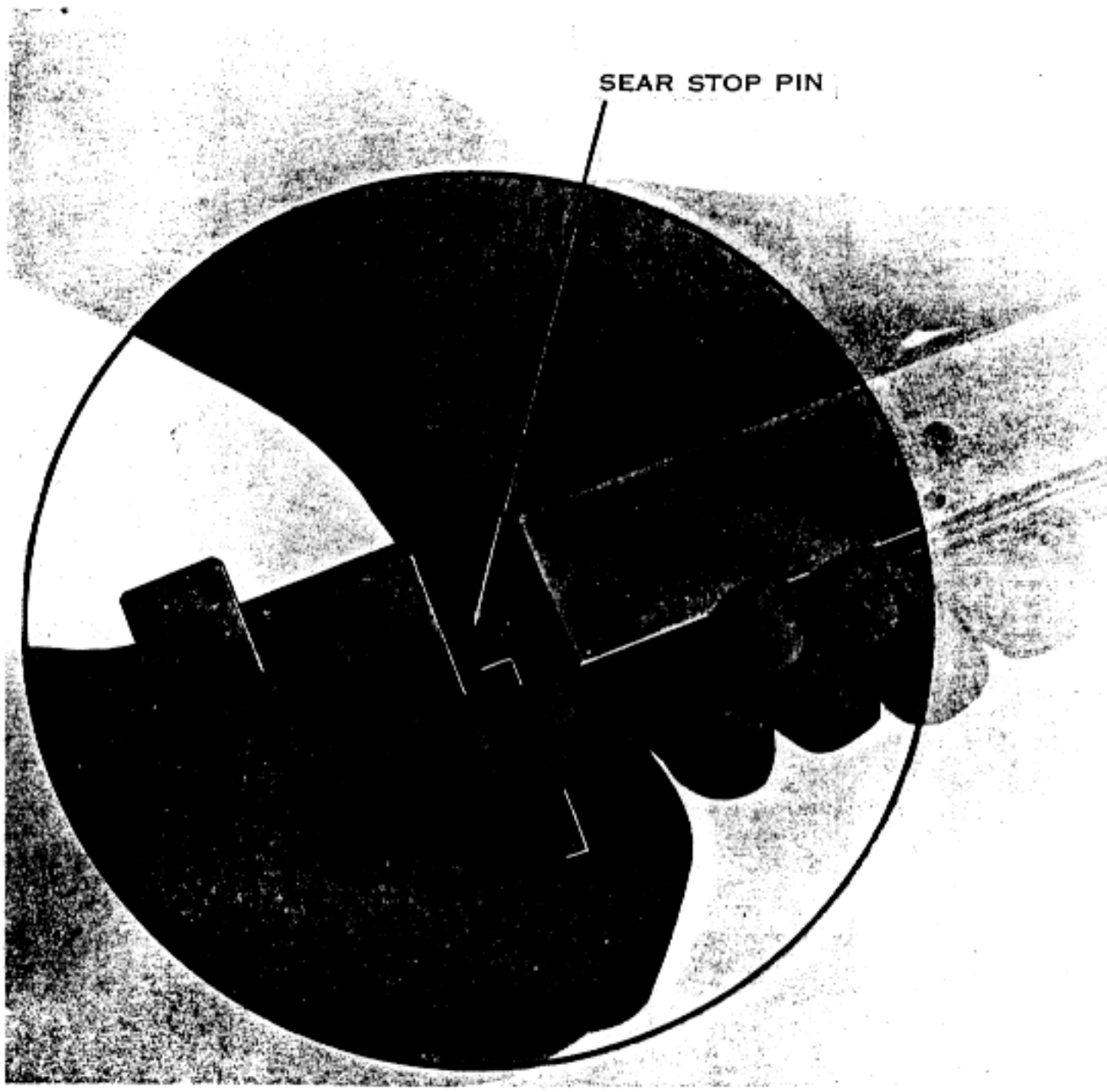


Figure 31. Drifting the sear stop pin free from engagement with the firing pin spring.

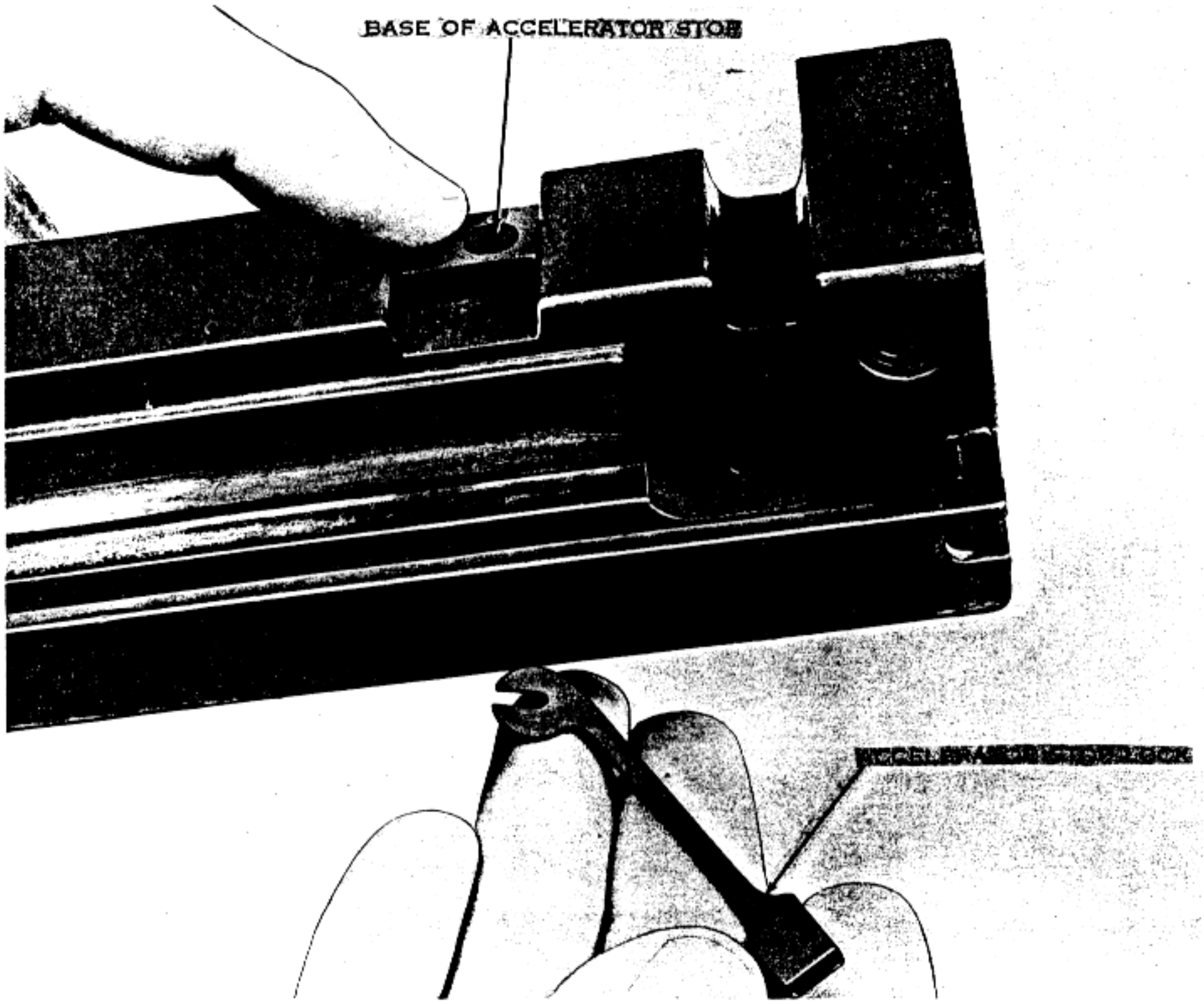


Figure 32. Removing the accelerator stop lock.

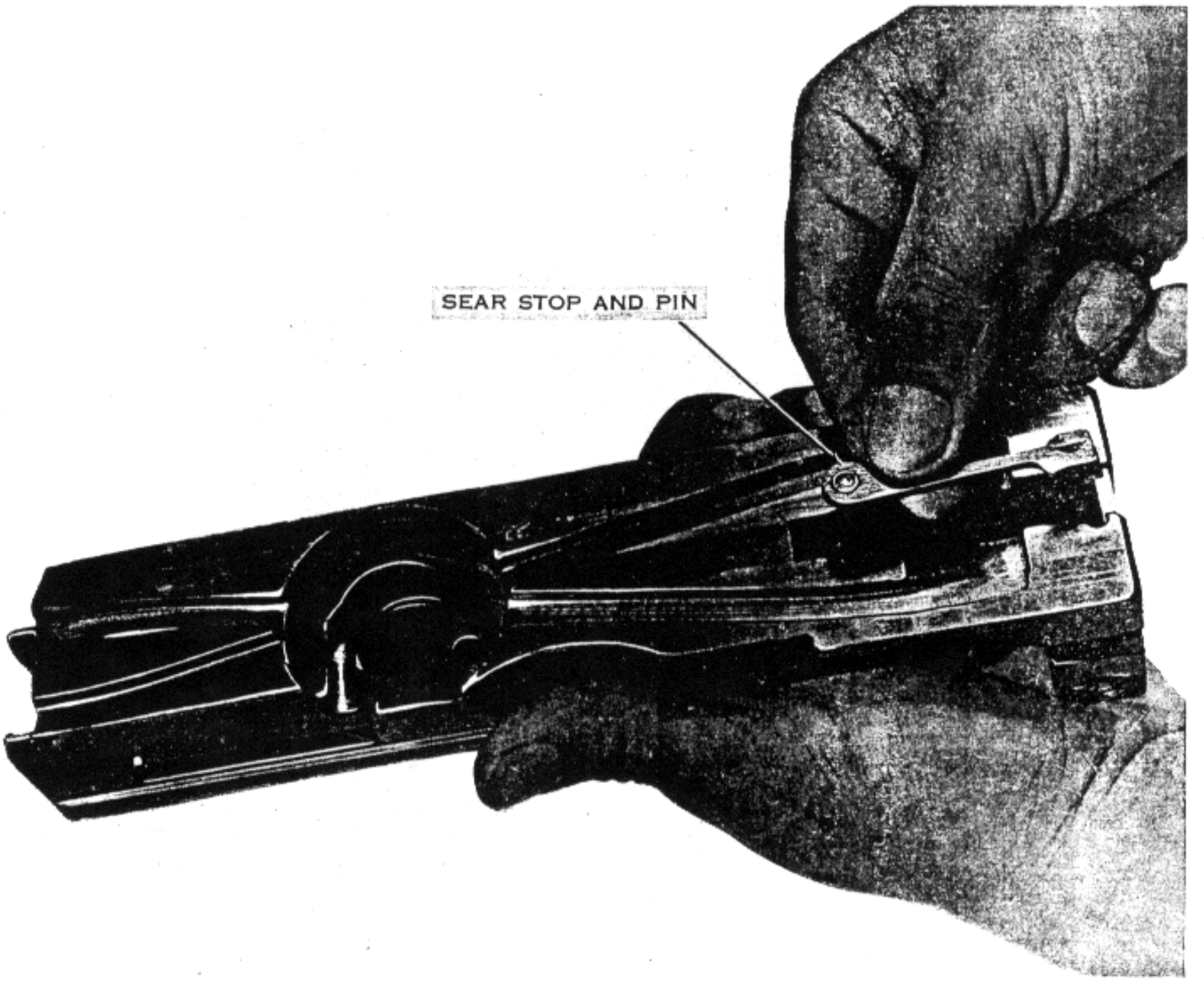


Figure 33. Removing sear stop and pin.

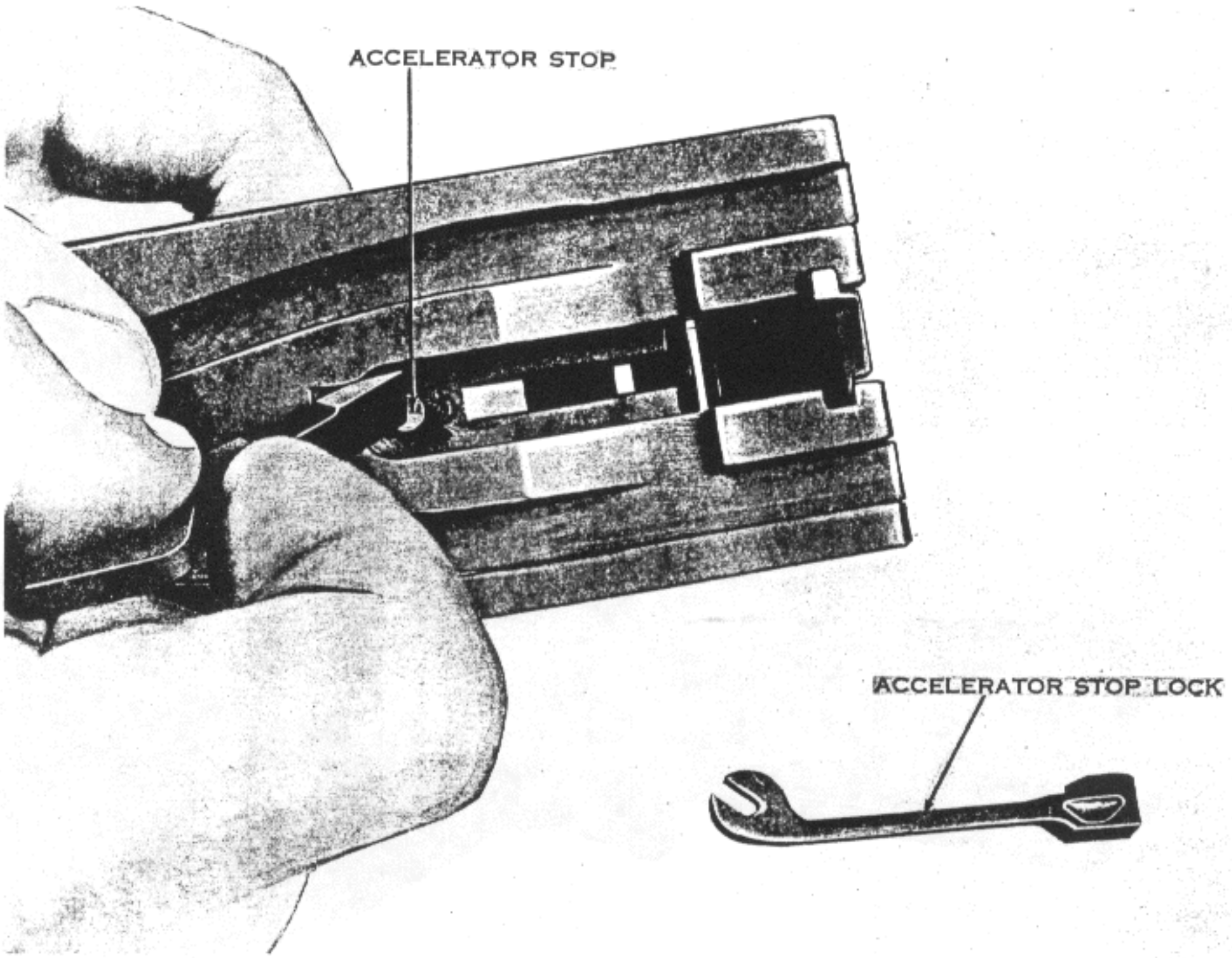


Figure 34. Removing the accelerator stop.

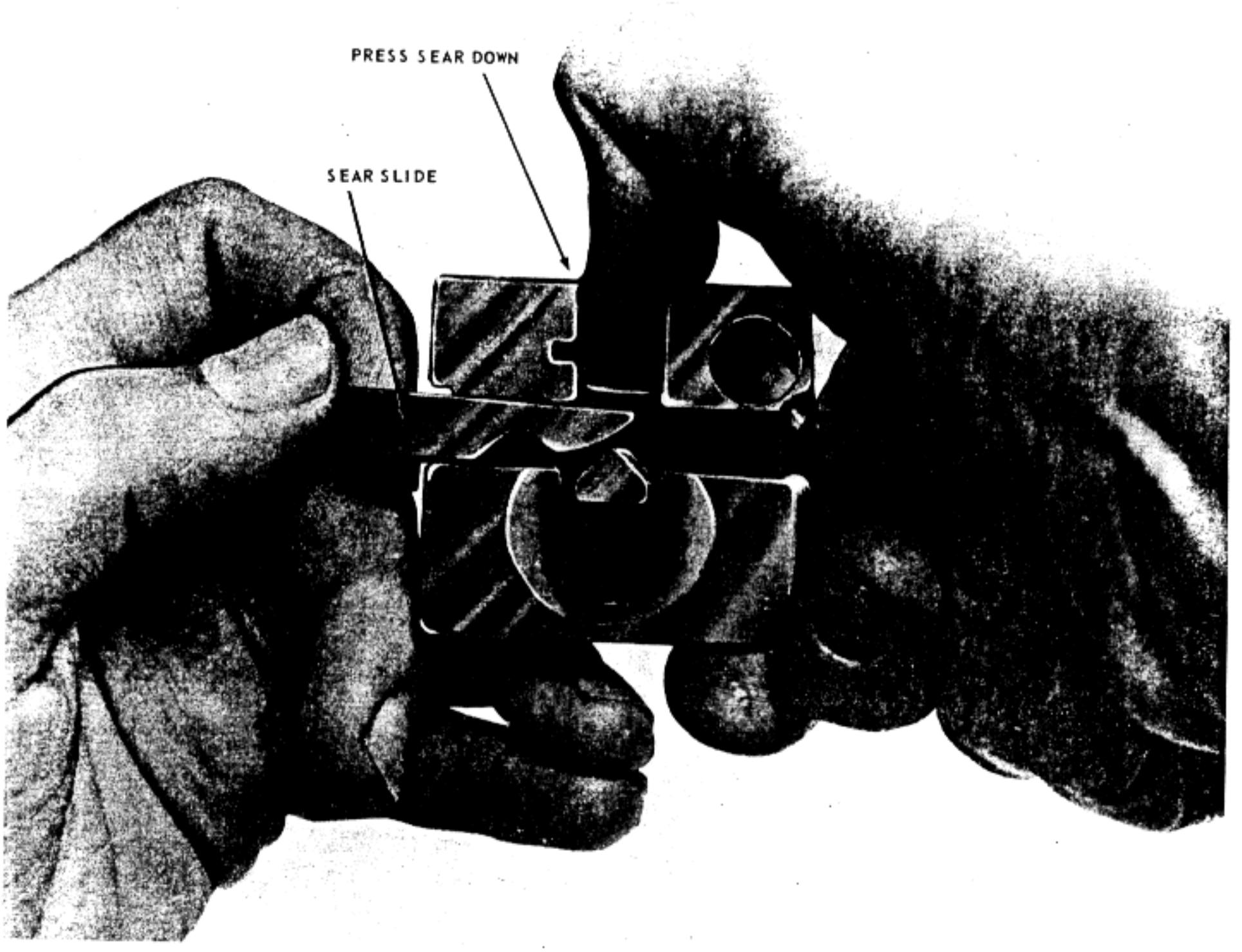


Figure 35. Removing and replacing the sear slide.

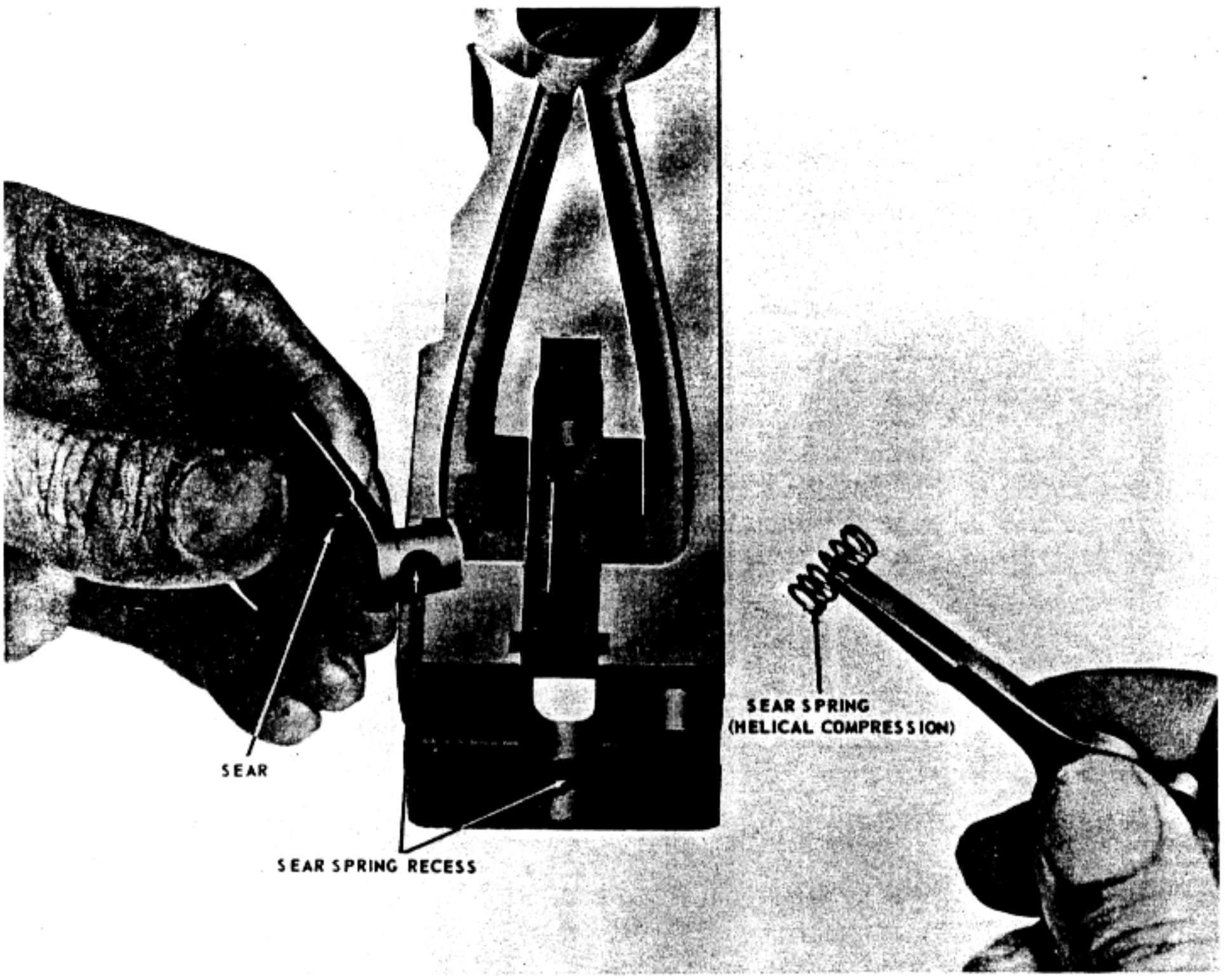


Figure 36. Removing and replacing the sear and sear spring.

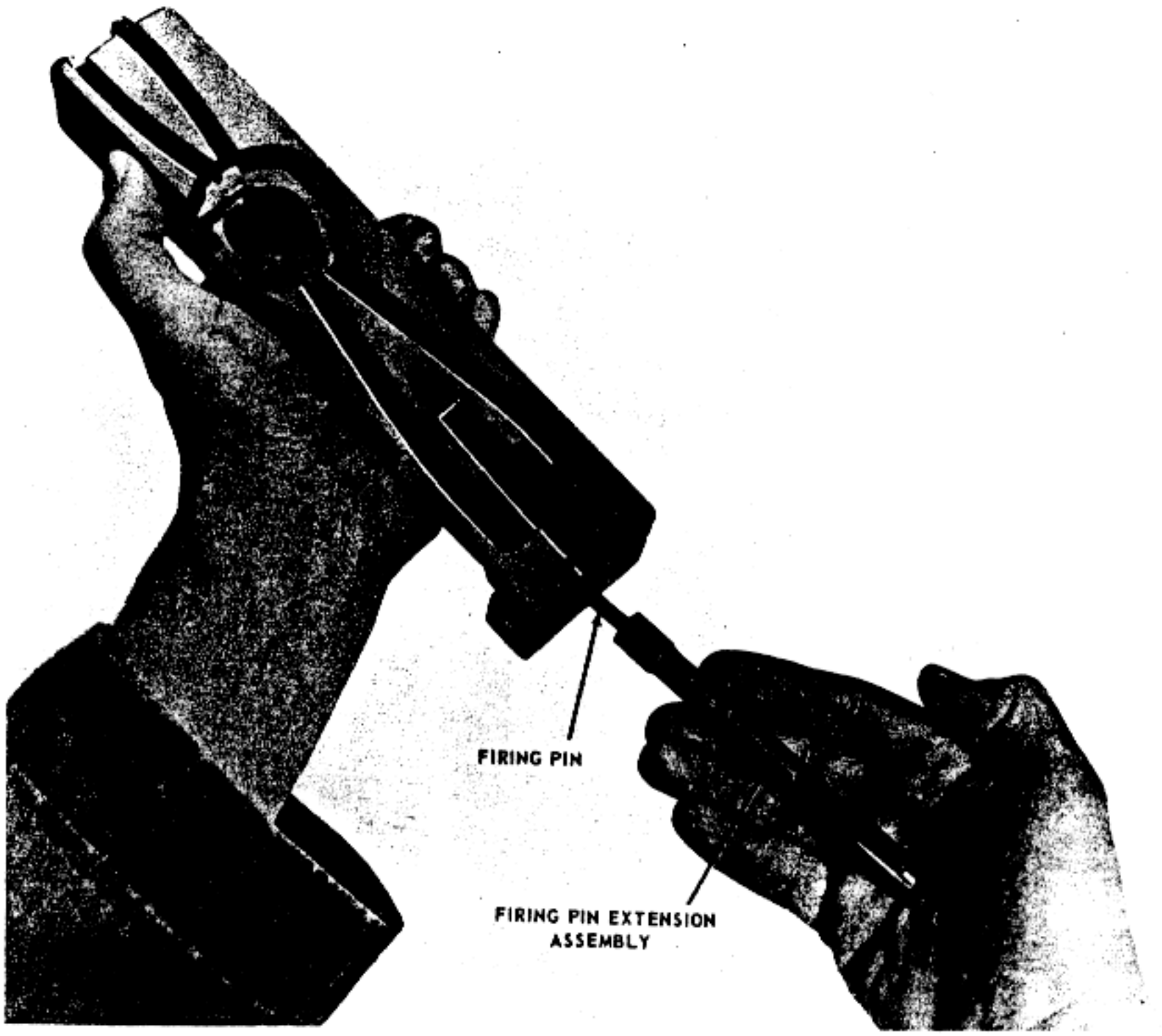


Figure 37. Removing the firing pin extension assembly and firing pin.

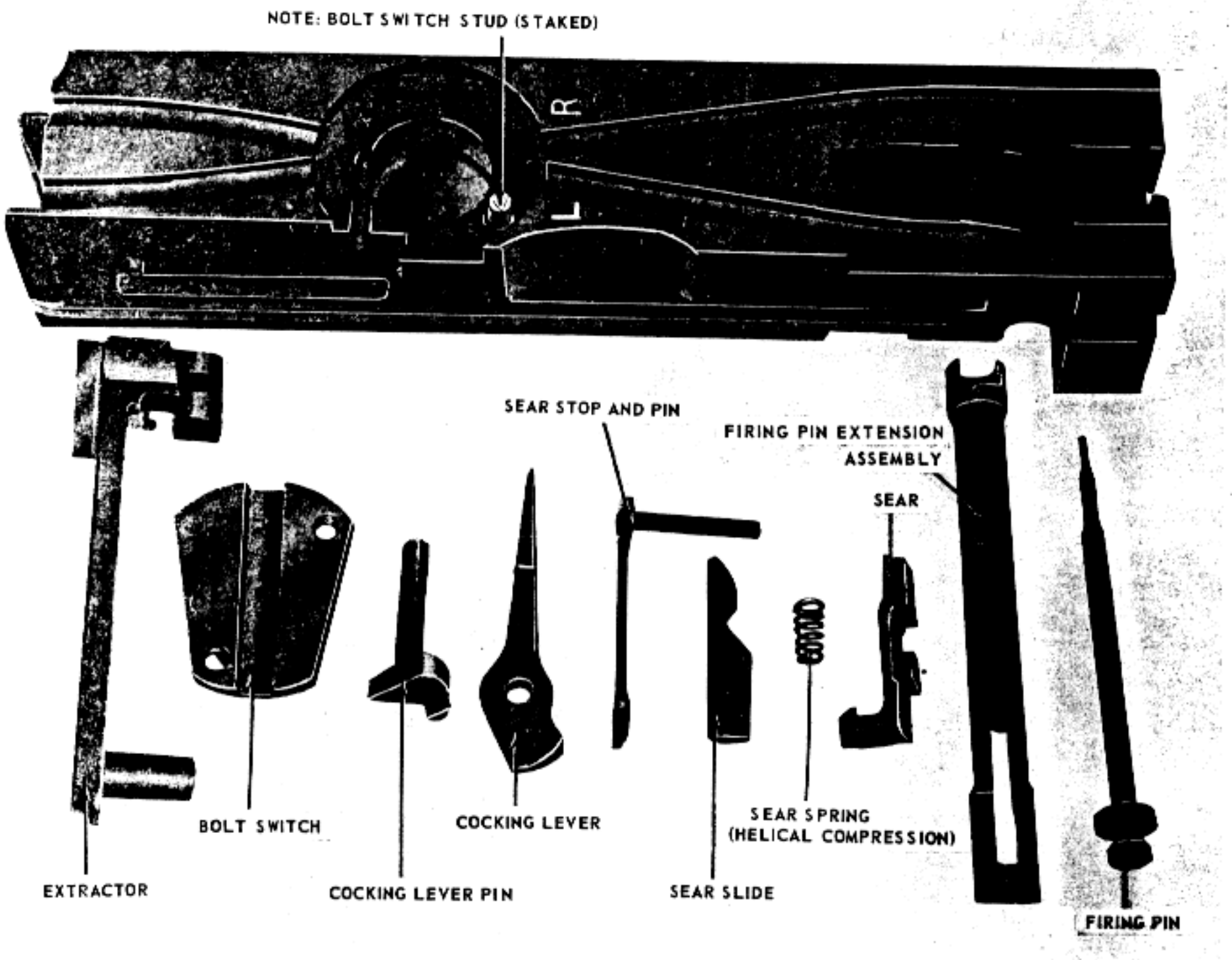


Figure 38. Bolt disassembled (sear stop and pin).

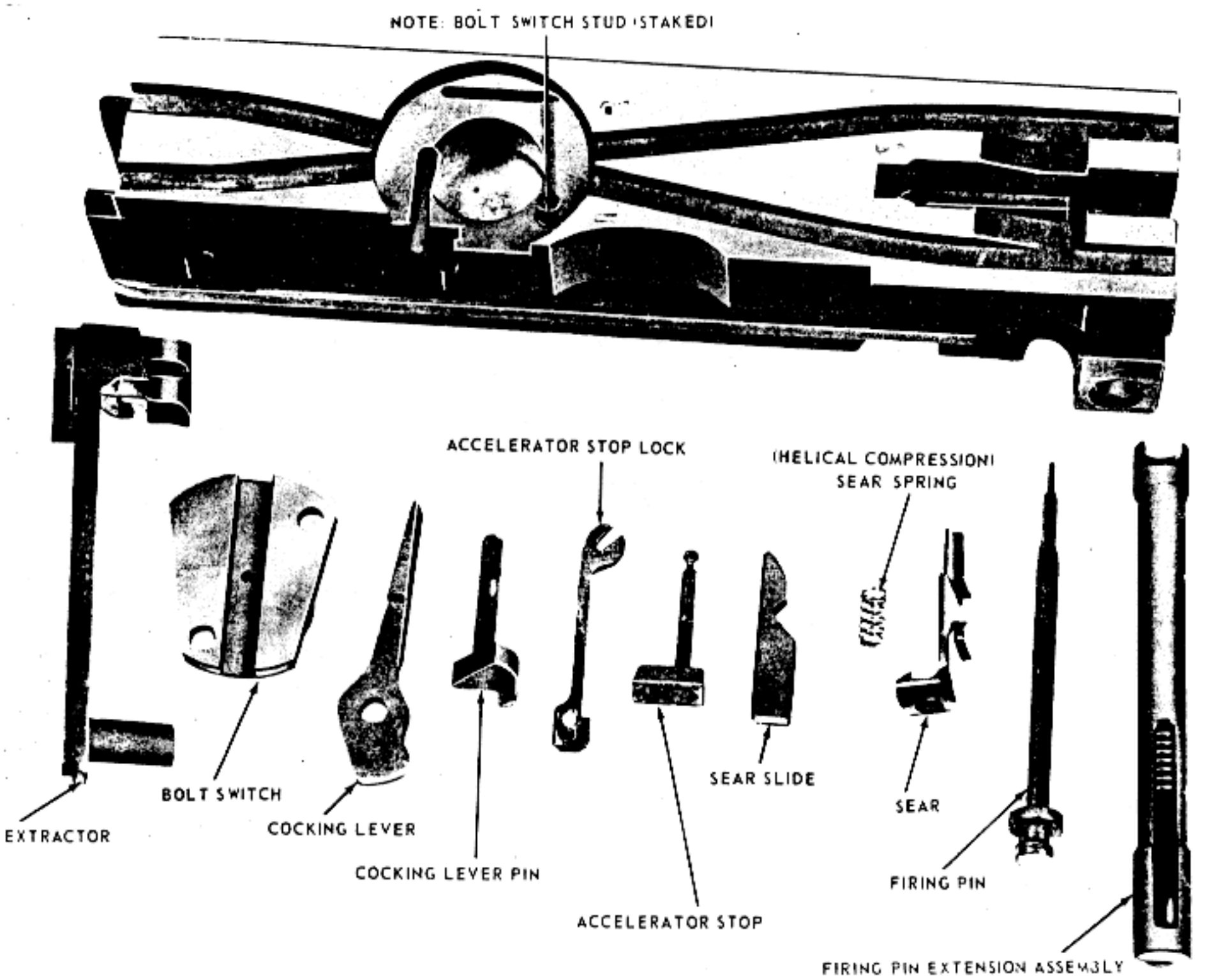


Figure 39. Bolt disassembled (accelerator stop and lock).

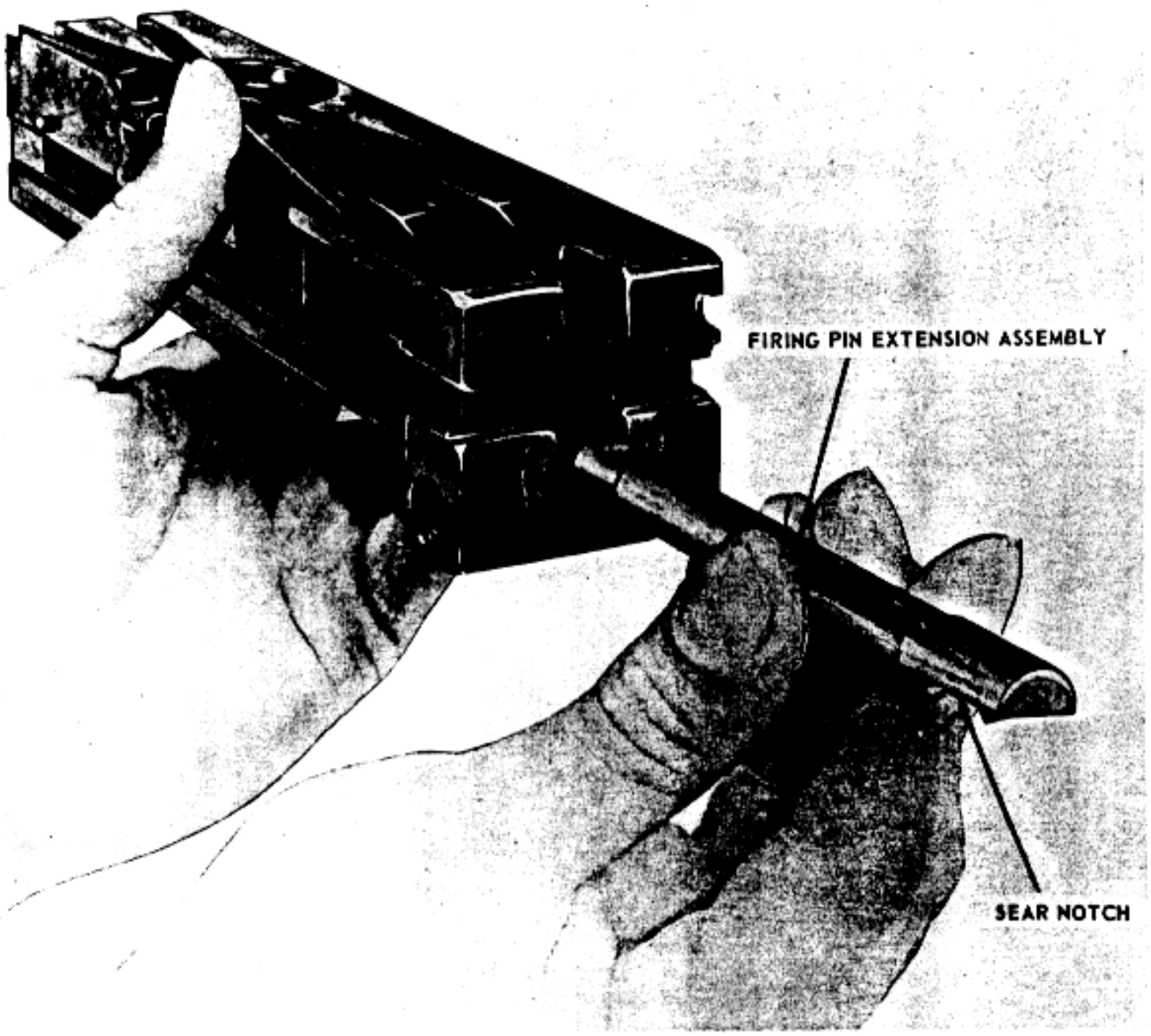


Figure 40. Replacing the firing pin and extension assembly.

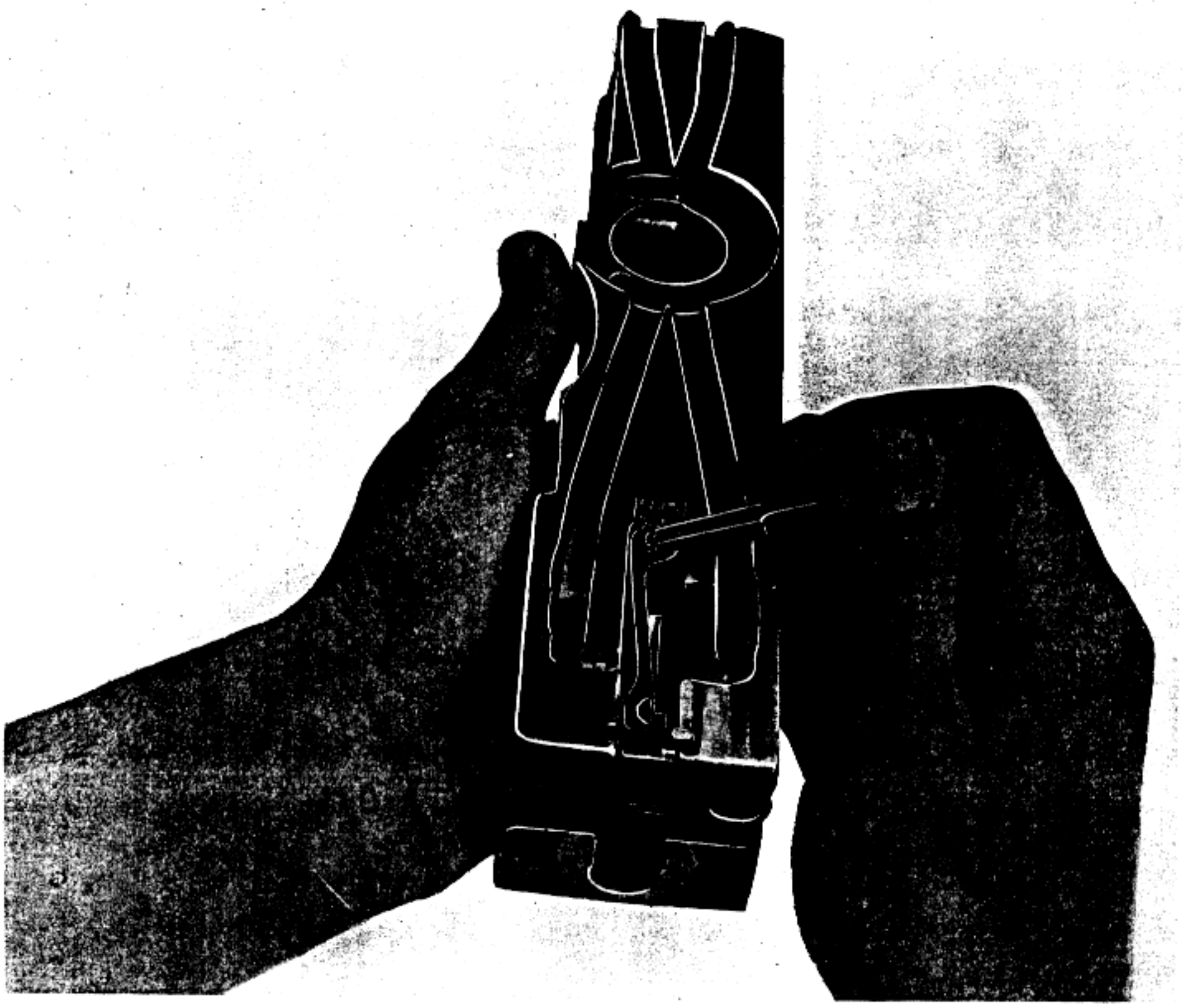


Figure 41. Replacing the sear stop and pin.

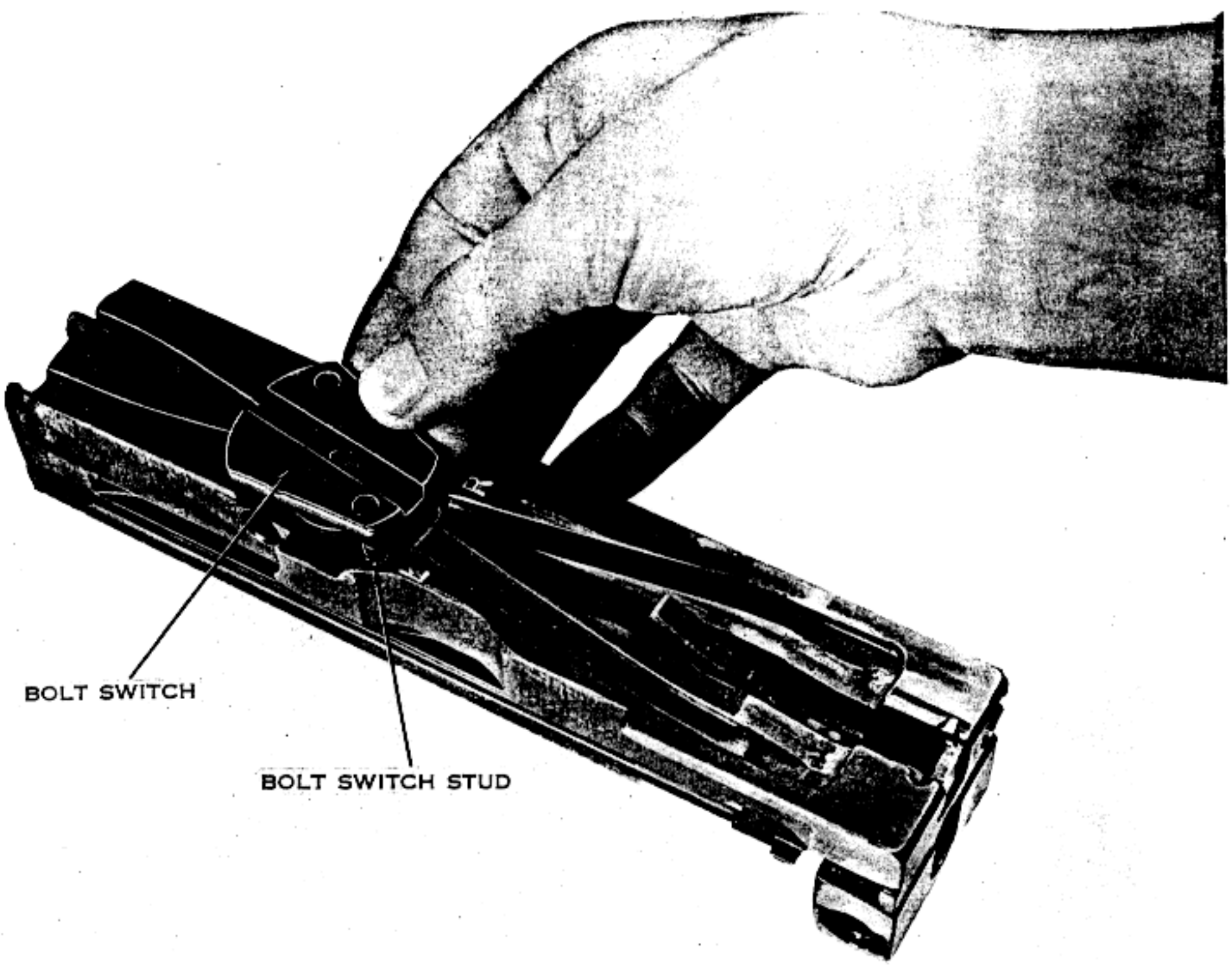


Figure 42. Replacing the bolt switch and stud.

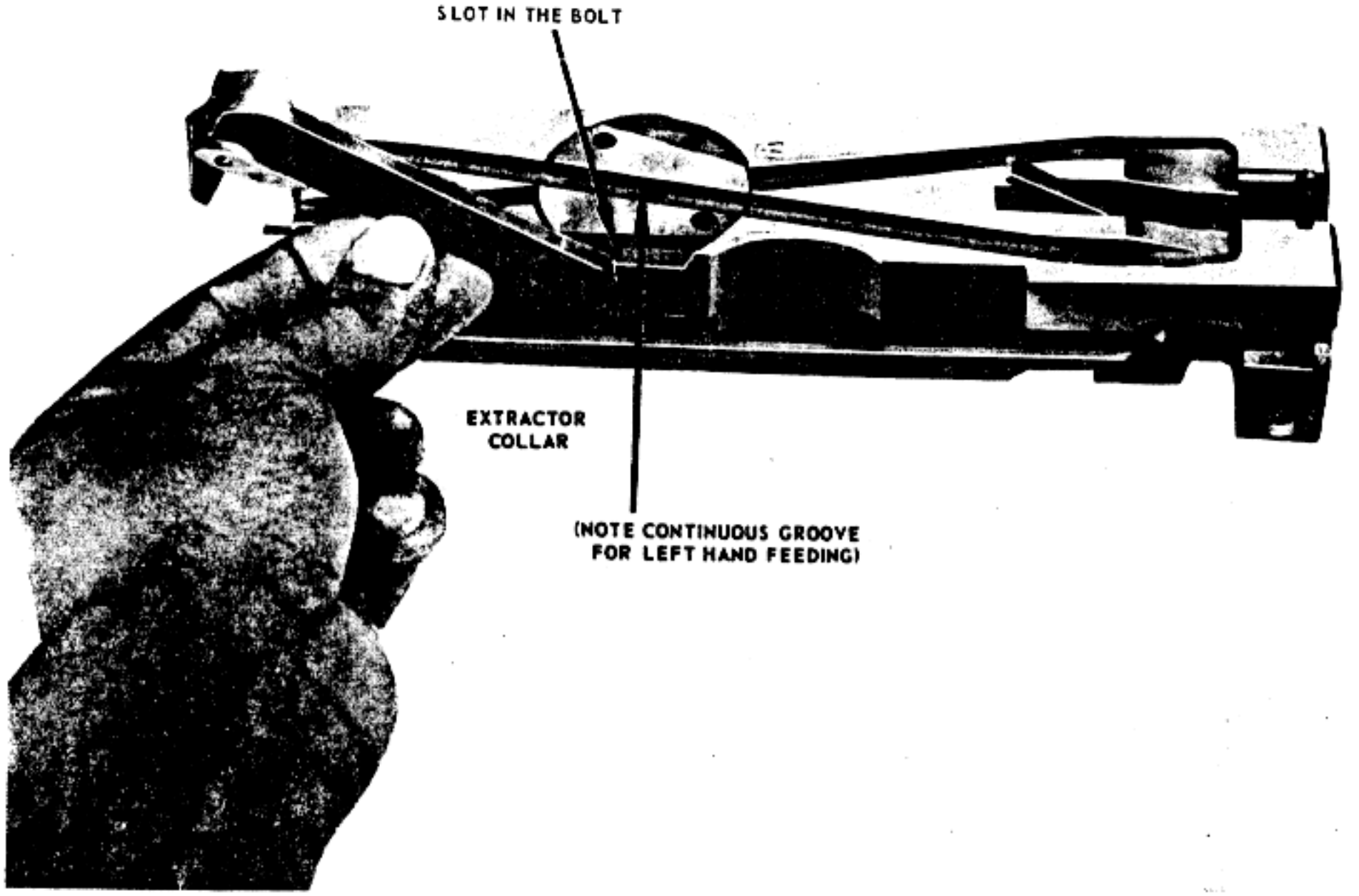


Figure 43. Extractor replaced in the bolt.

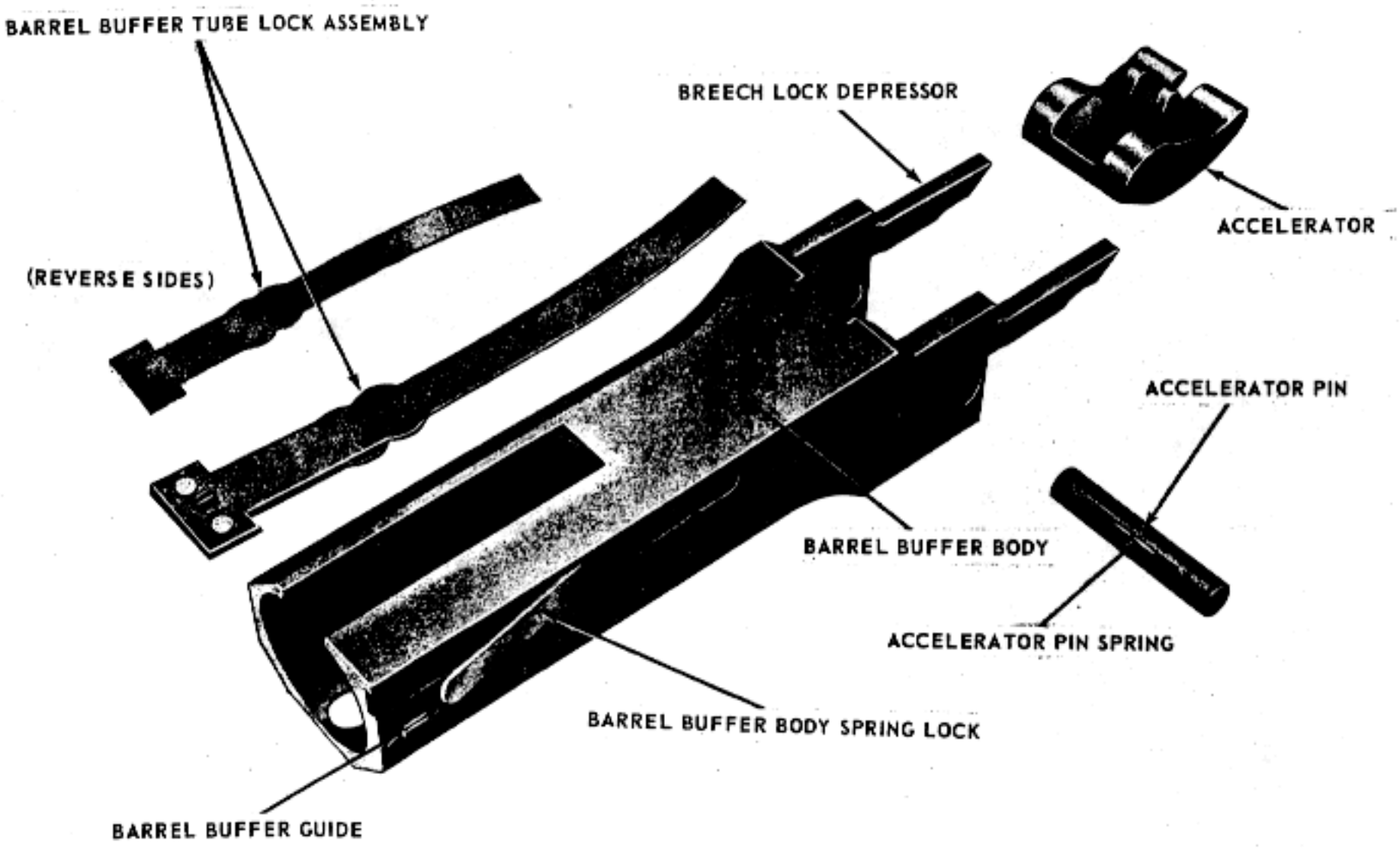


Figure 44. Barrel buffer body group, exploded view.

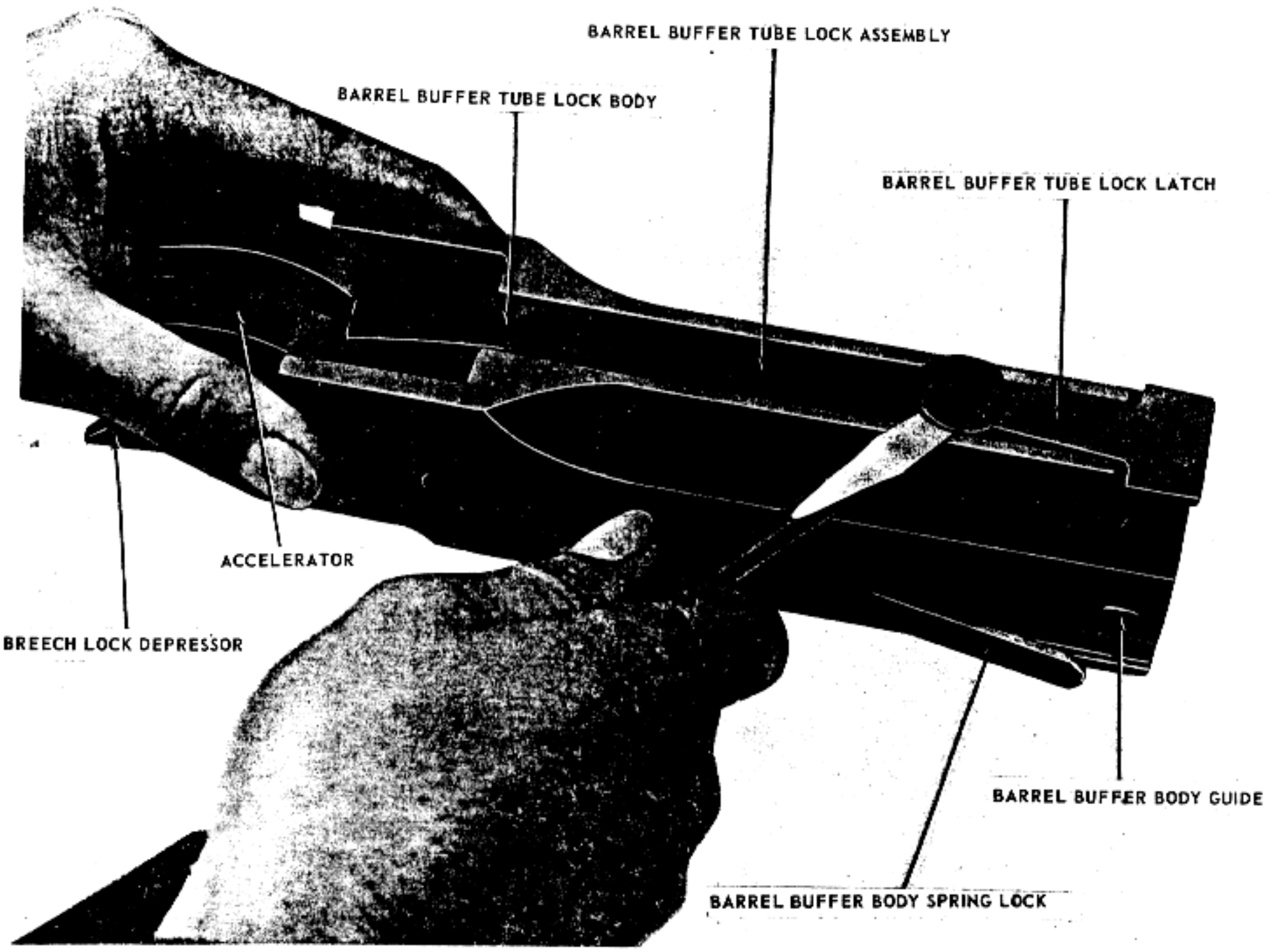


Figure 45. Disengaging the latch.

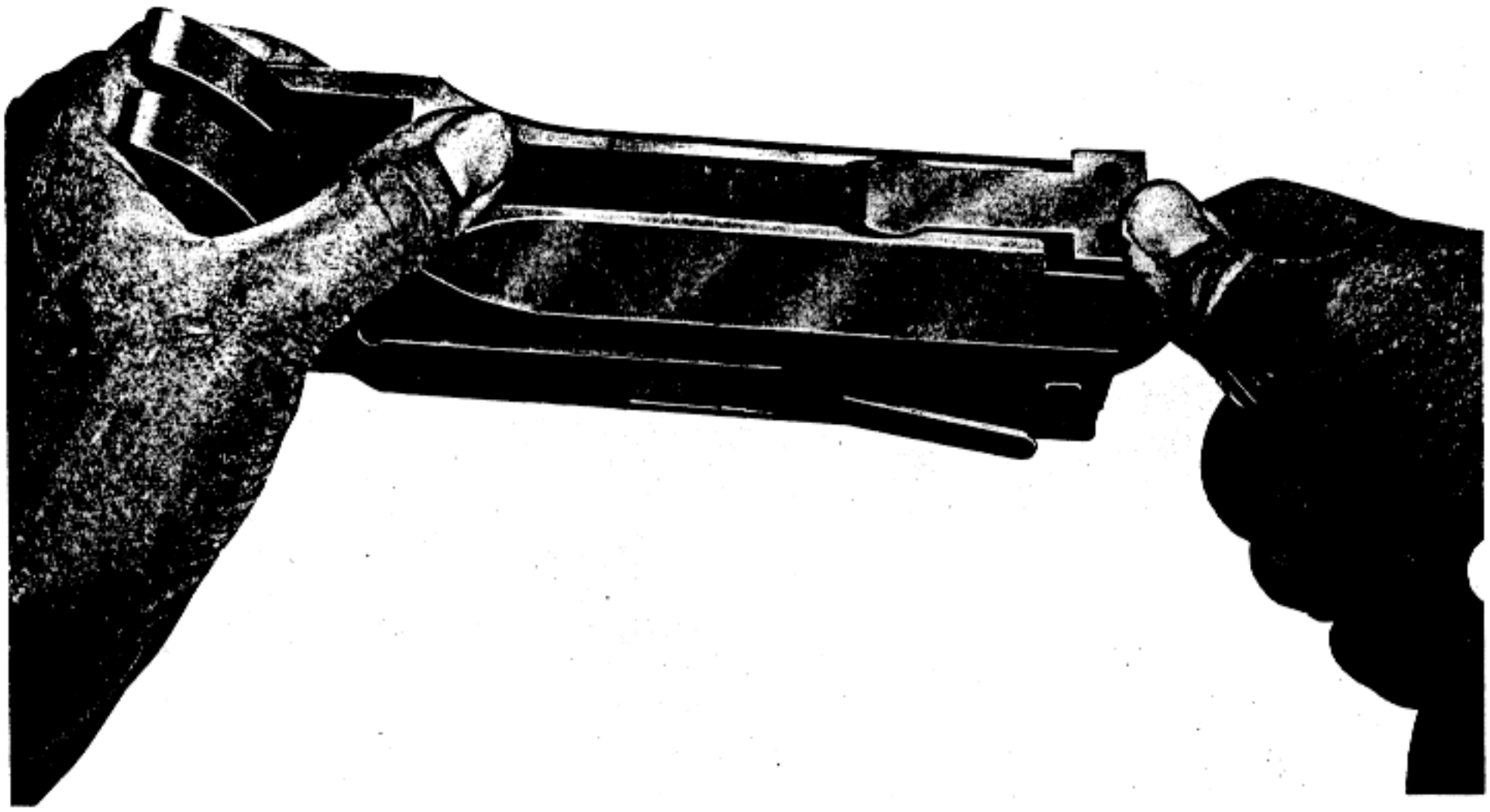


Figure 46. Removing the barrel buffer tube lock assembly.

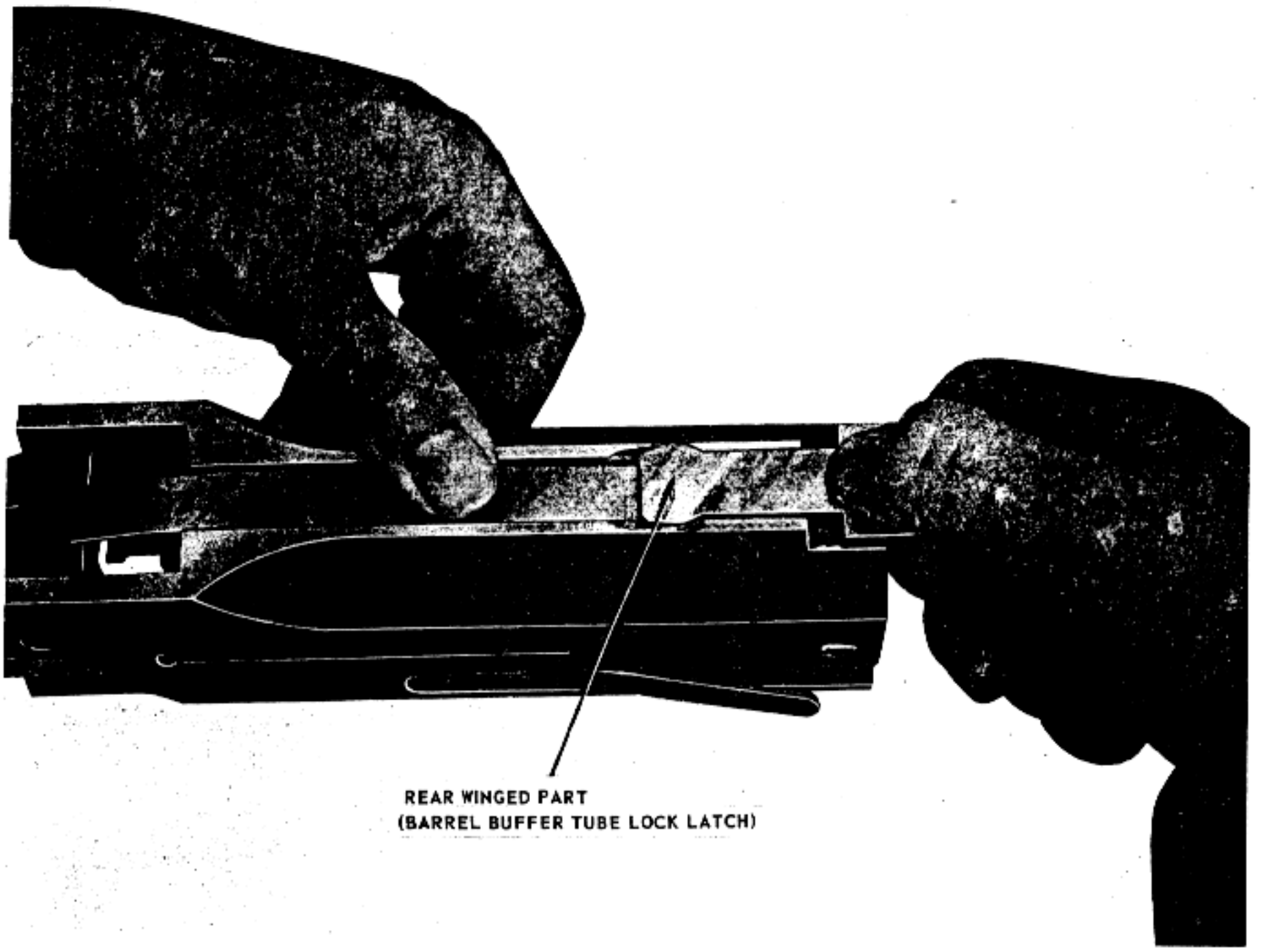


Figure 47. Replacing the barrel buffer tube lock assembly.

may have a large slot (fig 51). Guns currently manufactured have the breech lock with the slot on top, for use with the accelerator stop and lock. When the accelerator stop and lock replaces the sear stop and pin, the breech lock with slot will be used.

(*b*) *Barrel locking spring.* The barrel locking spring should already be staked to the barrel extension; it should not be removed. This completes detailed disassembly of the barrel extension group.

(2) *Assembly of breech lock and breech lockpin.* Replace the breech lock from the bottom of the barrel extension. Make sure that the wide, single-beveled edge (double-beveled edge) is up and to the front. In any case, the breech lock will be correctly positioned in its slot when the beveled edge is up and to the front, and the hole for the breech lockpin is toward the bottom of the barrel extension. Replace the breech lockpin so that the ends of the pin are flush with the sides of the barrel extension. This completes assembly of the barrel extension group.

d. Cover Group.

(1) *Disassembly (fig 52).*

(*a*) *Cover pin.* With the cover closed, remove the cotter pin and drift the cover pin out of the receiver. Unlatch the cover and rotate it up and forward to remove the cover from the trunnion block (fig 53). Place the cover group (top down) on a flat, sturdy surface, with the latch end to the front and the hinged end toward you.

(*b*) *Belt feed lever and lockpin.* Remove the belt feed lever pin (cotter pin). Push the belt feed lever to the right, until the toe end of the belt feed lever (engaging the slide) is in line with the slot in the cover. Lift the belt feed lever off its pivot stud. Insure the shoulder headless pin and spring do not fly out (fig 54).

(*c*) *Shoulder headless pin and spring.* Remove these from their seat in the side of the belt feed lever (fig 55).

(*d*) *Belt feed slide.* Remove the belt feed slide from either side (fig 56).

1. Drift the belt feed pawl pin out, maintaining pressure on the belt feed pawl to prevent the spring from flying out (fig 57).

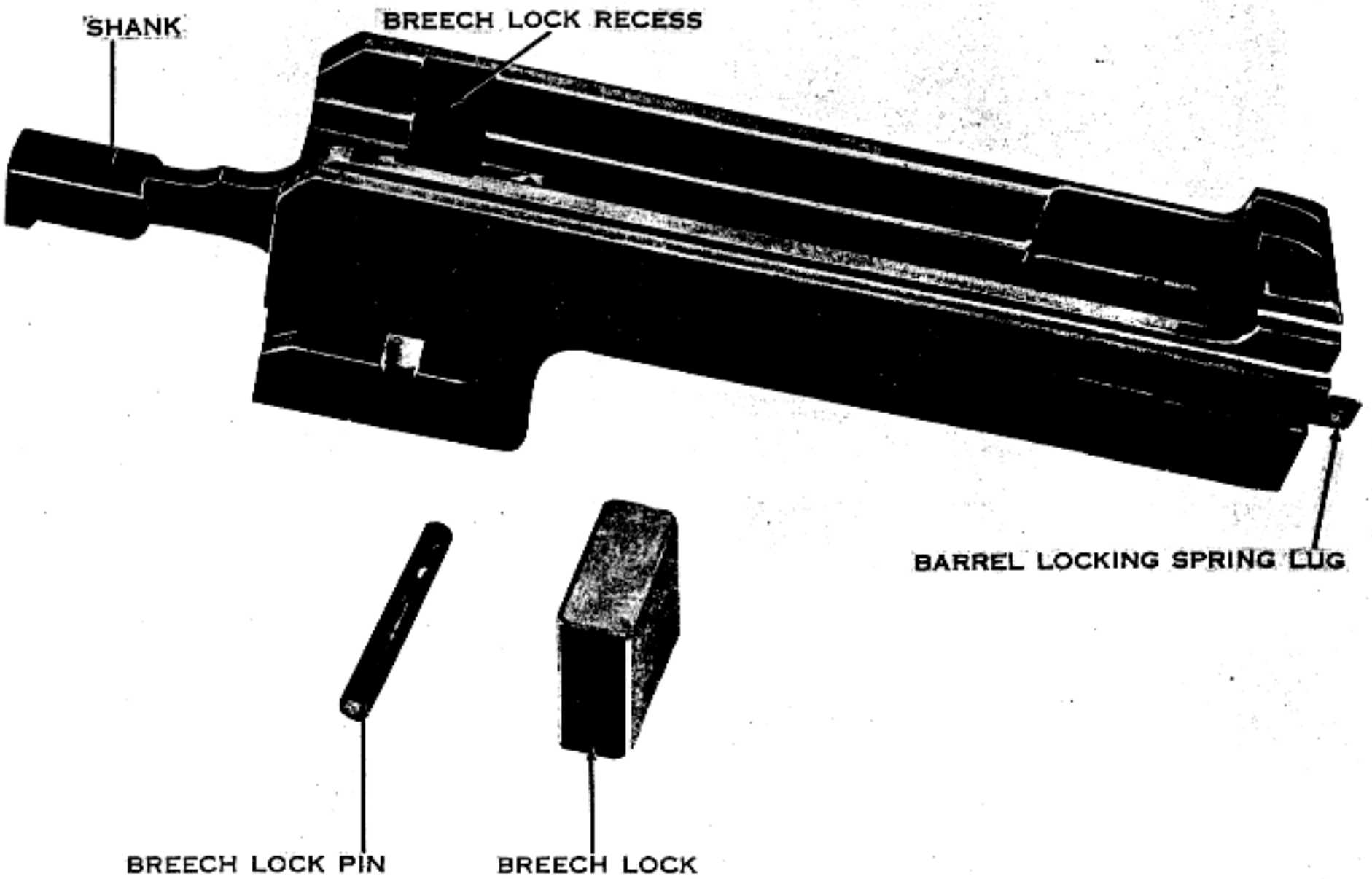


Figure 48. Barrel extension group with old type breech lock.

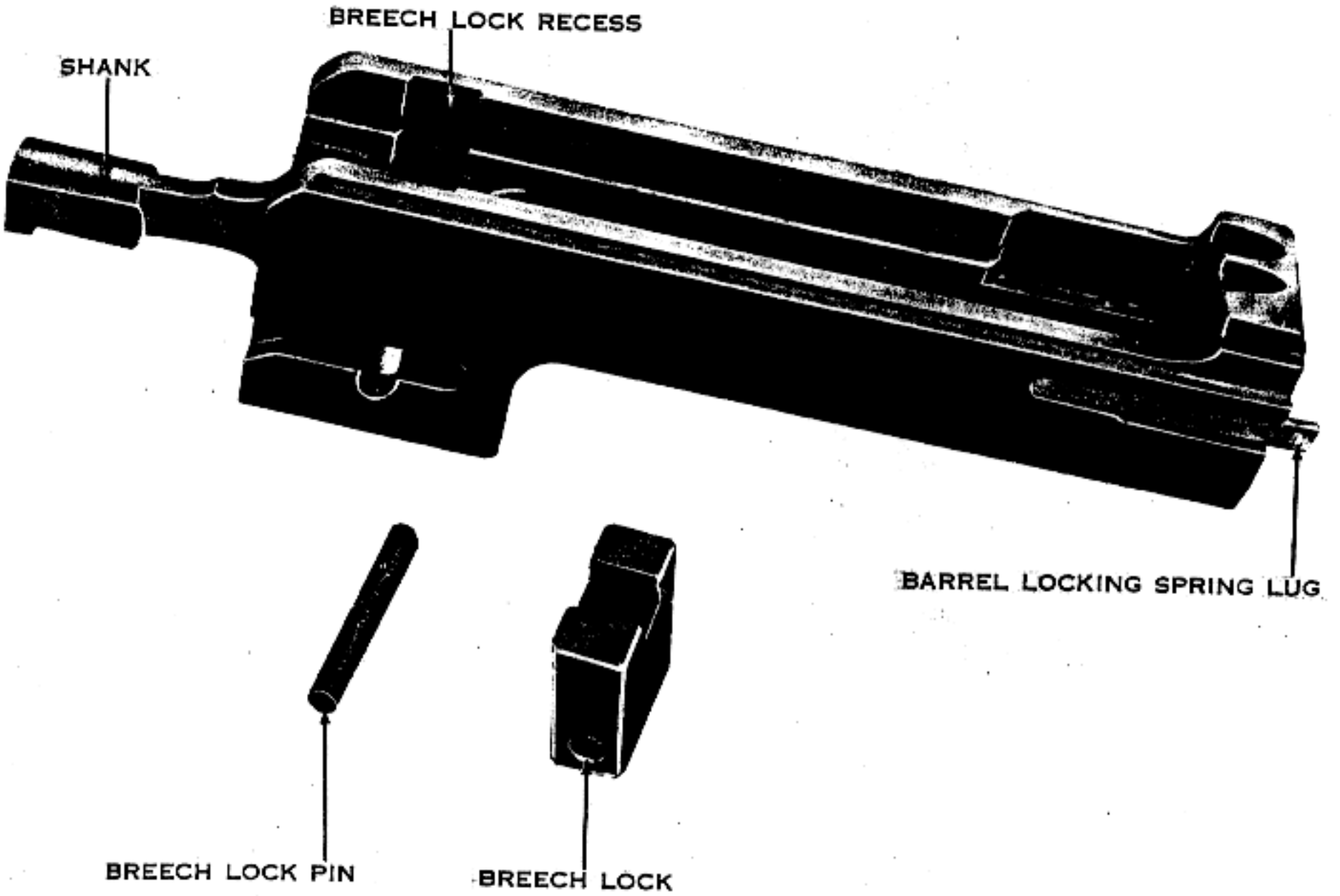


Figure 49. Barrel extension group with new type breech lock.

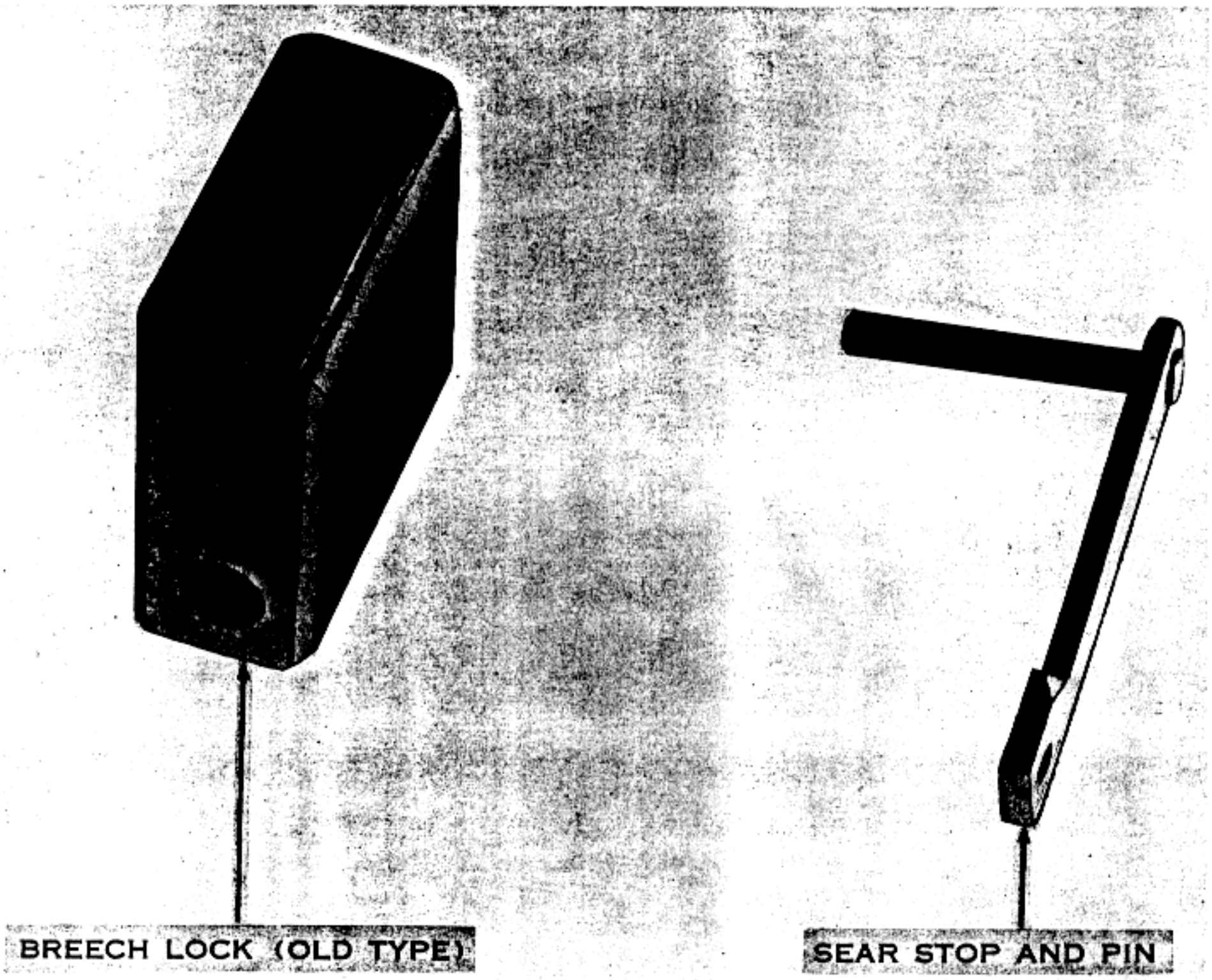


Figure 50. Breech lock (old type) to be used with the sear stop and pin.

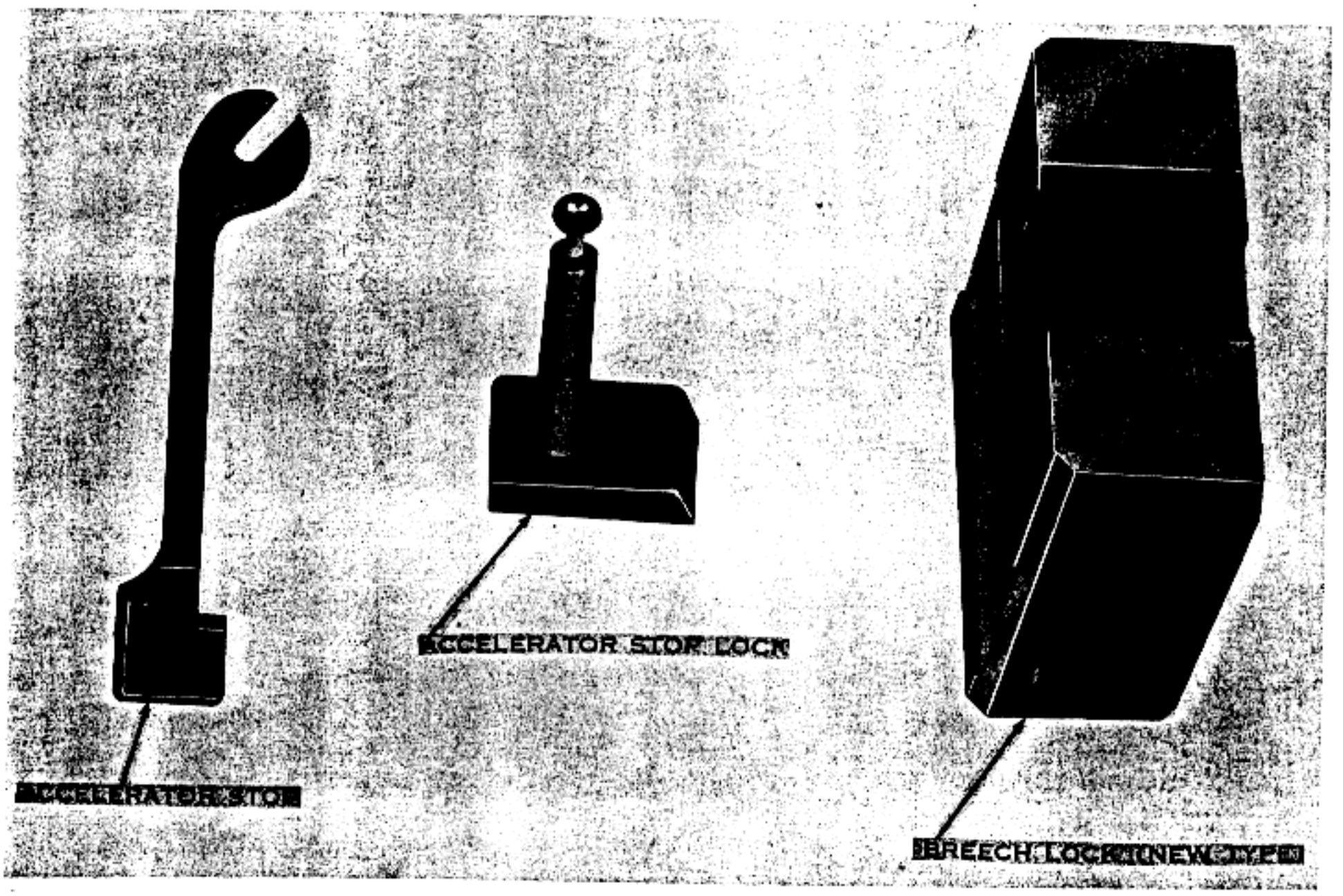


Figure 51. Breech lock (new type) to be used with the accelerator stop and lock.

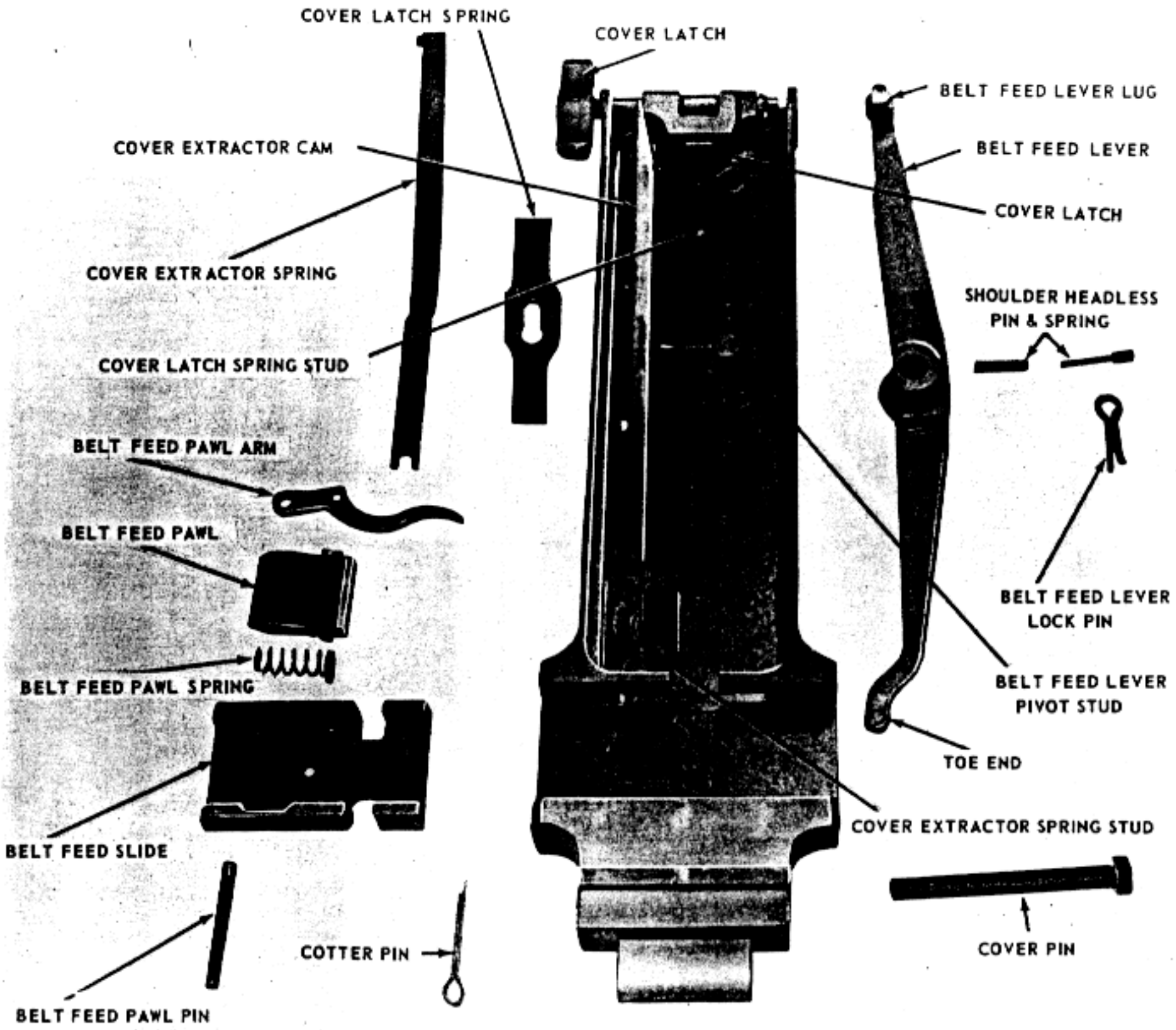


Figure 52. Cover group.

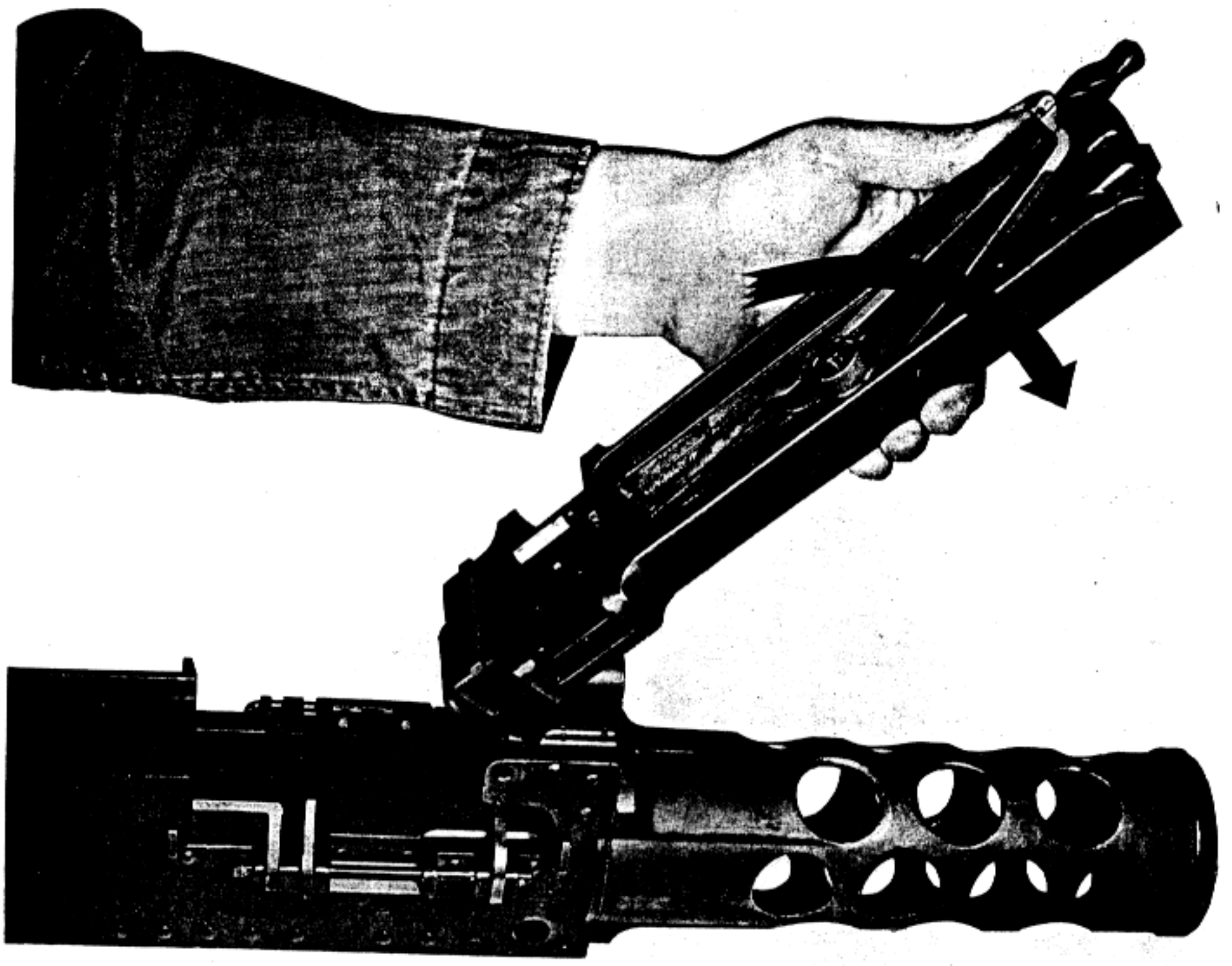


Figure 53. Removing the cover group.

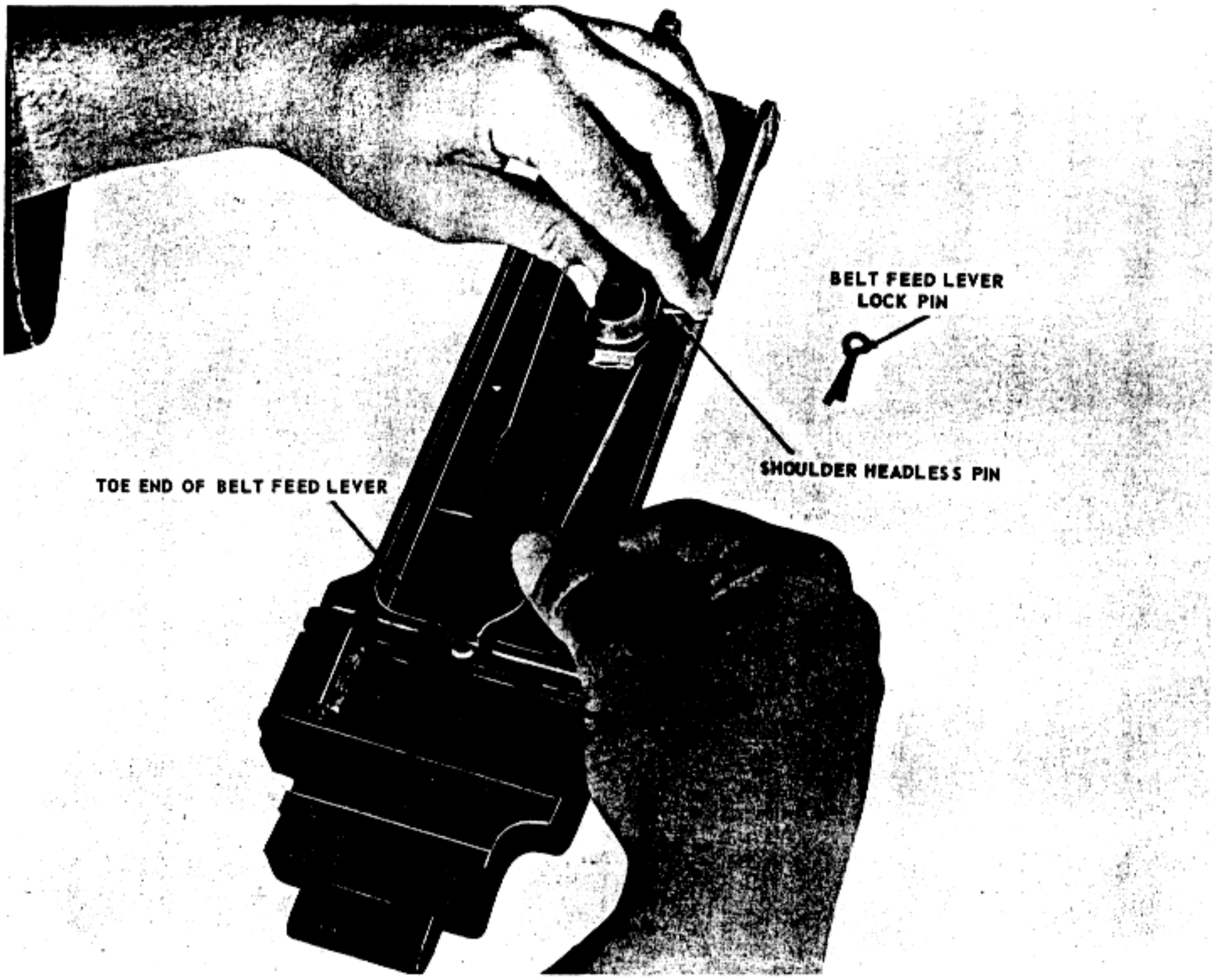


Figure 54. Removing the belt feed lever.

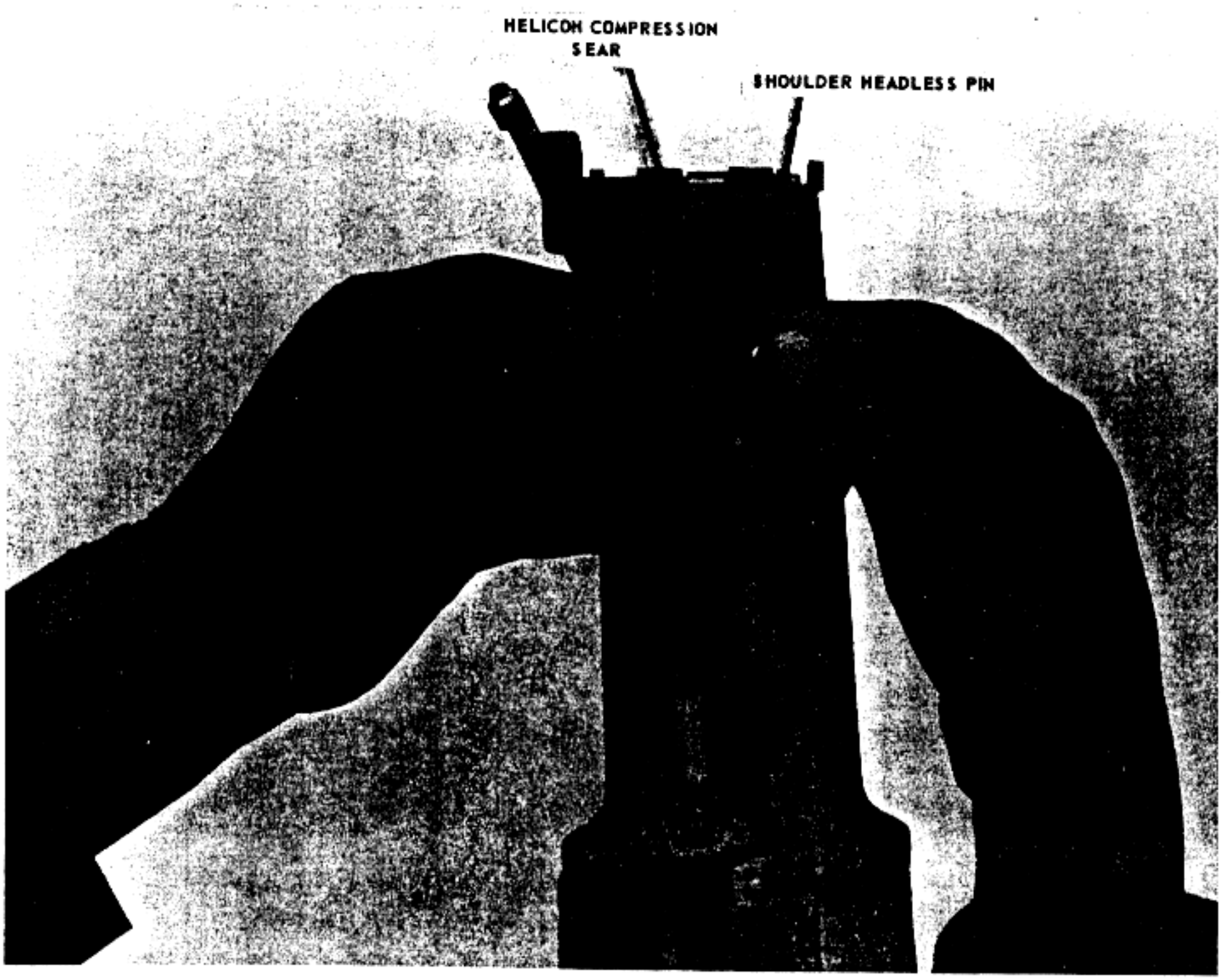


Figure 55. Removing the shoulder headless pin and spring.

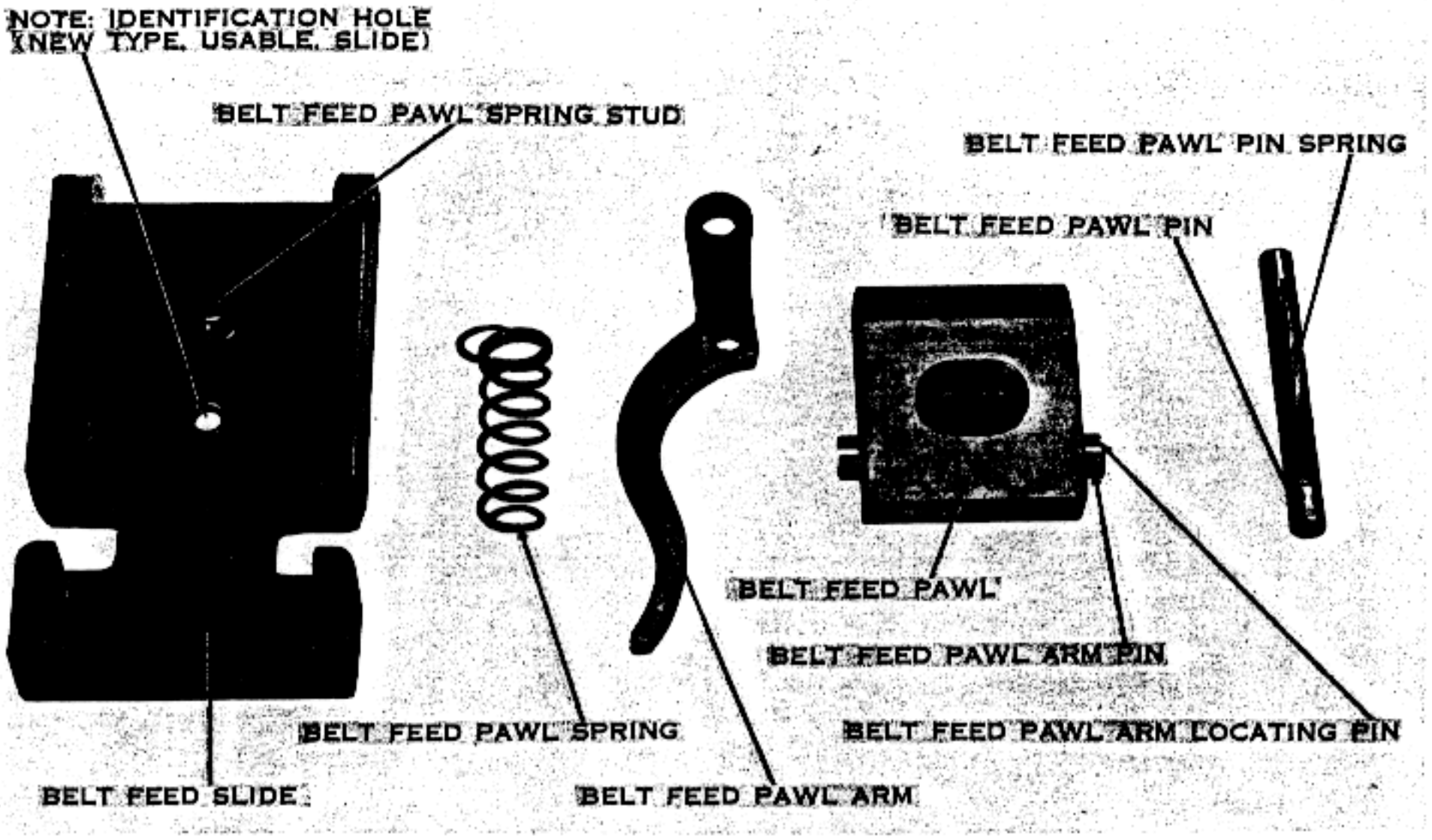


Figure 56. Belt feed slide.

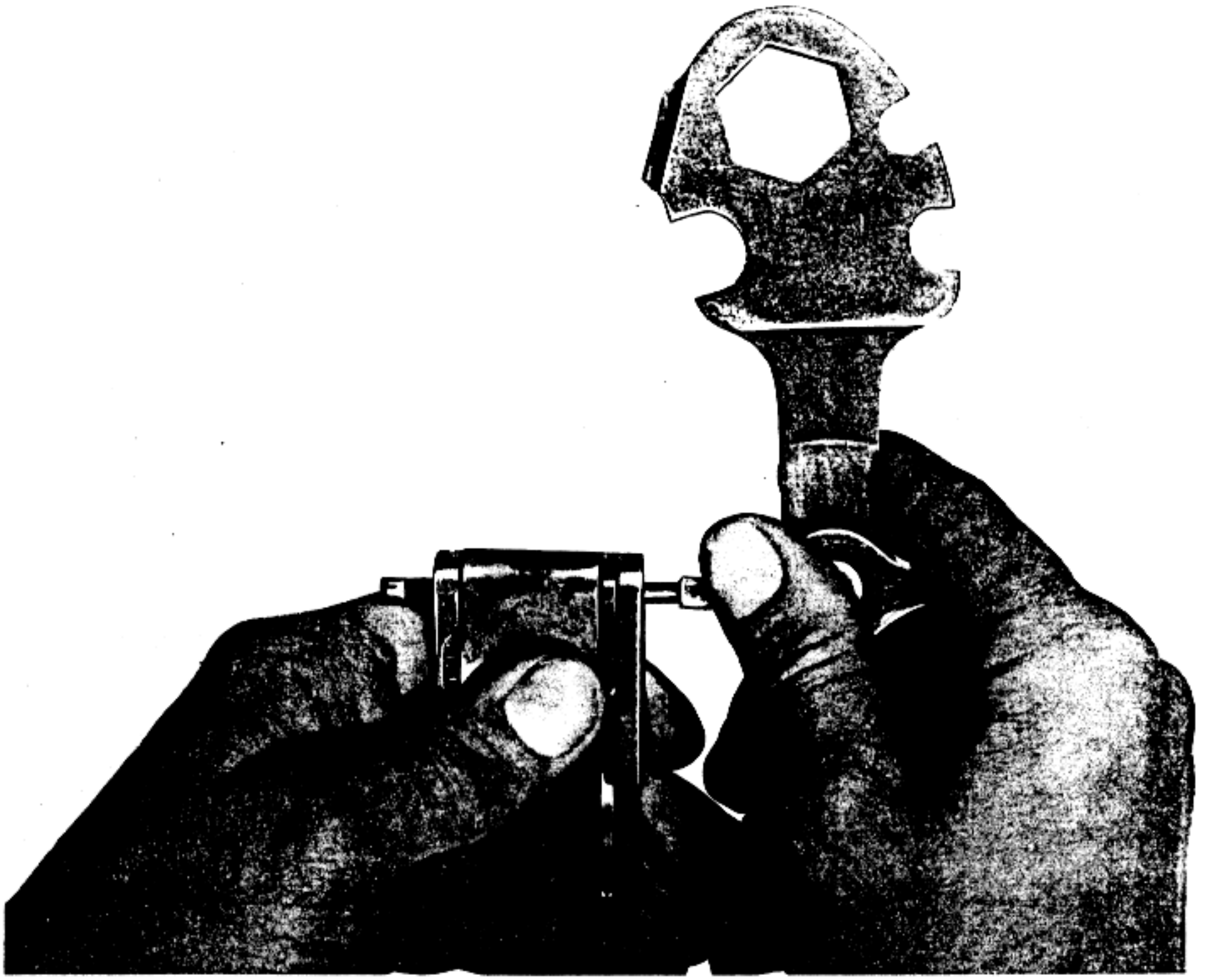


Figure 57. Drifting out the belt feed pawl pin. (Use any available punch or caliber .30 combination as shown above.)

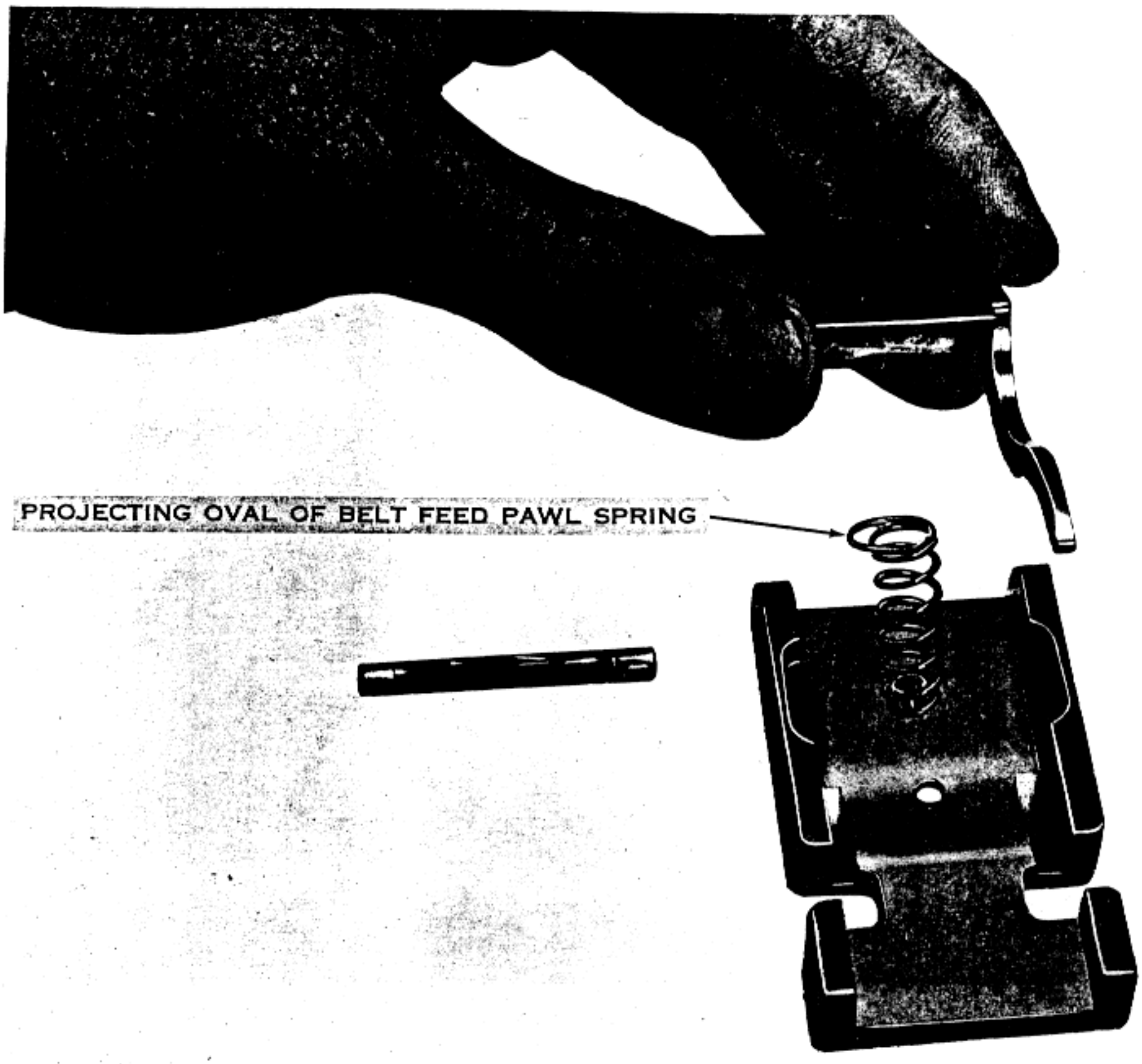


Figure 58. Removing the belt feed pawl and arm.

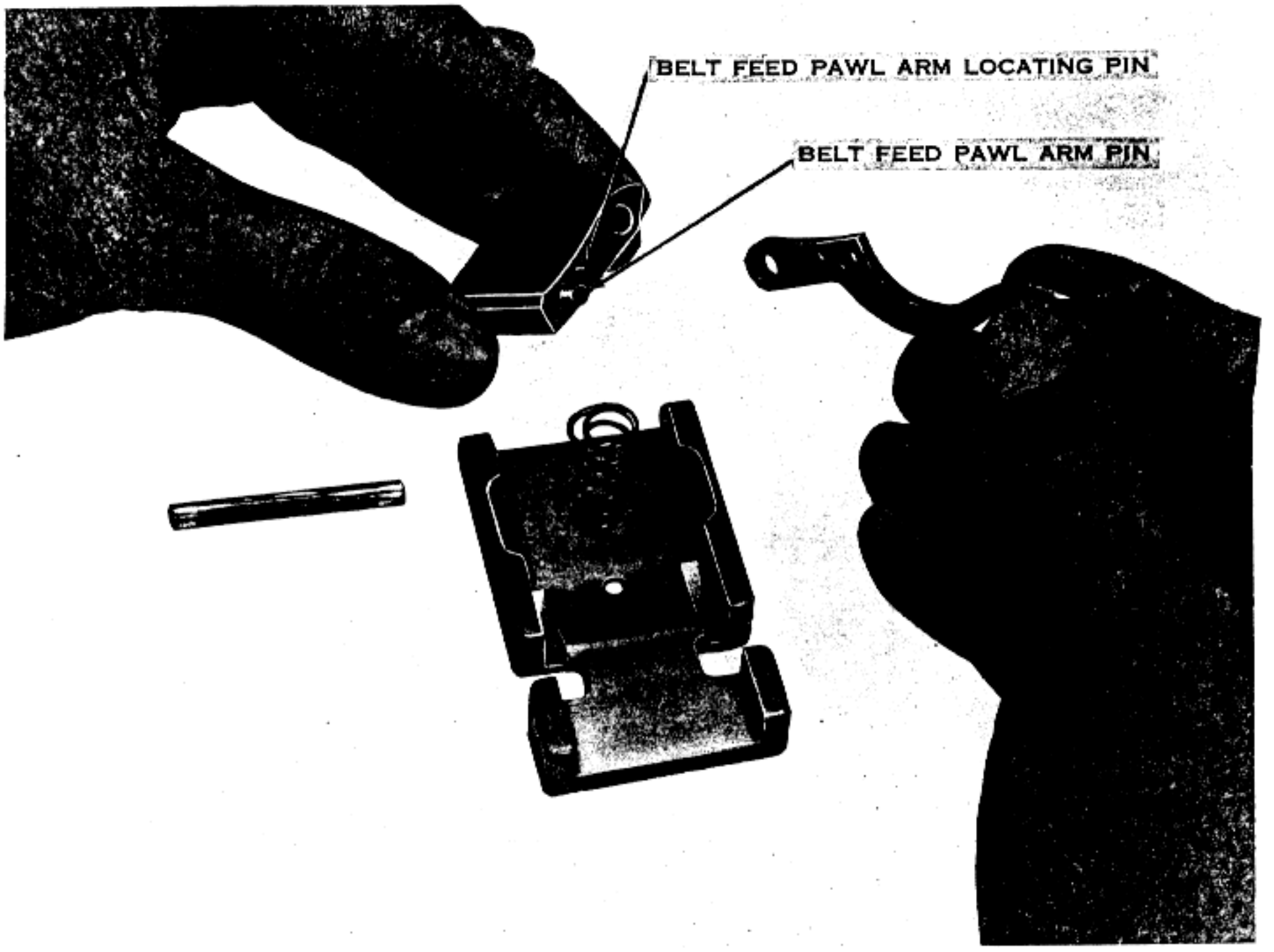


Figure 59. Disengaging the belt feed pawl arm from the belt feed pawl.

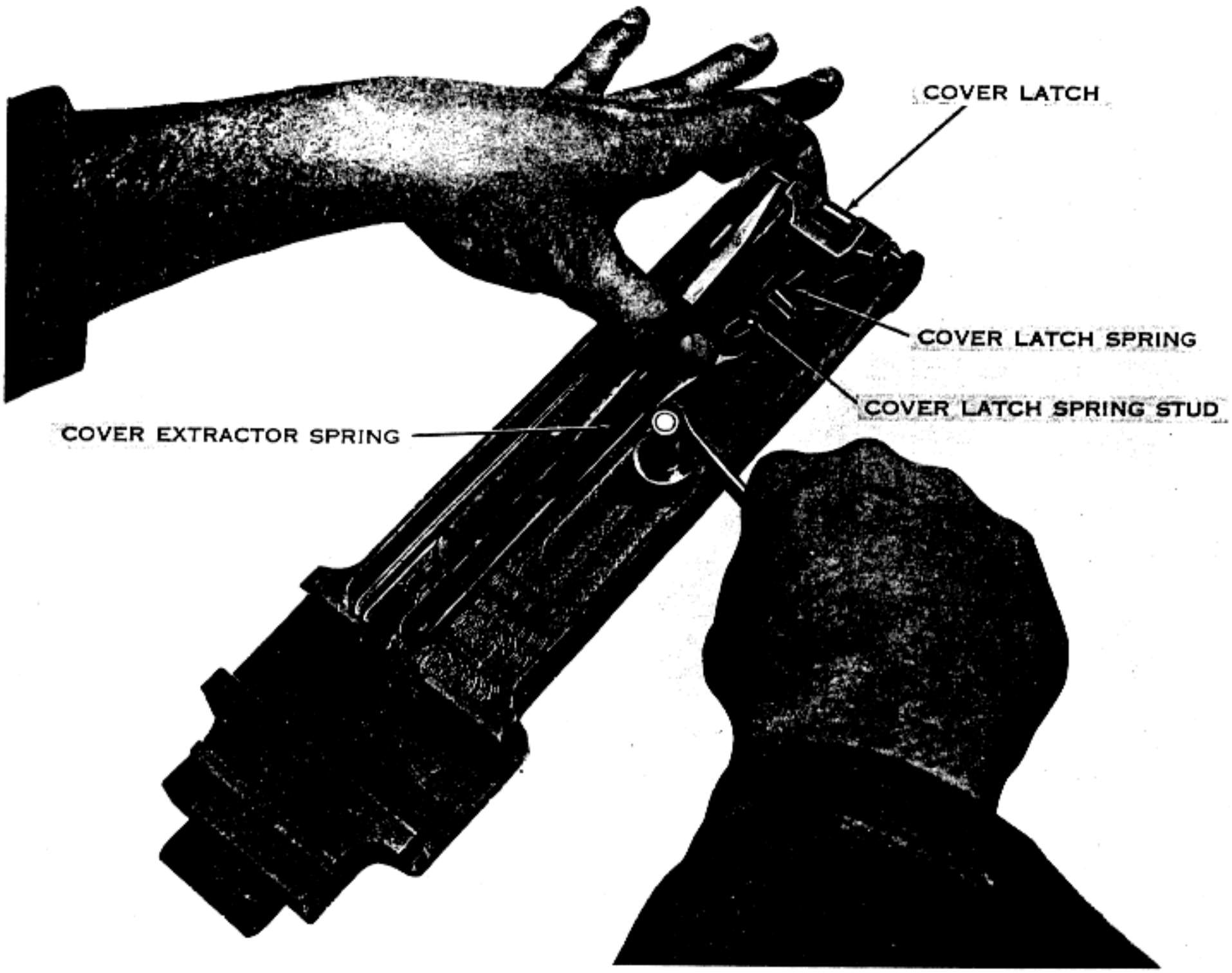


Figure 60. Removing the cover latch spring.

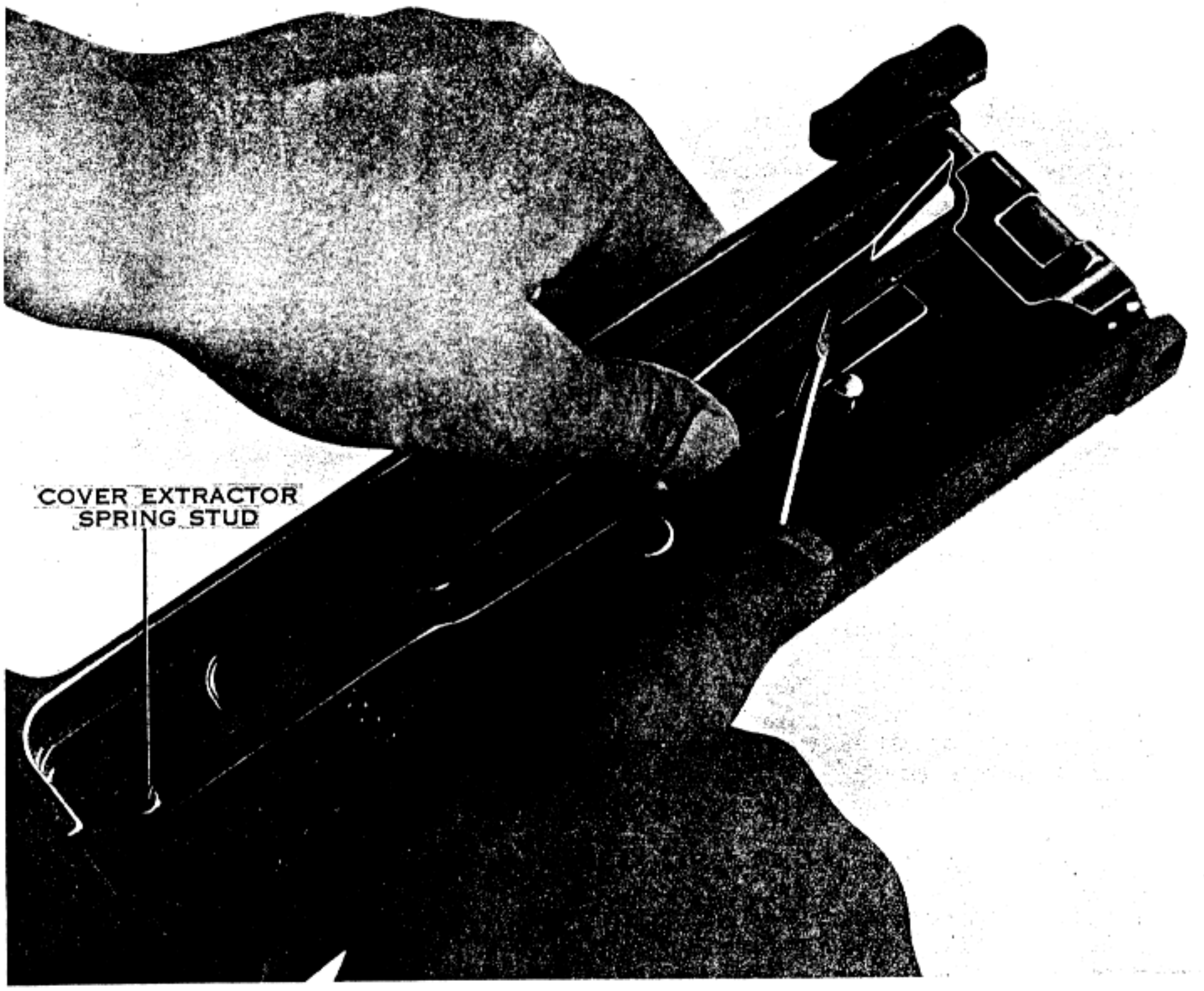


Figure 61. Removing the cover extractor spring.

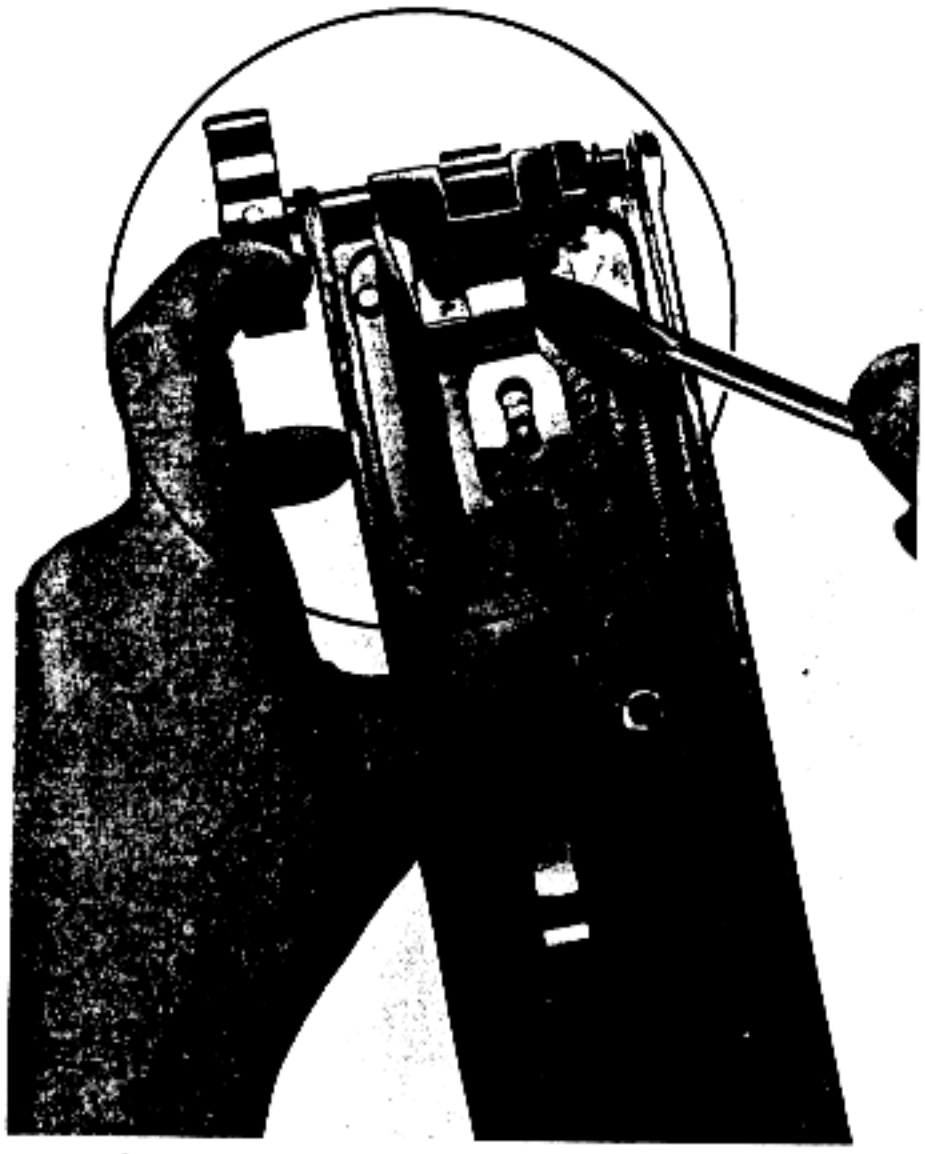


Figure 62. Replacing the cover latch spring.

2. Slowly release pressure, and remove the belt feed pawl and arm (fig 58).

3. Disengage the belt feed pawl arm from the belt feed pawl (fig 59).

4. Remove the belt feed pawl spring.

(*e*) *Cover latch spring.* Pry the hooked end of the spring out of its groove in the cover, and shift it to the left until it rests on the cover extractor spring. Press down on the cover latch spring, and slide it away from the cover latch. Make sure that it rides on top of the cover extractor spring. When the enlarged hole in the spring meshes with the cover latch spring stud, remove the spring from its stud (fig 60).

(*f*) *Cover extractor spring.* Press down on the cover extractor spring and pry the end of the spring out of its recess in the cover extractor cam (fig 61). This spring, if not handled carefully, can cause injury. Disengage the opposite end of the spring from the cover extractor spring stud. This completes detailed disassembly of the cover spring.

(2) *Assembly.*

(*a*) *Cover extractor spring.* Place the cover in the same position as for detailed disassembly. Hook the slotted end of the spring under the cover extractor stud with the projection pointing in the direction of its recess. Exercising caution, press down, and seat the projection of the spring in its recess in the cover extractor cam.

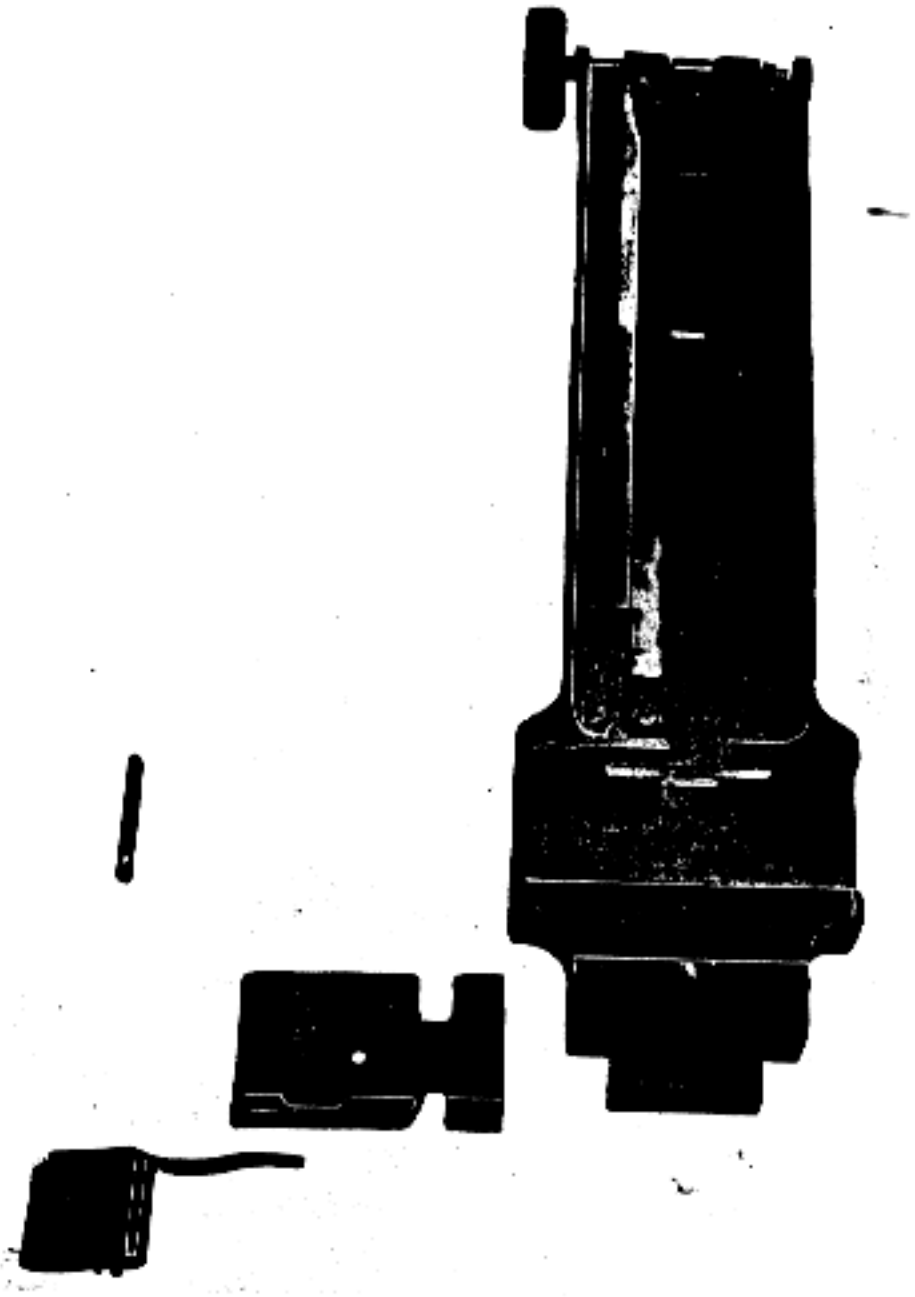


Figure 63. Parts of the belt feed slide, displayed for final assembly and return to the cover (left-hand feed).

(*b*) *Cover latch spring.* Place the cover latch spring inside the cover with the enlarged hole meshing with the cover latch spring stud, the hooked end down (resting on the cover extractor spring). Press down on the cover latch spring, and slide it toward the latch. Pry up on the latch end of the spring, so that it rides up over the projecting wing of the cover latch. Snap the hooked end of the spring into its groove in the cover (fig 62).

(*c*) *Belt feed slide.* To reassemble the belt feed slide:

1. Replace the belt feed pawl arm on the belt feed pawl.

Note. **There are two pins on each side of the belt feed pawl. The larger is the belt feed pawl arm pin; the smaller is the belt feed pawl arm locating pin (fig 59).**

For a left-hand feed, the belt feed pawl arm must be placed over the pins so that the belt feed pawl

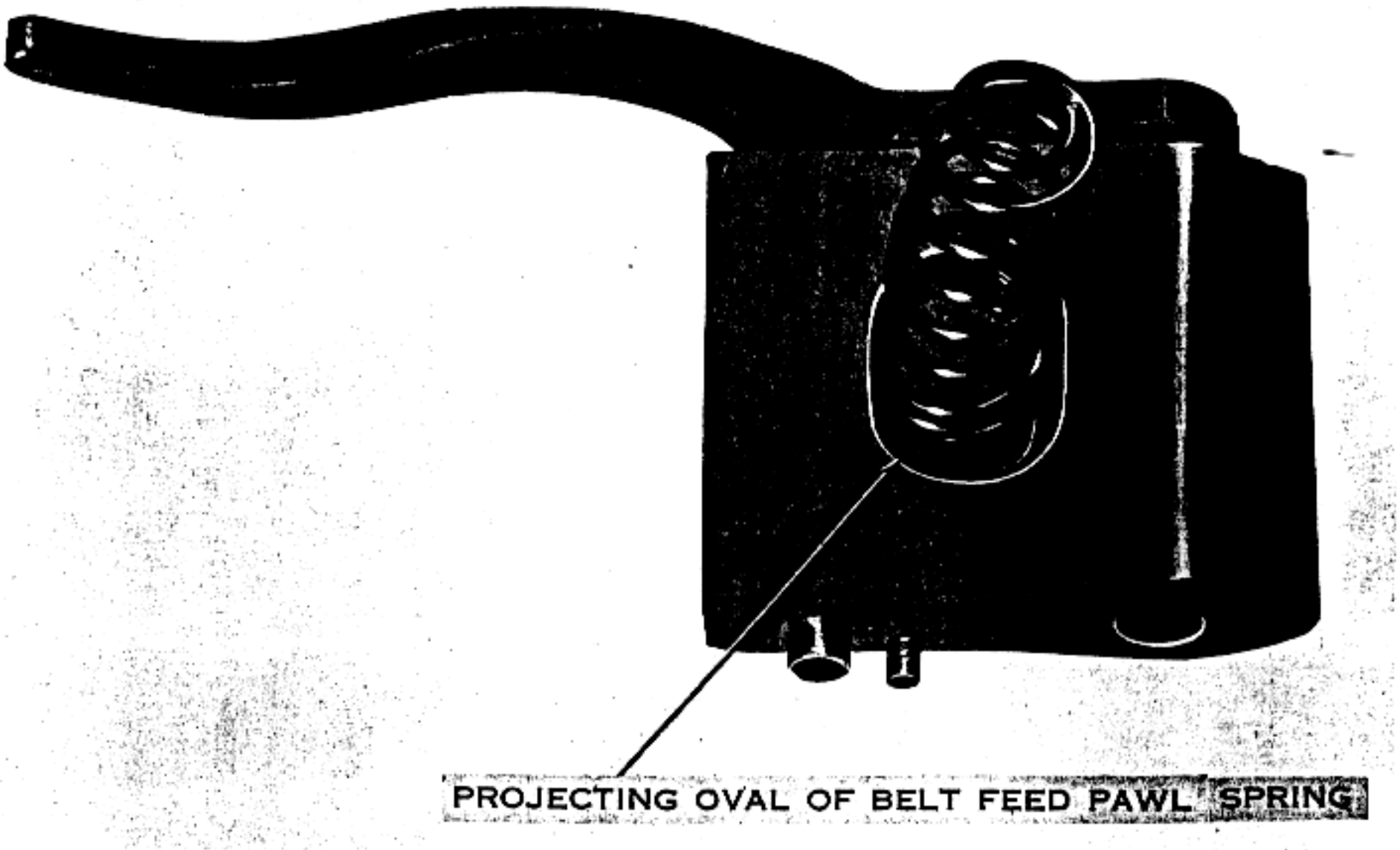


Figure 64. Projecting oval of the belt feed pawl, spring properly seated in relation to the belt feed pawl arm (left-hand feed).

arm is toward the latch end of the cover, when the assembled slide is returned to the cover (fig 63).

2. Place the small end of the belt feed pawl spring over the belt feed pawl spring stud (inside the belt feed slide). Place the assembled pawl and arm over the spring so that the large end of the spring is seated in the recess in the pawl, with the projecting oval (loop) of the spring away from the belt feed pawl arm (fig 64).

3. Aline the pinholes in the pawl, arm, and slide; replace the belt feed pawl pin (fig 65). Make sure that the pin is flush with the sides of the slide.

4. Replace the belt feed slide in its guideways, with the belt feed pawl to the left, arm toward the latch (fig 66).

(*d*) *Shoulder headless pin and spring.* Replace these in their seats in the side of the belt feed lever. For left-hand feed, the spring and pin are seated in the hole nearest the belt feed lever lug (fig 52).

(*e*) *Belt feed lever and lock pin.* Place the belt feed lever over the pivot stud, lug up and to the left (fig 67). With a thumb at either end of the lever, press down and turn the lever until the shoulder headless pin is against the inside of the cover. Pivot the lever until it is alined with the slots of the cover and slide. Press the lever down as far as it will go (fig 68). Move the lug end all the way to the right (fig 69). Maintain a downward pressure, and snap the lug end all the way to the left so that the shoulder headless pin is properly positioned in the cover (fig 70). Replace the lock pin (cotter pin) in the pivot stud. Make sure that the toe end of the lever moves laterally in its slot without binding.

(*f*) *Cover pin.* To replace the cover group on the receiver, place the latch end of the cover in position, with the latch engaging the top plate. With the heel of your hand, tap the hinged end downward into position (fig 71). Aline the pin holes and replace the cover pin. Insert the cotter pin in the cover pin and spread the ends. This completes assembly of the cover group.

e. Receiver Group.

(1) *Disassembly (fig 72).*

(*a*) *Belt holding pawl, spring(s), and pin.* Press down on the spring belt holding pawl and withdraw the belt holding pawl pin to the rear. Remove the belt holding pawl and springs, being careful not to lose the springs. The split belt hold-

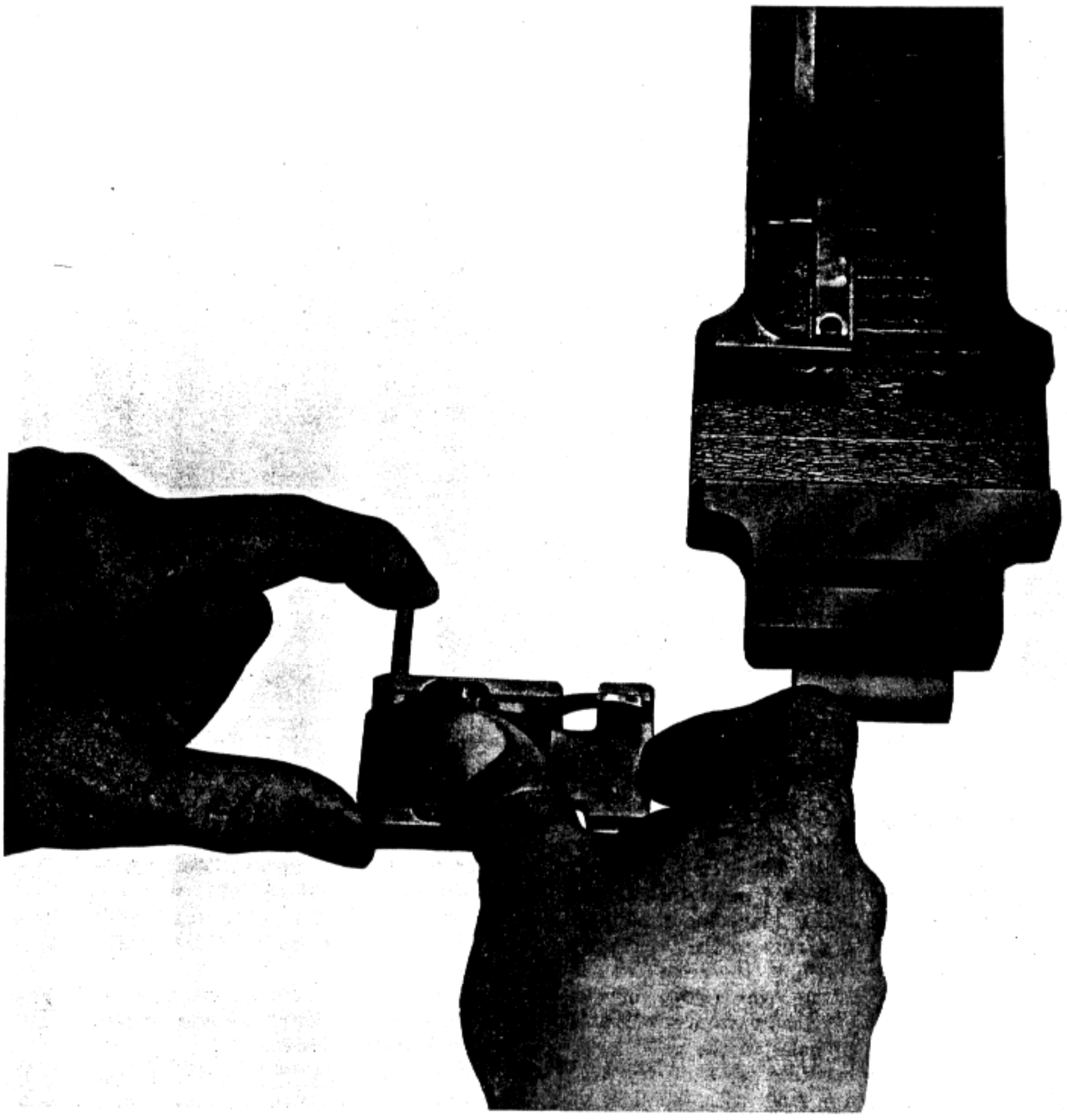


Figure 65. Replacing the belt feed pawl arm pin.

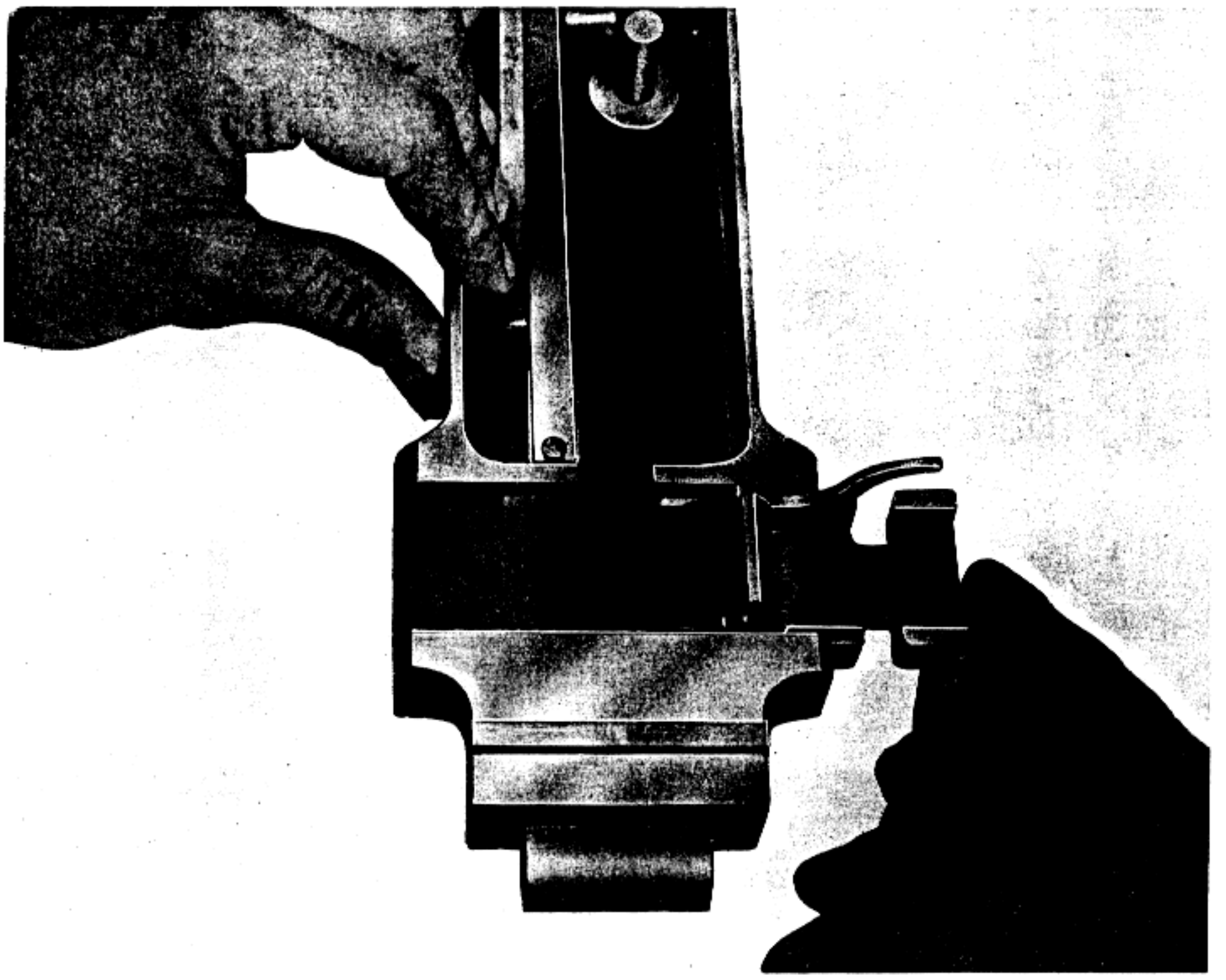


Figure 66. Replacing the belt feed slide in its guideways (left-hand feed).

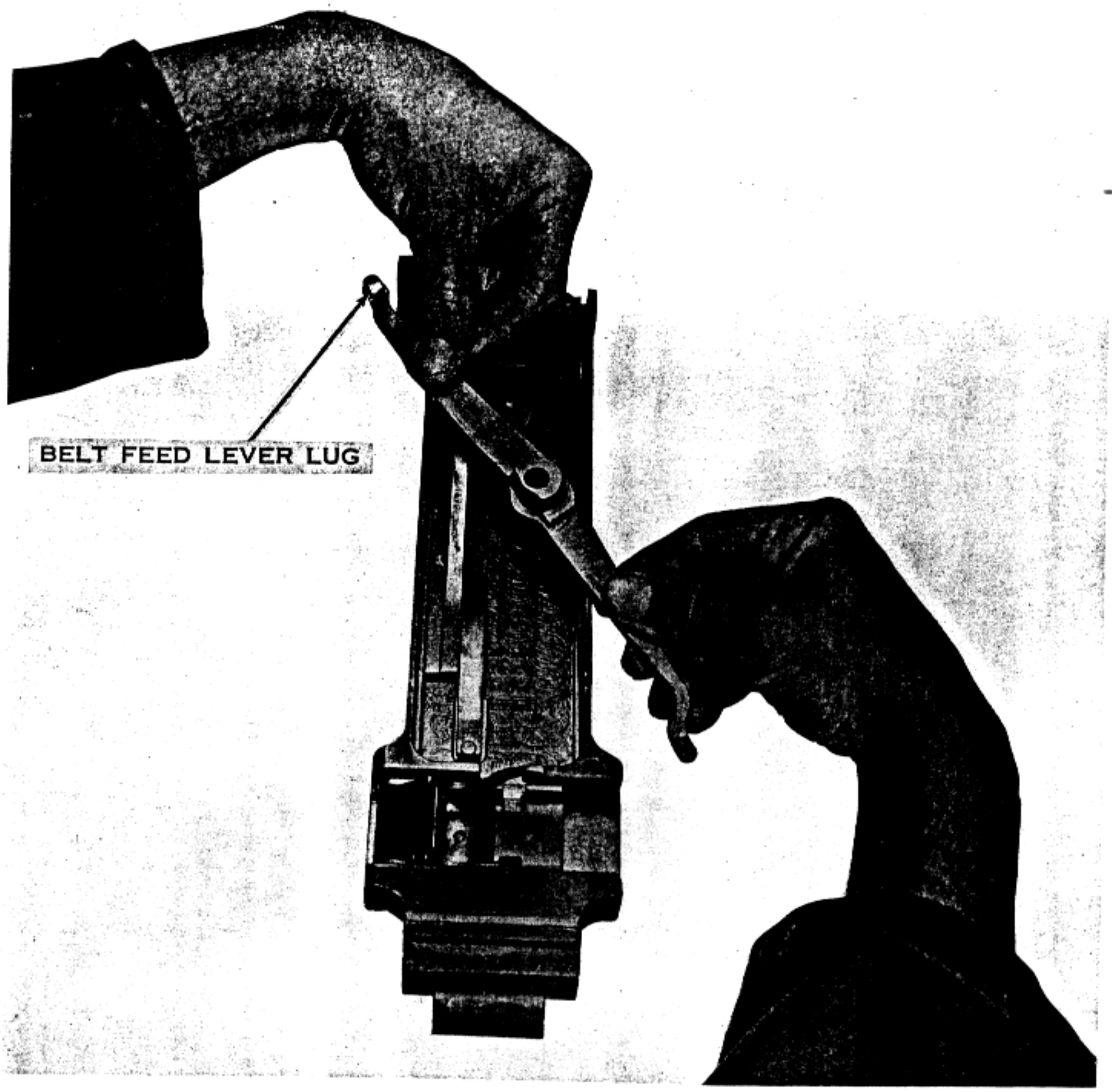


Figure 67. Placing the belt feed lever over its pivot stud.

Figure 68. Alining the belt feed lever with the slots in the cover and slides.

ing pawl assembly includes a left-hand and right-hand belt holding pawl, connected by a belt holding pawl sleeve; two belt holding pawl springs are used (fig 73). Guns of earlier manufacture use a single belt holding pawl, adapted for either one or two springs (fig 72).

(*b*) *Cartridge stop assembly, front cartridge stop, and belt holding pawl pin.* Withdraw the belt holding pawl pin from the right side of the receiver. Remove the cartridge stop assembly (or rear cartridge stop and link stripper—on guns of earlier manufacture), and front cartridge stop, from the right side of the receiver (fig 74).

(*c*) *Trigger lever pin assembly and trigger lever.* Release the hinged lock from the left sideplate; turn the pin clockwise, and withdraw the pin to the left. Remove the trigger lever from inside the receiver. Guns of earlier manufacture may have a trigger lever pin assembly without the hinged lock. In this case, lift the lock of the pin out of the small hole in the left sideplate and rotate the lock end downward 90° until it is just forward of a vertical position. Withdraw the pin to the left (fig 75, 76, and 77). This completes disassembly of the receiver group.

(2) *Assembly.*

(*a*) *Trigger lever and trigger lever pin assembly.* Replace the trigger lever in the receiver, with the long end forward and the bowed surface upward, between the top plate bracket and the bolt latch bracket (fig 78 and 79). The trigger lever should project about ⅛-inch beyond the timing adjustment nut. Aline the hole in the trigger lever with the holes in the receiver. Position the trigger lever pin assembly so that the key on the pin will pass through the keyway in the left sideplate. Push the trigger lever pin assembly all the way in and turn the pin 90° to the left, or counterclockwise. Turn the lock flat against the side of the receiver. (With the lock without the hinge, turn the lock counterclockwise until the lock fits in the small hole in the sideplate.)

(*b*) *Cartridge stop assembly, front cartridge stop, and belt holding pawl pin.* Install the cartridge stop assembly (or rear cartridge stop and link stripper) and front cartridge stop, on the right side of the receiver. Replace the belt holding pawl pin.

(*c*) *Belt holding pawl, spring(s) and pin.* Place the belt holding pawl in position on the left side of the receiver, first seating the springs. Depress the pawl and insert the belt holding pawl pin. This completes assembly of the receiver group.

f. Backplate Assembly. The backplate assembly is not disassembled by using units.

10. Positioning of Parts for Left-Hand feed (App B)

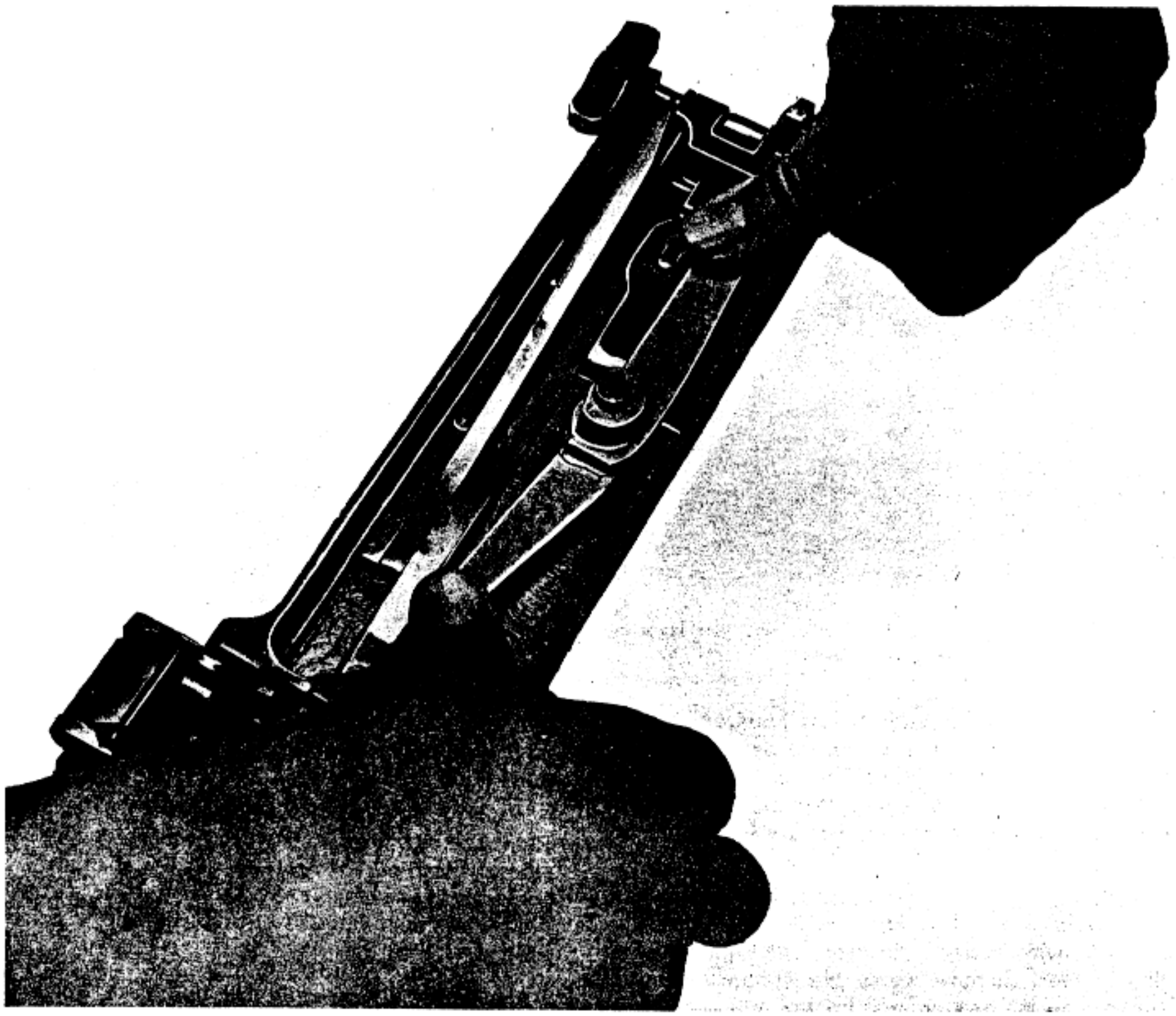


Figure 69. Moving the belt feed lever lug all the way to the right.

Figure 70. Snapping the belt feed lever lug all the way to the left, to seat the shoulder headless pin.

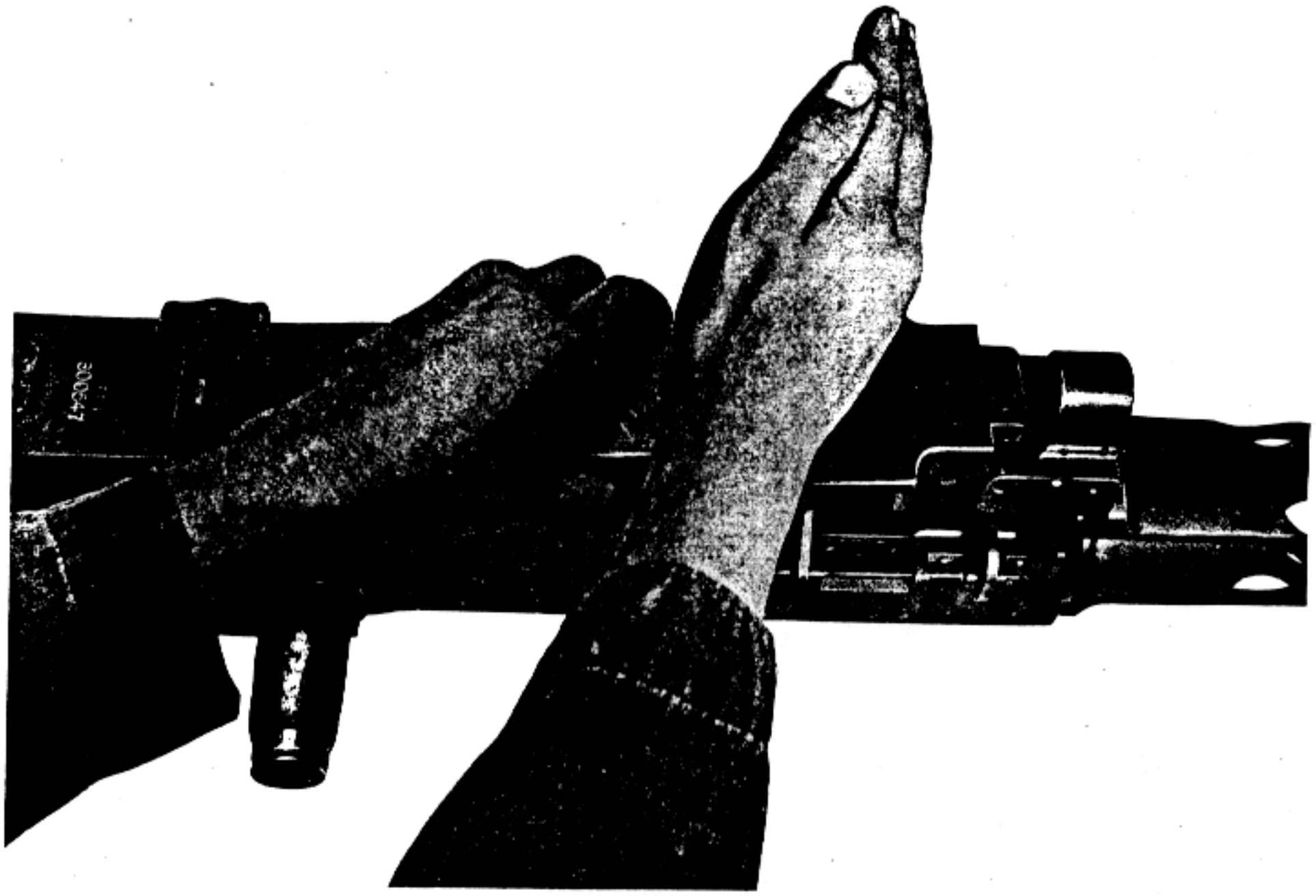


Figure 71. Replacing the cover.

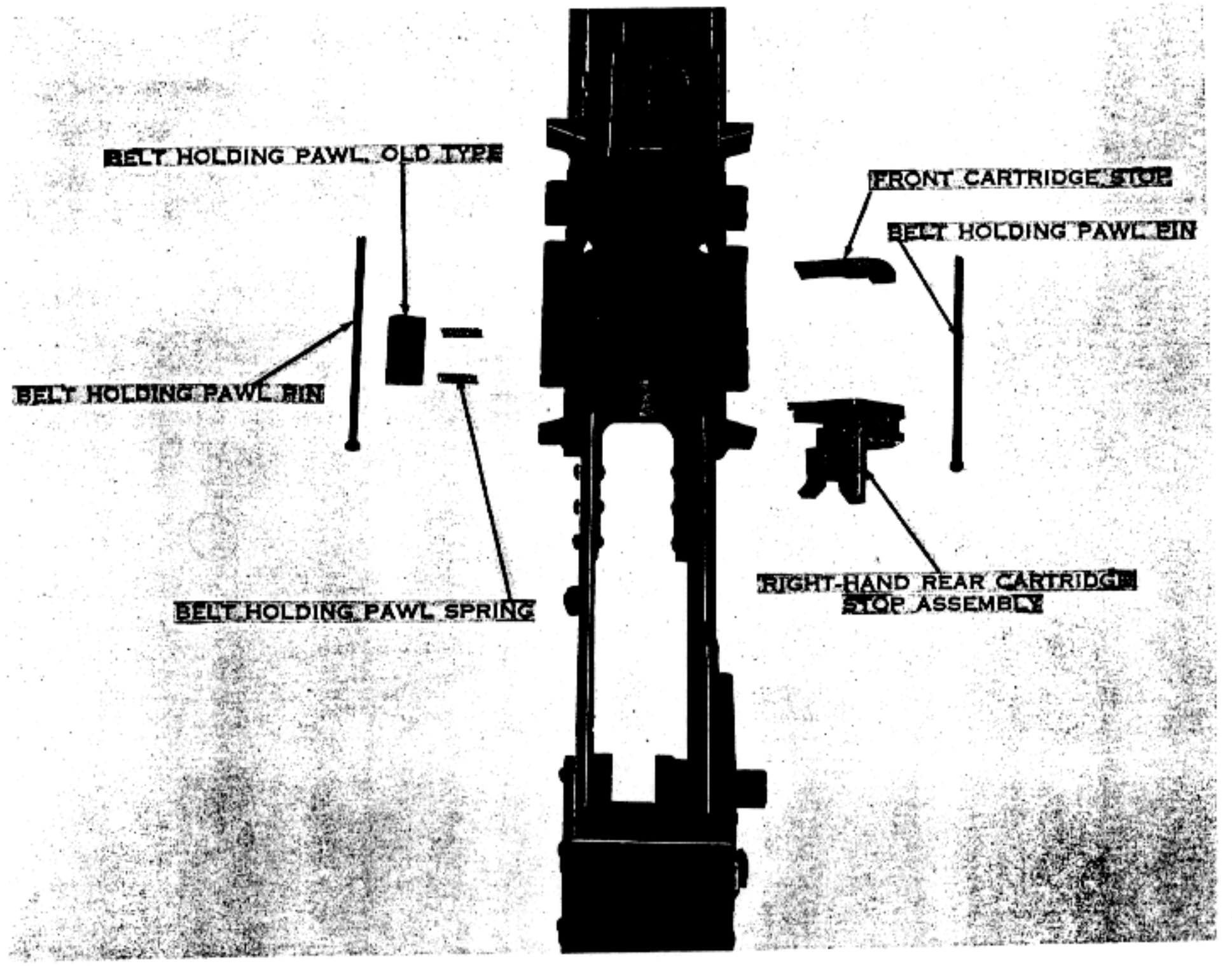


Figure 72. Receiver group, with old type belt feed pawl.

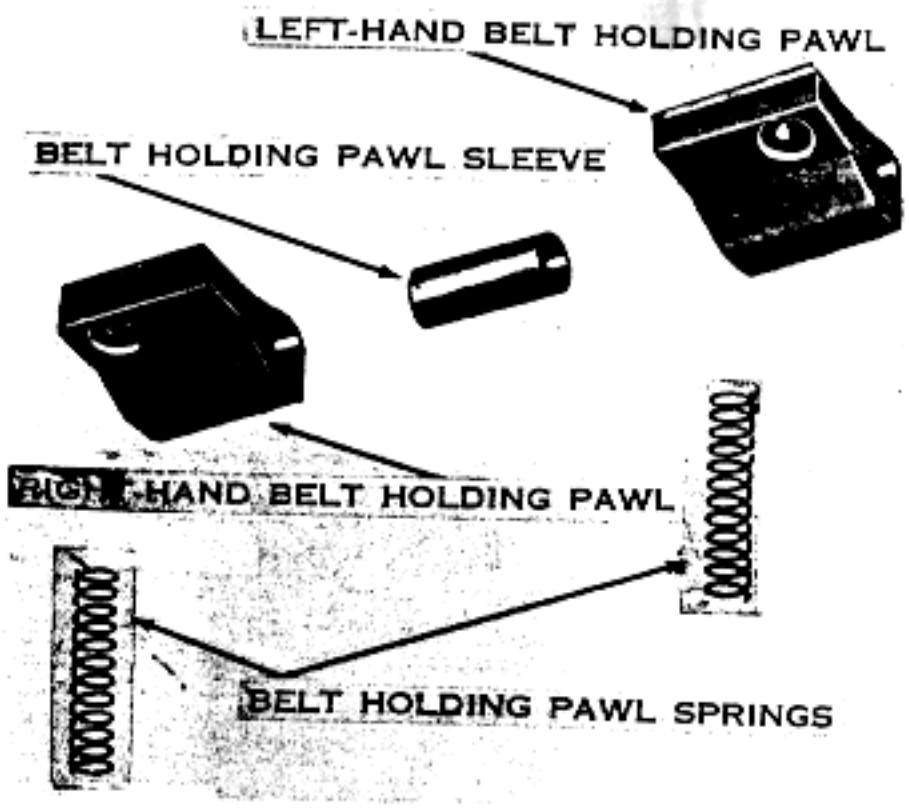


Figure 73. Belt holding pawl assembly (new type).

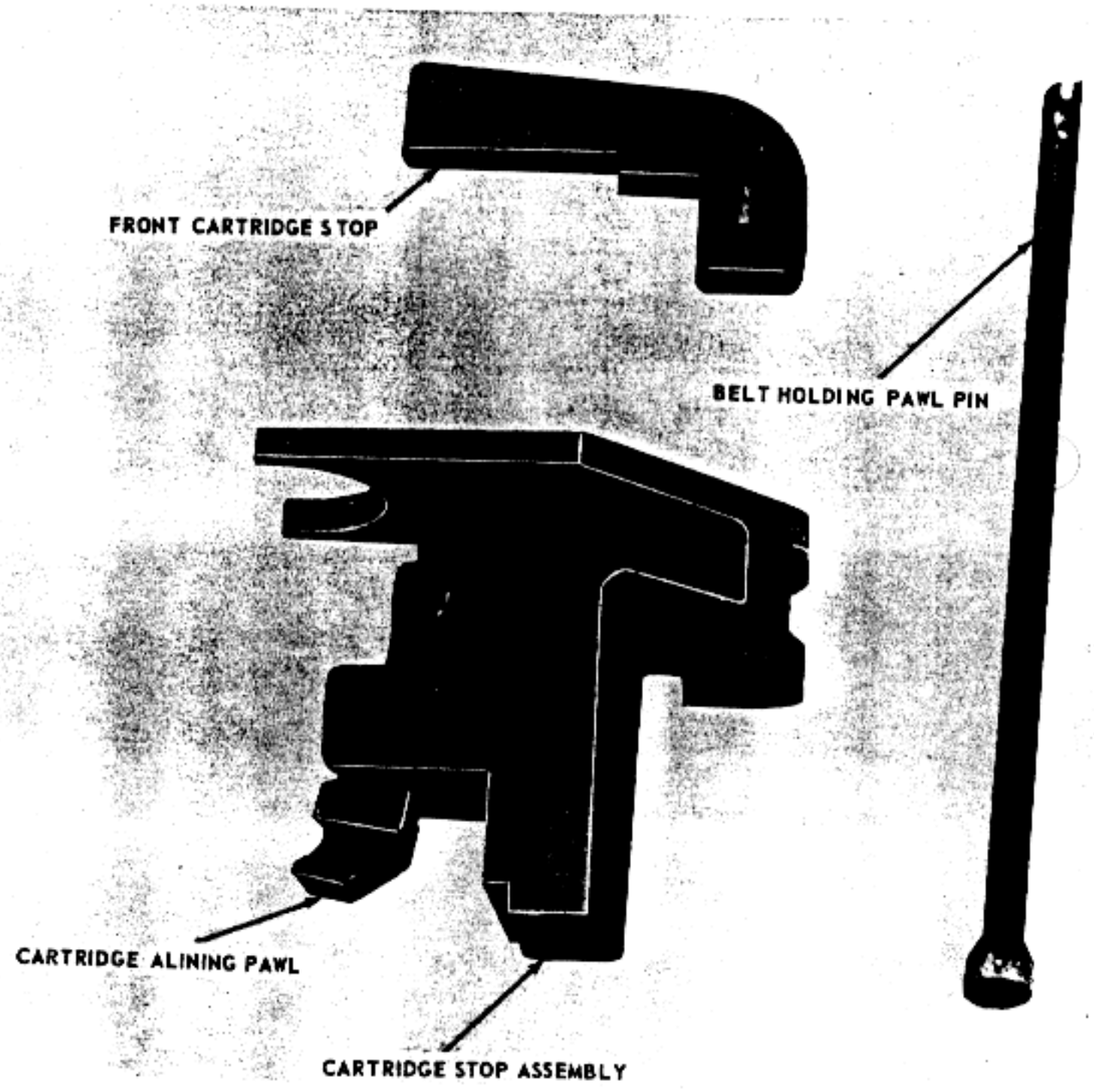


Figure 74. Cartridge stop assembly, front cartridge stop, and belt holding pawl pin.

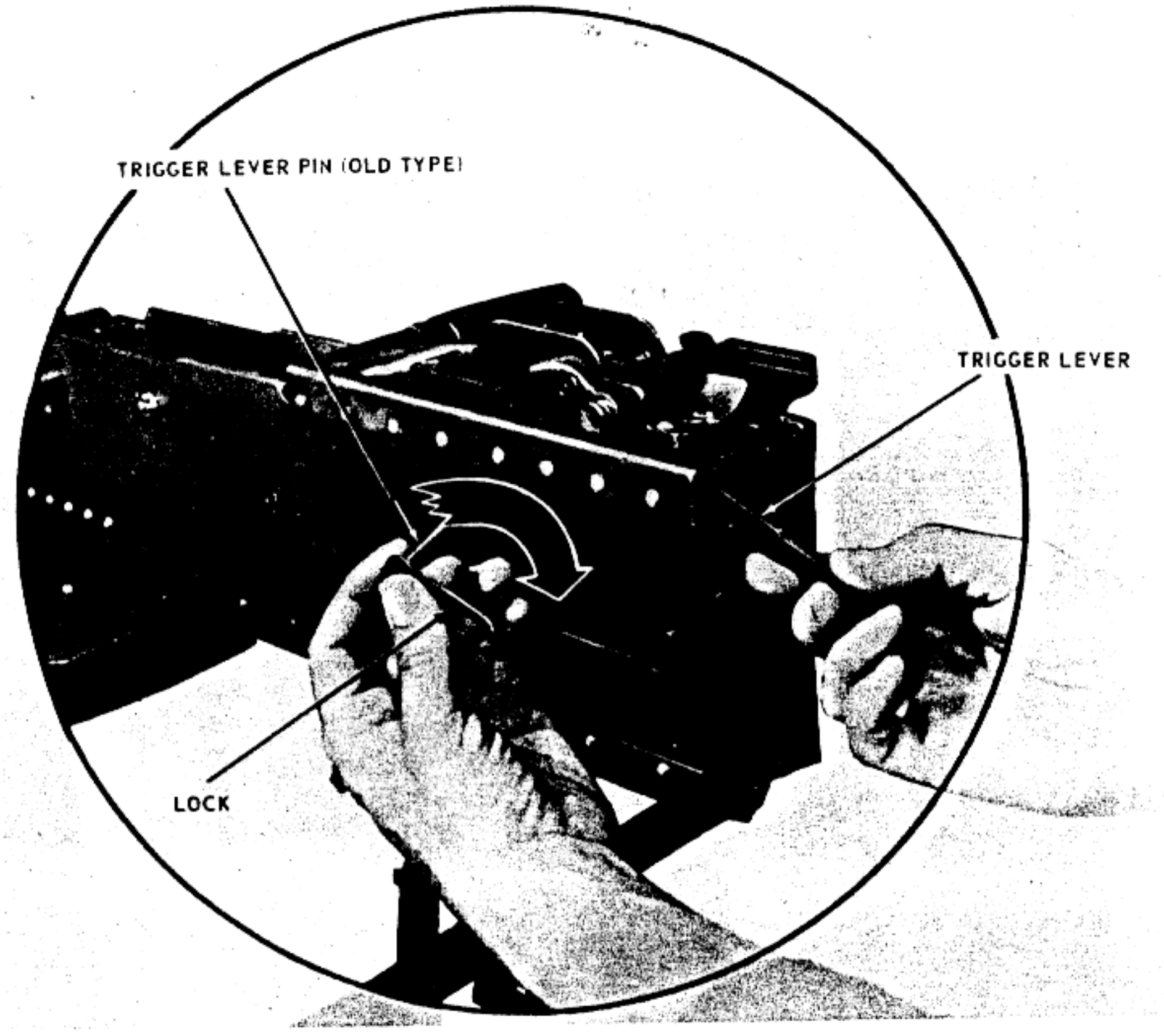


Figure 75. Removing the trigger lever pin assembly (old type).

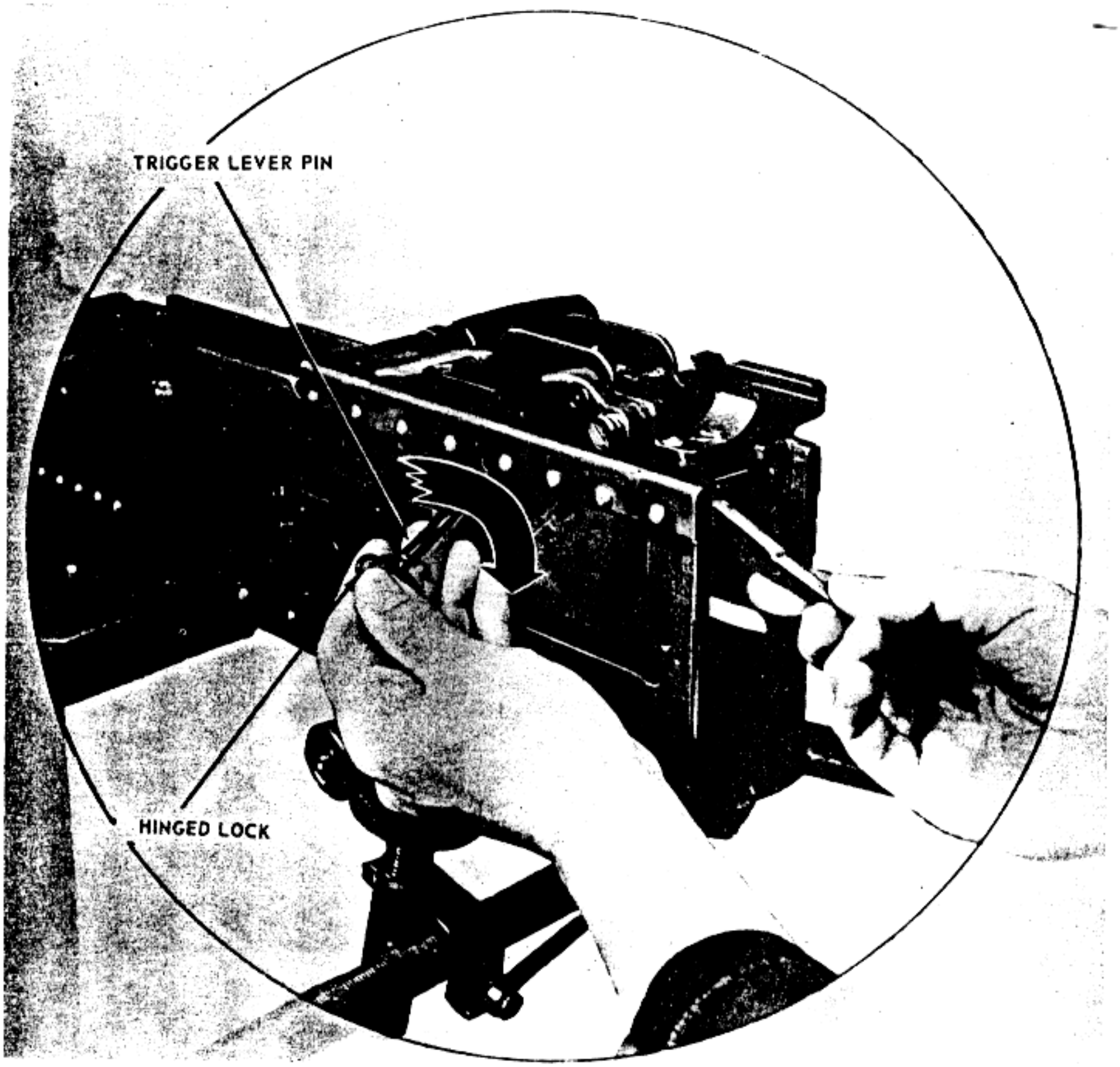


Figure 76. Removing the trigger lever pin assembly (new type).

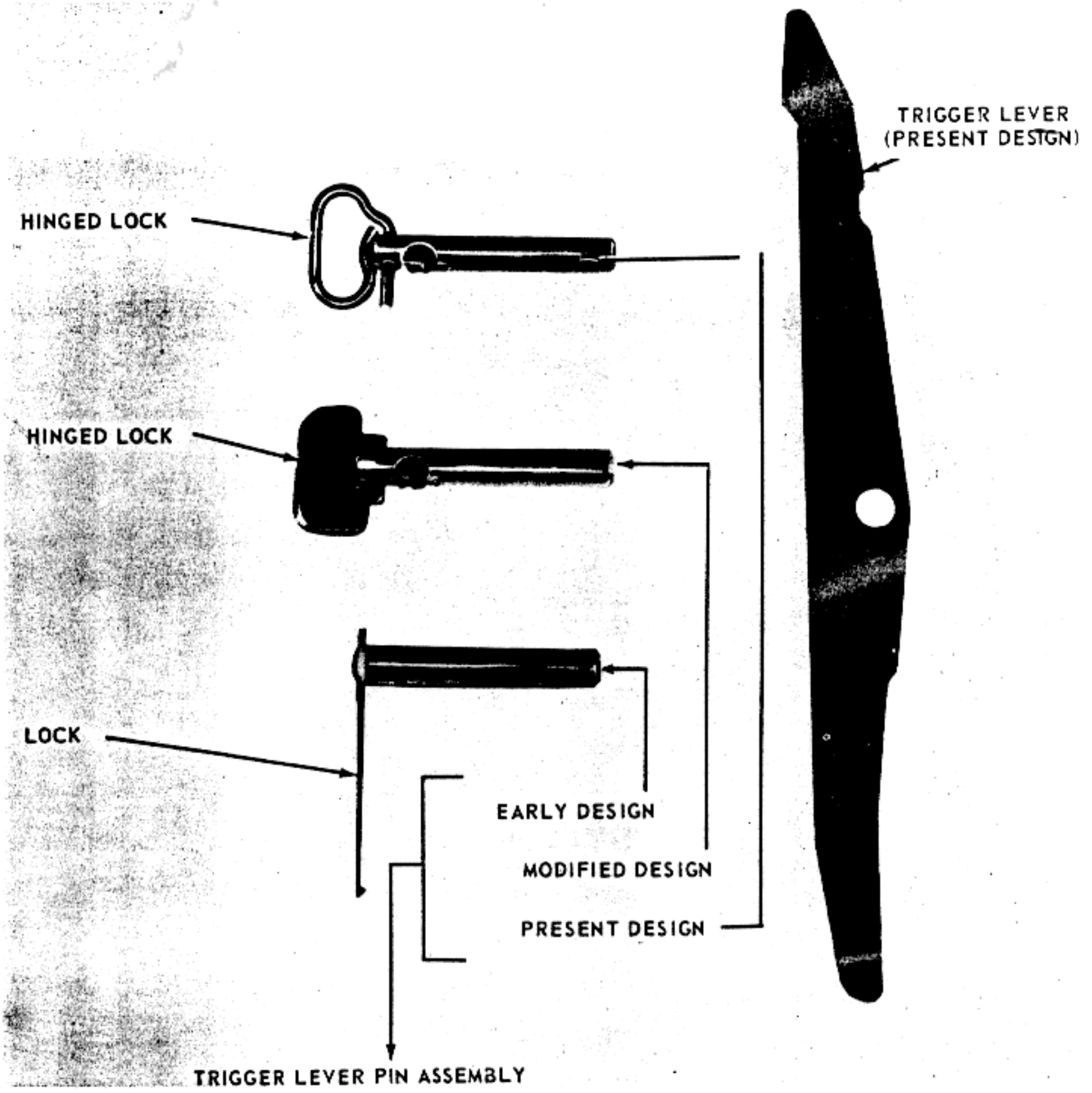


Figure 77. Trigger lever (present design), and trigger lever pin assemblies.

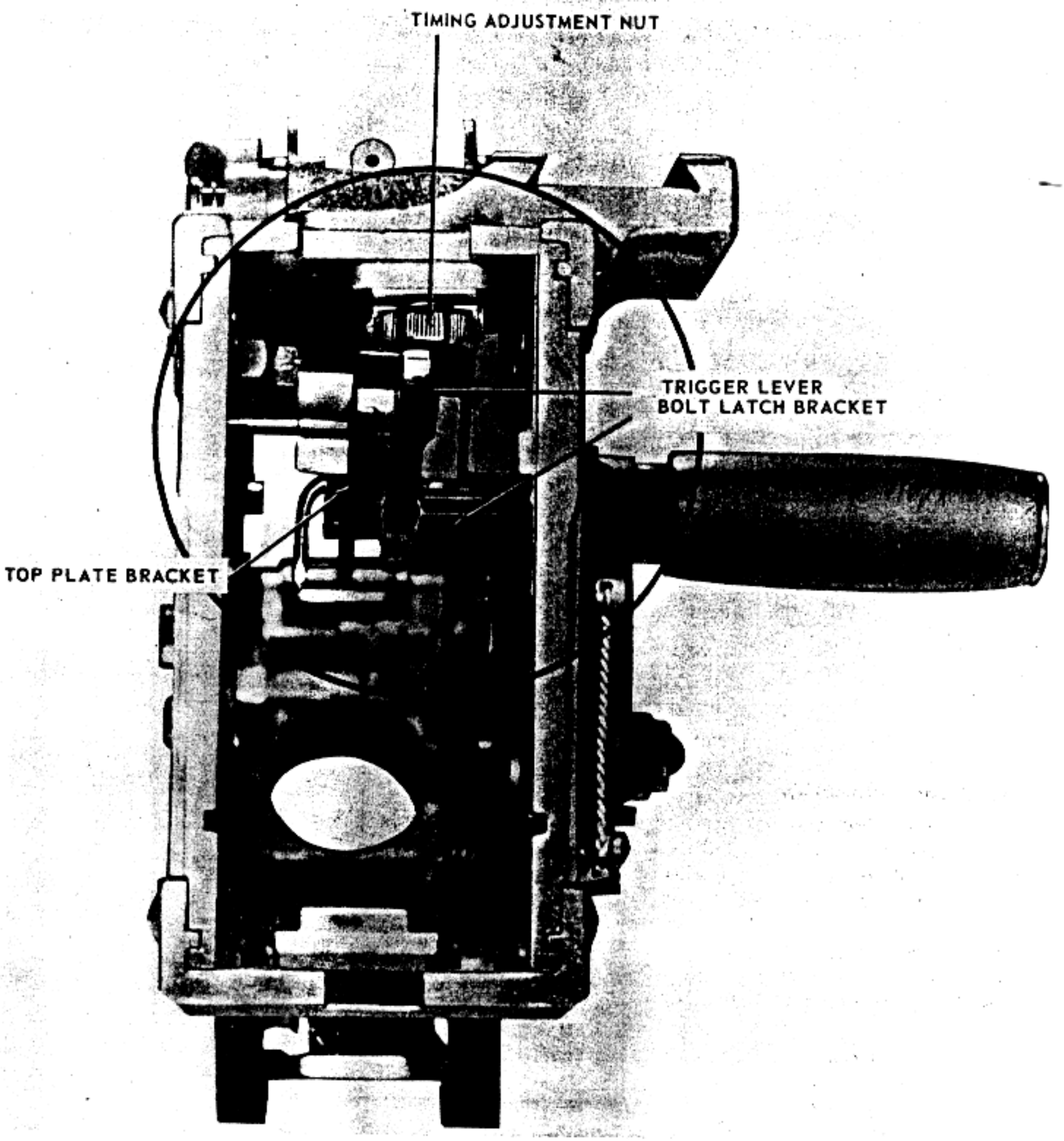


Figure 78. Trigger lever replaced (rear view).

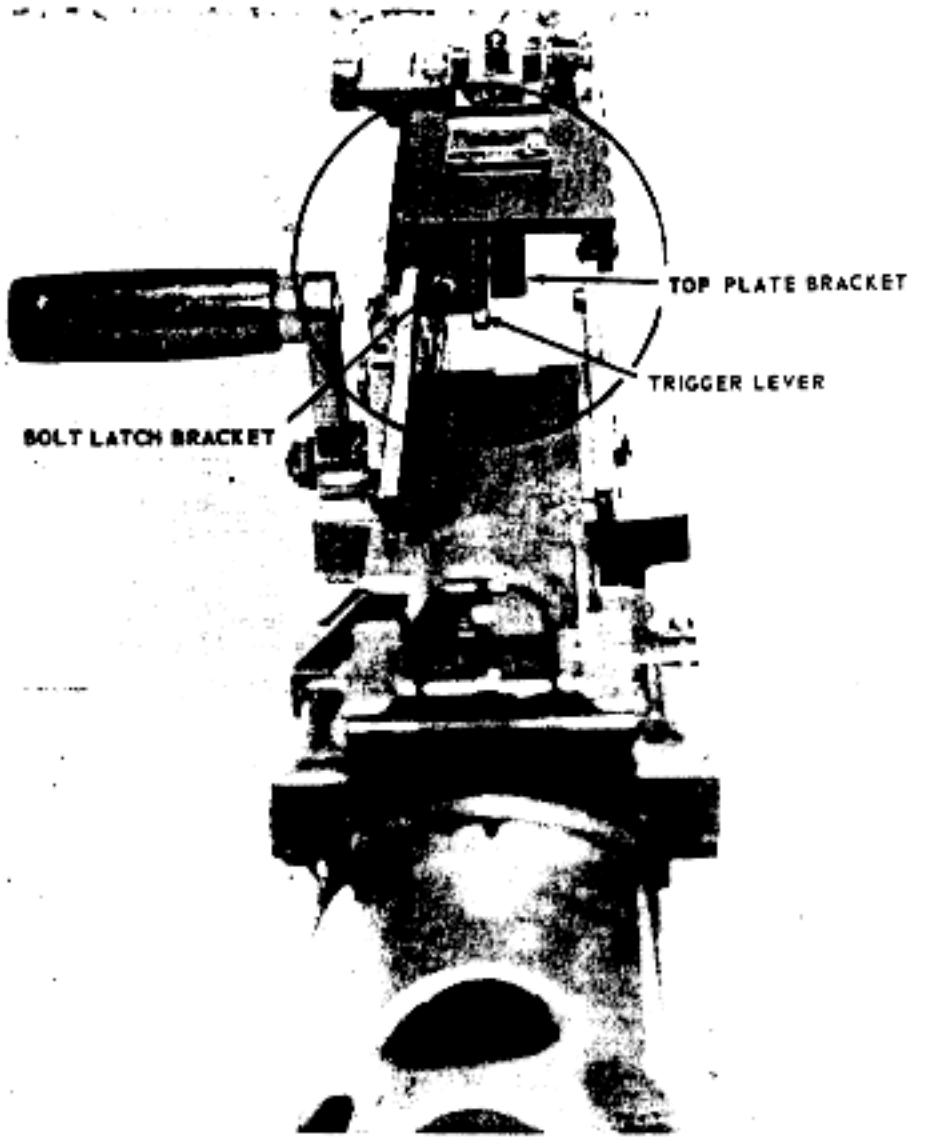


Figure 79. Trigger lever replaced (front view).

Section V. HEADSPACE AND TIMING

11. Headspace Adjustment

a. Introduction. Headspace is the distance between the face of the bolt and the base of cartridge case, fully seated in the chamber. Headspace adjustment is correct when the following conditions are met:

(1) The recoiling groups are fully forward.

(2) There is no independent rearward movement between the bolt, barrel, and barrel extension.

b. Importance of Correct Headspace. Improper headspace adjustment can cause improper functioning of the gun and, frequently, damage to parts and/or injury to personnel.

c. When to Check Headspace. Headspace is checked and set prior to firing. Other instances include:

(1) When the gun is assembled.

(2) When the barrel or any major group or assembly within the receiver is replaced.

(3) When there is doubt that correct headspace is set.

d. Gages. The headspace and timing gage consists of a headspace gage and two timing gages (fig 80). These gages provide an accurate means of checking the adjustment of headspace and timing.

Note. The headspace and timing gage should be kept with the gun at all times.

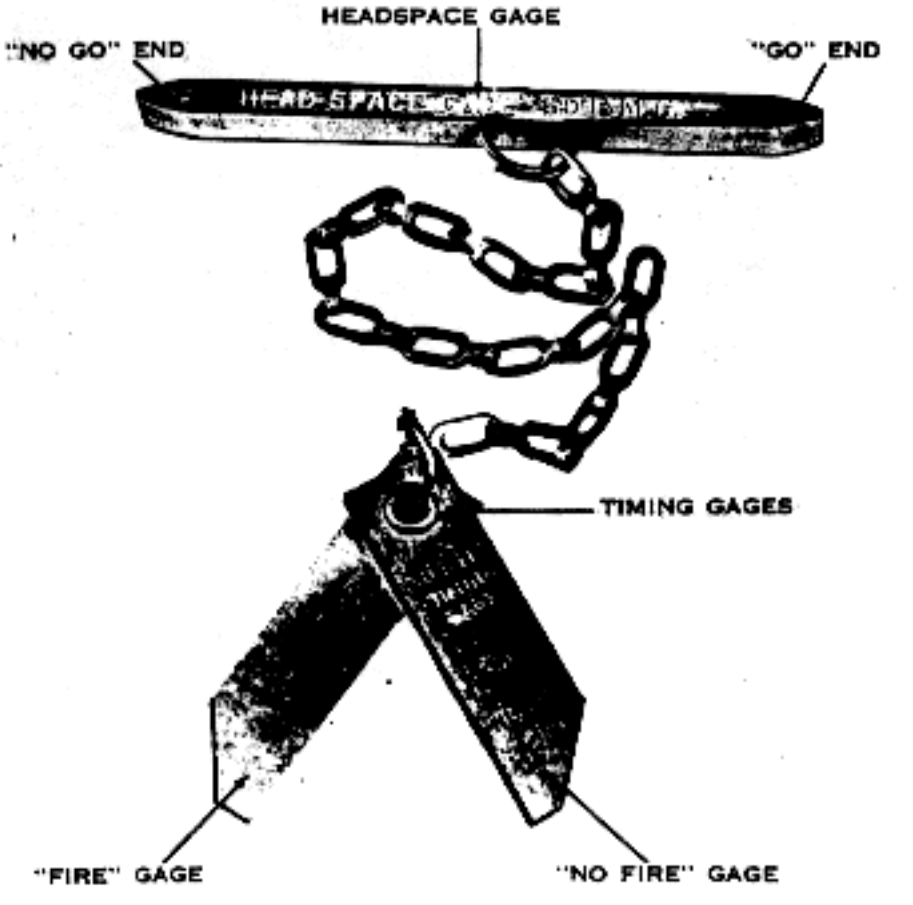


Figure 80. Headspace and timing gage.

e. Headspace Adjustment With the Gage. With the gage, you can accurately determine the distance between the face of the bolt and the chamber end of the barrel by the following procedures:

(1) Raise the cover. Retract the recoiling parts as described in paragraph 7*a*, and screw the barrel all the way into the barrel extension, then unscrew the barrel two notches.

(2) Cock the gun; pull the retracting slide handle all the way to the rear, then return it to its most forward position. Press the bolt latch release and allow the bolt to go forward.

Note. Be careful not to depress the trigger, since this will cause the firing pin to be released.

If the firing pin is forward, the gage cannot be inserted in the T-slot far enough to give an accurate determination.

Caution. **The firing pin should never be released with the gage in the T-slot as this could damage the firing pin and gage.**

(3) Pull the retracting slide handle back until the barrel extension is about one-sixteenth of an inch from the trunnion block. This will insure that the locking surfaces of the breech lock and the bolt are in proper contact. This prevents the driving spring group and weight of the parts from giving a false determination (fig 81).

(4) First, insert the GO end of the headspace gage in the T-slot, between the face of the bolt and the rear end of the barrel. If the GO end of the gage enters freely down to the center ring of the gage, then attempt to insert the NO GO end of the gage. If the GO end enters, and the NO GO end does not enter, correct headspace is set.

(5) If the GO end of the gage does not enter freely, headspace is too tight. When this condition exists the barrel must be unscrewed one click (notch) at a time (checking with the gage after each click), until the GO end of the gage enters freely. To complete the adjustment, attempt to

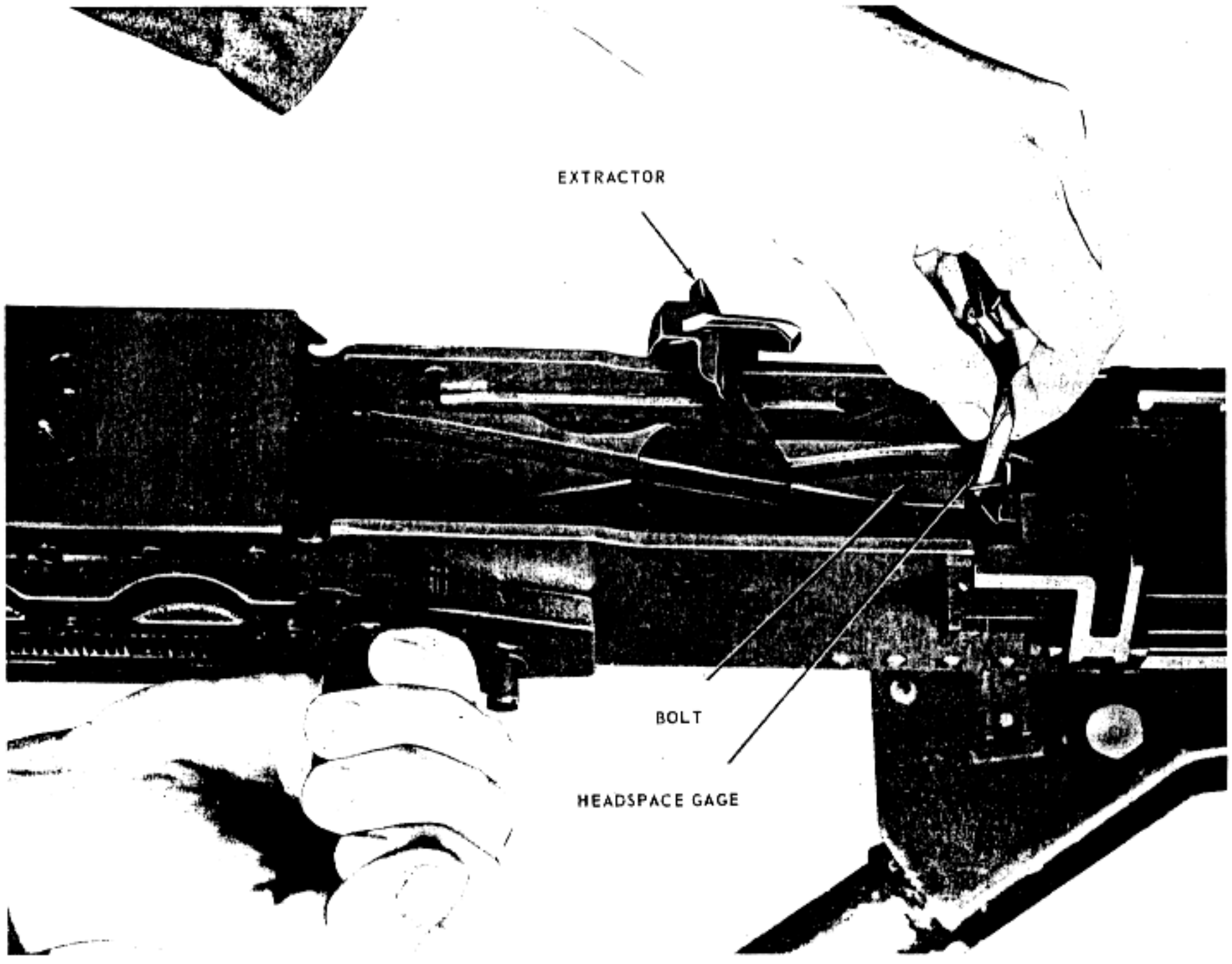


Figure 81. Inserting the headspace gage.

insert the NO GO end of the gage; if it does not enter correct headspace is set. Remember, to unscrew the barrel, or to screw the barrel into the barrel extension, the lug on the barrel locking spring must be alined with the ⅜-inch hole in the right side plate (para 7*b*.).

(6) If the NO GO end of the gage enters the T-slot, headspace is too loose. The barrel must be screwed into the barrel extension (one click at a time) checking with the gage after each click, until the GO end enters and the NO GO end does not.

(7) Remove the gage.

12. Timing

a. General. Timing is the adjustment of the weapon so that firing takes place when the recoiling parts are between .020 and .116 inches out of battery to prevent contact between the front end of the barrel extension and the trunnion block. Timing is correctly set when the following conditions are met:

(1) The recoiling parts are locked together.

(2) Firing takes place just before the parts are in battery (fully forward).

(3) When the gun fires on the FIRE gage, and does not fire on the NO FIRE gage. Timing must be checked and/or set each time headspace is set, or whenever timing is questionable.

b. Checking and/or Setting Timing.

(1) Insure that the gun has correct headspace adjustment.

(2) Cock the gun; pull the retracting slide handle all the way to the rear and return it to its most forward position. Press the bolt latch release and allow the bolt to go forward.

Note. Do not depress the trigger.

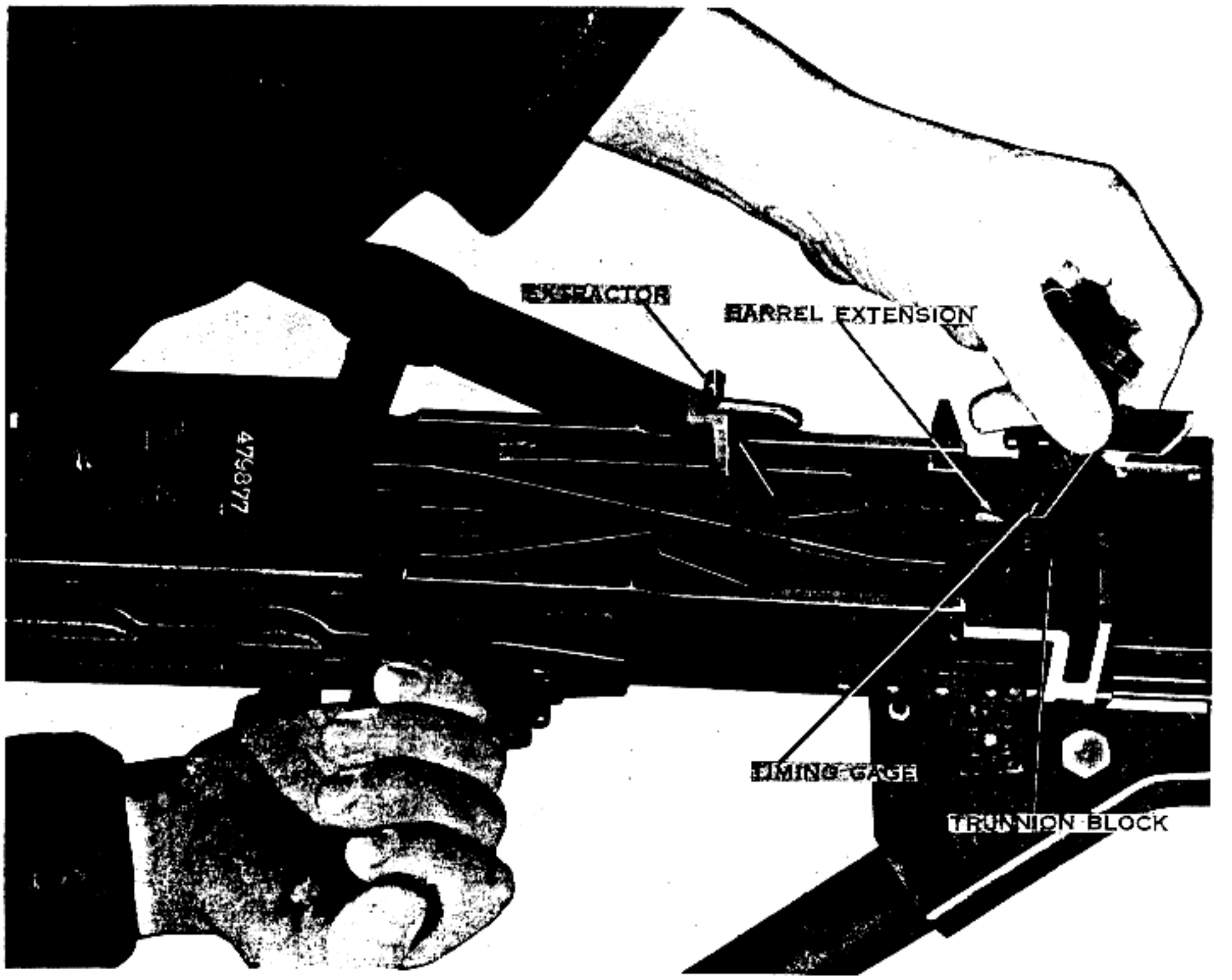


Figure 82. Inserting the timing gage.

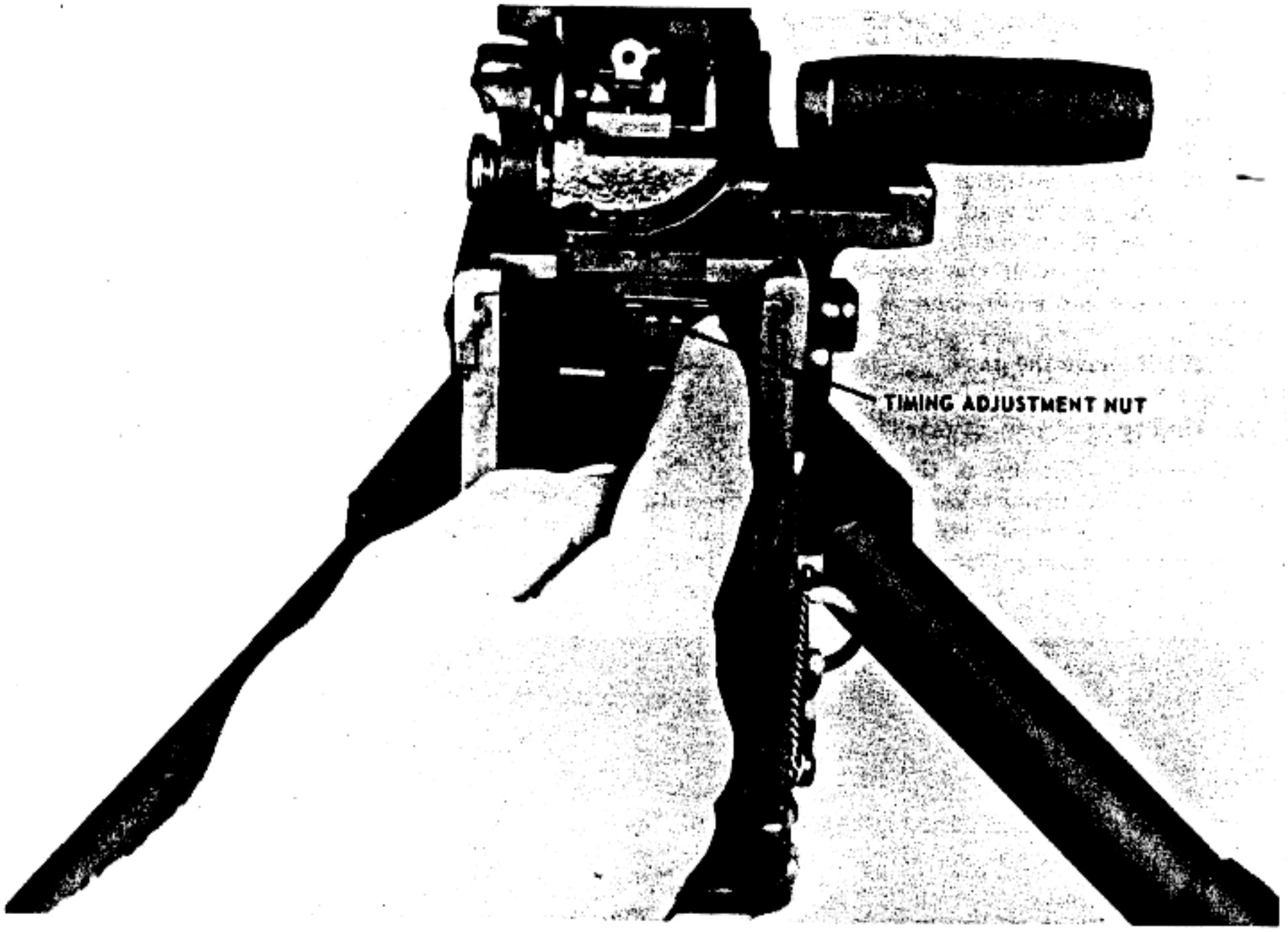


Figure 83. Rotating the timing adjustment nut to the left.

(3) Raise the extractor and pull the retracting slide handle back until the front end of the barrel extension is about one-fourth of an inch from the trunnion block.

(4) Insert the NO FIRE timing gage between the barrel extension and the trunnion block, placing the beveled edge of the gage on the barrel notches (fig 82).

(5) Let the barrel extension close slowly on the gage.

(6) Depress the trigger firmly, attempting to release the firing pin. The firing pin should not release. If the firing pin does release, the gun is timed to fire too early.

(7) To correct for this, pull the retracting slide handle to the rear, allow the bolt to go forward. Insert the fire gage, remove the backplate and screw the timing adjustment nut to the *left* until it rests on the trigger lever (fig 83). Press "up" firmly on the trigger lever attempting to fire. Rotate the timing adjustment nut to the *right* one (1) notch at a time, each time pressing up firmly on the trigger lever, attempting to fire the weapon.

(8) When the firing pin is released, turn the timing adjustment nut two (2) additional notches to the "right" and replace the backplate.

Caution. **Do not attempt to cock the gun with the backplate off.**

(9) Recock the weapon and allow the bolt to go forward. Insert the "NO FIRE" gage between the trunnion block and the barrel extension and attempt to fire the weapon by depressing the trigger. The weapon should not fire. If the weapon does fire, a mechanical defect exists and the gunner should notify his organizational maintenance personnel.

(10) Replace the "NO FIRE" gage with the "FIRE" gage and attempt to fire. The weapon should fire.

(11) When all of the above procedures have been completed, the weapon is correctly timed.

CHAPTER 3

OPERATION AND FUNCTIONING

Section I. OPERATION

13. General

Operation includes loading or unloading the gun, clearing the gun, or allowing the bolt to go forward.

14. Half-Loading and Loading the Gun

a. To half-load the gun, the gunner insures the bolt is forward and the cover is closed. The assistant gunner inserts the double loop end of the ammunition belt in the feedway until the first round is engaged by the belt holding pawl. The gunner grasps the retracting slide handle with the right hand, palm up, and vigorously jerks the bolt to the rear and releases the retracting slide handle. If the bolt latch release lock is engaging the bolt latch release, the bolt and retracting slide handle will move forward under pressure of the driving spring group, half-loading the gun. However, if the bolt latch release is up and free of the bolt latch release lock, the bolt latch will hold the bolt and retracting side handle to the rear. The retracting slide handle must be returned to its most forward position prior to releasing the bolt. To complete half-loading, press the bolt latch release, allowing the bolt to go forward.

b. To fully load the gun, the procedure is the same as in half-loading, except it requires the gunner to pull and release the bolt twice.

15. Unloading and Clearing the Gun

a. To unload the gun, the gunner unlocks the bolt latch release (if applicable) and raises the cover. The assistant gunner lifts the ammunition belt from the feedway. The gunner pulls the bolt to the rear and examines the chamber and T-slot to insure they hold no rounds. In darkness, the gunner must feel the chamber and T-slot.

b. To clear the gun additional precautions are taken. After the steps above have been accomplished, a wooden block, extending above and below the receiver approximately one inch, is inserted in the receiver between the bolt and the rear of the barrel. A cleaning rod is then inserted in the muzzle end of the barrel, pushed through the bore until it can be seen in the receiver, and immediately removed (fig 84).

c. During any temporary cessation of fire, where it is not necessary to unload or clear the gun, the bolt should be latched to the rear to prevent accidental firing.

16. Precautions During Operation

a. Insure that the cover (once raised) remains in the raised position, with the barrel remaining in the gun, before allowing the bolt to go forward.

Figure 84. Clearing the gun.

b. If the cover is lowered when the bolt is to the rear, the belt feed lever lug will not fit into its proper groove in the bolt. Thus, parts may be damaged as the bolt goes forward. In the cover assembly, the belt feed lever lug is held to the left by the action of the shoulder headless pin and spring, just above the pivot.

c. If the bolt is allowed to go forward with the barrel out of the gun, parts may be damaged when the bolt slams forward. The added weight and cushioning effect of the barrel act as a buffer and protect the parts from damage.

d. To allow the bolt to go forward with the barrel out of the gun, pull the retracting slide handle all the way to the rear, engaging the bolt stud in the notch in the rear of the retracting slide. Maintain a steady pressure to the rear on the retracting slide handle; press the bolt latch release and allow the bolt to ride slowly forwar

17. Single Shot Operation

a. To fire the gun single shot, the bolt latch release must be in the up position. The latch engages the notches on top of the bolt when the bolt is to the rear after each round is fired.

b. When the bolt latch release is depressed the latch assembly is raised, allowing the bolt to be driven forward into battery. The gun may then be fired by pressing the trigger.

c. When the bolt latch release is locked down by the bolt latch release lock on the buffer tube sleeve, the gun functions as an automatic weapon.

Section II. FUNCTIONING

18. General

a. The cycle of operation is broken down into eight basic steps. More than one step may occur at the same time. The steps are listed below in the order explained:

(1) *Feeding.* Feeding is the action of placing a cartridge in the receiver, approximately in back of the barrel, ready for chambering.

(2) *Chambering.* The round is placed in the chamber.

(3) *Locking.* The bolt is locked to the barrel and barrel extension.

(4) *Firing.* The releasing of the firing pin, igniting the primer of the cartridge.

(5) *Unlocking.* The bolt unlocks from the barrel and barrel extension.

(6) *Extracting.* The empty cartridge case is pulled from the chamber.

(7) *Ejecting.* The empty cartridge case is ejected from the receiver.

(8) *Cocking.* The firing pin is withdrawn into the cocked position.

b. With the Browning machinegun, caliber .50 HB, M2, the recoiling groups must be manually operated to place the first round in the chamber. The cycle of operation begins with the first round positioned over the belt holding pawl. The recoiling groups are in their forward position.

19. Feeding

a. Left-Hand Feed.

(1) When the bolt is fully forward, the belt feed slide is in the cover; the ammunition belt is held in the feedway by the belt holding pawl (fig 85 and 86).

(2) As the bolt moves to the rear, the cam grooves guide the belt feed lever, pivoting the lever and moving the slide out the side of the cover (fig 87). The belt is held stationary by the belt holding pawl, while the belt feed pawl pivots compressing its spring, and rides up over the link holding the first round (fig 88).

(3) When the bolt is all the way to the rear, the belt feed slide moves out far enough to allow the belt feed pawl spring to force the pawl down behind the first round (fig 89).

(4) As the bolt moves forward, the belt feed lever moves the slide back into the receiver. The

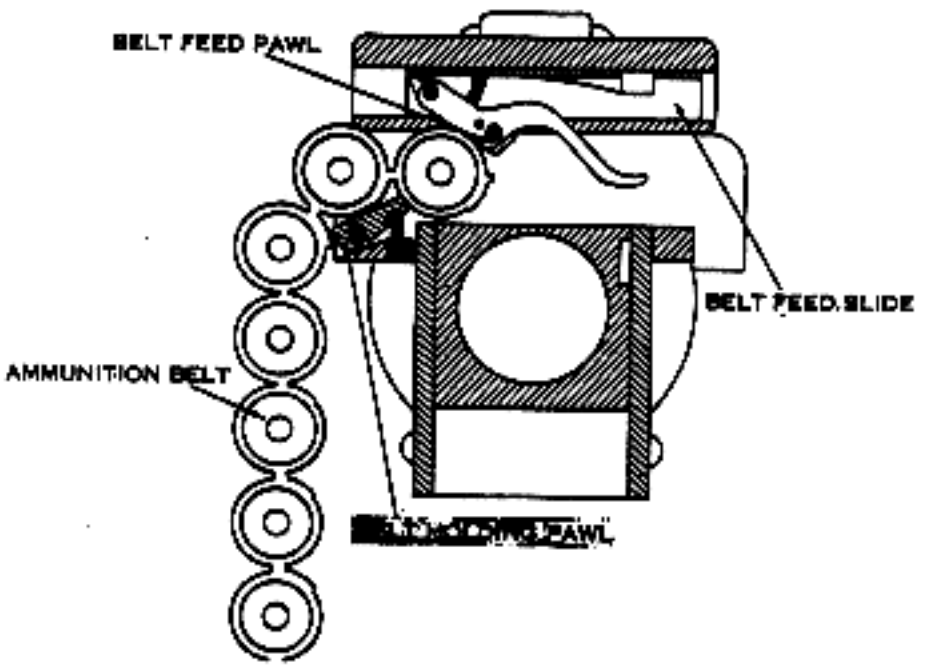


Figure 85. Feeding—bolt fully forward, belt feed slide in the cover and ammunition belt held in the feedway by the belt holding pawl (rear view).

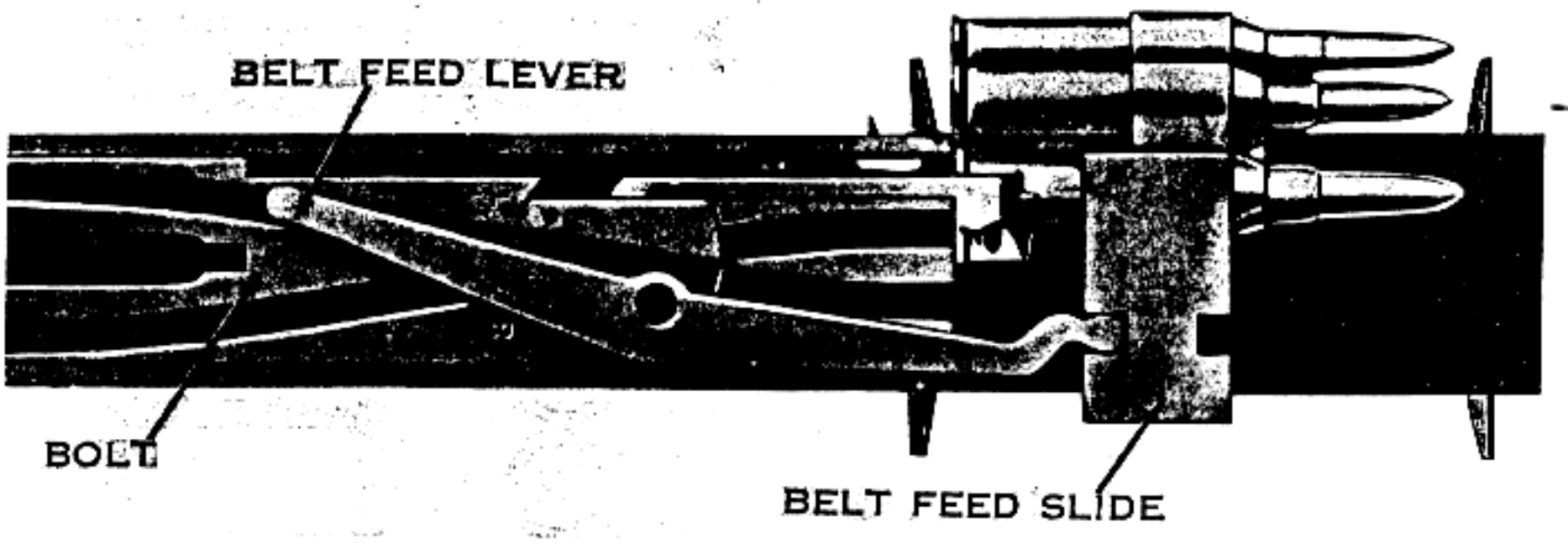


Figure 86. Feeding—bolt fully forward, belt feed slide in the cover and ammunition belt held in the feedway by the belt holding pawl (top view).

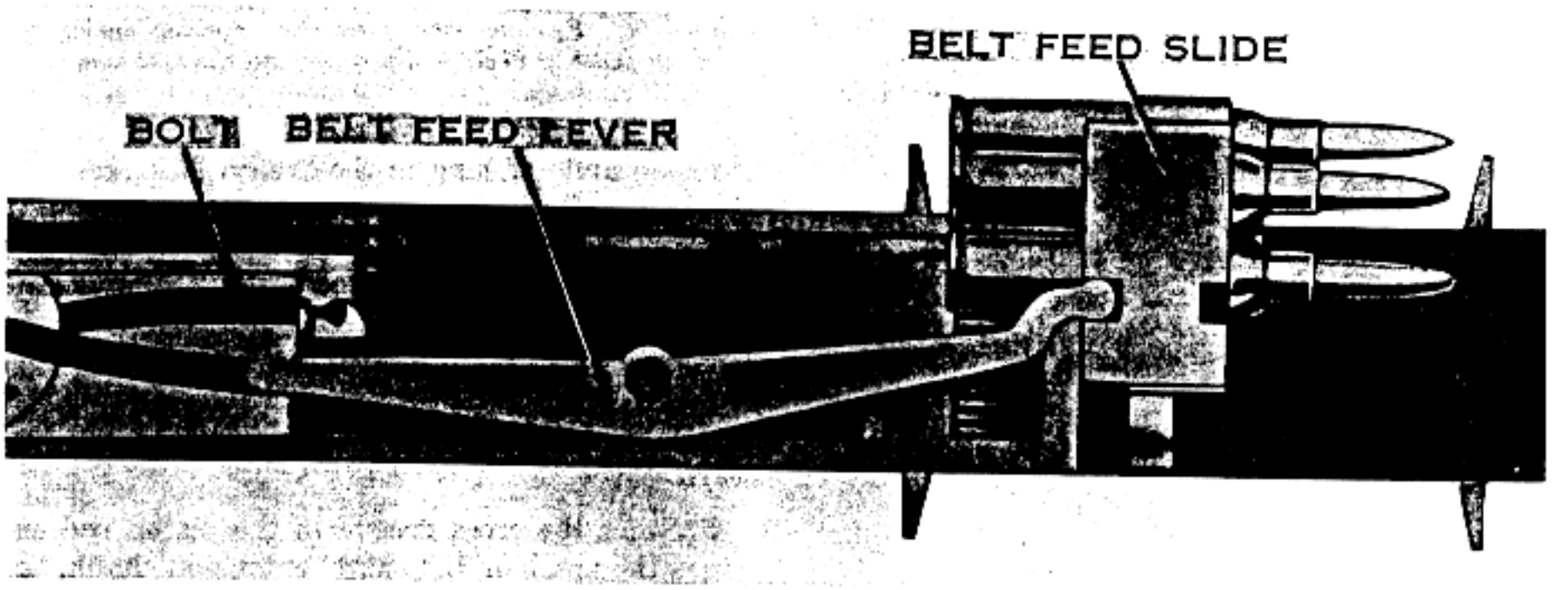


Figure 87. Feeding—belt feed slide moving out of the side of the cover.

belt is pulled in by the belt feed pawl. The next round rides over the belt holding pawl, compressing its spring and forcing the pawl down until the round has passed over the pawl (fig 90).

(5) When the bolt is fully forward, the slide is back in the cover; the first round is engaged by the extractor.

(6) If for any reason a round is not extracted from the belt, the belt feed pawl arm will ride up over the round, holding up the belt feed pawl to prevent double-feeding.

b. Withdrawing a Round From the Belt.

(1) The extractor grips the first round in the feedway and, as the recoiling parts move to the ear, withdraws it from the ammunition belt. Initially, the grip of the extractor is held secure by the downward pressure of the cover extractor spring (fig 91).

(2) As the bolt continues its movement to the rear, the cover extractor cam forces the extractor down, causing the cartridge to enter the T-slot in the bolt (fig 92).

(3) As the bolt moves to the rear and the extractor is forced down, the extractor lug, riding along the top of the extractor switch, forces the rear end of the extractor switch downward. Near the end of the rearward movement, the extractor lug overrides the end of the switch and the switch snaps back up into position.

20. Chambering

As the bolt moves forward, the round is held by the T-slot and the extractor assembly. The extractor stop pin (on the left side of the bolt) permits the extractor assembly to go down only far enough to aline the round with the chamber (fig

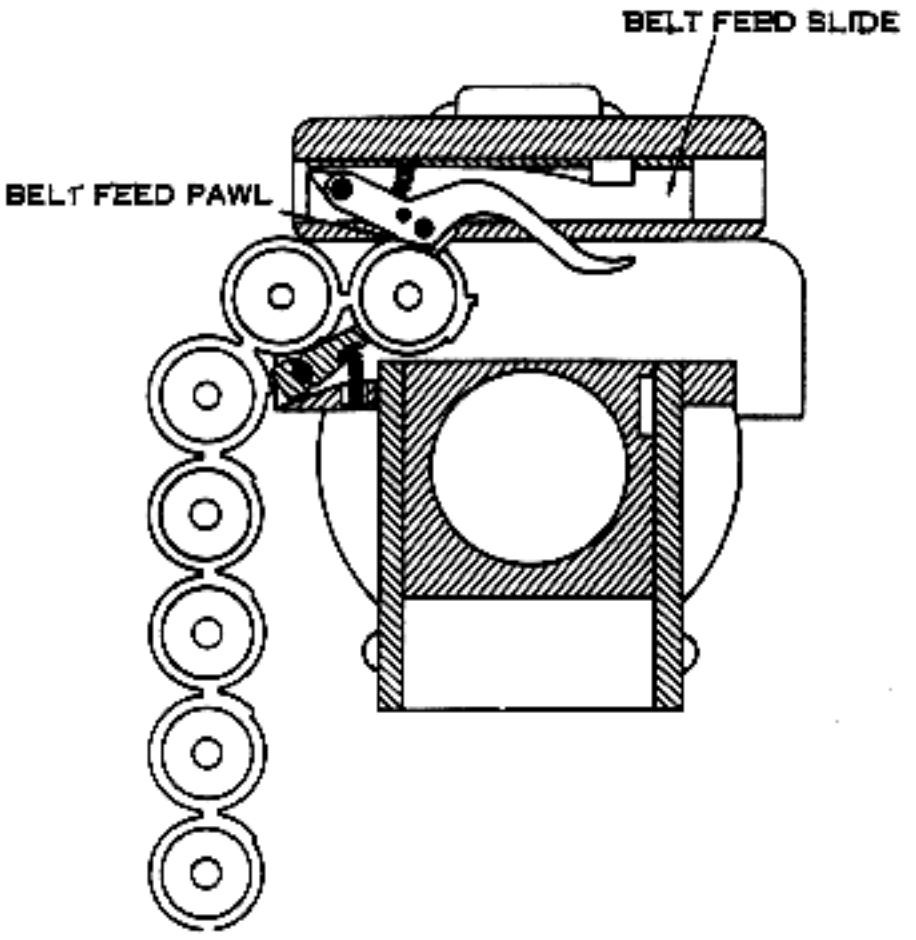


Figure 88. Feeding—belt feed pawl riding over the first round.

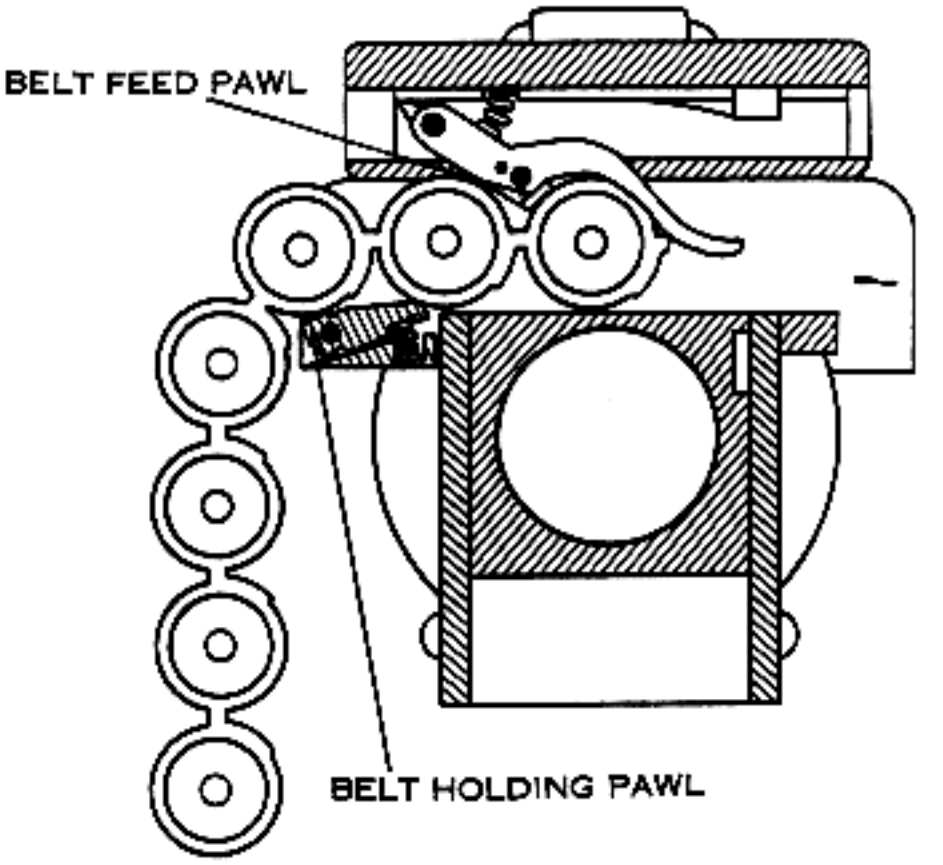


Figure 90. Feeding—belt feed slide moving inside the cover, with the belt feed pawl behind the first round.

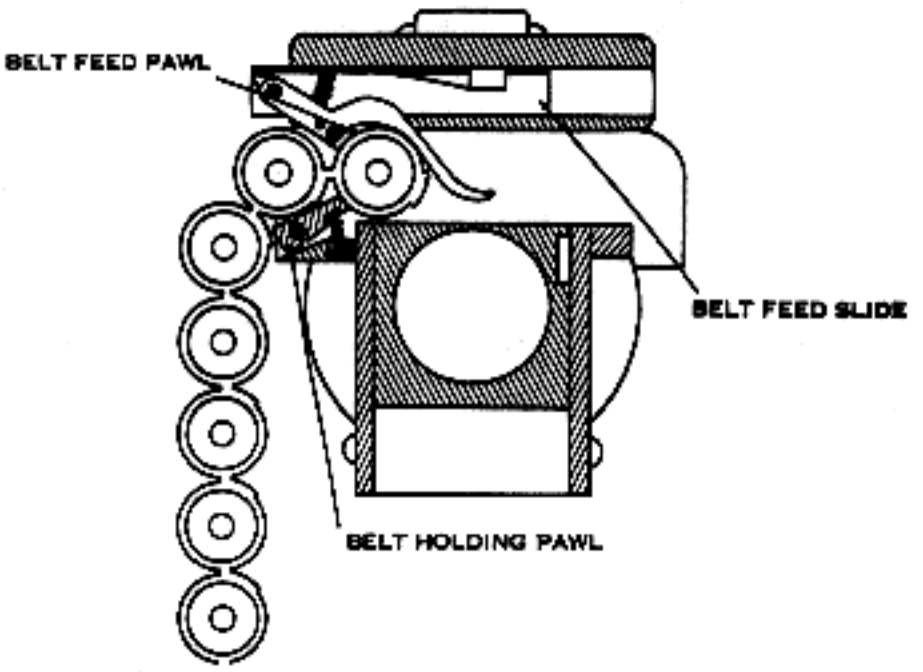


Figure 89. Feeding—belt feed pawl behind the first round.

93). As the bolt continues forward, the round is chambered. As this action takes place, the extractor lug rides up the extractor cam, compressing the cover extractor spring, and through the pressure of the spring, snaps into the groove in the next cartridge base.

21. Locking

a. Initially, the bolt is forced forward in counter-recoil by the energy stored in the driving spring assembly and the compressed buffer disks. At the start of counter-recoil, the barrel buffer body tube lock keeps the accelerator tips from bouncing up too soon and catching in the breech lock recess in the bolt. After the bolt travels forward about 5 inches, the lower rear projection of the bolt strikes the tips of the accelerator, turning the accelerator forward. This unlocks the barrel extension from the barrel buffer body group and releases the barrel buffer spring. The barrel buffer spring expands, forcing the piston rod forward.

b. Since the cross groove in the piston rod engages the notch on the barrel extension shank, the barrel extension and barrel are also forced forward by the action of the barrel buffer spring. Some of the forward motion of the bolt is transmitted to the barrel extension through the accelerator. As the accelerator rotates forward, the front of the accelerator speeds up the barrel extension; at the same time, the accelerator tips slow down the bolt.

c. Locking begins 1⅛ inches before the recoiling groups (bolt, barrel extension, and barrel) are fully forward. The breech lock in the barrel extension rides up the breech lock cam in the bottom of the receiver into the breech lock recess in the bottom of the bolt, locking the recoiling groups together. The recoiling groups are completely locked together three-fourths of an inch before the groups are fully forward (fig 94).

22. Firing

a. As the trigger is pressed down, it pivots on

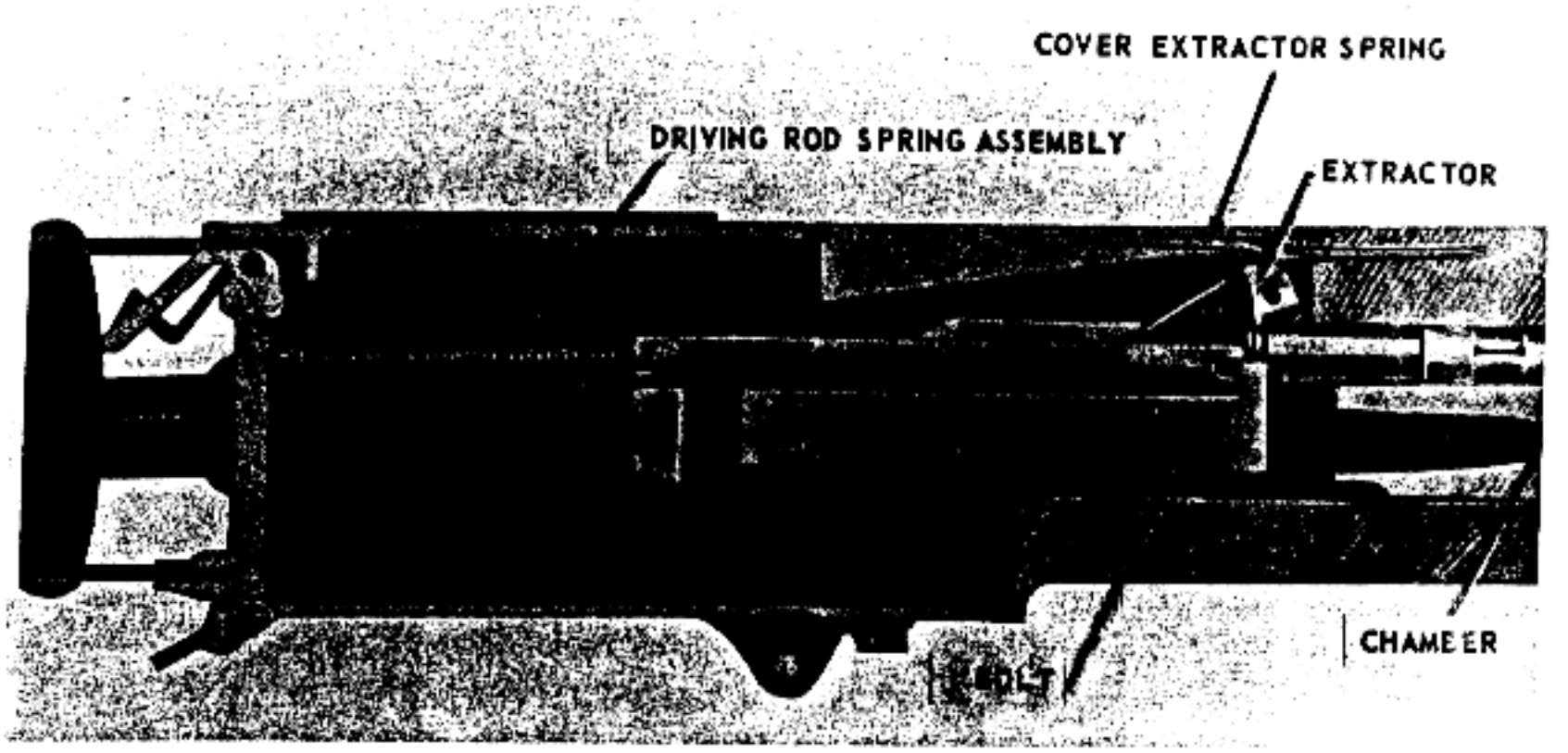


Figure 91. Feeding—withdrawing the first round from the feedway.

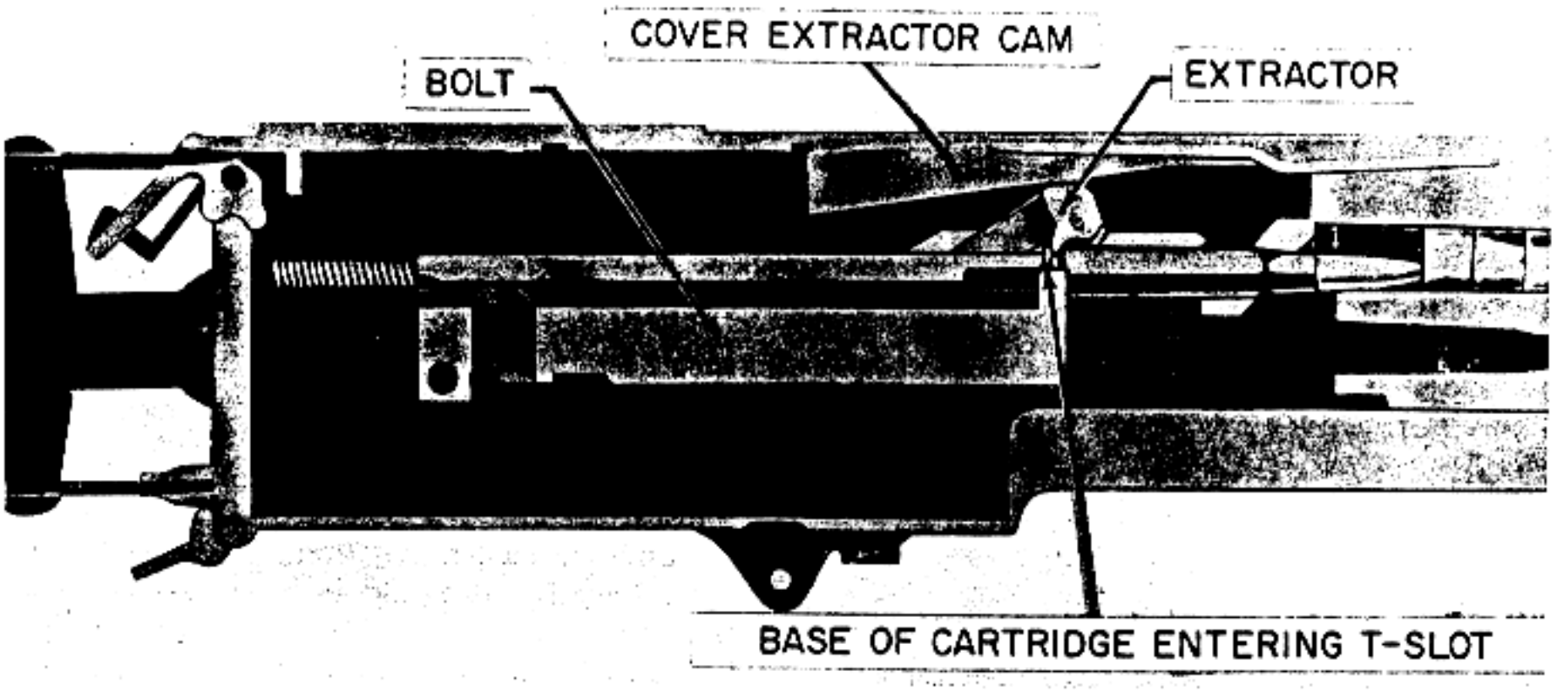


Figure 92. Feeding—cartridge entering the T-slot in the bolt.

the trigger pin, so that the trigger cam on the inside of the backplate engages, and raises, the rear end of the trigger lever, which, in turn, pivots on the trigger lever pin assembly, causing the front end of the trigger lever to press down on the top of the sear stud. The sear is forced down until the hooked notch of the firing pin extension is disengaged from the sear notch. The firing pin and firing pin extension are driven forward by the firing pin spring; the striker of the firing pin hits the primer of the cartridge, firing the round (fig 95 and 96).

b. For automatic firing, the bolt latch release must be locked, or held depressed, so that the bolt latch will not engage the notches in top of the bolt, holding the bolt to the rear, as in single-shot firing. The trigger is pressed and held down. Each time the bolt travels forward in counter-recoil, the trigger lever depresses the sear releasing the firing pin extension assembly and the firing pin, automatically firing the next round when the forward movement of the recoiling groups is nearly completed. The gun should fire about one-sixteenth of an inch before the recoiling groups are

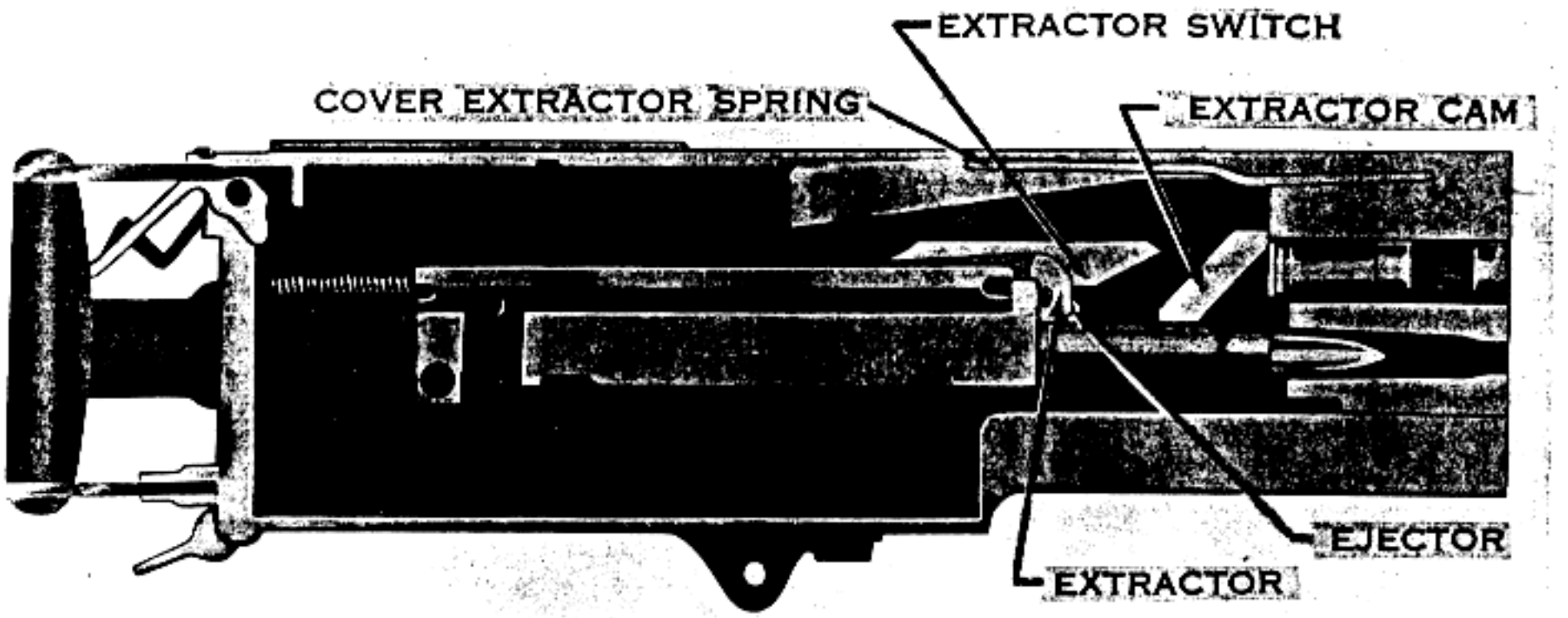


Figure 93. Chambering—new round alined with the chamber.

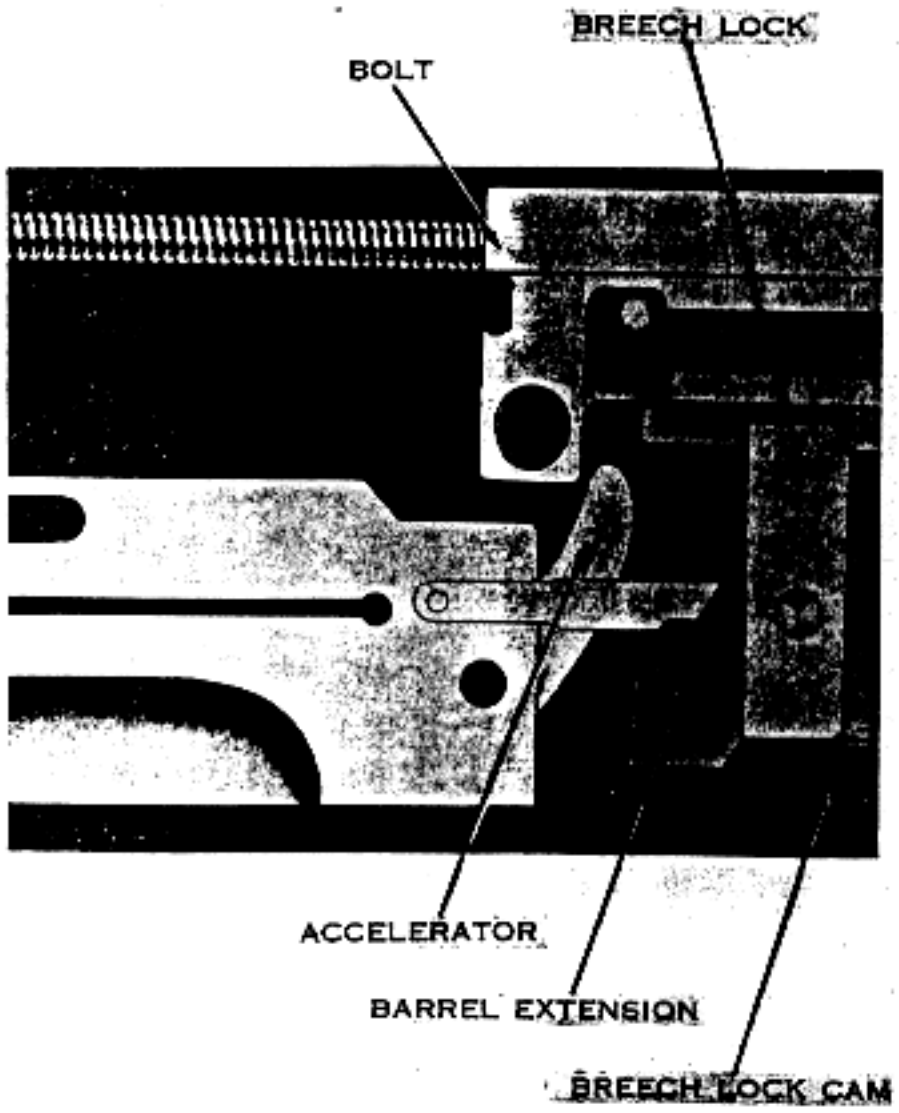


Figure 94. Locking-recoiling groups locked together.

fully forward. At the instant of firing, the parts are in battery, i.e., the proper position for firing. Only the first round should be fired with the parts fully forward. The gun fires automatically as long as the trigger and bolt latch are held down, and ammunition is fed into the gun.

23. Unlocking

a. At the instant of firing, the bolt is locked to the barrel extension and against the rear end of the barrel by the breech lock, which is on top of the breech lock cam and in the breech lock recess in the bottom of the bolt (fig 94).

b. When the cartridge explodes, the bullet travels out of the barrel; the force of recoil drives the recoiling groups rearward. During the first three-fourths of an inch, the recoiling groups are locked together. As this movement takes place, the breech lock is moved off the breech lock cam stop, allowing the breech lock depressors (acting on the breech lock pin) to force the breech lock down, out of its recess from the bottom of the bolt (fig 97). At the end of the first three-fourths of an inch of recoil, the bolt is unlocked, free to move to the rear, independent of the barrel and barrel extension (fig 98).

c. As the recoiling groups move to the rear, the barrel extension causes the tips of the accelerator to rotate rearward. The accelerator tips strike the lower rear projection of the bolt, accelerating the movement of the bolt to the rear (fig 99).

d. The barrel and barrel extension continue to travel to the rear an additional three-eighths of an inch, or an approximate total distance of 1⅛ inches, until they are stopped by the barrel buffer assembly (fig 100).

e. During the recoil of 1⅛ inches, the barrel buffer spring is compressed by the barrel extension shank, since the notch on the shank is engaged in the cross groove in the piston rod head.

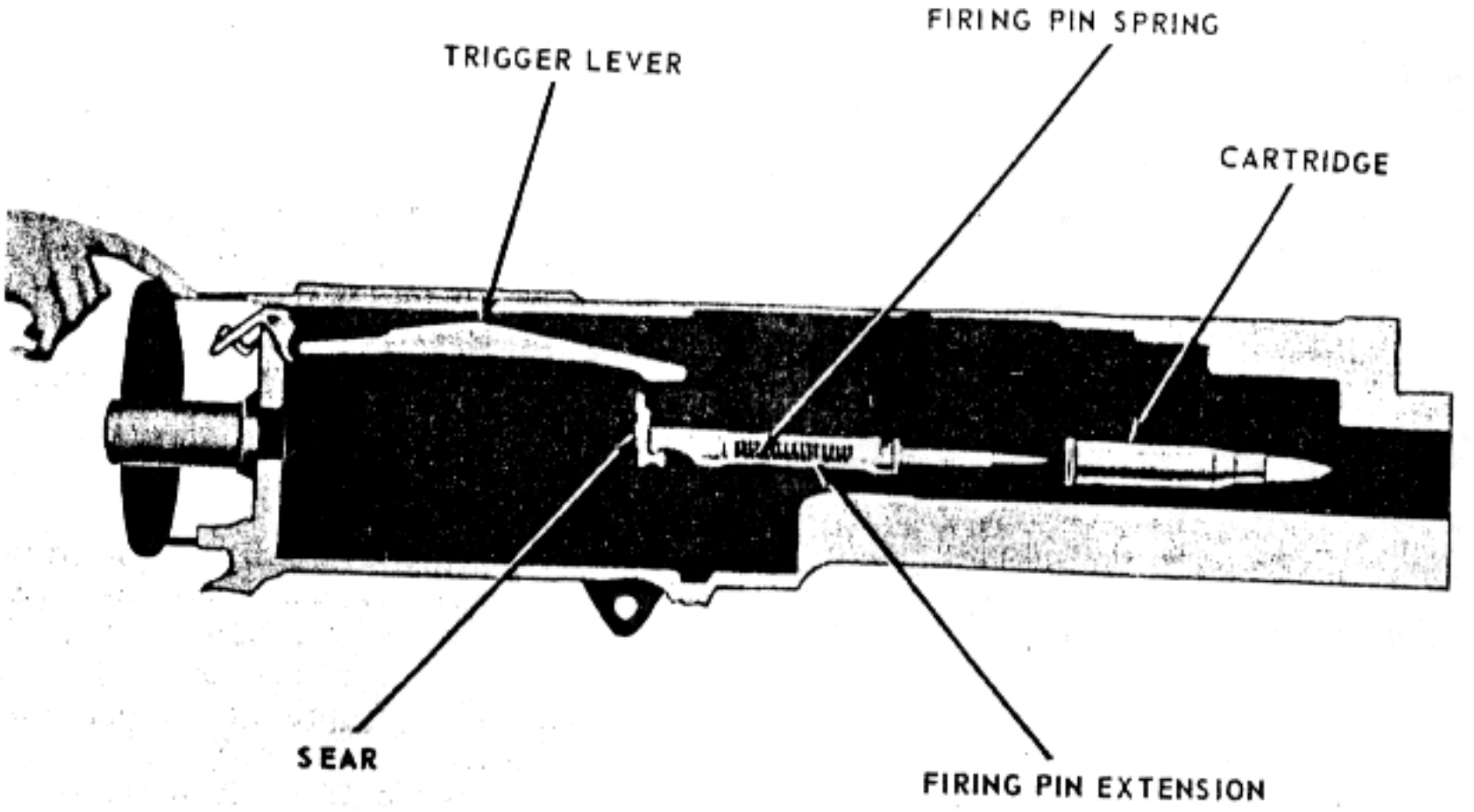


Figure 95. Firing—ready to fire.

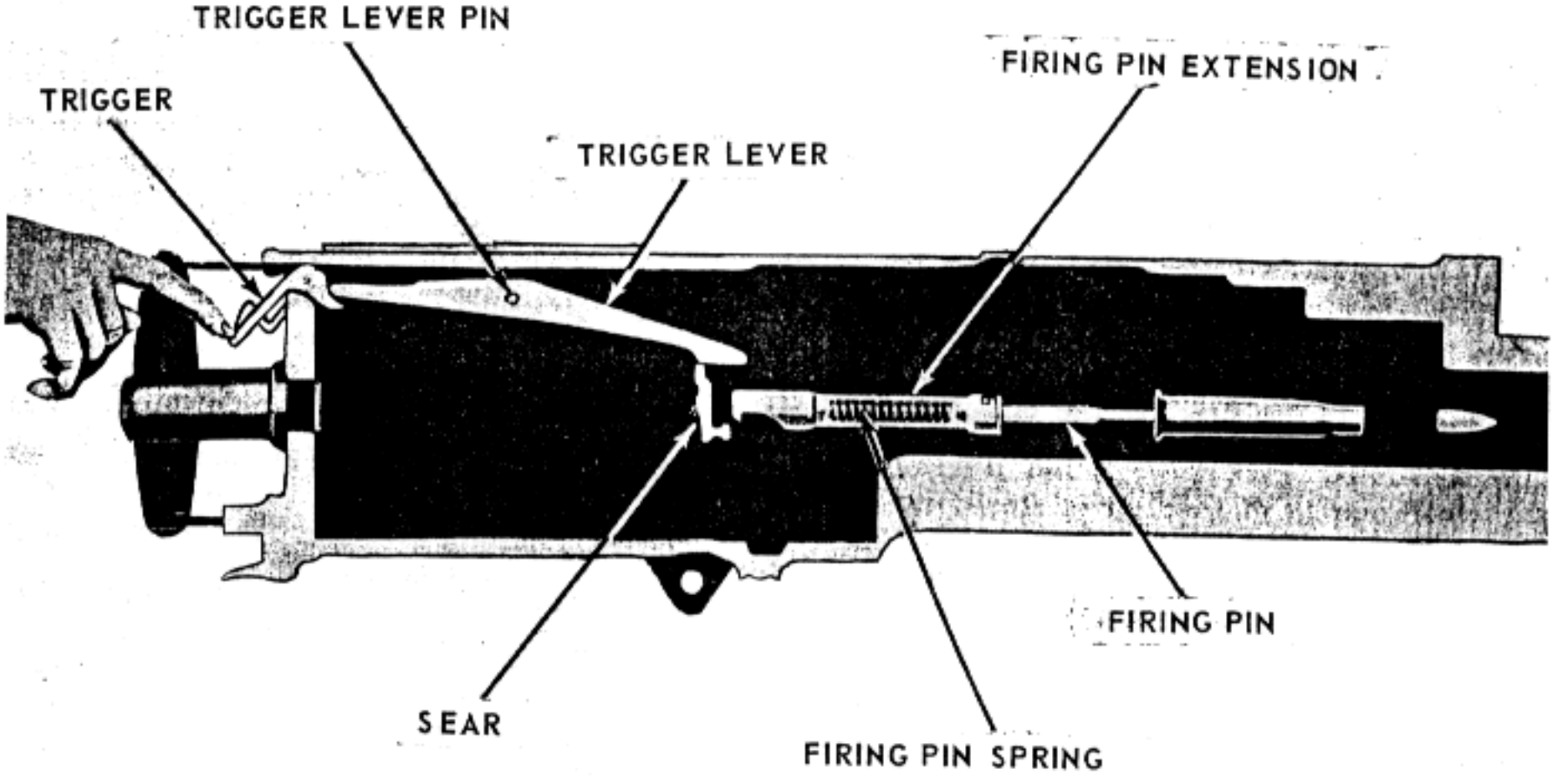


Figure 96. Firing—round ignited.

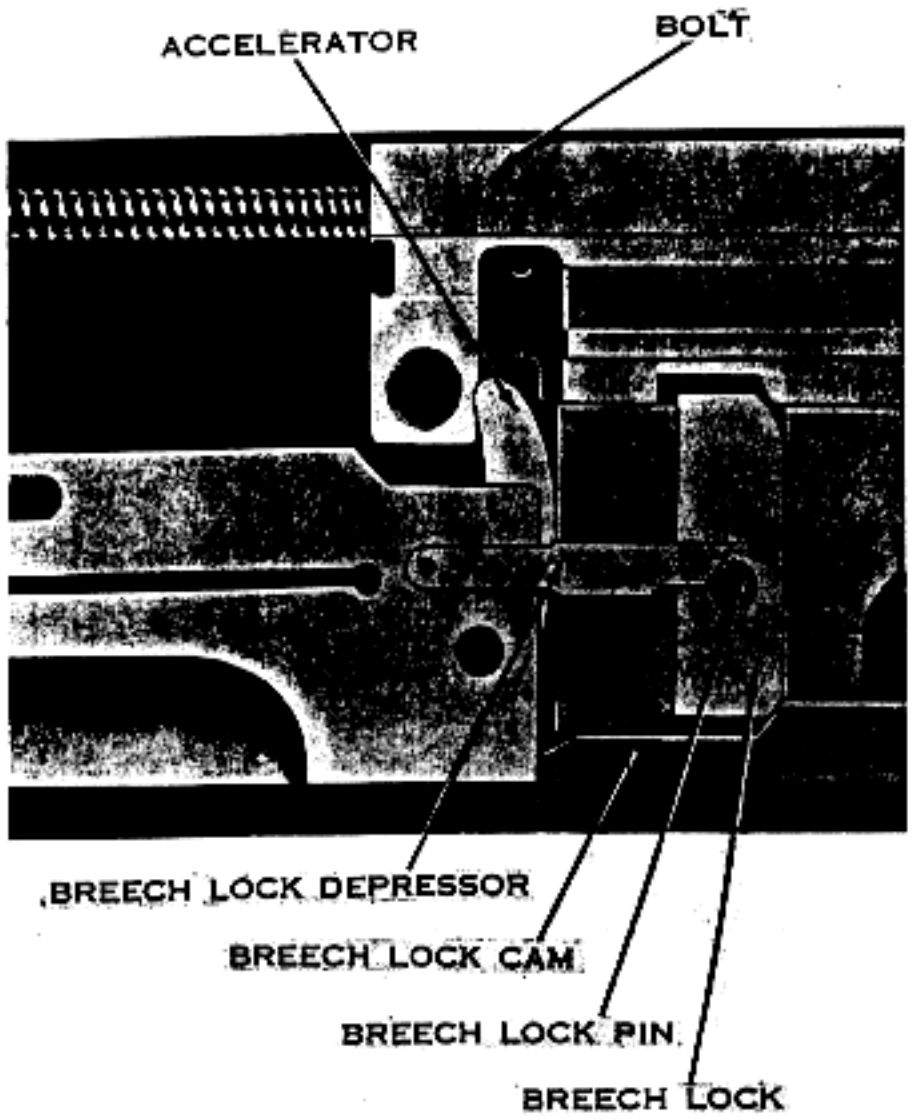


Figure 97. Unlocking—breech lock being forced out of its recess in the bolt.

The spring is locked in the compressed position by the claws of the accelerator, which engage the shoulders of the barrel extension shank (fig 101).

f. After its initial travel of three-fourths of an inch, the bolt travels an additional 6⅜ inches to the rear, after it is unlocked from the barrel and barrel extension, for a total of 7⅛ inches. During this movement, the driving springs are compressed. The rearward movement of the bolt is stopped as the bolt strikes the buffer plate. Part of the recoil energy of the bolt is stored by the driving spring rod assembly, and part is absorbed by the buffer disks in the backplate (fig 102).

24. Extracting

a. The empty case, held by the T-slot, has been expanded by the force of the explosion; therefore, it fits snugly in the chamber. If the case is withdrawn from the chamber too rapidly, it may be torn. To prevent this, and to insure slow initial extraction of the case, the top forward edge of the breech lock and the forward edge of the lock recess in the bolt are beveled. As the breech lock is unlocked, the initial movement of the bolt away from the barrel and barrel extension is gradual (fig 97).

b. The slope of the locking faces facilitates locking and unlocking and prevents sticking. The leverage of the accelerator tips on the bolt speeds extraction, after it is started, by kicking the bolt to the rear to extract the empty case from the chamber (fig 98).

25. Ejecting

As the bolt starts its forward movement (counter-recoil) the extractor lug rides below the extractor switch, forcing the extractor assembly farther down, until the round is in the center of the T-slot. The round, still gripped by the extractor, ejects the empty case from the T-slot. The last empty case of an ammunition belt is pushed out by the ejector.

26. Cocking

a. When the recoiling groups are fully forward, the top of the cocking lever rests on the rear half of the V-slot in the top plate bracket (fig 103). As the bolt moves to the rear, the top of the cocking lever is forced forward. The lower end pivots to the rear on the cocking lever pin. The rounded nose of the cocking lever, which fits through the slot in the firing pin extension, forces the extension to the rear, compressing the firing pin spring against the sear stop pin (accelerator stop).

b. As the firing pin extension is pressed to the rear, the hooked notch of the extension rides over the sear notch, forcing the sear down. The sear spring forces the sear back up after the hooked notch of the firing pin extension has entered the sear notch. The pressure of the sear and firing pin springs holds the two notches locked together. There is a slight overtravel of the firing pin extension in its movement to the rear, to insure proper engagement with sear (fig 104). As the bolt starts forward, the overtravel is taken up and completed when the cocking lever enters the V-slot of the top plate bracket, and is cammed towards the rear; pressure on the cocking lever is relieved as the bolt starts forward (fig 105).

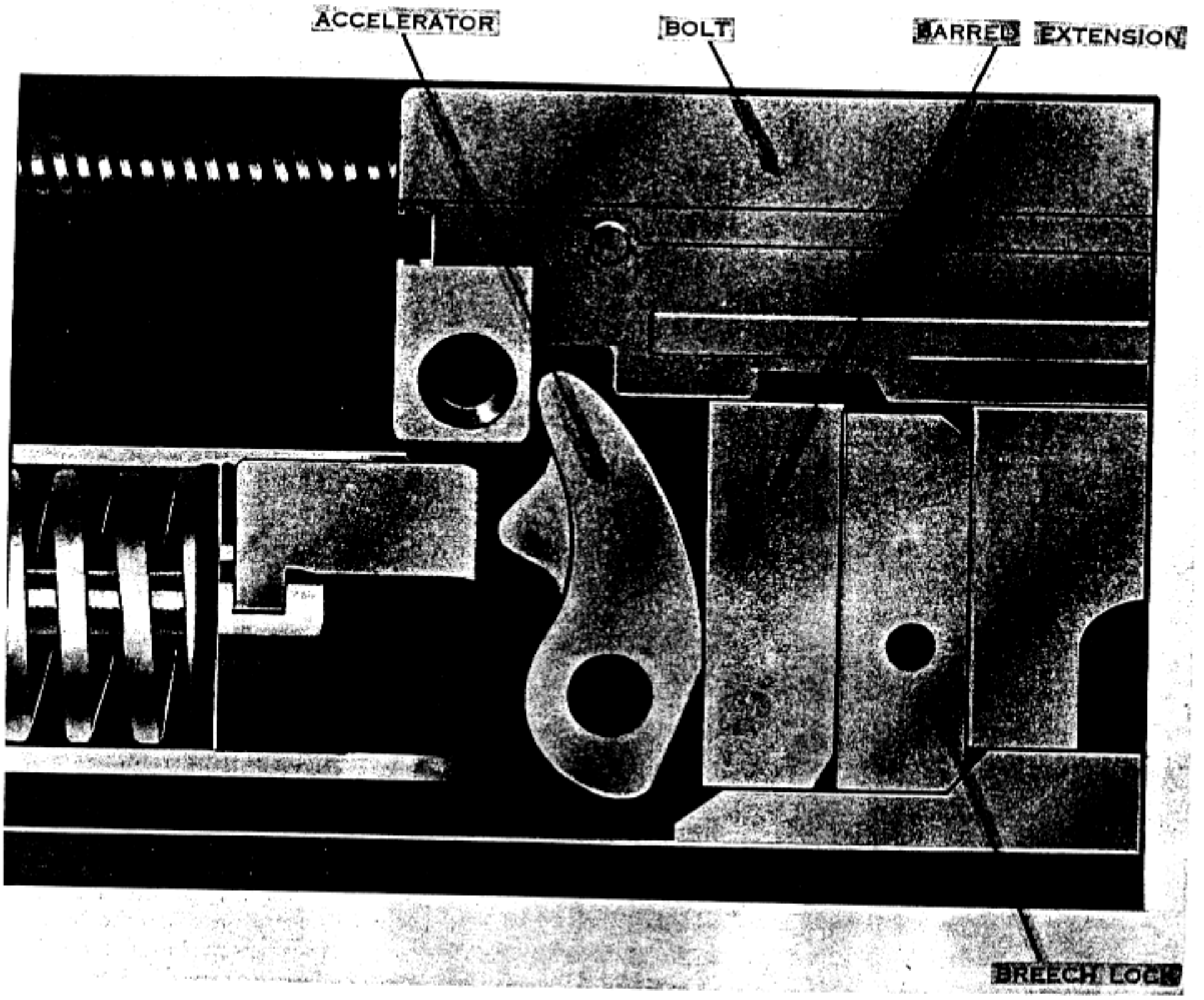


Figure 98. Unlocking—bolt unlocked from the breech lock.

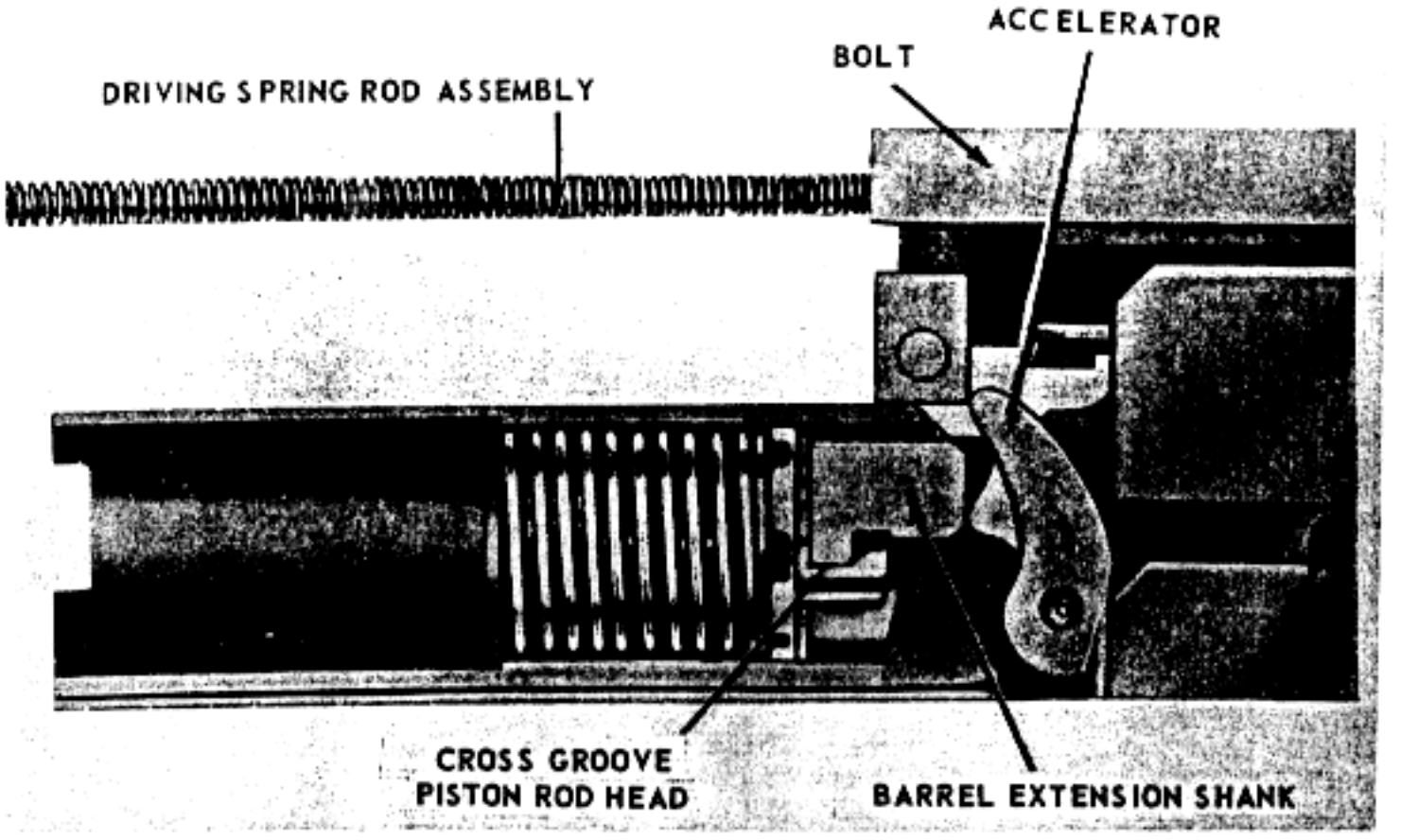


Figure 99. Unlocking—accelerator tips accelerating the movement of the bolt to the rear.

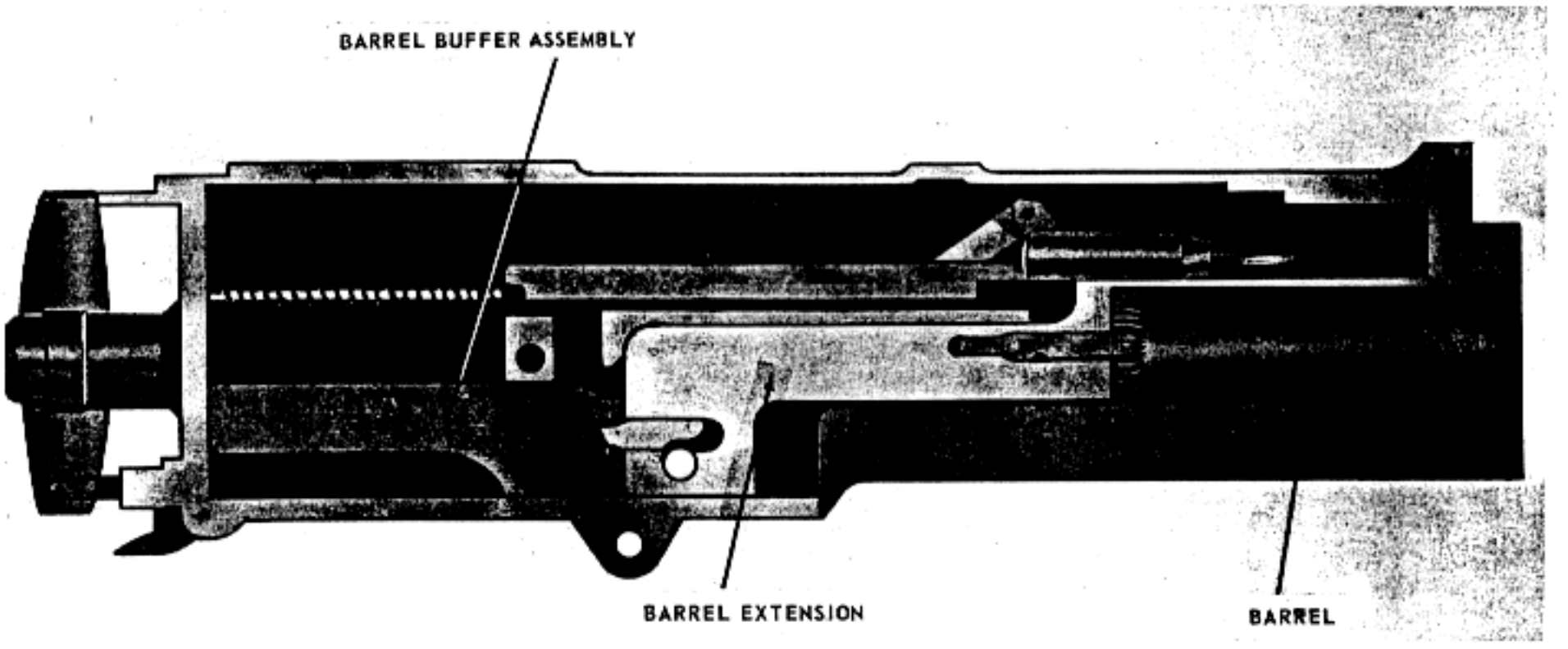


Figure 100. Unlocking—barrel and barrel extension stopped by the barrel buffer assembly.

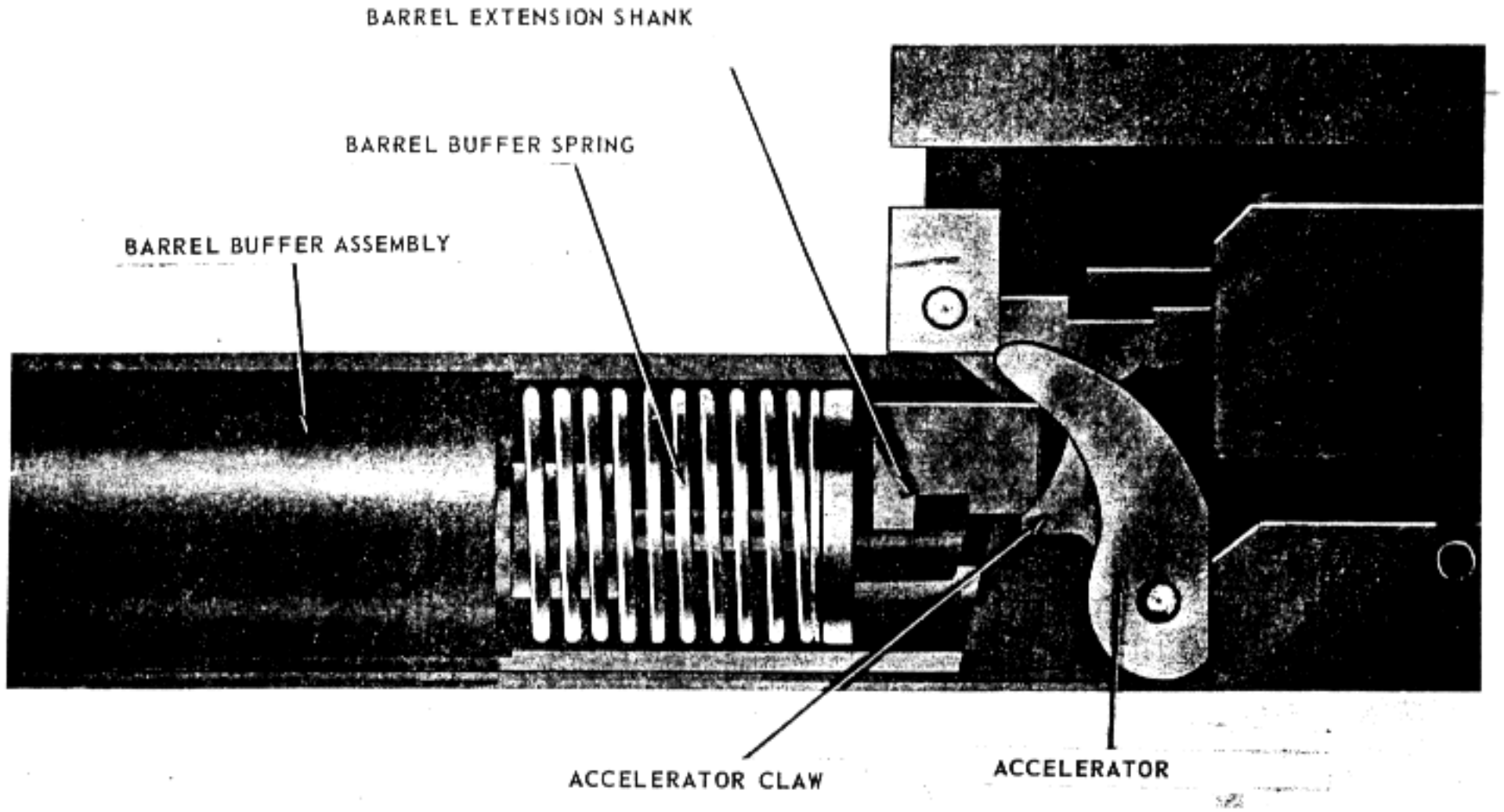


Figure 101. Unlocking—barrel buffer spring compressed and locked.

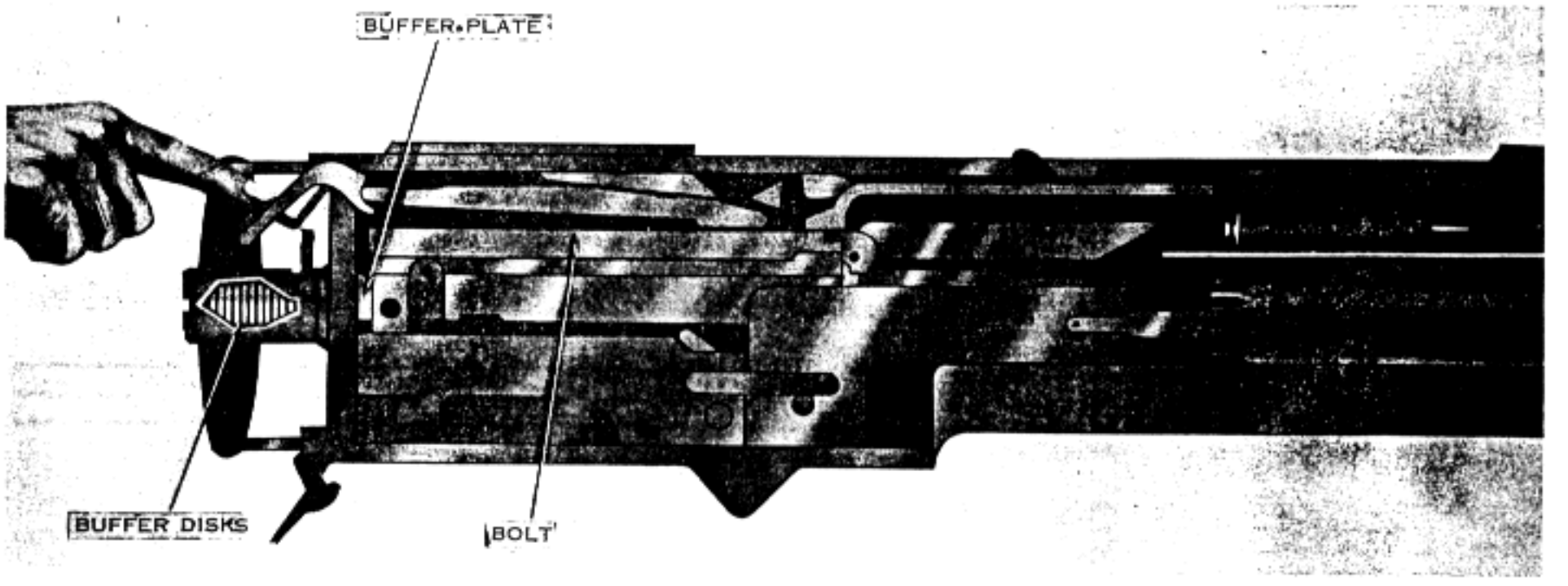


Figure 102. Unlocking—recoil movement completed.

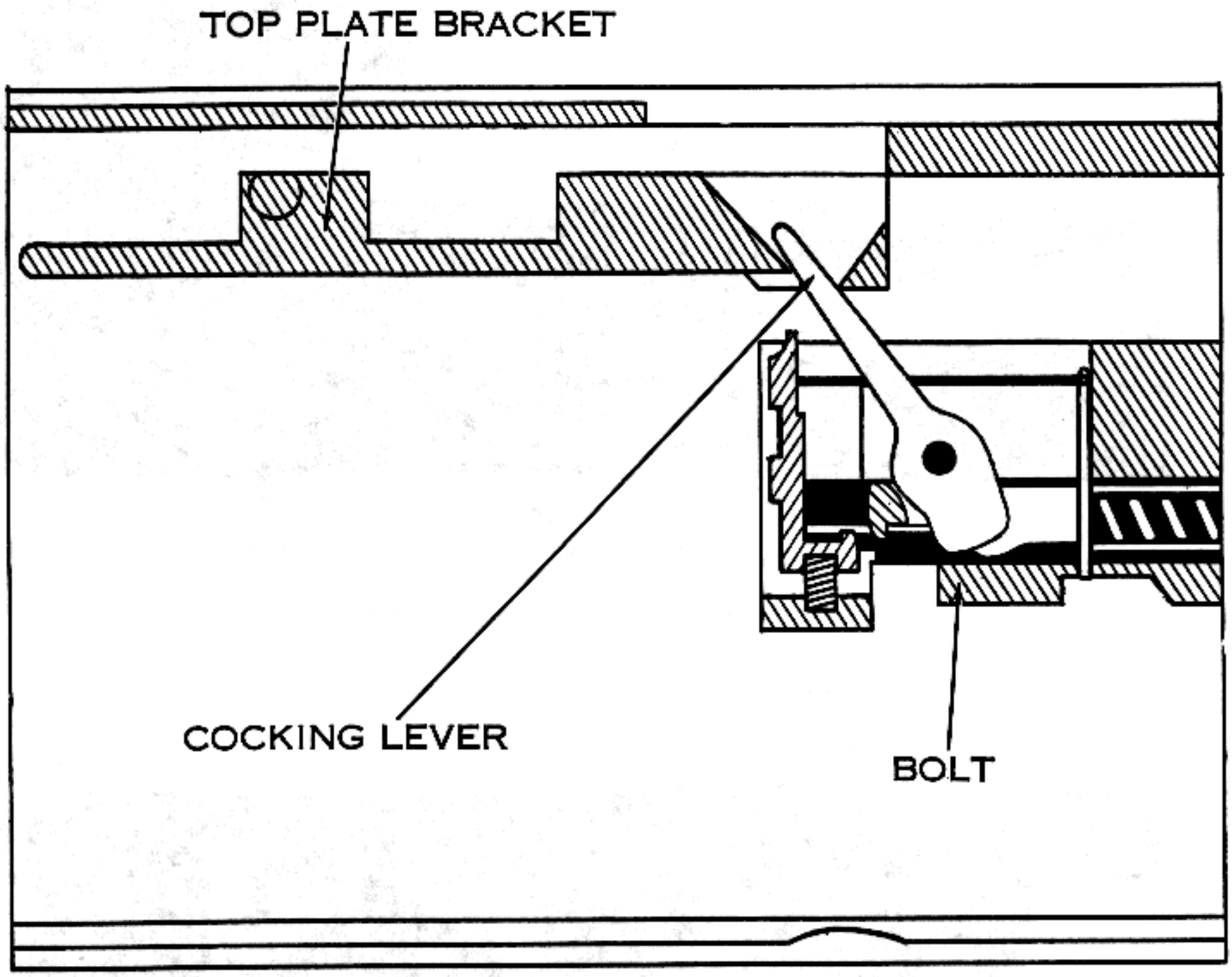


Figure 108. Cocking—recoiling group forward, gun not cocked.

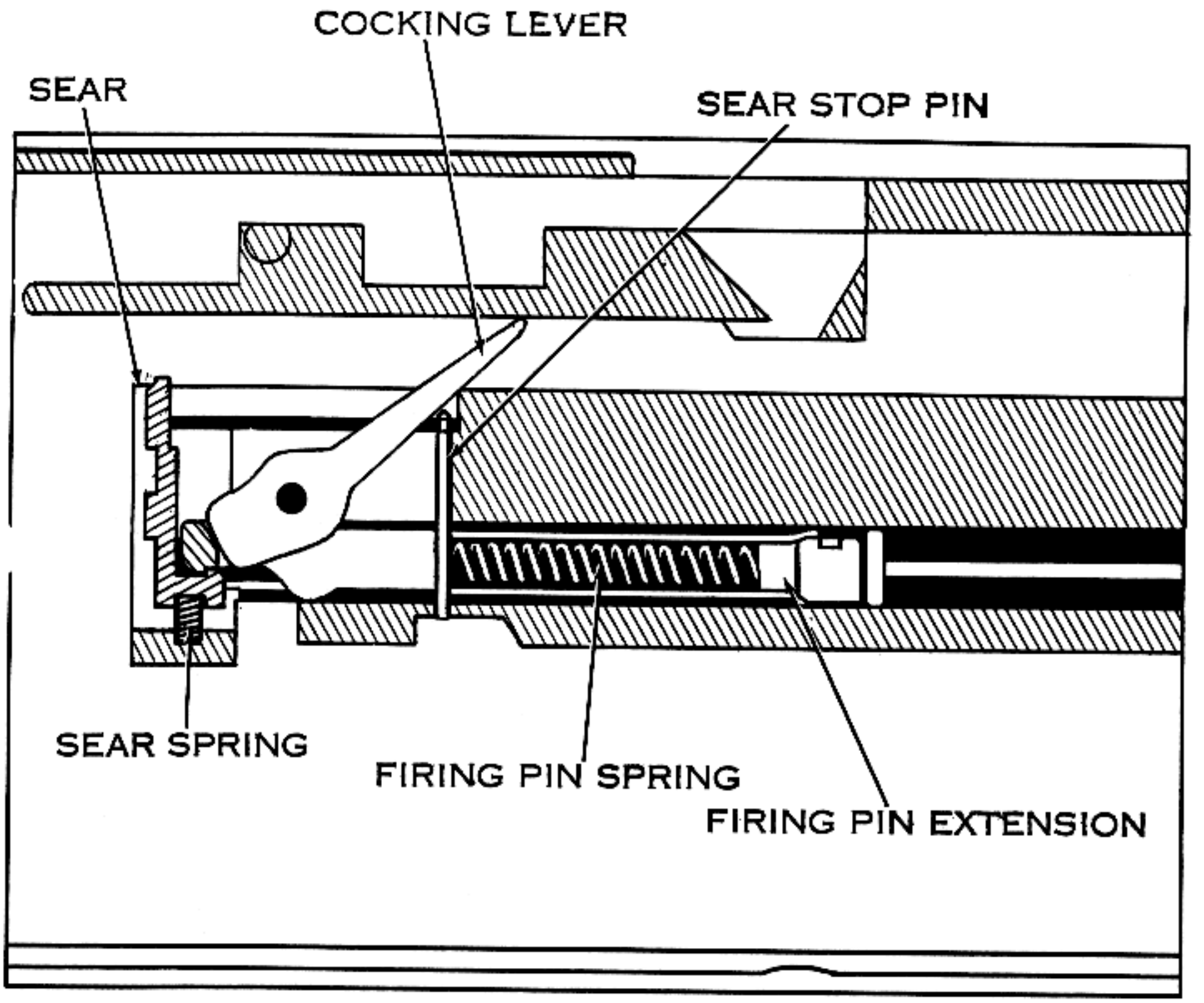


Figure 104. Cocking—hooked notch of the firing pin extension engaged by the sear notch.

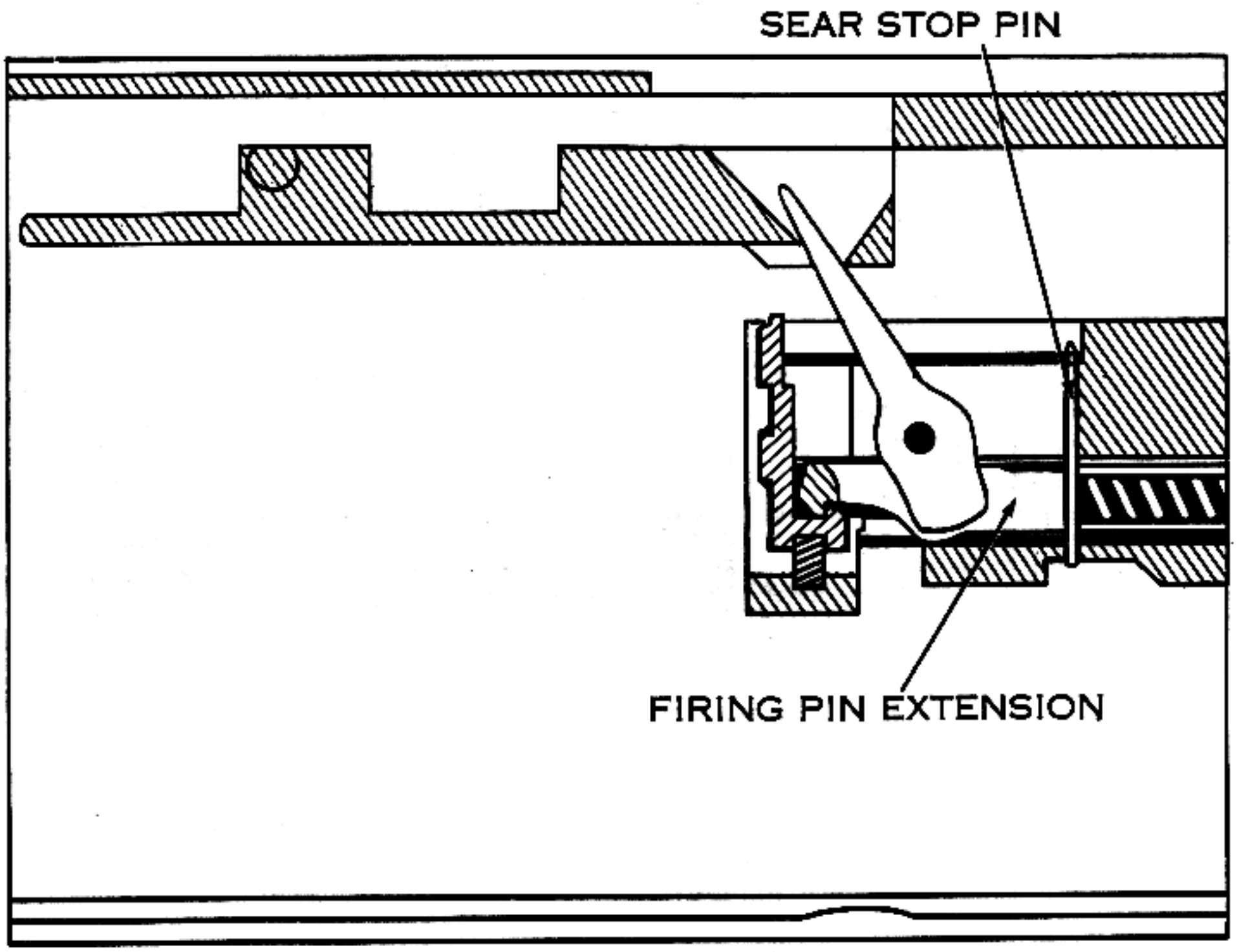


Figure 105. Cocking—recoiling group forward, gun cocked.

CHAPTER 4

MOUNTS

27. General

a. The two principal ground mounts used with the caliber .50 machinegun are the tripod mount, M3, and the antiaircraft mount, M63. The tripod mount, M3, is a ground mount designed for use against ground targets. The antiaircraft mount, M63, is a ground mount principally designed for use against aerial targets. Its use against ground targets is limited because the mount tends to be unstable when the gun is fired at low angles.

b. The three principal vehicular mounts used with the caliber .50 machinegun are the truck mount, M36; the pedestal truck mount, M31C and M24A2; and the commander's cupola, M113 armored personnel carrier.

Section I. GROUND MOUNTS

28. Tripod Mount, M3

a. General. The M3 mount is the standard ground mount of the caliber .50 machinegun (fig 106). It is a folding tripod with three telescopic, tubular legs, connected at the tripod head. Each leg ends in a metal shoe, which can be stamped into the ground for greater stability. The two trail legs are joined together by the traversing bar. The traversing bar serves as a support for the traversing and elevating mechanism, which in turn supports the rear of the gun. The tripod head furnishes a front support for the mounted gun which is further supported by the short front leg. When the tripoid is emplaced on flat terrain, with all extensions closed, the adjustable front leg should form an angle of about 60 degrees with the ground. This places the gun on a low mount, about 12 inches above the ground. To raise the tripod farther off the ground, extend the telescopic front and trail legs (enough to keep the tripod level and maintain the stability of the mount).

(1) *Front leg.* To adjust the front leg, turn the front leg clamp screw handle counterclockwise to loosen the front leg clamp screwnut. Adjust the leg to the desired angle, and tighten the front leg clamp.

(2) *Leg extensions.* To extend any of the tripod legs, unscrew the leg clamping handle; press down on the indexing lever, and extend the leg to the desired length. Aline the stud on the indexing lever with one of the holes in the tripod leg extension. Release pressure on the indexing lever, allowing the stud to fit the desired hole. Tighten the leg clamping handle.

b. Traversing and Elevating Mechanism.

(1) *The traversing mechanism.*

(*a*) Consists of a traversing bar, slide, and screw assembly. The traversing bar, graduated in 5-mil increments, fits between the trail legs of the tripod. The traversing slide and screw assembly are clamped in place on the traversing bar by the traversing slide lock lever. When the traversing slide is locked to the traversing bar, the traversing handwheel should be centered. The traversing slide is properly mounted when the lock lever is to the rear and the traversing handwheel is positioned to the left.

(*b*) To make changes in direction, loosen the traversing slide lock lever and move the slide along the traversing bar. This permits traverse of 400 mils left or right of the zero index in the center of the traversing bar. Readings on the traversing bar are taken from the left side of the traversing slide. For changes of 50 mils or less in deflection, turn the traversing handwheel of the screw assembly. This allows a traverse of 50 mils left or right of center. One click in the traversing handwheel signifies 1 mil change in direction.

(2) *The elevating mechanism (fig 107).*

(*a*) Consists of an upper and lower elevating screw, and is connected to the gun by inserting the quick release pin assembly through the holes in the upper elevating screw yoke and the rear mounting lugs of the receiver. A scale, graduated in mils, is fitted to the upper screw to indicate elevation. This scale is marked to show 250 mils in depression and 100 mils in elevation from the zero setting.

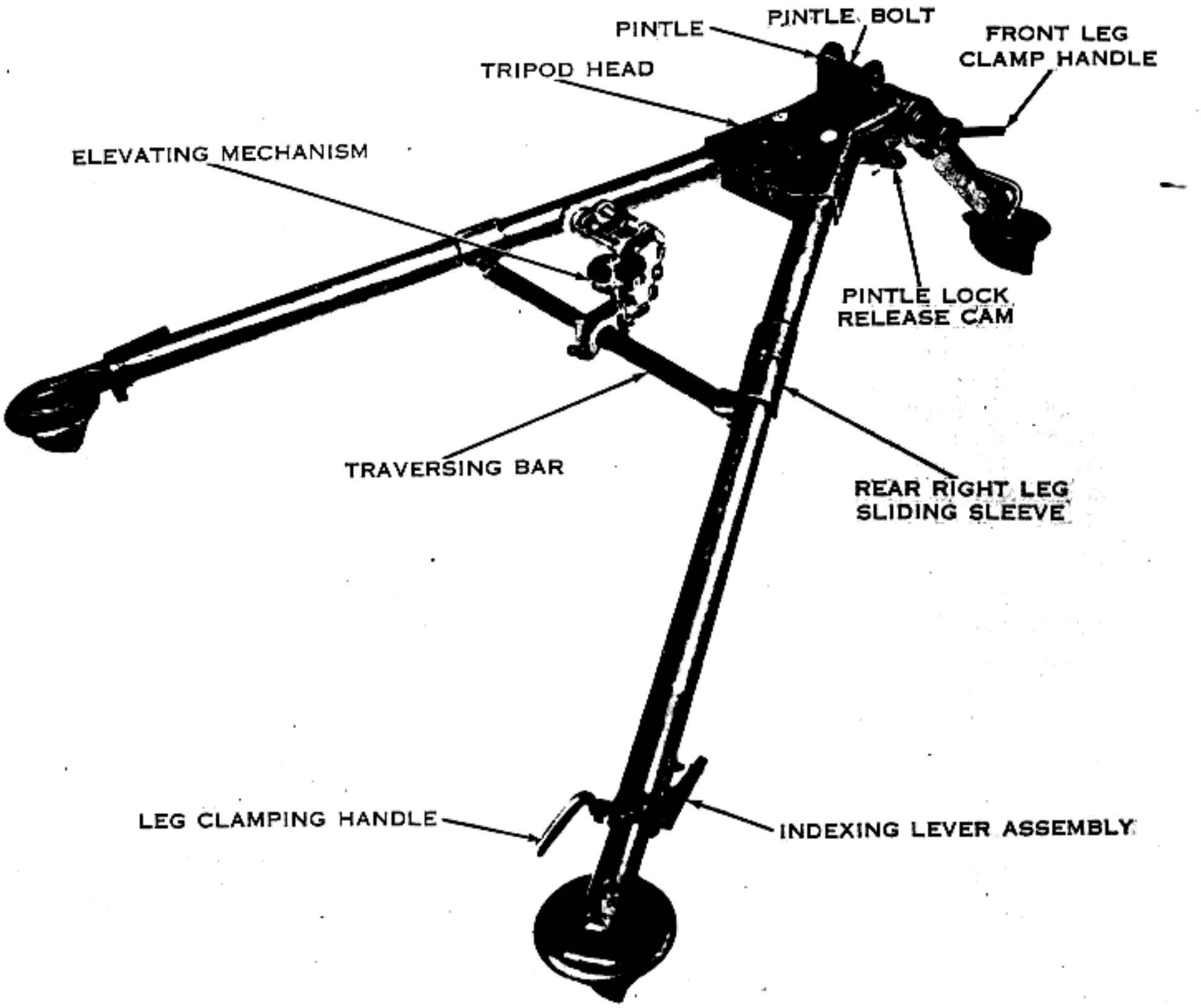


Figure 106. Tripod mount, M3.

(*b*) The elevating handwheel is graduated in 1-mil increments up to 50 mils, and is fastened to the elevating screw by a screw lock. This synchronizes the handwheel graduations with those on the upper elevating screw. A spring actuated index device produces a clicking sound when the handwheel is turned. Each click equals 1 mil change in elevation. The handwheel is turned clockwise to depress the barrel and counterclockwise to elevate.

c. Pintle. The gun is connected to the tripod mount, M3, by a pintle. This pintle is semipermanently attached to the machinegun by a pintle bolt through the front mounting hole in the receiver. The tapered stem of the pintle seats in the tripod head, and is held secure by a pintle lock and spring. To release the pintle, raise the pintle lock, releasing the cam.

d. General data. The weight of the pintle and traversing and elevating mechanism are considered as part of the total weight of the tripod mount, M3 (44 lbs).

29. Antiaircraft mount, M63

Reference TM 9–1005–213–10.

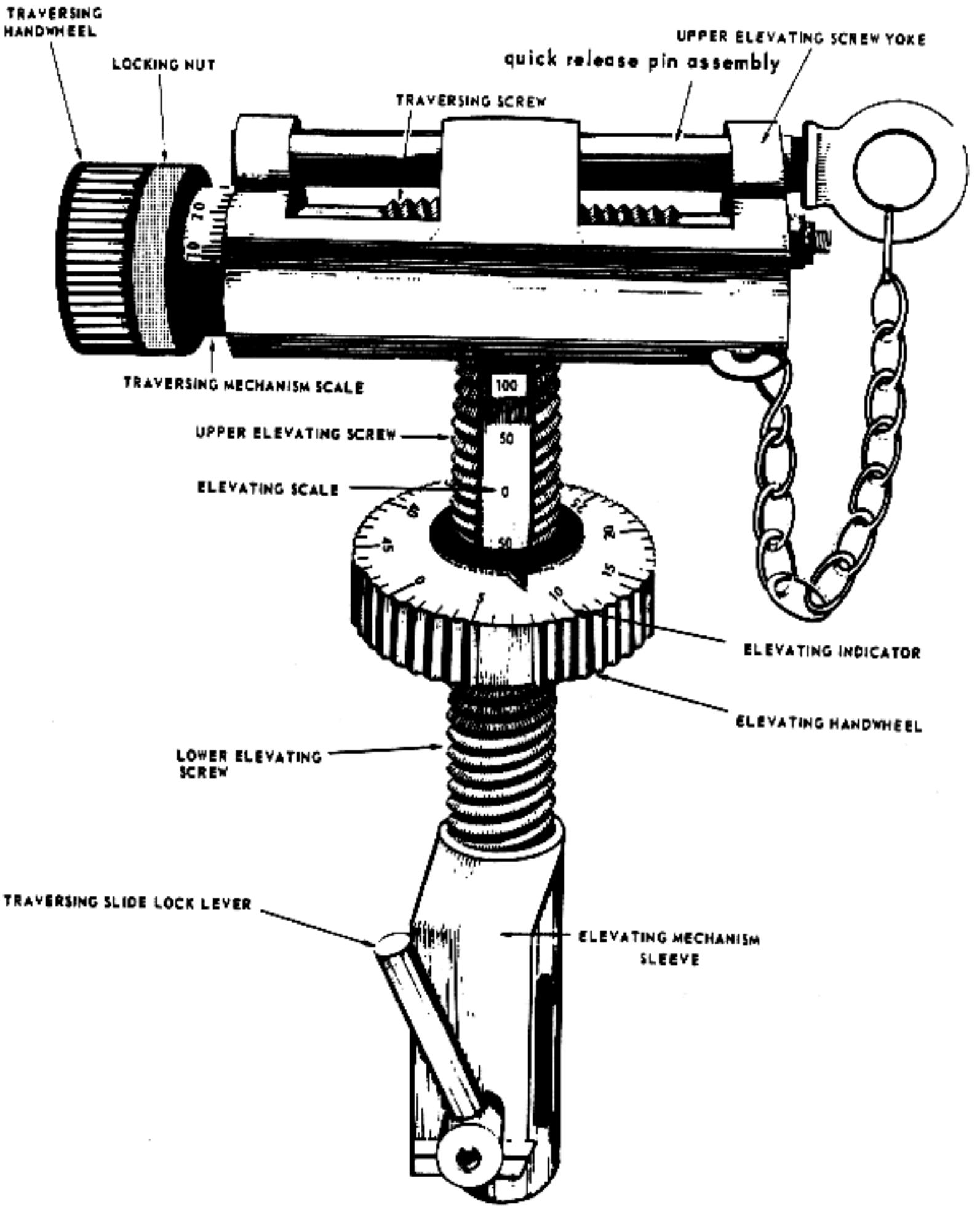


Figure 107. Elevating mechanism.

Section II. VEHICULAR MOUNTS

30. Truck Mount, M36 (Fig 108 and 109)

a. This mount consists of a cradle with a roller carriage on a circular track. The cradle can be rotated in the pintle sleeve of the carriage and can be adjusted for elevation. The carriage is guided on the track by rollers. The track is secured to the vehicle by supports.

b. To move the gun in elevation on the M36 mount, remove the cradle locking pin and place it in the carriage handle; grasp the spade grips and elevate or depress as desired. The gun is also moved in traverse by pressure on the spade grips. To move the gun on the track, raise the brake handle lever until it is retained by the brake de-

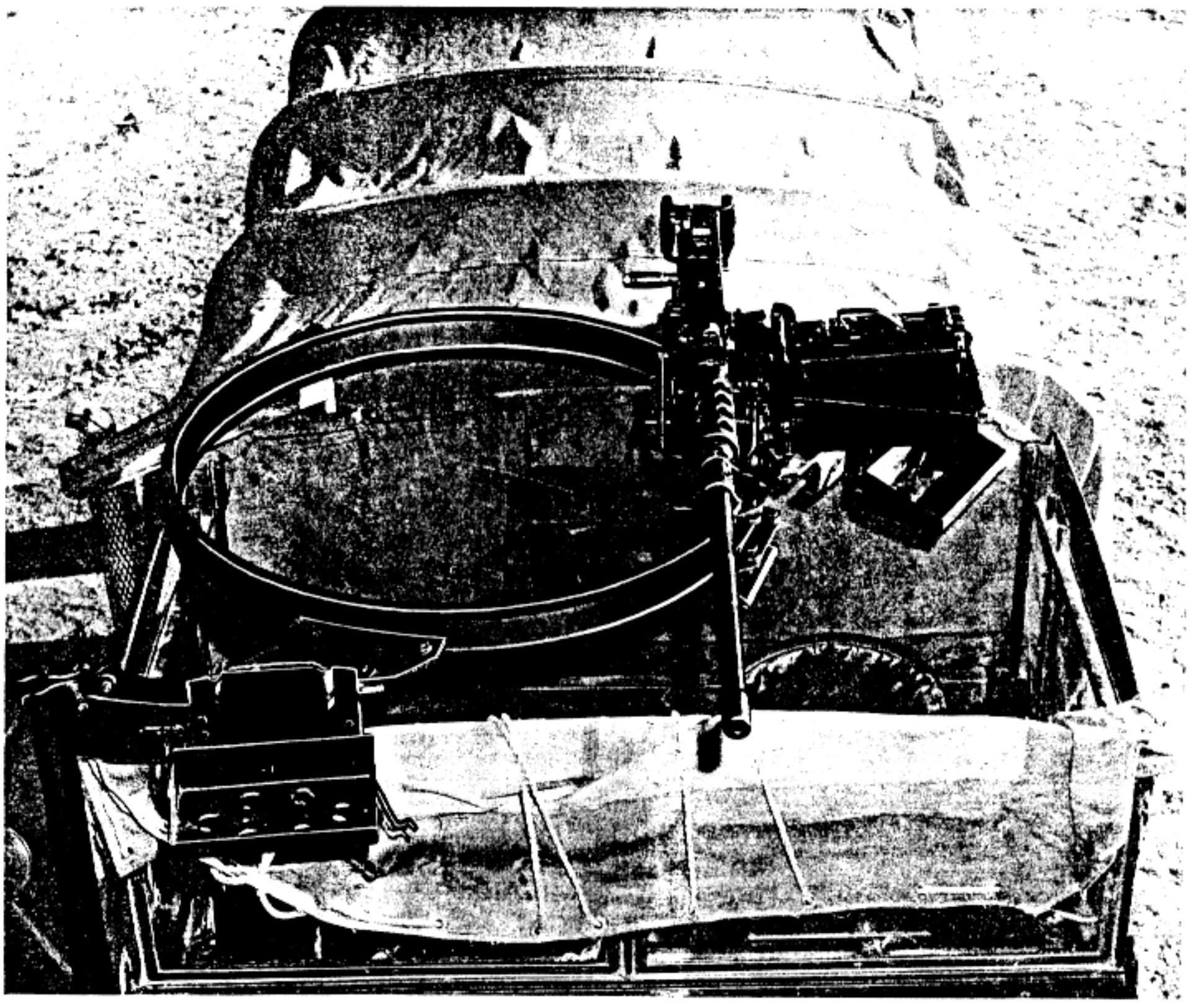


Figure 108. Browning machinegun, caliber .50 HB, M3, on truck mount M36.

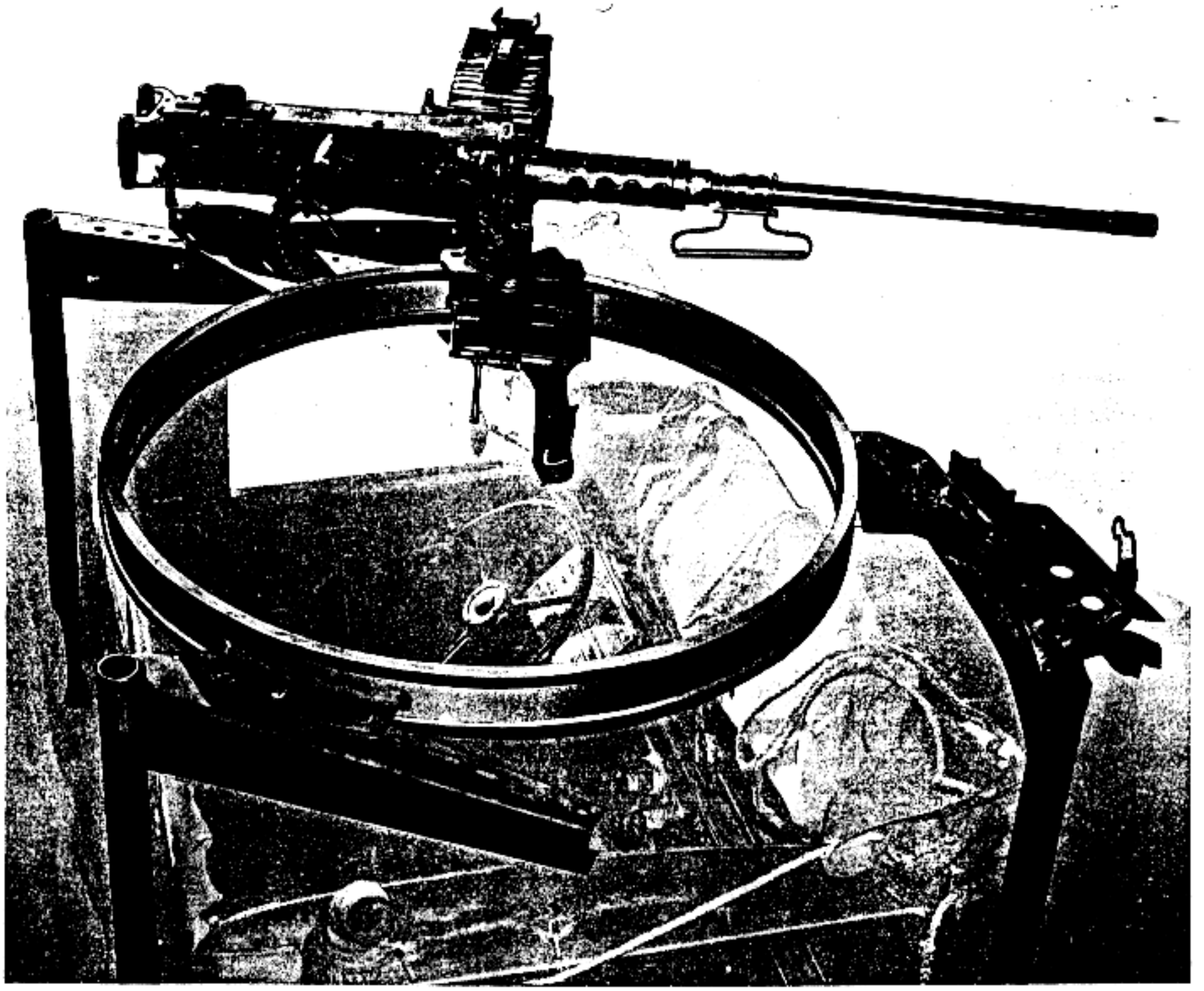


Figure 109. Browning machinegun, caliber .50 HB, M2, on truck mount M36.

tent plungers. The cradle may then be moved on the track by applying pressure on the carriage handle.

31. Pedestal Truck Mount, M31C

Reference TM 9–2016.

32. Pedestal Truck Mount, M24A2

Reference TM 9–2016.

33. Commander's Cupola—M113 Armored Personnel Carrier

A caliber .50, M2, machinegun and mount are installed in the gun support on the commander's cupola. The machinegun can be traversed 360 degrees, elevated 53 degrees, and depressed 21 degrees maximum.

CHAPTER 5

MALFUNCTIONS, STOPPAGES, IMMEDIATE ACTION, MAINTENANCE, INSPECTION, AND DESTRUCTION

Section I. MALFUNCTIONS AND STOPPAGES

34. General

A stoppage is any interruption in the cycle of operation caused by the faulty action of the gun or ammunition. The first thing to do when a stoppage occurs is to apply immediate action. Immediate action is the prompt action taken by the firer to reduce a stoppage (para 36).

35. Types of Stoppages

a. General. Stoppages are classified as follows:

(1) *Failure to feed:* A stoppage that prevents the round from being properly positioned in the receiver group.

(2) *Failure to chamber:* A stpppage that prevents the chambering of the round completely.

(3) *Failure to lock:* A stoppage that prevents the breech lock from correctly entering its recess in the bolt.

(4) *Failure to fire:* A stoppage that prevents the ignition of the round.

(5) *Failure to unlock:* A stoppage that prevents the breech lock from moving out of its recess in the bolt.

(6) *Failure to extract:* A stoppage that prevents the extraction of the expended cartridge from the chamber.

(7) *Failure to eject:* A stoppage that prevents the ejection of the expended cartridge from the receiver.

(8) *Failure to cock:* A stoppage that prevents the firing pin extension from being engaged with the sear.

b. Common Stoppages. The most common stoppages with caliber .50 HB, M2 machineguns are:

(1) Failure to feed.

(2) Failure to chamber.

(3) Failure to fire.

c. Causes of Stoppages. The chart below lists the usual, and other causes of the various stoppages.

Nature of stoppage	Usual causes	Other causes
Failure to feed	Defective ammunition belt	Improperly loaded belt.
	Defective feed mechanism.	
	Defective extractor	Short round.
Failure to chamber	Broken part or obstruction in T-slot or chamber. Separated (ruptured) case.	Thick or thin rim, bulged round, set back primer.
Failure to lock	Incorrect headspace	Broken parts.
		Battered breech lock.
		Barrel breech lock cam.
		Faulty breech lock cam adjustment.
Failure to fire	Defective parts in firing mechanism. Defective ammunition. Incorrect timing.	
Failure to unlock	Broken parts in receiver	Worn or faulty breech lock cam, or adjustment.
Failure to extract	Dirty chamber	Defective cartridge case.
Failure to eject	Defective ejector	Burred T-slot.
Failure to cock	Broken sear	Broken cocking lever.
	Worn sear notch.	
	Weak sear spring.	
	Worn hooked notch on firing pin extension.	

d. Malfunctions. A malfunction is any failure of the gun to function satisfactorily.

(1) *Failure to function freely.* Sluggish operation is usually due to human failure to eliminate excessive friction caused by dirt, lack of proper lubrication, burred parts, tight headspace adjustment, or incorrect timing.

(2) *Uncontrolled automatic fire.* Uncontrolled automatic fire is continued fire when the trigger or trigger control mechanism is released. If the cause is present before the gun is fired, the gun will start to fire when the recoiling groups move into battery the second time. If the defect occurs during firing, the gun will continue firing when the trigger control mechanism is released.

(*a*) Uncontrolled automatic fire (runaway gun) may be caused by the following:

1. Bent trigger lever, forward end of the trigger lever sprung downward.

2. Burred beveled contacting surfaces of the trigger lever and sear.

3. Jammed or broken sideplate trigger.

(*b*) To remedy uncontrolled automatic fire:

1. Keep the gun laid on target.

2. Twist the belt, causing the gun to jam.

Note. This may damage the feeding mechanism.

Caution. **DO NOT UNLATCH THE COVER!**

3. Replace broken, worn, or burred parts. Check the sideplate trigger and trigger control mechanism, when applicable.

Section II. IMMEDIATE ACTION

36. General

a. Immediate action is performed by the gunner; however, every crew member must be trained to apply immediate action. The procedures outlined below will assist in reducing most stoppages without analyzing their cause in detail.

b. If gun fails to fire:

(1) Wait 5 seconds; a hangfire may be causing the misfire. In the next 5 seconds, pull the bolt to the rear (check for ejection and feeding of belt), release it, relay on the target and attempt to fire.

Note. When the bolt latch engages the bolt and holds it to the rear, the gunner must return the retracting slide handle to its forward position.

If the boltlatch release and trigger are depressed at the same time, the bolt goes forward and the weapon should fire automatically.

(2) If the gun again fails to fire, wait 5 seconds, pull the bolt to the rear (engage with bolt latch if applicable) and return the retracting slide handle to its forward position. Open the cover and remove the belted ammunition. Inspect the gun to determine the cause of stoppage as outlined in paragraph 35*c*.

37. Safety Precautions After Misfire

A hangfire or cookoff can cause injury to personnel or damage to the weapon. To avoid these, the gunner must take the following precautions:

a. Always keep the round locked in the chamber the first 5 seconds after a misfire occurs. This prevents an explosion outside of the gun in event of a hangfire.

b. If the barrel is hot, the round must be extracted within the next 5 seconds to prevent a cookoff. When more than 150 rounds have been fired in a 2-minute period, the barrel is hot enough to produce a cookoff.

c. If the barrel is hot and the round cannot be extracted within the 10 seconds, it must remain locked in the chamber for at least 5 minutes, to guard against a cookoff.

d. The gun cover *will* remain closed during the waiting periods prescribed in *a*, *b*, and *c* above.

38. Reduction of Stoppages

When immediate action does not correct the malfunction, the quickest way to resume firing is to replace the defective part.

a. Removal of a Cartridge From the T-*Slot.* If the cartridge does not fall out, hold the bolt to the rear, and with the extractor raised, use a screwdriver to push the cartridge out the bottom of the receiver.

b. Removal of a Ruptured Cartridge. A ruptured (separated) cartridge case may be removed with a cleaning rod or ruptured cartridge extractor.

(1) To remove a ruptured cartridge with the ruptured cartridge extractor (cal .50 41–E–557–50, (7160041) raise the cover, and pull the bolt to the rear. Place the ruptured cartridge extractor in the T-slot of the bolt, in the same manner as that of a cartridge, so that it is held in line with the bore by the ejector of the extractor assembly of the gun. With the ruptured cartridge extractor alined with the bore and held firmly in the T-slot, let the bolt go forward into battery. This forces the extractor through the ruptured case, and the shoulders will spring out in front of the case. Pull the bolt to the rear and

Figure 110. Caliber .50 ruptured cartridge case extractor.

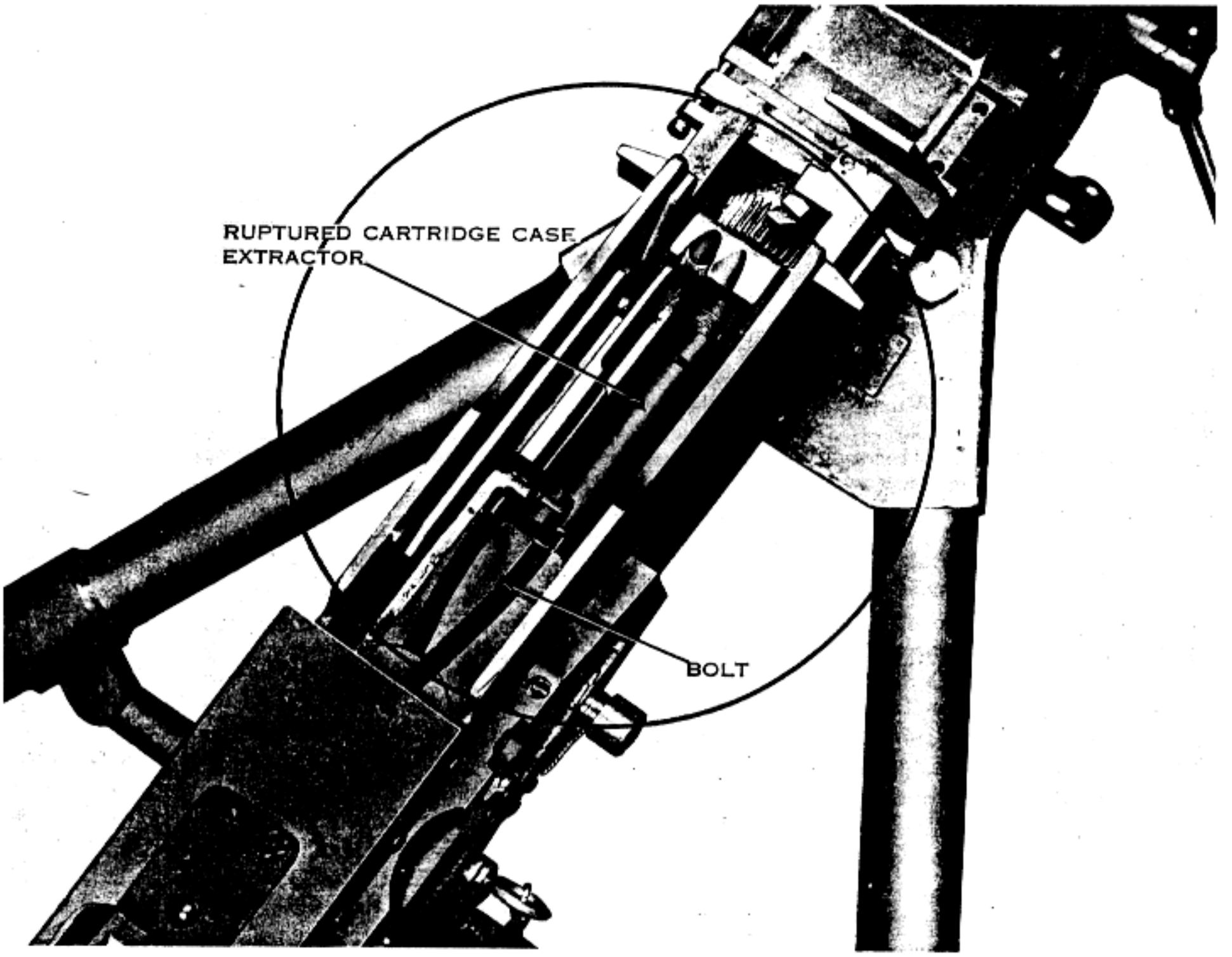


Figure 111. Ruptured cartridge case extractor alined with the chamber.

remove the ruptured case and extractor (fig 110 and 111).

(2) Always check headspace and timing after a ruptured cartridge occurs, and set if necessary.

Section III. MAINTENANCE (CARE AND CLEANING)

39. General

a. Gun Maintenance. The importance of a thorough knowledge of care, cleaning, and maintenance of the machinegun cannot be overemphasized. Care, cleaning, and maintenance determine whether or not the gun will function properly when needed. The bore and chamber must be properly maintained to preserve accuracy. Because of the close fit of working surfaces and the high speed at which the gun operates, the receiver and moving parts must be kept clean, correctly lubricated, and free from burrs, rust, dirt, or grease to insure proper, efficient functioning.

b. Mount Maintenance. The care, cleaning, lubrication, and adjustment of the mounts used with the gun are no less important. The functioning of the gun and mount together determine overall effectiveness. All accessories and equipment used with the gun and mount, including ammunition, must be properly maintained.

c. Maintenance System. To insure proper care of the machinegun, it is necessary to have a system of maintenance or a standard operating procedure (SOP) for the frequency of cleaning. Each gun should be cleaned as soon after firing as possible and each time it is exposed to field conditions. Under combat conditions, the gun should be cleaned and oiled daily. Under extreme climatic and combat conditions it may be necessary to clean and lubricate more frequently. Under ideal conditions, where the gun is not used, and is stored in a clean, dry place, it may only be necessary to inspect, clean, and lubricate every 5 days. The gun should be disassembled, cleaned, and oiled in a clean, dry location, where it is least exposed to moisture, dirt, etc. Maintenance and preparation for storage over a longer period of time is covered in ordnance regulations (Ord 3SNL A–1). If possible, keep the gun covered with a gun cover, canvas, tarpaulin, or poncho, when not in use.

d. Cleaning Materials.

(1) Rifle bore cleaner is used to clean the bore of the machinegun barrel after firing. Immediately after using bore cleaner, dry the bore and any parts of the gun exposed to the bore cleaner; then apply a thin coat of special preservative lubricating oil.

(2) When bore cleaner is not available, water can be used. Hot or cold water can be used; however, warm, or hot, soapy water is recommended. After using soap and water, dry the barrel and apply a thin coat of special preservative lubricating oil.

e. Lubricating.

(1) *Special preservative lubricating oil (PL-SPECIAL).* A thin oil used for lubricating at normal and low temperatures and for providing temporary protection against rust. The entire gun can be lubricated with this oil.

(2) *Lubricating oil (LSA).* Should be used to lubricate all friction-producing parts of the gun as well as exterior parts exposed to the elements. LSA will not burn off during firing or wash off during rain.

(3) *Cold climates (consistently below 0 degrees F).* Lubricate the gun with weapon lubricating oil (LAW) and keep it covered as much as possible. For further information, see TM 9–207 and FM 31–70.

(4) *Hot, humid climates.* Inspect the gun more frequently for signs of rust. Keep the gun free of moisture and lightly oiled with lubricating oil (LSA).

40. Care and Cleaning Before, During, and After Firing

a. Before firing (when the situation permits), take the following steps to insure efficient functioning of the machinegun:

(1) Disassemble the gun into its major groups or assemblies.

(2) Clean the bore and chamber, but do not oil them.

(3) Clean all metal parts thoroughly and apply a light coat of oil to all metal parts which do not come in contact with the ammunition. (See app C for a checklist of before, during, and after firing care and cleaning.)

b. To insure complete removal of powder residue and primer fouling from the bore of the machinegun barrel, the bore should be cleaned once each day, for at least three consecutive days after firing. The bore sweats out this fouling or residue, and cleaning must be repeated until there is no further evidence of sweating.

41. Care and Cleaning Under Unusual Climatic Conditions

Extreme cold, hot, dry, and tropical climates affect the gun and its functioning. Care should be taken under these climatic conditions to insure that the gun is cleaned daily with the prescribed

lubricants and protected from the elements by some sort of cover if possible. Further information on care and cleaning of the gun under unusual climatic conditions can be found in TM 9–1005–213–10.

42. Care and Cleaning Under CBR Conditions

a. If contamination is anticipated, apply oil to all outer surfaces of the machinegun (DO NOT OIL AMMUNITION). Keep the gun covered as much as possible.

b. If the gun is contaminated, decontaminate by following the procedures outlined in FM 21–40 and TM 3–220, then clean and lubricate.

43. Care and Cleaning of Mounts and Accessories

a. General. The mounts and accessories, such as the ammunition chest and spare parts, should also be kept clean and lubricated. Painted surfaces should be spot painted when necessary. Moving surfaces should be inspected and oiled with the prescribed lubricant.

b. Tripod Mount, M3. All external surfaces of the mount should be kept clean and lightly oiled. Be particularly careful that the pintle bushing is clean and lightly oiled, and that the pintle lock release cam is well-lubricated and free from grit. The sleeve lock indexing levers and telescopic legs should be clean and lubricated enough for ease in use. The mount should be cleaned and oiled with the same regularity as the gun. Cleaning of the mount can be accomplished in the same manner as the gun.

c. Antiaircraft Mount, M63. Lubrication on the M63 mount should be light. A drop of oil on the joints of the firing grips, trigger control linkage, slides of the trigger control mechanism, sideplate trigger, sideplate trigger cam, and pintle pivot bolts should be sufficient. Although the pintle does not revolve in the elevator, it should be lightly oiled to prevent rust. When in use, the traversing bearing should be sparingly lubricated monthly. Use automotive and artillery grease (GAA), injected by a lubricating gun through the lubricating fittings in the base. The bearing should be thoroughly lubricated at all times, but excessive lubrication should be avoided, since excess grease will work out onto the mount.

Section IV. INSPECTION

44. Preparation

When inspected, the machinegun should be completely assembled, mounted, and have headspace and timing properly set. Inspecting personnel should look for dirt, cracks, burrs, and rust, and operate the gun manually to insure it is functioning properly. Appendix D is an inspection checklist to be used as a guide for crew members or inspecting personnel to insure that the gun and equipment are properly maintained.

Section V. DESTRUCTION

45. General

The decision to destroy the gun to prevent its capture and use by the enemy is a command decision, and will be ordered and carried out only on authority delegated by the major unit commander.

a. Destroy the machinegun and mount only when they are subject to capture or abandonment. Destruction must be as complete as circumstances permit.

b. Lacking time for complete destruction, destroy the parts essential to operation of the gun, beginning with those parts most difficult for the enemy to duplicate.

c. Destroy the same parts of each gun to prevent the reconstruction of a complete gun from several damaged guns.

46. Methods of Destruction

a. Gun. Field strip the gun. Use the barrel as a sledge. Raise the cover and smash the cover forward and down, toward the barrel support. Smash the backplate group. Remove the firing pin from the bolt; place the striker in the hole in the face of the bolt and bend it until broken. Remove the barrel buffer tube lock assembly from the barrel buffer body group and bend and deform it. Smash and bend the breech lock depressors. Place the barrel extension in the rear of the receiver, with the barrel extension shank protruding; knock off the shank by striking it with the barrel from the side. Deform and crack the receiver by striking it with the barrel at the sideplate corners nearest the feedway. Smash the extractor.

b. Tripod Mount, M3. Leave the pintle on the tripod by removing the pintle bolt from the gun. Use the barrel as a sledge. Strike the sides of the pintle and deform it. Fold the trail legs and turn the mount over. Stand on the folded trail legs and knock off the pintle latch (pintle lock release cam). Smash the elevating mechanism with the barrel. If possible, smash the rear legs to prevent unfolding.

c. Antiaircraft Mount, M63. Remove the sideplate trigger control mechanism from its container, or the gun, and deform it by using the barrel. Lock the cradle and yoke assembly in the horizontal position, and beat the trigger frame assembly and cradle until they are bent down along the elevator assembly. Strike the elevator from the side, with the barrel, until it is bent so that the elevator will not rotate in the base.

d. Spare Parts. Destroy the bolt, barrel extension, firing pins, and barrel buffer groups as prescribed in 46*a* above. Break or deform all other parts.

e. Ammunition. When time permits and material is available, ammunition can be destroyed by burning. Unpack all ammunition from boxes or cartons, stack the ammunition in a heap and, using flammable material available, ignite and take cover immediately.

f. Burning. To destroy the gun by burning, place a thermite grenade in the receiver on the bolt (with the cover resting on the grenade) and fire the grenade. (This method may require the use of more than one grenade.) Remove the backplate group, place a thermite grenade in the rear of the receiver and fire the grenade.

g. Disposal. Bury in suitable holes or dump parts into streams, mud, snow, sumps, latrines, or scatter the parts over a wide area.

CHAPTER 6

CREW TRAINING

Section I. CREW DRILL

47. General

a. The purpose of crew drill is to develop precision, speed, skill, and teamwork in the techniques of examination of equipment, placing the gun into and taking it out of action. In crew drill, precision must be stressed. Once that is attained, speed, skill, and teamwork will be developed.

b. Duties are rotated during crew drill to allow each member of the gun crew to become familiar with the duties of the other members.

c. Precision is attained only through adherence to prescribed procedure. Precision is the first consideration. Speed, skill, and teamwork will develop with practice.

d. During crew drill, all oral or visual signals are repeated. When the fire command is completed, the gunner will give the assistant gunner an UP. The assistant gunner will extend his hand and arm into the air in the direction of the leader (to indicate READY) and announce, UP.

e. With the M3 mount, the crew must consist of at least four men, including the leader.

48. Crew Equipment

In addition to individual arms and equipment, crew members carry the following equipment for the tripod-mounted machinegun:

Crew member	Suggested minimum equipment
Squad or Crew Leader	Binoculars, compass, one box of ammunition.
No. 1. Assistant Gunner	Tripod.
No. 2. Gunner	Receiver, traversing and elevating mechanism attached, and headspace and timing gage.
No. 3. Ammunition bearer	Barrel, barrel cover, and box of ammunition.

49. Form for Crew Drill

a. Positions With Equipment. The crew leader commands, FORM FOR CREW DRILL. The crew forms in column, facing the crew leader, with five paces between men, in the following order: assistant gunner, gunner, and ammunition bearer; the assistant gunner is five paces from the crew leader. When the crew members reach their correct positions, they assume the prone position with equipment arranged as follows (fig 112):

(1) No. 1: tripod to his left, trail legs to the rear, front leg uppermost.

(2) No. 2: receiver across his front, backplate to the right, retracting slide handle uppermost.

(3) No. 3: barrel to his right, muzzle to the rear, and ammunition box to his left front with latch to the right (latch to the front for the new box).

(4) Other members, if present: ammunition boxes in front, one foot apart, latches to the right (front).

(5) Crew leader places the ammunition box to his right, as he faces the crew, latch to the right (front).

b. Rotation of Duties.

(1) Duties are rotated to insure that each member learns and is capable of performing the duties of the other members.

(2) The command to rotate all personnel is, FALL OUT LEADER. At this command each member of the crew rises, moves forward, and assumes a new duty. The crew leader becomes the ammunition bearer. The assistant gunner moves forward and becomes the crew leader. The gunner moves forward and becomes the assistant gunner. The ammunition bearer moves forward and becomes the gunner. If the leader is not changed, the command, FALL OUT ASSISTANT GUNNER, is given. At this command, the crew members rise, the gunner becomes the assistant gunner, the ammunitin bearer becomes the gunner, and the assistant gunner becomes the ammunition bearer. When the crew members have assumed their new positions, they call out their new duties in order, ASSISTANT GUNNER, GUNNER, AMMUNITION BEARER.

Figure 112. Crew formed in column, five paces apart.

50. Inspection of Equipment Before Firing

When the crew is formed with equipment, the comand is, INSPECT EQUIPMENT BEFORE FIRING. At this command, the crew proceeds as follows:

a. The assistant gunner inspects the tripod M3 mount to insure that:

(1) The indexing levers and clamps on the front and trail legs function properly, and the legs are in the short (low) position.

(2) Front leg and trail legs are closely folded; front leg clamp is handtight.

(3) Sleeve lock latch and pintle lock release cam are in working order; pintle lock release cam is down.

(4) Pintle bushing is free from dirt and burrs.

b. The gunner inspects the receiver group to insure that:

(1) Barrel support and breech bearing are free of dirt.

(2) Gun pintle is free of dirt.

(3) Feed mechanism and bolt switch are properly assembled to feed from left (raises cover for proper inspection).

(4) Striker projects through the aperture in face of bolt (closes the cover).

(5) Rear sight is set at 1000 yards (900 meters) windage zero.

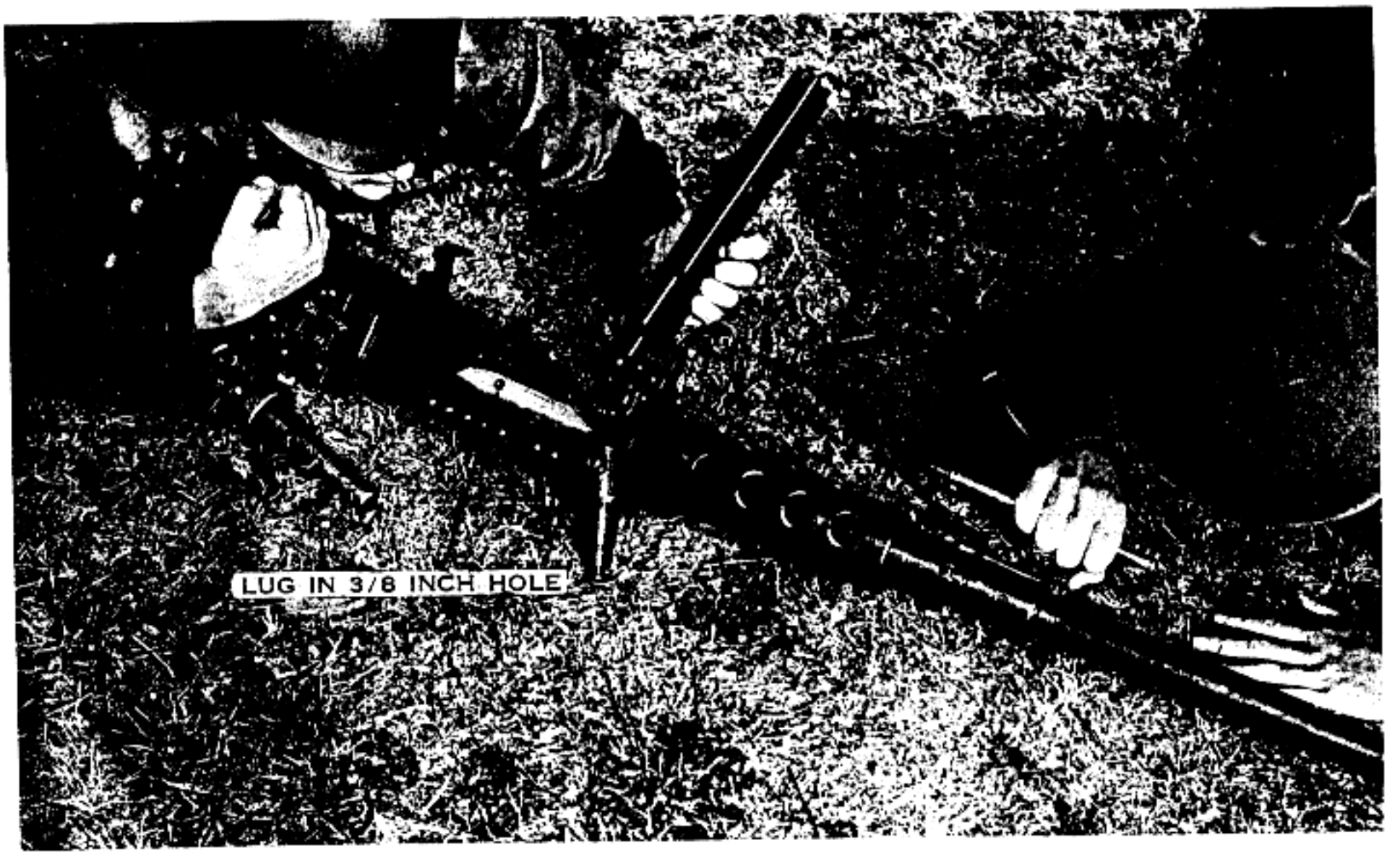


Figure 113. Screwing the barrel into the barrel extension.

(6) Traversing and elevating mechanism is securely attached to the receiver.

(7) Traversing handwheel is centered.

(8) Elevating screws are equally exposed (about 2 inches), above and below elevating handwheel.

(9) Backplate is latched and locked in place.

(10) Bolt latch release is locked in the down position by the bolt latch release lock.

c. The ammunition bearer inspects the barrel and ammunition box to insure that:

(1) Barrel is clear.

(2) Barrel carrier assembly is securely attached to barrel.

(3) Barrel bearing is free of dirt.

(4) Metallic links are clean (open ammunition box).

(5) Belt is properly loaded and placed in box, the double looped end up.

(6) Dummy ammunition will be used during crew drill and NO LIVE ammunition is present.

(7) The box is closed and latched.

d. When the ammunition bearer completes his inspection, he moves to the gunner's position, with the barrel in his right hand and ammunition box in his left hand. With the aid of the gunner, the ammunition bearer screws the barrel into the barrel extension. The headspace and timing adjustment is now made as prescribed in paragraphs 11 and 12 (fig 113). The ammunition bearer remains on the left and on line with the gunner.

e. The crew leader examines his ammunition as described in *c* above.

f. At the completion of the inspection, a report is rendered as follows:

(1) The ammunition bearer reports: AMMUNITION CORRECT (or any deficiencies).

(2) The gunner reports: GUN AND AMMUNITION CORRECT (or any deficiencies).

(3) The assistant gunner reports: ALL CORRECT (or any deficiencies) (fig 114).

Figure 114. Crew ready to place the gun into action.

51. Placing the Gun Into Action

To place the gun into action, the crew leader commands and signals, GUN TO BE MOUNTED HERE (pointing to the position where the gun is to be mounted), FRONT (pointing in the direction of fire), ACTION (vigorously pumping his fist in the direction of the designated gun position).

a. At the command or signal ACTION the assistant gunner grasps the left trail leg near the center with his left hand. Springing to his feet and grasping the tripod head with his right hand, he lifts the tripod across the front of his body with the front leg up, and carries the tripod to the desired location (fig 115). Upon arrival at the position, he places the trail leg shoes on the ground with the front leg pointing upward. Steadying the tripod with his left hand on the front leg, loosens the front leg clamp with his right hand (fig 116), positions the front leg with his left hand, tightens the front leg clamp with his right hand. With his right hand on the tripod head, he slides his left hand down on the left trail leg and with a snapping motion, pulls the left leg (to the left), engaging the sleeve latch. He then alines the tripod for direction, drops the mount to the ground, stamps the right and left trail shoes with his right or left foot, and assumes the prone position behind the mount.

b. The gunner and ammunition bearer move together. When the tripod is nearly mounted, the gunner and ammunition bearer spring to their feet. The gunner places both hands on the spade grips, the ammunition bearer grasp the ammunition box in his left hand and the gun carrying handle with his right hand; both men lift the gun from the ground and move rapidly to the gun position. At the gun position, the ammunition bearer places the ammunition box on line and in front of the leader's ammunition box. The gunner, assisted by the ammunition bearer, inserts the pintle into the pintle bushing. The ammunition bearer stamps the front shoe into the ground with his left foot (fig 117), releases the carrying handle, lowers his right hand and lifts the gun pintle lock release cam. When the gun pintle is fully seated, he presses down the pintle lock release cam with his right hand; then turns to his left and returns to his original position.

c. The assistant gunner holds the left spade grip with his left hand, and with his right hand, lowers the traversing and elevating mechanism to the traversing bar, insuring that the traversing handwheel is to the left and the lock lever is to the rear. He then assumes a semiprone position to the left of the gun with his feet to the rear, and his head on line with the feedway. He unlatches and

Figure 115. Assistant gunner—(No.1) opening the tripod.

Figure 116. Emplacing the mount.

Figure 117. Mounting the gun.

raises the cover of the ammunition box, removes the ammunition belt, and inserts the double looped end into the feedway and taps the cover with his right hand to insure it is closed.

d. With his right hand, palm-up, the gunner grasps the retracting slide handle, vigorously jerks it to the rear and releases it. The gun is half-loaded (fig 118). He then assumes the correct gunner's position by taking a prone position directly behind the gun, legs spread and heels down. His right hand lightly grasps the right spade grip with the thumb in position to depress the trigger. His left hand is on the elevating handwheel (palm down) with his thumb near the traversing slide lock lever. He rests on his left elbow, head as close as possible to the rear sight (fig 119). He then gives the assistant gunner an UP. The assistant gunner announces UP and extends his hand and arm into the air in the direction of the leader.

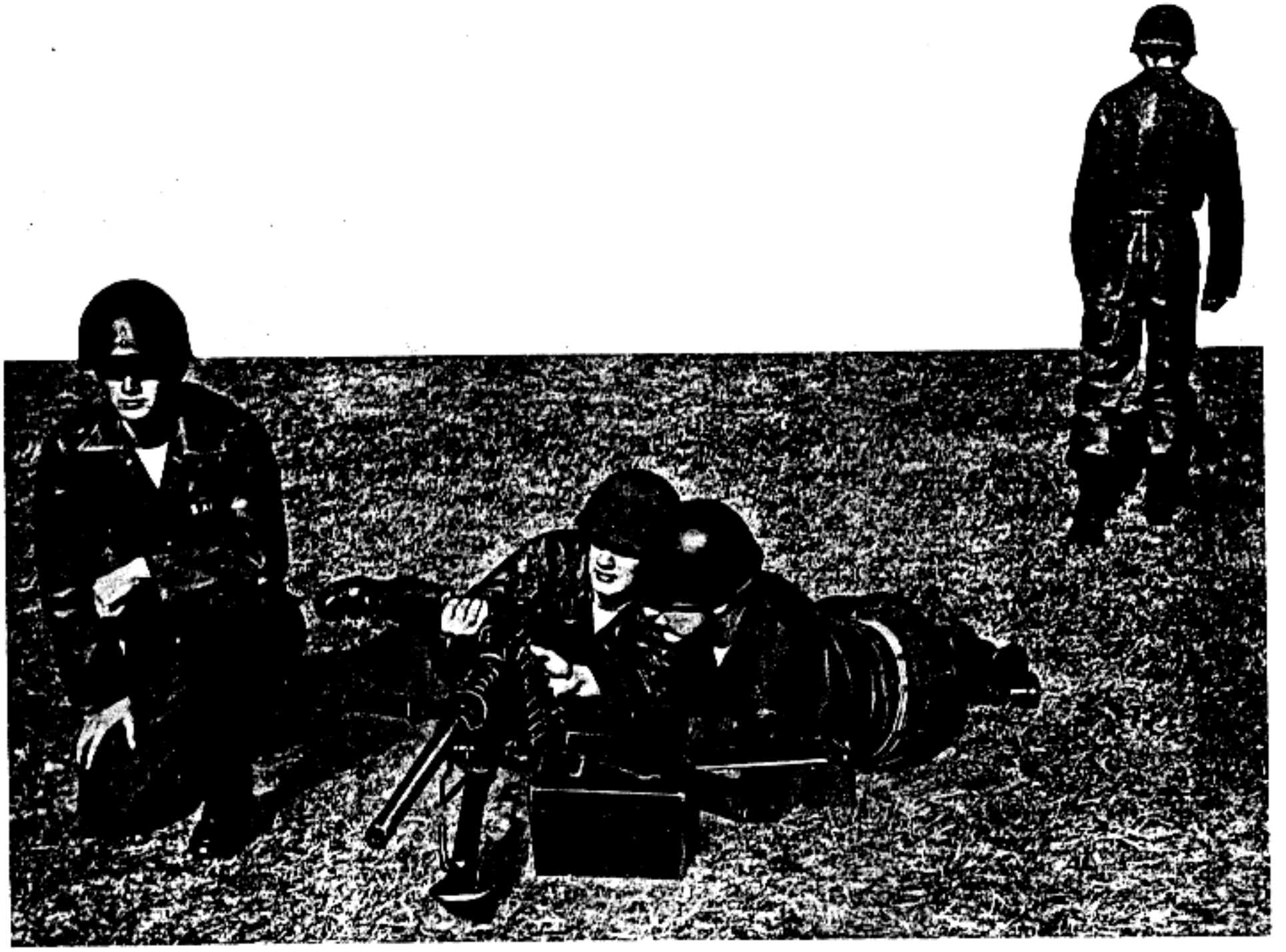


Figure 118. Gun mounted, gunner half-loading the gun.

52. Taking the Gun Out of Action

To take the gun out of action, the command is OUT OF ACTION.

a. The gunner raises the cover with his left hand, the assistant gunner lifts the ammunition out of the feedway, replaces the ammunition in the box, closes and latches the box. The gunner closes the cover, pulls the retracting slide handle to the rear with right hand (palm up) releases it, presses the trigger with his right thumb, and loosens the traversing slide lock lever with his left hand. He rises to his feet, grasping both spade grips. At this time the ammunition bearer will arrive at the gun position. With his left hand, the ammunition bearer grasps the ammunition box and places his right foot on the front leg shoe. With his right hand, he reaches down and lifts up the pintle lock release cam and grasps the carrying handle (fig 120).

Figure 119. Crew ready for action.

b. The gunner and ammunition bearer lift the gun from the tripod, turn right and carry the gun back to their original position. They set the gun down, muzzle to the left, retracting slide handle up. The gunner pulls the retracting slide handle to the rear, alines the lug on the barrel locking spring with the ⅜-inch hole in the right side of the receiver. The ammunition bearer unscrews the barrel from the receiver, picks up the ammunition box and barrel, moves five paces to the rear, places the barrel to his right, muzzle to the rear, ammunition box to his left, and assumes the prone position.

c. The gunner rotates the bolt latch release lock to the right and releases the bolt latch. He checks his sights to insure they are properly set.

d. The assistant gunner assumes a kneeling position behind the tripod and releases the sleeve

Figure 120. Crew taking the gun out of action.

Figure 121. Folding the trail legs.

lock latch with his right hand, rises to his feet, grasps the front leg with his left hand, and rotates the tripod to a vertical position on the trail legs. With his right hand, he loosens the front leg clamp, folds down the front leg, then tightens the clamp. With his right hand on the tripod head, he rotates the tripod on the right trail leg and releases the sleeve latch, folds the left trail leg against the right, with his left hand (fig 121). Holding the tripod head with his right hand, trail legs with his left, he lifts the tripod across the front of his body, with the front leg up. He turns to the right and returns to his original position. At this time, the crew leader picks up his ammunition box and faces the crew. The assistant gunner places the tripod on the ground, assumes a prone position to the right of the tripod, and announces UP.

Figure 122. Dragging the gun into position.

53. Duties of Crew

To hand-carry gun and equipment, the command is SECURE EQUIPMENT, FOLLOW ME. At this command—

a. The crew leader carries his ammunition box in his right hand.

b. The assistant gunner carries the tripod over either shoulder.

c. The gunner carries the receiver on either shoulder, spade grips to the front.

d. The ammunition bearer carries his ammunition box in his left hand, and the barrel in his right hand, muzzle to the rear; or on his left shoulder with the muzzle to the front.

54. Carrying the Tripod-Mounted Gun

When the gun is mounted on the tripod, it can be

Figure 123. Two-man carry.

moved for short distances by dragging, or by a two- or three-man carry. (In the two- or three-man carry, men should move in step to make carrying easier.)

a. Dragging. The gun is dragged when limited cover or the situation requires the gun to be moved in this manner. The gunner and assistant gunner drag the mounted gun to the desired position (fig 122).

b. Two-Man Carry. With the gunner on the right and assistant gunner on the left, each grasps the front leg with his forward hand, and a trail leg with the other hand, just above the traversing bar (fig 123).

c. Three-Man Carry.

(1) *When the barrel is hot.* The gunner is behind the tripod with a trail leg in each hand. The assistant gunner is on the left and the ammunition bearer on the right, each grasps the carrying handle. In addition, the assistant gunner carries the ammunition in his left hand (fig 124).

(2) *When the barrel is cool.* The ammunition bearer and the assistant gunner each grasp the front leg (fig 125).

Note. Carrying the gun by the barrel may cause damage to the barrel support and the barrel extension.

55. Carrying the Gun to Other Mounts

With the mount prepared to receive the gun, the cradle of the mount is placed in a horizontal position To move the gun to the mount, the gunner carries the right spade grip with his left hand, and a box of ammunition in his right. The assistant gunner grasps the carrying handle with his left hand, and a box of ammunition in his right

Figure 124. Three-man carry (hot barrel).

hand. Upon arrival at the mount, the gunner and assistant gunner place their ammunition boxes near the mount. The gunner removes the rear mounting (gun-locking) pin with his right hand. The assistant gunner removes the front mounting (gun-locking) pin with his right hand. The gun is placed on the mount. The gunner alines the holes in the rear mounting lugs of the receiver with the rear mounting bracket and inserts the rear mounting pin. The assistant gunner alines the front mounting hole in the front of the receiver with the front mounting bracket and inserts the front mounting pin. (For use of the sideplate trigger with the M63 mount, see TM 9–1005–213–10.)

Figure 125. Three-man carry (cold barrel).

PART TWO
TECHNIQUE OF FIRE AND EMPLOYMENT

CHAPTER 7
TECHNIQUE OF FIRE DURING PERIODS OF GOOD VISIBILITY

Section I. INTRODUCTION

56. General

a. Technique of fire is the method of delivering and controlling effective fire. Each member of the machinegun crew must be trained in the standard methods of applying fire, either as a crew member or an individual, and must perform his assigned task automatically and effectively.

b. The simplest and most effective technique of delivering fire with the machinegun, mounted on its ground or vehicular mounts, is to aline the sights of the gun on the target and properly apply fire. This technique of fire is called direct laying.

c. At times, techniques of fire other than direct laying are more appropriate and effective. When delivering overhead fire and fire from position defilade, the gunner must use the appropriate techniques described in paragraphs 87 through 96.

d. Before the machinegun can be employed to the best advantage using any firing technique, certain fundamentals must be understood and applied. These include:

(1) Characteristics of fire.
(2) Classes of fire.
(3) Range determination.
(4) Fire control and fire commands.
(5) Target designation.
(6) Methods of engaging targets.
(7) Overhead fire.
(8) Predetermined fire.
(9) Methods of laying the gun.
(10) Final protective fires.
(11) Range cards.
(12) Firing from position defilade.

e. This chapter discusses the above subjects, which apply to all phases of techniques of fire.

57. Marksmanship Training

Training in machinegun marksmanship (chap 9) is a prerequisite to training in the technique of fire.

Section II. CHARACTERISTICS OF FIRE

58. General

The gunner's knowledge of his machinegun is not complete until he learns something of the action and effect of the projectiles when fired. This section discusses various characteristics of machinegun fire, including trajectory, cone of fire, and the beaten zone.

59. Trajectory

a. The trajectory is the curved path of the projectile in its flight through the air, from the muzzle of the weapon to its area of impact. The major factors which influence the trajectory are: the velocity of the round, gravity, rotation of the round, and resistance of the air.

b. The farther the round travels, the greater the curve of the trajectory. The highest point of the trajectory is called the *maximum ordinate*. This is a point approximately two-thirds of the distance from the gun to the target. The maximum ordinate increases as the range increases (fig 126).

60. Cone of Fire

When the weapon is fired automatically in bursts, all the rounds do not follow the same path. This is due to the vibrations of the gun and mount, varia-

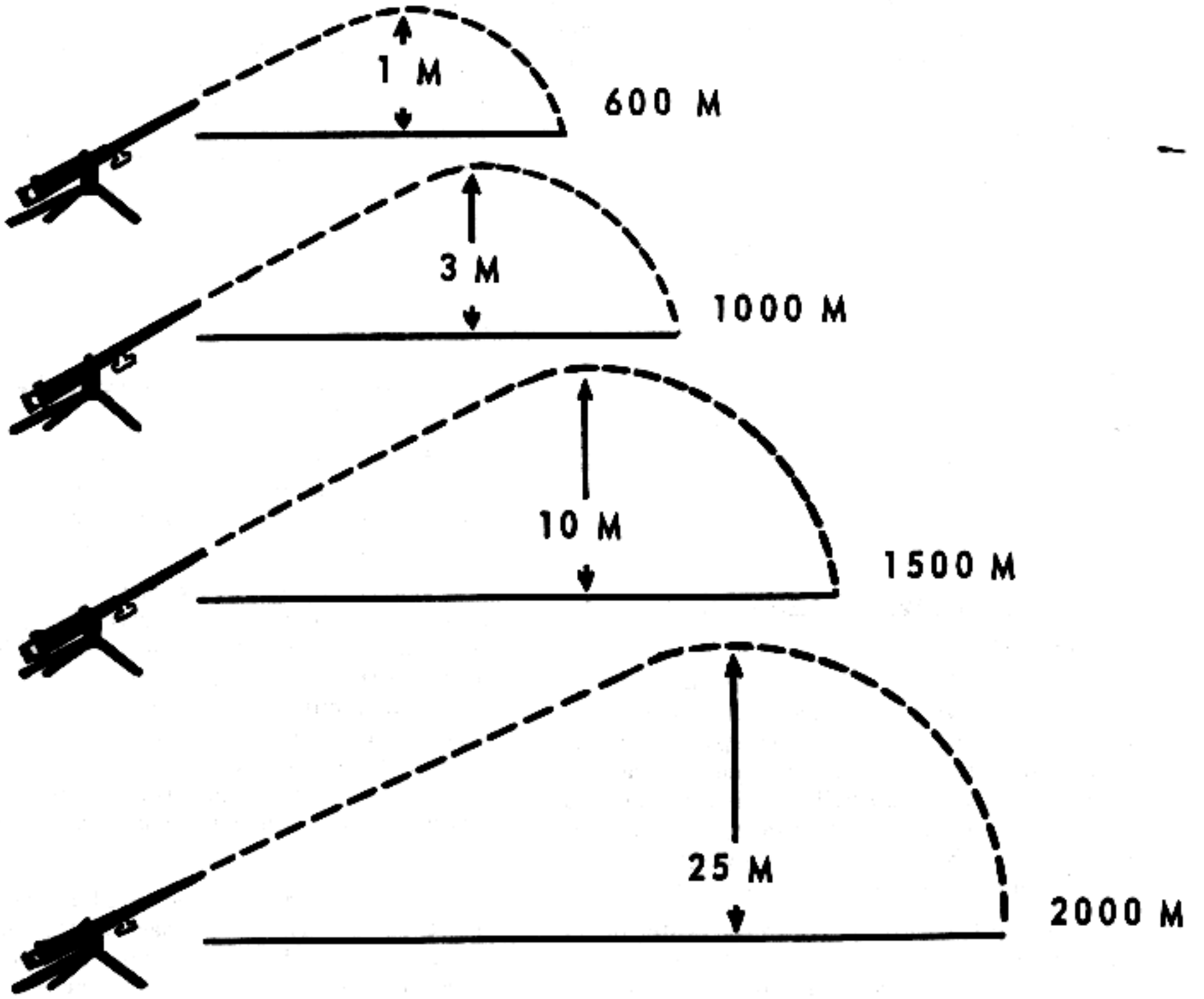


Figure 186. Maximum ordinates at key ranges.

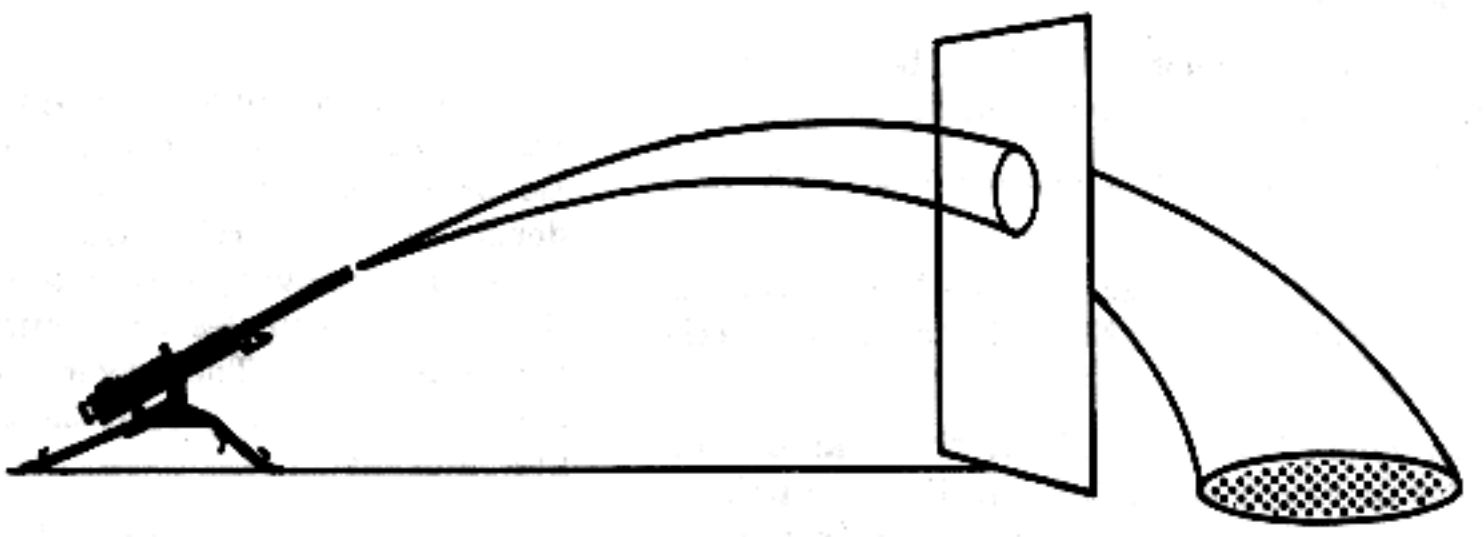


Figure 187. Cone of fire.

tions in ammunition, and atmospheric conditions which cause the rounds to follow a slightly different trajectory. This group of trajectories formed by a single burst is called the *cone of fire* (fig 127).

61. Beaten Zone

The beaten zone is an elliptical pattern formed by the cone of fire as it strikes the ground.

a. Effect of Range. As the range to the target increases, the beaten zone becomes shorter and wider.

b. Effect of Terrain. The length of the beaten zone for any given range will vary according to the slope of the ground. On rising ground, the beaten zone becomes shorter, but remains the same width. On ground that slopes away from the gun, the beaten zone becomes longer, but remains the same width.

Section III. CLASSES OF FIRE

62. General

Machinegun fire is classified with respect to:

a. The ground.

b. The target.

c. The gun.

63. Class of Fire With Respect to the Ground (Fig 128)

a. Plunging Fire. Fire in which the angle of fall of the rounds, with reference to the slope of the ground, is such that the danger space is practically confined to the beaten zone, and the length of the beaten zone is materially shortened. Plunging fire is obtained when firing from high ground into low ground, when firing from low ground into high ground, and when firing at long ranges.

b. Grazing Fire. Fire in which the center of the cone of fire does not rise more than one meter above the ground. When firing over level or uniformly sloping terrain, the maximum extent of grazing fire obtainable is approximately 1000 meters.

64. Classes of Fire With Respect to the Target (Fig 129)

a. Frontal. The long axis of the beaten zone is at a right angle to the long axis of the target.

b. Flanking. Delivered against the flank of a target.

c. Oblique. The long axis of the beaten zone is at an angle, but not a right angle, to the long axis of the target.

d. Enfilade. The long axis of the beaten zone coincides or nearly coincides with the long axis of the target. This class of fire is either frontal or flanking and is the most desirable class of fire with respect to the target, because it makes maximum use of the beaten zone.

65. Classes of Fire With Respect to the Gun (Fig 130)

a. Fixed Fire. Fire delivered on a point target. Little or no manipulation is required. After the initial burst, the gunners will follow any change or movement of the target without command.

b. Traversing Fire. Fire distributed against a wide target requiring successive changes in the direction of the gun. When engaging a wide target requiring traversing fire, the gunner should select successive aiming points throughout the target area. These aiming points should be close enough together to insure adequate target coverage, but not so close as to be wasteful of ammunition by concentrating a heavy volume of fire in a small area.

c. Searching Fire. Fire delivered against a deep target or a target that has depth, requiring changes in elevation of the gun. The amount of elevation change depends upon the range and slope of the ground.

d. Traversing and Searching Fire. Fire delivered both in width and depth by changes in direction and elevation. It is employed against a target whose long axis is oblique to the direction of the fire.

e. Swinging Traverse. Employed against targets which require major changes in direction but little or no change in elevation. Targets may be dense, of considerable width, in relatively close formations moving slowly toward or away from the gun, or vehicles or mounted troops moving across the front. The traversing slide lock lever is loosened enough to permit the gunner to swing the gun laterally.

f. Free Gun. Fire delivered against moving targets which must be rapidly engaged with rapid changes in both direction and elevation. Examples are: aerial targets, vehicles, mounted troops, or

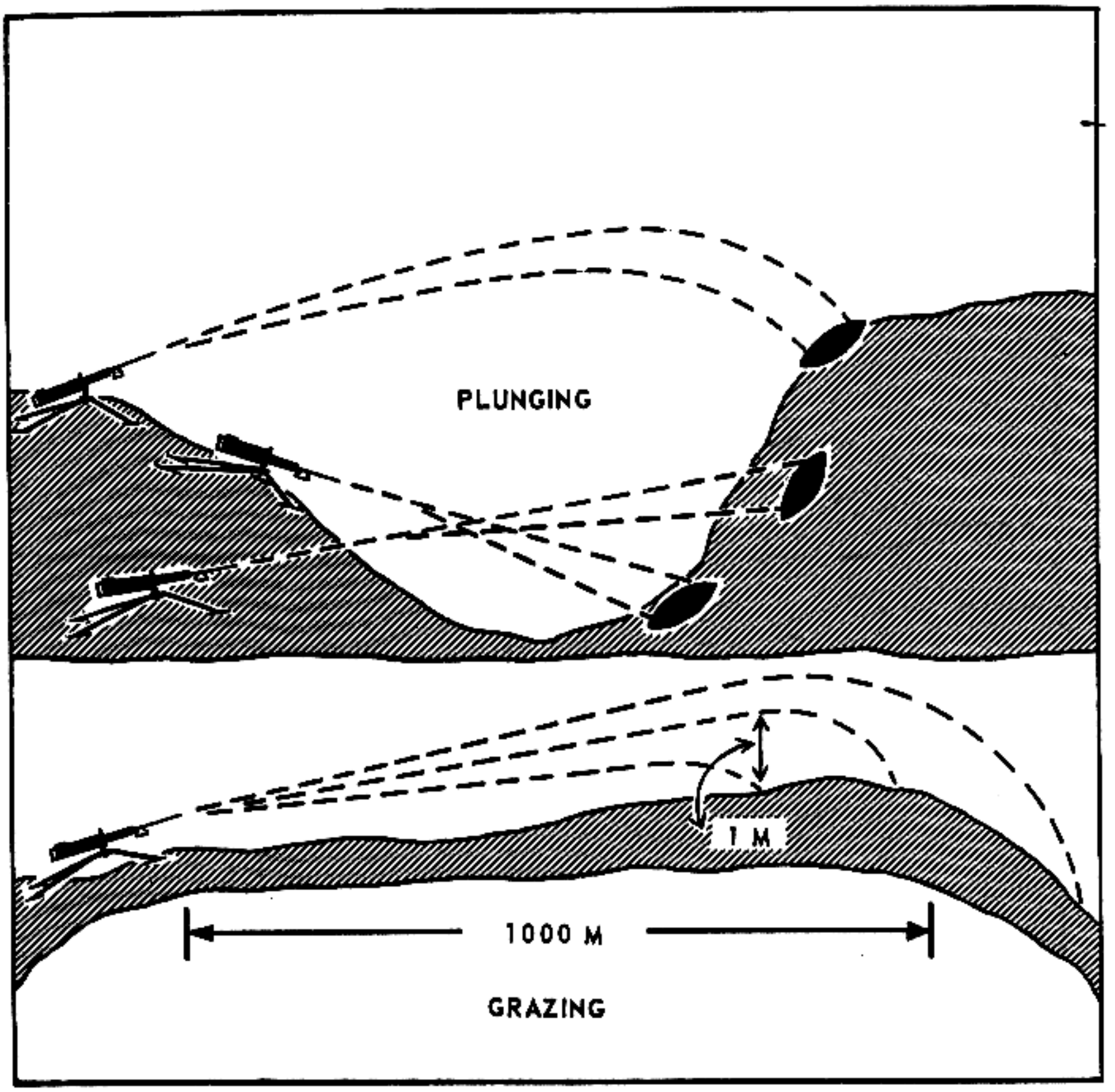


Figure 128. Classes of fire with respect to the ground.

infantry in relatively close formations moving rapidly toward or away from the gun position. To fire free gun on the M8 tripod mount, the gunner disengages the traversing slide lock lever from the traversing bar and pushes the traversing and elevating mechanism up, out of the way.

g. Rate of Fire. When firing swinging traverse and free gun, the weapon is normally fired at the cyclic rate of fire which is in excess of 450 rounds per minute, consuming a large quantity of ammunition. Also, there is no beaten zone as such, as each round seeks it own area of impact.

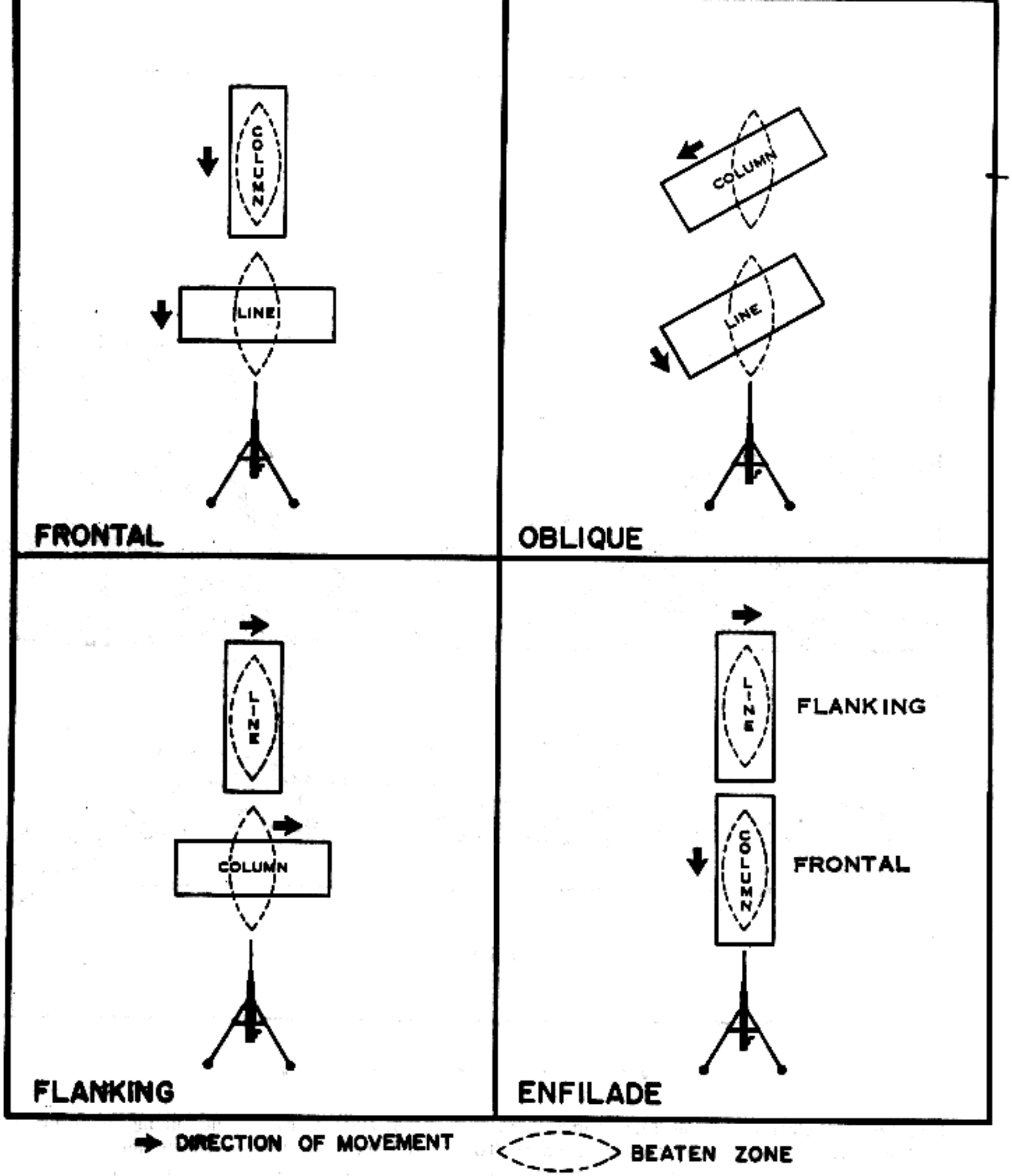


Figure 130. Classes of fire with respect to the target.

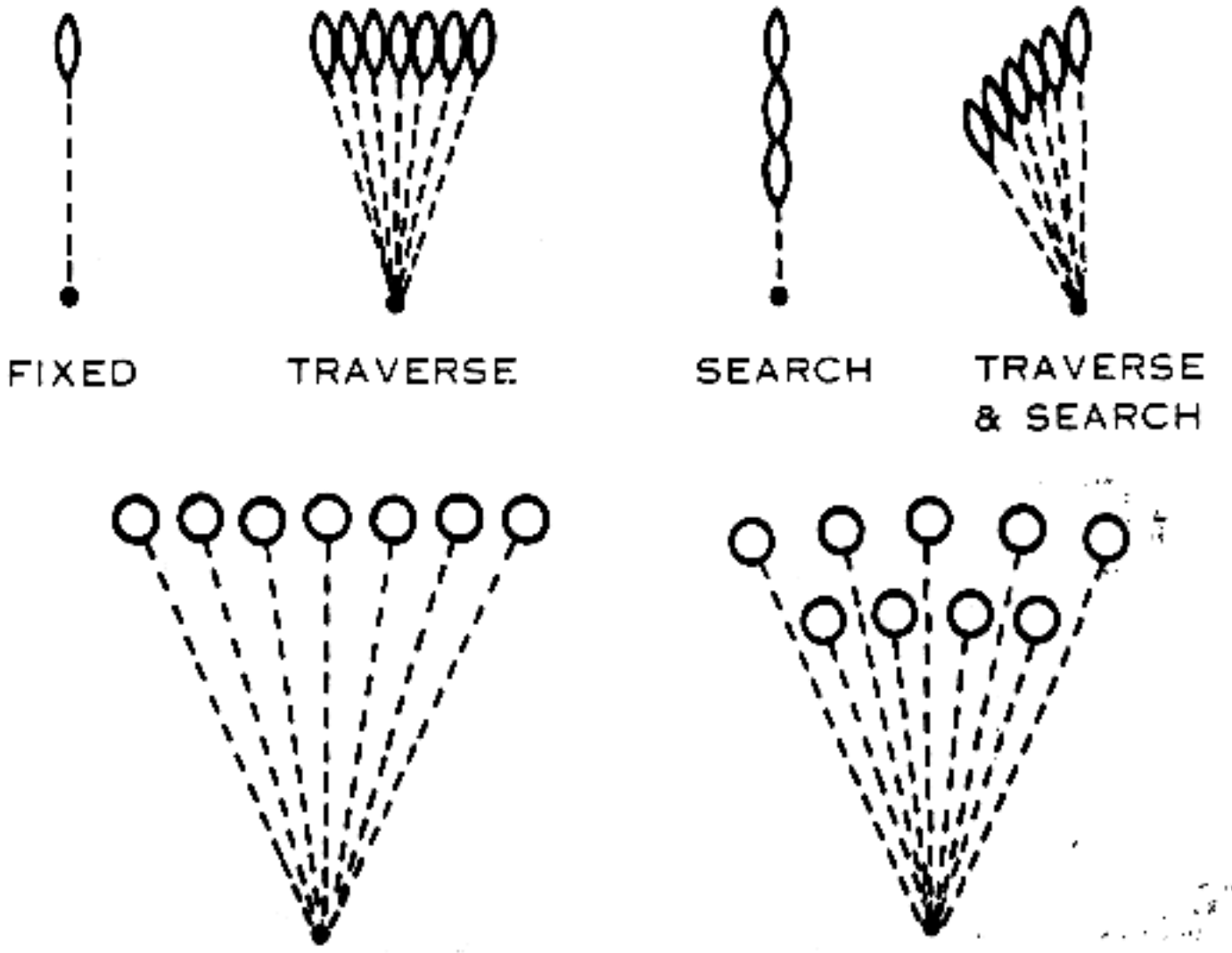


Figure 130. Classes of fire with respect to the gun.

Section IV. RANGE DETERMINATION

66. General

Range determination is the process of determining the distance between the gunner's position and his target. The gunner's ability to engage a target depends on his ability to accurately determine the range to the target. Under combat conditions, ranges are seldom known in advance; therefore, the effectiveness of fire depends largely upon the accuracy of range determination.

67. Maximum Usable Range

The maximum usable range is the range at which the target is visible to the gun crew or leader. This range varies with the terrain and visibility, but normally will not exceed the maximum effective range of the weapon. The caliber .50 HB, M2, machinegun has a maximum effective range of 1830 meters.

68. Methods of Range Determination

There are many methods for determining range. Some of these are estimating by eye, firing the gun, measuring range from a map or aerial photograph, stepping off the distance, or securing the information from other units. Ranges are determined to the nearest 100 meters for machinegun firing. In combat, the most commonly used methods are estimating by eye and firing the gun.

69. Estimating by Eye

This is the method most often used in the field. There are two methods of estimating by eye; the 100-meter unit of measure method and the appearance of objects method.

a. 100-Meter Unit of Measure Method. To use this method, the gunner must be able to visualize a 100-meter distance on the ground. With this distance in mind, he can mentally determine how many of these 100-meter units there are between his position and the target. In training, his estimates should be checked by pacing off the distance (the average soldier takes about 180 steps per 100 meters). Constant practice in applying the 100-

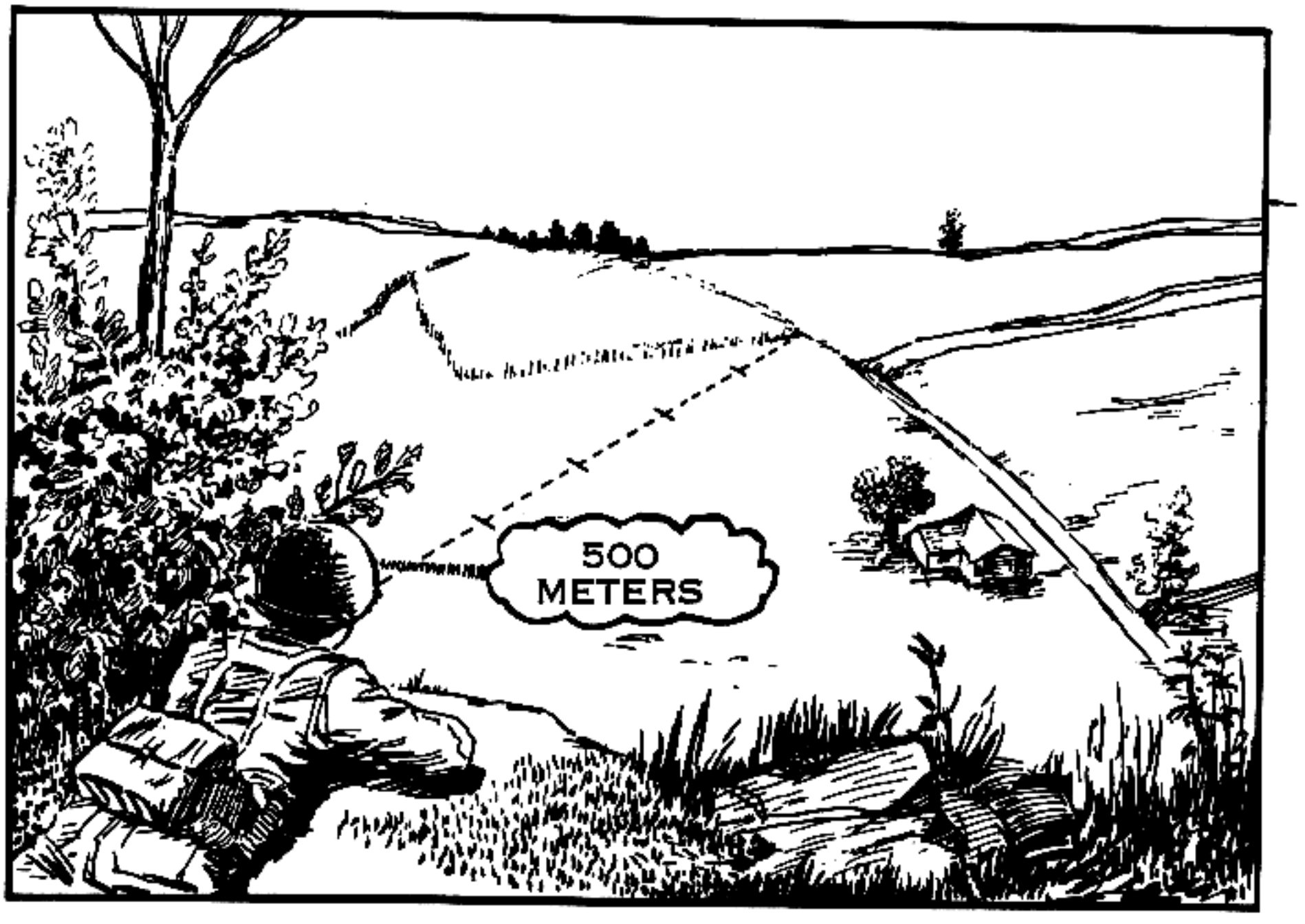


Figure 131. Applying the 100-meter unit of measurement method for ranges up to 500 meters.

meter unit of measure is essential. This method is used for ranges up to 500 meters (fig 131).

(1) For ranges from 500 to 1,000 meters, the soldier selects a point halfway to the target, determines the range to the midpoint by applying the 100-meter unit of measure, then doubles the estimate (fig 132). This method of determining range is not accurate beyond 1,000 meters.

(2) Certain types of terrain will affect the appearance of 100-meter units of measure. On terrain that slopes upward toward the target, 100 meters appears longer than on level terrain; on ground that slopes downward toward the target, 100 meters appears shorter than on level terrain.

b. The Appearance-of-Objects Method. Many times it is impossible to observe all of the terrain to the target. When this occurs, it is impractical to apply the 100-meter unit of measure, and ranges must be determined by the appearance-of-objects method. To use this method, the soldier must learn through practice how familiar objects look at various known ranges. For example, he studies the appearance of a man standing 100 meters away. He fixes the appearance of the man firmly in mind—his size and the details of his uniform and equipment. Next, he studies the man in a kneeling position, then in a prone position. This procedure is followed at various known ranges out to 500 meters. By comparing the appearance of the man in these positions at known ranges, he can establish a series of mental images which will help him to determine range on unfamiliar terrain out to 500 meters.

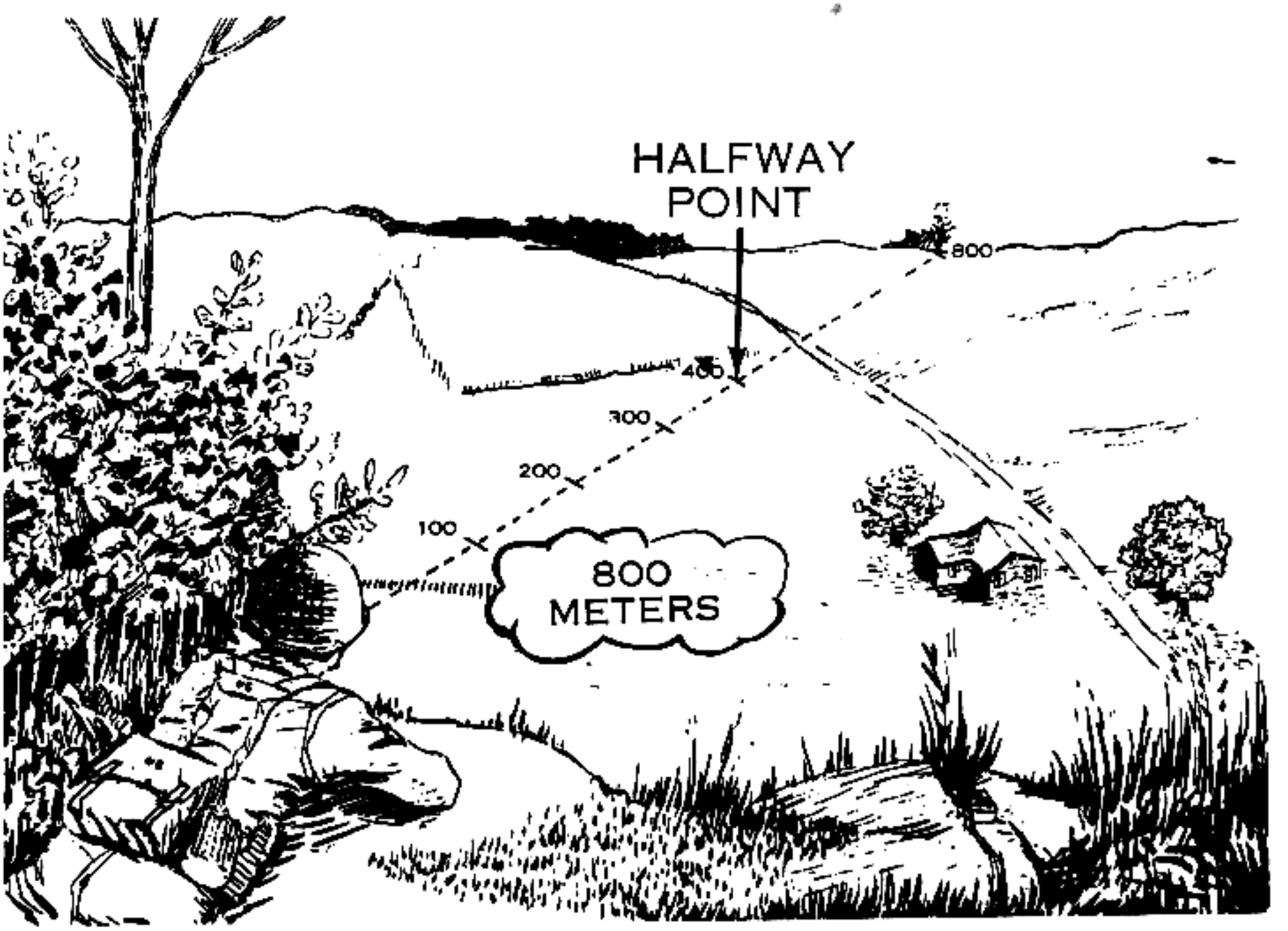


Figure 132. Applying the 100-meter unit of measure method for ranges greater than 500 meters.

(1) Training should be conducted to familiarize the soldier with the appearance of other familiar objects, such as weapons and vehicles, at various ranges.

(2) Factors which affect the appearance of objects must be considered, and an understanding of these factors will help to make estimates more accurate.

Table 1. Factors Affecting Range Estimation by Eye

Factor	Appears nearer (range is underestimated) when—	Appears more distant (range is overestimated) when—
Target visibility	Most of the target is visible and offers a clear outline.	Only a small part of the target is seen or target is small in relation to its surroundings.
Terrain, or position of the observer	Looking across a depression, most of which is hidden from view.	Looking across a depression, all of which is visible.
	Looking from low ground toward high ground. Looking down a straight, open road or along a railroad track.	Looking downward from high ground. Vision is narrowly confined as in streets, draws, or forest trails.
	Looking over uniform surfaces like water, snow, desert, or grain fields.	
Light and atmosphere	In bright light or the sun is shining from behind the observer.	In poor light such as dawn, and dusk, in rain, snow, fog, or when the sun is in the observer's eyes.
	The target is in sharp contrast with the background, or is silhouetted by reason of size, shape, or color, seen in the clear atmosphere of high altitudes.	The target blends into the background or terrain.

70. Other Methods of Determining Range

a. To determine range by firing the gun, the gunner opens fire on the target at the estimated range, and moves the center of the beaten zone into the center base of the target by means of the traversing and elevating handwheels. He resets the sight so the new line of aim is at the center base of the target and notes the sight setting on the rear sight. This sight setting may apply only to this gun.

b. When the ground in the vicinity of the target does not permit observation of the strike of the rounds, or when surprise fire on the target is desired, fire is adjusted on a point which offers observation and is known to be at the same range as the target. The gunner then lays his gun on the target when ordered.

c. When moving into positions occupied by other units, range cards prepared by those units can furnish valuable range information on targets, suspected targets, and various terrain features.

d. When the tactical situation and time permit, range may be determined by pacing off the distance.

71. Lateral Distance Measurement

In addition to the ability to determine range accurately, the gunner needs a quick method of measuring lateral distance right or left from a reference point to a target.

a. When the gun is mounted on the M3 tripod, width can be measured by aiming on a point and manipulating the traversing handwheel, counting the clicks from one point of aim to another point of aim. Each click equals one meter at 1,000 meters, or half a meter at 500 meters. This method is accurate but time-consuming.

b. The finger measurement method is not a method of range determination but only a method

Figure 133. The finger measurement method.

of measuring the lateral distance (in fingers) between two points. To measure the distance in fingers between a reference point and a target, extend the arm with the palm outward, the fingers cupped, and the elbow locked. Close one eye, raise the index finger, and sight along its edge, placing the edge of the finger along the flank of the target or reference point. Note the space remaining between the two points, and then fill this space by raising fingers until the space is covered. The measurement from the reference point to the target is then stated as being one or more fingers, depending on how many fingers are raised to cover this distance (fig 133).

Section V. FIRE CONTROL AND FIRE COMMANDS

72. Fire Control

a. General. Fire control of machineguns includes all operations connected with the preparation and actual application of effective fire on a target. It implies the ability of the leader to open fire at the instant he desires, adjust the fire of the gun(s) on the target, regulate the rate of fire, shift from one target to another, and cease firing. This ability to exercise proper fire control depends primarily on the discipline and the proper training of the crew. Failure to exercise fire control results in danger to friendly troops, loss of surprise effect, premature disclosure of positions, application of fire on unimportant targets, loss of time in adjusting fire, and waste of ammunition.

b. Methods of Fire Control. There are several methods of controlling machinegun fire. The noise of battle will limit the use of some of these methods; therefore, the leader must select the method or combination of methods which will best accomplish his purpose.

(1) *Oral.* This is an effective method of control; but at times the leader will be too far away from the gun crew(s) or the noise of battle will make it impossible for the gun crew(s) to hear him.

(2) *Arm-and-hand signals.* This is an effective method when the gun crew(s) can see the leader. All crew members must understand the standard arm-and-hand signals used to control machinegun fire.

(3) *Prearranged signals.* These are either visual or sound signals, such as pyrotechnics or blasts on a whistle. These signals should be included in appropriate SOP's and must be clearly understood by all crew members.

(4) *Personal contact.* In many situations, the leader must move to individual crew members to issue orders. This method of control is used more than any other by small unit leaders. The leader must use maximum cover and concealment to keep from disclosing the gun crew's position.

(5) *Standing operating procedures.* Standing operating procedures are actions the gun crews perform automatically, without command. SOP's, such as those described in (3) above, are developed during the training of the gun crews, and their application eliminates many commands and simplifies the leader's job of fire control.

c. Chain of Fire Control. The chain of fire control begins with a fire unit leader. Although there is no fixed unit organization for the caliber .50 machinegun, this type of unit can be selected from available personnel. The fire unit leader is responsible for both the technical and tactical employment of the gun(s) and the training of the crew. He is responsible for passing on to the crew members all instructions and orders from his next higher leader (commander) regarding the situation and mission. He assigns sectors of fire and firing positions, designates targets to be engaged, adjusts fire, and insures effective coverage of the targets.

d. Rates of Fire.

(1) Rapid: over 40 rounds per minute.

(2) Slow: 40 rounds or less per minute.

(3) Single-shot: one round.

(4) When engaging targets at ranges greater than 1,100 meters, the gunner should use single shot tracer ammunition. Firing the gun one round at a time allows the gunner to deliver well-aimed fire on the target.

e. Adjustment of Fire.

(1) Machinegun fire is adjusted by observing the strike of the rounds, observing the flight of tracers, frequently relaying the gun, or by a combination of these (para 118).

(2) Adjustment by observation of fire is the most important element of fire control if it is bold, aggressive, rapid, and continuous throughout the action. The gunner is trained to observe and adjust his gun's fire without command. He is trained to anticipate the action of the enemy after the initial burst, and is prepared to shift his fire to cover any change in formation or movement of his target. If the gunner fails to accomplish this, the fire unit leader must promptly correct him by announcing or signalling subsequent fire com-

mands. This responsibility to adjust fire continues through the chain of commands. When subsequent fire commands are given, the gunner makes the required corrections and continues to engage the target without any further command to fire.

(3) If the gun is fired on the tripod mount, subsequent commands are given to make changes in direction, elevation, and the rate of fire. These changes are given orally as, SHIFT RIGHT, SHIFT LEFT, ADD, or DROP. (For arm-and-hand signals see FM 21–60.) When making these announced changes, mils may be used to indicate the amount of desired shift; for example, SHIFT RIGHT 5, or SHIFT LEFT 7. When making changes in elevation, mils are not used, as it is normally difficult to determine just how high or low the center of the beaten zone is striking the ground in relation to the target.

73. Fire Commands

Fire commands are technical instructions issued by a leader to enable the unit or crew to accomplish a desired fire mission. Fire commands have been standardized for infantry direct fire weapons, and follow the same sequence. There are two types of fire commands: initial fire commands are issued to engage a target; and subsequent fire commands are issued to adjust fire, change the rate of fire; interrupt fire, shift fire to a new target, or to terminate the alert. A correct fire command is one that is as brief as clarity permits and includes all the elements necessary for the accomplishment of the fire mission. It is given in the proper sequence, transmitted clearly, and at a rate that permits receipt and application of instructions without confusion.

a. Elements of the Initial Fire Command. There are six essential elements of the initial fire command for the machinegun that are given or implied by using one or more of the methods of control. During training, the gun crew repeats each element of the fire command as it is given. This is done to avoid confusion and to train the crew to think and act in the proper sequence. The six elements of the initial fire command as they apply to the machinegun are, *alert, direction, description, range, method of fire,* and *the command to open fire.*

(1) *Alert.* This element brings the crew(s) to a state of readiness to receive further instructions. Once alerted, the gunner insures the gun is loaded; the assistant gunner continuously checks with the leader for orders or instructions and passes them on to the gunner. The oral alert is announced as, FIRE MISSION. At this command, the gunner is alerted that a target has been detected and fire may be delivered upon it. Since there is no fixed unit organization for the caliber .50 machinegun, it is possible that the leader may have more than one gun under his command. In this situation, the leader must number the gun crews. If the leader desires to alert the gun crews, but only fire one gun, he will announce, FIRE MISSION, then designate the number of the gun to fire, NUMBER 2 (or 1). If he wants to alert only one gun crew he will announce NUMBER 1 (or 2), FIRE MISSION.

(2) *Direction.* This element indicates the general direction to the target and may be given in one or a combination of the following ways:

(*a*) *Orally.* The leader gives the direction to the target in relation to the position of the gun(s). For example, FRONT, RIGHT FRONT, LEFT FRONT.

(*b*) *Pointing.* The leader can designate a small or obscure target by pointing with his arm and hand or aiming the machinegun(s). When pointing with his arm and hand, a man standing behind him should be able to look over his shoulder and sight along his arm and index finger to locate the target. When a gun has been aimed at a target, a soldier looking through the sights should be able to see the target.

(*c*) *Use of tracer ammunition.* Tracer ammunition is a quick and sure method of designating a target which is not clearly visible. When using this method, the leader should first give the general direction to direct the gun crew's attention to the desired area. To minimize the loss of surprise when using tracer ammunition, the leader does not fire until he has given all the elements of the fire command except the command to fire. When using this method of designating a target, the leader may use his individual weapon or fire one or more bursts from the machinegun. The firing of the tracer(s) then becomes the last element of the fire command and is the signal to open fire. For example:

FIRE MISSION
FRONT
BUNKER
WATCH MY TRACER(S)
BURST (OR SINGLE ROUND)

The leader fires his individual weapon or a machinegun at the enemy bunker then his gun crew(s) open fire.

(*d*) *Reference points.* Another method of designating obscure targets is by using easily recognizable reference points. Prominent terrain features and manmade objects make good reference points. All leaders and members of the

crew(s) must be familiar with the terrain features and the terminology used to describe them. When using a reference point, the word "reference" precedes its description and the word "target" precedes the target description. This is done to avoid confusion. The general direction to the reference point should be given.

1. Example of the use of the reference points:

FIRE MISSION, NUMBER 2
FRONT
REFERENCE: LONE PINE TREE
TARGET: TRUCK

2. Sometimes a target must be designated by using successive reference points. For example:

NUMBER 1, FIRE MISSION
RIGHT FRONT
REFERENCE: RED-ROOFED HOUSE, LEFT TO HAYSTACK, LEFT TO BARN
TARGET: MACHINEGUN

3. Finger measurements (para 71*b*) can be used to direct the gun crew's attention to the right or left of reference points. For example:

FIRE MISSION
LEFT FRONT
REFERENCE: CROSSROAD
RIGHT FOUR FINGERS
TARGET: LINE OF TROOPS

4. When the guns are mounted on tripods, lateral distance from reference points can be accurately announced. When gunners are firing the tripod-mounted gun, lateral distance is assumed to be in mils unless otherwise indicated, so the word "mils" is not necessary. For example:

FIRE MISSION
FRONT
REFERENCE: KNOCKED-OUT TANK
LEFT FOUR ZERO
TARGET: COLUMN OF TROOPS

(*e*) *Description.* The target description is used to create a picture of the target in the minds of the gun crew. The gun crew(s) must know the type of target they are to engage to properly apply their fire. The leader should describe it briefly, but accurately. For example:

Dismounted enemy personnel ..... TROOPS
Automatic weapons ..... MACHINEGUN
Armored vehicles ..... TANK
Artillery or antitank weapon ..... ANTITANK
Airplanes or helicopters ..... AIRCRAFT

If the target is obvious, no description is necessary. Finger measurements or mil measurements can be used to designate the width of a linear target when the flanks cannot be pinpointed.

(*f*) *Range.* The range to the target is given so the gun crew(s) know how far to look for the target and immediately know what range setting to place on the rear sight. Range is determined and announced in meters. Since the meter is the standard unit of range measurement, the word "meters" is not announced. With machineguns, the range is determined and announced in even hundreds and thousands. For example: THREE HUNDRED, ONE THOUSAND, ONE ONE HUNDRED. This element may be omitted when the gunners can obviously determine the range; however, it is desirable in some situations to announce the range.

(*g*) *Method of fire.* This element includes manipulation and rate of fire.

1. Manipulation is used to prescribe the class of fire with respect to the gun (para 65). It is announced as FIXED, TRAVERSE, SEARCH, TRAVERSE AND SEARCH, SWINGING TRAVERSE, or FREE GUN.

2. Rate is used to control the rate of fire. There are three rates of fire which may be announced for the gun: slow, rapid, or single-shot (para 72*d*).

(*h*) *Command to open fire.* If surprise fire is not desired the command FIRE is given without pause. It is often important that machinegun fire be withheld for maximum effect of surprise fire. To insure this, the leader may preface the command to commence firing with the words AT MY COMMAND or AT MY SIGNAL. When the gunner(s) are ready to engage the target, they report UP to the assistant gunner(s) who signal READY to the leader. For example:

FIRE MISSION
FRONT
TROOPS
AT MY COMMAND (Pause until crew members are ready and fire is desired.)
FIRE (or appropriate arm-and-hand signal)

74. Abbreviated, Informal Fire Commands

Fire commands need not be the complete formal command to be effective. In combat, the leader's fire command will seldom include all elements of the formal fire command. He will use only those elements necessary to rapidly place effective fire on a target without confusion. However, during training he should initially use all elements of the formal fire command to instill in the crew mem-

bers the habit of thinking and reacting in the proper manner when a target is to be engaged. After the crew members have been thoroughly trained in formal fire commands, they should be taught to react to the abbreviated or informal fire command, using the various methods of control as discussed in paragraph 72. There are three elements that must be given in the abbreviated or informal fire command: the *alert, range,* and *the command to commence firing.* Other elements of the formal fire command may be used, depending upon the tactical situation and time.

75. Doubtful Elements and Corrections

a. Doubtful Elements. When the gunner is in doubt about any element of the fire command, he repeats the element of the fire command in question and states THE COMMAND WAS. At this time the leader announces THE COMMAND WAS, and repeats the element in question, and continues with the fire command.

b. Corrections.

(1) *Initial fire commands.* When the leader makes a mistake in the initial fire command, he corrects it by announcing CORRECTION, and then gives the corrected element(s). For example:

FIRE MISSION
FRONT
TROOPS
FIVE HUNDRED
CORRECTION
SIX HUNDRED
TRAVERSE
AT MY COMMAND

(2) *Subsequent fire commands.* When the leader makes an error in the subsequent fire command, he may correct it by announcing CORRECTION, and then repeating the entire subsequent fire command. For example:

LEFT FIVE, DROP ONE
CORRECTION
LEFT FIVE, DROP ONE ZERO

76. Subsequent Fire Commands

If the gunner fails to adjust his fire on the target, the leader must promptly correct him by announcing or signaling the desired changes. When changes are given, the gunner makes the required corrections and continues to engage the target without further command. When firing under the control of a leader, the assistant gunner checks with the leader for instructions which he passes on to the gunner (para 72*e*).

a. Changes in the rate of fire are given orally and by arm-and-hand signals.

b. To interrupt firing, the leader announces CEASE FIRE or gives a signal to cease fire. The gun crew(s) remain on the alert and firing can be resumed on the same target by announcing FIRE.

c. To terminate the alert, the leader announces CEASE FIRE, END OF MISSION.

Section VI. PRINCIPLES OF APPLICATION OF FIRE

77. Direct Laying

Direct laying is pointing the gun for direction and elevation so that the sights are alined directly on the target. An intelligent application of the principles of direct laying involves a knowledge of the factors contained in this chapter.

78. Target Designation

Target designation follows a logical prescribed sequence. The three elements used to designate targets are *direction, description,* and *range.* These elements may be transmitted orally, by using arm-and-hand signals, by pointing, or by a combination of these methods. Targets may also be designated by laying or firing the gun.

79. Fire Distribution, Concentration, and Rates of Fire

a. General. To be effective, machinegun fire must be distributed over the entire target area. Improper distribution of fire results in gaps which allow the enemy to escape or use weapons against friendly positions without effective opposition. The method of applying fire to a target is generally the same for either a single gun or a pair of guns.

b. Engaging Ground Targets. There are five main factors that govern employment against ground targets.

(1) Greater accuracy when fired single-shot.
(2) Long beaten zone.
(3) Low rate of sustained fire.
(4) Any number of guns may be operating together at any given time, as opposed to fixed organization.
(5) Best used at long ranges or against targets where penetration of cover is a consideration.

c. Distribution and Concentration of Fires.

(1) Fire is delivered in width, depth, or in a

combination of the two. To distribute fire properly, the gunners must know where to aim, how to adjust their fire, and the direction to manipulate the gun.

(*a*) *Point of initial lay and adjustment.* The gunner must aim, fire, and adjust on a certain point of the target. It is extremely important that fire be adjusted boldly, rapidly, and continuously. Binoculars may be used by the leader to facilitate fire adjustment. The gunner insures, throughout his firing, that the center of the beaten zone is maintained at the center base of the target for maximum effect from each burst of fire. When this is done, projectiles in the upper half of the cone of fire will pass through the target if it has height, and the projectiles in the lower half of the beaten zone may ricochet into the target (fig 134).

(*b*) *Direction of manipulation of the gun after adjusting fire onto the point of initial aim.* The gunner must move his beaten zone in a cer-

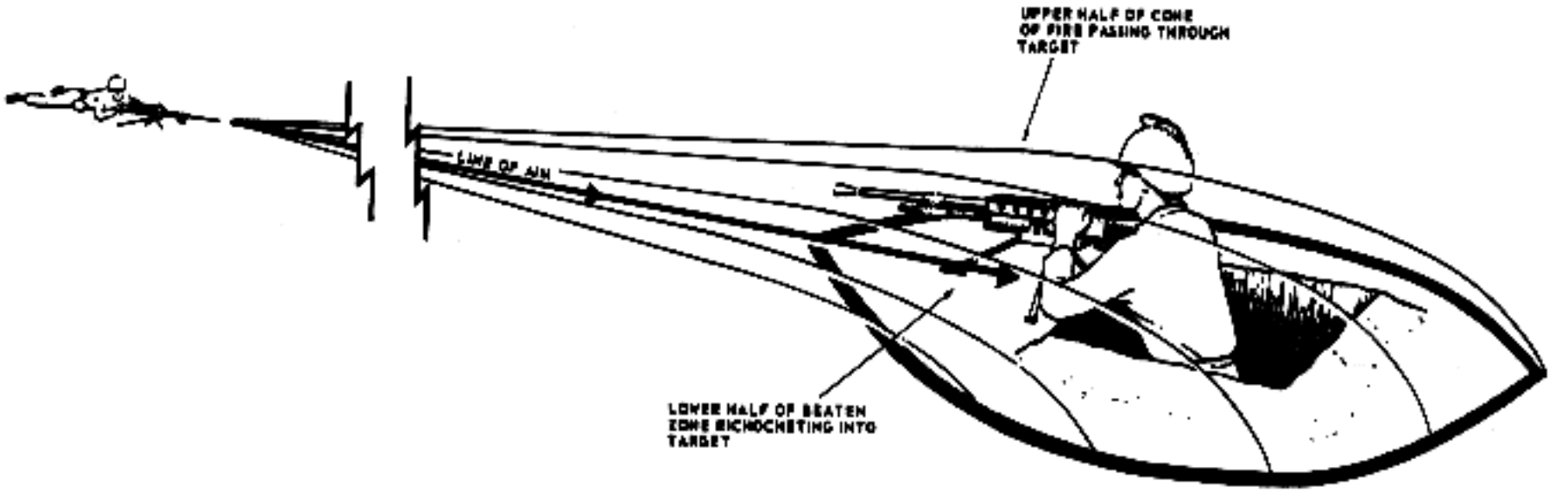


Figure 134. Line of aim and placement of center of beaten on target.

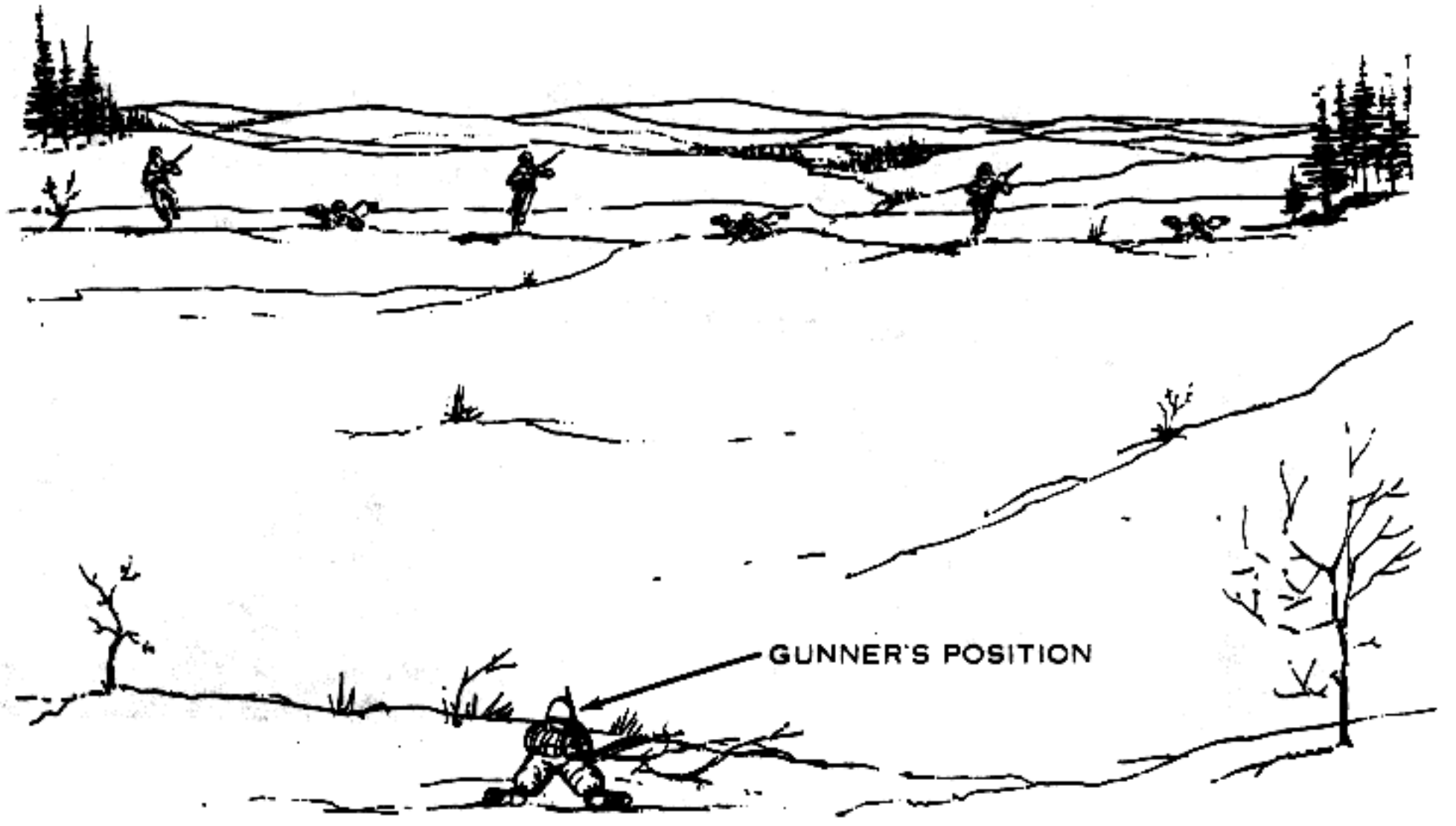


Figure 135. Linear target.

tain direction over the target. The direction depends on the type of target and whether the target is engaged with a pair of guns or a single gun. When engaging targets other than point targets with a pair of guns, the targets are divided so that fire is evenly distributed through the target area.

(2) Fire delivered on point targets or a specific area of other target configurations is called concentrated fire.

d. Rates of Fire.

(1) There are three rates of fire with the machinegun; slow, rapid, and single-shot. These rates are established primarily as a guide for training. In training, the rate of fire should be announced to facilitate learning and to provide the gunners with a basis for judging the number of rounds being expended.

(*a*) *Slow fire* is any number of rounds less than 40 rounds per minute in bursts of six to nine rounds at 10 to 15 second intervals. It is directed by announcing SLOW.

(*b*) *Rapid fire* is any number of rounds greater than 40 rounds per minute fired in bursts of six to nine rounds at 5 to 10 second intervals. It is directed by announcing RAPID.

(*c*) *Single-shot.* The caliber .50 machinegun, as compared with other automatic weapons, has the capability of firing one round at a time. It is directed by announcing SINGLE-SHOT. This rate of fire can be delivered very effectively against targets at great ranges since it allows the gunner to place well-aimed shots into the target. Single-shot rounds can be fired every 2 or 3 seconds; however, the rate of fire is dictated by the nature of the target and the range.

(*d*) *The cyclic rate of fire* represents the maximum amount of ammunition which can be expended by a gun in 1 minute. The cyclic rate of fire for the caliber .50 machinegun is in excess of 450 rounds per minute. The gun fires at this rate of fire when the trigger is held down and ammunition is continuously fed into the gun for any given period of time.

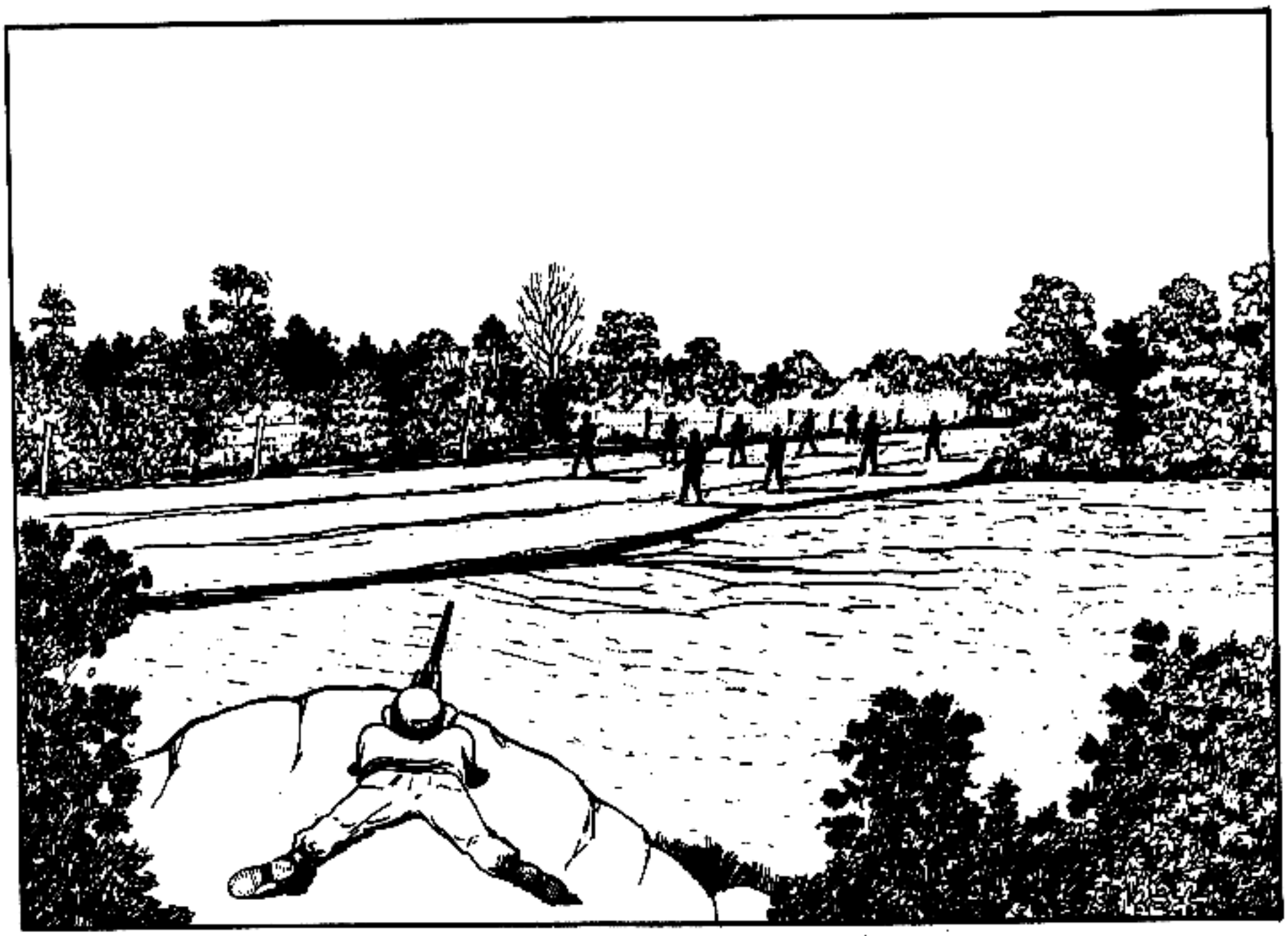


Figure 136. Linear target with depth.

(2) The rates of fire below should be followed for maximum effect:

(*a*) Ground targets are initially engaged using the rapid or higher rate in order to gain fire superiority. Once fire superiority has been gained, the rate of fire is reduced to a point that is sufficient to maintain fire superiority. This reduction in rate of fire is necessary to keep the barrel from overheating and to conserve ammunition.

(*b*) Aerial targets (chap 11) are engaged using the cyclic rate.

80. Types of Targets

Targets presented to the machinegunners during combat will in most cases consist of enemy soldiers in various formations which require distribution and concentration of fire. These targets have width and depth, and the application of machinegun fire is designed to thoroughly cover the area in which the enemy is known or suspected to be. These targets may be easily distinguishable or may be indistinct and difficult to locate.

a. Point targets are targets which require the use of a single aiming point. Enemy bunkers, weapons emplacements, vehicles, small groups of soldiers, and aerial targets such as helicopters or descending paratroopers are examples of point targets.

b. Linear targets have sufficient width to require traversing fire and no more depth than can be effectively covered by the beaten zone (fig 135).

c. Linear targets with depth are targets which have sufficient width to require traversing fire, and depth which cannot be covered by the beaten zone. A combined change in direction and elevation (traversing and searching fire) is required to maintain effective fire on these targets (fig 136).

d. Deep targets have depth but very little width and can be effectively covered by searching fire (fig 137).

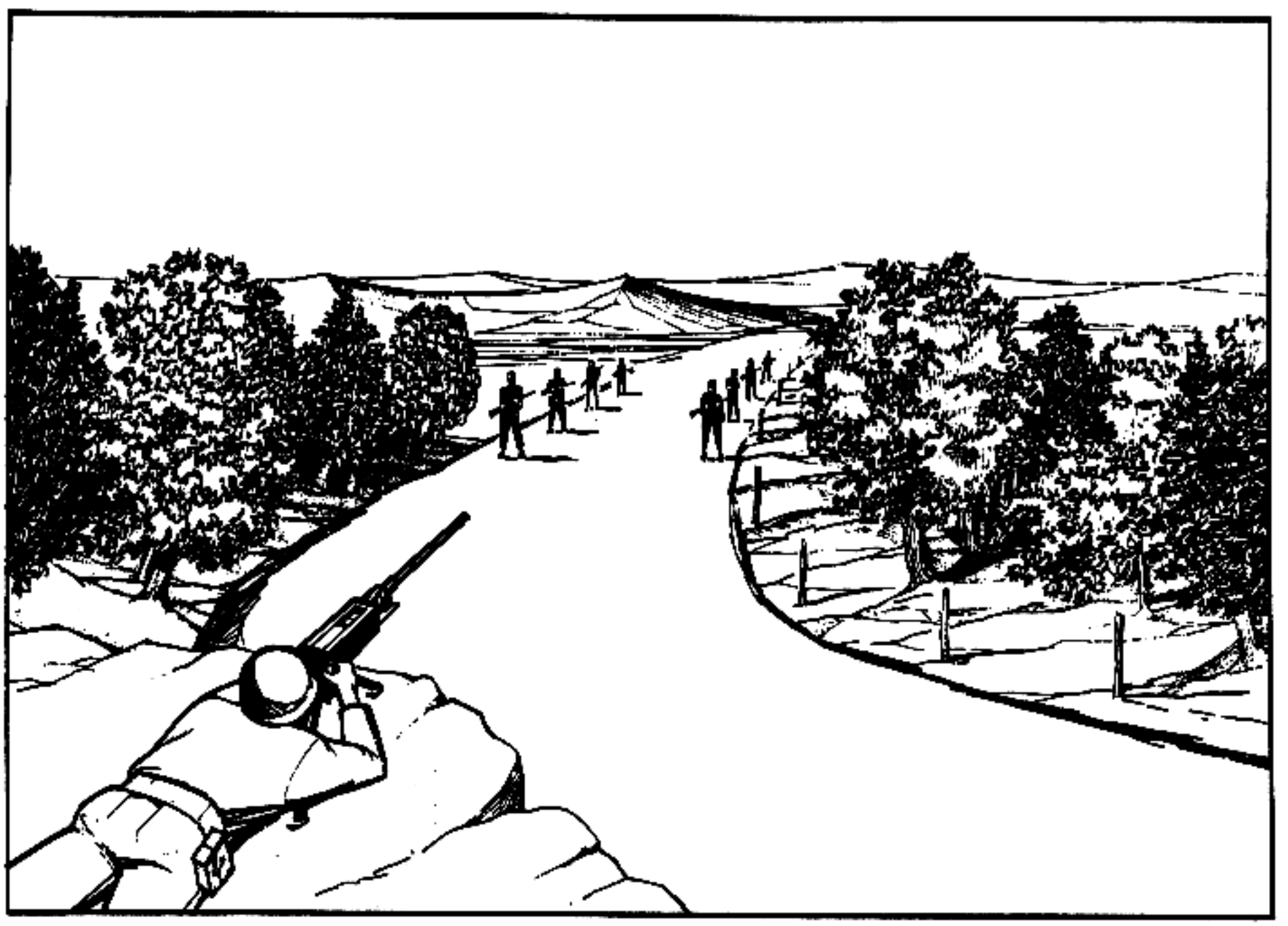


Figure 137. Deep target.

e. Area targets as discussed in this manual have considerable width and depth and require extensive traversing and searching fire. This type target exists when the enemy is in a certain area but his exact location is not known. A hilltop is a typical area target.

Section VII. APPLICATION OF FIRE (TARGET ENGAGEMENT/DIRECT LAY)

81. General

a. When machinegun fire is under direct control of a leader, he designates the midpoint and flanks or ends of a target unless they are obvious to the gun crew(s).

b. When a target other than a point target is engaged by two gunners, it is always divided. Each gunner applies his fire to that portion of the target corresponding to his position with relation to the other gun. Normally, each gunner engages one-half of the target; however, gunners must be prepared to engage the entire target if necessary. Gunners continue to fire on the target until it is neutralized or until another signal is received from the leader.

c. The gunner's positions should be numbered so each gunner will know which portion of a target he should engage. (This pertains also to the vehicular-mounted weapons.) It should be emphasized that the positions are numbered, not the guns or gunners.

d. To insure that gunners react quickly and properly when they detect a target or when a target is designated by the leader, standard methods of applying fire to the various type targets are taught. These methods are the same for ground and vehicular-mounted guns.

82. Point Target

A point target is engaged with fixed fire. If the target moves after the initial burst, the gun crew(s) keeps fire on the target by following its movement with the gun(s).

83. Linear Targets

Linear targets are engaged with traversing fire.

a. Two Guns.

(1) *Normal division.* The target is divided at the midpoint; the right gun (No. 1) engages the right half of the target, and the gun on the left (No. 2) engages the left half of the target. The point of initial lay and adjustment for both guns is at the midpoint of the target. After adjusting on the midpoint, the right gun(No. 1) traverses the right half of the target to include one aiming point beyond the last visible target flank and returns to the midpoint.

(2) *Special division.* If one portion of the target presents a greater threat than another, the target can be divided so fire is concentrated on that portion presenting the greatest threat. The special division of the target is accomplished by a subsequent fire command after firing begins. The gunners initially lay at the midpoint, regardless of the special division to be made, thus precluding confusion.

b. One Gun. A Single gunner must engage the entire width of a linear target. The point of the initial lay and adjustment is on the midpoint, or that portion of the target presenting the greatest threat. The gunner traverses to either flank and then covers the remainder of the target.

84. Deep Targets

Deep targets are engaged with searching fire. When range is announced, it is given to the midpoint of the target.

a. Two Guns. The point of initial lay of both guns is on the midpoint, which is also the point of division. Since enfilade fire (para 64*d*) is delivered, it is not necessary to adjust on the midpoint of the target because the long axis of the beaten zone will compensate for missing the midpoint. However, should the gunner's beaten zone be out of the lateral confines of the target it will be necessary to adjust fires into the target area. After the initial bursts, the right gun (No. 1) searches to the near end of the target, the left gun (No. 2) searches to the far end of the target. Both gunners then reverse their direction of search and return to the midpoint (fig 138).

b. One Gun. A single gunner initially lays and fires at the midpoint of a deep target, unless another portion of the target presents a greater threat. The gunner immediately searches to the near end then covers the entire target.

85. Linear Targets with Depth

Linear targets with depth are engaged with traversing and searching fire. When range is announced, the range to the midpoint is given.

a. Two Guns. The method of division, the point of initial lay and adjustment, and the extent of

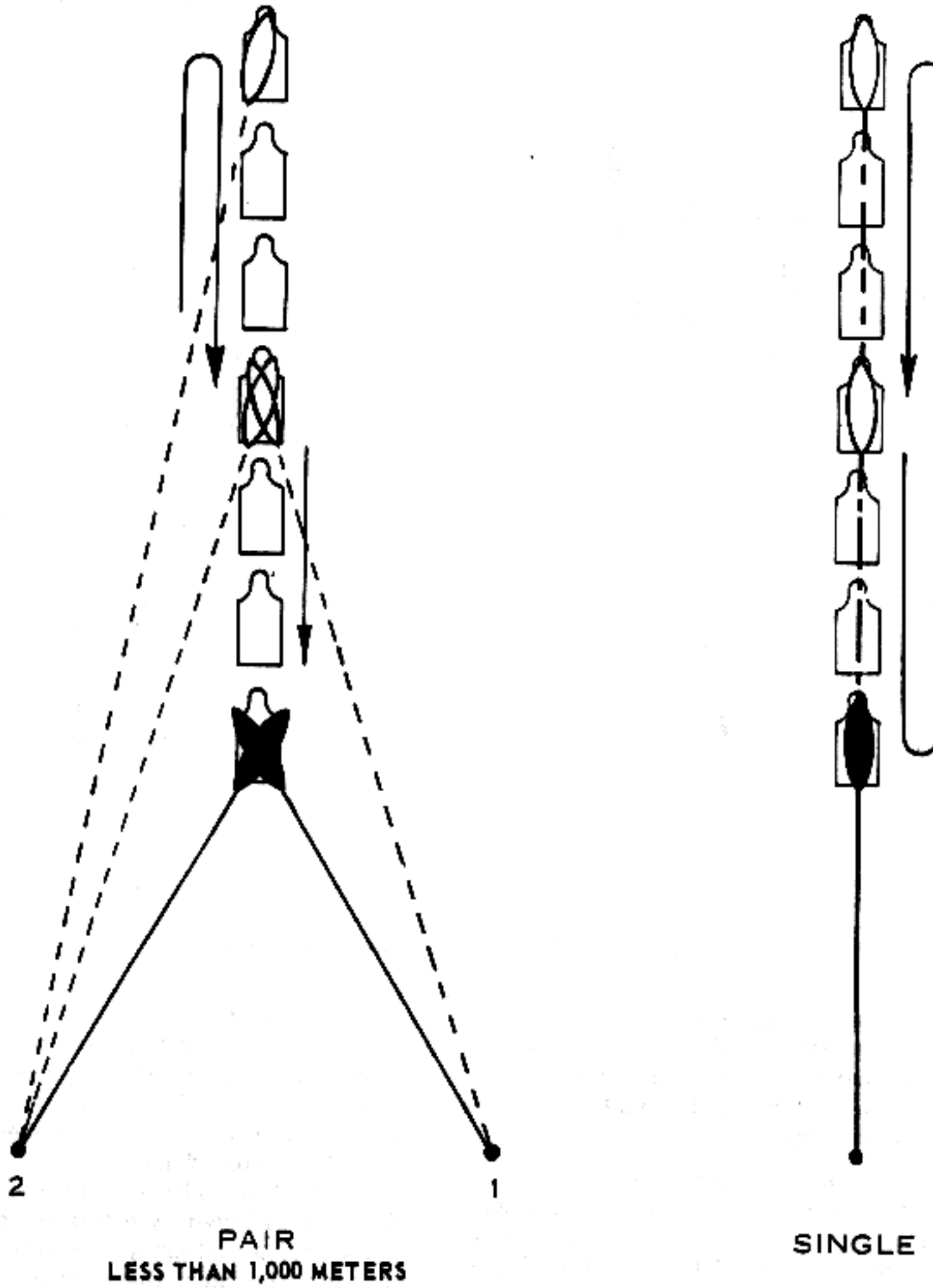


Figure 188. Engagement of deep targets.

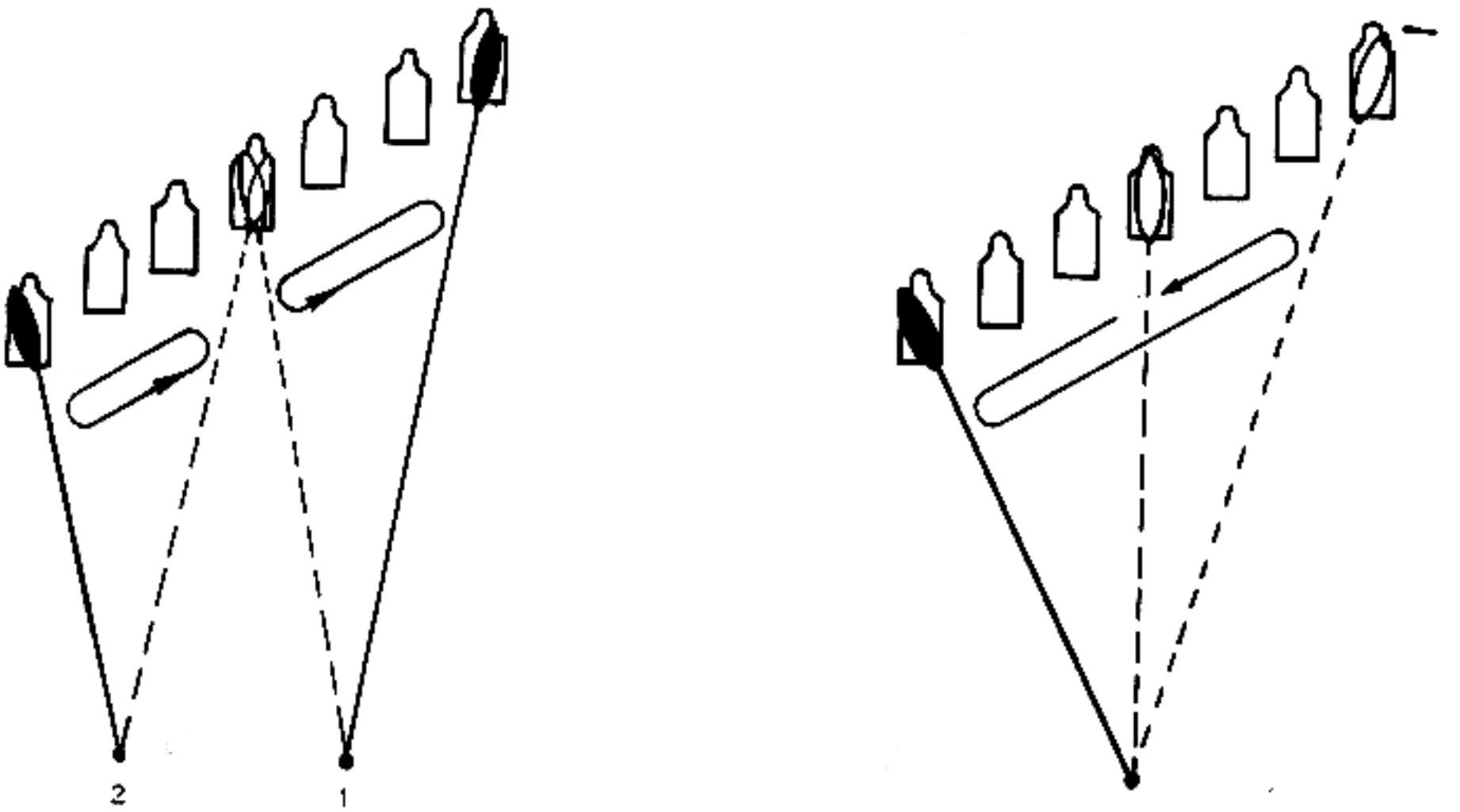


Figure 139. Engagement of linear targets with depth.

manipulation for both guns are the same as prescribed for linear targets. The gunners, however, apply enough search between each burst to insure the center of the beaten zone is maintained at the center base of the target.

b. One Gun. A single gunner initially lays and adjusts on the midpoint of a linear target with depth, unless some other portion of the target presents a greater threat. The gunner traverses and searches to the near flank, then covers the entire target area (fig 139).

86. Area Targets

The leader designates an area target by indicating to the gun crew(s) the width and depth of the target. Area targets are engaged with traversing and searching fire.

a. Two Guns.

(1) The target is divided at the center of mass; the right gun (No. 1) fires on the right half and the left gun (No. 2) fires on the left half. The point of initial lay and adjustment for both guns is on the center of mass.

(2) After adjusting on the center of mass, fire is distributed by determining the size of the beaten zones and applying direction and elevation changes that cause the most effective coverage of the target area. Both guns traverse and search their respective halves to the flanks, then return to the midpoint.

b. One Gun. A single gunner engages an area target by laying and adjusting on the center of mass, traversing and searching to either flank, then, reversing the direction, traversing and searching to the other flank (fig 140).

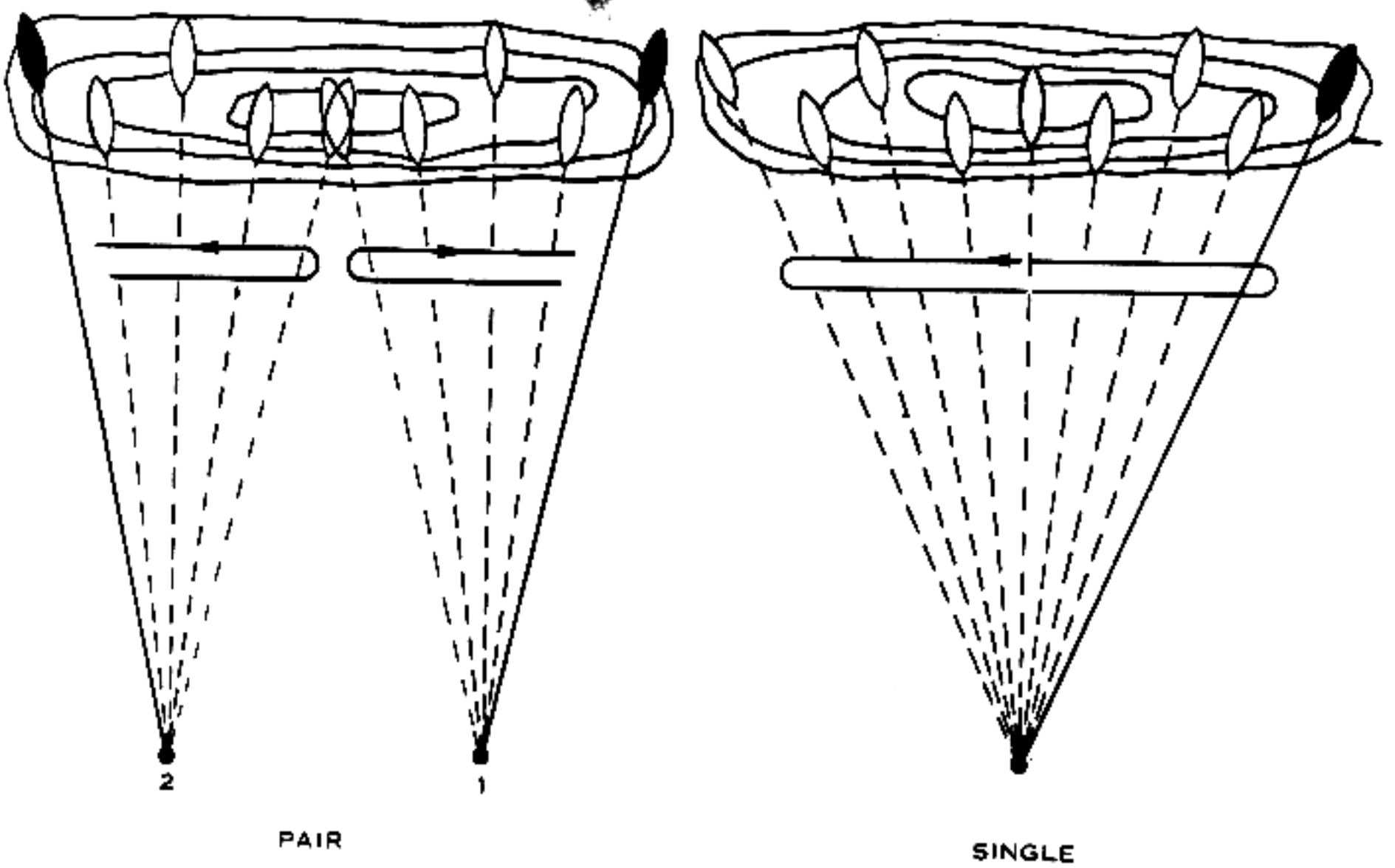


Figure 140. Engagement of area targets (objective).

Section VIII. OVERHEAD FIRE

87. General

a. Fire delivered over the heads of friendly troops is overhead fire. During training, it is used only when troop safety has been proven. The terrain and visibility dictate when overhead fire can be delivered safely.

b. Overhead fire is used only when the following conditions have been met:

(1) The safety limit has been determined and has been identified on the ground.

(2) The gun mount is firmly seated.

(3) Friendly troops have been notified, if at all possible, that fire is to be delivered over them.

(4) The rate of fire does not exceed 40 rounds per minute.

(5) The gun barrel is not badly worn. This condition is indicated by excessive muzzle blast.

88. Determining the Safety Limit

a. Minimum Clearance. When delivering overhead fire, the center of the cone of fire must clear the feet of friendly troops by a prescribed distance. This distance is known as minimum clearance.

b. Safety Angle. The amount of elevation change required on the gun to give minimum clearance is known as the safety angle. The safety angle is the difference between the angle of elevation to hit the troops and the angle of elevation for troop safety.

c. Corresponding Range. When the safety angle is placed on the gun, the point where the center of the beaten zone would strike the ground determines the shortest range at which fire can be delivered over the heads of friendly troops. When the ground is level or uniformly sloping between the gun and the target, the corresponding range for the safety angle used is obtained by converting the troop safety angle from mils into meters. The corresponding ranges are in firing table FT .50 AA–T–2 or FT .50–H–2, for types of ammunition indicated.

d. Uneven Terrain. Level or uniformly sloping ground is seldom found in the field. This limits the use of firing tables and corresponding ranges in determining the limit of troop safety. In lieu of firing tables, a rule of thumb has been devised to give the gunner a simple method of checking for troop safety.

(1) The gunner's rule can be applied when the friendly troops are at least 350 meters in front of the gun position, and the range to the target is 850 meters or less.

(*a*) Lay the gun on the target with the correct sight setting to hit the target.

(*b*) Without disturbing the lay of the gun, set the rear sight at a range of 1600 meters.

(*c*) Look through the sights and notice where the new line of aim strikes the ground. This is the limit of troop safety. When the feet of the friendly troops reach this point, fire must be lifted or shifted.

(2) When the range to the target is greater than 850 meters, overhead fire should be delivered only in an emergency and then only out to a range in which either the tracers of the strike of the bullets can be seen by the gunner.

89. Precautions for the Overhead Fire

The following safety precautions *must* be observed in delivering overhead fire.

a. Firmly emplace the tripod mount.

b. Use depression stops to prevent the muzzle of the gun from accidentally being lowered below the safety limit.

c. Do not deliver overhead fire through trees.

d. Inform commanders of friendly troops when fire is to be delivered over their heads.

e. Insure that all members of the gun crew(s) are aware of the safety limit.

f. Do not deliver overhead fire if the range from the gun to the target is less than 850 meters or exceeds 850 meters.

g. Do not use a barrel which has excessive muzzle blast or is otherwise determined to be badly worn.

h. During training exercises:

(1) Do not lay machineguns so their fire will cross at any point over the heads of friendly troops.

(2) Consult AR 385–63 and local safety regulations concerning overhead fire.

Section IX. DEFILADE POSITION

90. General

In order to achieve maximum effectiveness, the machinegun must be employed using the technique of direct lay; however, at times it may be desirable to employ guns from defilade positions. A machinegun is in defilade when the gun and its crew are hidden from enemy ground observation by a land mass such as the crest of a hill. The position may be on the reverse side of the crest or the forward slope of the next higher ground (fig 141).

a. Advantages.

(1) The gun and crew have cover and concealment from direct fire weapons.

(2) The crew has some freedom of movement in the vicinity of the gun position.

(3) Control and supply are facilitated.

(4) The characteristic smoke and flash of the gun are partially concealed from observation.

b. Disadvantages.

(1) Rapidly moving ground targets are not easily engaged because adjustment of fire must be made through an observer.

(2) Targets close to the mask usually cannot be engaged.

(3) It is difficult to secure grazing fire for a final protective line.

c. Defilade. A gun is in defilade when the gun and its crew are completely behind the terrain which masks them from the enemy (usually on the reverse slope of a hill). The gun must fire up and over the hill. Fire must be observed and adjusted by a crew member who can observe the target from a position on a flank or to the rear of the gun (on higher ground). A defilade position allows little opportunity to engage new targets.

d. Partial Defilade. A machinegun is in partial defilade when a mask (usually the crest of a hill) provides the gun and gunner with some protection from enemy direct fire, but the gunner is able to engage the target using direct laying techniques. The gun is far enough up the slope so that the gunner can see the target through the sights but the lower portion of his body and lower portion of the gun are protected by the mask. Partial defilade positions are desirable when a fire mission cannot be accomplished from a defilade position.

91. Selection, Preparation, and Occupation of Firing Positions

a. The fire unit leader selects the location of the gun position.

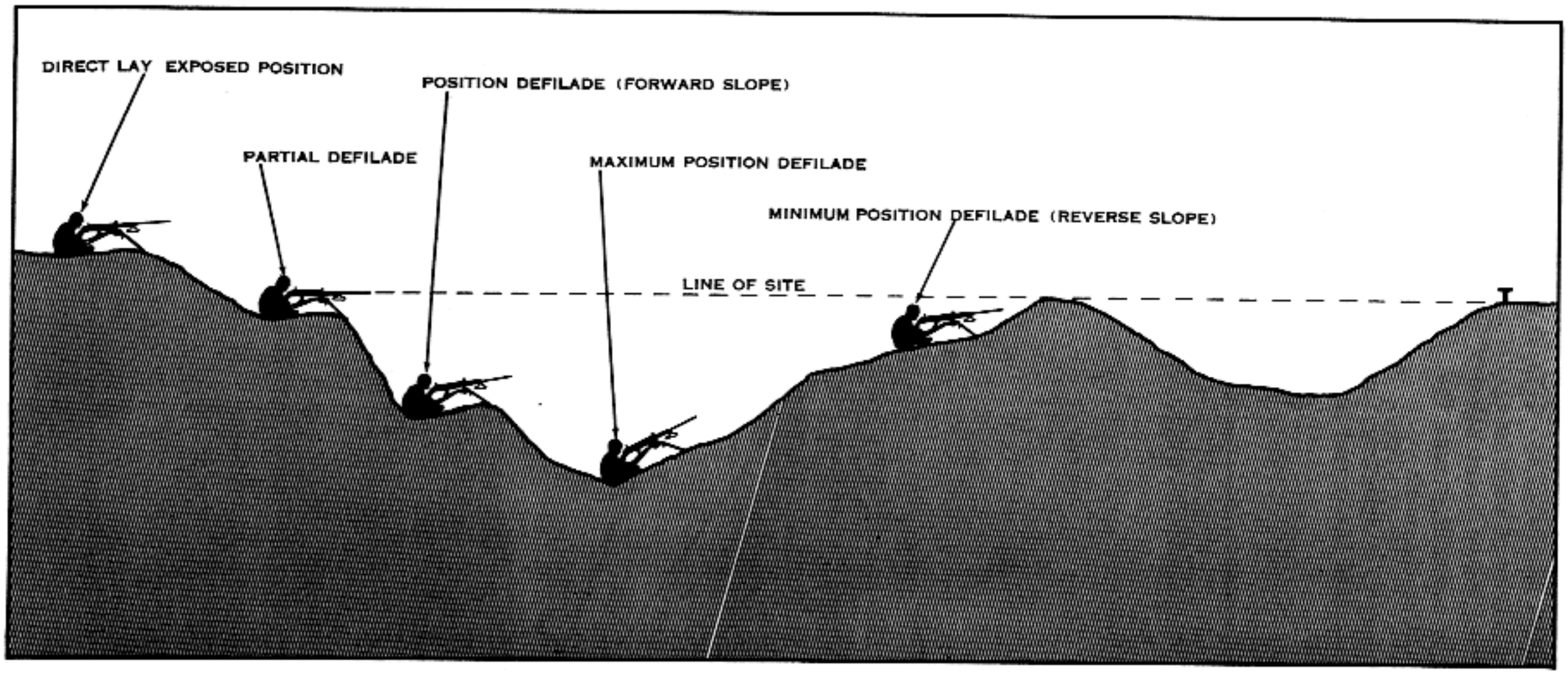


Figure 141. Minimum and maximum position defilade, partial defilade, and direct lay areas.

b. To select a position in partial defilade, the fire unit leader moves up the reverse side of the slope until he has the target in view above the mask when sighting at the height of the gunner's eyes.

c. To select a position in maximum defilade, the fire unit leader estimates the lowest point below the mask at which his gun can still engage the target without danger of hitting the mask.

d. While the fire unit leader is selecting the position, the gun crew examines equipment and mounts the gun under cover.

e. Upon signal or command from the fire unit leader, the gun is carried or dragged into the selected firing position.

92. Engaging Targets

The essential elements in engagement of a target from defilade are direction, elevation, mask clearance, and adjustment of fire. These elements are discussed in paragraphs 93 through 96. More than one gun may be employed using the techniques outlined in this section.

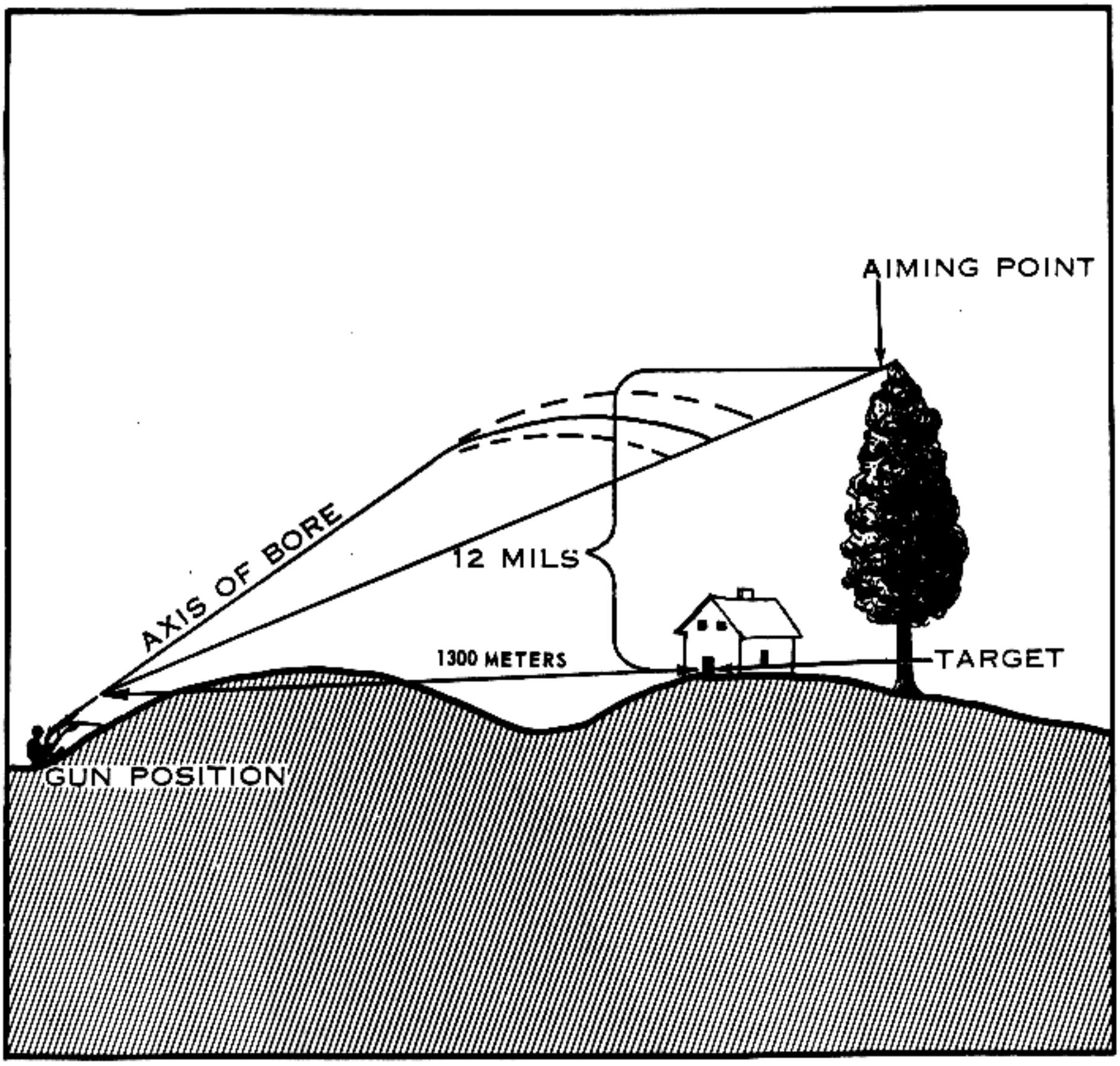


Figure 148. Aiming point method.

93. Laying the Gun for Direction

a. Direction Alinement Method. An observer places himself on the gun-target line, and in a position from which he can see the gun and the target. He alines the gun, approximately, by having the gunner shift the mount. The gunner then loosens the traversing slide lock lever and, directed by the observer, moves the gun right or left until it is alined on the target; then clamps it in that position.

b. Use of an Aiming Point. A prominent landmark, visible to the gunner through his sights, is selected as an aiming point. An aiming point on the gun-target line, and at an equal or greater range than the target is desirable. However, an aiming point on the mask may be used.

(1) If the aiming point is on the gun-target line, the gun is laid on the aiming point and is thereby alined for direction.

(2) If the aiming point is not on the gun-target line, the deflection is measured by means of binoculars or compass. This measured deflection is laid-off with the gun.

94. Aiming Point Method of Laying the Gun for Elevation

An aiming point visible from the gun position is selected (preferably a point at a greater range than the target, and at a higher elevation than the target) and the range to the target is determined. The leader, using binoculars, measures the vertical angle in mils from the aiming point to the base of the target. He then lays the gun on the aiming point with the sight setting to hit the target (fig 142), and directs the gunner to manipulate the gun through the number of mils measured. For example, in figure 142 the range to the target is 1,800 meters. The angle read with the binoculars from the aiming point down to the base of the target is 12 mils. The sight is set at 1,300 meters, the gun laid on the aiming point, and muzzle depressed 12 mils (fig 142). If the aiming point is off the gun-target line, deflection in mils may be taken with the rear sight windage screw knob, if not over 5 mils; otherwise, the deflection must be taken up on the traversing handwheel.

95. Establishing Mask Clearance

After the gun has been laid, determine whether or not the entire cone of fire will clear the mask.

a. Visual Method. When the range to the mask is not more than 450 meters, mask clearance exists when the axis of the bore is elevated 7 mils or more above the gunmask line. Mask clearance can be checked, after the gun has been laid on the target, by depressing the muzzle of the gun 2 mils and sighting along the bottom of the receiver and the barrel support. If this line of sight clears the mask, mask clearance exists. Elevate 2 mils before firing.

b. Use of Firing Tables. Determine the range to the mask and obtain the corresponding angle of elevation for mask clearance from firing tables FT .50 AA–T–2 and FT .50–H–2. The range corresponding to the angle of elevation is set on the gun sight. If the line of aim through the sight clears the mask, mask clearance exists.

96. Adjustment of Fire

Under field conditions, even the most practical methods of laying the gun on the target quickly do not always result in the initial burst being on the target. For this reason, rapid adjustment of fire on the target is essential. Adjustment of fire must be bold, rapid, and continuous. Creeping fire should be avoided.

CHAPTER 8

TECHNIQUE OF FIRE DURING PERIODS OF LIMITED VISIBILITY

Section I. INTRODUCTION

97. General

The machinegun is provided with a stable tripod mount, M3, and traversing and elevating mechanism. By manipulating the traversing and elevating mechanism, gun crew(s) can record target data during hours of good visibility, and engage the same targets under conditions of poor visibility. This chapter provides guidance in machinegun firing techniques, and terms used during periods of limited visibility. Periods of limited visibility include darkness, smoke, fog, rain, or snow.

a. Gunners, as well as other members of the crew, encounter difficulties while defending during periods of limited visibility. These difficulties preclude the use of many of the daylight techniques of engaging targets.

(1) During periods of limited visibility. the machinegunner's sector of responsibility cannot be observed in depth as during periods of good visibility. Most targets are difficult or impossible to detect.

(2) Visibility may be so limited that the leader cannot control the fires of his guns by selecting and directing fire on targets as he would during periods of good visibility. Oral commands are not dependable, arm-and-hand signals may not be seen, and personal contact with the gunner is difficult.

(3) At night, machinegunners have a tendency to fire indiscriminately at noises and suspected enemy locations other than preplanned target areas.

b. To overcome the difficulties encountered during periods of limited visibility, special techniques must be developed for engaging targets and delivering preplanned fires by the use of range cards.

98. Terms

a. Sector of Fire. An area (to be covered by fire) assigned to an individual or unit. Machineguns are normally assigned two sectors of fire, a primary and a secondary sector.

b. Final Protective Line. A predetermined line along which grazing fire is placed to stop an enemy assault. This line is fixed as to direction and elevation; however, a few mils of search are employed during firing to compensate for irregularities in the terrain. The final protective line can be delivered regardless of conditions of visibility. The final protective line is always the inner limit of the primary sector which, ideally, is assigned close to the forward edge of the battle area. When terrain permits, final protective lines are assigned to machineguns along the forward edge of the battle area as a part of the final protective fires of the defending unit.

c. Principal Direction of Fire. A priority direction of fire which marks a specific area assigne to a weapon. This area may extend from the gun position to the maximum effective range of the weapon and is, therefore, not fixed for elevation. Visible targets appearing in the principal direction of fire take priority over targets which may appear elsewhere in the sector. A principal direction of fire may be assigned to cover an area which provides good fields of fire, a likely avenue of foot approach, or mutually supports an adjacent unit.

(1) *Principal direction of fire, day.* A priority direction of fire which marks the center of a specific principal area assigned to a weapon, to be covered during periods of good visibility.

(2) *Principal direction of fire, night.* A priority direction of fire which marks the center of a specific principal area assigned to a weapon, to be covered during periods of limited visibility.

d. Sector of Graze. A wedge-shaped area formed by assigned sector limits, which affords grazing fire (1 meter high, maximum) from the muzzle of the weapon to the first major break in the terrain. The sector of graze is fired using swinging traverse in the primary sector of fire. I can be fired in the secondary sector in conjunction with field expedients, by freeing the travers-

ing and elevating mechanism and using the mount as a pivot. A sector of graze can be delivered regardless of the condition of visibility.

e. Area of Graze. An area, other than the sector of graze, within a sector of fire which is covered by grazing fire. Grazing fire need not be continuous from the muzzle of the weapon to the area over which grazing fire is desired.

Section II. TECHNIQUES OF ENGAGING TARGETS

99. General

A gunner's ability to detect and identify targets during periods of limited visibility will vary, depending upon the amount of natural and artificial illumination and the types and numbers of sensors utilized. Complete definition of these targets as to exact size and flanks will be questionable in many cases.

100. Fire Control

During periods of limited visibility, the leader cannot direct the fires of his guns as effectively as with good visibility. Consequently, initiative is required of the gunners. When targets within their sectors become visible to gunners, they must engage such targets without command and continue to fire until the targets have been neutralized. Gun crews engage targets only when they can identify them, unless ordered to do otherwise. For example, if one gunner detects a target and engages it, the other gunners will observe the area in which fire is being placed. They will add their fire only if they can identify the target or are ordered to place fire in the area.

101. Target Engagement

a. All-tracer ammunition enables a gunner to more effectively engage visible targets during periods of limited visibility and should be used when possible. Gunners must be trained to fire low initially and adjust up when engaging targets during periods of limited visibility. This aids in overcoming the tendency to fire high during these conditions.

b. In engaging linear, linear with depth, and deep targets, no attempt is made to divide the targets (when two or more guns are engaging the same targets) as is done during periods of good visibility. During periods of limited visibility, the center and flanks of these targets will not be clearly defined; therefore, each gunner observes his tracers and covers what he believes to be the entire target.

(1) *Linear targets.* The gunner lays on what he considers to be the center of mass of the target. With the tripod mounted gun, he uses traversing fire and maintains his beaten zone on the base of the target.

(2) *Linear targets with depth.* The gunner lays on what he considers to be the center of mass of the target, traverses and searches it first, covering the side which is closest to his position, then covers the entire target.

(8) *Deep targets.* The gunner lays on what he considers to be the center of mass of the target then searches it. The direction of search is to what is considered the near end, then up to what is considered the far end.

c. The types of point targets machinegunners will be concerned with during period of limited visibility, particularly at night, are enemy automatic weapons and assaulting enemy personnel.

(1) *Enemy automatic weapons.* Point targets such as automatic weapons may be identified during conditions of limited visibility by their muzzle flashes. To effectively engage these targets, fire should be delivered in a heavy volume and adjusted by observing the tracer stream.

(2) *Assaulting enemy personnel.* During the final stage of an enemy assault, machineguns normally fire on a final protective line (FPL). They may be assigned a principal direction of fire (PDF). Both are considered as final protective fires (FPF) and should be planned for and coordinated as such. If individual enemy soldiers are observed in the proximity of the gun position, they must be neutralized by members other than the machinegunner (by the other crew members or by security forces of the supported unit). FPF are fired according to the order or SOP, and the machinegunner is not allowed to cease firing them except in accordance with those orders or SOP.

Section III. TECHNIQUES OF DELIVERING PREPLANNED FIRES

102. General

In addition to engaging appropriate visible targets, the machinegunner must be able to deliver preplanned fires during periods of limited visibility. These fires are used to cover target areas of tactical significance such as routes, avenues of ap-

proach, anticipated enemy supporting weapons positions, probable enemy assault positions, and to establish sectors of graze and final protective lines.

103. Grazing Fire

For maximum effect in all preplanned target areas, grazing fire should be obtained when possible.

a. Obtaining Maximum Extent of Grazing Fire Over Level or Uniformly Sloping Terrain. The machinegunner sets the rear sights at 1000 yards, selects a point on the ground which he determines to be at a range of approximately 100 meters, lays, fires, and adjusts on this point. If the gunner cannot obtain 1000 meters of grazing fire because of a major break in the ground at a range of less than 1000 meters, he places the range to the break on his sight and lays, fires, and adjusts at that point.

b. Determining the Extent of Grazing Fire on the Final Protective Line. The extent of grazing fire on the final protective line is determined using the techniques described in *a* above. Any intermediate breaks in the terrain along this line, which cannot be covered by grazing fire from a gun firing along the line, is considered deadspace.

c. Determining the Extent of Grazing Fire in the Sector of Graze. The ranges to the extent of grazing fire in a sector of graze are determined by observation of the terrain and by observing the tracer stream from behind or from a flank of the gunposition. Normally, the extent of grazing fire within this area will be much less than on a final protective line and will form an irregular pattern.

d. Determining the Amount of Grazing Fire in an Area of Graze. The same procedures used in *a* above are used in determining the extent of grazing fire in an area of graze. The ranges to areas of grazing fire are determined by observing the flight of tracer ammunition from behind or from the flank of the gun position. The gunner determines the lateral extent of areas of graze by selecting and engaging successive aiming points in the area believed to afford grazing fire, using the same range setting as when determining the range to the extent of grazing fire.

104. Fire Control

Predetermined targets are engaged on order from the fire unit leader or by SOP.

a. Final Protective Fires. The signal used in calling for final protective fires is normally prescribed in the company operation order. The authority to call for these fires may be delegated to the platoon leader of a forward rifle platoon. Final protective fires are ceased on order.

(1) *Signals.* Arm-and-hand signals, voice commands, or pyrotechnic devices may be used in calling for these fires.

(2) *Rates of fire.* When firing final protective fires, the rapid rate of fire is used unless it is obvious that a different rate is necessary to accomplish the mission.

b. Engaging Other Preselected Target Areas. When engaging other preselected target areas, the rapid rate of fire is used until commanded to cease fire.

105. Methods of Laying the Gun

The technique of laying the gun to engage preselected target areas during periods of limited visibility is effective only if the data is correct. Such data is determined from the lay of the gun on targets. If possible, the lay is verified by firing and adjusting on targets. There are two methods of determining data necessary to engage selected targets during periods of limited visibility; readings taken from the traversing bar and traversing and elevating mechanism, and by the use of field expedients.

a. Traversing Bar and Traversing and Elevating Mechanism Method. Direction and elevation readings constitute the data necessary to engage preselected target areas during periods of limited visibility. These readings are measured by and recorded from the traversing bar and traversing and elevating mechanism. All measurements are recorded in mils.

(1) *Preliminary steps before direction and elevation readings are obtained.*

(*a*) To position the traversing mechanism, turn the traversing handwheel toward your body as far as it will go, then turn it away two complete revolutions. Check the traversing handwheel scale to insure the same reading is lined up with the index line before and after the two revolutions. The traversing mechanism can be positioned at night by turning the traversing handwheel toward your body as far as it will go, and then turning it away 50 clicks (two revolutions).

(*b*) To lay the gun for direction when a final protective line has been assigned, lock the traversing slide on either the extreme left or right side of the traversing bar, depending upon which side of the sector the final protective line has been assigned. Pick up the rear legs of the tripod and shift the tripod until the muzzle of the gun points

along the final protective line. If a final protective line has not been assigned, the gun will be laid for direction on the center of the primary sector. In this case, lock the left edge of the traversing slide on the "O" graduation on the traversing bar. The left edge of the traversing bar slide is always used as the index. Pick up the rear legs of the tripod and shift the tripod until the muzzle of the gun is laid on the center of sector.

(*c*) Once the gun is laid for direction, emplace the tripod shoes firmly by digging the tripod shoes in or by placing sandbags on the tripod legs. This is done to insure greater stability and prevent accidental movement of the tripod.

(2) *Direction readings.* Direction readings are obtained and recorded to all targets within the primary sector of fire with the exception of the final protective line. The final protective line does not require a direction reading since the traversing slide is positioned to the extreme right or left of the traversing bar. To obtain direction readings to targets other than final protective line:

(*a*) Loosen the traversing slide lock lever and slide the traversing bar slide along the traversing bar until the gun is laid on the center of a point target and on either flank of a linear target.

(*b*) Lock the traversing slide to the traversing bar and read the direction reading from the scale on the traversing bar (fig 148). If the left edge of the traversing slide does not fall exactly on a 5-mil graduation (tickmark), use the nearest 5-mil graduation as the direction reading.

(*c*) A direction reading to a target is determined by the direction of the barrel. When the barrel of the gun moves to the right, a right direction reading will be recorded. This number will be indicated on the traversing bar and read from the left side of the traversing slide lock. If the barrel moves to the left, there will be a left reading, and the traversing slide lock will be on the right side of zero.

(*d*) After taking a direction reading of a linear target, the width of the target is measured in mils by traversing across the target using the traversing handwheel. The traversing mechanism must be repositioned before moving to another target.

(3) *Elevation readings.*

(*a*) After obtaining the direction reading to a target, an elevation reading is obtained before moving to another target. To obtain ths reading, the gun is laid on the base of the target.

(*b*) The elevation reading is obtained from two scales. The first portion (or major reading) is taken from the engraved scale on the upper elevation screw plate. The second portion (or minor reading) is taken from the engraved scale on the top of the elevating handwheel, using the indicator as the index (fig 143). The two portions of the elevation reading are separated by a slash (/) when they are recorded (for example 50/8).

(*c*) The engraved scale on the upper elevating screw plate is graduated in 50-mil increments from MINUS 250 mils to PLUS 100 mils. There is an index line *below* each number and a plus or minus sign *above* each number, with the exception of the "O". The zero reading has no sign. In obtaining the elevation reading, the gunner should lower his head until his eyes are level with the top of the elevating handwheel. The first portion of the reading is the number with the plus or minus sign indicated above the first visible index line (fig 143).

(*d*) The scale on the elevating handwheel is graduated in 1-mil increments for a total of 50 mils. Locate the graduation on line with the indicator (fig 143).

(*e*) An elevation reading is valid on only one mechanism. If data is placed on another mechanism using the same amount and gun, the data could be inaccurate. The number of threads exposed on the lower elevation screw (fig 143) must remain the same both when obtaining and using data. If the number of threads is increased or decreased after the data is recorded, accurate fire cannot be placed on the target. For example, when a gun is freed to engage a secondary sector, should the base of the traversing and elevating mechanism rotate, the data is correct only if the gunner insures that the same number of exposed threads is replaced on the mechanism.

(*f*) To replace an elevation reading of —50/3 on the traversing and elevation mechanism, manipulate the elevating handwheel until the horizontal line below —50 is visible at eye level, with the handwheel indicator on 8.

(4) *Verifying elevation reading.* To insure a correct elevation reading to a target, the gunner should fire and adjust on this target.

(5) *Dry-fire method.* Data may be obtained to targets without firing and adjusting as mentioned in the preceding paragraph. This is accomplished using the dry-fire method of laying the gun. In using this method, the range to the target is placed on the rear sight and the gun is laid on the center base of the target. The direction and elevation readings are then taken. Range determination is critical because any discrepancy will cause an error in the elevation when the target is engaged. The dry-fire method of obtaining data is used only when firing is not feasible.

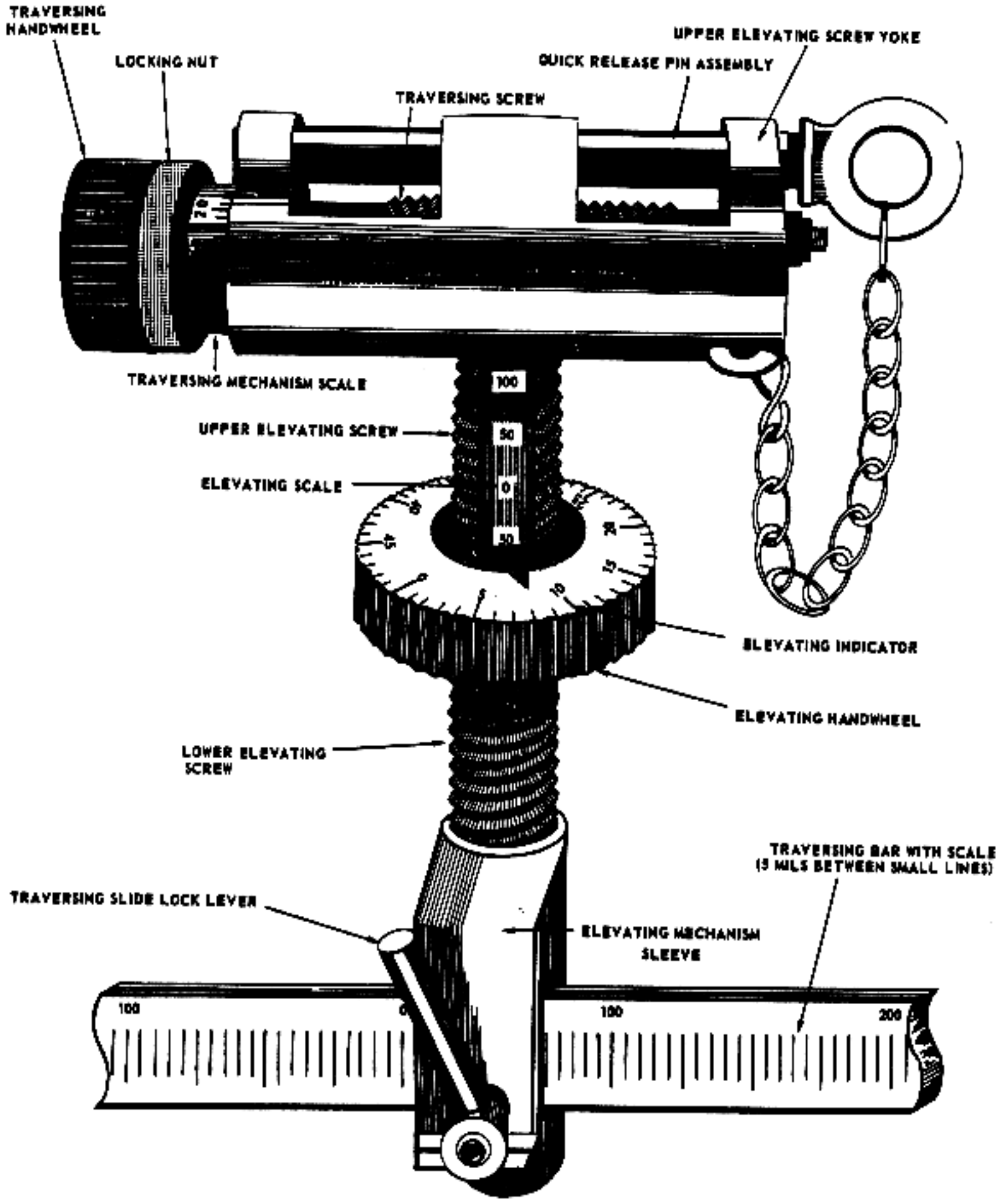


Figure 143. Traversing bar and traversing and elevating mechanism.

b. Field Expedient Methods. The field expedient method serves to supplement employment of the machinegun in engaging preselected target areas. This method is not as effective as the traversing bar and traversing and elevating mechanism method and requires additional material. Field expedients are a primary means of engaging preselected target areas in a secondary sector during periods of limited visibility.

(1) *Stake method.*

(*a*) Lay the gun on the limit of the sector and drive a stake into the ground next to the barrel. This method can be used to establish direction for one or both limits of the sector.

(*b*) If one limit of the sector is a final protective line, anothe stake should be driven into the ground beside the sector stake, in such a manner that it touches the bottom of the barrel when the gun is laid on the final protective line. This establishes both direction and elevation.

Note. This expedient may be employed as a primary means in the primary sector until such time as conditions of visibility permit recording data from the traversing bar and traversing and elevating mechanism.

(*c*) To engage targets in the secondary sector of fire using this technique, the gunner releases the traversing and elevating mechanism, using the pintle as a pivot.

(2) *The horizontal log or board method.*

(*a*) This technique is used to mark sector limits and provide a sector of graze. The horizontal log or board technique is effective in all conditions of visibility. This technique can be used effectively if the sector of fire is no wider than 800 mils.

(*b*) Place a log or board beneath the barrel of the gun. The log or board should be positioned in such a way that the barrel, when resting on the log, will be at the proper elevation to obtain a sector of graze. The limits are marked when appropriate. (Sector of fire less than 800 mils wide.)

(*c*) *Dry-fire method.* Data to targets may be obtained without firing and adjusting. This is accomplished using the *dry-fire* method of laying the gun. In using this method, the range to the target is determined by eye; this range is placed on the rear sight and the gun is laid on the center base of the target. The direction and elevation readings are then taken. Range determination is critical because any discrepancy will cause an error in the elevation when the target is engaged. The dry-fire method of obtaining data is used only when firing is not possible or when the situation is such that firing would disclose the position.

Section IV. RANGE CARDS

106. General

a. A range card is a record of firing data necessary to engage preselected target areas within the sectors of fire during periods of limited visibility. The range card may also be used as a reference to engage targets during periods of good visibility, and to aid the leaders in preparing the supporting fire plans.

b. Data for areas within the primary sector are of first concern. The tripod mounted gun is employed to cover the primary sector of fire. Preselected targets in the secondary sector are engaged during periods of limited visibility by the use of field expedients (para 105*b*).

c. A range card contains two parts; a sketch of the sectors of fire containing drawings of targets, and a data section which lists data necessary to engage these targets during periods of limited visibility. The sketch section is not drawn to scale, but the data referring to the areas is accurate.

107. Preparation of a Range Card

Range cards are prepared in duplicate; one copy stays at the gun position, the other copy is sent to the next higher headquarters. Complete range cards are prepared for primary gun positions, and partially completed range cards are prepared for alternate and supplementary gun positions. The gunner, assisted by other crew members and the leader, is responsible for the preparation of the range card. Range cards are prepared immediately upon arrival in a position regardless of the anticipated length of stay. The range cards will be constantly revised during occupation of a position. Military symbols are used in preparing range card (fig 144). The following are steps in preparing a range card. They need not be accomplished in the order outlined:

a. Position the traversing mechanism (para 105*a*).

b. Position the weapon with the muzzle oriented on the final protective line. If a final protective line is not assigned, the muzzle should be oriented on the center of sector. Emplace the tripod as explained in paragraph 105*a*(1)(*b*).

c. Sketch in the basic symbol for the machinegun in the lower center portion of the card, oriented in the direction of the final protective line or center of sector, as appropriate (fig 145).

d. If a final protective line is assigned, draw in the final protective line using the procedure outlined in *k* below.

e. Draw in the limits of the primary sector which does not contain a final protective line on the sketch. No data is recorded in the data section for the limits of sector unless a target is located along this line (fig 145).

f. Draw in the limit of the secondary sector which does not border the primary sector on the range card sketch.

g. Draw in and label friendly positions which are located forward of the forward edge of the battle area (FEBA) and in the vicinity of machinegun's sector of fire (fig 145).

h. Draw a magnetic north arrow from the base of the machinegun symbol pointing in the direction of magnetic north on the sketch.

i. Orient the gun position with a prominent terrain feature recognizable on a map by obtaining the magnetic azimuth from the terrain feature to the gun position. Determine the distance in meters between these two points (fig 145). Place arrow barbs along this line to indicate the direction in which the magnetic azimuth was taken. If a prominent terrain feature is not available, the gun position may be oriented by using an 8-digit grid coordinate.

j. As marginal data, record the gun number, unit designation, and date in one corner of the sketch. No higher unit designation than company

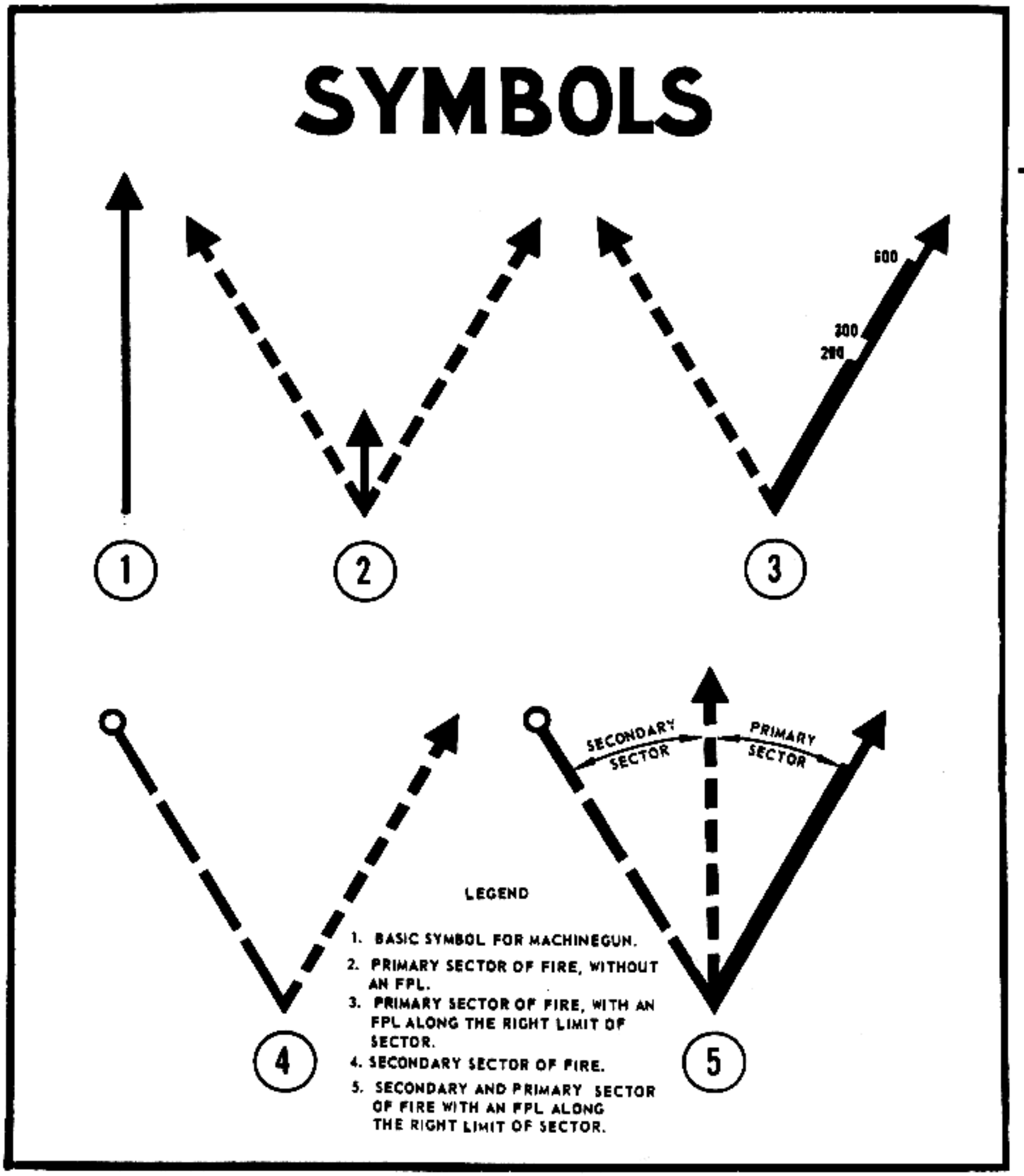
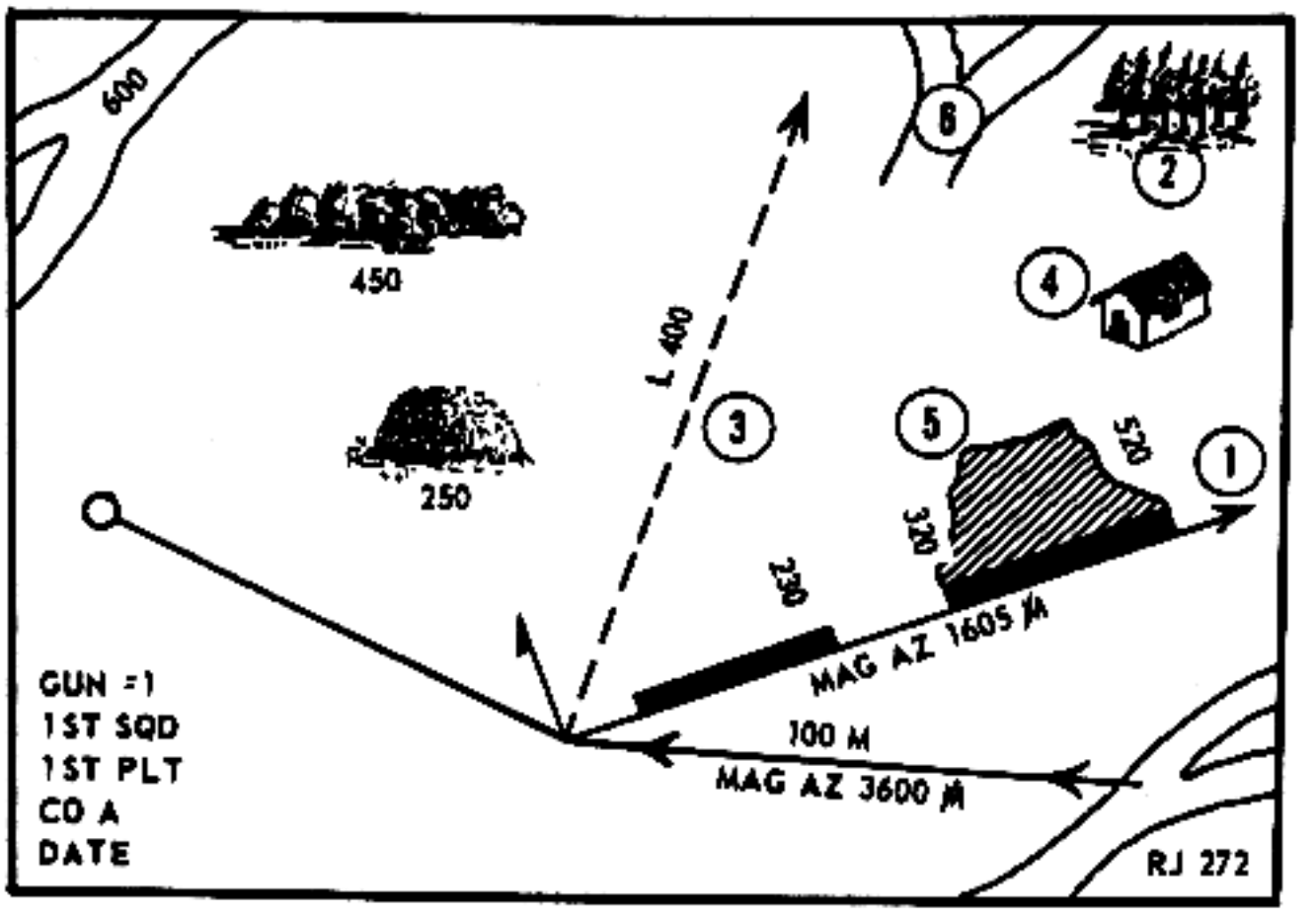


Figure 144. Military symbols applicable to the caliber .50 machinegun.

is recorded on the sketch for security reasons (fig 145).

k. Obtain data to target areas.

(1) When a final protective line is assigned, determine the maximum extent of grazing fire on this line, then draw a solid line in extension to the basic symbol for the machinegun. This line ends in an arrowhead. Sketch a shaded blade on the inside of the final protective line to represent the extent of grazing fire. If the final protective line has deadspace, breaks are left in the shaded blade



DATA SECTION

NO.	DIRECTION	ELEVATION	RANGE	DESCRIPTION	REMARKS
1		+50/15	520	FPL	1605 M
2	R 20	0/43	700	PDFD	
3	L 305	0/18	280	PDFN	R 30
4	R 250	+50/15	580	HOUSE	R 25
5	R 100	+50/3	360	AG	R 50
6	L 210	0/28	600	RJ	

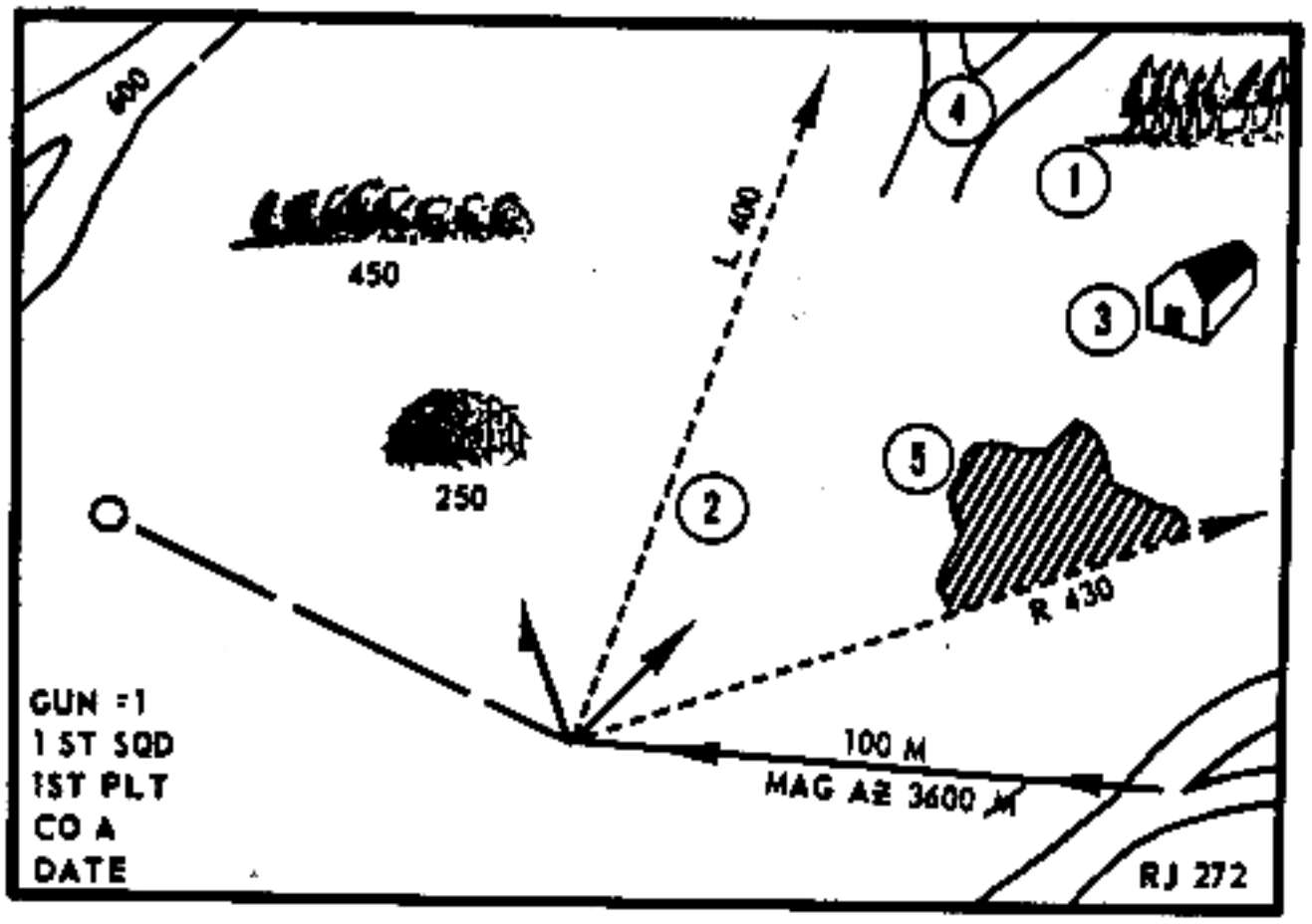
RANGE CARD WITH A FINAL PROTECTIVE LINE.

Figure 145. Range card with the final protective line.

where it occurs. Record the ranges to the near and far edges of the deadspace and to the maximum extent of graze along the final protective line. Deadspace must be accurately recorded and sent to higher headquarters so that it may be covered by the fires of other weapons. Record the elevation reading and other pertinent data under appropriate columns in the data section (fig 145).

(2) Select the principal direction of day fire and principal direction of night fire and mark the center of these areas on the sketch with a number, as discussed in (6) below. Obtain direction readings to this marked area and enter in appropriate columns of the data section.

(3) If a sector of graze is obtained, determine the elevation setting which gives the maximum extent of grazing fire between the muzzle of the weapon and the first major break in the ter-



DATA SECTION

NO.	DIRECTION	ELEVATION	RANGE	DESCRIPTION	REMARKS
1	R 20	0/43	700	PDFD	
2	L 305	0/18	280	PDFN	R 30
3	R 250	+50/15	580	HOUSE	R 25
4	L 210	0/28	600	RJ	
5	R 100	+50/3	360	AG	R 50

Figure 146. Range card without a final protective line.

rain within the primary sector limits. Record this elevation reading in the data section. The sector of graze is referred to in the data section as "SG."

(4) After laying the gun on other target areas in the primary sector, obtain direction and elevation readings for these areas and record in the data section (fig 145).

(5) An area of graze is treated as a target area, and is referred to in the data section as "AG."

(6) Target areas in the primary sector are marked on the range card sketch section by numbers inclosed in circles. These numbers are assigned in the order of target priority.

(7) When field expedients are used to engage targets, replicas of the field expedients are sketched above the drawing of the targets and the word "stake" with its number, is written in the data section (fig 146).

(8) Preselected targets in the secondary sector are sketched in on the range card. Ranges to these targets are not recorded below the sketches. Data to these targets is recorded in the data section (fig 146).

CHAPTER 9

MARKSMANSHIP TRAINING

Section I. GENERAL

108. Method of Instruction

a. It is essential that assistant instructors and demonstration personnel be thoroughly trained and rehearsed in their duties before group instruction commences.

b. Each exercise is first explained and demonstrated, Each man is then given practical work in the exercise, supervised by assistant instructors. Finally, the men are given an examination in order to determine their progress and proficiency.

c. The coach-and-pupil method is used wherever practicable. Under this method, men are grouped in pairs and take turns as coach and pupil.

d. A crew is the largest unit in which individual instruction can be closely supervised. If a sufficient number of machineguns are available, it is preferable to assign an assistant instructor and four men to one gun.

e. Training prescribed herein, including courses to be fired, should be conducted on the M60 machinegun prior to training with the caliber .50. The machinegunners should be capable of firing both weapons. This method permits the caliber .50 gunners to receive the maximum machinegun training without excessive expenditure of caliber .50 ammunition.

109. Phases of Training

a. Marksmanship training is divided into two major phases—

(1) Preparatory marksmanship training.

(2) Range firing.

b. These phases are further broken down into progressive steps, and should be taught in the order outlined herein.

c. The following must be observed during marksmanship training:

(1) Each student will be proficient in mechanical training and crew drill before he receives instruction in machinegun marksmanship.

(2) No man will be allowed to fire on the range until he has received thorough training in preparatory marksmanship, regardless of previous qualifications.

110. Fundamentals of Marksmanship

To become accurate and proficient in machinegun marksmanship the soldier must be thoroughly trained in the following fundamentals:

a. Accurate delivery of initial round (burst) of fire on either stationary or moving targets.

b. Mechanical skill in manipulating the gun and rapid shifting of fire to new targets.

c. Adjustment of fire by the following methods:

(1) Observation of strike.

(2) Observation of flight of tracer.

(3) Frequent relaying of the gun during firing.

d. Speed in combining these fundamentals when delivering fire.

Section II. PREPARATORY EXERCISES

111. General

a. The purpose of the preparatory exercises in marksmanship training is to teach the essentials of marksmanship. A thorough, carefully supervised course in the preparatory exercises conserves time and ammunition during range practice.

b. The preparatory exercises consist of the following eight steps:

(1) Positions for firing and introductory manipulation with both the tripod and vehicular mounted machinegun.

(2) Sighting and aiming exercises.

(3) Sight setting and laying exercises.

(4) Manipulation exercises.

(5) Fire adjustment.

(6) Range determination.

(7) Tracking and leading exercises.

(8) Examination before range firing.

c. The first five steps are listed in the order of instruction. They must be taught in that order. As the sixth step is not based on the material covered in any of the other steps, it may be taught any time before the examination. The seventh step will be conducted after 10-meter firing, but before firing on moving targets.

d. Every man who is to fire on the range, including those who have previously qualified, will receive complete instructions in the preparatory exercises. The instructor *insures that each man is tested thoroughly and graded in the exercises before he is allowed to fire.* Men with an unsatisfactory rating will be given additional instruction until a satisfactory rating is obtained.

112. Equipment for Training

The following equipment per four men is desirable for the preparatory exercises:

a. One sighting bar.

b. One machinegun and mount complete (tripod and vehicular mounts).

c. One ½-inch aiming paster per gun.

d. One vehicle silhouette aiming target per gun.

e. One target frame per gun, covered with blank paper and equipped with braces for mounting.

f. One 10-meter machinegun target per gun.

g. Material for blackening sights.

113. Positions for Firing

a. The caliber .50 machinegun can be fired from the prone or sitting position with the gun mounted on the tripod in low position, or from a sitting position with the gun mounted on the tripod in high position. The prone position is used for tables 2 and 3 qualification firing. However, the gunner should be thoroughly trained in both positions. The standing position with vehicular mount is used for table 4.

b. In the prone position, the gunner is between the trail legs with his body extending directly to the rear of the gun (fig 147).

(1) The inside of his feet are as flat as possible on the ground, legs well-spread, toes turned outward.

(2) His left elbow rests on the ground, the left hand placed on the elevating handwheel with the palm down.

(3) The gunner lightly grasps the right spade grip with his right hand, thumb in position to press the trigger.

(4) The position of the body varies according to the physique of the individual so that the eye is in the proper position to aline the sights.

c. In the sitting positon, the gunner sits between the trail legs, directly in rear of the gun. He may sit with his legs extended under the tripod or with his legs crossed, depending upon his physique (fig 148, 149).

(1) The gunner places his elbows on the inside of his thighs to obtain maximum support.

(2) He grasps the elevating handwheel with his left hand, palm down.

(3) He lightly grasps the right spade grip with his right hand, thumb in position to press the trigger.

d. With the M118 turret mount, the gunner places both hands on the spade grips, locks his

Figure 147. Prone position.

Figure 148. Sitting position, legs extended.

elbows into the sides of his body with his body forward and chest against his hands, thumbs in position to press the trigger. Brace the body and arms firmly and aim low on the target, as the muzzle has a tendency to rise during firing.

114. Introductory Manipulation

To give the gunner practice in manipulation, the following procedure is used: the coach stands about 10 paces in front of the gun, and uses hand signals to indicate the direction in which the gunner is to move the muzzle. The gunner manipulates the handwheels, observed by the coach who makes necessary corrections. When the gunner reacts quickly, and can manipulate the gun as indicated, he is ready to continue his instruction (fig 150).

115. Sighting and Aiming Exercises

a. First Sighting and Aiming Exercise (Sighting Bar).

(1) The purpose of the first sighting and aiming exercise is to teach the correct sight alinement and sight picture.

(2) When the top center of the front sight blade is in the center of the peep sight, the sights are correctly alined.

(3) A correct sight picture is one in which the sights are correctly aligned, with the top of the front sight blade just touching the bottom center of the target (fig 151).

(4) All men will be required to demonstrate proficiency in obtaining the correct sight alinement and a correct sight picture with a sighting bar (fig 152).

b. Second Sighting and Aiming Exercise (With Gun).

(1) The purpose of the second sighting and aiming exercise is to apply the preceding lesson to sight alinement of the machinegun sights on a target.

(2) A machinegun target is placed 10 meters from the pintle (fig 153).

(3) The instructor uses a demonstration crew of two assistants who are placed at the gun. One acts as the coach, and the other as the pupil during the demonstrations.

(4) The exercise is first explained and then demonstrated. The coach shows the gunner the correct sight picture. The coach then moves the gun off the target, and requires the gunner to move the gun back on the correct sight picture using the handwheels. (See para 129 for positions and duties of the coach.)

(5) The coach checks and critiques the alinement made by the gunner.

(6) Practical work is then conducted using the method demonstrated.

Figure 149. Sitting position, legs folded.

Figure 150. Introducing manipulation.

116. Sight Setting and Laying Exercises

a. Sight Setting Exercise. The purpose of this exercise is to teach the method of setting the rear sight, and to develop accuracy and speed in its use.

(1) The exercise is first explained and demonstrated.

(2) The sight slide is set at the desired range by turning the elevating screw knob. The hairline through the peep sight is used as an index in setting the sight at the desired graduation.

(3) To demonstrate the exercise, the instructor has one demonstrator take the pupil's position at the gun and another the coach's position. The exercise is demonstrated as follows:

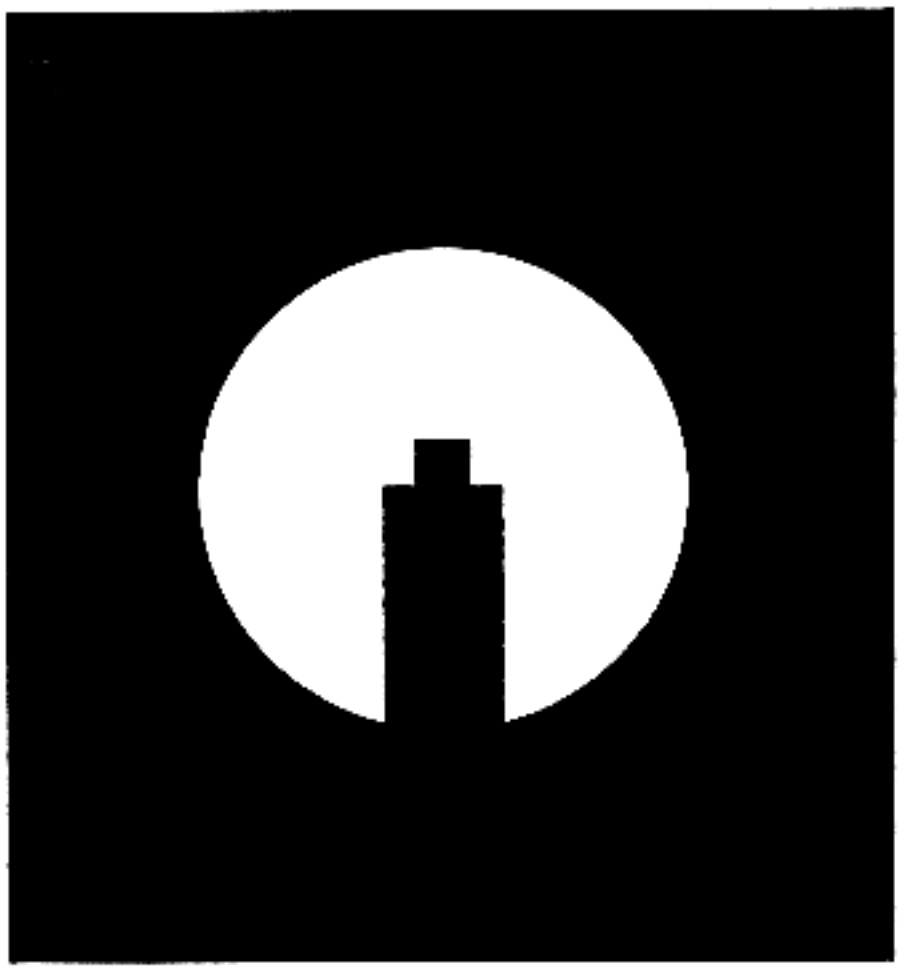


Figure 151. Correct sight picture.

(*a*) The instructor announces the range, (For example: EIGHT HUNDRED.)

(*b*) The pupil repeats the range, sets the sight at the announced range, then assumes the correct gunner's position and reports UP.

(*c*) The coach checks the setting of the slide and points out errors.

(4) All men go to their groups, work in pairs, go through the exercise until each man has become proficient in accurate and rapid sight setting.

b. Sight Setting and Laying. The purpose of the sight setting and laying exercise is to develop accuracy and speed in laying the gun on an aiming point, and to give additional practice in sight setting.

(1) The instructor explains that the exercise starts with the sight leaf down and the slide at 1,000 yards, that ranges less than 1,000 or greater than 1,800 will not be announced.

(2) To demonstrate the exercise, the instructor has one demonstrator take the pupil's position at the gun and another the coach's position. The exercise is demonstrated as follows:

(a) The instructor announces an aiming point and range. (For example: 1. PASTER NUMBER FIVE, 2. ONE TWO HUNDRED.) After giving the first element, the instructor pauses long enough to permit the pupil to repeat it and then gives the second element.

(*b*) The pupil repeats both elements, raises the sight leaf, and sets the sights. Upon completing the sight setting, he manipulates the gun by turning the traversing and elevating handwheels until the sights are accurately alined on the designated aiming point. He then assumes the correct gunner's position, and announces UP.

(3) The coach checks the sight setting and lay at the completion of the exercise.

(4) All men go to their groups, and instruction is continued.

117. Manipulation Exercises

Manipulation is the process of shifting the direction of the gun from one definite point to another definite point. After the soldier understands the principles of sighting and aiming, and can assume a satisfactory firing position, he is given instruction in manipulating the gun to obtain an accurate initial lay; then, to shift the direction of the gun to successive points with proficiency.

a. Second Manipulation Exercise. The instructor insures that the following instructions are understood and followed:

(1) A machinegun target is placed out 10 meters from the pintle for this manipulation exercise (figure 153).

(2) Manipulation of the gun for great shifts in direction is obtained by releasing the traversing slide lock lever, and moving the slide to the right (left). Small changes in direction are made by turning the traversing handwheel with the left hand. One click on the traversing or elevating handwheel moves the strike 1 mil, or 1 centimeter on the target.

(3) Manipulate for elevation by rotating the elevating handwheel with the left hand.

(4) Traversing and searching the target is accomplished by laying on the initial aiming paster (number 5 or 6) and then shifting to each of the other numbered pasters in order (5 through 10 or its reverse). All major shifts in traverse are done by loosening the traversing slide lock lever. When shifting from pasters number 7 to 8 or 8 to 7, use the traversing handwheel.

(5) Upon receiving the command, the pupil repeats the instructions, sets the sight, lays the gun on the designated paster, assumes the correct gunner's position, and reports UP.

(6) At the command FIRE. the pupil repeats the command, simulates firing two single shots, then shifts to the next paster and simulates firing until the exercise is completed. The pupil aims at each paster.

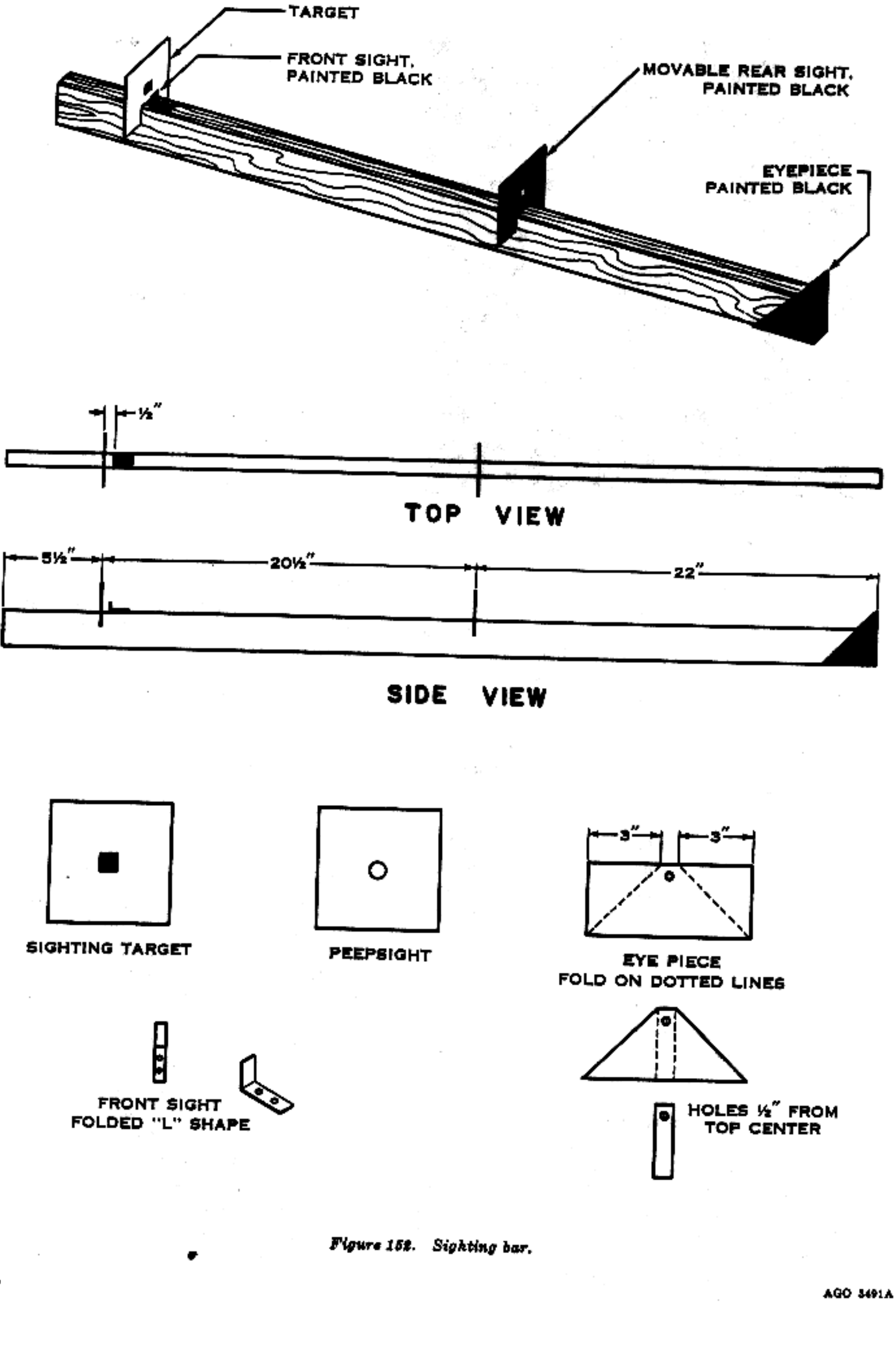


Figure 152. Sighting bar.

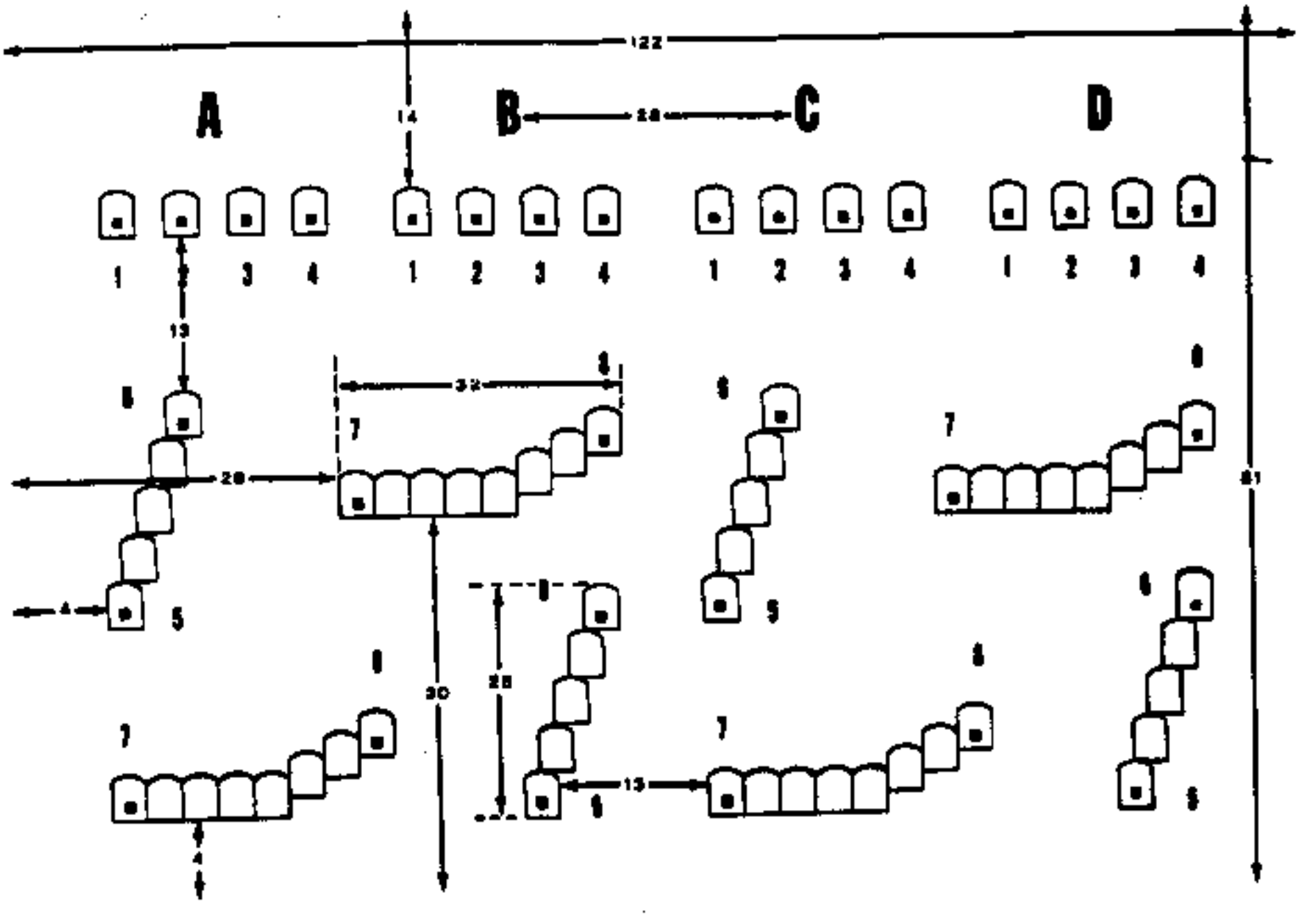


Figure 151. Basic machinegun marksmanship targets.

(7) While the pupil is performing these operations, the coach:

(a) Checks the sight setting and initial lay.

(b) Checks the pupil's position.

(c) Sees that the pupil simulates firing a shot(s) before manipulating the gun.

(d) Checks for proper manipulation.

(e) At the completion of the exercise, checks the lay and critiques the exercise.

b. The Announcement of Instructions. (Examples):

(1) PASTER NUMBER FIVE (SIX) TO PASTER NUMBER SIX (FIVE).

(2) ONE THOUSAND.

(3) TRAVERSE AND SEARCH. At the command FIRE, the instruction proceeds as described in a(4), (5), (6) above.

118. Observation and Adjustment of Fire

The purpose of observation and adjustment practice is to teach the adjustment of fire by observing the strike of the bullets, the flight of tracers, or by frequent relaying on the target using the sights.

a. Observation.

(1) When firing on the 10 meter range, the strike of the bullets is visible on the target.

(2) When firing at greater distances, the strike of the bullets on the ground may cause dust to rise which is visible to the gunner; however, during wet weather, the strike can not always be seen. In this event, the tracers will allow the gunner or crew leader to note the strike of the burst in relation to the target.

b. Adjustment.

(1) Using the mil relation, 1 click of the traversing handwheel or elevating handwheel moves the strike of the bullet ½-inch on the target at a range of 10 meters.

(2) When firing on the 10-meter range, adjust, moving the shot group a required number of centimeters vertically or horizontally until the center of the group is on the aiming paster. Should the gunner's initial burst strike the target 2 centimeters to the left and 3 centimeters below

the aiming paster, he adjusts his fire by traversing right 4 clicks, and elevating 6 clicks before firing again.

(3) When firing on field targets, adjustment is made by moving the burst into the target. One click (mil) on the traversing handwheel will move the strike ½ meter at 500 meters, or 1 meter at 1,000 meters; however, the distance 1 click (mil) in the elevating handwheel will move the strike depends on the range to the target and the slope of the ground. The gunner determines the number of mils necessary to move the center of the strike into the target and he manipulates the gun the required number of mils. This does not require the use of sights. For example, should the gunner fire on a target at 500 meters and observe the strike 10 meters to the right of the target *and short about 50 meters*, he would traverse the gun to the left 20 clicks (mils) and adds one or more clicks (mils) depending on the slope of the ground.

(4) The gunner may use the "adjusted aiming point" method to adjust the fire. In this method the gunner must use his sights. He selects an aiming point which will place the next burst on the target. For example, should the gunner fire on a target at 500 meters and estimate that the strike is 20 meters short and 10 meters to the right of the target, he would rapidly select an aiming point approximately 20 meters beyond the target and 10 meters to the left of the target, lay on that aiming point and fire.

119. Range Determination and Windage Corrections

Range determination is the process of determining distance between two points. There are two methods of estimating range by eye—mental unit of measure (yardstick), and the appearance of objects. The soldier needs training and practice in both methods over varied terrain and under varied conditions of light and weather. A definite system of range determination, frequently practiced, is the only way to make estimation by eye reliable. For information and exercises recommended for training in range estimation by eye, see paragraphs 68 and 69.

120. Tracking and Leading Exercises

a. General.

(1) The gunner normally completes a course of instruction in firing a machinegun at stationary targets before instruction is given in firing at moving targets.

(2) Battlefield targets may be either moving or stationary. The technique of engaging a moving target differs from that of engaging a stationary target. The gun must be aimed ahead of the target a sufficient distance to cause the bullet and target to arrive simultaneously at the same point. This distance is measured in target lengths. One target length as seen by the gunner is one lead. Leads are measured from the center of mass (fig 154). The lead necessary depends upon range, speed, and direction of movement of the target. To hit the target, the gunner aims at a point ahead of the target equal to the estimated number of leads, maintains this lead by tracking the target (manipulating the gun at the same angular speed as that of the target), and then fires. Fire is adjusted by observation of strike and/or tracer.

b. Tracking. Tracking consists of maintaining correct alinement of the sights (with or without a lead) on a moving target by moving the gun at the same angular speed as that of the target.

(1) The gunner is required to aim at a prescribed point (center of mass) on the target and maintain that aim during uniform movement of the target. As instruction progresses, speeds used should differ from successive runs of the target. Speeds, at which 10-meter targets should be run to represent speeds at various ranges, are shown in the following table.

Target Speeds, 10-Meter Moving Target

Target speeds in mph	Target speeds in inches per seconds corresponding to—		
	300 M	600 M	900 M
7 ½	6	4	2
15	12	8	4
30	24	15	9

(2) The target handler must have practice in moving the target silhouette across the blank target at the varying speeds.

c. Leads.

(1) *Lead table.* Mathematical computation or use of voluminous lead tables to obtain exact leads to be used on a moving target are impractical in combat. The simple lead table shown below gives amount of lead necessary to hit a target moving at right angles (0 degrees) to direction to hit at speed and ranges indicated.

Speed in miles per hour	Range of target		
	300 M	600 M	900 M
15	½ target length	1 target length	2 target lengths.

(2) *Correction changes.* The gunner must make corrections as conditions change. If the tar-

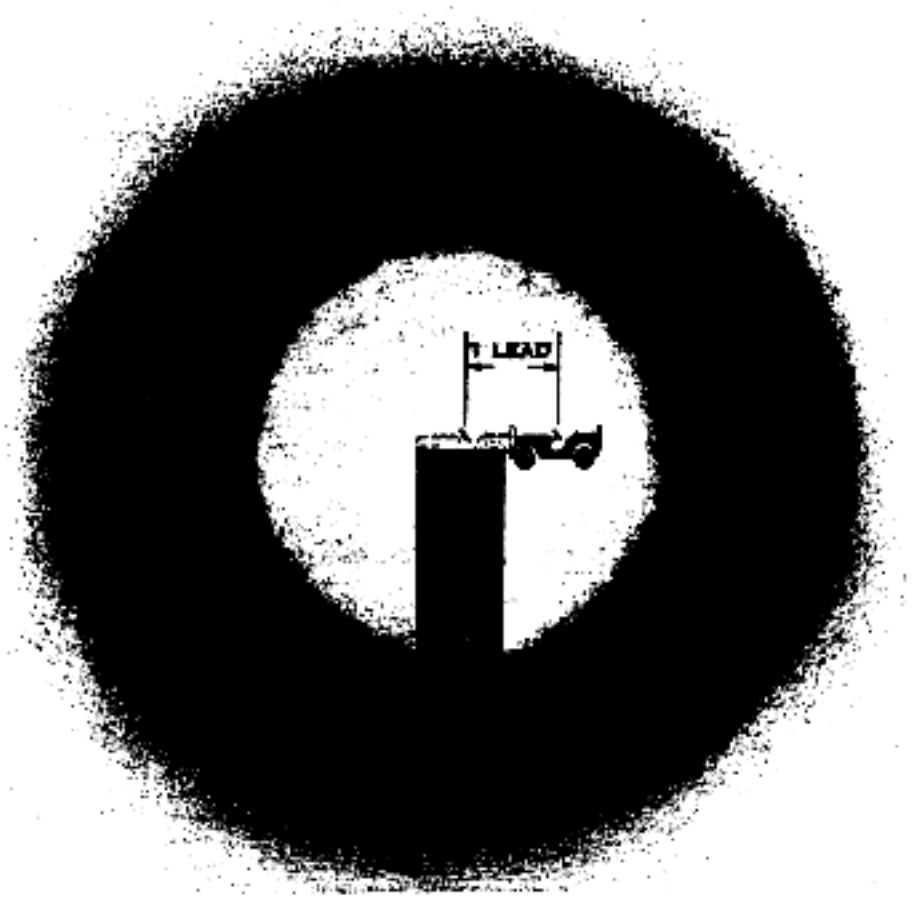


Figure 154. Sight picture with one target length lead.

get speed is 7½ miles per hour, the amount of lead is half that shown in the table; at 30 miles per hour, double that shown. The angle at which the target is moving also alters the amount of lead taken (if the angle between line of fire and line of travel of the target is less than 45 degrees, use one-half the lead shown in the table). For a target moving directly toward the gun, the line of aim is placed on the center or the lower edge of the target, depending on range and slope of the ground. The lower edge is used for longer ranges and for broken ground. For a target moving directly away from the gun, the line of aim is placed similarly on the center or upper edge of the target. Too much lead is better than too little because the target runs into the fire, also the observation of a strike is easier. Intelligent use of the lead table includes immediate application of fire with estimated lead followed by necessary corrections based upon observation of strike and/or tracer.

(3) *Lead exercise (10 meter).*

(*a*) The gunner is required to take a position at the gun. swing through the target silhouette, and aim at a point ahead of the target equal to the prescribed lead from the center of mass.

(*b*) The gunner then directs the target handler to move the marking silhouette until the center of the target is at the point of aim. He then repeats this procedure three times for each target lead announced (fig 155).

(*c*) The target handler places his marking silhouette on the blank target, traces around it, and holds it in place for the pupil to aim using the

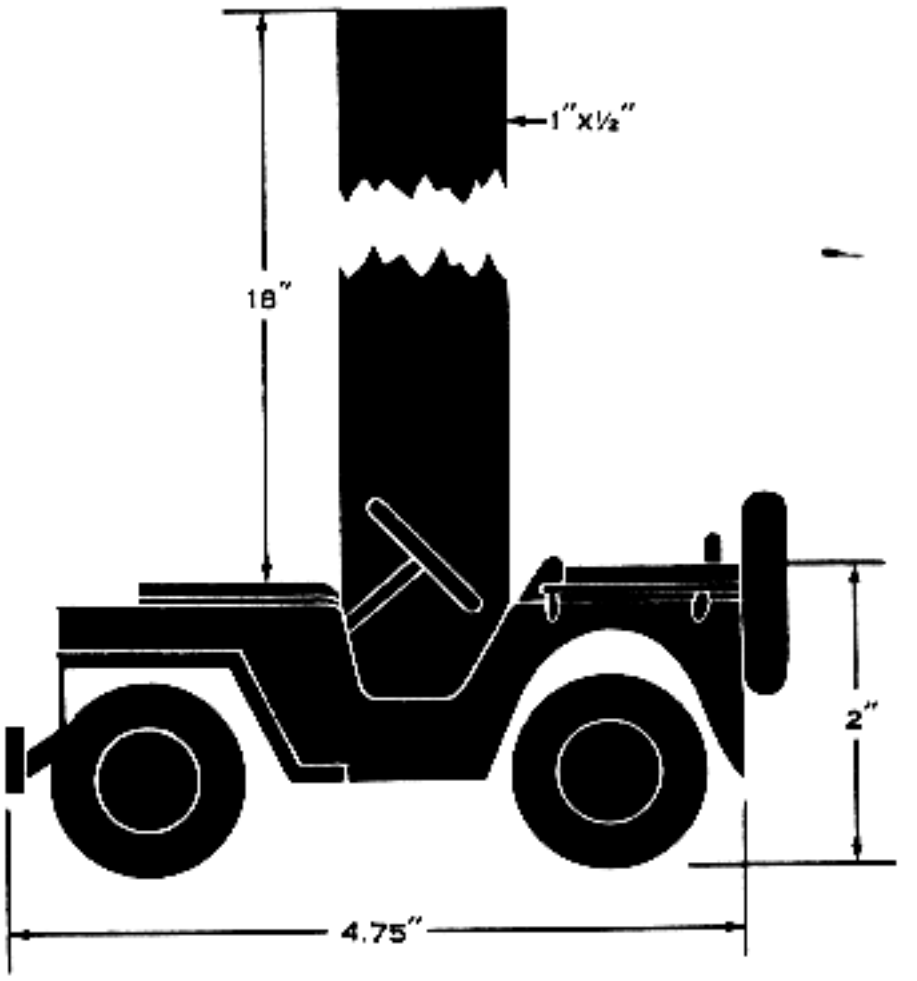


Figure 155. Aiming target used in tracking and leading exercises.

prescribed leads. Following the pupil's instructions, he moves the marking silhouette until the pupil commands HOLD. He then places a pencil dot at this point, and returns the silhouette to the original position. This procedure is followed until the pupil has completed three tries for each target lead announced. The three pencil dots for each target should be inclosed in a circle 1 centimeter in diameter.

(*d*) The exercise should be conducted for varying right and left leads.

d. Tracking and Leading.

(1) Combine tracking and leading exercises at 10 meters. After the gunner has gained proficiency in tracking the target, he is required to repeat the tracking exercises while using a designated lead to simulate firing when his sights are properly alined.

(2) As a further exercise in tracking and leading, the gunner may be required to track and lead moving targets at greater ranges. A vehicle can be run at right angles to the line of aim at ranges between 500 and 1,000 yards, and at varying speeds, averaging 15 miles per hour.

121. Preliminary Gunner's Test

a. Preliminary gunner's tests should be held periodically. Training units should prescribe meth-

ods and procedures, and issue orders announcing satisfactory completion of the preliminary gunner's test, including the scores attained.

b. Preliminary gunner's test, if given, should be given prior to range firing.

c. The recommended preliminary gunner's test has a possible score of 100 points. A score of 80 should be required for satisfactory completion of the test.

	Points
Remove the groups from the receiver	5
Disassemble and assemble the bolt	5
Disassemble and assemble the oil buffer body group	5
Assemble the machinegun	5
Demonstrate and explain the setting of correct headspace	10
Demonstrate and explain setting the correct timing	10
Demonstrate application of the first phase of immediate action	5
Explain one phase of functioning (as directed by the examining officer)	5
Explain why the machinegun will not fire automatically with the cover unlatched	5
Inspect a loaded belt and make any corrections necessary to prepare it for firing (Belt to have at least one of each of the following: Short round, bent round, loose bullet, broken link and round not pushed fully into the link)	5
Explain and demonstrate checks to be made before firing.	5
Explain the full care and cleaning of the gun after firing	15
Explain how gun is targeted at 10 meters	10
Demonstrate and explain care, adjustment, and lubrication of the M3 mount	10
TOTAL	100

Section III. RANGE FIRING

122. General

Range firing is conducted upon completion of preparatory marksmanship training. Range firing consists of the following:

a. Range Firing. Range firing begins with instruction firing. Each student completes instruction firing before firing for record. Once record firing is begun, the table is completed before additional instructional firing is undertaken.

b. Instruction Firing. This is practice firing on a marksmanship range with the help of an instructor. The coach and pupil method may be used.

c. Record Firing. A record is kept and used as the basis for a soldier's classification in marksmanship.

d. Familiarization Firing. This is firing to acquaint a soldier with a weapon. For familiarization training prior to firing, see paragraph 198.

123. Purpose

a. The purpose of range firing is to teach the soldier to apply the fundamentals of marksmanship as prescribed in paragraph 110. The method of instruction is prescribed in paragraph 108.

b. Instruction firing teaches the accurate delivery of fire, mechanical skill in manipulating the gun to engage various types of targets, and observation and adjustment of fire within the time prescribed.

c. Record firing is a test of the gunner's proficiency in all phases of instruction in machinegun marksmanship and furnishes the means for classification according to the proficiency attained.

124. Course to be Fired

a. General.

(1) The following course is prescribed for personnel required to fire the machinegun for qualification.

(2) The amount of instruction firing is not limited to that prescribed in the following tables. The minimum number of instruction firings recommended is four. Such additional practice as time and ammunition allowance permit may be given. The gunner will be proficient on the 10-meter range before he is permitted to fire on the transition range. The gunner can learn all basic elements of marksmanship by firing on the 10-meter range with the exception of range determination, and leading and tracking.

(3) Before range firing, the instructor will insure that all minimum qualifying scores conform to the latest published directives.

b. Tables. Instruction firing consists of firing tables 2, 3, and 4 (4 firings of each recommended). Record firing consists of firing tables 2, 3, and 4 once.

Table 2. 10 Meter

Range (meters)	Time (seconds)	Total rounds	Target	Type of fire
10	No Limit	6	10 Meter Target Paster 1, 2, 3, or 4	Targeting (singleshot fired in groups of three).
10	No Limit	2	10 Meter	Sighting shots*
10	90	78	Target Paster 5, 6, 7, and 8.	Traverse and Search.

*The gun having been targeted, each successive gunner is allowed two shots to confirm the accuracy of the targeting. *These are sighting shots.*

Table 3. Transition Range

Range (meters)	Time (seconds)	Total rounds	Target	Type of fire
400 to 1,000	No Limit	6	Double E-silhouette	Targeting (singleshot).
400 to 1,000	180	60	Double E-silhouette (5) (400 to 1,000)	Free gun (two 6-round bursts per target).

Table III. Moving Target

Range (meters)	Time (seconds)	Total rounds	Target	Type of fire
Minimum 500. Maximum 1,000	Variable. Not less 60 seconds	25	Rectangle 6' x 8' or 6 x 12	Speed variable 10 to 30 mph averaging 15 mph. Direction of target variable, but standardized during record firing. Engage target with single shots, fire automatic bursts when adjusted.

Section IV. CONDUCT OF RANGE FIRING

125. Officer in Charge of Firing

a. The officer in charge of firing is responsible for the conduct of range firing. This officer is detailed by the brigade, battalion, or equivalent commander of the troops being trained.

b. His principal duties are as follows:

(1) To arrange, coordinate, and supervise the assignment of firing points.

(2) To insure the application of safety precautions by all units firing.

(3) To make decisions upon interpretation of the rules governing record firing.

126. Range Officer

Operation of the range is the responsibility of the range officer. He should be appointed well in advance of range firing. The principal duties of the range officer are:

a. To make timely estimates of material and labor in order to place the range in proper condition for firing.

b. To supervise and direct repairs of installations.

c. To regulate the distribution of ranges and targets.

d. To maintain a supply of materials required.

e. To instruct and supervise range guards.

f. To assist the officer in charge of firing in enforcing safety regulations.

127. Uniform and Equipment

a. The uniform and individual equipment worn during range firing are prescribed by the commanders of the units to be trained.

b. A sufficient number of guns should be available for one gun per four men.

c. Sufficient cleaning rods, waste, spare parts, ruptured cartridge extractors, wrenches, cleaning materials, and other required equipment should be available on the range.

128. Control Commands

a. General. In order to control the firing, and to insure that all men fire the same exercises, a set of control commands is established for the conduct of firing. The complete command is divided into two parts; the first part permits the gunner to lay on the exercise, and allows the coach time to make inspections and corrections as required. The second part tells how and when to fire.

b. Explanation of Control Commands for 10-Meter Range.

(1) *Space six* (one two, four zero), denotes the number of belted rounds to be used for the exercise.

(2) *Half-load.* (Load). The belt is half-loaded as directed.

(3) *Paster number one* (two, five, eight). This is the command used to indicate the initial aiming point (paster) used in the exercise to be fired.

(4) *One four hundred.* This is the command used to indicate the range that is set on the rear sight in preparation for, or to actually fire, the exercise. In the absence of an announced range the exercise is fired with the sight setting at which the gun was targeted.

(5) One of the following commands will be given at this time:

(*a*) *Fixed.* This command indicates that the target is a fixed target requiring no change in direction or elevation.

(*b*) *Traverse.* This command indicates that the gunner is required to make changes in direction (right or left).

(*c*) *Search.* This command indicates that the gunner is required to make changes in elevation only.

(*d*) *Traverse and search.* This command indicates that the gunner is required to make changes in both direction and elevation.

(6) *Single-shot (four rounds).* This command is to indicate to the gunner that he must fire the exercise single-shot. In the execution of this command, the gunner reaches forward, palm up, and places his hand below, but not touching, the retracting slide handle.

(7) *Fire.* This is the command for the gunner to load his weapon, relay on the paster and fire the exercise.

(8) *Cease firing.* At this command or signal, the gunner must stop firing.

(9) *Clear and check.* This command is *always* given, to insure that all guns are free of ammunition.

c. Example of a Control Command.

(1) For fixed fire, the instructor commands:1. SPACE SIX, HALF-LOAD, 2. PASTER NUMBER ONE (TWO), 3. ONE THOUSAND, 4. FIXED. The second part is: 5. SINGLE SHOT, 6. FIRE.

(2) For exercises other than fixed fire, the instructor commands: 1. SPACE ONE TWO (FOUR ZERO), HALF-LOAD, 2. PASTER NUMBER FIVE (ONE ZERO), 3. ONE THOUSAND, 4. TRAVERSE AND SEARCH. The second part is: 1. FOUR-ROUND BURSTS, 2. FIRE.

129. Duties of the Coach

a. General. During preparatory exercises and instruction firing, the coach is allowed to be at the gun. The success of the instruction during both the preparatory exercises and the instruction firing depends to a great extent upon the thoroughness with which the coach performs his duties.

b. Coaches. When enough experienced personnel are available, well-trained and well-rehearsed personnel are assigned as coaches. Otherwise, the gunners take turns coaching.

c. Duties of the Coach. The duties of the coach are to:

(1) Require the gunner to inspect his gun and equipment.

(2) Assist the gunner in targeting the gun.

(3) Require the gunner to explain the exercise which he is about to perform.

(4) Check the sight setting and *sight picture* (*lay*) for accuracy, and then lay the gun off in direction not less than 5, nor more than 10 mils.

(5) Observe the gunner's position, grip, and manipulation during firing.

(6) Require the gunner to adjust his fire by observation.

(7) Point out errors and explain their effect on the exercise.

(8) Constantly watch the adjustment and condition of the gun.

d. Position of the Coach.

(1) The coach takes a position to the left of the gun. He may move in order to accomplish his duties as outlined in *c* above.

(2) When firing the caliber .50 machinegun from the M3 mount, the coach should be lying on his side, feet to the rear, where he can watch the

gunner, and also observe control flags placed at the right limit of each unit on the firing line.

130. To Emplace the Gun

a. To insure maximum accuracy during firing, the mount must be adjusted so that the traversing bar is level.

b. Before emplacing the mount, make certain that the sleeve lock latch engages the sliding sleeve. After placing the gun on the mount, stamp all shoes firmly into the ground.

131. Targeting the gun

a. Targeting is the process used to determine and apply corrections for mechanical errors between the barrel and sights so that the line of aim and strike of bullet will intersect at the target.

b. Method of targeting at 10 meters.

(1) Set the sights at 1,000 and windage at zero.

(2) Lay on a paster.

(3) Fire three rounds in single shots; use the same sight picture for each shot.

(4) Locate, by inspection, the center of impact of the shots.

(5) If the center of impact is on the paster, the gun is targeted.

(6) If the center of impact is not on the paster, insure that the gun is laid on the original paster. Without moving the gun, move the rear sight first for deflection, then for elevation, until the line of aim is on the center of impact.

(7) Confirm the adjustment by again aiming at a paster and firing three rounds, single-shot.

(8) If the center of impact still is not on the paster, repeat the above procedure (6) until the center of impact coincides with the point of aim.

(9) Record the sight settings.

132. 10-Meter Machinegun Targets

The 10-meter target will be used to fire table 2 for instruction and record firing. The scoring spaces measure 4 centimeters by 5 centimeters.

Section V. CONDUCT OF EXERCISES

133. General

a. All firing is initiated by control commands of the type in paragraph 128. The gunner (pupil) repeats all commands.

b. The use of a T-base or other device for steadying the mount is prohibited.

c. The sight leaf is raised for all firing. Both sights of the machinegun may be blackened.

d. Before firing, the gunner examines all the equipment and insures that it is in order and ready for firing (para 50).

e. The coach performs the duties outlined in paragraph 129.

134. Instruction Firing, Table 2

a. Purpose. The purpose of instruction firing in table 2 is to develop skill in the delivery of initial fire on a series of targets that vary in direction and elevation.

b. Demonstration of Firing.

(1) To demonstrate each of the exercises, the instructor uses a demonstration crew of two men. One man (the gunner) takes his position at the gun, the other man to the left of the gun as coach. The equipment required is one machinegun (properly mounted and targeted), ammunition for the exercise, and two 10-meter machinegun targets. One of the targets is set up 10 meters from the gun (measured from the pintle). The other target is placed near the instructor to be used in explanation of table 2.

(2) The procedure in demonstrating each of the exercises is as follows:

(*a*) The instructor explains the exercise the gunner is about to fire, including sighting shots (para 124 and 131).

(*b*) The instructor gives the first part of the control command.

(*c*) The gunner repeats the command, half-loads, lays on the designated paster, assumes the correct gunner's position, and reports UP.

(*d*) The coach checks the lay of the gun, and the gunner's position. He then lays the gun off in direction not less than 5 or more than 10 mils.

(*e*) The instructor then gives the remainder of the control command.

(*f*) The gunner repeats the command, and after the command to fire, fully loads, relays the gun, assumes the correct gunner's position and fires the exercise.

(*g*) Prior to firing, the coach requires the gunner to relay, and to assume the correct position. During the firing, he notes any errors in position and grip, or manipulation, and, if neces-

sary, stops the gunner from firing, to correct errors.

(*h*) After the exercise is fired, the coach checks the lay of the gun, points out any errors made by the gunner and explains their effect on the target.

(*i*) The coach and gunner then examine the target. The instructor explains the effect of an improperly mounted gun or incorrect lay (target analysis).

c. Explanation of Exercise. The instructor explains that the scoring spaces represent point targets, and that this exercise requires accurate delivery of initial fire. Table 2 is fired by engaging scoring spaces 5–6 and 7–8, or 8–7 and 6–5 in that order. The gunner has 6 rounds to engage each scoring space with a 4–6 round burst, total of 78 rounds. The shots should strike in the scoring space. Pasters 1, 2, 3, and 4 are used for targeting and sighting shots.

d. Dry Run. If time is available, the gunner should be required to "dry run" the exercise a number of times prior to firing. The control command is preceded by the word SIMULATE.

135. Record Firing for Table 2

a. General.

(1) Record firing consists of the firing prescribed in paragraph 124. The rules for instruction firing apply to record firing as well, except where stated otherwise. Any departure from the rules governing record firing will disqualify a gunner. This includes firing single shot when bursts are required.

(2) After completing instruction firing, each gunner fires the table in one period as prescribed in paragraph 124. After the gunner has completed firing table 2, the targets are changed and another gunner then fires table 2. Once begun, record firing of any table is carried to completion before any other firing is permitted. Ordinarily, a gunner is required to fire for record on the day following that on which he fired any part of his instruction firing. When necessary, the officer in charge of firing may authorize the firing of both instruction and record on the same day. The two types of firing are conducted simultaneously only on ranges where each type of firing is conducted on a different part of the range.

b. Equipment. The machinegun and mount as issued will be used in all firing. The use of additional clamps or appliances of any kind on the gun or mount is prohibited. Cloth patches or similar soft material may be used for the elimination of excessive looseness, such as between the pintle and the pintle bushing, and between the upper elevating screw yoke and rear mounting lugs. Only authorized ammunition will be used. It will be examined carefully and defective cartridges and/or links eliminated.

c. Coach. Coaching the gunner is not authorized at any time during record firing. The officer in charge of firing may employ the coaches to assist in control of firing, for transmitting the cease fire signal from the officer in charge of firing to the gunner, and to lay the gun off in direction, not less than 5, nor more than 10 mils.

(1) The coach will not touch the gunner during the conduct of the exercise, except to transmit the cease firing signal.

(2) The coach will not speak to the gunner other than to give control commands.

d. Gunner. In record firing, the gunner takes his position at the gun to fire the prescribed exercises with the prescribed amount of ammunition.

(1) During this firing, he performs required operations, such as setting the sight, laying the gun, manipulating, and firing within the prescribed time limit.

(2) After the gunner has taken his place at the gun for an exercise, all rounds fired by him will count as part of that exercise. The total amount of ammunition used in any exercise, including rounds fired accidentally, will not exceed the amount authorized for that exercise. Ammunition remaining from one exercise, due to expiration of the time allowance, is lost to the gunner. However, it may be used for targeting purposes.

e. Stoppages.

(1) When a stoppage occurs during record firing, the gunner will raise his hand, call TIME, and without touching the gun, await further instructions from the officer in charge of firing (para 85 and 86). The assistant notes the time that the gunner signals, and determines the remaining time for the exercise by deducting the elapsed time from the allotted time.

(2) The assistant determines where the gun is laid and counts the ammunition remaining for the particular exercise. He lays the gun off the exercise and presses the trigger, making sure that the bolt is forward, to determine if there is a stoppage. If a stoppage exists, he directs the gunner to reduce it.

(3) He then reports the nature of the stoppage to the officer in charge of firing, who gives instructions as to whether or not the gunner will be permitted to complete the exercise. If the cause

SCORECARD
MG, CAL.50, HB, M2
(For use of this form, see FM 23–65; the proponent agency is U. S. Continental Army Command.)

NAME:	SSAN:	GRADE:
ORGANIZATION:	PLACE: TABLE I (10 METER)	DATE:

NUMBER OF ROUNDS	BONUS	HITS	PENALTIES	SCORE MAX. 104
80*				

*INCLUDES TWO SIGHTING SHOTS. DISREGARD IN SCORING

DATE:	SCORER:
	CERTIFIED CORRECT:
	FIRER:

DATE: TABLE II (TRANSITION)

NUMBER OF ROUNDS	6	NO TIME LIMIT	TARGETING
	60	3 MINUTES	TRANSITION FIRING

TARGETS ENGAGED (TOTAL)	
NUMBER OF HITS	
NUMBER OF POINTS	SCORE MAX: 50

TARGETS :	RANGES	HIT	MISS
1	400		
2	500		
3	600		
4	800		
5	1000		
		TOTAL:	

10 POINTS PER TARGET
X 5 TARGETS
50 POINTS TOTAL

TOTAL TABLES I, II.
CLASSIFICATION:

TABLE III (MOVING TARGETS)

NUMBER OF ROUNDS	TOTAL HITS	SCORE MAX: 125
25		

DATE:	SCORER:	
	CERTIFIED CORRECT:	TOTAL SCORE MAX: 279
	FIRER:	
	TOTAL TABLES I, II, III: CLASSIFICATION:	

DA FORM 3647-R, 1 Jun 72

Figure 156. Caliber .50 machinegun scorecard.

TABLE	POSSIBLE SCORE
I	104
II	50
III	125

QUALIFICATION USING TABLES I & II POSSIBLE 154

EXPERT	139 – 154
1st CLASS	123 – 138
2d CLASS	108 – 122
UNQUAL	BELOW – 108

QUALIFICATION USING TABLES II & III POSSIBLE 279

EXPERT	252 – 279
1st CLASS	223 – 251
2d CLASS	195 – 222
UNQUAL	BELOW 195

Figure 156—Continued

of the stoppage was the fault of the gunner, the exercise is not completed and the score stands. If it is not the fault of the gunner, he is permitted to complete the exercise. To complete the exercise, the gunner fully loads and lays on that point of the exercise where the stoppage occurred. At the command FIRE, given by the assistant, the gunner fires the ammunition that remained for the particular exercise, in the time remaining to complete the exercise. In no case will any exercise be completely refired. Should a breakage occur, the gun is retargeted or replaced before firing to complete the exercise. If, as a result of pulling the bolt to the rear when a stoppage occurs, any unfired or damaged rounds are ejected from the gun, the gunner is allowed to fire the equivalent of these rounds as soon as the exercise is completed. At the command FIRE, given by the assistant, the gunner is allowed one second for each ejected round.

f. Penalty.

(1) A penalty of 5 points is deducted from the score of any firer who fails to cease firing at the command or signal. An additional 2 points are deducted for each round fired after the command CEASE FIRE is given. The assistant will exact the penalty.

(2) A gunner who fires on the wrong target receives credit only for hits on his own target. He does not refire the exercise. The man whose target was erroneously fired on refires the exercise.

(3) Five points are deducted from the score for each shot-hole in excess of the prescribed number of rounds. No deductions are made for the targeting or sighting shots. No deductions are made if the firing is under the circumstances described in (2) above.

g. Scoring.

(1) DA Form 3867–R (Score Card, MG, CAL .50, HB, M2) is kept for each man firing. The date of the firing and all other entries are recorded in ink or indelible pencil. No erasures are made on scorecards. Alterations may be made only by the unit commander or the officer acting as scorer, and each alteration is authenticated by the initials of the officer who made it. In record firing, the target is scored by an assistant. An officer authenticates the entry on the scorecard (fig 156). DA Form 3867–R will be reproduced locally on 8x10½ inch paper.

(2) Two points bonus are scored for each scoring space hit. The maximum bonus for table 2 is 26 points. One point is scored for each hit in the prescribed scoring space up to a maximum of six hits per scoring space. Strikes touching the boundary line of a scoring space are hits. Maximum score for table 2 is 104 points.

h. Assistant Instructors. Officers or noncommissioned officers who supervise record firing are detailed as assistants to the officer in charge of firing. Personnel performing this duty should be from units other than the one firing. A maximum of two guns can be supervised by one assistant instructor. He performs the following duties:

(1) Lays the gun off in direction not less than 5 and not more than 10 mils, as prescribed for the exercise, unless a coach is at the gun.

(2) Sees that the gunner does not alter the lay of the gun until after the command (signal) FIRE is given.

(3) Sees that the gun is not fully loaded until after the command (signal) FIRE.

(4) Watches for stoppages, and performs the duties prescribed in *e* above.

SCORECARD
MG, CAL.50, HB, M2
(For use of this form, see FM 23-65; the proponent agency is U. S. Continental Army Command.)

NAME: WARREN, CHARLES	SSAN: 543-20-1408	GRADE: PFC
ORGANIZATION: B/5/85 INF	PLACE: FT. BENNING TABLE I (10 METER)	DATE: 18 Feb 71

NUMBER OF ROUNDS	BONUS	HITS	PENALTIES	SCORE MAX. 104
80*	26	72	5	93

*INCLUDES TWO SIGHTING SHOTS. DISREGARD IN SCORING

DATE:	SCORER: SFC ROBERT L. STANFORD
18 Feb 71	CERTIFIED CORRECT: Donald F. Chandler, 2 Lt. Inf.
	FIRER: Charles V. Warren

DATE: 19 Feb 71 TABLE II (TRANSITION)

NUMBER OF ROUNDS:	6	NO TIME LIMIT	TARGETING
	60	3 MINUTES	TRANSITION FIRING

TARGETS ENGAGED (TOTAL)	5
NUMBER OF HITS	4
NUMBER OF POINTS	SCORE MAX: 50

TARGETS :	RANGES	HIT	MISS
1	400	✓	
2	500	✓	
3	600	✓	
4	800		0
5	1000	✓	

TOTAL: 40

10 POINTS PER TARGET
X 5 TARGETS
50 POINTS TOTAL

TOTAL TABLES I, II.

CLASSIFICATION:

TABLE III (MOVING TARGETS)

NUMBER OF ROUNDS	TOTAL HITS	SCORE MAX: 125
25	20	100

DATE:	SCORER: SFC Robert L. Stanford	
22 Feb 71	CERTIFIED CORRECT: Donald F Chandler	TOTAL SCORE MAX: 279
	FIRER: Charles V. Warren	
	TOTAL TABLES I, II, III: CLASSIFICATION: 1ST CLASS GUNNER	233

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Figure 158—Continued

(5) Makes the deduction described in *f* above for firing after the command CEASE FIRE is given.

(6) Counts the total number of holes in the target and deducts, if necessary, points as prescribed in *g* above.

(7) Counts and records the score as prescribed in *g* above.

136. Instruction Firing for Table 3

Table 8 is the connecting link between basic marksmanship and the engagement of field targets. It is designed to provide transition or progressive instruction as it is an introduction to engagement of field targets at unknown locations and ranges. The targets vary in type and therefore require engagement by varying types of fire. The purpose of instruction firing is to teach the gunner to locate the target, estimate the range, engage the target, and to adjust his fire if necessary.

a. Demonstration of Firing.

(1) The instructor uses a demonstration crew of three men. The acting safety NCO, takes a position on the right of the gun facing to the rear. The gunner is in prone position, five paces in rear of the gun. The ammunition bearer is five paces in rear of the gunner, with one ammunition case containing the prescribed number of rounds to fire the course. The equipment for the demonstration consists of one mounted machinegun, ammunition for the course, and two double E-silhouette targets. The targets are placed so that the instructor can point to them.

(2) The instructor explains that the five targets are located in a lane that is not more than 100 meters wide at the extreme range, and not less than 10 meters wide at the firing line. The nearest target is located approximately 400 meters from the firing line, and the far target is 1,000 meters. Intermediate targets are placed irregularly in width and depth (fig 157). The targets may be the disappearing type or may be used with the bases flush with the ground on stakes. All targets consist of double E-type silhouettes mounted abreast, without interval (fig 158). Ricochets hitting the targets are hits.

b. Field Targeting.

(1) Six rounds are used for targeting the gun on table 3. Any target in the lane may be used; however, it is recommended that a target at approximately 600 meters be used. The range to the target used must be known, because a *known range* is required for accurate targeting.

(2) The gunner will:

(*a*) Set the sights at 600 (or range to the target), windage zero.

(*b*) Lay on the target.

(*c*) Fire one round.

(*d*) Observe the strike.

(*e*) If the strike is on the target, check sight setting and sight picture, and fire the confirming round(s).

(*f*) If the strike is not on the target, the gunner estimates the number of meters he is off, then places the changes in elevation and windage on his rear sight.

(*g*) Lay on the target by using the traversing and elevating mechanisms, and confirm.

(*h*) If the strike is not on the target, the gunner repeats steps (*f*) and (*g*).

c. Explanation of the Course.

(1) Time begins at the command, ACTION, given by the instructor in charge of firing. At this time, the acting safety NCO gives the hand signal for ACTION, and the crew goes into action in the following manner: upon the command and signal, the gunner springs to his feet and runs to the gun where he takes the prone gunner's position; the assistant gunner arrives as the gunner takes his position, and places the ammunition case close to and on line with the feedway, and assumes a position on his left side, facing the gun, head even with the feedway. He then assists the gunner in loading the gun. After the gun is loaded, the gunner estimates the range to the target, sets his sights, lays on the target, fires, and *observes* the strike. If the target is not hit, the gunner may change the elevation and windage on the sights or select a new aiming point to place the next burst on the target.

(2) Two 6-round bursts (automatic fire) *may be* fired at *each* of the targets until a kill has been registered.

(3) The gunner engages the three near targets (400—600 meters) before engaging the far targets (800—1,000 meters). The officer in charge of firing prescribes the order to fire the targets in each group.

(4) The ammunition container carried by the assistant gunner contains 60 rounds of ammunition. Tracers may be used to observe fire, but not to exceed the ratio of one tracer to four ball cartridges.

(5) The acting safety NCO assists the gunner in *locating* targets, but at no time does he announce the range or adjustment for any firing. He also has these additional duties:

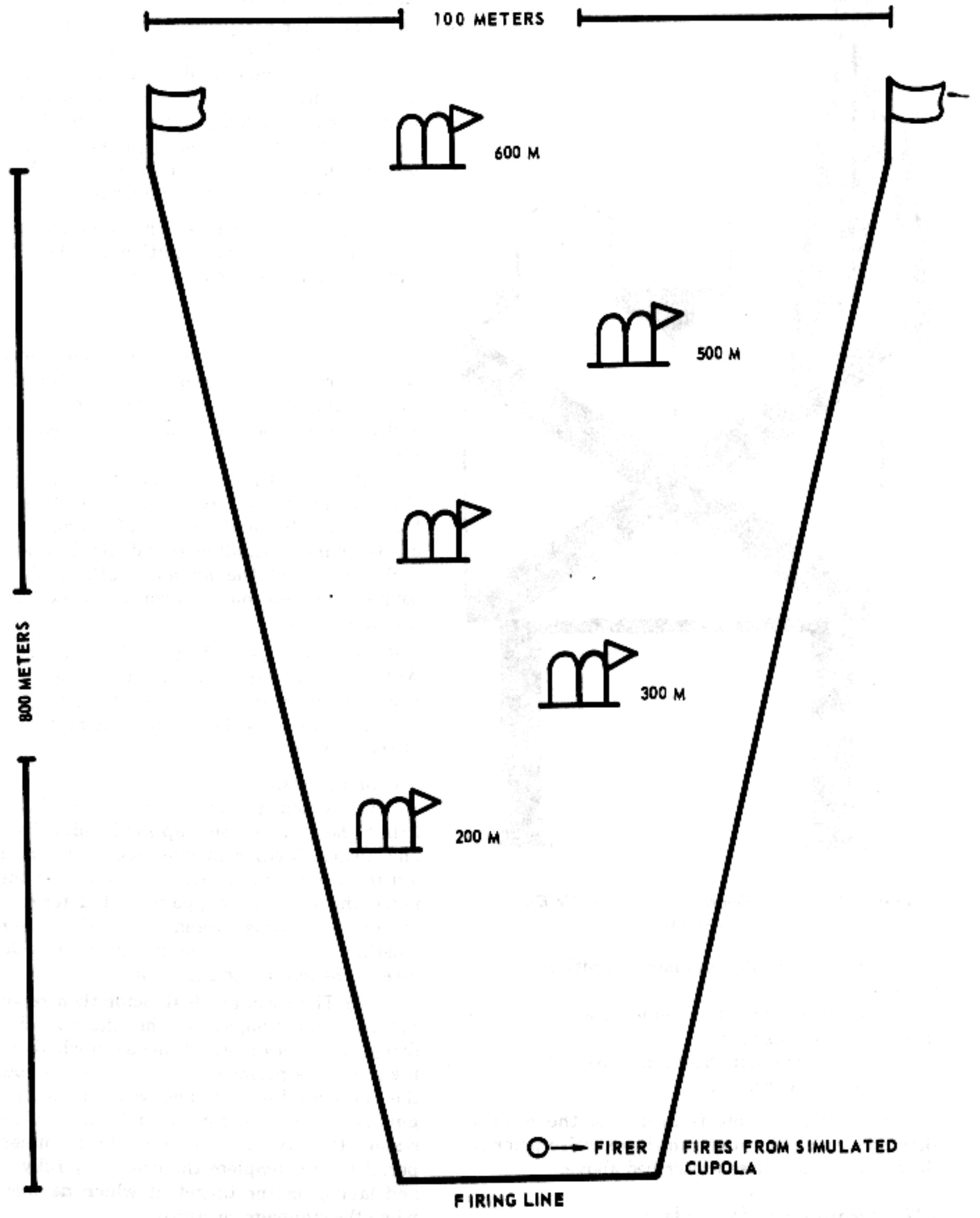


Figure 157. Range layout, transition range.

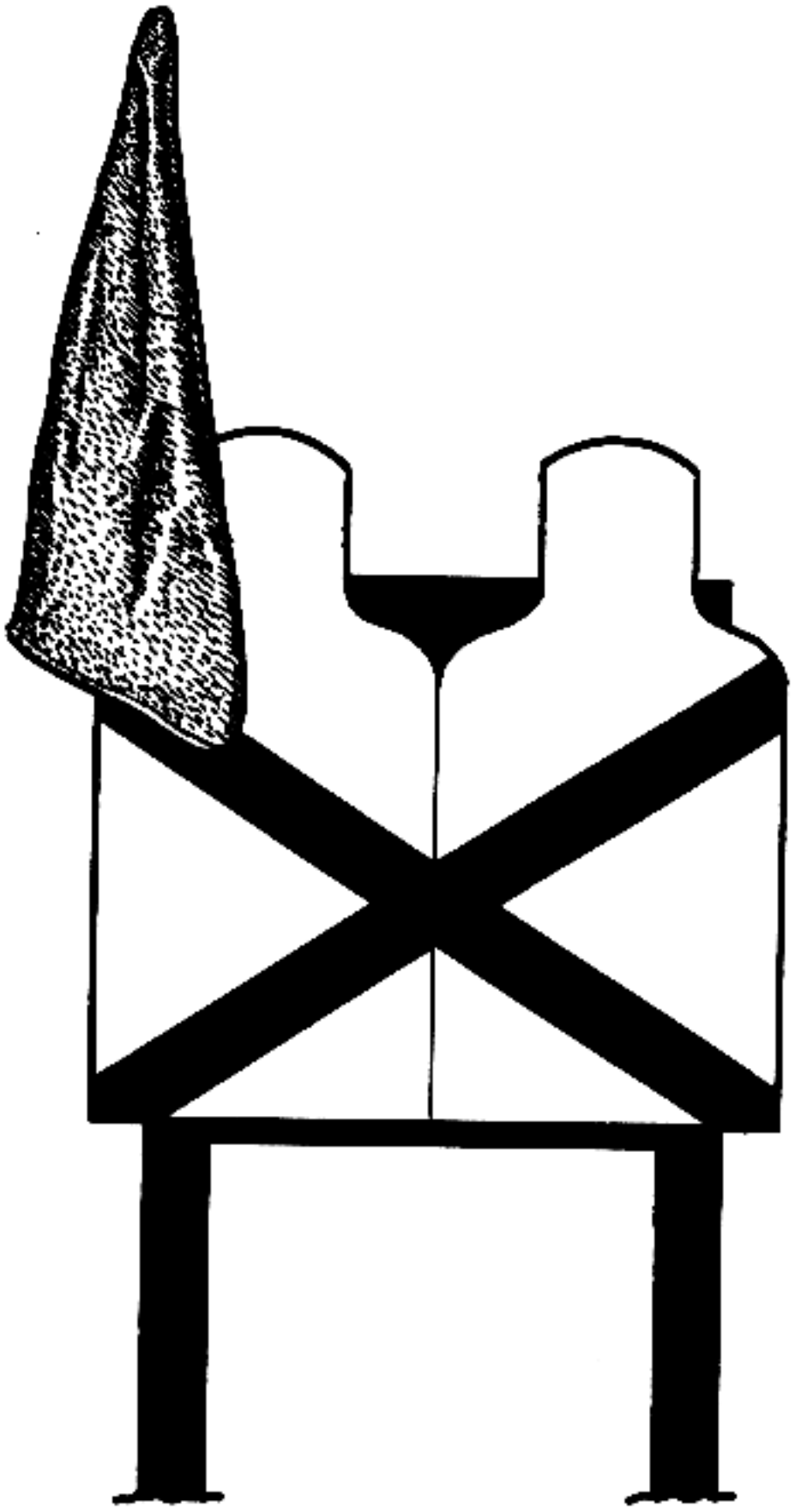


Figure 153. Transition range target, double E-type silhouettes.

(*a*) Check the gunner's position before firing.

(*b*) Insure that the gunner fires within the safety limits of the range.

(*c*) Insure that the gunner fires the course in the prescribed manner.

d. Dry Run. If time is available, the gunner should be required to dry run the exercise prior to the firing of the course prescribed above.

137. Record Firing for Table 3

a. General.

(1) The rules for instruction firing apply to record firing except where otherwise stated. Any departure from the rules governing record firing disqualifies the gunner.

(2) After completing instruction firing, each gunner, when firing table 3, fires the exercise in a single time period. Ordinarily, a gunner is required to fire the exercise on a day subsequent to that on which he fired any part of his instruction firing. However, if necessary, the officer in charge of firing may authorize the firing of both instruction and record firing the same day.

b. Equipment. The machinegun as issued is used in all firing. Ammunition will be examined carefully and defective cartridges and or links eliminated.

c. Gunner.

(1) In record firing, the gunner must perform operations required, such as estimating the range, setting the sights, laying the gun, firing and adjusting the fire, within the prescribed time limits.

(2) After the gunner has taken his place at the gun, all rounds fired by him count as part of the course. The total amount of ammunition used on the course, including rounds fired accidentally, will not exceed the amount authorized for the course. Ammunition left over at the expiration of the time is lost.

d. Acting Safety NCO. After the command ACTION, the acting safety NCO assists the gunner only in locating the target, and in no way assists or disturbs the gunner during the conduct of the exercise.

e. Stoppages.

(1) When a stoppage occurs during record firing, the gunner holds up his hand, calls TIME, and awaits further instructions from the assistant to the officer in charge of firing. The assistant notes the time of stoppage and determines the amount of time remaining. He determines whether an actual stoppage exists; if it does, he directs the gunner to reduce it.

(2) The assistant instructor then reports the nature of the stoppage to the officer in charge of firing, who gives instructions as to whether or not the gunner is permitted to complete the course. If the cause of the stoppage was the fault of the gunner, the course is not completed, and the score stands. If it was not the fault of the gunner, he is permitted to complete the course by fully loading and laying on the target at which he was firing when the stoppage occurred.

f. Penalties.

(1) If the gunner does not cease firing at the

command, 10 points are deducted from his total score.

(2) Five points are deducted from the total score for each of the first three targets not engaged by two bursts.

(3) Five points are deducted from the total score for each round in excess of 4 rounds fired at each of the last two targets.

(4) If the gunner fails to engage a target, 10 points are deducted for each from his total score.

g. Scoring. Ten points are scored for 3–5 target hits (400–1,000 meters). Seven points are scored for 1–2 target hits. Total possible score is ten points. Four points are awarded for completion of exercise.

h. Assistant Instructors. Assistant instructors and noncommissioned officers to supervise record firing are detailed as assistants to the officer in charge of firing. Personnel performing this duty should be from units other than the one firing. A maximum of two guns can be supervised by one assistant instructor.

i. Range Detail. A sufficient number of men to operate the range will be detailed to assist the officer in charge of firing.

138. Inspection Firing for Table 4

a. This section outlines the methods of conducting preparatory training, instruction firing, and record firing at moving ground targets at ranges from 300 to 1,000 meters.

b. Moving target range facilities vary widely at different installations. For this reason, the provisions of this section furnish a *guide* for correct training procedure.

c. Men are not permitted to fire for record at moving targets unless they are qualified in tables 2 and 3 as 1st class gunners.

d. In addition to the preparatory exercises prescribed in paragraph 121. the following additional exercises will be conducted before firing at long range moving targets.

(1) *First exercise:* Use a light and easily maneuverable vehicle to represent the target. The target should move parallel to the firing point at a range of 300 to 400 meters, at an initial speed of five miles an hour. Require estimates of range, speed, and point of aim. As proficiency is gained, increase the range to 800 to 900 meters and the speeds up to 25 or 30 miles per hour.

(2) *Second exercise;* This exercise is conducted similarly to the first exercise. Direction of movement is changed. The vehicle (target) is moved toward the firing point on diagonal courses, varying in direction and speed. Require estimates of range, speed, and point of aim.

(3) *Third exercise:* This exercise requires actual manipulation of the gun to track the target moving on courses as prescribed in (1) and (2).

(4) *Fourth exercise;* This exercise requires range estimation, sight setting, estimation of lead, leading the target with the gun, simulating fire, and continuation of aiming with a predetermined lead while simulating single-shot fire. It should be conducted using the target on which the guns will fire, running the course on which it will operate during actual firing.

(5) *Gunner.* During the leading and tracking exercises, the traversing slide lock lever is released and the traversing slide is moved along the traversing bar. The gunner applies a steady and firm pressure to the elevating handwheel with the left hand, changes in elevation are made by rotating the handwheel. For smoother tracking, a steady lateral pressure is applied to the right spade grip with the right hand. The gunner must shift his body in order to stay directly behind the gun.

139. Demonstration of Firing

To demonstrate the firing, the instructor uses a demonstration crew of three men. One man, a trained safety NCO (assistant instructor), takes a kneeling position to the right rear of the gun. The gunner (No. 1) is in the correct gunner's position behind the gun (prone). The assistant gunner (No. 2) is to the left of the gun. The equipment required for demonstration is a caliber .50 machinegun (mounted), ammunition for the course, and one target of the type to be fired upon. This target is placed so that the class can see it and the instructor can point to it.

a. Procedure in Demonstrating the Firing.

(1) The instructor explains that prior to mounting the gun, the examination of equipment was accomplished by the crew as outlined in paragraph 48. The instructor then explains the course that the gunner will fire.

(2) The instructor explains how the target will move across the front, and gives the range (500 to 1,000 meters depending on range layout) that the speed of the target will vary, that the gunner estimates the leads necessary to place fire on the target, and that the gunner is not aided in his fire adjustment.

b. Explanation of Course.

(1) The control command is given by the of-

ficer (instructor) in charge of firing. Time begins at the command FIRE. A typical control command is MOVING TARGET, LEFT FRONT (RIGHT FRONT), SIX HUNDRED, AT MY COMMAND. The command to fire is given at the same time the target commences its movement across the course.

(2) At the command MOVING TARGET, the gunner and assistant gunner load the gun in the prescribed manner. At the command LEFT FRONT (RIGHT FRONT), the gunner releases the traversing slide lock lever and swings the gun through free traverse to the left (right) front, and sets the sight at 600. At the command FIRE, the gunner lays on the target, takes the necessary lead and commences firing.

(3) A maximum of five shots may be fired single-shot for adjustment. For the first round, the gunner looks through the sights. After the first round is fired, the gunner makes the necessary adjustments by observing the flight of the tracer and/or the strike of the bullet. The remaining ammunition is fired in a burst. If there is a stoppage, the gunner relays on the target using the sight, then takes the necessary lead before firing is resumed.

(4) The ammunition container contains 25 rounds of ammunition. Tracers are used, but not to exceed the ratio of one tracer to four ball cartridges.

(5) The safety NCO (assistant instructor) notes any error in position, grip, sight setting, manipulation, and/or adjustment. If necessary, he stops the firing to correct errors. After the exercise has been fired, he explains how the errors made by the gunner affected the firing. The safety NCO keeps a close watch on the fire delivered along the flanks of the range, and prevents the gunner from firing outside the safety limits.

(6) The gunner should be required to dry run the exercise prior to the firing prescribed above.

140. Targeting the Gun

Prior to firing the course, the gun will be targeted at the mid-range over which the target moves. The same procedure is followed as in field targeting, paragraph 131.

141. Record Firing for Table 4

a. General.

(1) Record firing consists of the firing prescribed in paragraph 139*c*. The rules for instruction firing apply to record firing, except when otherwise stated. Any departure from the rules governing record firing disqualifies the gunner.

(2) All men firing table 4 must first be qualified as First Class Gunner in tables 2 and 3.

(3) After completing instruction firing, each gunner will fire the exercise in table 4 in a single time period. Ordinarily, a gunner is required to fire for record on a day subsequent to that which he fired any part of his instruction firing. However, when necessary the officer in charge of firing may authorize the firing of both instruction and record on the same day.

(4) As far as practicable, the gunner fires for record with the target moving on a different course than for instruction firing.

b. Equipment. The machinegun and ammunition as issued is used in all firing. Ammunition *will* be examined carefully and defective cartridges and/or links eliminated.

c. Gunner.

(1) In record firing, the gunner must perform the operations required; such as setting the sights, determining the leads, laying the gun, firing, and adjusting the fire within the prescribed time limit.

(2) All rounds fired by the gunner will count as part of the course. The total amount of ammunition used on the course, including rounds fired accidentally, will not exceed the amount authorized for the course. Ammunition left over at the expiration of the time is lost to the gunner.

d. Stoppages. When a stoppage occurs during record firing, the gunner holds up his hand and calls TIME, and awaits further instructions from the officer in charge of firing. The assistant determines whether an actual stoppage exists; if it does, he directs the gunner to reduce it.

(1) The assistant then reports the nature of the stoppage to the officer in charge of firing, who gives instructions as to whether or not the gunner is permitted to refire the course.

(2) If the cause of the stoppage was, without doubt, the fault of the gunner, the course is not refired, and the score stands.

(3) If it was not the fault of the gunner, he is permitted to refire the course.

e. Penalty. If the gunner does not cease firing at the command, 5 points for each round fired are deducted from his total score.

f. Scoring. Five points are scored for each hit on the target. The total possible score is 125 points.

g. Assistant Instructors. Officers and noncommissioned officers to supervise record firing in strict accordance with the rules governing this

firing are detailed as assistants to the officer in charge of firing. Personnel performing this duty should be from units other than the one firing. Each gun will have one safety NCO.

h. Range Detail. A sufficient number of men to operate the range are detailed to assist the officer in charge of firing.

142. Safety Precautions

a. General. General safety precautions for firing caliber .50 machinegun ammunition are contained in AR 385–63.

b. Additional Safety Precautions.

(1) No firing is done except under the direct supervision of an officer.

(2) No firing is done until correct headspace and timing have been checked by the safety NCO.

(3) No firing will be done until a cleaning rod and dry patch have been run through the bore from the muzzle and *immediately removed.*

(4) No gun is loaded or half loaded until a command to do so has been given.

(5) After machineguns are fired, each gun is cleared and checked prior to being removed from the firing line.

(6) No one is allowed in front of the gun for any purpose unless authorized by the officer in charge of firing.

(7) During moving target firing, conspicuous markers are placed to indicate the right and left safety limits of the range. The safety NCO for each gun makes certain his gun does not fire outside these limits.

(8) Firing at moving targets is not permitted on any range until the safety angles have been checked.

(9) Personnel of the towing vehicle operate at sufficient distance from line of fire in order to be protected not only from direct hits but also from ricochets.

(10) Vehicles operating in the range area in front of the firing line will be equipped with red flags.

(11) Target personnel do not leave designated safety areas until the command to do so has been given.

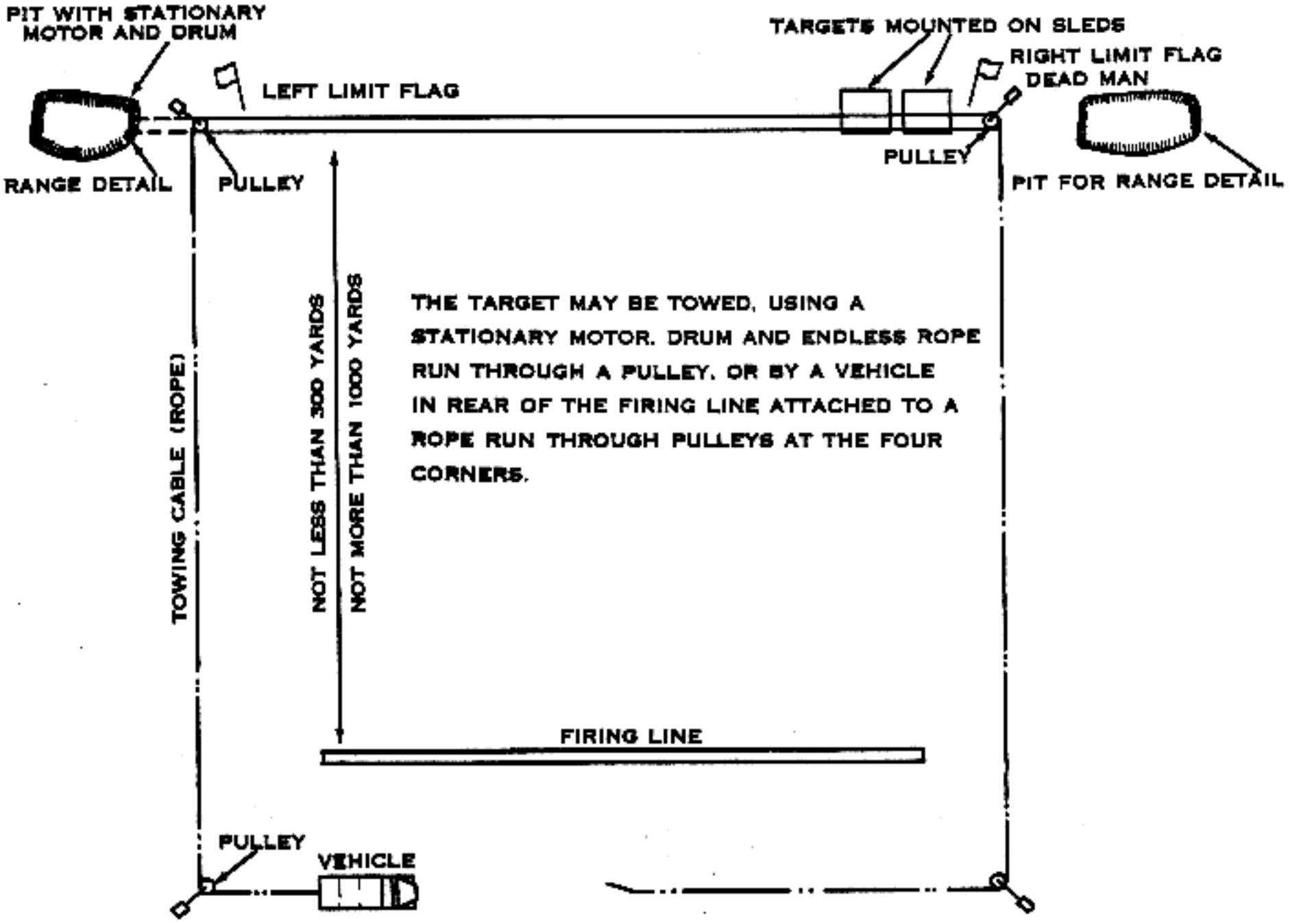


Figure 159. Moving target range layout, stable target course.

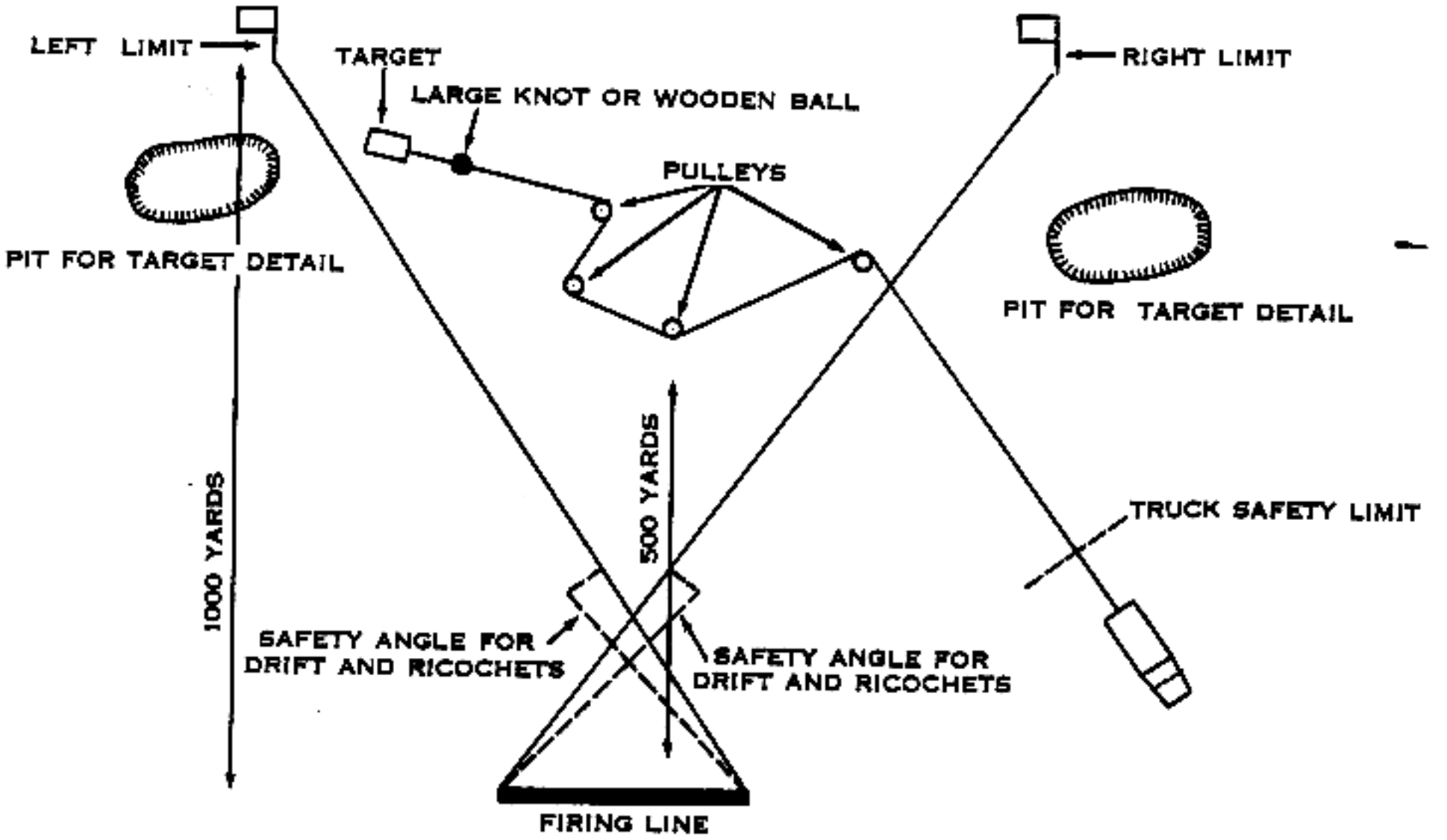


Figure 160. Moving target range layout, variable target course.

(12) A safety officer is designated. At least one safety officer is designated for each four guns firing, and one safety noncommissioned officer is detailed to assist him at each gun position.

c. Duties of the Safety Officer and His Assistants Are to Insure—

(1) Guns are never pointed in such a direction that the target detail is endangered.

(2) Guns do not fire outside the prescribed safety limits.

(3) Firing ceases immediately upon the command CEASE FIRING.

(4) Guns are cleared, covers opened, bolts to the rear, and the gun crews standing clear of the guns at the end of each run, before the target detail moves onto the range.

(5) That all target personnel have returned to the designated safety area before guns are loaded.

143. Moving Target Ranges

a. A level or gently rising piece of ground should be selected for the moving target range. It should be at least 900 meters in depth and of sufficient width to permit convenient operation of the moving target. Pits conveniently placed for the scoring and target details, with telephone communication with the firing line, and targets that are rapidly mounted and dismounted from the sled or carriage facilitate scoring and changing targets. The pits must be constructed so that they are impervious to the type of ammunition used.

b. Targets may be towed across the course by truck or by motor and drum located in a pit at the end of the run. See figure 159 for one type of range layout. With this type of range, the target course cannot vary. Therefore, one end of the run should be at a higher elevation than the other so that the gunner must continually adjust for elevation.

c. Figure 160 illustrates one type of range layout that provides changes in direction of the target in addition to range changes. Changes in direction of the target are accomplished by setting pulleys at desired locations. A large knot or wooden ball fastened to the towline about 15 feet in front of the sled or car will disengage the line from the pulley, thereby changing direction of the target. The towline should be of ⅜-inch wire cable or ¾-inch rope. For an example of the towed types of target see figure 161.

d. Target speeds should approximate speeds that might be expected of combat vehicles on com-

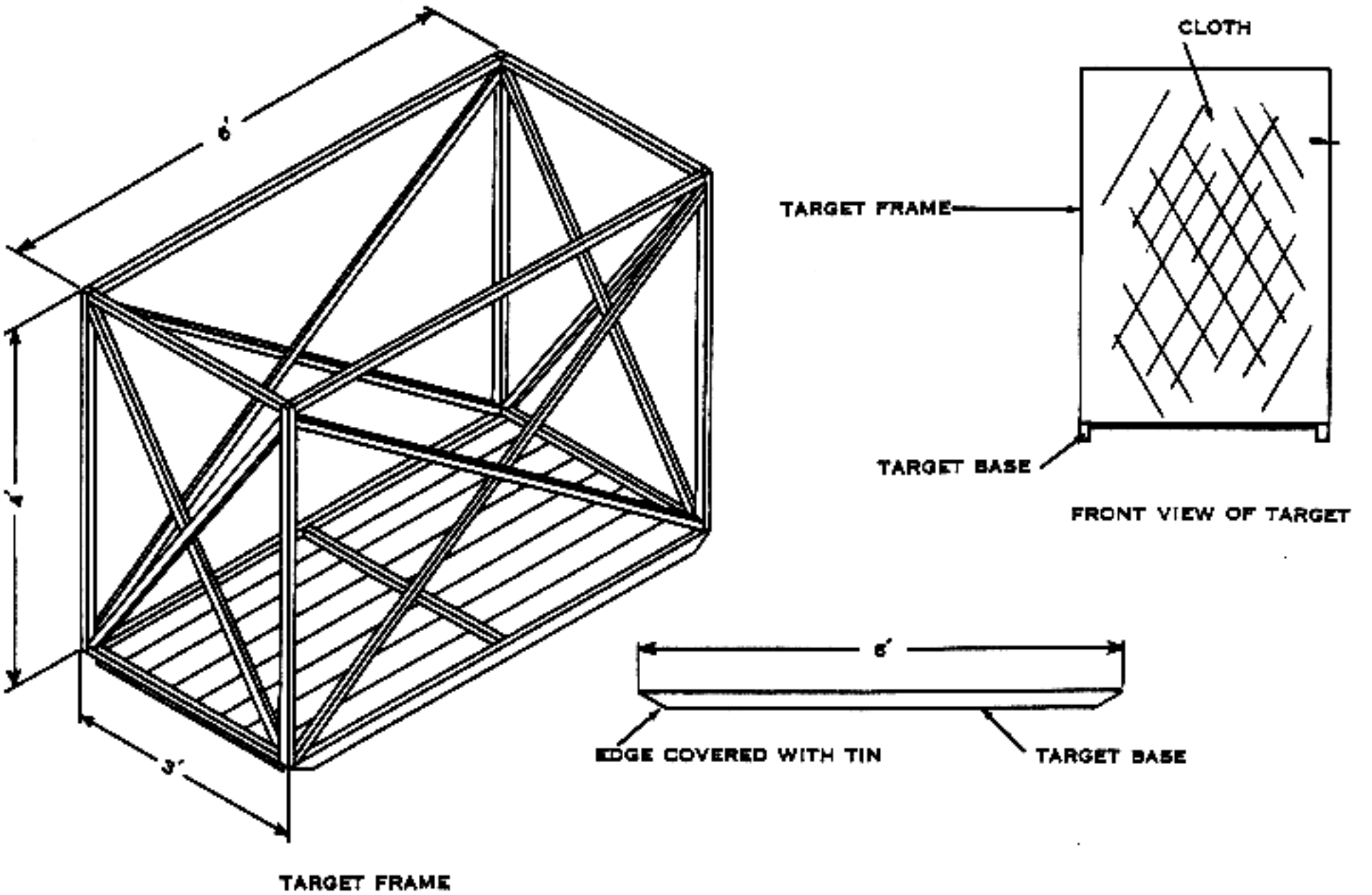


Figure 161. Towed target for moving target range.

parable terrain. Better regulation of speeds is obtained if the towing vehicle can operate on a road and is not required to change direction.

e. Target courses must be smooth and free from rocks that will fray the towing rope, and from stumps, roots, etc., which may damage or upset the target.

144. Qualifications

a. To qualify with the caliber .50 machinegun, a gunner must fire a minimum score of 55 points on table 2 and 7 points on table 3. The total minimum score is 62 points.

Rating	Score
Expert	165
1st Class	120
2d Class	85
Unqualified	Table 2, less than 55 Table 3, less than 7

b. The total qualification score is determined by adding the scores made on tables 2, 3, and 4.

c. The gunner must score 85 points on table 2 and 3, qualifying as a 1st Class Gunner, before firing table 4 for record. He must score 80 points on table 4 to qualify as Expert. If the gunner does not score 80 points on table 4, his qualification remains 1st Class Gunner.

145. Other Mounts

The courses prescribed in the preceding paragraph may be fired using other standard mounts.

a. Position (for Mounts Other Than the M3). The gunner takes a position that will permit him to brace himself without constraint and at the same time control his gun effectively. The positions vary for men of different physiques and according to the mount used. The hands are placed to facilitate manipulating and firing. A free gun should be held securely without rigidity. "Riding" the gun in an effort to hold it on the target causes excessive dispersion and ineffective fire. The head is placed in the position best suited to aline the sights and to observe the target. Standard equipment issued for the support of the gunner may be used. The use of pads or other improvised supports for the gunner or the mounts

is prohibited during record firing. Position exercises, using a target or other aiming point, will be conducted to insure that each man can take a suitable position at the gun and aim without delay.

b. Engagement of Rapidly Moving Ground Targets. When firing on rapidly moving ground targets, the gunner assumes a position that will permit him to observe the target and manipulate freely through large angles.

c. Manipulation.

(1) When manipulating to engage a rapidly moving target, the mount should be adjusted to permit free movement of the gun.

(2) When manipulating to engage a stationary target, the gunner should be required to manipulate slowly over the target; accuracy is checked by an assistant instructor (coach). As he gains proficiency in manipulating, the time should be reduced until the gunner can accurately manipulate over the target without firing, and within approximately three-fourths of the authorized time limit.

CHAPTER 10

COURSES OF FIRE: FIELD TARGET FIRING

Section I. INTRODUCTION

146. General

After firing on the basic and transition ranges, gunners need practice in applying all of the fundamentals they have learned, and the experience of engaging targets that depict enemy formations the gunner would be likely to engage on a battlefield during periods of good or limited visibility. Field target firing courses will provide this experience. This training is conducted on day defensive and predetermined fire ranges.

147. Organization

a. Paragraphs 148 through 154 on organization for training suggest methods for conducting field firing exercises for a 200- to 250-man unit. Commanders may modify the outlined procedures to fit the facilities, the time available, and the number of gunners to receive training. Training prescribed is conducted during unit training at the discretion of the unit commander, and includes instruction for personnel assigned to machinegun crews only.

b. Maximum use is made of available training time by conducting field target firing exercises and training in related subjects concurrently. On the *day defensive field firing range* the unit is assembled, receives instruction, and is organized into groups which rotate through concurrent training ranges or stations until completion of training. Following this, the entire unit is assembled and organized for a continuation of the training on the *predetermined fire range.*

Section II. DAY DEFENSIVE FIELD FIRING

148. Training Facilities

a. General Characteristics. Figure 162 shows a schematic diagram and the dimensions of a daylight defensive field firing range.

(1) A tower or elevated platform from which the officer-in-charge (OIC) can observe each lane is desirable.

(2) Seating facilities must be available to seat the entire unit for instruction.

(3) The range is set up with lanes 10 to 20 meters wide at the firing line and 100 to 200 meters wide at the end of the lane. The lanes should be at least 1100 meters deep so targets can be placed at the maximum effective range of the guns.

(4) Terrain should be irregular so gunners have the opportunity to fire into various types of ground.

(5) Each lane should have seating facilities for the gunners not firing, and the rear area of the range should include facilities for concurrent training (fig 162).

b. Targets. "E" type silhouettes are arranged to represent the enemy in linear, deep, and linear with depth formations. This is accomplished by placing 10 to 12 silhouettes five to 10 meters apart for each type of target. Earth bunkers may be constructed and salvage vehicles may be placed downgrade to depict enemy point targets. One of each of the various types of targets should be constructed in each lane.

149. Organization for Training

a. The unit is assembled in one bleacher and presented instruction covering—

(1) The location of machineguns in infantry units and the duties of the weapons squad leader and members of the machinegun crew.

(2) Direct laying to include a review of characteristics of fire, classes of fire with respect to the ground, target and gun, and methods of fire control (chap 7).

(3) A review and demonstration of the engagement of distinct and indistinct linear, deep,

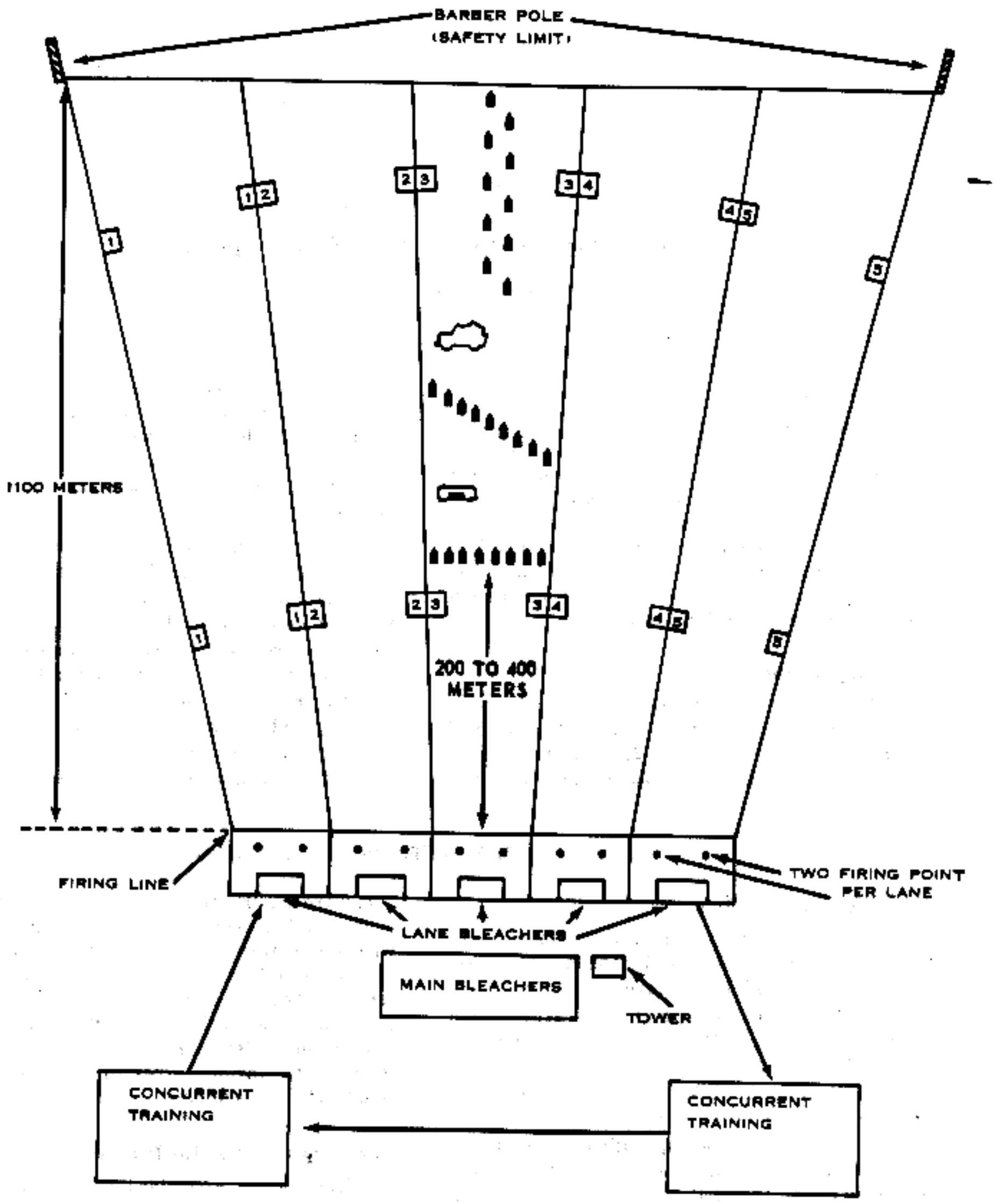


Figure 168. Daylight defensive field firing range.

and linear targets with depth, with guns in pairs and single guns (chap 7).

b. At the end of the instruction, the unit is organized into three equal groups. Two of the groups move to concurrent training stations as discussed in paragraph 148*b* and receive instruction on the preparation and use of a range card and assault firing.

c. The third group remains at the firing line and is organized into equal groups. The number of groups will depend on the number of firing lanes available. Ideally five lanes are used. A lane NCO is placed in charge of each group.

d. Upon arriving at the lane the gunners are given a brief orientation by the lane NCO concerning the targets to be engaged, safety limits for firing, and the method of rotation for firing. The lane NCO assigns each man a number to facilitate control. On each lane there is a critique chart (fig 163), and two machineguns. These guns are tripod mounted.

150. Conduct of Firing

The gunners target their weapons and engage targets using the technique of direct lay. During the engagement of targets, some of the individuals will be called upon to act as squad leaders applying the various methods of fire control. Each gunner fires 130 rounds as prescribed in figure 164. Gunners should engage targets firing as a single gunner before engaging targets firing as one of a

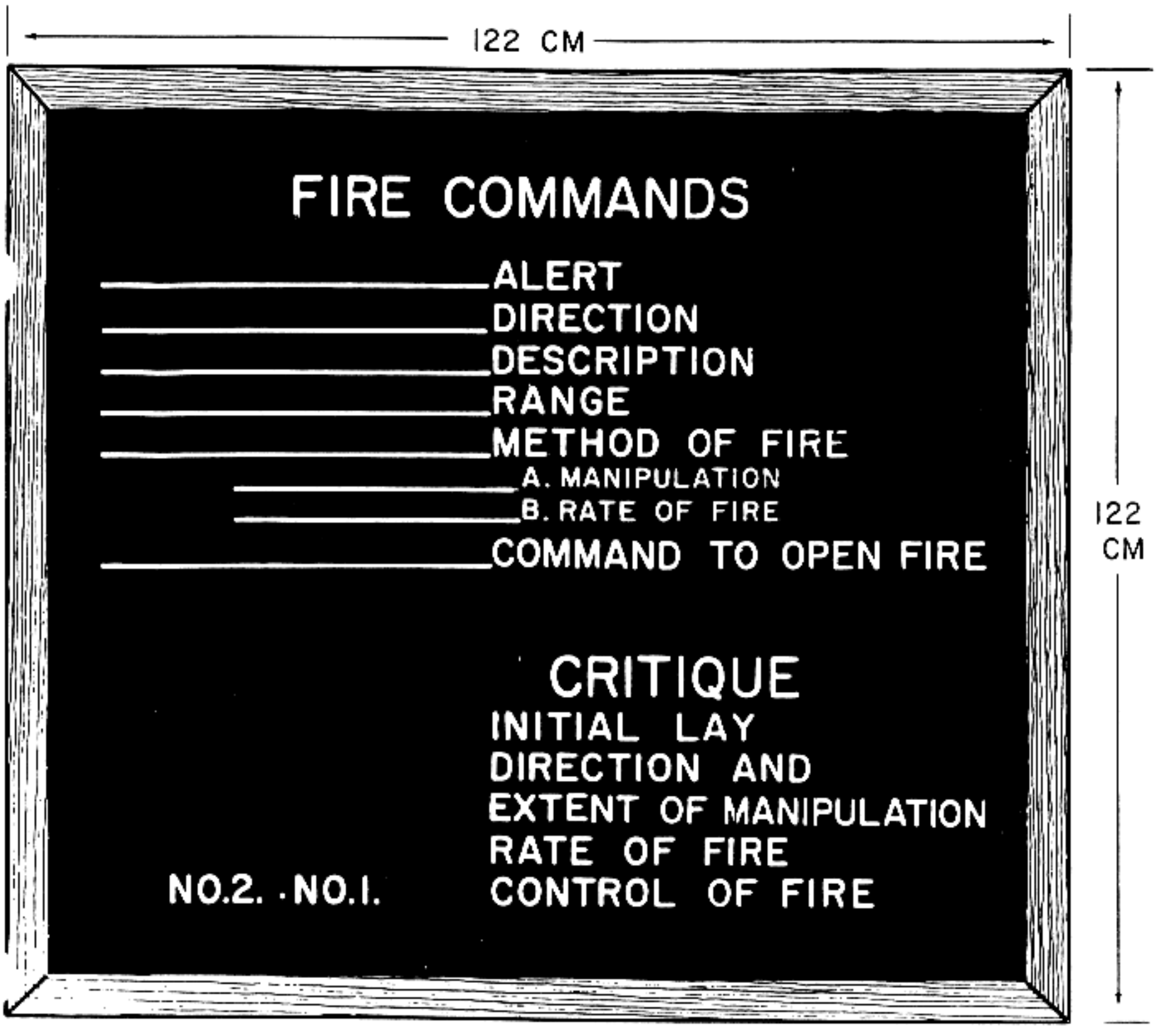


Figure 163. Lane NCO's critique chart.

Range	Time	Total per indiv	Target	Type ammo	Type fire
300—700 meters	No limit	20	"E" type silhouette	4–1	Targeting (three 6-round bursts)
300—1100 meters	No limit	60	Linear, deep, or linear with depth.	4–1	6- to 9-round bursts–single gun
300—1100 meters	No	50	Vehicle-type target	4–1	6- to 9-round bursts–guns employed in pairs.
Total		130			

Figure 164. Table of ammunition for day defensive field firing.

pair. To insure that firing is conducted in a safe and orderly manner, it will be conducted according to the safety instructions in paragraph 143. A recommended method of conducting firing is as follows:

a. The lane NCO designates two gunners and two assistant gunners. The crews move to the guns and load a 20-round belt.

b. The lane NCO instructs the gunners to prepare to target their weapons. When the gunners indicate they are ready to target, the lane NCO announces UP to the OIC.

c. When all lanes are ready to fire, the OIC announces GIVE ME AN UP WHEN YOU HAVE TARGETED AND ARE READY TO ENGAGE THE FIRST TARGET. YOU ARE CLEAR TO FIRE.

d. When the gunners have zeroed their weapons, the lane NCO directs them to load a 60-round belt of ammunition. He also selects another individual to act as squad leader.

e. The squad leader takes a position to the rear of the two gun crews. He issues a fire command requiring one of the crews to engage either a linear, deep, or linear target with depth. The fire command is issued *only* up to the command to fire. The lane NCO then signals the OIC that his lane is ready to fire by announcing UP.

f. When all lanes are ready to fire, the OIC announces GIVE ME AN UP WHEN YOU ARE READY TO ENGAGE YOUR NEXT TARGET. YOU ARE CLEAR TO FIRE.

g. The squad leader announces FIRE, observes the fire, and issues subsequent fire commands if they are needed to place effective fire on the target.

h. When the gun crew has fired 60 rounds, the lane NCO conducts a critique. Special attention should be given to initial fire commands, accuracy of the initial bursts, direction and extent of manipulation, rate of fire, and the squad leader's control of fire. At the end of the critique, the squad leader issues a second fire command, and the second crew engages a target as described in *e*, *f*, and *g* above.

i. When the second gunner has fired 60 rounds, the lane NCO conducts a critique and instructs each gunner to load a 50-round belt.

j. The squad leader issues a third fire command requiring both gunners to engage a vehicle-type target. The gunners fire as a pair.

k. After they have engaged the target and have been critiqued, the gunners and squad leader return to their seats.

l. The procedure in *a* through *j* above is repeated until all gunners have fired. The assistant gunners are always the next men to act as gunners.

Section III. PREDETERMINED FIRING COURSE

151. General

After firing on the day defensive range which included concurrent training in preparation of range cards, the unit is moved to the predetermined fire field firing range. The instruction presented on this range is conducted in two phases, one during good visibility and the other during limited visibility.

a. The daylight phase consists of a review on the preparation and use of range cards, which was covered concurrently during previous training. Following this review they receive practical work in the preparation of a range card by obtaining data to assigned targets.

b. The night phase is presented after darkness on the same day that the daylight phase is con-

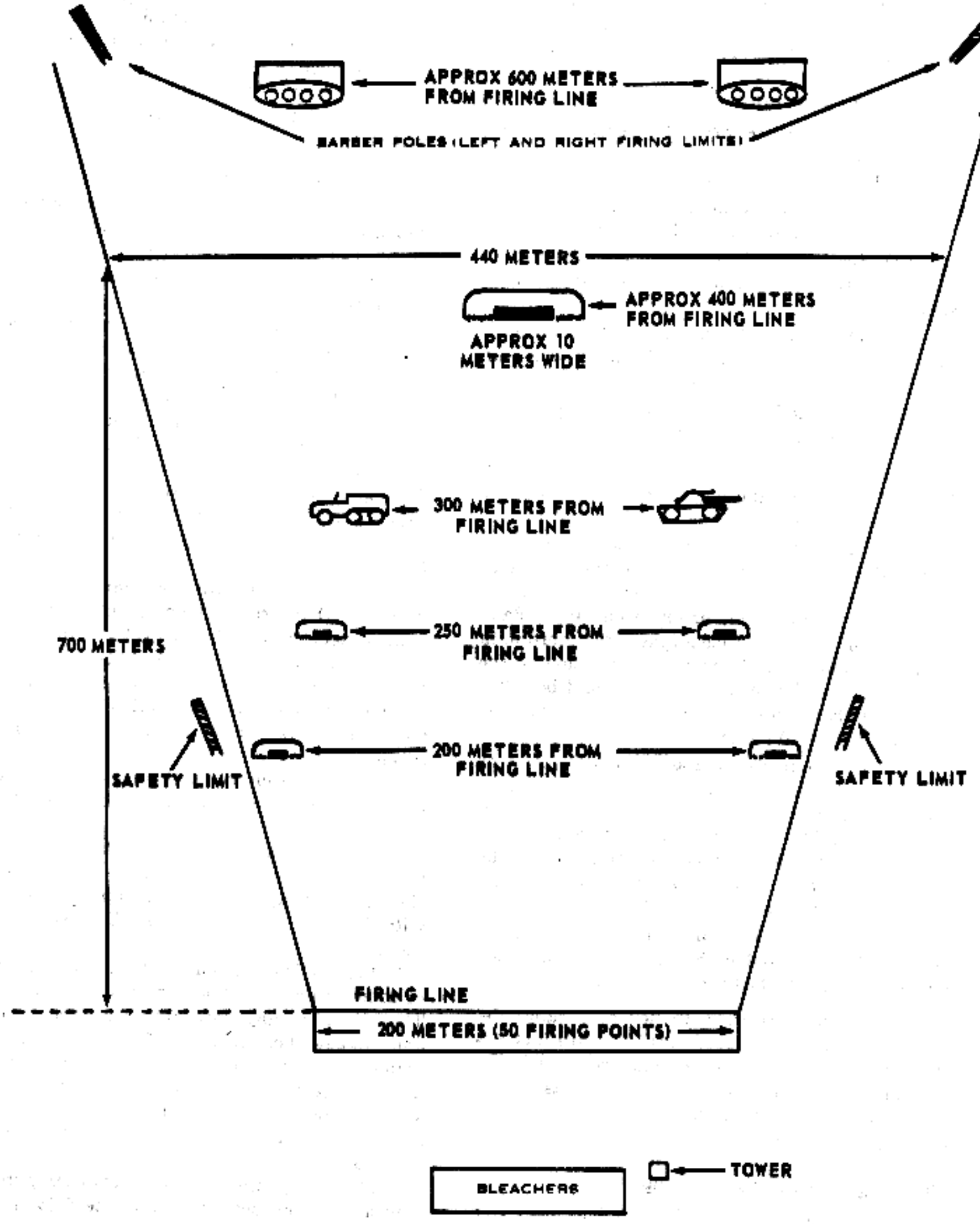


Figure 165. Predetermined fire field range.

ducted. In the night phase the fundamentals reviewed during the daylight phase are applied. The gunners reapply the data they obtained to their assigned targets, then engage those targets.

152. Training Facilities

a. General Characteristics. Figure 165 shows a schematic diagram and the dimensions of a predetermined fire field firing range.

(1) A tower or elevated platform from which the OIC can observe firing is desirable.

(2) Seating facilities must be available to seat the entire unit for a conference and demonstration

(3) The range should be constructed on a flat, open piece of terrain which allows one man to control the firing of all weapons.

(4) A firing line consisting of 50 points is desirable, allowing at least 4 meters per point.

b. Target Area. In figure 165, everything in front of the firing line out to the range limits is considered target area.

(1) The target area should be at least 700 meters deep and 440 meters wide at the 500 meter range. It should contain at least three targets which will permit engagement from either flank of the firing line and cuase gunners to record data to the left and right of the zero graduation on the traversing bar. The center target should be a linear target that requires about 20 mils of traverse (approximately 10 meters wide).

(2) Hard objects such as salvage vehicles or dirt-filled gasoline drums may be positioned to represent targets. Earth mounds may also represent targets. The construction of targets in this manner assists the gunner in determining the effectiveness of his fire by enabling him to see his tracers or hear his projectiles hit the target.

(3) The lateral firing limits of the target area must be marked with safety fan poles. Red lights must be attached for night firing.

c. Allowable Difference. In lieu of a range designed specifically for predetermined fire instruction, the day defensive range may be used if the terrain between the firing line and targets at 500 meters is such that final protective lines and sectors of graze can be obtained.

153. Organization for Training

a. The entire unit is seated in the bleachers and presented a review and demonstration on the preparation and use of a range card in predetermined fire and an orientation on the range procedures

b. Upon completion of the instruction, the unit is organized into five equal groups. Ideally, a group NCO and a minimum of three assistant instructors are assigned to each group to assist and supervise.

c. The group NCO organizes his group into gunners and assistant gunners, and a crew is assigned to each gun.

154. Conduct of Firing

Each gun crew fires 200 rounds as indicated by figure 166. Safety procedures as outlined in paragraph 142 must be followed. The firing is conducted in two separate exercises as follows:

a. Day Firing.

(1) Each crew is issued 80 rounds of ammunition (four 20-round belts) and instructed by the group NCO to load a 20-round belt for targeting.

(2) When all the gunners of a group indicate that they are ready to target their weapons, the group NCO announces UP to the OIC.

(3) When all groups are ready to fire, the OIC announces GIVE ME A CLEAR AND CHECK WHEN YOU HAVE OBTAINED DATA TO ALL TARGETS. YOU ARE CLEAR TO FIRE.

(4) When the gunners have targeted, the group NCO instructs them to obtain data to the final protective lines by firing 20 rounds.

(5) After data to the final protective line has been obtained and recorded, the assistant gunner becomes the gunner and obtains data to a point and a linear target by firing 20 rounds at each target.

(6) The group NCO then instructs the crews to obtain data to a point target by using the dry fire method.

(7) After all data to targets have been obtained and recorded, the group NCO clears and checks the weapons of his group and announces GROUP ____ CLEARED AND CHECKED, to the OIC.

b. Night Firing. Each crew is issued 120 rounds of ammuition (two 20- and two 40-round belts). They then reapply data obtained during the day and engage their targets. If at any time during firing it becomes obvious that a large error in data has been made by the gunner, he should be stopped and directed to check his data and gun settings. A recommended method of conducting firing is as follows:

(1) The group NCO instructs each gunner to load a 20-round belt and apply the data that was obtained by dry firing on a point target.

(2) When all the gunners under the control of a group NCO indicate that they are ready to fire, the group NCO announces UP to the OIC.

Time	Total rounds per two-man crew	Target	Type ammo	Type fire
a. Day Firing				
No Limit	20	Point	4–1	Targeting—three 6- to 9-round bursts.
No Limit	20	Final protective line	4–1	Obtain direction and elevation readings to final protective line.
No Limit	20	Point	4–1	Obtain direction and elevation readings to point target.
No Limit	20	Linear	4–1	Obtain direction and elevation readings to engage linear target.
No Limit		Point		Obtain direction and elevation readings by use of the "dry fire" method.
b. Night Firing				
No Limit	20	Point (dry fire)	Tracer	Predetermined data
No Limit	40	Linear	Tracer	Predetermined data
No Limit	20	Point	Tracer	Predetermined data
No Limit	40	Final protective line	Tracer	Predetermined data
Total	100 per individual (200 rounds per 2-man crew)			

Figure 166. Predetermined firing (range cards).

(3) When all groups are ready to fire, the OIC announces GIVE ME A CLEAR AND CHECK WHEN YOU HAVE ENGAGED ALL TARGETS. YOU ARE CLEAR TO FIRE

(4) The group NCO instructs one gun crew at a time to engage the point target.

(5) When all point targets have been engaged, the group NCO instructs gunners to load a 40-round belt and instructs the gun crew one at a time to engage the linear target.

(6) After the gunners engage the linear target, they become the assistant gunner, and the assistant gunners become the gunners.

(7)The gunners apply data and engage the second point target with 20 rounds and the final-protective line with 40 rounds using the same procedure outlined in (4) and (5) above.

(8) The group NCO and assistant conduct a critique as each crew fires its exercise. The critique should cover the following: the importance of maintaining the correct position and grip while laying on and engaging targets, accuracy in obtaining and recording data, accuracy in reapplying data. and adjustment of fire.

(9) After all targets have been engaged and all crews have been critiqued, the group NCO clears and checks the weapons of his group and announces GROUP ____ CLEARED AND CHECKED, to the OIC.

CHAPTER 11

ANTIAIRCRAFT GUNNERY

Section I. ENGAGEMENT AND EMPLOYMENT

155. General

a. Individual caliber .50 machineguns can provide units with a self-defense capability against hostile low-flying, low-performance aircraft. These guns are employed in the air defense (AD) role as part of the unit's local defense. The machineguns are not components of an integrated and coordinated AD system. Normally, the following rules for engagement apply:

(1) Attack aircraft identified as hostile.

(2) Attack aircraft committing a hostile act.

b. Unless otherwise directed, hostile aircraft within range of the gun (approximately 800 meters maximum effective range) should be engaged. Surveillance, reconnaissance, and liaison aircraft; troop carriers; helicopters; and drones are typical targets.

156. Employment

a. Employment of machineguns used for AD is

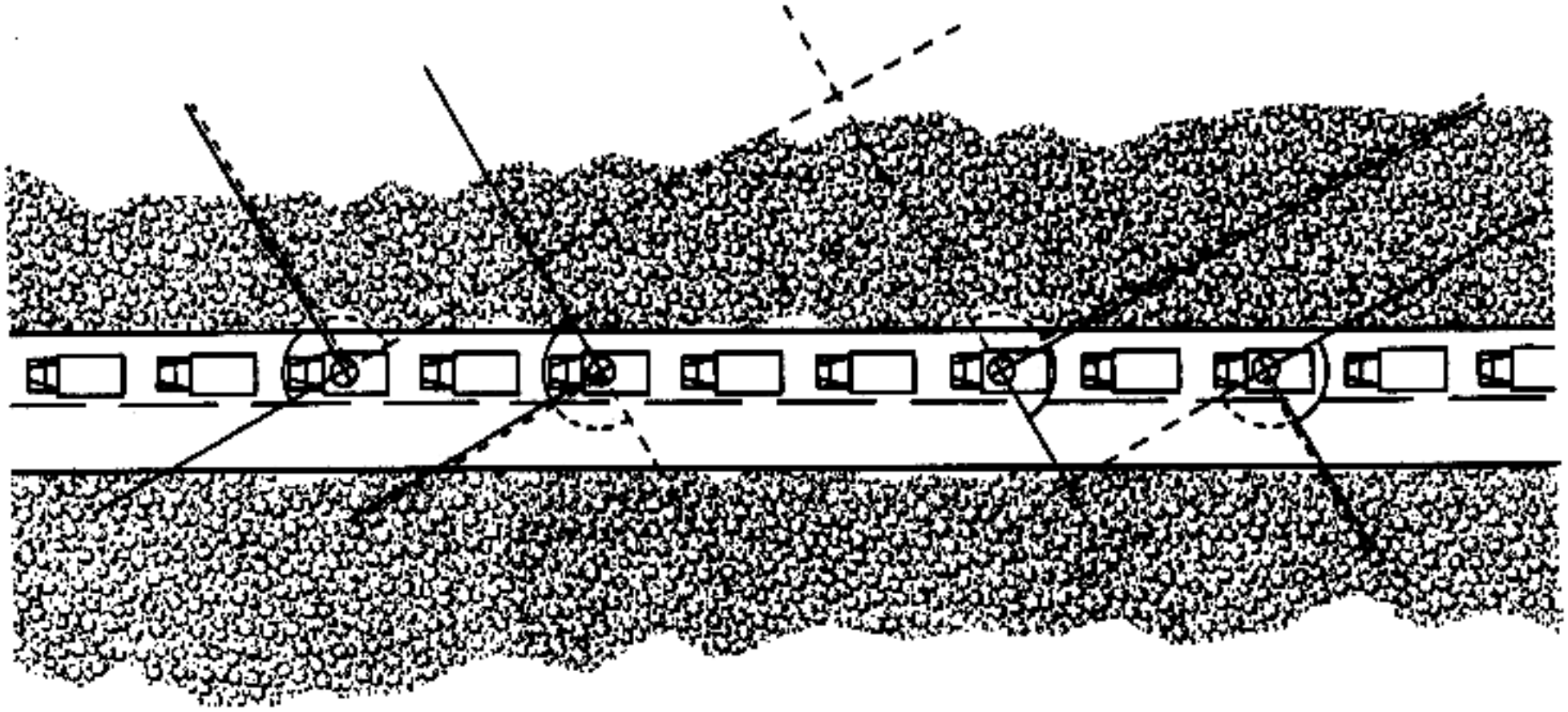


Figure 167. March column with four caliber .50 machineguns (added).

guided by the following defense design factors:

(1) The mission of AD machinegun defense is to impose maximum attrition upon the attacking enemy.

(2) Machinegun defenses are designed to combat lowflying, low-performance aircraft.

(3) Defense design should produce an equally balanced defense that is effective in all directions, unless a forced route of approach exists. Defense design should weight those routes of approach which are likely to be used.

(4) Machineguns should be sited so that the maximum number of targets can be engaged, continuous fire can be delivered, and the most likely routes of approach are covered.

b. Machineguns used to defend march columns should be interspersed in the convoy, with emphasis on the lead and rear elements (fig 167).

c. Target selection and engagement control depend upon visual menas. The sites selected for the guns must provide maximum observation and unobstructed sectors of fire. Units furnished caliber .50 machineguns in sufficient numbers should site them within mutual support distances of 90 to 860 meters. Each gun is assigned a primary and secondary sector of fire. Weapon crews maintain constant vigilance in their primary sectors of fire, regardless of the sector in which the guns are actually engaged. For detailed coverage of aircraft recognition and identification, see Fm 44–30.

157. Allocation

a. The Browning machinegun, caliber .50 HB, M2 is provided to forward area units on a Table of Allowance basis. Issue is determined by tactical considerations, extent of air parity, and the type of unit (artillery, armor, engineer, infantry) concerned.

b. Applicable mounts for the machinegun include:

(1) Antiaircraft mount, M63
(2) Truck mount, M36
(3) Pedestal truck mount, M31C.
(4) Pedestal truck mount M24A2.
(5) Cupola mount (M26) modified.

c. The M63 mount is portable and can be employed either on the ground or bolted to a vehicle platform. Unless modified, the other mounts listed are suitable for vehicular use only. The M26 mount was designed for the personnel carrier, M114. In a modified version it is appropriate for use on the personnel carrier M113.

Section II. TARGET COURSES

158. Definitions (Fig 168)

a. The line along the course which the target is flying is the *course line.*

b. The point along the course of any target at which the target is nearest the gun position is the *midpoint.*

c. That part of the course in which the target is flying toward midpoint is the *approaching leg.*

d. That part of the course in which the target is flying away from midpoint is the *receding leg.*

e. The angle formed by the gun, present position of the target, and any future position is the *angle of approach.* The angle of approach at midpoint is always 1,600 mils.

159. Target Course Names

Aircraft may fly any of the following types of courses (figure 169).

a. Level. In a level course, the target is flying at a constant altitude.

b. Diving. In a diving course, the target is flying with altitude decreasing.

c. Climbing. In a climbing course, the target is flying with altitude increasing.

d. Incoming. An incoming course is one in which the target will fly directly over the gun.

e. Outgoing. An outgoing course is one in which the target is flying away from the gun.

f. Crossing. A crossing course is any course not incoming or outgoing.

g. Directly at the Gun. This type of course is one in which the target is flying toward the pintle center of the gun.

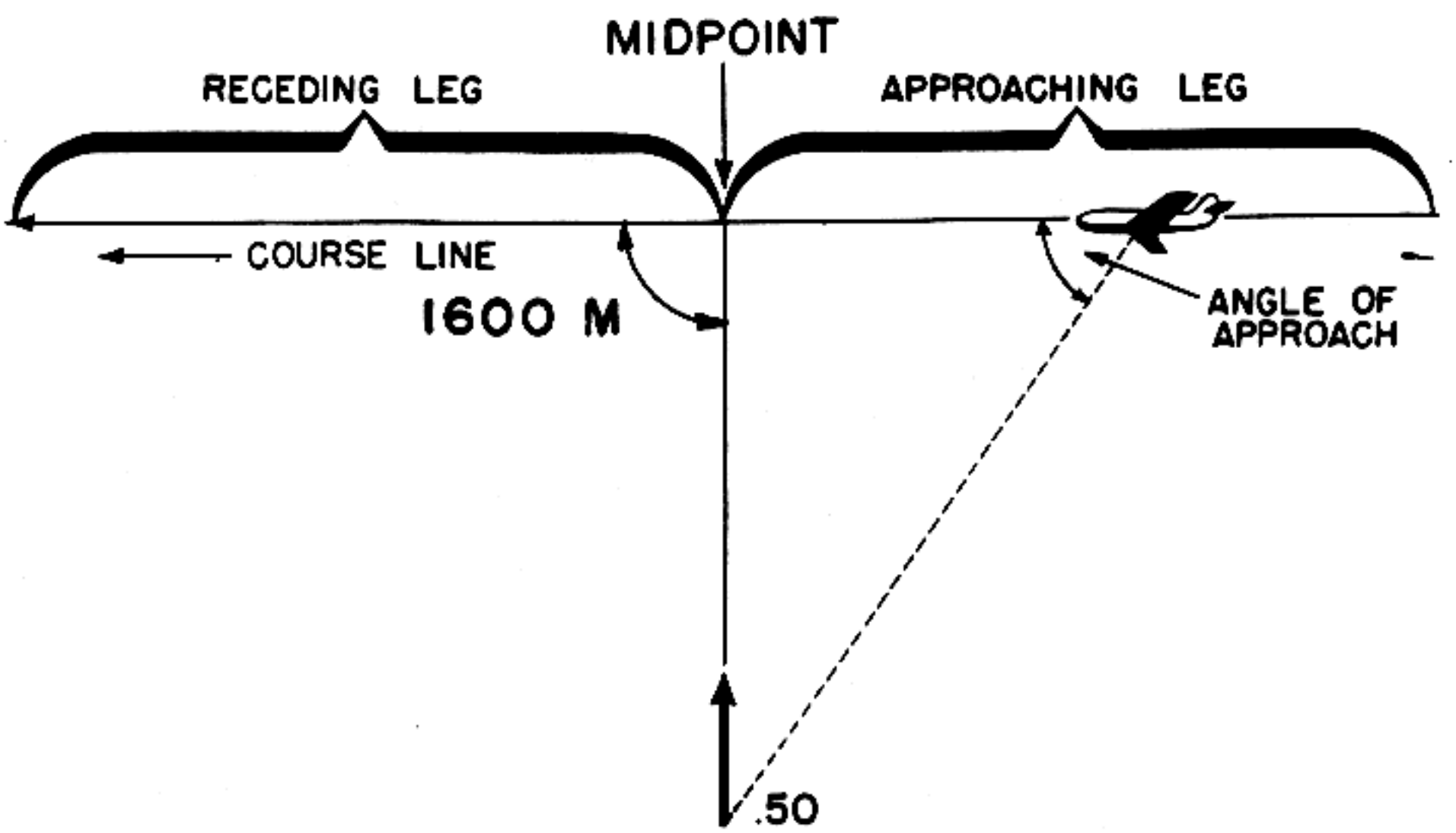


Figure 168. Diagram showing midpoint, approaching leg, and receding leg.

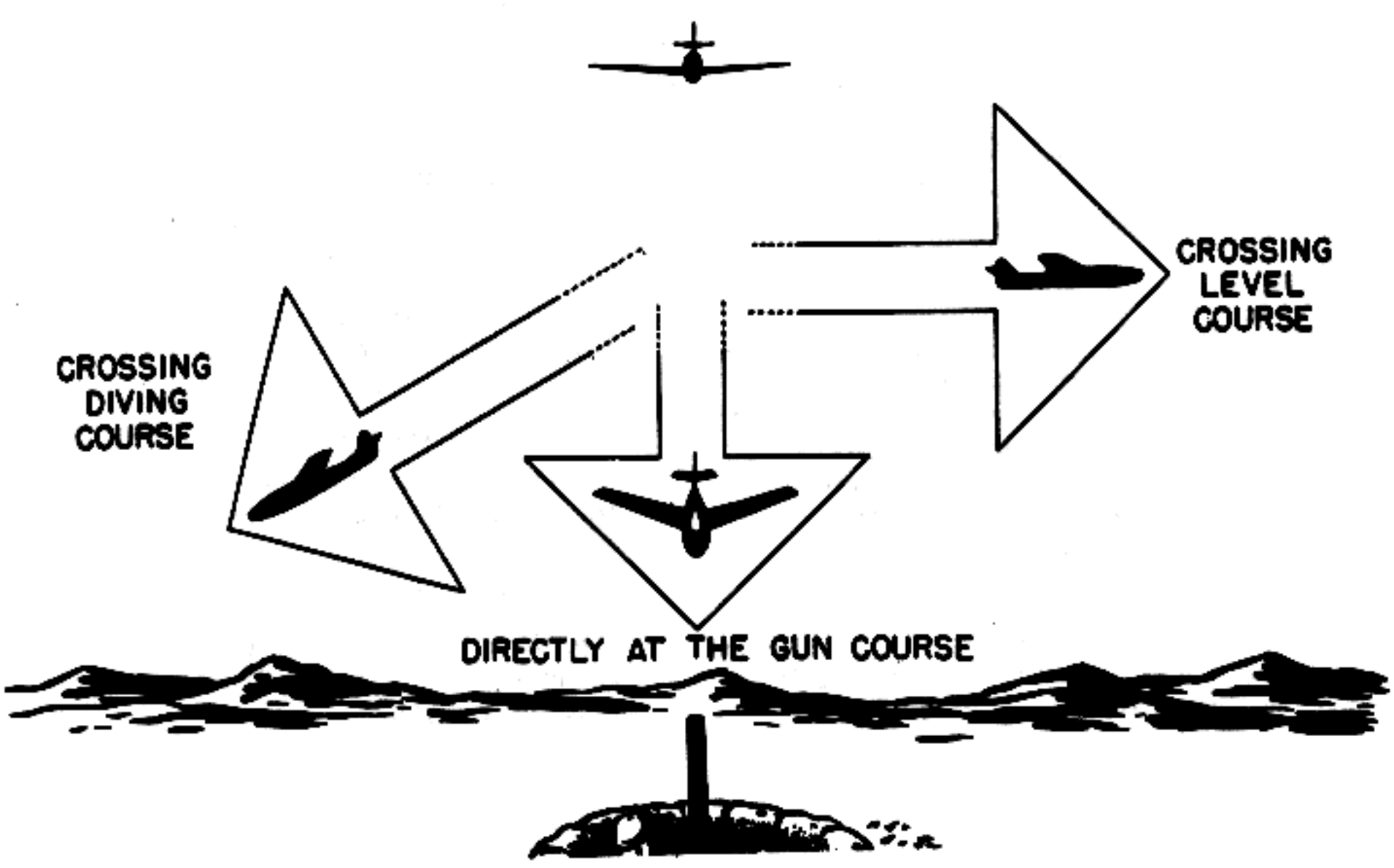


Figure 169. Target course names.

Section III. REQUIREMENTS FOR A HIT

160. General

a. To engage enemy aircraft effectively, the machinegunner must accurately estimate the future position of the target, and point his gun in such a manner that the fired rounds and the aircraft will arrive at the estimated point at the same time.

b. The problem can be compared to that of a machinegun firing up a hill. Laying the gun in elevation is accomplished by tracking the target. In figure 170, despite the fact that the vehicle is moving along the side of a hill, the machinegunner concerns himself with only a 1-lead angle measured along the slope of the hill. If the vehicle is replaced by an aircraft, and the hill is replaced by air space (fig 171), it is apparent that the gunner's problem in figure 171 is identical to that in figure 170. (There is a faster speed in the case of the aircraft.) To hit the target, the gunner must fulfill two requirements: *line and lead.*

161. Line Requirement for a Hit

The line requirement demands that the gunner cause the round to intersect the target course line. The vertical mass of the target affords the gunner a small angular (elevation) tolerance in fulfilling the line requirement. The size of this angle varies directly with the diameter of the fuselage and inversely with the range to the target.

162. Lead Requirement for a Hit

The lead requirement demands that the gunner cause the round to intersect the target. Angular tolerance in fulfilling the lead requirement is provided by the horizontal mass of the target. The magnitude of this angle varies directly with the length of the target fuselage and the sine of the angle of approach. It varies inversely with the range to the target.

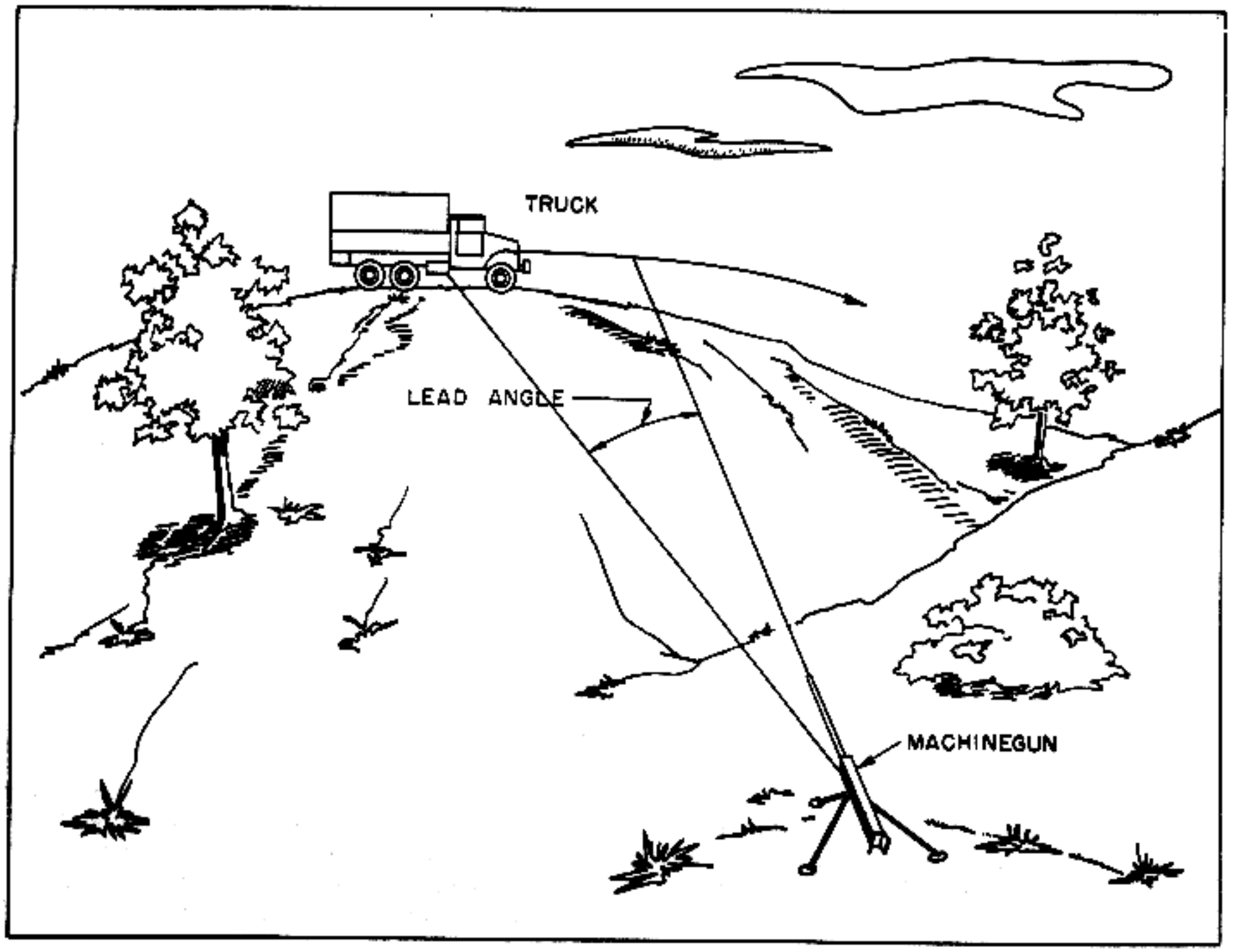


Figure 170. Lead angle, moving ground target.

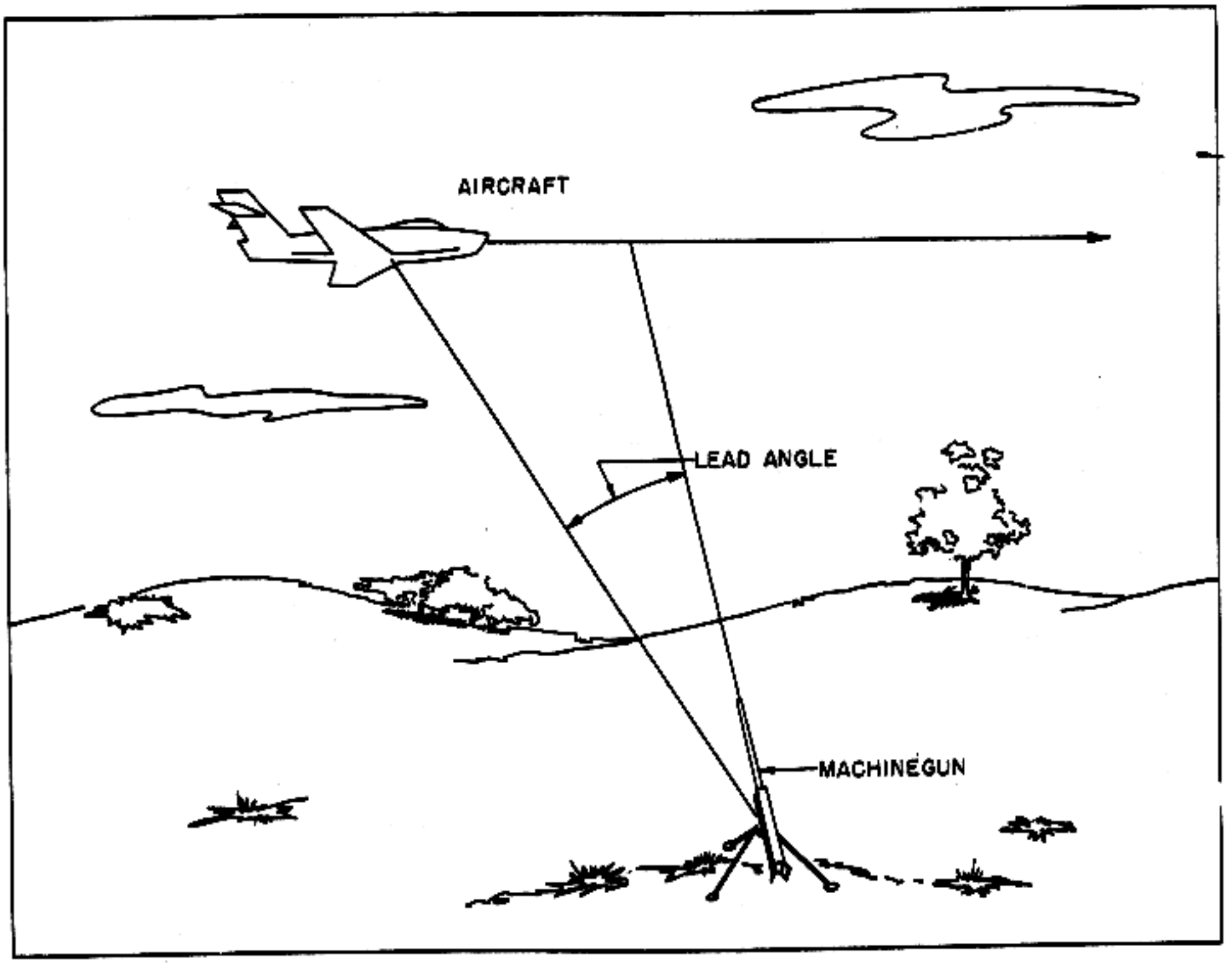


Figure 171. Lead angle, aerial target.

Section IV. LEAD

163. General

a. The gunner has no sighting devices for setting initial leads on the machinegun, cal .50, HB, M2, or on mount M63. The discussion in this section presents the magnitude of leads in antiaircraft firing.

b. Prior to opening fire, the gunner estimates the amount his gun will lead the target. This estimate is based upon an understanding of the magnitude of the lead required under varying conditions of target speed, target range, and angle of approach. For example, a target, traveling 600

miles per hour, flies a crossing course that causes it to pass at a midpoint range of 460 meters from the gun position. To hit the aircraft at this midpoint, the gunner aims and fires his weapon at a point on the target course line 165 meters ahead of the target. (The time of flight for a caliber .50 round for a range of 460 meters is 0.6 second. A speed of 600 miles per hour is approximately 275 meters per second. During the time of flight of the projectile, the target will have traveled 0.6 x 275 or 165 meters.) Using the mil relation rule, with a range of 460 meters and 165 meters as the distance traveled by the aircraft, the lead required to hit the target at midpoint is 360 mils.

c. Lead for specific midpoint ranges may be calculated on the basis of target speed. For a midpoint range of 460 meters, the midpoint lead required is 60 mils or 27 meters for each 100 miles per hour of target speed. The length of the target is a convenient unit of measure in establishing initial leads. The estimated lead is divided by the length of the target to determine the number of apparent target lengths which the gunner will lead the target. Midpoint leads expressed in meters, mils, and apparent target lengths for selected targets, target speeds, and midpoint ranges are contained in figure 172.

164. Effect of Angle of Approach on Lead

a. As the angle of approach increases up to midpoint, the amount of lead necessary also increases. When the target passes midpoint and continues on the receding leg, the amount of lead decreases, while the angle of approach continues to increase. The amount of lead necessary at mid-

MIDPOINT LEADS (BASED UPON FT 0.50 – H – 1)

AIRCRAFT (TYPE)	AVERAGE LENGTH AIRCRAFT (METERS)	SPEED (MPH)	MIDPOINT RANGE (METERS)	MIDPOINT LEAD		
				METERS	MILS	APPARENT TARGET LENGTHS*
FIGHTER	7	600	920	378	414	414
FIGHTER	7	600	460	165	360	18
FIGHTER	7	400	920	252	276	27.6
FIGHTER	7	400	460	109	240	12
FIGHTER	7	200	920	126	138	13.8
FIGHTER	7	200	460	54	120	6
TRANSPORT	21	200	920	126	138	6
TRANSPORT	21	200	460	54	120	2.6
LIAISON	7	100	920	62	69	7.7
LIAISON	7	100	460	27	60	3.3

DROP ALL FRACTIONS IN ESTIMATING LEAD IN TARGET LENGTHS

Figure 172. Midpoint leads.

ANGLE OF APPROACH IN MILS	LEAD
0 -100 (APPROACHING LEG)	0
100 -500 (APPROACHING LEG)	1/2
500 - 800 (APPROACHING LEG)	3/4
800 - 1 600 (APPROACHING LEG)	FULL
1 600 - 2 400 (RECEDING LEG)	3/4

Figure 173. Amount of lead necessary for various angles of approach.

point is called "full lead." Figure 172 is based on targets at or near midpoint.

b. Figure 173 gives the fraction of full lead necessary for various angles of approach.

c. To simplify the lead problem, the following rules may be used as a guide in determining initial leads:

(1) *Crossing courses.*

(*a*) Open fire with a ¾-full estimated lead, when the target is on the approaching or receding leg.

(*b*) Open fire with a full estimated lead, when the target is at midpoint.

(2) *Directly at the gun courses.* Open fire with no lead.

(3) *All courses.* Observe tracers and make corrections accordingly.

Section V. TARGET ENGAGEMENT

165. Sequence of Events

The following are the gunner's actions to bring the target under fire:

a. Estimates the necessary lead.

b. Elevates his weapon until the axis of the bore is alined with the target-course line, and applies the estimated lead.

c. Opens fire, and observes only the tracers in the vicinity of the target (para 167—170).

d. Elevates or depresses the gun until line shots are obtained.

e. Corrects his lead until hits are obtained, using tracer observation.

166. Techniques

a. The machinegunner fires continuously throughout the engagement. Since the large amount of smoke created by continuous fire tends to restrict visibility, the gunner keeps his head and eyes high above the gun to observe the tracers. When there is doubt as to the tracers positions, he increases his lead. It is important that the gunner initially opens fire with an adequate lead and, once established, his tracking is not reversed. If his initial lead is too great, the tracking rate is slowed and he allows the target to catch up with his tracers.

b. The dispersion cone is excessive when the gun is fired as a free weapon. To offset this, the gunner seizes the grips firmly with both hands and braces the gun with his body. When firing from the M63 mount, the gunner stands erect and makes changes in elevation by moving his hands and arms up and down. For a change in azimuth he shifts his feet and moves around the mount. The gun is fired with the left hand by depressing either one of the upper and lower firing grips on the left side of the frame. The upper firing grip is used for fire at medium and high angles of elevation. The lower firing grip is used for fire at low angles of elevation.

167. General

To make adjustments during firing, the gunner must know the location of the round with respect to the target. Tracer ammunition provides this information. However, the gunner must be trained to sense tracers correctly to produce a hit. Where target courses and target speeds can be fixed, valid lead data is obtained from a tracer observer located down-course from the gun (FM 44–2). Under normal conditions, valid sensings are obtained only if the tracer observer is stationed as close to the gun as possible

168. Principles

a. Superimposition. In observing tracers, the machinegunner utilizes the principle of superimposition. By alining the tracer with the target, the gunner compares the range from his eye to the target and from his eye to the tracer. In figure 174, it can be seen that regardless of the range to the target, he can compare the range to the tracer, and the range to the target as long as the two are superimposed. Lead can be judged on the basis of these comparisons. Because of the common tendency of gunners to attempt to judge lead when tracers are not alined with the target, the first basic principle of tracer observation must be stressed. *Fulfill the line requirement before attempting to judge lead.*

b. Localized Vision. In figure 175, the tracer is shown as a single spot in the sky, moving directly away from the gunner's eye. In actual practice, the tracer does not appear as a fixed spot, but rather as a curved path (fig 175). This apparent curvature of the tracer path is called the *illusion*

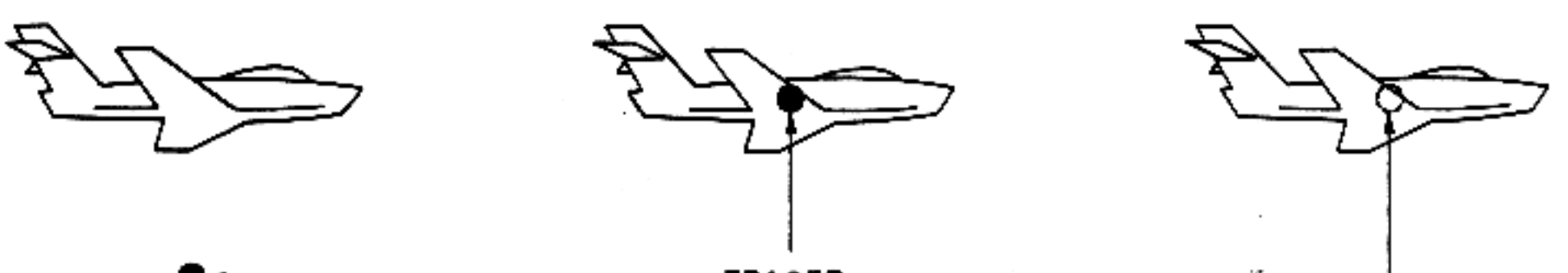


Figure 174. Superimposition.

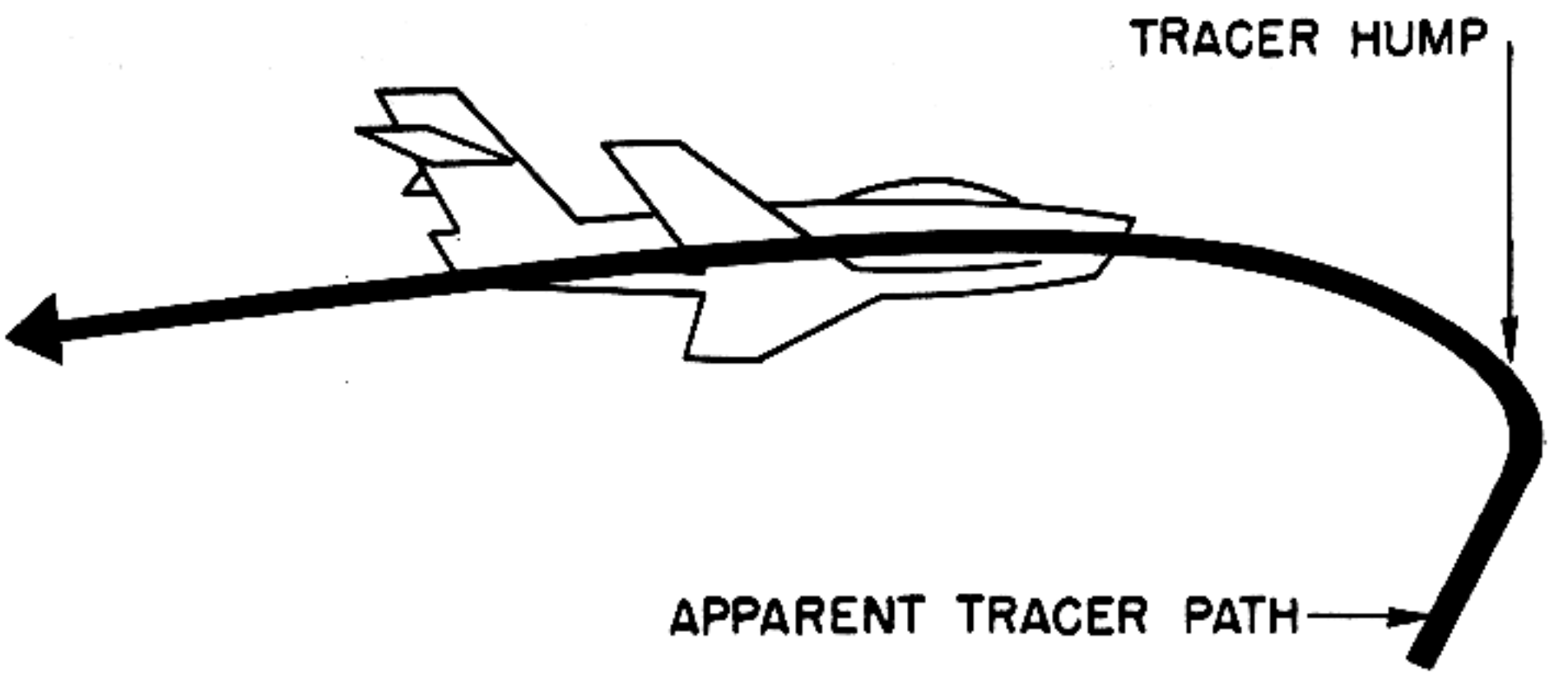


Figure 175. Illusion of curvature.

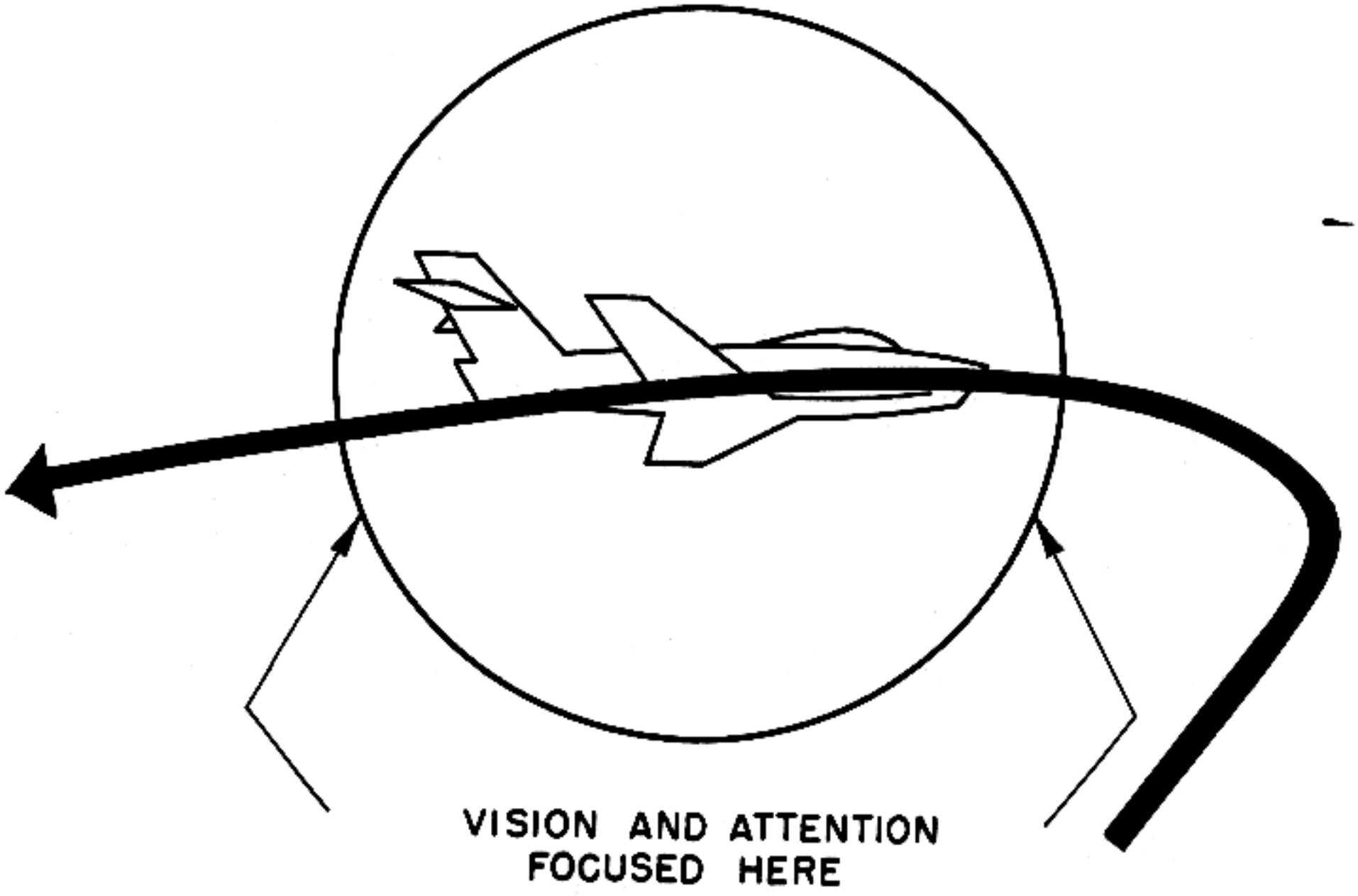
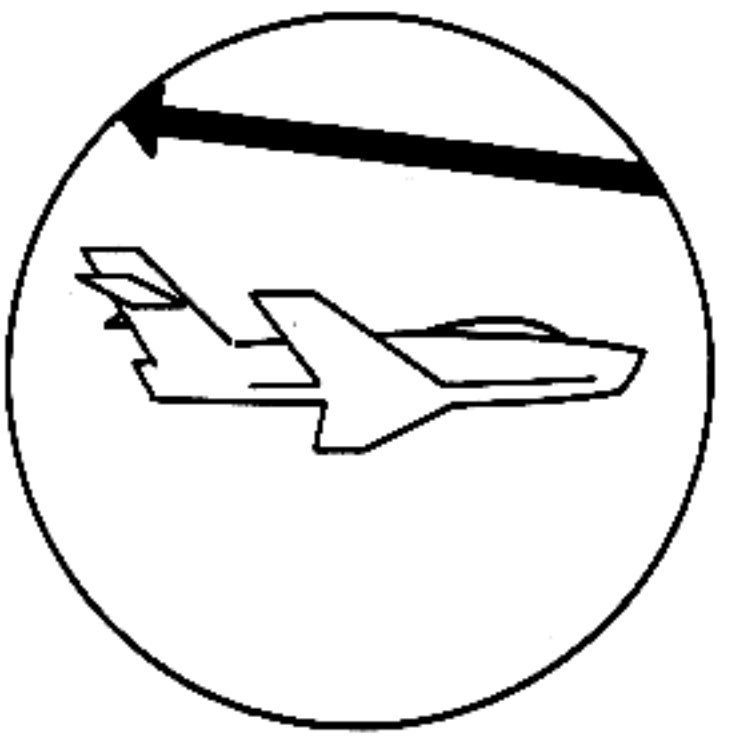


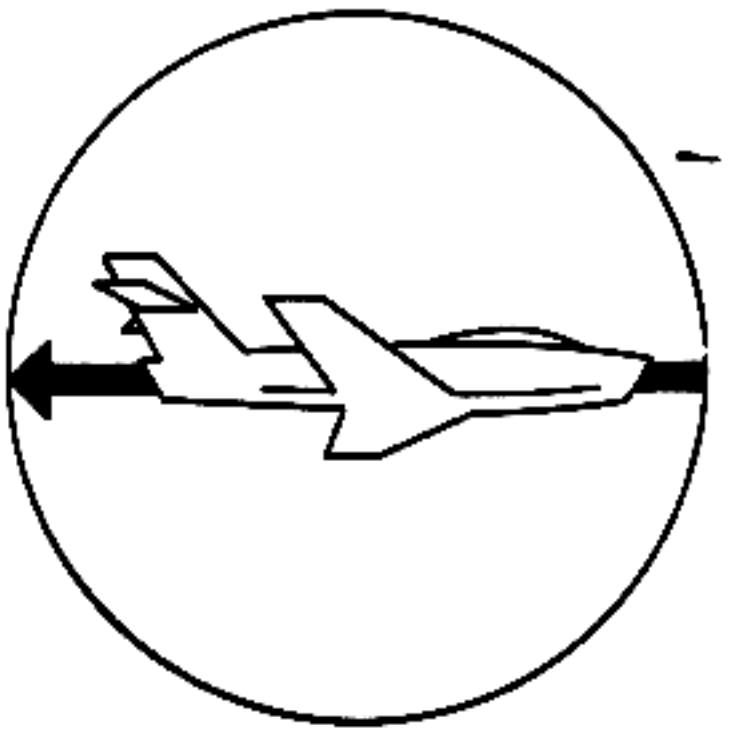
Figure 176. Localized vision.

of curvature. Once a round is fired, it moves in a straight line directly away from the gun. Gravity causes the trajectory to curve down toward the earth; but under no conditions, other than wind or drift, does the round move to the left or right. The illusion of curvature occurs because the gunner is concentrating upon a moving reference point, the target. As the tracer moves along its path, the distance between the target and the tracer is reduced to the point that the eye relates the two separate motions. The illusion of curvature then takes place. The point of maximum apparent curvature is referred to as the tracer hump. Here, the tracer path appears to curve sharply into a direction opposite from that in which the target is moving. The gunner must focus his attention on the immediate vicinity of the target, just as if he were looking through a telescope with a restricted field of view (fig 176). *The gunner's (observer's) vision must be localized to the immediate vicinity of the target.*

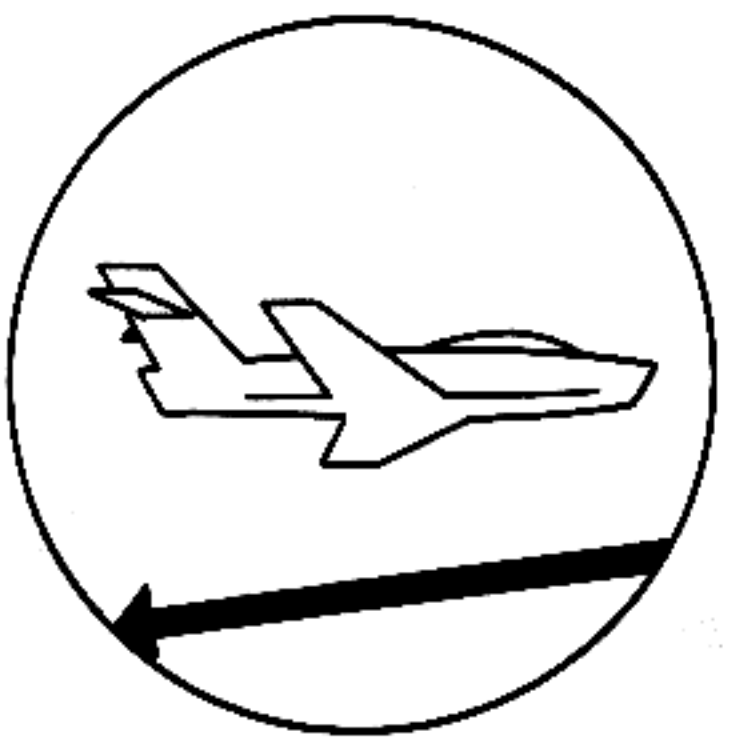
c. Read Nose-to-Tail. In certain types of target



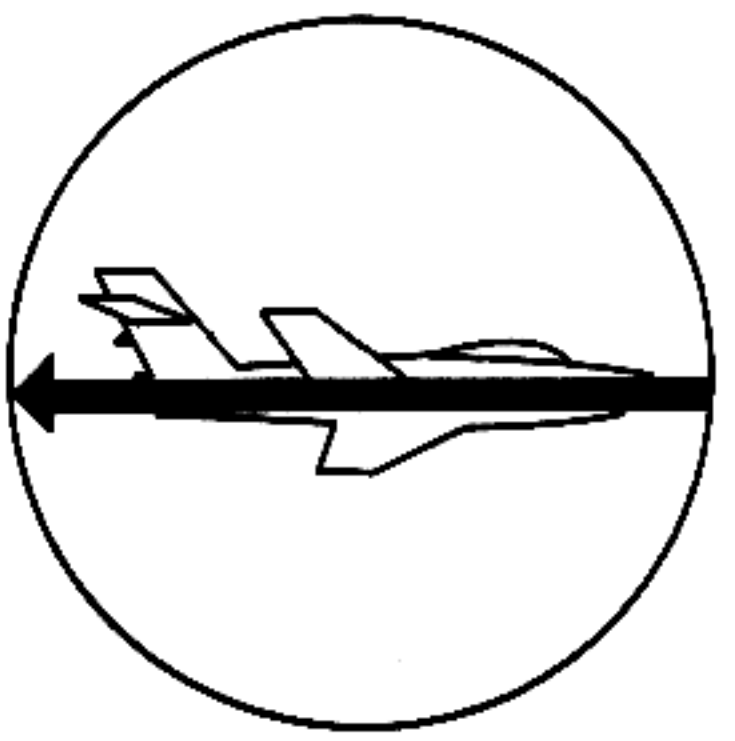
A. HIGH



C. AHEAD



B. LOW



D. ASTERN

Figure 177. Line and lead information, based on tracer sensings.

courses, particularly incoming and outgoing, the tracer may intersect the gunner's line of vision to the target in two places. Here, the gunner first sees the tracer passing the target in a tail-to-nose direction. Lead information, based upon a sensing of a tracer that appears to pass the target in this direction, is invalid. The target actually crosses the tracer path only once, entering the path nose first, and leaving tail last. Because of the illusion of curvature, the gunner sees this passage when the tracer appears to float by the target in a nose-to-tail direction. *Read when the tracer passes the target nose-to-tail.*

169. Line Information

a. Level and Nonlevel Crossing Courses.

(1) *High.* When the tracer is above the target course line (A, fig 177).

(2) *Low.* When the tracer is below the target course line (B, fig 177).

(3) *Line.* When the tracer intersects a line from the gunner's eyes, through the target to infinity. This line might be described as the gunner's line of vision through the target to infinity (C and D, fig 177). In referring to a tracer that is

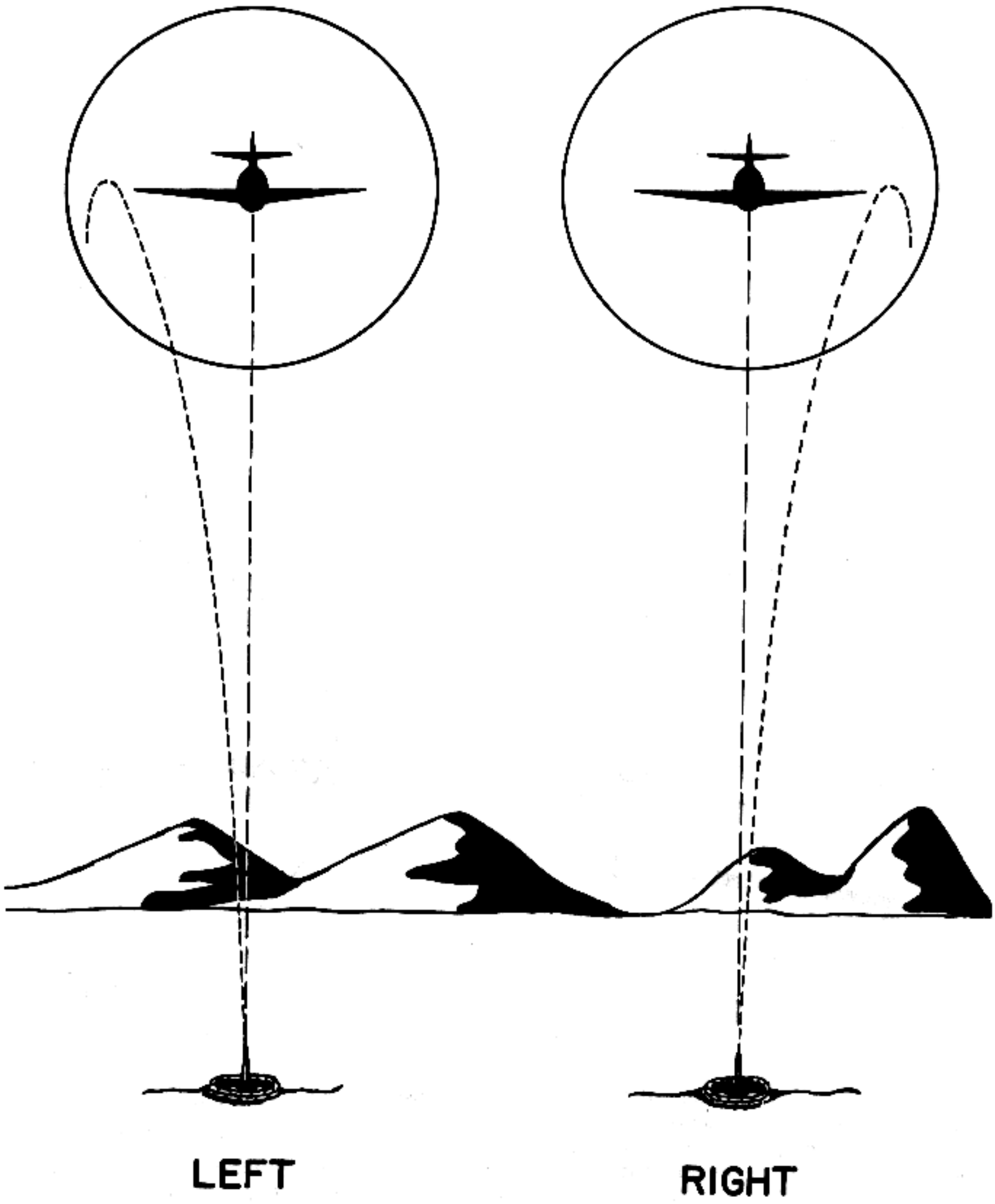


Figure 178. Off-line tracer sensings for incoming, outgoing, directly at the gun, and very steep diving course.

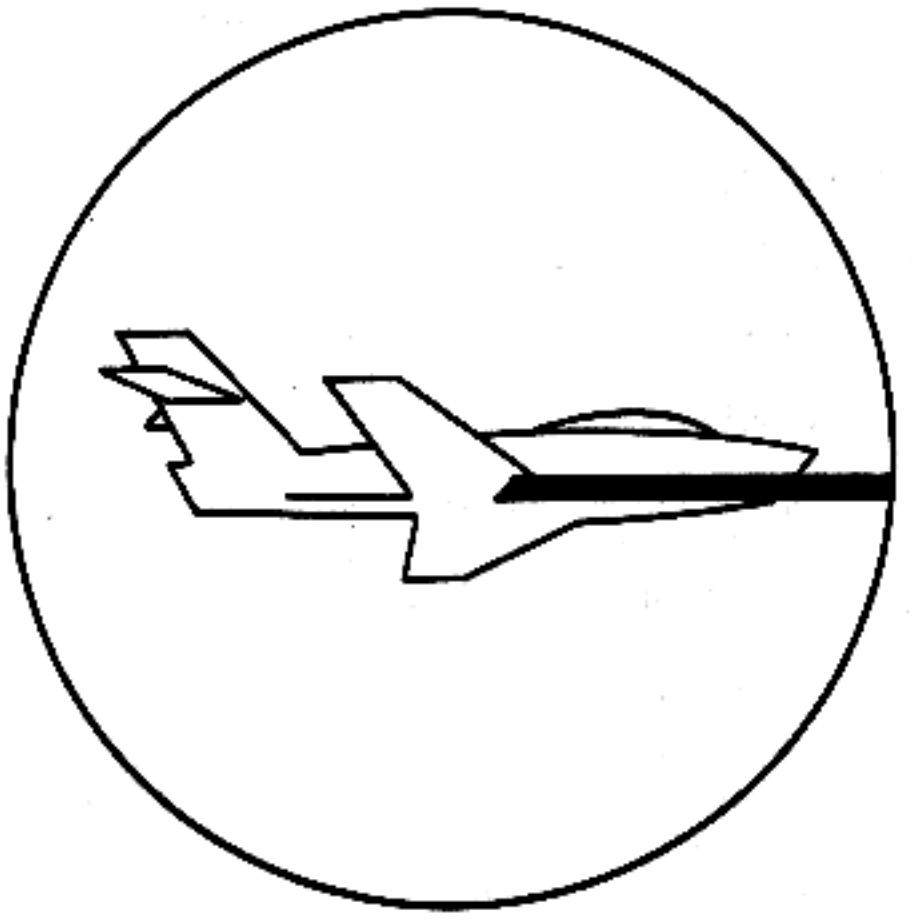


Figure 179. A hit.

alined with the target, the term "line" is omitted, and only the lead sensing is mentioned. (The tracer must be alined with the target before a lead sensing can be made.)

b. Other Courses. For incoming, outgoing, directly at the gun, and very steep diving courses, off-line sensings change from high or low to left and right (fig 178).

170. Lead Information

a. Ahead. If the tracer intersects the gunner's line of vision beyond the target; i.e., if a portion of the tracer's path is hidden by the target the round is ahead, the lead is too great (C, fig 177).

b. Astern. If the tracer passes between the gunner's eye and the target, the sensing is astern or too little lead (A, fig 177).

c. Hit. If the tracer path terminates in the target itself, the sensing is lead correct, a hit (fig 179).

CHAPTER 12
ADVICE TO INSTRUCTORS

Section I. GENERAL

171. Purpose

This chapter will assist instructors in effectively training men assigned to a caliber .50 machinegun crew to become a proficient machinegun team. Approximately 186 hours of instruction are necessary prior to training the crew as a unit.

172. Preparation

To present effective instruction in the time allotted, the instructor must be thoroughly prepared and rehearsed. Assistant instructors and demonstrators must also be thoroughly trained and rehearsed to conduct demonstrations that clearly illustrate the instruction. Support instruction with the training aids essential to presentation of the subject. Use public address sets if the group is larger than platoon size.

173. Organization

Divide the men into groups of appropriate size, considering the phase of instruction and the facilities available. If sufficient assistant instructors are available, assign one to each group; otherwise, position the assistant instructors so they can closely supervise the groups.

174. Presentation

Explain and demonstrate each portion of the instruction. Follow this by practical work, closely supervised by the instructors. Emphasize practical work throughout machinegun training, in order to develop skill and teamwork. Score and critique all machinegun firings during training.

175. Examination

Insure that students make satisfactory progress throughout each period of instruction. Those men who do not progress satisfactorily must receive additional instruction under close supervision. Give a formal or semiformal participation-type examination following each phase of instruction to measure effectiveness of instruction.

Note. For Techniques of Fire and Training Techniques, see TC 23–15.

Section II. MECHANICAL TRAINING

176. Disassembly and Assembly

a. Aids to Instruction.

(1) During this phase of training, the gun is mounted on the M3 mount, or installed on a table, so that students may better observe removal and replacement of parts.

(2) Nomenclature charts, or "mats," are a material aid in explaining mechanical training, and help the students to learn nomenclature of the parts.

b. Organization. Assign one assistant instructor per group (gun) if possible; otherwise, place assistant instructors where they can supervise assigned groups.

c. Presentation.

(1) Present a brief historical background of the gun. Stress the combat role it has played, and the mission it is assigned. Emphasize the purpose, scope, and importance of the instruction to be presented.

(2) Give a brief description of the operation, general data, and exterior nomenclature of the gun.

(3) Assistant instructors should disassemble and assemble the gun as the instructor explains the procedure.

(4) After the students become skilled in disassembly and assembly, demonstrate this phase of instruction with an assistant blindfolded. This often encourages men to practice during their free time, and develops their individual skill and initiative. Stress that *this is not done against time,* because of the danger of damaging parts of the gun.

177. Headspace and Timing

a. Aids to Instruction.

(1) During instruction in headspace and timing adjustment, use a caliber .50 machinegun and a headspace and timing gage for demonstration and practical work.

(2) A large wooden operating model of a headspace and timing gage should be obtained for use in demonstration.

(3) Filmstrips and training films covering headspace and timing adjustment give clearer understanding of the subject.

b. Organization. Organize the class as explained in paragraph 176*b*.

c. Presentation.

(1) Stress the importance of correct headspace and timing adjustment with the gages. Explain and demonstrate the proper method of adjusting headspace and timing. Discuss the effects of tight and loose headspace, and early and late timing.

(2) Every member of the crew must know how to correctly adjust headspace and timing. This is the most important single phase of caliber .50 machinegun training. If the gun is to fire, the headspace and timing must be correct.

(3) Talk the demonstrators through headspace adjustment and timing, with students observing the demonstrators at each gun position.

(4) Each student will adjust headspace and timing.

(5) Explain the field expedient methods of adjusting headspace and timing as the last phase of instruction. Make sure students understand that the gun *will not* be fired under training conditions with field expedient adjustments.

178. Operation

a. Aids to Instruction. Each instructional group requires a caliber .50 machinegun mounted on an M3 mount, a belt of approximately five dummy rounds, a clearing block, and caliber .50 cleaning rod.

b. Organization. Organize the class as described in paragraph 176*b*.

c. Presentation.

(1) Explain and demonstrate the proper method of half-loading, loading, unloading, and clearing the gun. Stress the safety factors involved.

(2) Point out how the belt feed lever stud can be broken if the bolt is released (in the rearward position) with cover lowered. The stud will not fit into its proper groove.

(3) Explain the damage that results from allowing the bolt to slam forward with the barrel out of the gun.

(4) Demonstrate the proper method of letting the bolt go forward, when the barrel is out of the gun.

(5) Explain the role of the bolt latch, bolt latch release, and bolt latch release lock in single-shot, semiautomatic operation. Demonstrate single-shot operation. Graphic training aids (GTA) charts will be beneficial in platoon-size groups.

179. Functioning

a. Aids to Instruction.

(1) Graphic training aids are useful if the class is approximately platoon size; otherwise, they may be made available for study and discussion during breaks.

(2) Use one gun per group, as in previous mechanical training instruction.

b. Organization. Organize the class as described in paragraph 176*b*.

c. Presentation.

(1) Divide functioning into eight phases, as described in paragraph 18*a*.

(2) Explain and demonstrate each phase of functioning. Assistant instructors should duplicate each demonstration on the guns within each group. With these "setups" at the guns, each soldier can see functioning of the various groups and their component parts. Setups, which may be used for each phase of functioning, are described below, as applicable.

(*a*) *Feeding.* Insert a 5-round belt in the feedway. Demonstrate the action of the belt feed pawl and belt holding pawl in bringing the new round against the cartridge stops. Have the demonstrators raise the cover to illustrate how the new round is engaged by the extractor, and to explain the operation of the bolt and cover groups in feeding.

(*b*) *Chambering.* Have a dummy round placed in the T-slot of the bolt, engaged by the extractor. Instruct the demonstrator to depress the bolt latch release, and let the bolt ride slowly forward, pointing out to the student how the ejector is cammed out into the grooved surface in the left side of the barrel extension.

(*c*) *Locking.* Demonstrate this phase with the barrel extension, barrel buffer, and bolt

groups inside and outside the gun. Make certain that the students are shown the location of the breech lock cam and understand its function.

(*d*) *Firing.* Have the demonstrators cock the gun, allow the bolt to go forward, and remove the backplate, to demonstrate this phase of functioning. Explain each action that takes place from trigger down to the firing pin, removing the driving spring group and bolt in the final phases of explanation.

(e) *Unlocking.* Instruct the demonstrators to remove the backplate, bolt, barrel extension, and barrel buffer groups from the receiver. Finally, remove the barrel buffer assembly from the barrel buffer body group. Again, explain the function of the breech lock cam in the bottom of the receiver.

(*f*) *Extracting.* Point out this phase of functioning with groups outside of the receiver, explaining the job of each part. Afterwards, assemble the gun and complete explanation. Use dummy rounds.

(*g*) *Ejecting.* Demonstrators should have the gun fully assembled with a dummy round in the T-slot, and another against the cartridge stop in the feedway.

(*h*) *Cocking.* Remove the bolt group from the receiver for the initial demonstration; complete instruction with the gun fully assembled.

(3) Throughout the instruction, explain the similarity and difference between the functioning of the caliber .50 and the M60 machineguns.

(4) Functioning is taught by visualizing how the parts work, rather than by memorizing the text. Test retention of the instruction by asking questions concerning combined phases of functioning. Example: "The first cartridge in the belt is positioned against the cartridge stops, and the bolt is forward. Explain the functioning of the parts involved in chambering this round."

180. Malfunctions (Stoppages and Immediate Action)

a. Aids to Instruction.

(1) Clearly define the term "stoppage" in introduction to this portion of the instruction.

(2) Emphasize the need for correct care and cleaning procedures.

b. Organization. Organize the class as described in paragraph 176*b*.

c. Presentation.

(1) The following chart can be used as a guide in presenting instruction in stoppages and immediate action:

Stoppages	To prepare for instruction
1. Misfire due to defective primer	1. Place a dummy cartridge in the belt.
2. Short round	2. Place a short round in the belt.
2. Bulged round	3. Insert a bulged round in the belt.
4. Belt improperly loaded	4. Pull a cartridge partially out of the belt.
5. Battered or thick rimmed cartridge	5. Place a battered or chick rimmed cartridge in the belt.
6. Failure to remove a round from the chamber	6. Place a dummy cartridge with the rim filed off, in the chamber.
7. Separated case which is removed from the chamber by the new round when the bolt is pulled to the rear.	7. Drive the front portion of a cartridge securely on a dummy cartridge. Pull the bolt to the rear and place the cartridge properly on the face of the bolt. Ease the bolt forward.
8. Separate case, which stays in the chamber when the bolt is pulled to the rear. (Do not set up loose headspace.)	8. Insert the front end of a case in the chamber, and load.
9. Short or broken firing pin or extension	9. Assemble the bolt with a defective firing pin, or extension, or place fire or more successive dummy cartridges in the belt for instruction in immediate action.
10. Weak or broken firing pin spring	10. Same as 9.
11. Faulty engagement of the hooked notch of the firing pin extension and the sear notch.	11. Same as 9.
12. Broken or weak sear spring	12. Same as 9.
13. Belt feed lever pivot out, worn, or broken	13. Assemble the cover with a defective part.
14. Bent, or worn, belt feed lever	14. Same as 13.
15. Belt feed pawl spring out, or weak.	15. Remove the belt feed pawl spring.
16. Belt feed pawl pin out or partially out	16. Remove the belt feed pawl pin.
17. Cover extractor spring out or weak	17. Remove cover extractor spring.
18. Belt feed lever bent up (stud jumps out of cam groove)	18. Assemble with a defective part.
19. Damaged extractor	19. Same as 18.
20. Belt holding pawl out, or springs weak	20. Remove the belt holding pawl or springs.
21. Broken extractor or ejector	21. Assemble the bolt with a defective part.

Stoppages	To prepare for instruction
22. Broken or damaged T-slot, causing misalinement and buckling of the cartridge as the bolt moves forward, or a failure to extract.	22. Do not prepare.
23. Weak ejector spring, causing misalinement and buckling of the cartridge as the bolt goes forward.	23. Assemble with a defective part.
24. Broken barrel extension or barrel buffer group	24. Same as 23.
25. Defective trigger mechanism, (runaway gun)	25. Do not prepare.

(2) Stress precision in detecting the cause and reducing stoppages. As the soldiers progress, concentrate on speed in applying immediate action and other methods of reducing a stoppage. Train the crew to function as a team.

(3) Stress safety precautions in connection with a hangfire or cookoff.

(4) When covering removal of ruptured cartridges, stress the *cause:* loose headspace, timing; and the *prevention:* correct headspace and timing.

Section III. MOUNTS

181. Ground Mounts:

a. Aids to Instruction.

(1) Provide a gun, mounted on a M3 or M63 mount (dependent upon the mount to be covered by instruction) for each group.

(2) Set up an additional pair of guns on their respective mounts (M3 and M63), for demonstration purposes.

(3) When M63 mounts for each group are not available, at least one mount should be obtained for demonstration purposes.

(4) When both the M3 and M63 mounts are set up for demonstration purposes, only one mount should be exposed to the students view at any one time.

(5) Use applicable GTA's or filmstrips.

b. Organization.

(1) For instruction on the M3 mount, organize groups as outlined in paragraph 173.

(2) If enough M63 mounts are available to provide one per group, organize the class for instruction as outlined in paragraph 176*b*.

(3) If sufficient mounts are not available to conduct instruction on the M63 mount, use the mounts for demonstration purposes only, dividing the class so that each man can get the best possible view of the demonstration.

c. Presentation.

(1) Introduce the M3 and M63 mounts as the two principal ground mounts used with the caliber .50 machinegun.

(2) Explain the role of the M3 mount against ground targets.

(3) Explain the role of M63 mount against aerial targets.

(4) Present the following information and demonstrate; first the M3 and then the M63 mounts.

(*a*) General nomenclature and data.

(*b*) Functioning of the mount.

(*c*) Use, or operation, of the mount.

182. Vehicular Mounts

a. Aids to Instruction.

(1) This instruction will be more effective if the mounts are demonstrated on a firing range.

(2) If a firing range is not available, give general data on the mounts and place the mounts adjacent to the class area for inspection during breaks.

(3) If mounts are not available, and the class is small, refer to available GTA's.

b. Organization. Due to the nature of the subject, instruction in vehicular mounts is presented by conference and discussion, and demonstration and practical work, when mounts are available. The class should be organized into one large group initially, and divided into smaller groups for practical work.

c. Presentation.

(1) Where possible, introduce each type mount, followed by demonstration firing before proceeding to the next mount.

(2) Following the initial conference, divide the class into small groups for practical work firing, changing stations after each group has completed familiarization firing with each mount.

Section IV. ORGANIZATIONAL MAINTENANCE

183. Care and Cleaning

a. Aids to Instruction.

(1) Use one cleaning rod and one dummy round per weapon, plus bore cleaner, lubricating oil, patches and waste (rags).

(2) Assemble a display of all available cleaning materials, lubricants, and rust preventives, as listed in paragraph 39. Display according to category, and label each item.

(3) Use available filmstrips, or similar instructional aids.

(4) Refer to the inspection checklist, appendix C.

b. Organization. Organize the class as outlined in paragraph 173.

c. Presentation.

(1) Emphasize meticulous cleaning, lubrication, inspection, and preventive maintenance to insure performance.

(2) Use the care and cleaning period to further the soldier's knowledge of nomenclature, and skill in assembly and disassembly.

(3) Emphasize inspection, care, and preventive maintenance under combat conditions, which is the final test of the weapon maintenance program.

(4) Conduct semiformal practical work instruction before, during, and after firing.

(5) Emphasize care of the *mount*, as well as the gun, throughout care and maintenance instruction.

(6) Point out the differences in care and cleaning in cold climates, tropical climates, hot-dry climates, and care and cleaning following a CBR attack.

(7) Emphasize the importance of *frequent inspection*, as a means of insuring proper maintenance of the gun and mount.

Section V. MOUNTING AND PLACING THE GUN IN ACTION

184. Crew Drill (M3 Mount)

a. Aids to Instruction.

(1) The demonstration crew must be well-trained and demonstration equipment complete. Use basic TOE equipment and distinctive helmet liners (identifying each crew member according to his duties), and normal individual equipment.

(2) Issue equipment for each group participating in practical work.

b. Organization.

(1) Present initial instruction and demonstration to one group.

(2) For practical work, divide the class into crews of four men per gun.

(3) To facilitate control and supervision, aline equipment with engineer tape or wire, with the students in files behind their equipment.

c. Presentation.

(1) Emphasize the fact that crew drill is the first step in developing teamwork in the machine-gun crew, and that precision is required of every member for the crew to function smoothly.

(2) During initial practical work periods, stress precision; talk each man through his particular duties as a crew member. Require the students to perform each operation *when* directed and precisely *as* directed.

(3) As precision is attained, introduce and develop speed.

(4) In advanced training, use speed drill to create interest and stimulate competition. This also furthers teamwork and tests individual crew performance. A well-trained crew should be able to place the gun in action, or take it out of action, in 25 seconds, with all points correct.

185. Crew Drill (Other Mounts)

Due to the nature of mounts other than the M3 mount, crew drill with these mounts is limited to instructing two men to properly mount the gun (the mount already emplaced, as with the M63 mount), or take the gun out of action.

Section VI. MARKSMANSHIP

186. Preparatory Exercises

a. Aids to Instruction. Demonstration crew with gun and mount, a sighting bar, graphic illustration of correct sight picture, sighting target (panel with holder), stopwatch, control flags, cleaning rods, clearing blocks, and patches.

b. Organization.

(1) Preferably two soldiers per group.

(2) Centralized area (preferably with bleachers) for conference and demonstrations. Any relatively level area that will permit the guns to be placed 10 meters from the targets.

c. Presentation.

(1) The instructor should convince the individual soldier that in order to fire the marksmanship course satisfactorily, the fundamentals of marksmanship must be *learned* and *practiced* during the preparatory phase of marksmanship training.

(2) Explain that a marksman is made during preparatory training and not on the firing line.

(3) Through proper supervision by coaches, assistants, and the instructor, insure that *correct practices are followed* (good habits initiated, and bad ones eliminated), during the preparatory phase of marksmanship.

(4) The gunner's test is given prior to firing on the 10 meter range (para 128).

187. 500-Inch Firing

a. Aids to Instruction.

(1) Demonstration crew with gun and mount, a 10 meter machinegun target, control flags and/or whistles, stopwatches, patches, cleaning rods, clearing blocks, and ½-inch aiming pasters. Sound equipment is desirable during firing.

(2) Each firing point (group): See equipment listed in paragraph 112.

b. Organization. The minimum required number of soldiers remain on the firing line, with the remainder receiving concurrent instruction on the dry line or in rear areas.

c. Presentation.

(1) Conference, demonstration, and practical work for the correct procedures in emplacing the gun on the firing line will be conducted. Emphasis is placed on three-point contact (tripod leg shoes), correct shimming (when necessary), and preparation of the gun for firing, to include safety checks.

(2) The interval between the two portions of the control command should be sufficient to permit the execution of the command, and for the coach to perform his duties properly. Coaches are required to perform their duties quickly and precisely. These duties should be reduced to writing, given to each coach, and their execution supervised.

(3) During instruction firing, the coach, through corrections, places the gunner in the proper position before he permits him to commence firing. This correction should be done from the standing position.

(4) The soldier should become proficient in the execution of the exercise within the prescribed time limit. After the introduction, firing (dry or instruction) is done against time; however, the soldier is permitted to complete the exercise except for the last instruction or record firing.

(5) The soldier should know and understand the principles of targeting the machinegun prior to firing.

(6) After each firing, assistants analyze each target and point out errors made and their causes. This assists the gunner in correcting errors.

188. Transition Firing

a. Aids to Instruction.

(1) Demonstration crew with gun and mount, double E-type silhouette targets, mounted on one target frame, cleaning rods, clearing blocks, patches; sound equipment is desirable during firing.

(2) Two guns with mounts, telephones, targets, cleaning rod, oil, patches, waste, clearing blocks are required for each lane.

b. Organization. Preferably, two crews per lane (one gun dry fires while the other fires). Personnel not required as crew members or in the operation of the range should receive concurrent training in rear areas. One assistant instructor per lane is desirable.

c. Presentation.

(1) Prior to the conference and demonstration of firing table 8 (marksmanship course), the instructor briefly reviews range determination, techniques of long range fire adjustment, and explains the characteristics of machinegun fire, and its effect on field targets.

(2) When firing, the alternate aiming point method of adjustment is explained and demonstrated. Gunners should be required to use this method.

(3) The guns are targeted at a known distance on the transition range (preferably at 600 yards). The soldiers receiving the instruction should do the targeting.

(4) The acting safety NCO for each gun crew requires the gunner to be in the correct position before permitting him to fire.

(5) The acting safety NCO may assist the gunner in locating the targets, but is not permit-

ted to aid in range determination or fire adjustment.

(6) At the completion of each exercise, the members of the firing crew rotate.

(7) Appropriate subjects to be included in rear area training are —

(*a*) Mechanical training.

(*b*) Any other machinegun subjects in which additional training is needed.

189. Moving Target Firing

a. Aids to Instruction.

(1) Demonstration crew with gun and mount. One appropriate target, cleaning rods, clearing blocks, patches, waste, vehicle (preferably ¼-ton truck), blank target with holder, and a marking silhouette.

(2) Two guns per firing point, cleaning rod, clearing blocks, oil, and patches.

b. Organization.

(1) Preferably two crews per firing point (one gun dry fires while the other fires). Personnel not required as crew members or in the operation of the range, receive concurrent training in rear areas.

(2) One assistant instructor per lane as the safety NCO.

c. Presentation.

(1) Prior to the conference and demonstration of firing table 4, the instructor conducts the preparatory exercises as prescribed in paragraph 138 (tracking and leading). He should also review and discuss range determination, the techniques of long range fire adjustment, and characteristics of machinegun fire.

(2) The gun should be targeted at a known distance on the range, preferably at the midrange of the target run.

(3) The acting safety NCO requires the gunner to be in the correct gunner's position before permitting him to fire.

(4) At the completion of each firing, the members of the crew are rotated.

(5) Appropriate subjects to be included in rear area training are—

(*a*) Mechanical training to include headspace and timing adjustments.

(*b*) Care and cleaning.

(*c*) Any other machinegun subject in which additional training is needed.

Section VII. TECHNIQUE OF FIRE, GENERAL, DIRECT LAY, PREDETERMINED FIRE, AND POSITION DEFILADE

190. PURPOSE

The objective of this training is to *teach the soldier teamwork and give him confidence* in his ability to quickly deliver a large volume of accurate machinegun fire against targets. Technique of fire training also *gives him further training* in the basic fundamentals of gunnery.

191. Organization

a. The instructional area should have seating facilities for the entire group during conferences and demonstrations.

b. After the conference and demonstration, the group is divided into smaller groups for practical work, each under the control of an assistant instructor. (These smaller groups should be less than platoon size.)

c. The officer in charge of instruction controls all firing.

d. If space permits, all men are employed on the firing line.

e. Keep requirements for the various exercises simple and progressive.

f. Coordinate demonstrations and exercises with the instruction. Demonstration crews should have distinctive helmet liners to indicate their position within the crew.

g. If possible, select terrain suitable for the subject; otherwise, apply the subject to the terrain.

h. Improvise targets from salvage material, and make them durable. Dirt mounds, drums filled with dirt, do not require frequent replacement.

192. Introduction

a. Aids to Instruction.

(1) A blackboard, appropriate charts, guns with mounts, ammunition, and appropriate equipment.

(2) Equip each practical work area with guns and mounts, ammunition, clearing blocks, cleaning rod, gun cover, and other necessary equipment.

b. Presentation. If possible, control firing with a sound system. Flags, arm-and-hand signals, or whistles, may be used as alternate means of con-

trol in an *emergency*, or to supplement the sound system.

(1) Explain and demonstrate the characteristics of fire, classes of fire, target designation, fire control, and review range determination and windage adjustments.

(2) Explain the proper sequence and use of fire commands.

(3) Conduct practical exercises (in practical work areas) in applying fire commands.

193. Distribution of Fire

a. Aids to Instruction. Same as paragraph 192*a*.

b. Area. Field target range or landscape target range.

c. Presentation.

(1) Explain and demonstrate the engagement of various types of targets (wide, deep, oblique, etc.) using direct laying. Demonstrate methods by using a punchboard (fig 180), if available, and by firing.

(2) In the first demonstration of each type of target, show step-by-step the initial lay, direction of manipulation, and extent of manipulation of the gun (or each gun when employed in pairs). Fire the remaining demonstrations of each type of target in the normal manner.

(3) Follow the conference and demonstration of each type target with practical work. The assistant instructor in charge of the smaller group breaks the group down into gun crews, and designates crew leaders and crews to fire the guns singly, or in pairs. The crew leader then gives the fire command, which is placed on a blackboard. It is corrected, and the gun crew(s) take appropriate action to prepare to engage the designated target. The crew(s) engages the target, and the group critiques their firing and performance. After the critique, other crews are designated. Follow the same procedure throughout practical work, engaging as many targets as time permits.

194. Overhead Fire

a. Aids to Instruction. Same as paragraph 192*a*.

b. Area. Field target range.

c. Presentation.

(1) Explain and demonstrate the advantages, limitations, and application of overhead fire, to include safety angles and the gunner's rule. Use tracer ammunition throughout this instruction so that the trajectories are seen by the soldiers. *(Emphasize that tracer ammunition is not used in the actual delivery of overhead fire.)*

(2) During practical work, each assistant instructor points out the location of friendly troops (indicated by flags, silhouette targets, etc.); designates the target, obtains the range by group estimation, and requires the group to determine, by using the gunner's rule with the guns, whether or not overhead fire can be delivered safely. The correct fire command is given, and the target is engaged. Thus, the group can see whether or not the fire clears friendly troops. The assistant instructor and the group critique the firing and the performance of the crews.

195. Predetermined Fire

a. Aids to Instruction. Same as paragraph 192*a*.

b. Area. Field target range, or landscape target range.

c. Presentation.

(1) Explain and demonstrate methods of laying the gun and firing, using the traversing bar and elevating mechanism, auxiliary aiming points, aiming stake, and various field expedients.

(2) Explain and demonstrate the employment of the caliber .50 machinegun, firing final protective fires. Explain how the terrain controls the extent of grazing fire obtainable along the final protective line.

(3) Explain the purpose and use of a range card. Draw a range card on the blackboard as data is obtained by the demonstration crew. Require each soldier to record the same information on his individual range card.

(4) The groups report to their practical work areas along the firing line and are divided into gun crews (three or four men per gun). They prepare a group range card for each gun, including data for a final protective line and targets. Use as many of the methods as possible to engage targets and fire the final protective line. This data should be confirmed by firing through target cloth screens placed in front of the gun position, so that the gunner cannot see the target through his sights. If possible, these same targets should be engaged at night to show the soldier the technique of applying data in the dark.

196. Position Defilade

a. Aids to Instruction. Same as paragraph 192*a*.

b. Area. Use a field target range affording a defiladed firing line. If possible, the mask should be at least 100 yards in front of the gun positions to avoid danger from possible ricochets.

c. Presentation.

(1) Explain and demonstrate the types of de-

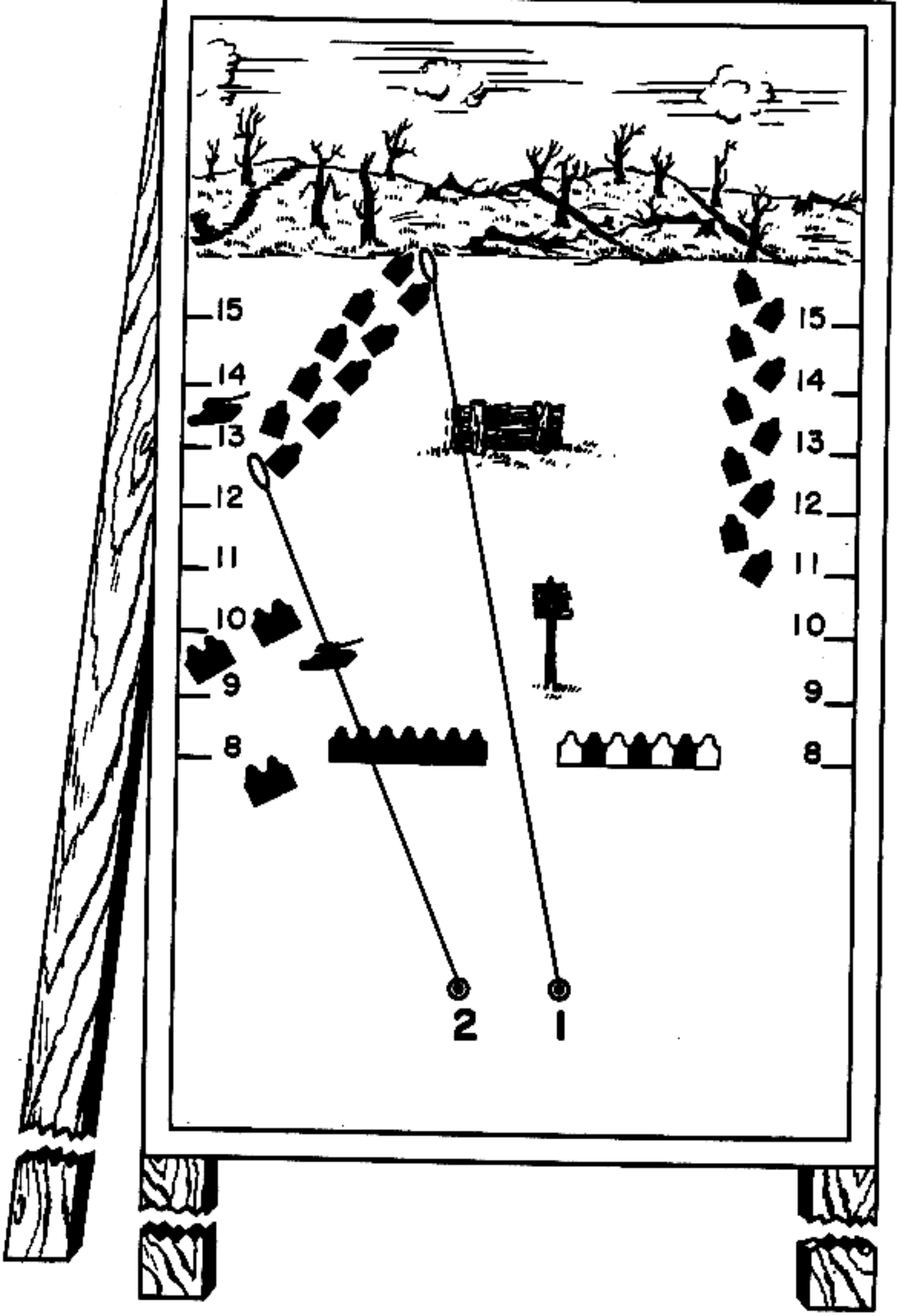


Figure 180. Technique of fire (pumahboard).

filade positions, the four essentials of positions defilade, and the aiming point method of laying the gun for direction and elevation.

(2) Assemble the groups in their practical work areas, and have them place the guns in position defilade on a reverse slope (also on a forward slope) and engage targets by—

(*a*) Applying the four essentials in the engagement of targets from position defilade.

(*b*) Laying the gun for direction and elevation by use of the aiming point method.

(3) When time permits or concurrent training is used, a review of the following subjects is recommended, using sand tables, charts, diagrams, and terrain:

(*a*) Firing positions.

(*b*) Laying the gun for direction and elevation.

(*c*) Checking for mask clearance.

(*d*) Adjustment of fire.

197. Advanced Training

As the soldier gains proficiency in the basic principles of techniques of fire, and as training for noncommissioned officers (NCO's), the following guide may be applied to various phases of instruction:

a. The NCO may be placed in charge of a crew, or crews, during practical work periods, and inspect weapons. He may also be used to critique firing and give fire commands.

b. In applying the gunner's rule, binoculars may be used to determine whether or not it is safe to fire. The student must understand, however, that before firing, calculations must be checked by using the gun.

c. Noncommissioned officers and experienced soldiers may select gun positions and determine data to be placed on the guns, when firing from position defilade.

Section VIII. FAMILIARIZATION FIRING

198. General

a. The following course may be fired for familiarization with the Browning machinegun, caliber .50, HB, M2, on ground mount, or mounted on vehicles:

Range (meters)	Rounds	Targets	Type of fire
400–1000	56	5 type double E silhoutte targets per gun	Targeting—6 rds single-shot. Bursts of 5—10 rounds.

b. When fired for familiarization, the course outlined in *a* above is operated as follows:

(1) Each man receives 12 hours of preliminary marksmanship instruction.

(2) Each man receives 4 hours of familiarization firing.

(3) The ammunition allowance of 56 rounds per individual contains at least 1 round of tracer ammunition to every 4 rounds of ball ammunition.

(4) Before the course is fired, each man is allowed 6 rounds for targeting. The entire group at each gun observes the targeting fire.

(5) No time limit is set for firing the allotted ammunition.

(6) All guns are stationary.

(7) All targets are stationary.

(8) The 5 targets, which may be placed in the lanes of a transition range, are mounted at ranges varying from 400 to 1,000 meters. Red flags may be used to identify the targets.

Section IX. ANTIAIRCRAFT GUNNERY TRAINING

199. Preliminary Training

a. Scope. Gunners must complete the following preliminary training before firing at moving aerial targets:

(1) Aircraft recognition.

(2) Range estimation.

(3) Speed estimation.

(4) Position exercise.

(5) Tracer observation.

(6) Demonstration firing.

(7) Tracking exercises.

b. Aircraft Recognition. Refer to FM 44–80.

c. Range Estimation. The purpose of range estimation is to teach the gunner when to open fire. The only basis for aerial range estimation is the appearance of the airplane. Trainees observe the

RANGE (METERS)	DETAILS SEEN BY UNAIDED EYE
200	THE SYMBOLS AND NUMBERS. LETTERS ON THE AIRCRAFT CAN BE SEEN PLAINLY.
500	THE SMALL PROJECTIONS FROM THE FUSELAGE, SUCH AS GUNS AND AERIALS
700	THE RUDDER AND COCKPIT
1000	THE GENERAL OUTLINE OF THE AIRCRAFT (OPENING RANGE)
OVER 1000	THE GENERAL SHAPE GRADUALLY DISAPPEARS AND BECOMES ONLY AN ELONGATED SPECK IN AIR

Figure 181. Details seen by the unaided eye on aircraft at various ranges.

plane as it flies courses at known ranges until they become familiar with the plane's appearance at various ranges. The 1,000 meter range is stressed because this is the range where the gunner is taught to open fire. If an airplane is not available, figure 181 may be used as an aid for training.

d. Speed Estimation. When possible, an airplane is used for training men to estimate speeds of aerial targets. Trainees observe the aircraft as it flies various courses at known speeds until they become capable of estimating speeds with reasonable accuracy. The usual speeds of attack for various types of aircraft are covered in aircraft recognition training and repeated as concurrent instruction in this phase.

e. Position Exercise.

(1) This exercise teaches the gunner to assume the antiaircraft firing position quickly and accurately. The instructor sees that each man assumes a stable position. Speed in assuming the position is obtained by practice. The position of each gunner is tested by his moving a free gun through a wide traverse at high elevation without reference to any target.

(2) The ability to fire a machinegun effectively is directly dependent on hand-eye-foot coordination. Practice alone will develop these skills. To engage targets quickly and track them smoothly and accurately, a machinegunner must develop a feel for his weapon. He should track moving aerial targets frequently.

f. Tracer Observation.

(1) This instruction teaches the gunner the principles of tracer observation (para 167–170) and develops the ability to properly interpret the relationship of target and tracer, under varying conditions of line and lead.

(2) Graphic representations similar to those in figures 177, 178, and 179, and chalkboard sketches are effective aids in teaching the fundamentals of tracer observation. Advanced instruction in tracer observation is conducted concurrently with all phases of antiaircraft firing.

(3) Further information on this subject is contained in FM 44–2.

g. Demonstration Firing.

(1) This firing familiarizes the gunner with the appearance of the tracer path with its apparent curve, and demonstrates the methods of adjusting the tracer path onto the target.

(2) The demonstration consists of the following:

(*a*) Without reference to a target, traverse a free gun while firing. Call attention to the need for keeping the head high above the gun so that the tracer path can be observed through the smoke.

(*b*) Fire at aerial targets that are flying incoming and crossing courses. Demonstrate how lead is applied, and how a moving reference point in the sky (the target) introduces an apparent curvature in the tracer path.

(*c*) Stress the principles of tracer observation.

(*d*) Test the trainee's ability to sense tracers correctly.

h. Tracking Exercise. The tracking exercise teaches control of the free gun, and tests the gunner's ability to estimate and apply initial leads. Gunners track and simulate continuous fire on aerial targets flying various types of courses. The radio-controlled airplane is the most suitable target for this type of exercise.

200. Firing Exercises

a. General. Firing at high-speed aerial targets

is the final phase of antiaircraft machinegun training. It consists of firing the caliber .50 machinegun from ground and/or vehicular mounts at targets towed by aircraft or at radio-controlled airplane targets. The purpose of the firing exercise is to—

(1) Teach control of the free gun while tracking an aerial target and firing continuously.

(2) Develop and test the gunner's ability to estimate initial leads, and make appropriate corrections in line and lead based on tracer observation.

b. Essentials for Firing. Prior to a firing exercise, the instructor explains the importance of keeping the proper position with a firm grip on the gun while firing, and the necessity of firing continuous fire. The techniques of estimating lead and the principles of tracer observation are reviewed. During a firing exercise, the instructor or his assistants carefully check each man before and during firing to insure that instructions are followed and malpractices are corrected on the spot.

c. Faulty Training Methods. Antiaircraft firing without the use of tracers is obviously wasteful and useless training. Errors cannot be seen and corrected, and, although a few hits may be obtained, the gunner never knows at what time and with what lead, these hits were obtained.

201. Targets

a. Towed Targets. These targets are very reliable; however, safety factors limit the types of courses which can be flown by the towing aircraft. Two types of targets are available; the flag (or banner), and the sleeve target. Both types of targets are provided in a variety of colors; red, white, and black for use under varying conditions of cloud and sky. These targets may be towed at speeds in excess of 200 miles per hour, the only limiting factor being the disintegration ratio of the target.

b. Radio-Controlled Airplane Targets. These targets are 147 inches long, 81 inches high, and have a wing span of 138 inches. They are remote-controlled by radio and are the most realistic and maneuverable type of target available. (See TC 23–15 for additional information.)

APPENDIX A

REFERENCES

AR 310–25	Dictionary of United States Army Terms.
AR 310–50	Authorized Abbreviations and Brevity Codes.
AR 350–4	Qualification and Familiarization with Weapons and Weapon Systems.
AR 385–63	Regulations to Firing Ammunition for Training, Target Practice, and Combat.
FM 5–15	Field Fortifications.
FM 7–10	The Rifle Company, Platoons and Squads.
FM 7–20	The Infantry Battalions
FM 21–5	Military Training Management.
FM 21–6	Techniques of Military Instruction.
FM 21–30	Military Symbols.
FM 21–40	Chemical, Biological, Radiological and Nuclear Defense.
FM 21–60	Visual Signals.
FM 31–70	Basic Cold Weather Manual.
FM 44–1	US Army Air Defense Artillery Employment.
FM 44–2	Air Defense Artillery Employment Automatic Weapons. M42/M55.
FM 44–30	Visual Aircraft Recognition.
TM 3–220	Chemical, Biological, and Radiological (CBR) Decontamination.
TM 9–207	Operation and Maintenance of Army Materiel in Extreme Cold Weather. (0° to—60°F.) To 36–1–40.
TM 9–247	Materials used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel.
TM 9–1005–213–10	Operators Manual: Machinegun, Caliber .50, Browning, M2.
TM 9–1005–213–25	Organizational, DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tool Lists, Machinegun Cal .50.
TM 9–1300–206	Care, Handling, Preservation, and Destruction of Ammunition.
TM 9–2300–224–10	Operator's Manual: Carrier, Personnel, Full-Tracked, Armored M113.
TM 10–1101	Petroleum-Handling Equipment and Operations.
TA 23–100–1	Ammunition, Rockets, and Missiles for Basic and Advanced Individual Training. (By MOS)
TC 23–13	Crew-Served Weapon Night Vision Sight.
TC 23–15	Engagement of Aerial Targets with Small Arms.
DA Pam 310–4	Military Publications: Index of Technical Manuals, Technical Bulletins, Supply Manuals, Supply Bulletins and Lubrication Orders.
DA Pam 310–7	Military Publications: US Army Equipment Index of Modification Work Orders.
SC 4933–95–C.–E04	Tool Set, Direct and General Support Maintenance, Basic Small Arms.
SM Ord 7, 8, 9, SNL A–55	Mount Machinegun, AA Cal .50 (6580080) and (8367286).

APPENDIX B

POSITION OF PARTS FOR LEFT-HAND FEED

Part	Position
Belt feed lever, shoulder headless pin, and spring	Upper (rear) hole. Lug of feed lever is on left side of cover.
Belt feed slide	Feed pawl is on left side of cover.
Belt feed pawl arm	Arm toward latch end of cover, pointing right.
Cover latch shaft lever	Left side of cover.
Cartridge stops and link stripper	Right-hand rear cartridge stop assembly and front cartridge stop on right side of feedway.
Retracting slide with handle	Right sideplate.
Bolt holding pawl	Left side of feedway.
Bolt switch	Cam groove in line with "L" on bolt.

APPENDIX C

BEFORE, DURING, AND AFTER OPERATION CHECKLIST

Part	Before	During firing or temporary cessation	After
Bore	Make sure it is clear and clean		Clean and oil lightly.
Moving parts	Oil lightly and test for worn or broken parts. They should function without excessive friction.	Lubricate working parts. Observe the functioning of the gun to anticipate failures.	Inspect, clean, and oil lightly.
Headspace timing	Check adjustment by gage and correct if necessary.	Watch for bulged cases to prevent a ruptured (separated) case. If separated case occurs, remove it, readjust headspace and timing.	Check adjustment.
Rear sight and windage knob.	See that the sight is clean and functions properly. Set sight at 1,000, windage zero.	Keep properly set.	Clean and oil; set at 1,000, windage zero.
Spare parts and tools	Clean and oil spare parts and tools. Check kits for completeness. Examine newly drawn parts.	Keep available	Clean and oil. Check and replace damaged or missing parts.
Ammunition	Have an adequate supply; clean, correctly loaded, and in good condition *Not oiled.*	Keep correctly alined with the feedway, check resupply. Protect from sun, moisture, and dirt. Watch for link stoppage.	Clean, store carefully, and replenish supply.

APPENDIX D

INSPECTION CHECKLIST

Unit	Inspection
1. *Gun.*	
a. Barrel	Inspect the bore and chamber for rust. See that they are clean and lightly oiled.
b. Moving parts	See that they are clean and lightly oiled. Operate the retracting slide handle and bolt latch release several times, to see that the parts function without excessive friction.
c. Headspace and timing	Check with the gages to insure that headspace and timing are correct.
d. Rear sight and windage knob	Insure that the sight is in good condition, clean, free of grease or dirt, and lightly oiled. Elevation should be set at 1,000, windage zero, and the sight should be down.
2. *Mount*	See that it is clean, lightly oiled, lubricated, and that all clamps are securely tightened. It should function properly and be complete.
3. *Spare parts and tools*	Inspect to see that they are clean and lightly oiled. See that spare parts kits are complete and in good condition. Replacement parts should be requisitioned and newly drawn parts examined.
4. *Ammunition*	See that ammunition is properly stored, and that boxes and ammunition are in good condition and not oiled.

APPENDIX E
AMMUNITION

1. General

This appendix describes the ammunition used in caliber .50 machineguns. You should be able to recognize the types of ammunition available, and know how to care for that ammunition.

a. The caliber .50 cartridge consists of a cartridge case, primer, propelling charge, and the bullet. See TM 9–1300–200.

b. The term bullet refers only to the small-arms projectile. The term "ball" was originally used to describe the ball-shaped bullet of early small-arms ammunition. The term "ball ammmunition" now refers to a cartridge having a bullet that has a metallic jacket, filled only with lead.

2. Classification

Based on use, the principal classifications of the several types of ammunition used with the machinegun are as follows:

a. Ball. For use in marksmanship training, against personnel, and light material targets.

b. Tracer. To aid in observing fire. Secondary purposes are for incendiary effect and for signalling.

c. Armor-Piercing. For use against armored aircraft and lightly armored vehicles, concrete shelters, and other bullet-resisting targets.

d. Incendiary. For incendiary effect, especially against aircraft.

e. Armor-Piercing-Incendiary. For combined armor-piercing and incendiary effect.

f. Armor-Piercing-Incendiary-Tracer. For combined armor-piercing and incendiary effect, with the additional tracer feature.

g. Blank. For simulated fire (contains no bullet).

h. High-Pressure Test. For use *only* in *proof firing* of weapons and barrels.

i. Dummy. For training (completely inert).

3. Lot Number

When ammunition is manufactured, it is given an ammunition lot number, which is marked on all packing containers. It is also on the identification card inclosed in each packing box. The lot number is required for purposes of record, such as grading and use, and reports on the condition, functioning, and accidents in which the ammunition might be involved. It is impractical to mark the ammunition lot number on each individual cartridge. Every effort should be made to maintain the ammunition lot number, or the repacked lot number, with its original packing. Cartridges that have been removed from their original packing, and for which the ammunition lot number has been lost, are automatically placed in grade 3 (unserviceable and not to be issued or used).

4. Identification

a. Marking. The contents of original boxes or containers may be readily identified by markings on the box. They indicate, by stencil, the number of rounds in the box or container, the caliber, the code symbol, and the lot number.

b. Code Symbol. The code symbols for machinegun ammunition indicate the grade as well as contents and type of inner packing. To provide proper identification, the abbreviated markings are stenciled in yellow on each metal ammunition container, together with the repacked lot number.

c. Ammunition Marking. Colors painted on the tips of the bullet aid in identification of the various types of ammunition. The following colors are used:

Type of cartridge	*Color of tip of bullet*
Ball	None
Tracer	Red, maroon, or orange tip
Armor-piercing	Black tip
Incendiary	Blue tip, light blue ring with blue tip.
Armor-piercing-incendiary	Aluminum colored tip, or aluminum ring with blue tip.
Armor-piercing-incendiary-tracer	Aluminum ring with red tip.
Blank	No bullet.
Dummy	None, holes in cartridge case.
High-pressure-test	None, tinned cartridge case.

d. Ammunition Grades.

(1) The grades for caliber .50 ammunition are as follows:

AC—Aircraft and antiaircraft machineguns.

MG—Ground machineguns.

S—Unserviceable, not to be issued or used.

(2) More than one grade may be authorized for ammunition, as an example, AC or MG ammunition may be used for both aircraft and antiaircraft machineguns, and ground machineguns.

(3) Ammunition that cannot be identified is considered as grade S, but is not classified unserviceable until every effort has been made to establish its identity. Ammunition placed in grade S (due to loss of lot number) and identified as having been in serviceable lots issued to a specific organization, may be reissued after visual inspection for local training purposes (graded *"for training purposes only"*) in ground machineguns. *It will not be used for overhead fire.*

5. Care, Handling, and Preservation

a. Exercise care to prevent ammunition boxes from becoming broken or damaged. Repair all broken ammunition boxes immediately. Transfer all original markings to the new parts of the box.

b. Ammunition boxes should not be opened until the ammunition is to be used. Ammunition removed from the airtight container, particularly in damp climates, is likely to corrode.

c. Protect ammunition from mud, sand, and water. If the ammunition gets wet or dirty, wipe it off at once with a clean, dry cloth. Wipe off light corrosion as soon as it is discovered. Turn in heavily corroded cartridges.

d. Do not expose ammunition to the direct rays of the sun. If the powder is hot, excessive pressure may be developed when the weapon is fired.

e. Do not oil or grease ammunition. Dust and other abrasives that collect on greasy ammunition are injurious to the operating parts of the gun. Moreover, oiled cartridges produce excessive chamber pressure.

f. Do not fire dented cartridges, cartridges with loose bullets, or otherwise defective rounds.

6. Storage

a. Small-arms ammunition is not an explosive hazard, but under poor storage conditions, it may become a fire hazard.

b. Store ammunition of all classes away from radiators, hot water pipes, and other sources of heat.

c. Whenever possible, store ammunition under cover. If it is necessary to leave ammunition in the open, keep it at least 6 inches off the ground, and covered with a double thickness of tarpaulin. Place the tarpaulin so that it gives maximum protection, and allows free circulation of air. Dig suitable trenches to prevent water from flowing under the ammunition pile.

7. Ballistic Data

The approximate maximum range, and average muzzle velocity of some of the different types of caliber .50 ammunition authorized for use in the machinegun are as follows:

Cartridge	Maximum range (meters)	Meter trace	Average muzzle velocity (feet per second)
Ball, M2	7,400		2,930
Armor-piercing, M2	7,400		2,930
Armor-piercing-incendiary, M8	6,470		3,050
Armor-piercing-incendiary-tracer, M20	6,470	**300—1750	3,050
Incendiary, M1	6,050		3,090
Tracer, M1 (with gliding metal jacket)	5,575	1800	2,860
Tracer, M1 (with clad steel jacket)	5,450	1800	3,030
Tracer, M17	5,450	2450	3,030
High pressure test, M1	(*)		(*)

*This round is designed only for use in proof-firing of caliber .50 machineguns at the place of manufacture. The cartridge develops a chamber pressure of 60,000 to 65,000 pounds per square inch, in contrast to the average chamber pressure of 55,000 pounds per square inch developed in most of the rounds commonly used in the field.

**This tracer is dim at near ranges, but increases to bright as it moves farther from the gun.

8. Miscellaneous Ammunition Data

a. The cartridge, ball, caliber .50, M2 is about 5½ inches long and its bullet is about 2½ inches long. The cartridge weighs 1,813 grains; its case weighs 850 grains, the powder charge weighs 235 grains, the primer 19.06 grains, and the bullet 709.5 grains.

b. The following chart lists the *maximum penetration in inches* for armor-piercing cartridge, caliber .50, M2, fired from the 45-inch barrel (muzzle velocity 2935 feet per second):

Material	Inches at:		
	200 M	600 M	1,500 M
Armor plate (homogeneous)	1.0	0.7	0.8
Armor plate (face-hardened)	0.9	0.5	0.2
Sand (100 lb dry wt/cu ft)	14	12	16
Clay (100 lb dry wt/cu ft)	28	27	21

c. The following chart lists the maximum penetration in inches for ball cartridge, caliber .50, M2, fired from the 45-inch barrel (muzzle velocity 2,935 feet per second):

Material	Inches at:		
	200 M	600 M	1,500 M
Sand (100 lb dry wt/cu ft)	14	12	6
Clay (100 lb dry wt/cu ft)	28	26	21
Concrete	2	1	1

9. Precautions in Firing Service Ammunition

The general precautions concerning the firing and handling of ammunition in the field, as prescribed in TM 9–1300–206 are observed. Precautions that apply particularly to small-arms ammunition are—

a. Do not fire small-arms ammunition (other than blank ammunition) until it has been positively identified by ammunition lot number and grade. Do not fire small-arms ammunition, graded and marked "For Training Use Only," over the heads of troops.

b. Do not use armor-piercing cartridges in demonstrations where tanks are used as demonstration targets.

c. Before firing, make sure that the bore of the weapon is free from foreign matter, such as cleaning patches, mud, sand, snow, etc.

APPENDIX F

TELESCOPIC SIGHTS

At the present time, there is no definite telescopic sight designed for exclusive use with the Browning machinegun, caliber .50 HB, M2. However, the telescopic sight M85C can be adopted for use with this caliber .50 machinegun by adjusting the sight reticle. Any direct fire sight that can be adapted to fit in the dovetailed slot on top of the receiver, and can be adjusted for range, is suitable for use with this caliber .50 machinegun. A telescopic sight is primarily used when the machinegun is employed as a sniper weapon on the M3 mount. For this purpose, the sight presents a clearer, closer picture of the target area. When the sight is properly adjusted, single-shot sniper fire can be very accurate at ranges up to 1,500 meters. With different optical equipment, accurate fire can be achieved at greater ranges.

APPENDIX G

CREW-SERVED WEAPON NIGHT VISION SIGHT

1. General

Training circular 23–13 provides guidance for the conduct of training with the Crew-Served Weapon Night Vision Sight.

2. Scope

TC 23–13 contains a complete description of the Crew-Served Weapon Night Vision Sight, mechanical training to include assembly, disassembly, operation, installation, functioning, and maintenance; marksmaship training to include boresighting, aiming, positions, and zeroing; and other information pertinent to its employment and the conduct of training. The material is applicable, without modification, to nuclear and nonnuclear warfare.

APPENDIX H
AERIAL TARGET ENGAGEMENT

1. Line and Lead

In engaging aerial targets, there are two requirements that must be considered: "Line" and "Lead." "Lead" is the compensation made for the speed of the aircraft and the projectile that will allow the two to intersect at a given point. The required lead for a given aircraft is always calculated as a certain number of lengths of that aircraft. A high performance aircraft will require a greater lead factor because of its high speed than a low performance, slower, aircraft. "Line" is the requirement that the projectiles must intersect the target course line of the aircraft. If the projectiles do not pass through this target course line, the aircraft cannot be engaged. Super-elevation is the compensation that must be made for the pull of gravity on the projectile. Since the caliber .50 machinegun projectile is basically flat out to a distance of 800 meters, the gunner need not worry about super-elevation, for, by tracer observation, he can observe the rounds crossing the target course line and make the required adjustments.

2. Fly Through Technique

As an aerial target moves along its target course line, the required lead to engage the target changes due to the changing range and angle between the aircraft and the gun position. The lead required increases from the initial sighting (fig 182, point A) until midpoint (fig 182, point C). The required lead is at its maximum at midpoint. As the aircraft moves beyond the midpoint on the target course line, the required lead begins to decrease, again due to changing ranges, etc. Therefore, by leading an aerial target by less than the maximum required lead, there will be two points along the target course line where the constant lead will be the correct lead and "fly through" will be achieved. "Fly through" is further explained below.

a. If the gunner is able to track an aircraft and

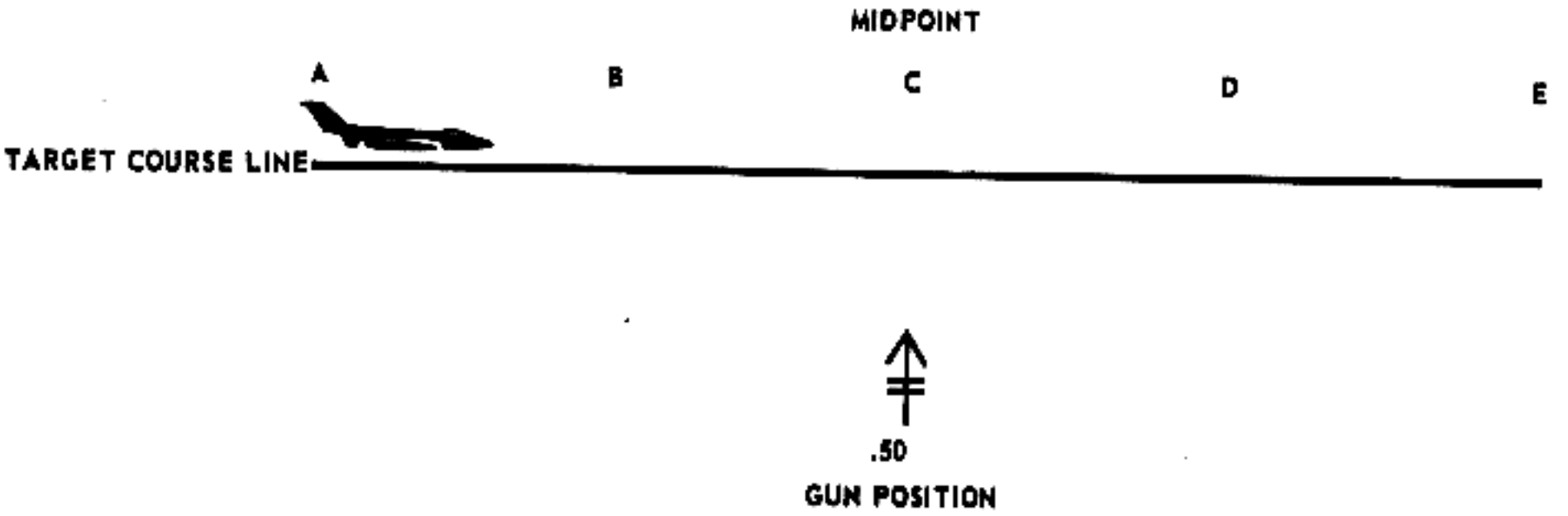


Figure 182. Aerial target engagement.

lead the aircraft with a constant number of leads, there will be two points along the target course line where he will attain hits. As long as the gunner understands this principle, he can bring effective fire on an aircraft.

b. (Refer to fig 182.) Let us assume that the gunner brings continuous fire on the aerial target from Point A through Point E. Point A is the point at which the gunner sights and begins to engage the aerial target. Between Point A and B, the rounds will cross the line of flight in front of the aircraft. At Point B, "fly through" will be achieved. Between Points B and D, the rounds will cross the target course line behind the aircraft. At midpoint, the required lead begins to decrease until, at Point D, "fly through" is achieved for the second time. Between Points D and E, the rounds will again cross the target course line ahead of the aircraft.

c. There are many different types of hostile aircraft (FM 44–80), so, to simplify the matter for the gunner, all aircraft are classified into two types: "high performance" and "low performance." Any aircraft which has an estimated speed of *greater* than 150 knots will be classified as "high performance." Any aircraft which has an estimated speed of *less* than 150 knots will be classified as "low performance."

d. It has been found that for low performance aircraft, the gunner should apply a lead factor of 8 and a lead factor of 7 for high performance aircraft. He should be taught to estimate leads by projecting images of the fuselage in front of the aircraft. In instructing the "fly through" method of aerial target engagement, the student would not be instructed to bring continuous fire from Points A through E, but would be instructed to bring fire at Points A through B and again before Point D through the second "fly through." As the gunner becomes proficient in this "fly through" method, he will learn to adjust his lead and bring longer and more accurate fire on the target.

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