Tank Destroyer School

WEAPONS DEPARTMENT

Camp Hood, Texas

TANK DESTROYER WEAPONS

CHAPTER 11

75-MM GUN, M1897A4,

ON MOTOR CARRIAGE, M3A1

MARCH 1943

TDS 105-11

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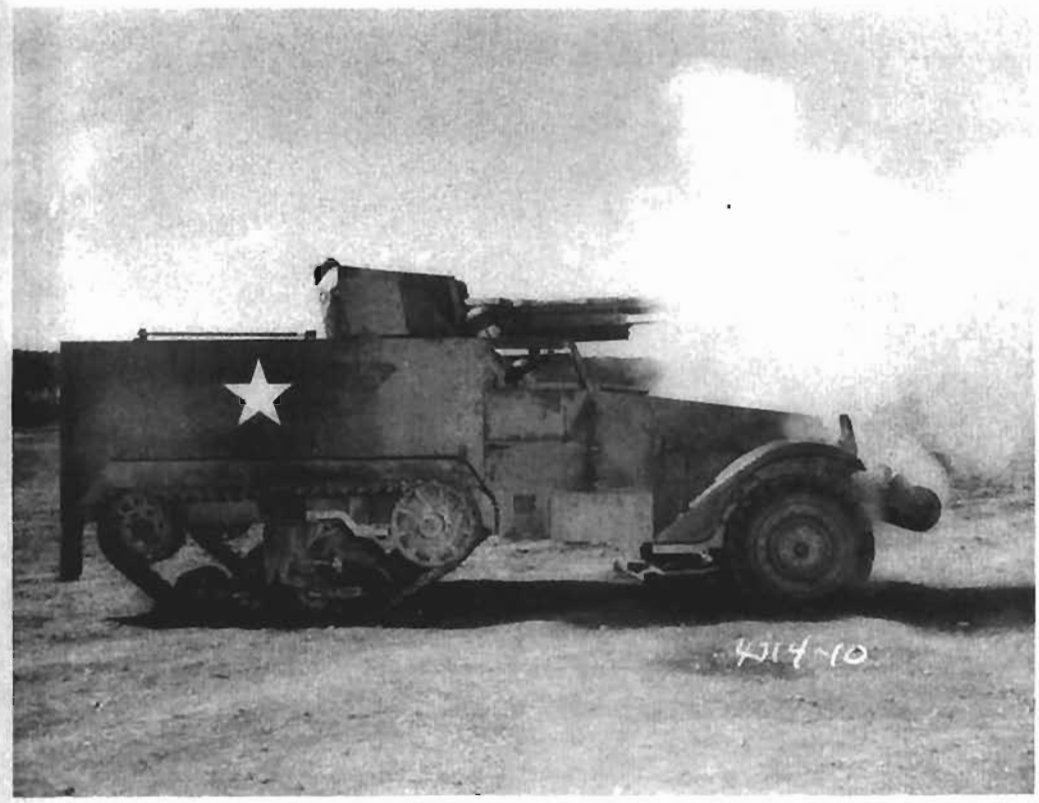
75-MM GUN, 1897A4, ON MOTOR CARRIAGE, M3A1



Backbone of the destroyer companies in a TD battalion is the heavy destroyer. One expedient for a more highly developed model is the 75-mm gun, M1897A4, on the motor carriage, M3A1.

Sacrificing armor for superior visibility and speed, this 10-ton vehicle carries a far greater punch than any tank of comparable weight. It can knock out a tank, displace to a new position and take a second one under fire before hostile artillery can get its range.

Its mobility and fire power insure the heavy destroyer a leading role in the fulfillment of the TD mission: "Seek, strike, destroy." This destroyer--or some lineal descendant embodying improvements in its balanced characteristics--may well blast the tank from the modern battle scene.

Section 1

CHARACTERISTICS AND DESCRIPTION

I. GENERAL

A. 75-mm gun, M1897A4.

1. Single-shot, flat-trajectory weapon.

2. Dependent sighting system; that is, sight moves with tube in elevation and traverse.

3. Rate of fire—12 to 15 aimed shots per minute.

B. Motor carriage, M3A1.

1. Wheel base—135½ inches.

2. Overall length—237½ inches.

3. Overall width—77 7/8 inches.

4. Overall height, less gun—72½ inches.

5. Gross weight—10 tons (approx.).

6. Capacity of crankcase—12 quarts.

7. Capacity of cooling system—26 quarts.

8. Capacity of gasoline tanks—80 gallons.

9. Cruising range without refueling—300 miles (approx.).

10. Bridging limits:
    a. Approach angle—37 degrees.
    b. Departure angle—45 degrees.
    c. Vertical obstacle—12 inches.

11. Minimum turning diameters:
    a. Right—60 feet.
    b. Left—59 feet.

12. Ground clearance--17 1/8 inches.

13. Fording depth (muffler pipe)--32 inches.

14. Climbing ability with 4500-pound towed load:
    a. 25 m.p.h. up 4% slope (4-foot rise in 100 feet).
    b. From standstill up dry 60% slope (60-foot rise in 100 feet--approximately 31 degrees).

II. DETAILED DESCRIPTION OF GUN

A. Barrel assembly (weight 1035 lbs.)

BUILT UP BARREL 75MM GUN

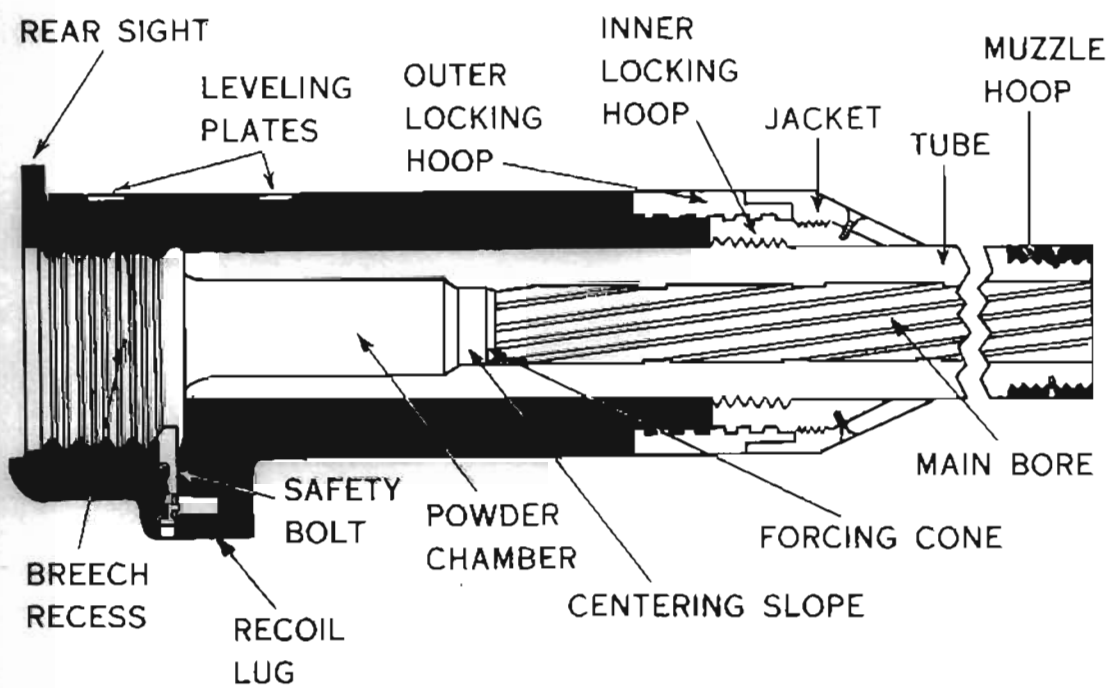


Figure 1

1. Barrel—built-up type (fig. 1).
    a. Tube--extends from forward face of breechblock to muzzle.
    b. Breech hoop--shrunk on tube.
    c. Inner locking hoop--screwed on tube and held in place by four screws.
    d. Outer locking hoop--screwed over inner locking hoop and forward end of breech hoop.
    e. Bronze jacket--screwed over inner locking hoop and held in place by four screws.
    f. Muzzle hoop—screwed over muzzle end of tube and held in place by four screws.

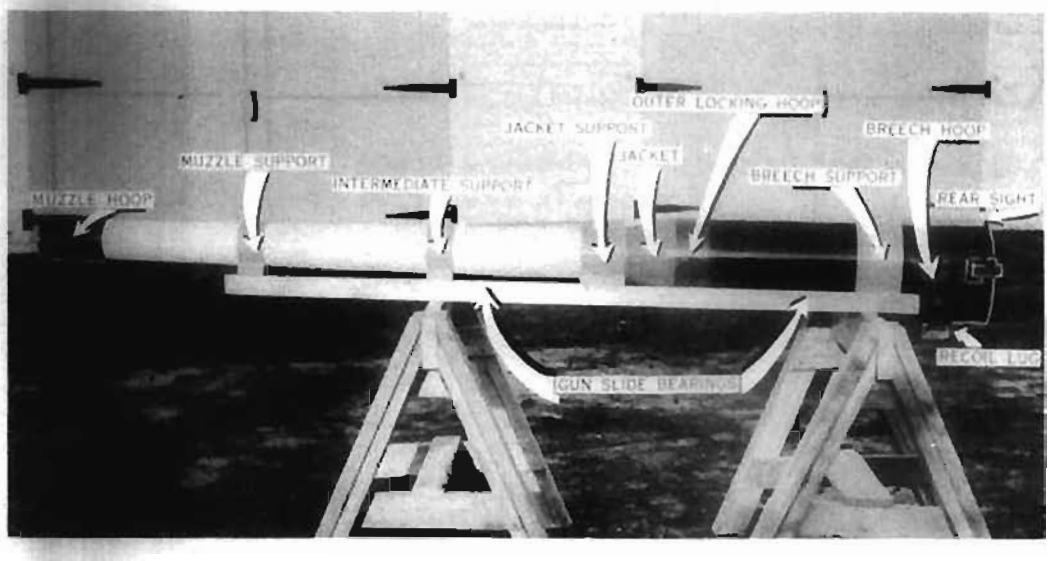


Figure 2

2. Supports--hold gun slide bearings in alinement (fig. 2).
   a. Breech support--pinned to breech hoop in front of recoil lug.
   b. Jacket support--pinned to tube.
   c. Intermediate support--pinned to tube.
   d. Muzzle support.

3. Gun slide bearings--guide gun in recoil and counterrecoil.
   a. Steel rails dovetailed to all supports and pinned rigidly to jacket support only.
      (1) Dovetailed connection permits independent expansion of tube and rails on either side of jacket support.
   b. Bronze strips--provide bearing surface.
      (1) Pinned and riveted to rails.
      (2) Pinned to jacket support through rails.

4. Parts of bore (fig. 1).
   a. Breech recess.
   b. Powder chamber.
   c. Centering slope.
   d. Forcing cone.
   e. Main bore--lands and grooves.

B. Breechblock assembly (weight 60 lbs.).

1. Nordenfeld eccentric screw breechblock.
   a. Eccentric, because axis of breechblock is not in line with axis of bore.
   b. Remains in gun during both loading and firing action. Loading hole in breechblock provides means of breech-loading.

c. Breechblock rotates 156 degrees from open to closed position (fig. 3).

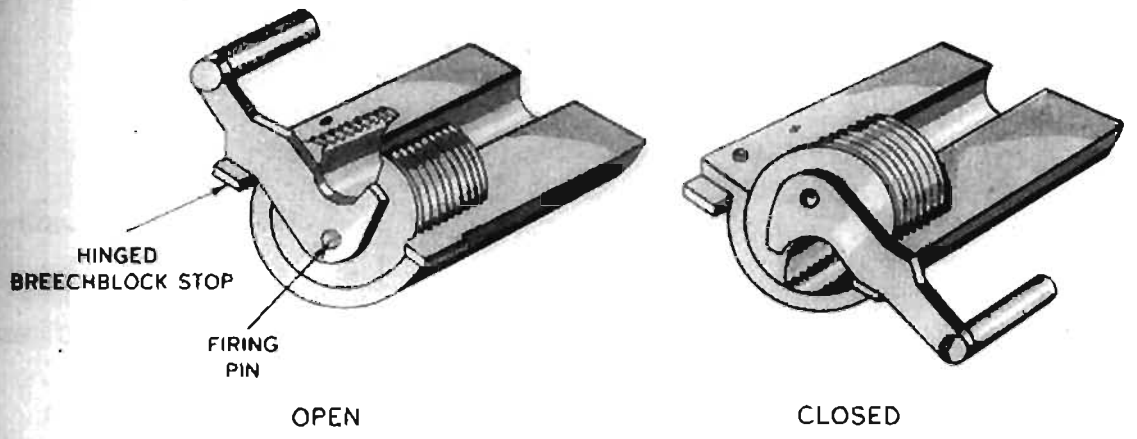


Figure 3

(1) In open position, loading hole is alined with chamber; hinged breechblock stop limits further opening of breechblock.

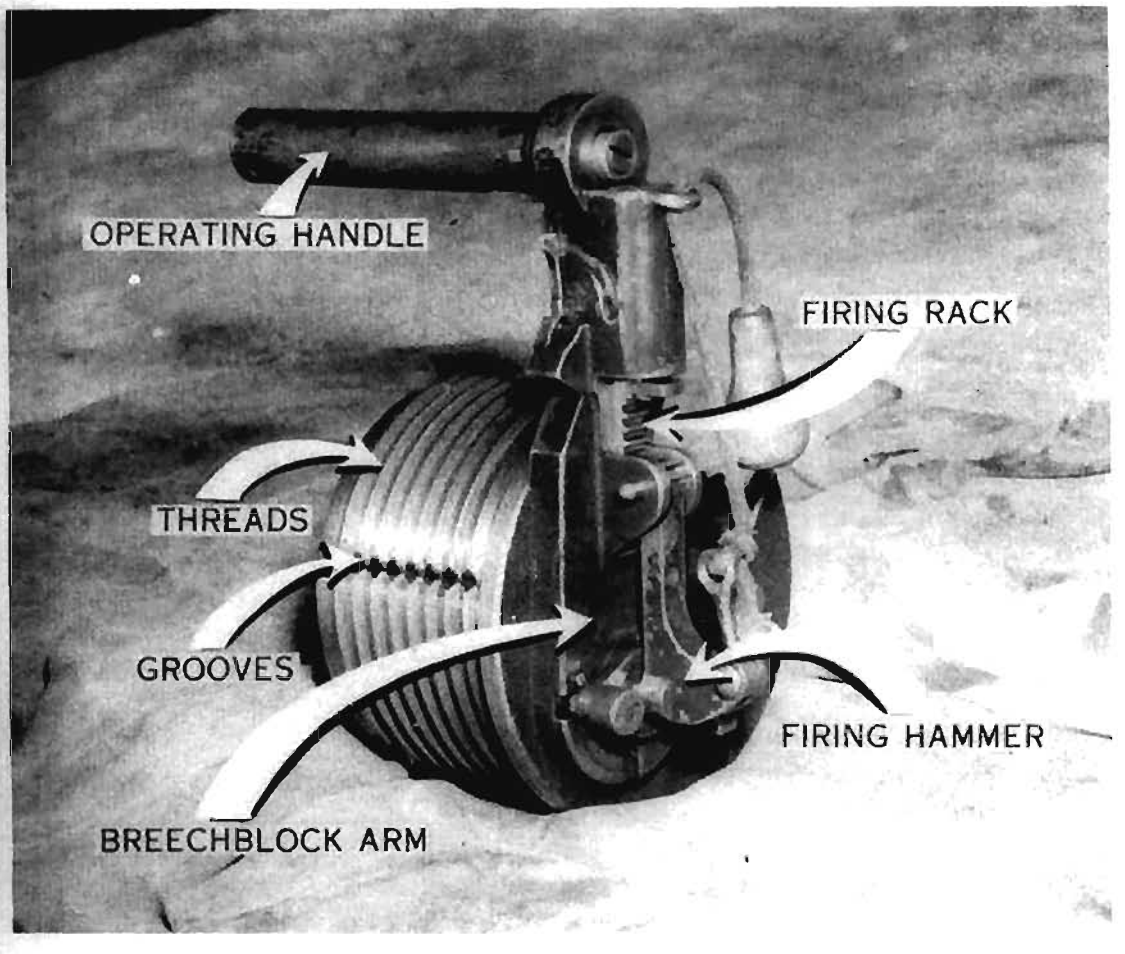


Figure 4

(2) In closed position, firing pin is alined with primer. (A safety feature, since breechblock must be fully closed for gun to be fired.)
(3) When closed, breechblock automatically locks, and remains so until fired or unlocked manually.

2. Breechblock has "buttress" type threads.
   a. Perpendicular side of thread is toward rear face of breechblock, and absorbs shock of firing.
   b. Grooves are cut at right angles to threads to facilitate self-cleaning.

3. Breechblock arm is permanently assembled to rear face of breechblock (fig. 4).
   a. The arm contains lugs in which firing hammer pivots.
   b. It provides a projection which houses firing rack spring.
   c. Operating handle screws into breechblock arm.

C. Elevating and traversing mechanism (fig. 5).

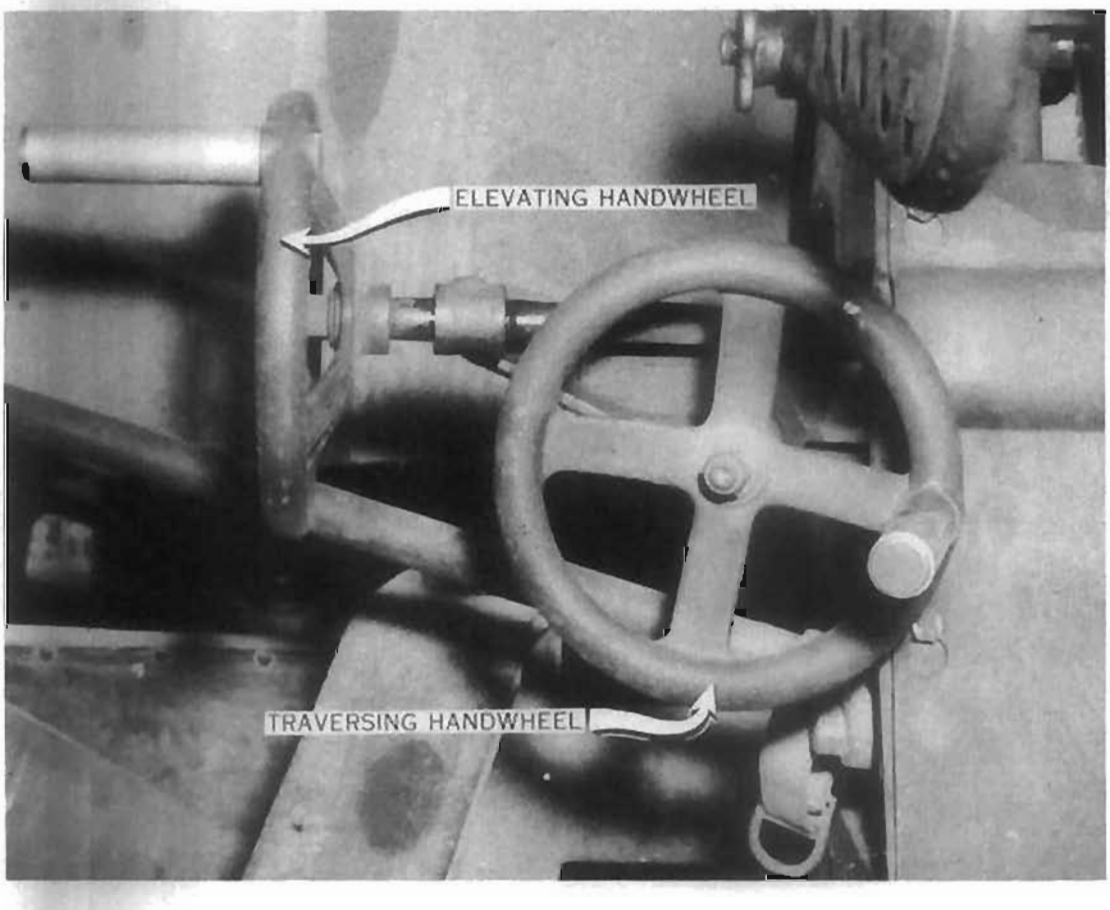


Figure 5

1. Elevating mechanism--operated by handwheels on both left and right side of breech; gear train acts on elevating arc.
   a. Elevation--450 mils.
   b. Depression--140 mils.
   c. One turn of handwheel produces 10 mils change in elevation.

2. Traversing mechanism--operated by handwheel on left side of the breech; gear train acts on traversing rack.
   a. Total traverse--700 mils.
      (1) Right--355 mils.
      (2) Left--345 mils.
   b. One turn of handwheel produces 19 mils traverse.

D. Equilibrator assembly (fig. 6).

1. Neutralizes preponderance of weight toward muzzle end.

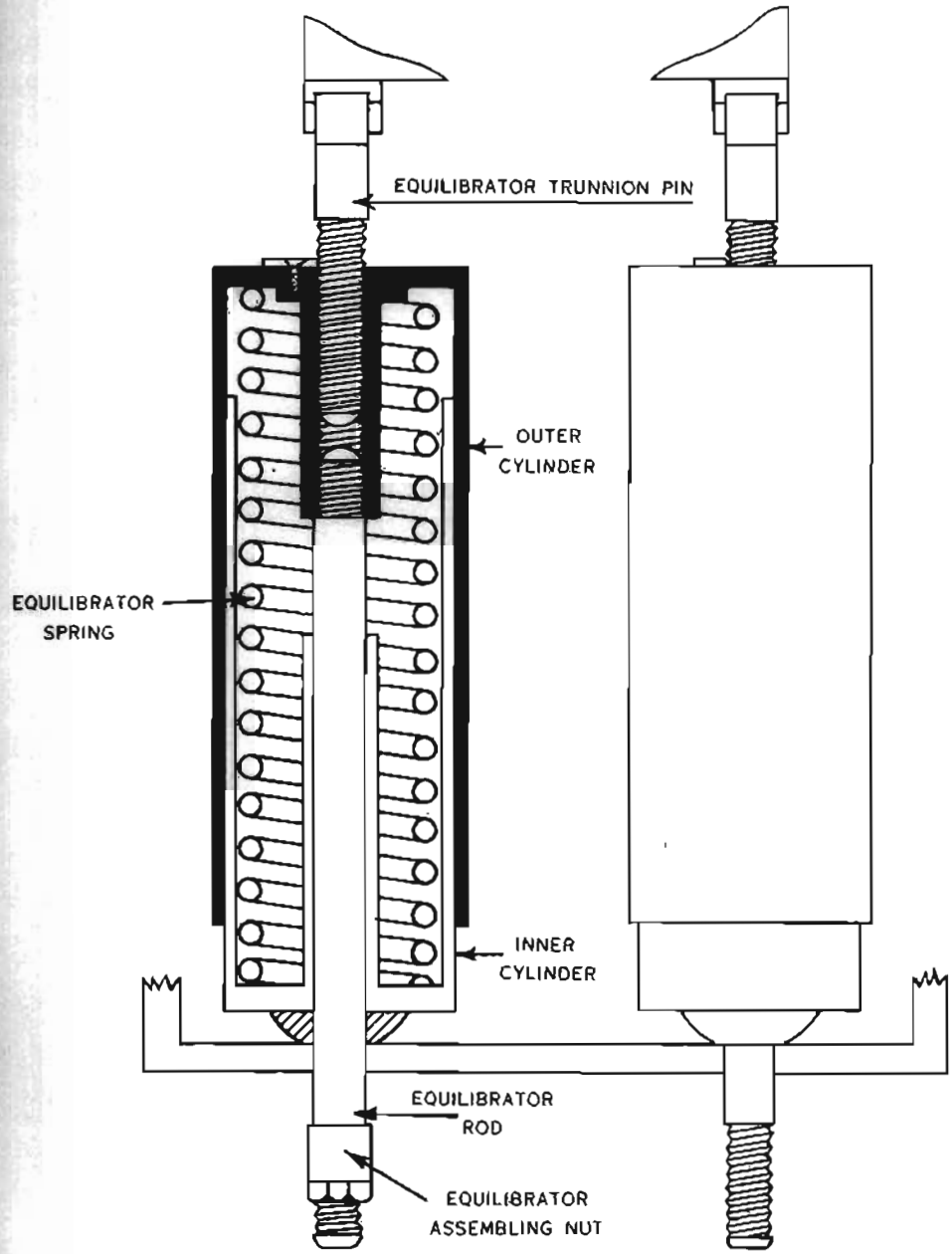


Figure 6

a. Assembly consists of two equilibrators. each in turn being composed of:
   (1) Compression spring--exerts upward force.
   (2) Inner cylinder.
   (3) Outer cylinder.
   (4) Equilibrator trunnion pin--seats in bearings of recoil mechanism holding cradle.
   (5) Equilibrator rod, threaded at both ends.

2. Rests on seats in lower portion of top carriage.

3. Protected by rear cover plate of top carriage.
   CAUTION: Before tube is removed, equilibrator assembling nuts must be installed to keep springs from expanding.

Section 2

DISASSEMBLY AND ASSEMBLY

I. REMOVAL OF BREECHBLOCK FROM GUN

A. Loosen shoulder guard nut and elevate tube so that operating handle will clear shoulder guard bracket. If possible, swing shoulder guard

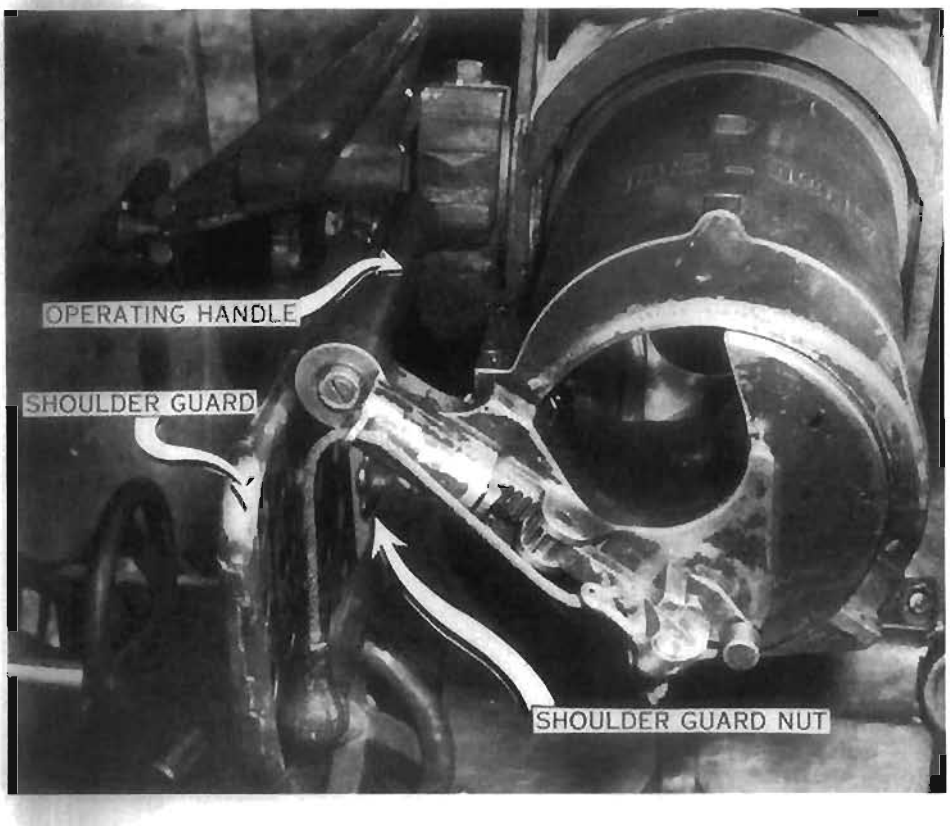


Figure 7

up and out to simplify removal (fig. 7).

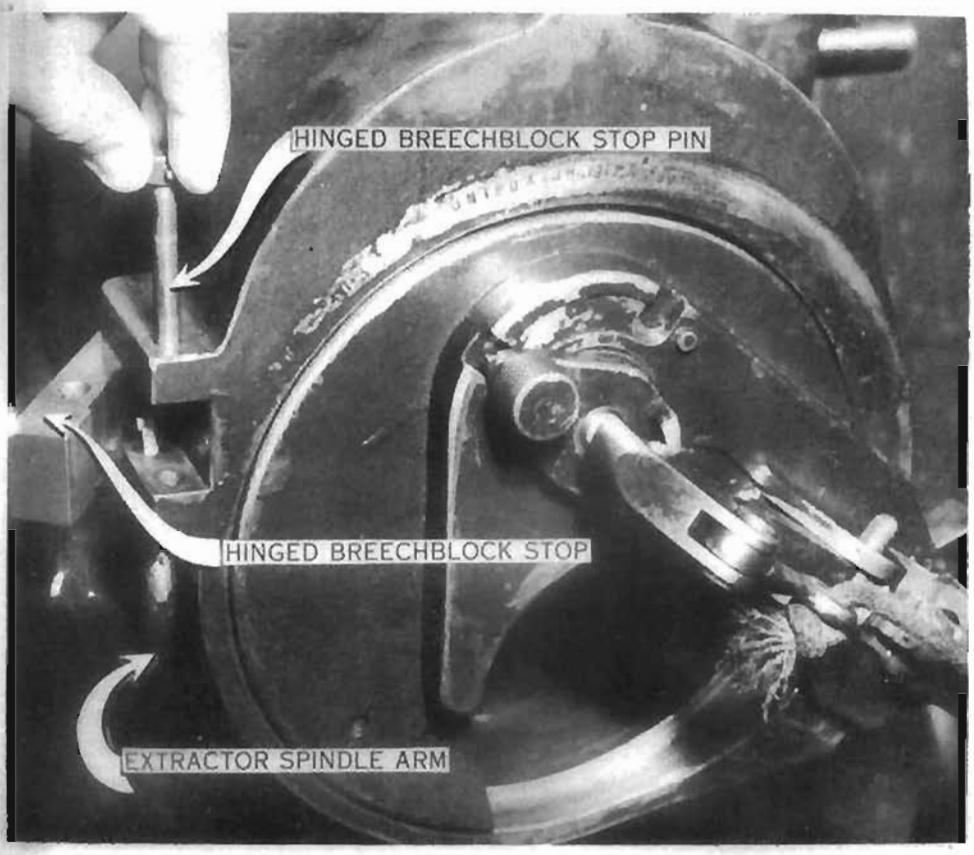


Figure 8

B. Turn and lift breechblock stop pin and swing hinged breechblock stop to left (fig. 8).

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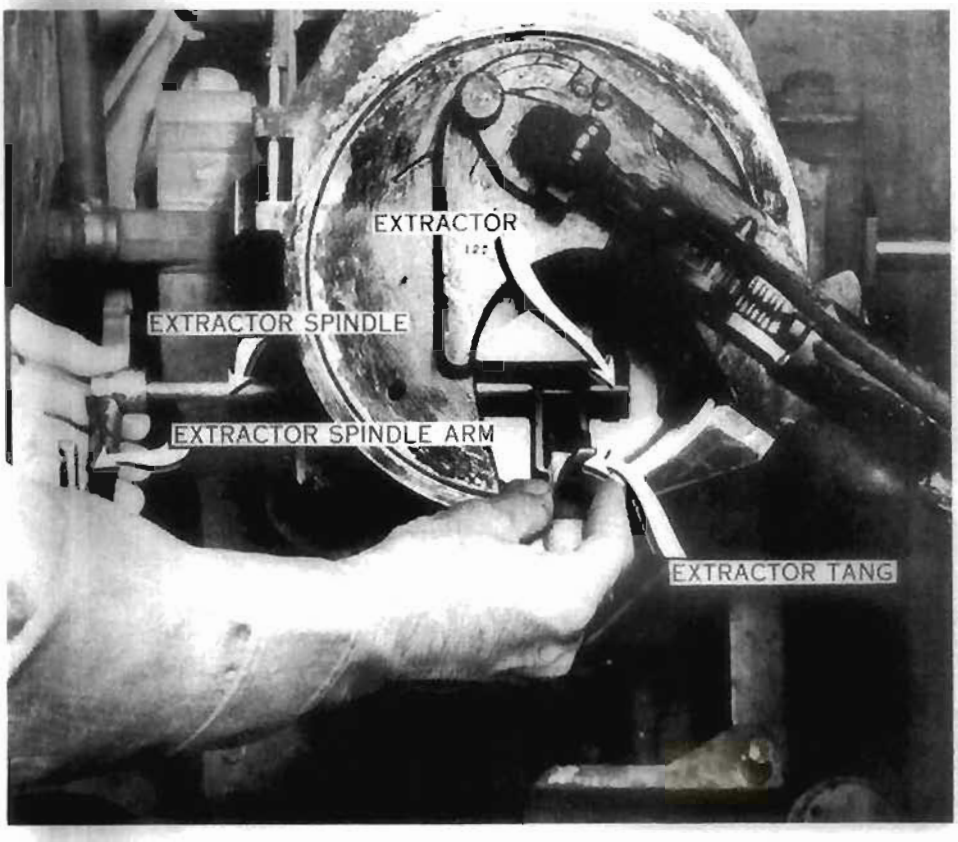


Figure 9

C. Swing extractor spindle down by extractor spindle arm; pull it to the left just far enough to remove extractor tang (fig. 9).

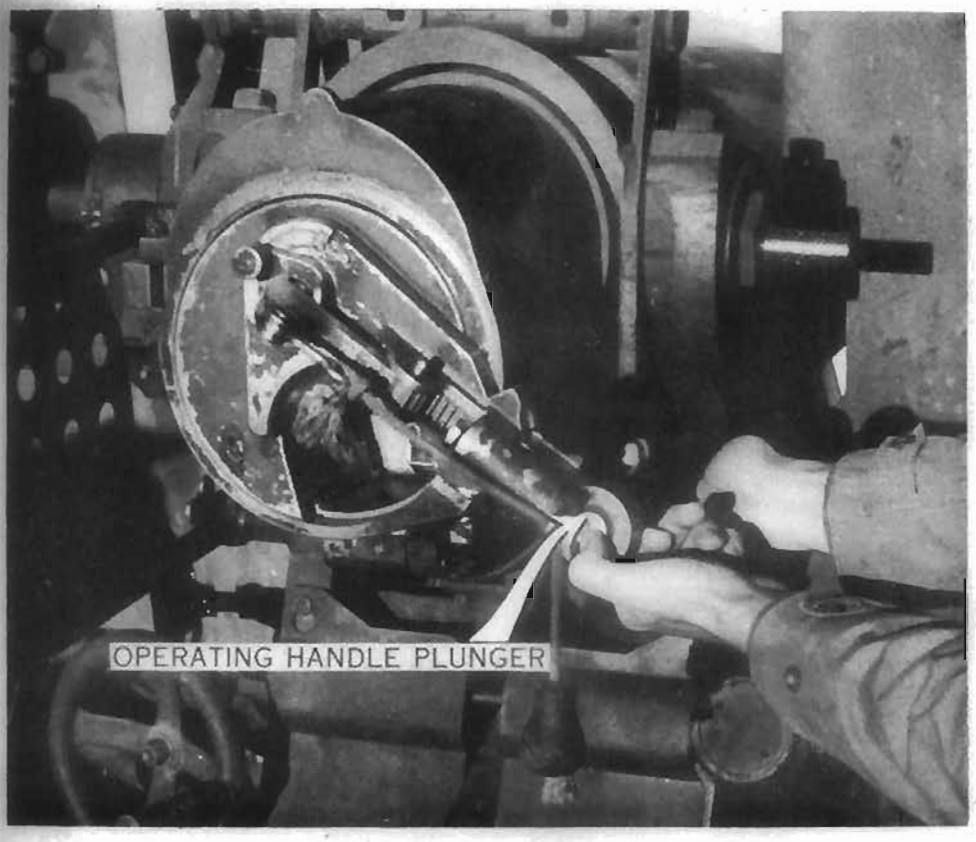


Figure 10

D. Replace extractor spindle. NEVER COMPLETELY REMOVE EXTRACTOR SPINDLE UNTIL BREECHBLOCK IS REMOVED.

E. Unlock breechblock by pushing on operating handle plunger (fig. 10).

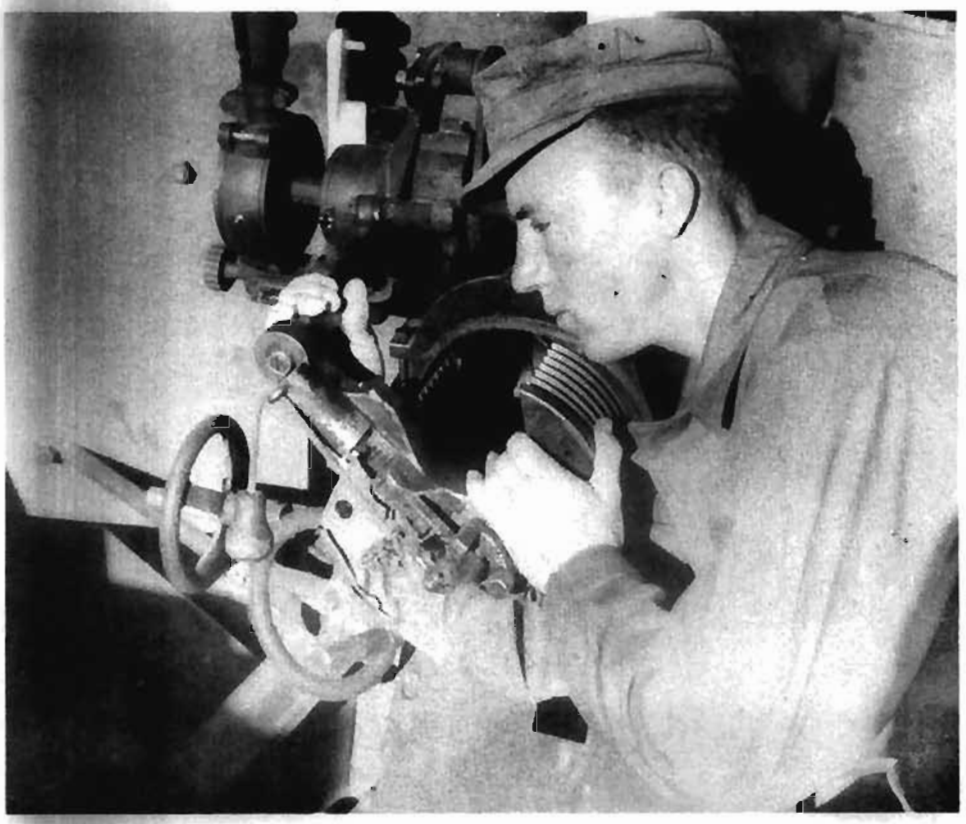


Figure 11

F. Unscrew breechblock; it comes out between sixth and seventh turn. Note: Never use lanyard to unscrew breechblock.

G. Observe correct position for removing breechblock (fig. 11). Support breechblock in crook of right arm, right hand on operating handle, and all supported by left hand in loading hole. This is also the best way to replace it.

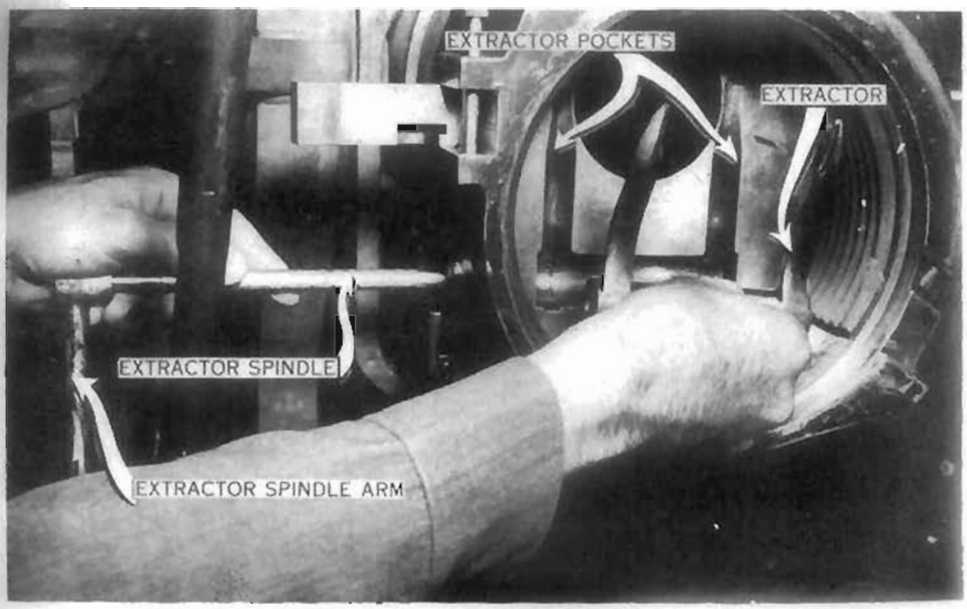


Figure 12

H. Swing extractor spindle down, pull out to the left and remove spindle and extractor (fig. 12).

Figure 13

II. DISASSEMBLY OF BREECHBLOCK

A. Safety piece assembly--with firing hammer pulled back, unscrew and remove safety piece assembly (fig. 13).

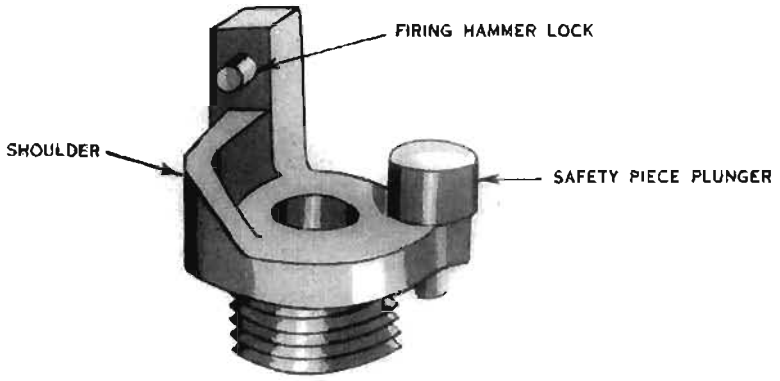


Figure 14

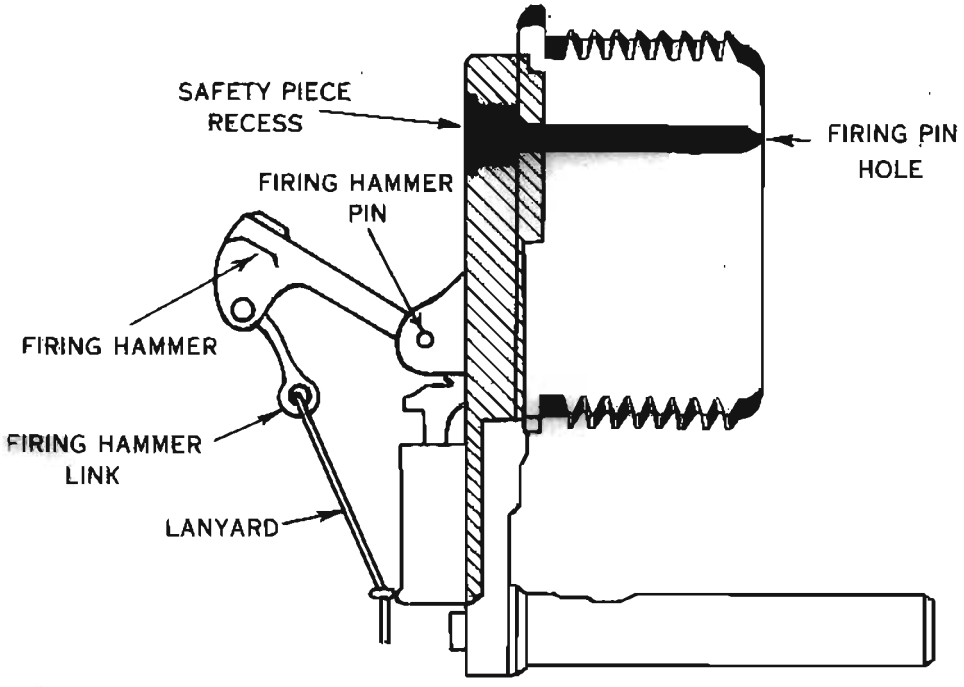


Figure 15

1. Note shoulder upon which firing hammer rides when piece is set on SAFE.

2. Note firing hammer lock, which locks firing hammer (fig. 14).

3. Safety piece assembly fits in a recess in breechblock arm (fig. 15).

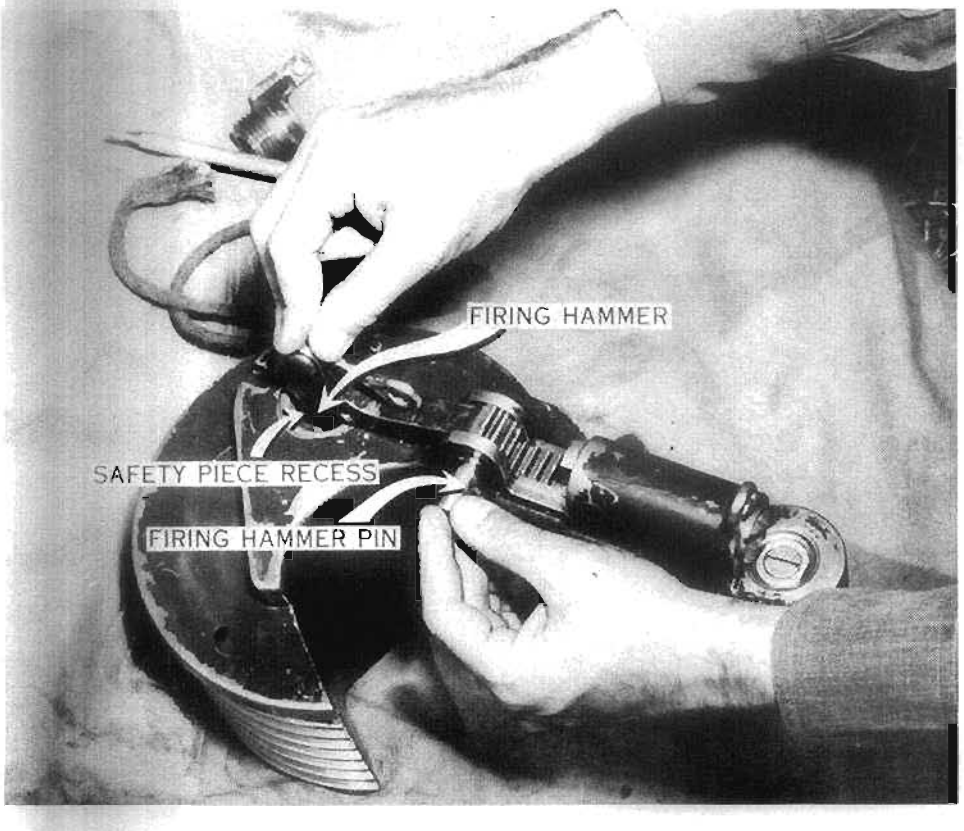


Figure 16

B. Firing pin--with firing hammer pulled back, remove firing pin.

1. This is known as a "floating" type firing pin: no springs are used in its operation.

2. The pin is located in a firing pin hole in breechblock (fig. 15).

C. Firing hammer.

1. Remove lanyard.

2. Press firing hammer into safety piece recess as far as it will go, and remove firing hammer pin (fig. 16).

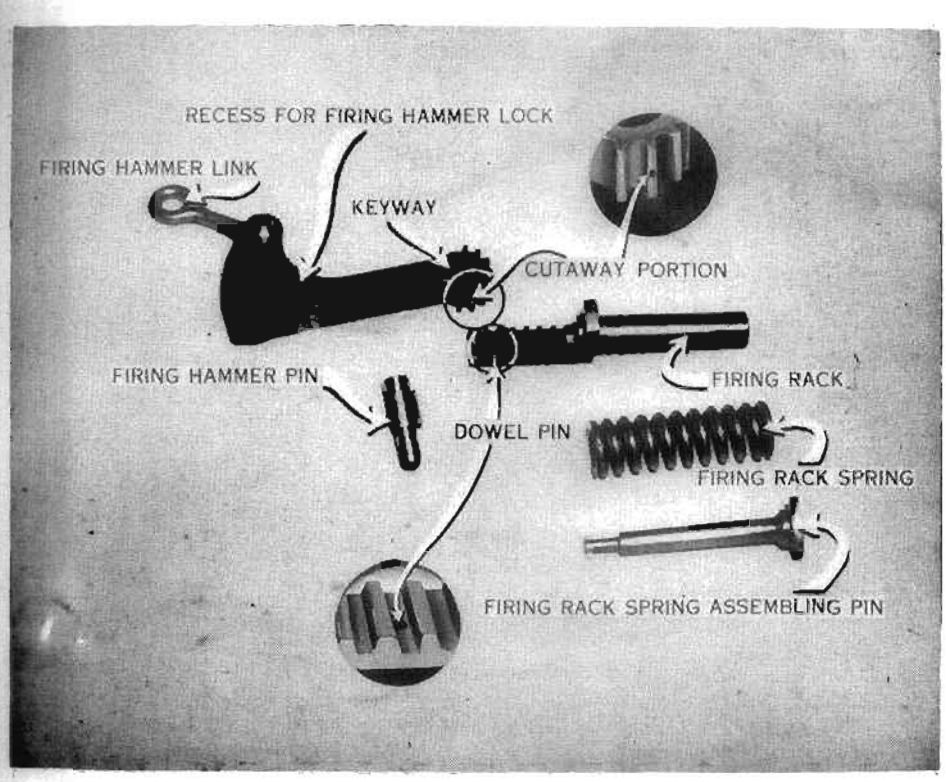


Figure 17

3. Note keyway in pivot end of firing hammer, also small gear. Observe cutaway portion of gear tooth; this is assembled over dowel pin in firing rack.

4. Observe key on firing hammer pin.

5. Firing hammer link--permanent part of firing hammer; if broken, replace entire firing hammer (fig. 17).

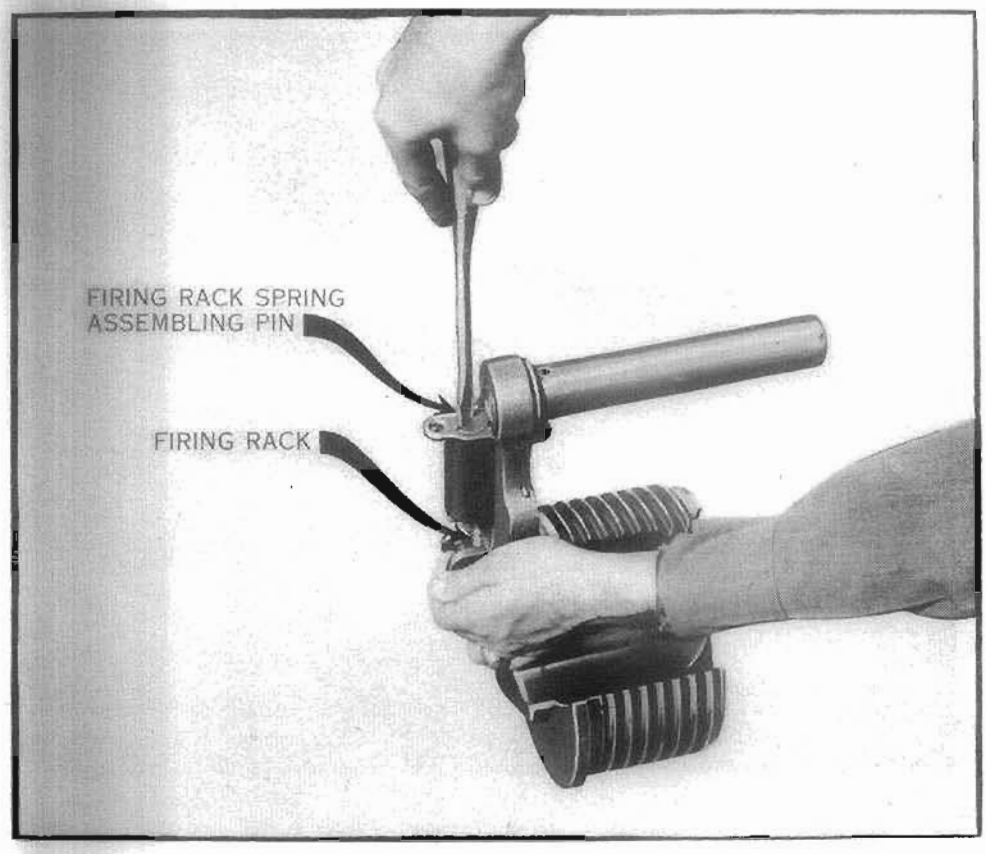


Figure 18

D. Firing rack assembly.

1. Depress operating handle plunger.

2. With screwdriver, push on firing rack spring assembling pin, hold firing rack with one hand and turn it 90 degrees in either direction (fig. 18).

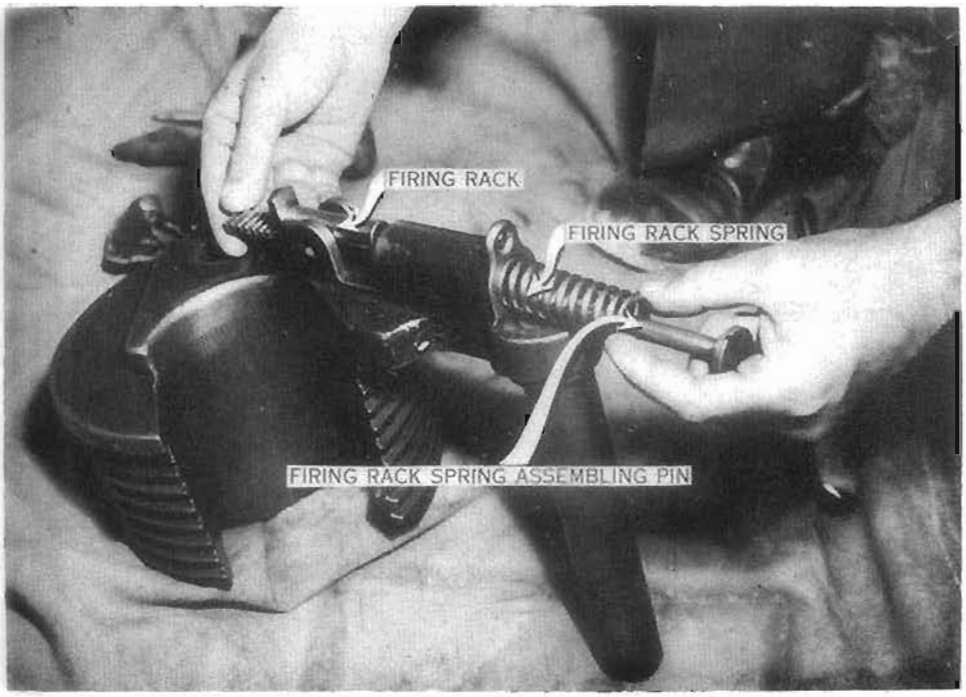


Figure 19

3. Remove firing rack spring assembling pin.

4. Remove firing rack spring (figs. 19 & 20).

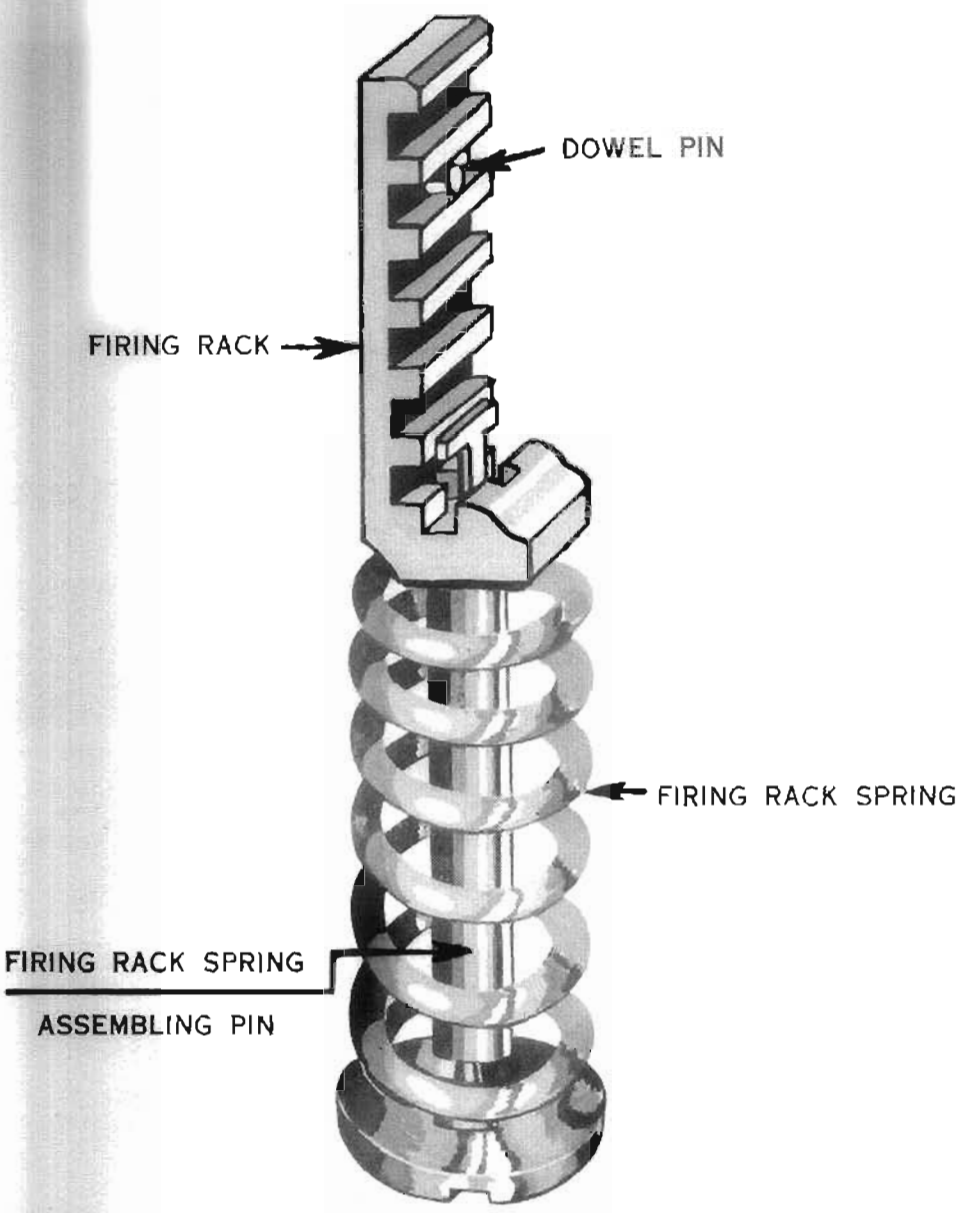

DOWEL PIN
FIRING RACK
FIRING RACK SPRING
FIRING RACK SPRING
ASSEMBLING PIN

Figure 20

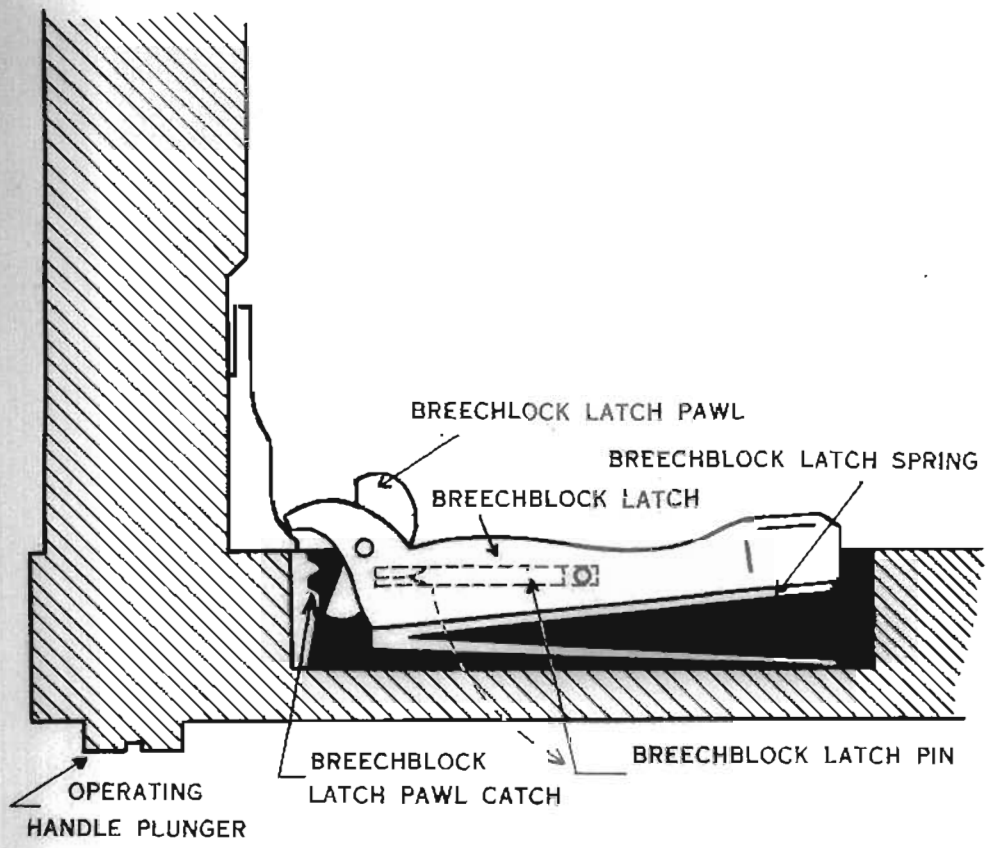


Figure 21

E. Breechblock latch assembly.

1. Trip breechblock latch pawl.
2. Unlock breechblock latch pin by turning 90 degrees, and remove.
3. Remove breechblock latch and pawl.
4. Remove breechblock latch spring (fig. 21).

Figure 22

F. Operating handle plunger assembly.

1. Unscrew operating handle plunger screw; remove (fig. 22).

Figure 23

2. Remove operating handle plunger block--observe projections on plunger block.

3. Remove operating handle plunger.
   a. Heavy mass of metal, essential to automatic action of breechblock when gun is fired.
   b. Being of comparatively soft metal, operating handle plunger threads will wear. DO NOT DISASSEMBLE MORE THAN IS ABSOLUTELY NECESSARY.

G. Operating handle plug and cushion.

1. Operating handle plug is locked into end of operating handle by locking screw. (Never disassembled except for replacement.)

2. Operating handle cushion--small fiber disk which prevents operating handle plunger from striking operating handle plug in recoil of gun (fig. 23).

3. Operating handle houses pawl catch inside junction of operating handle and breechblock arm.

III. ASSEMBLY OF BREECHBLOCK

A. To assemble breechblock, reverse procedure of disassembly.

B. Replace breechblock latch spring with open end toward breechblock; insert breechblock latch and pawl (be sure pawl goes under pawl catch), and lock into position with breechblock latch pin.

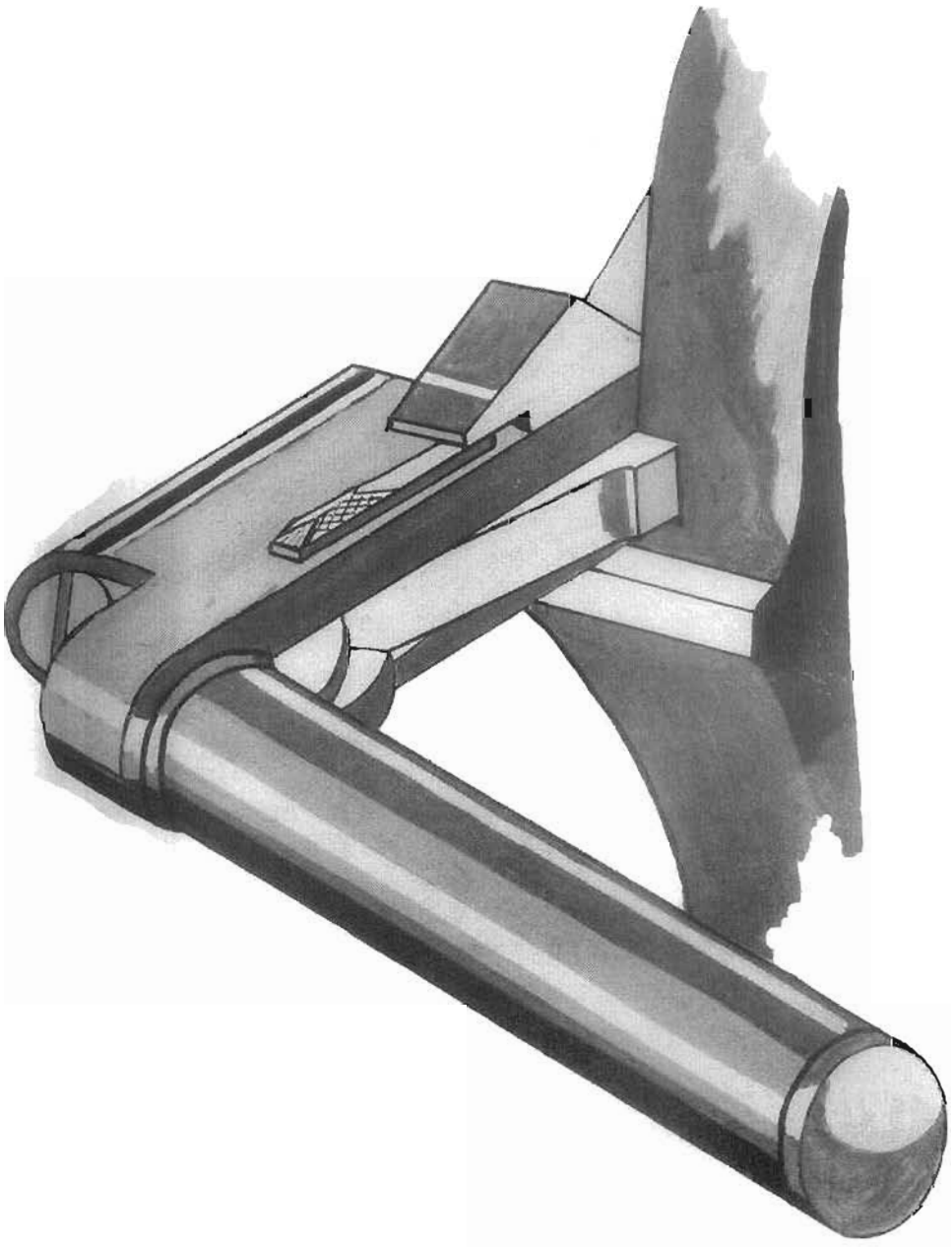


Figure 24

Section 3

FUNCTIONING

I. BREECHBLOCK

A. When the breechblock is closed, it is automatically locked by heel of breechblock latch engaging in latch catch on breech hoop (fig. 24).

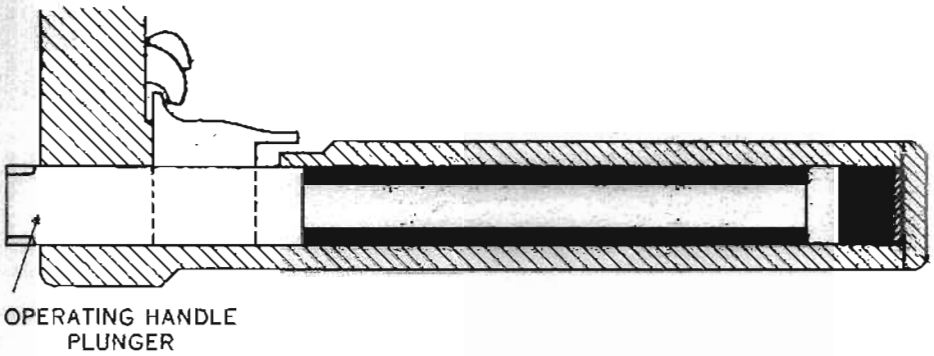


Figure 25

B. Breechblock will remain locked until gun is fired or operating handle is pushed forward (fig. 25).

1. It is necessary to unlock breechblock manually for loading first round only.

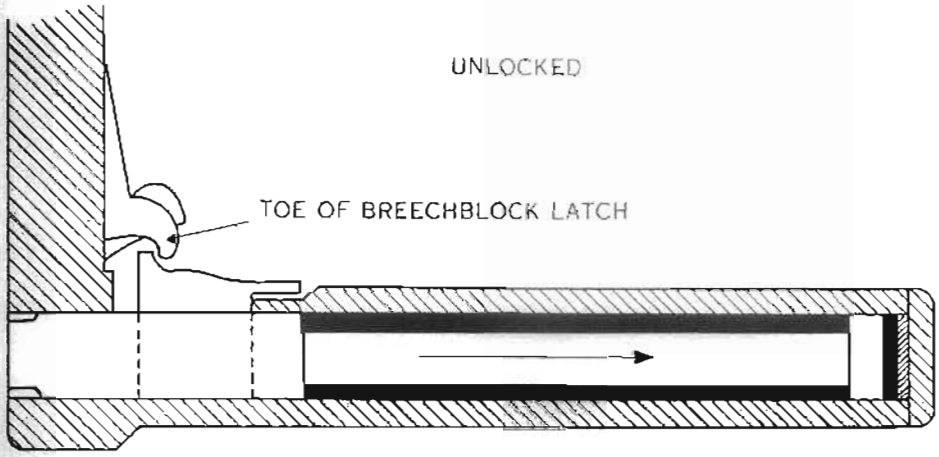


Figure 26

2. Recoil of gun unlocks gun for subsequent rounds.
   a. When gun is fired, breechblock and operating handle move to rear. Operating handle plunger, which is heavy and is free to ride in operating handle for about ¼-inch, remains momentarily stationary during first instant of recoil (fig. 26).

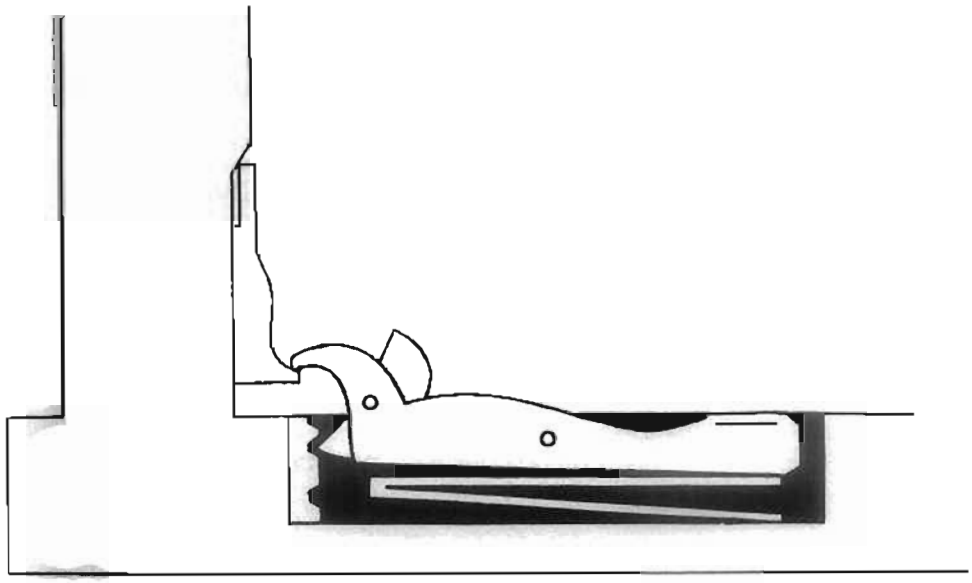


Figure 27

b. As gun recoils, operating handle moves to rear over operating handle plunger. This movement causes toe of breechblock latch and pawl to ride up on the small projection of operating handle plunger block (fig. 27).

Note: With heel of breechblock latch held down by pawl, we then have heel of latch disengaged from latch catch, and breechblock is free to open. (The action described is in effect the same as obtained when pressing in on operating handle plunger to open breechblock manually.)

c. As breechblock is opened, pawl rides over rear sight and is tripped (fig. 28).

d. Compression of latch spring forces heel of breechblock latch out; this heel, being released, will engage latch catch again as soon as breechblock is closed.

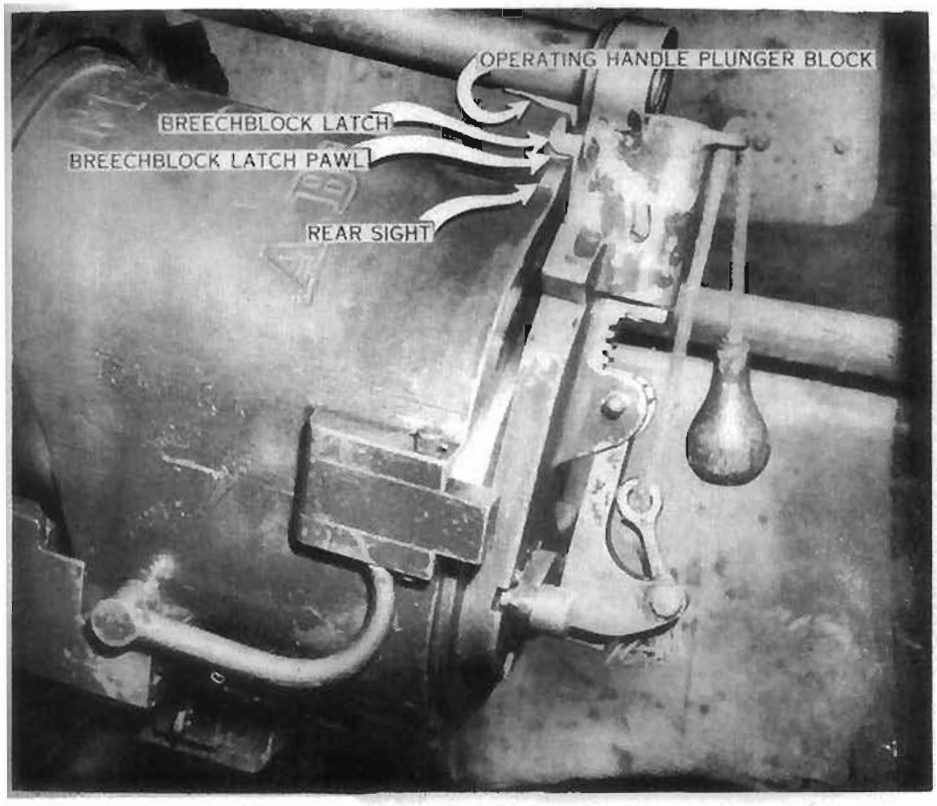


Figure 28

II. FIRING PIN

A. Firing pin moves back and forth in firing pin hole. Forward movement of firing pin is limited by shoulder striking the breechblock; rearward movement by shoulder striking safety piece.

B. Blunt end of firing pin rides over left arm of extractor in opening and closing of breechblock; this cams firing pin back into firing pin hole.
CAUTION: Never sharpen blunt end of firing pin.

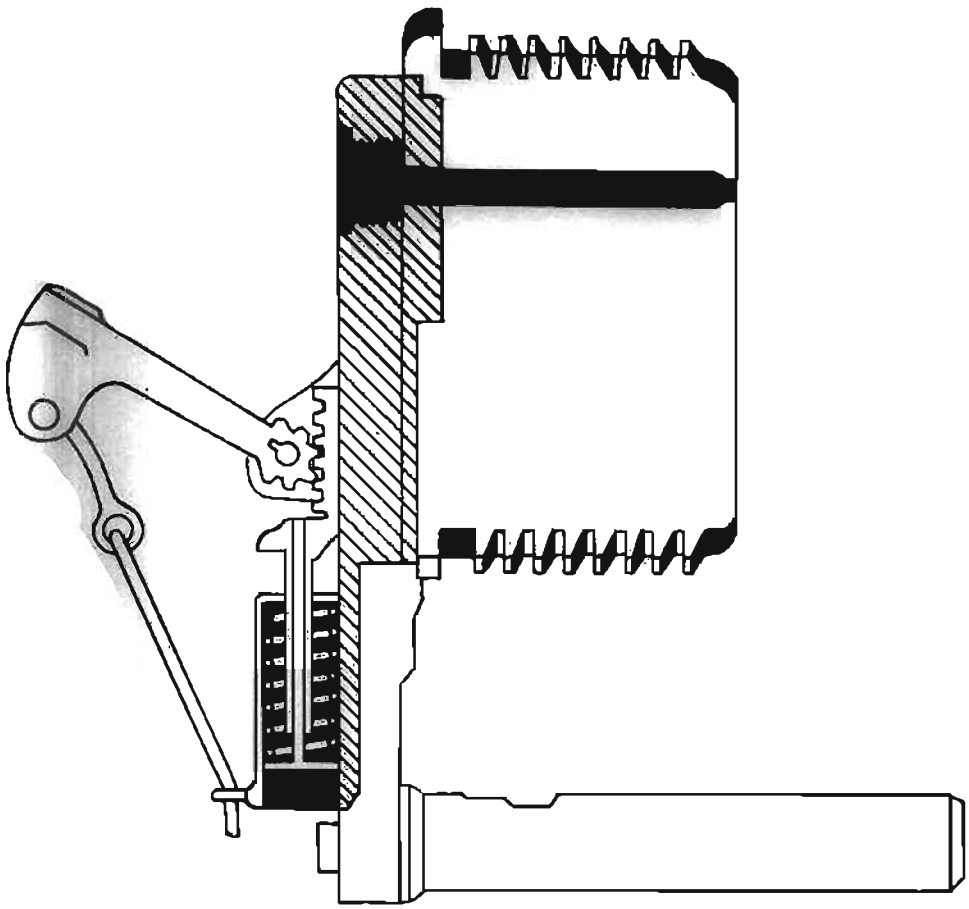


Figure 29

III. FIRING RACK SPRING

A. Furnishes force to firing hammer, which strikes firing pin and explodes primer.

B. With lanyard pulled back, firing rack spring is compressed (fig. 29).

C. When lanyard is released, sudden expansion of this spring drives firing hammer against firing pin and causes gun to be fired.

Section 4

RECOIL MECHANISM

I. GENERAL

A. Puteaux brake, referred to as "hydro-pneumatic constant recoil with floating piston."

B. Maximum length of recoil is 45 inches.

C. Composition (fig. 30).

RECOIL MECHANISM OF 75MM GUN

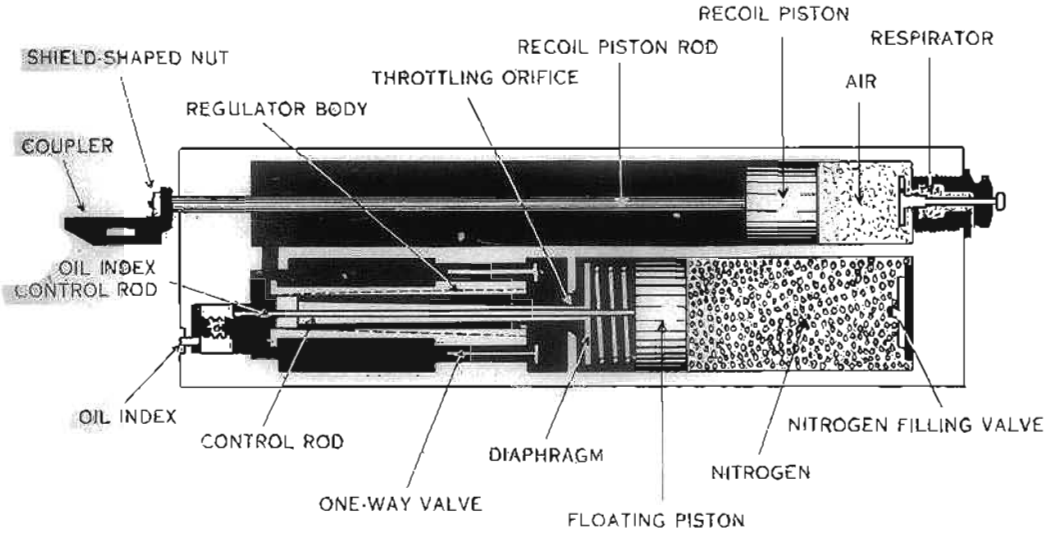


Figure 30

1. Recoil cylinder, containing:
   a. Recoil piston--movable air- and oil-tight seal.
   b. Recoil piston rod--coupled to barrel assembly.
   c. Respirator--on front head of recoil cylinder.
   d. Recoil cylinder rear head (stuffing box)--prevents leakage of oil as recoil piston rod moves in and out of cylinder.

2. Counterrecoil cylinder, or recuperator, containing:
   a. Floating piston—movable oil- and gas-tight seal.
   b. Regulator body--immovable; its main elements are the one-way valves, throttling orifice and tapered grooves.
   c. Diaphragm--separates floating piston and regulator body. A spring between diaphragm and floating piston causes diaphragm to bear against regulator body when gun is in battery.
   d. Control rod--attached to diaphragm; it is characterized by tapered shape and piston-like head.
   e. Counterrecoil cylinder front head--delicately constructed

COUPLER BODY & KEY

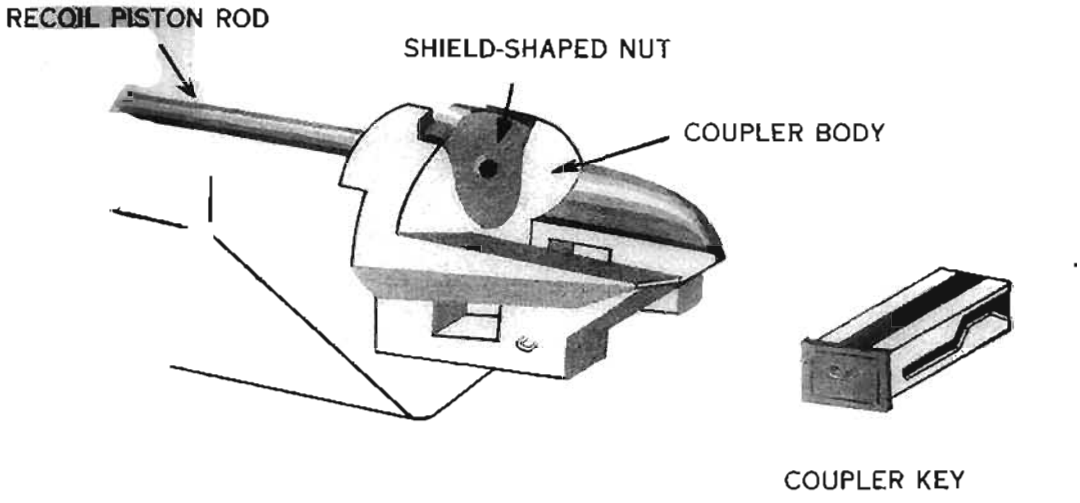


Figure 31

one-way valve which permits passage of gas in only one direction, and then only if under high pressure.

f. Oil index assembly—see II A below.

3. Piston rod coupler assembly (fig. 31), consisting of:
   a. Coupler body—permits flexible connection between piston rod and barrel assembly.
   b. Shield-shaped nut--threaded on piston rod and collared by coupler body.
   c. Coupler key—locks coupler body to recoil lug of tube.
   d. Recoil lug—attached to breech hoop.

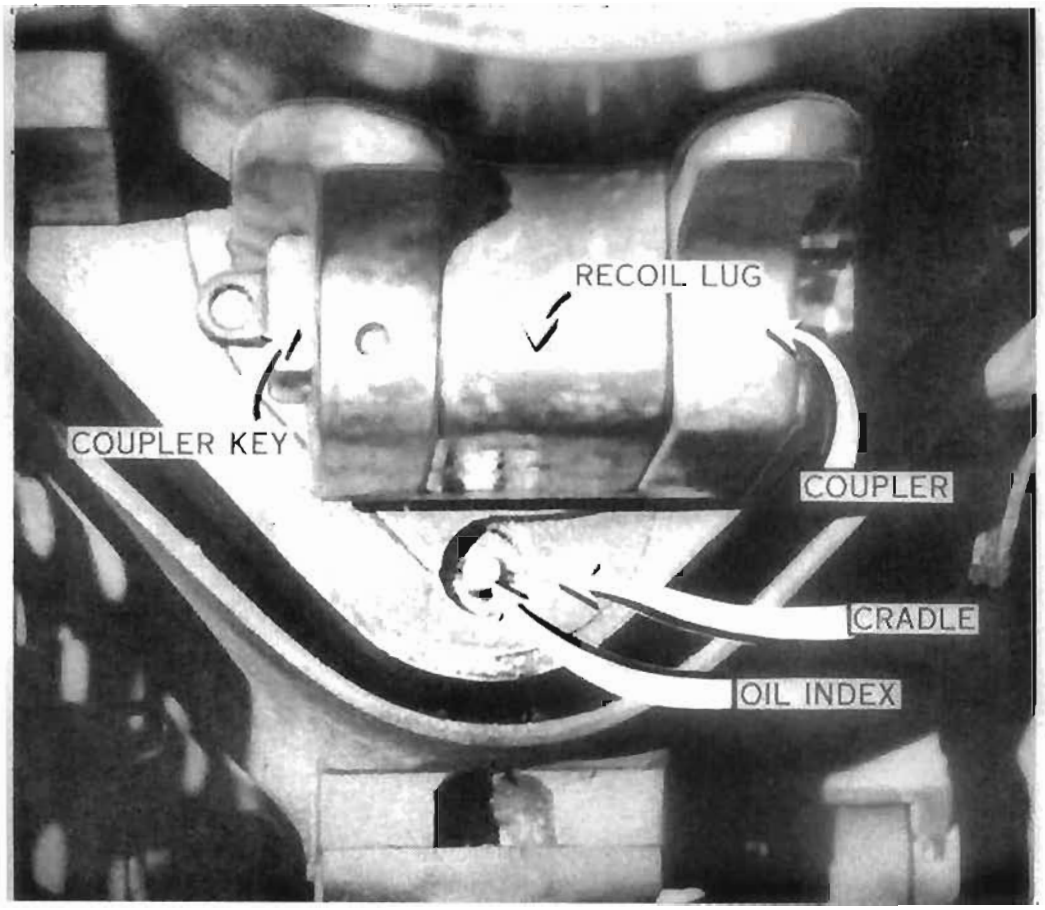


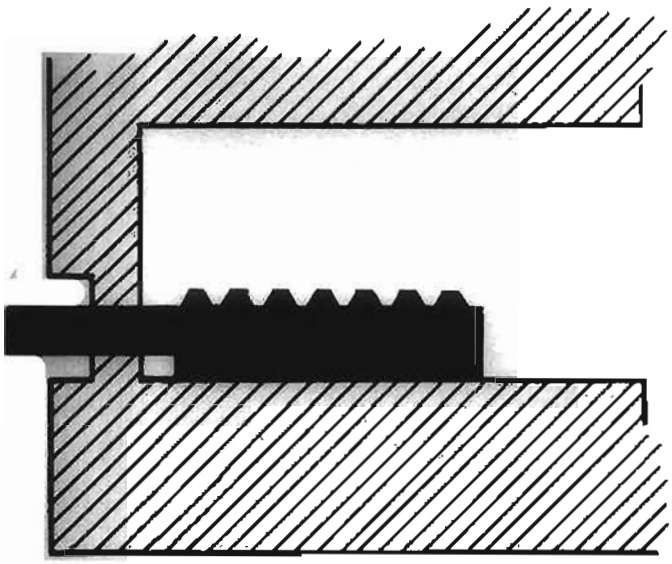
Figure 32

II. INDICES OF RECOIL SYSTEM

A. Oil index (fig. 32).

1. Located at rear end of cradle, in recess at bottom center of cradle. Position of index is controlled by amount of reserve oil in system.

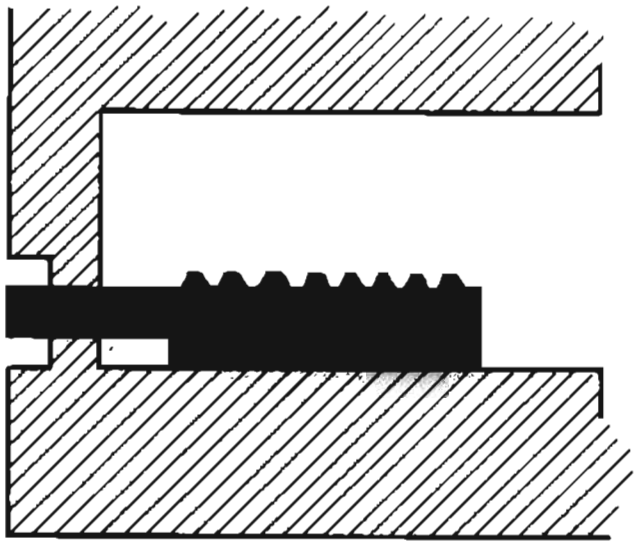
2. Reserve oil is contained between floating piston and diaphragm: its main purpose is to maintain the column of oil under pressure throughout entire system, thereby holding gun in battery.



POSITION OF OIL INDEX SHOWING EXCESS RESERVE

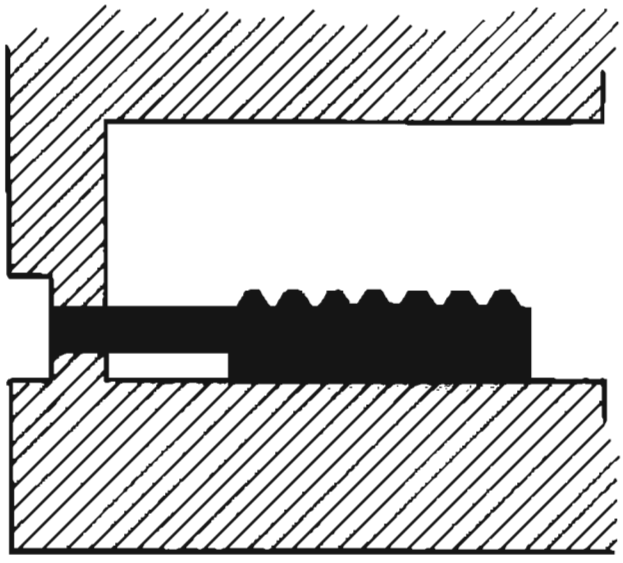
Figure 33

3. There are three essential positions of oil index in respect to rear sealing plate of counterrecoil cylinder:
   a. Protruding beyond rear sealing plate indicates <u>excess reserve</u>: this condition will tend to cause gun to slam into battery in counterrecoil (fig. 33).



POSITION OF OIL INDEX SHOWING FULL RESERVE

Figure 34



POSITION OF OIL INDEX SHOWING LOW RESERVE

Figure 35

b. Flush with rear sealing plate indicates full reserve; this is proper position for firing and travel (fig. 34).
c. Receding into recess indicates low reserve; gun must not be fired or allowed to travel in this condition (fig. 35).

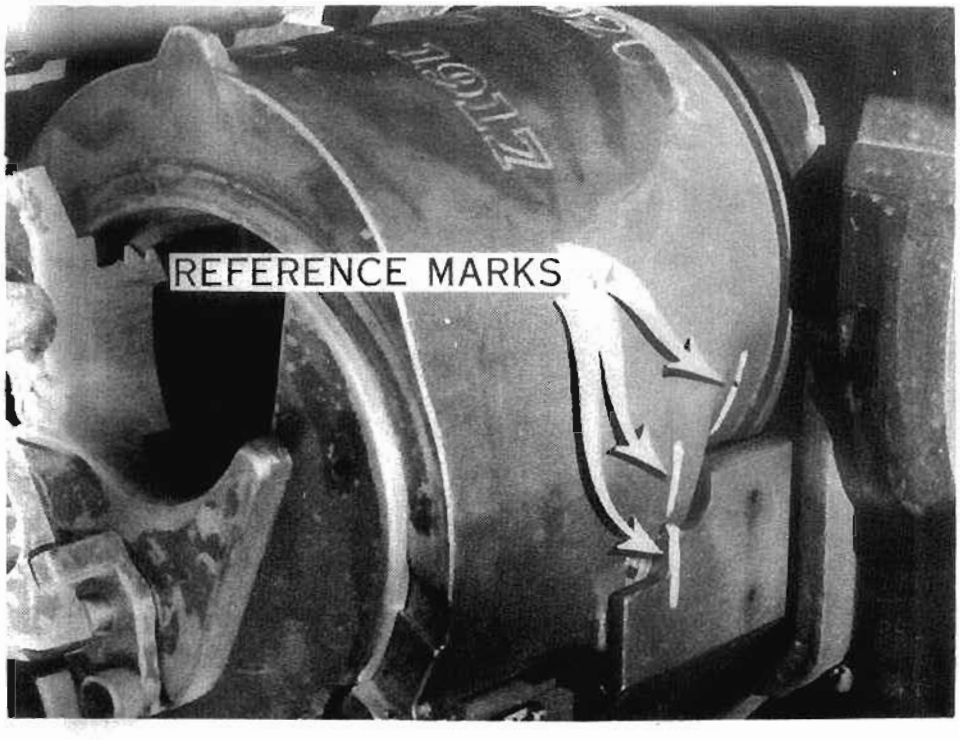


Figure 36

B. Reference marks (fig. 36).

1. Two red lines approximately four inches apart, located on right side of breech hoop; single red line on cradle.

2. When gun is in battery, single red line on cradle will point to space between the two lines on tube. When this condition exists, gun is safe to fire.

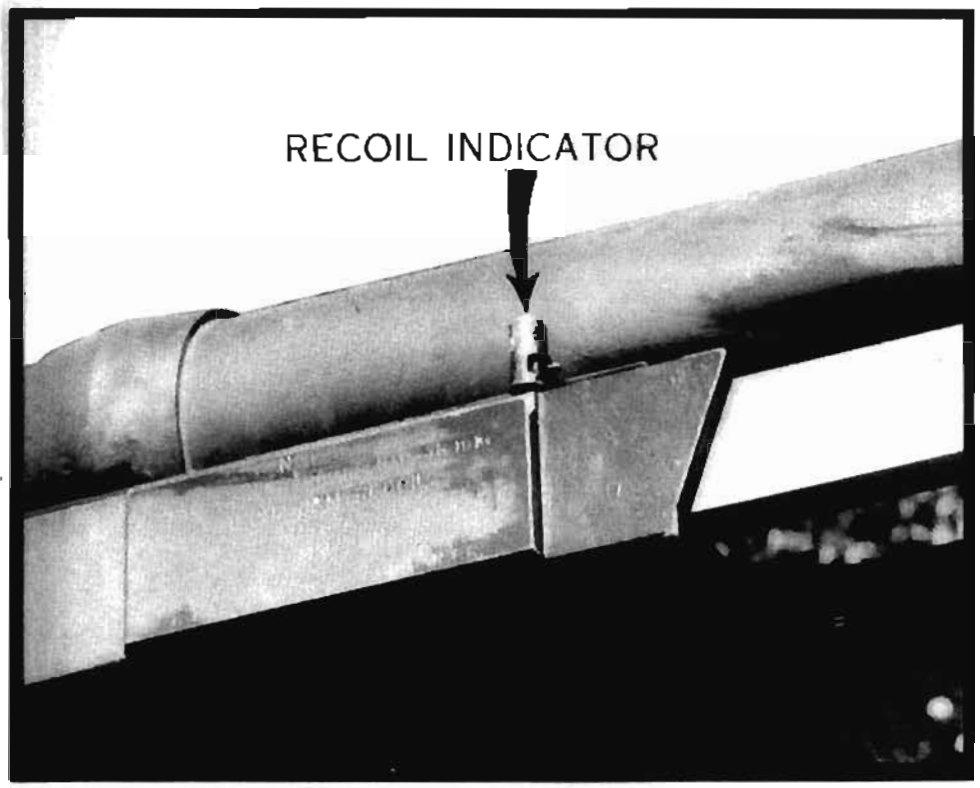


Figure 37

C. Recoil indicator (fig. 37).

1. Located on right side of gun slide bearings about seven inches forward from intermediate support.

2. Use of indicator:
   a. Cover top of cradle with grease or chalk.
   b. Release plunger of indicator.
   c. After piece has been fired, measurement of mark made in grease or chalk will indicate length of recoil.

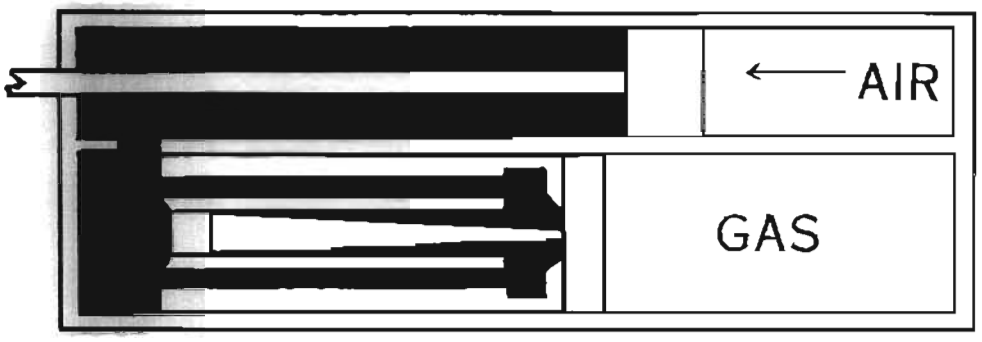


Figure 38

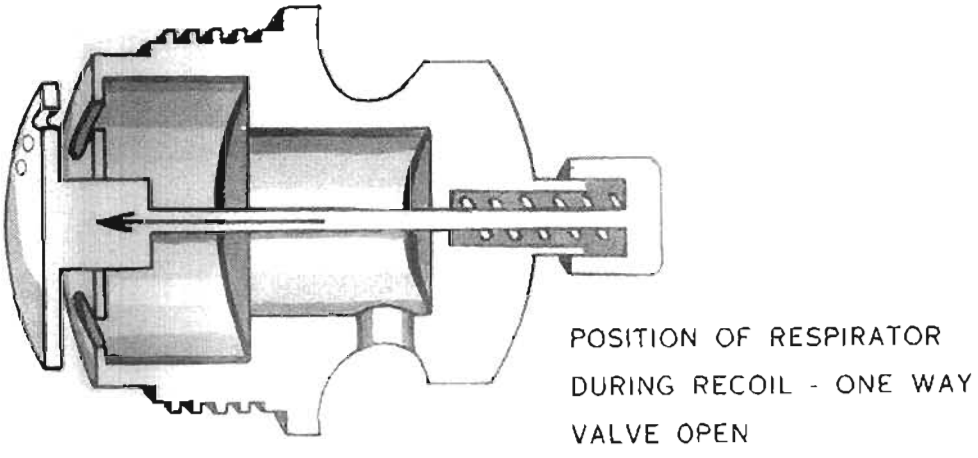


Figure 39

III. FUNCTIONING OF RECOIL SYSTEM

A. During recoil.

1. When gun is fired, recoil piston is pulled to rear, forcing oil through connecting port and into counterrecoil cylinder (fig. 38).

2. Suction created by this rearward motion causes one-way valve of respirator to open, and air is sucked through it into recoil cylinder (fig. 39).

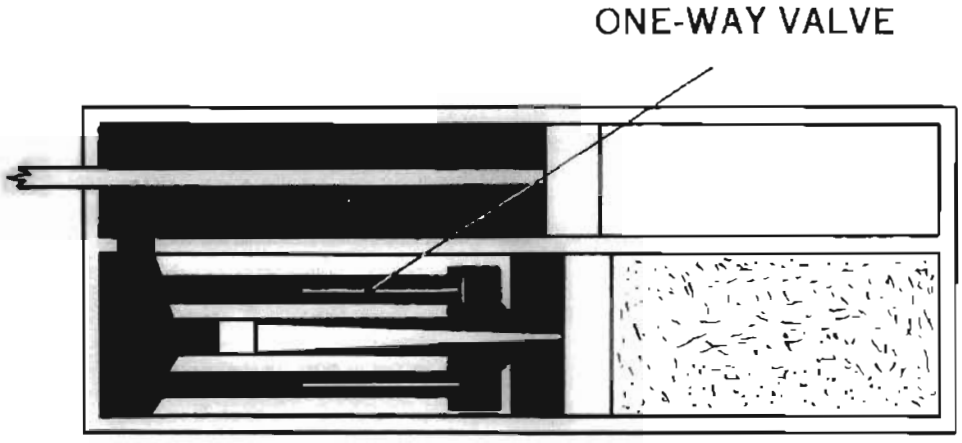


Figure 40

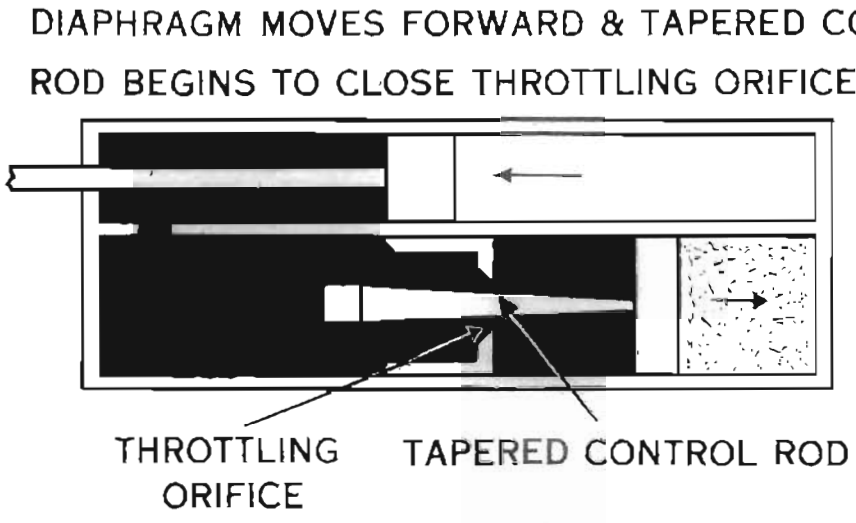


Figure 41

3. Recoil piston continues moving to rear, and oil is forced into regulator body; oil contacts and forces open one-way valves of regulator (fig. 40).

4. After passing through one-way valves, oil flows through throttling orifice and presses against diaphragm; diaphragm, in conjunction with floating piston, moves forward (fig. 41).

5. As diaphragm moves forward, it draws with it the tapered control rod, which gradually closes the throttling orifice as it is pulled forward. When control rod cuts off all flow of oil through throttling orifice, gun is in "full recoil."

DIAPHRAGM MOVES TO REAR - TAPERED CONTROL ROD GRADUALLY CLOSES TAPERED GROOVES

Figure 42

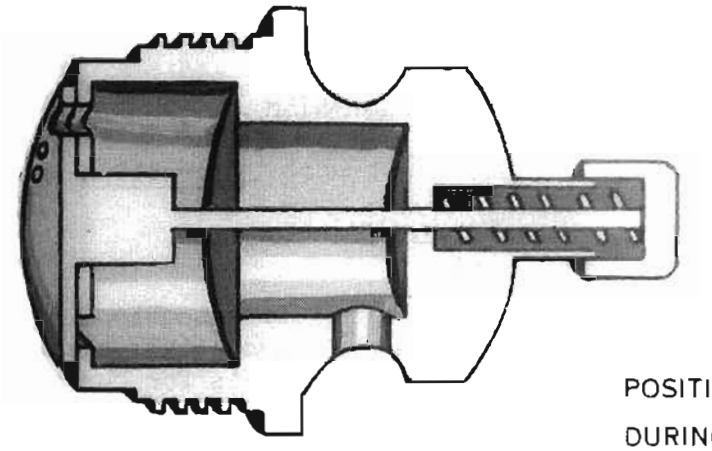
B. During counterrecoil.

1. When moving parts of recoil mechanism reach the stage described above as "full recoil," the nitrogen gas, which has been compressed by forward action of floating piston, exerts pressure in opposite direction, forcing floating piston to rear.

2. Motion of floating piston results in movement of diaphragm; this in turn causes control rod to open throttling orifice. Oil now reverses its direction of flow, and starts back through throttling orifice.

3. This time, however, it is impossible for the oil to pass through one-way valves of regulator body, so it flows through center of this body and up into recoil cylinder, pushing recoil piston forward.

4. Passage of oil through center of regulator body is gradually throttled by tapered grooves of regulator body, thus cushioning movement of gun into battery. Grooves are largest at forward end of regulator, and rearward motion of control rod gradually reduces size of passages through which oil can flow (fig. 42).



POSITION OF RESPIRATOR
DURING COUNTER-RECOIL-
ONE WAY VALVE CLOSED

Figure 43

5. As recoil piston moves forward, it compresses the air which has been sucked into recoil cylinder. This air is forced out through one or more holes in respirator. (Number and size of these holes are governed by setting of respirator.) Cushioning action of compressed air assists in buffing final movement of gun into battery (fig. 43).

Section 5

MALFUNCTIONS, CAUSES AND CORRECTIONS

I. BREECH AND FIRING MECHANISM

	Malfunction	Cause	Correction
A.	Lack of momentum of firing hammer	Broken firing rack spring	Replace
B.	Failure to fire until after several percussions on primer	Firing rack and spring not working freely	Disassemble firing mechanism; examine parts for burrs or roughness of surfaces. Remove with crocus cloth, fine file or oilstone. Wash all the parts with dry cleaning solvent. Dry thoroughly and lubricate with SAE 30 or SAE 10 lubricating oil
		Weak firing rack spring	Replace
		Deformed or broken firing pin point	Replace
C.	Failure to discharge; no percussion on primer	Safety piece not locked	Set safety piece plunger properly in breechblock arm
		Breechblock not fully closed	Close breechblock
		Broken firing pin	Replace
D.	Failure to extract empty cartridge case	Broken extractor	Ram the case out gently from muzzle end. Examine edge of chamber for deformation or burrs which might cause difficult extraction. Disassemble mechanism; replace the extractor if necessary.

E.	Breechblock latch pawl fails to operate	Broken pawl spring or broken breech-block latch spring	Disassemble breech mechanism to stage where latch can be removed. Examine springs; if latch spring is broken, replace. If pawl spring is broken, replace with new breechblock latch assembly
F.	Breechblock does not rotate freely	Lack of lubrication	Remove breechblock assembly and clean block and recess with dry cleaning solvent; wipe thoroughly dry. Lubricate with SAE 30 or SAE 10 oil. Assemble
		Burrs or roughness on threads of breechblock or in breech recess	Remove breechblock assembly and clean block and recess. If burrs or roughness are present, correction must be made by Ordnance personnel
G.	Safety bolt can be pushed down by hand after piston rod coupler key is withdrawn	Broken safety bolt spring, weak spring or spring not engaging in notch	Replace the safety bolt assembly or report to Ordnance personnel
H.	Safety bolt fails to rise	Broken lug	Replace the safety bolt assembly
I.	Safety bolt does not remain in upper position when coupler key is withdrawn	Weak or broken spring; spring does not engage in notch	Replace the safety bolt assembly
	II.	RECOIL MECHANISM	
A.	Oil leaking into front of recoil cylinder	Failure of piston packing or wear of cylinder wall	Report to Ordnance

B.	Oil leaking into filling and drain plug recess	Failure of filling and drain valve	Report to Ordnance
C.	Oil leaking around oil index	Failure of packing	Report to Ordnance
D.	Oil index not functioning	Index stuck	Withdraw the oil reserve and insert approximately one-half capacity of oil screw filler. Tap index lightly as oil is being added
E.	Failure of gun to return to battery	Insufficient oil in recoil mechanism	Withdraw the oil reserve and insert sufficient oil to bring index even with rear face of counterrecoil cylinder rear sealing plate
		Low nitrogen pressure	Report to Ordnance
		Excessive friction	Report to Ordnance
		Damaged gun slide bearings, piston rod or piston	Report to Ordnance
F.	Gun returns to battery with a shock	Excess reserve oil	Withdraw amount of oil necessary to bring index even with rear face of counterrecoil cylinder rear sealing plate
		Air from recoil cylinder escaping too fast through respirator	Adjust respirator to small air vent; if this fails to remedy the defect, withdraw oil, as indicated above

Section 6

SIGHTS AND BORESIGHTING

I. MATERIEL

A. The M1897A4 gun is equipped with the M33 sight on the M36 mount.

B. Characteristics of M33 sight.

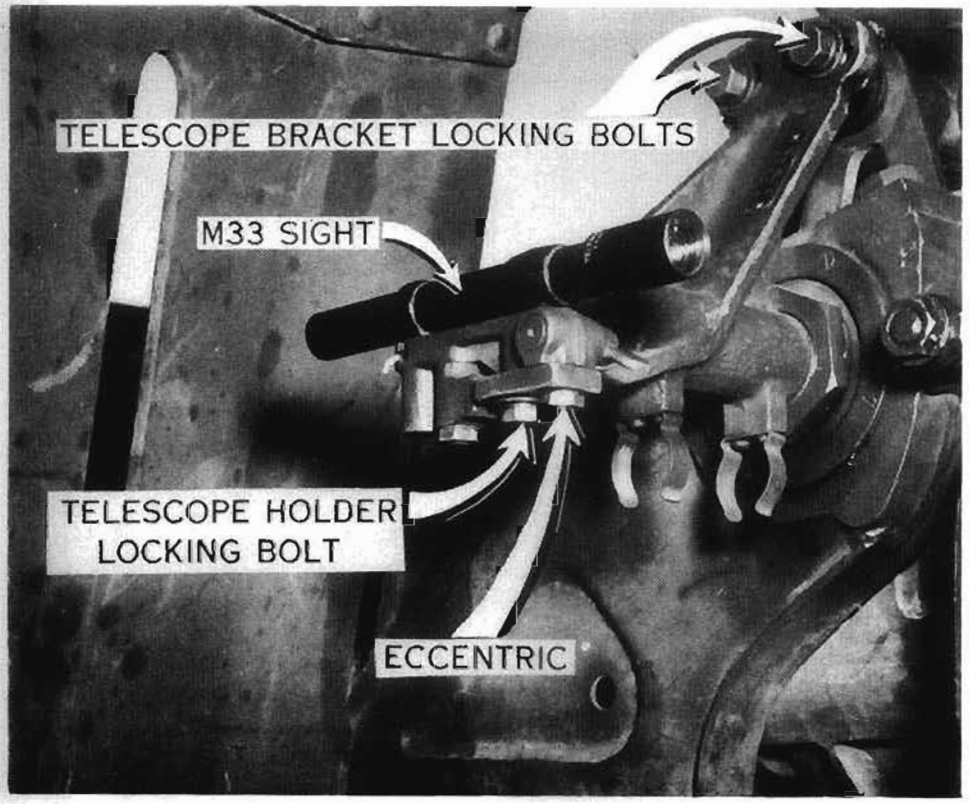


Figure 44

1. Fixed mount; no leveling bubbles (fig. 44).

2. Dependent sighting system: sight moves with tube in both elevation and traverse.

3. Does not magnify.

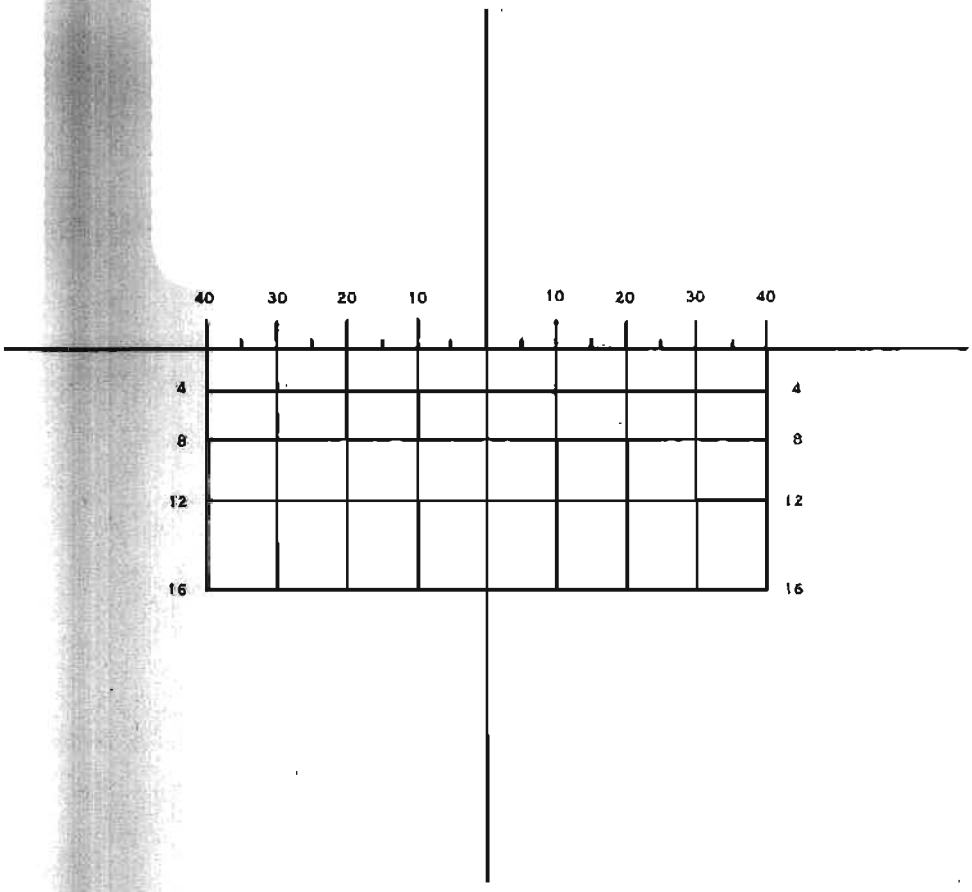


Figure 45

4. Gridded reticle (fig. 45).
   a. Horizontal lines establish elevations required for ranges of 400, 600, 800 yards, etc., for Shell Mk I (MV 1768 f/s).
   b. Numbered vertical lines establish angles of 10, 20, 30 mils, etc., from axis of bore. Since angular lead is a five-mil unit, these lines represent two, four and six leads, and so on. Odd-numbered leads, such as one, three and five, are determined from short lines projecting upward from zero range line between long vertical lines.

II. BORESIGHTING

A. Boresighting consists of either actually paralleling axis of sight with bore, or causing the two axes to intersect at such a distance that for all practical purposes they may be considered parallel.
   Note: In any case, the distance from the gun to the intersection of the axes should not be less than that at which firing will be conducted.

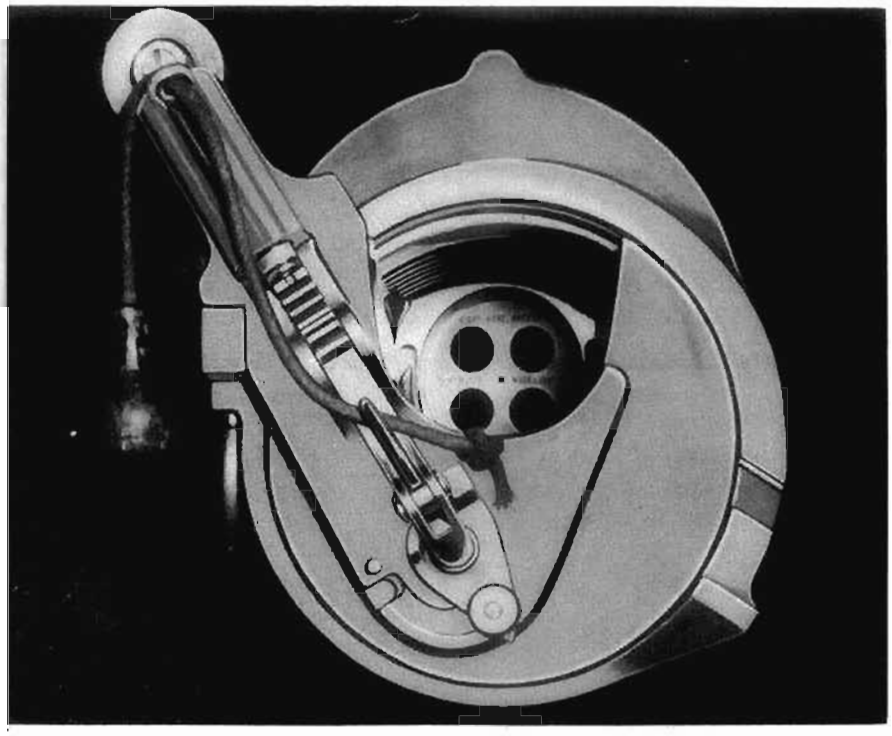


Figure 46

B. Two methods of boresighting:

1. Distant aiming point method.
   a. Axes of sight and bore are directed at a common aiming point at sufficient distance from piece so that, although they intersect, point of intersection is so distant that error is negligible.
   b. When used.
      (1) When suitable objects on terrain are present.
      (2) During lulls in firing, or before firing.
   c. Equipment.
      (1) Breech boresight--brass disk which fits into bore at the breech (fig. 46).

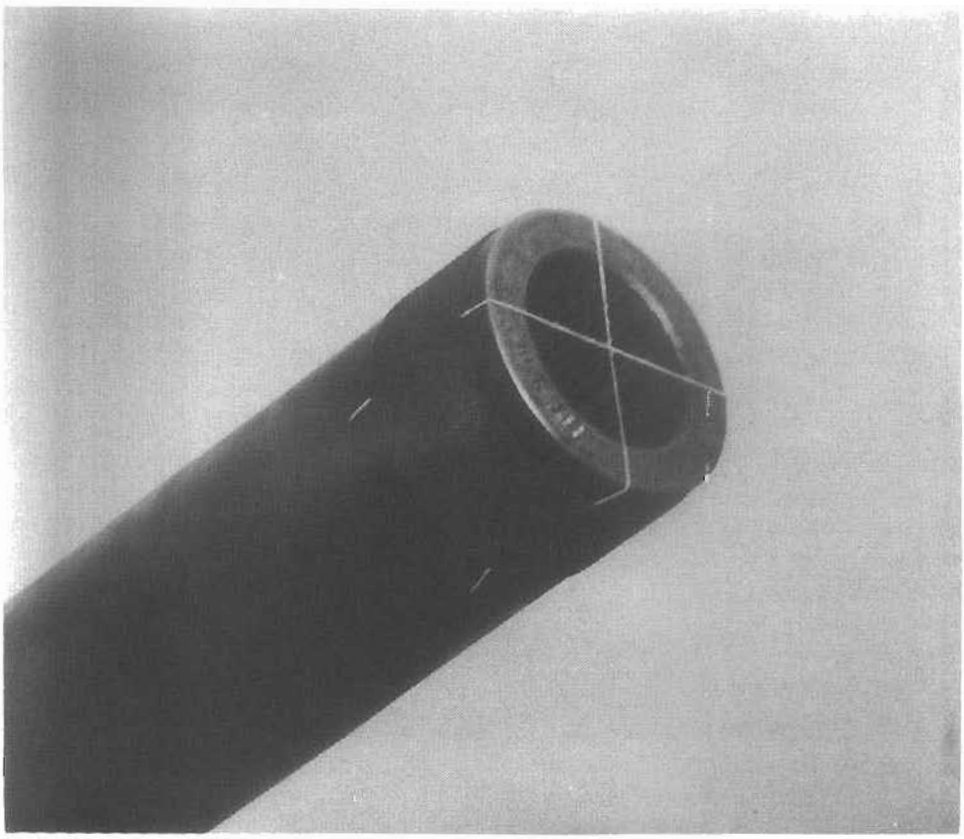


Figure 47

(2) Muzzle boresight--black linen thread and web belt (fig. 47).

M36 SIGHT MOUNT

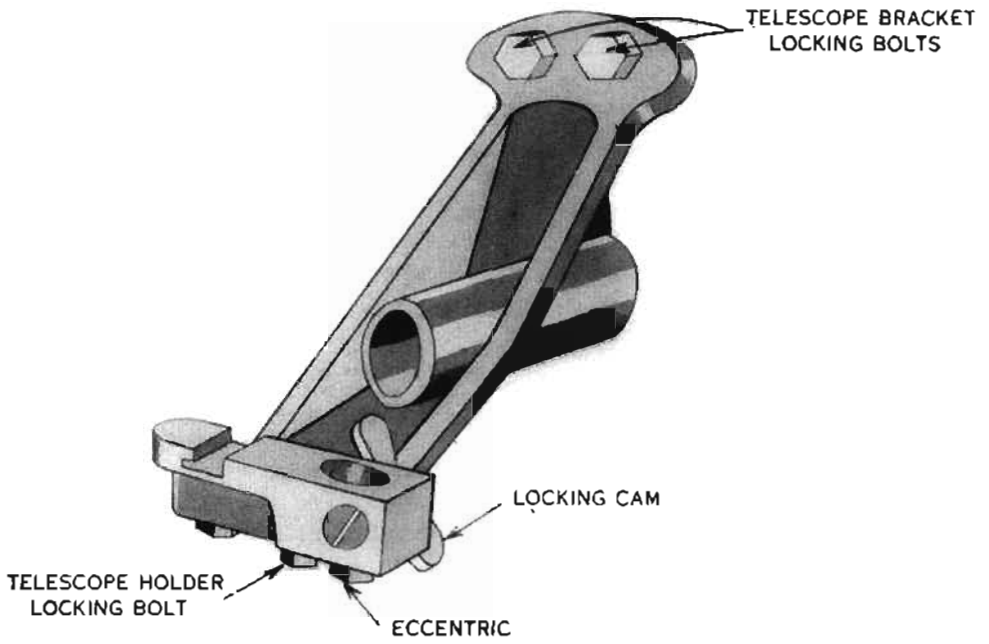


Figure 48

d. Procedure.
   (1) Pick out clearly defined object <u>at least</u> 1000 yards from destroyer, if possible, and choose definite part of this object--preferably a corner.
   (2) Using boresights, or suitable substitutes (see C below), aline tube on the distant point. Note carefully exact part of point on which tube is alined.
   (3) Check sight to see if zero range and lead lines intersect on same elements of the point respectively as vertical and horizontal crosshairs do.
   (4) If crosshairs do not coincide, adjust as follows:
      (a) To aline zero range line, loosen bracket locking bolts on sight mount. Tap mount forward or back until zero range line is on proper part of aiming point. Tighten bracket locking bolts; recheck tube (fig. 48).

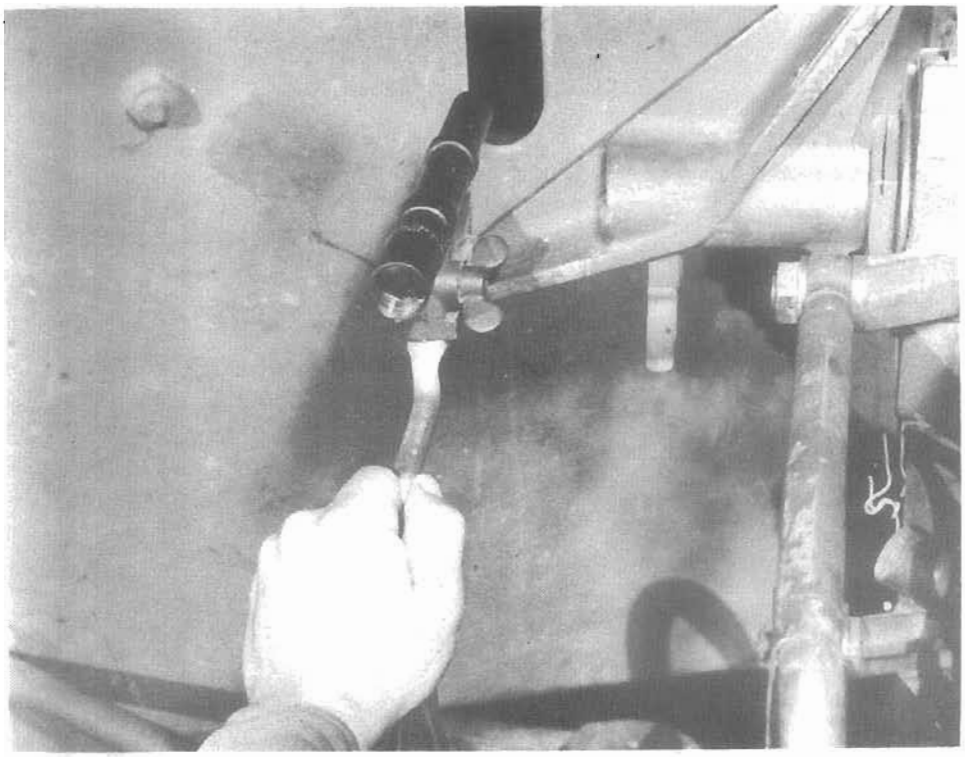


Figure 49

(b) To aline zero lead line, loosen telescope holder locking bolt. Turn eccentric until zero lead line is on proper part of aiming point. Tighten telescope holder locking bolt; recheck sight and tube (fig. 49).

2. Test target method.
   a. When used.
      (1) Periodically in garrison or bivouac, for accurate adjustments.
      (2) In action, when distant aiming points are not available and time is not important.
   b. Equipment.
      (1) Breech and muzzle boresights.
      (2) Any object with comparatively flat vertical surface, such as side of another destroyer.
      (3) Chalk, or substitute.
   c. Procedure.
      (1) Place destroyer on level ground about 80 to 120 feet from flat surface selected.
      (2) Draw a straight horizontal line on selected surface; intersect it with two vertical lines 16 7/16 inches apart (fig. 50).

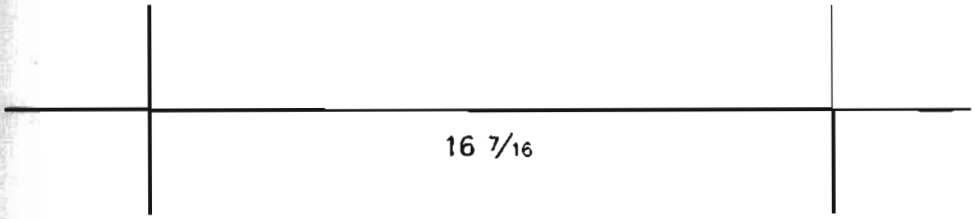


Figure 50

      (3) Aline tube so that horizontal muzzle boresight coincides with horizontal line, and vertical muzzle boresight coincides with right-hand vertical line.
      (4) Proceed as in distant aiming point method, adjusting zero lead line on left-hand vertical line and zero range line on single horizontal line.

C. Expedients.

1. For muzzle boresights: thread from waste; blades of grass held in place by string or grease.

2. For breech boresight: remove safety piece and firing pin, and sight through firing pin hole.

3. In order to have permanent measurement of 16 7/16 inches, cut notches this distance apart in rammer staff.

11


DRIVER
LOADER
ASSISTANT GUNNER
GUNNER
DESTROYER COMMANDER

Figure 51

Section 7

SERVICE OF THE PIECE

I. GENERAL

A. This section covers the training of crews in placing the destroyer in action quickly and efficiently. Organizations not equipped with the 75-mm gun on the motor carriage, M3A1, may use this material as a guide in preparing a drill suited to their equipment.

B. Terms

1. "In battery" is used to designate the position of the gun when it is in its normal firing position.

2. To avoid confusion, right and left are always taken to mean the directions as they appear to an observer facing the direction of fire.

C. Composition of heavy destroyer squad

1. Destroyer commander.

2. Gunner.

3. Assistant gunner.

4. Loader.

5. Driver.

D. To form the squad

1. Destroyer commander
   a. Places himself one pace to the right and three paces to the rear of the right track, or one pace to the right and three paces to the front of the right front wheel, facing in the same direction as the vehicle.
   b. Commands TO THE REAR (FRONT) (RIGHT) (LEFT), FALL IN.

2. Crew members form at double time, in line at close interval to commander's left, in following order from <u>right to left</u> (fig. 51):
   a. Gunner.
   b. Assistant gunner.
   c. Loader.
   d. Driver.

3. Falling in of squad to the front of destroyer generally is used in reviews and ceremonies only.

E. To call off

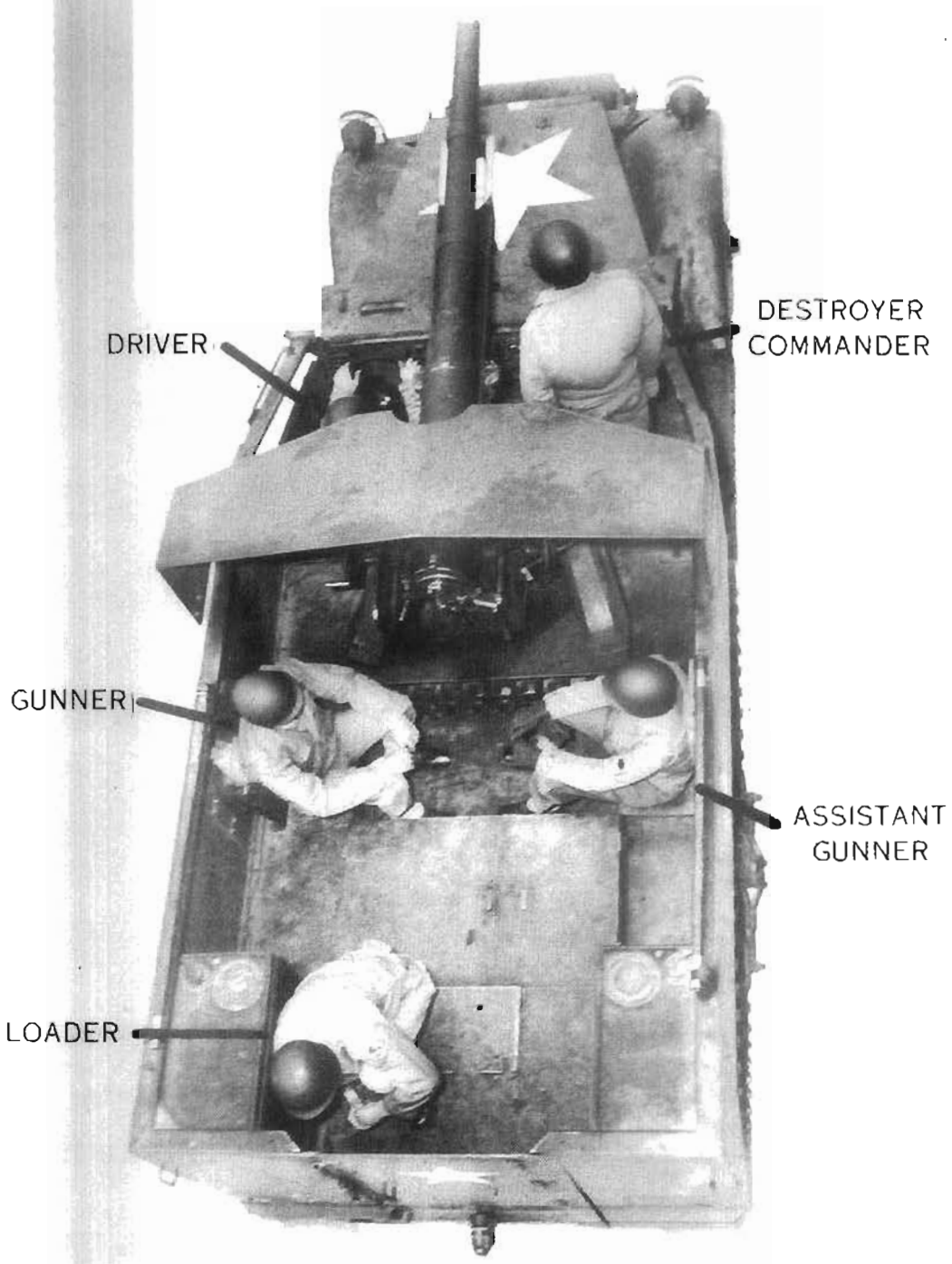

DRIVER
DESTROYER
COMMANDER
GUNNER
ASSISTANT
GUNNER
LOADER

Figure 52

1. Command is CALL OFF.

2. Squad members call off as follows:
   a. Gunner calls "One."
   b. Assistant gunner calls "Two."
   c. Loader calls "Three."
   d. Driver calls "Four."

F. To post the squad

1. Command is POSTS.

2. Squad members take posts at a run, as follows (fig. 52):
   a. Destroyer commander in right front seat.
   b. Driver in driver's seat.
   c. Gunner on rear seat to left of gun.
   d. Assistant gunner on rear seat to right of gun.
   e. Loader on the deck, near rear door.

3. Members will reach their posts as follows:
   a. Driver moves quickly to left door of cab, mounts and closes doors.
   b. Destroyer commander mounts <u>over</u> armor shield from right front.
   c. Gunner mounts <u>over</u> left side of destroyer.
   d. Assistant gunner mounts <u>over</u> right side of destroyer.
   e. Loader mounts <u>over</u> rear door of destroyer.

II. DUTIES OF SQUAD MEMBERS

A. To prepare for action

1. Command is PREPARE FOR ACTION.

2. Destroyer commander
   a. Removes muzzle cover and checks respirator setting.
   b. With driver, raises front shield; raises and locks right side shield; closes radiator shutters.
   c. Supervises duties of the other members and receives their reports.
   d. Reports to his immediate superior: "No. -- in order," or reports any defects the squad cannot remedy without delay.
   e. Puts on headset and takes his post.
   f. Observes surrounding terrain, principally to front, for hostile ground and air forces (see C below).
      Note: Whenever it appears advisable--even while traveling--destroyer commander may give the command to load.

3. Gunner
   a. Removes sight from case and attaches it to sight bracket.
   b. Makes as complete a boresight as time permits.
   c. Elevates or depresses gun until it is parallel with truck bed; points barrel directly to front; at the same time, checks functioning of traversing and elevating mechanism.

d. Takes his post and observes assigned sector (see C below).

4. Assistant gunner
   a. Removes breech cover and places it on the deck to right side of gun.
   b. Checks oil reserve index and reference marks to see that gun is in battery, and reports to commander:
      (1) OIL INDEX, CORRECT; REFERENCE MARKS, CORRECT, if they are in proper position; or,
      (2) Their condition, if not correct.
   c. Places safety piece on FIRE position.
   d. Inspects breech mechanism and bore, and leaves breech open; reports BORE CORRECT, if it is so; reports condition of bore, if not correct.
   e. Assembles rammer staff and places it on the right in fighting compartment, sponge to the front.
   f. Takes his post and observes assigned sector (see C below).

5. Loader
   a. Sees that ammunition rack is filled.
   b. Checks floor boxes and reports to destroyer commander quantity and kinds of ammunition on hand.
   c. Checks to see that HE shells are set SQ (superquick).
   d. Distributes waste to squad members.
   e. Takes his post and observes assigned sector (see C below).

6. Driver
   a. Releases traveling lock.
   b. With destroyer commander, raises and locks front shield; raises and locks left side shield.
   c. Takes his post, starts engine and cuts wheels to right.
   d. Reports condition of oil and gasoline supply to commander.
   e. Observes assigned sector (see C below) and instrument panel of vehicle.

B. Posts at a halt--having prepared the destroyer for action, squad members take posts as follows:

1. Destroyer commander--in or near his seat.

2. Gunner--immediately to left of breech.

3. Assistant gunner--immediately to right of breech.

4. Loader--near rear door of vehicle.

5. Driver--in his seat.

C. During marches--when prepared for action during a march, squad members observe definite sectors for both air and ground attack, as follows:

1. Destroyer commander--left front, front and right front, paying particular attention to sides of road.

2. Gunner--to the side opposite his post.

3. Assistant gunner--to the side opposite his post.

4. Loader--to the rear.

5. Driver--road and ground directly ahead, maintaining a careful lookout for mines, traps and other obstacles.

D. To bring destroyer to firing position

1. Command is ACTION FRONT (RIGHT) (LEFT) (REAR). Destroyer commander points in direction of fire upon giving command.

2. If destroyer is in march order, squad prepares it for action upon above command.

3. When the destroyer is prepared for action, duties of squad members are as follows:
   a. Destroyer commander
      (1) Supervises placing of vehicle in position, standing with his eyes at height of gun barrel.
      (2) Assigns sector and point of aim (point where targets are expected to appear).
      (3) Observes his sector.
   b. Gunner
      (1) Checks sight for proper setting and seating in bracket.
      (2) By aiming with the sight, determines whether or not gun can cover the sector. Shifts position of destroyer if necessary.
      (3) Lays gun on point of aim.
      (4) Observes to left and left front.
   c. Assistant gunner
      (1) Opens breech and inspects bore; reports BORE CORRECT, or condition of bore, if not correct.
      (2) When gun is loaded, closes breech and takes lanyard knob in right hand and calls SET after loader has called CLEAR.
      (3) Observes to right and right front.
   d. Loader
      (1) Opens rear door.
      (2) Loads, crouches in well and calls CLEAR when he is clear of path of recoil.
      Note: If command DO NOT LOAD is given, he crouches behind gun with round in his hand.
      (3) Observes to right rear, rear and left rear.
   e. Driver
      (1) Halts destroyer in designated position.
      (2) Cuts wheels hard to the right.
      (3) Sets brakes and places gears in neutral.
      (4) Leaves engine running at idling speed.
      (5) Watches thermometer; if motor overheats, opens radiator shutters slightly, unless under fire.

(6) Observes to the front.

E. During firing

1. Destroyer commander
   a. Gives appropriate fire order, pointing toward target as he gives the order. Example: RIGHT FRONT, LAST TANK, 600. . . ONE LEAD.
      Important: After giving the range (600), commander waits till gunner calls CHECK, signifying he has identified target; then commander gives lead.
      Note: If ammunition other than AP is to be used, destroyer commander gives the type as the first element of the fire order. If he wishes to withhold fire, he announces AT MY COMMAND immediately following the lead given in the original fire order.
   b. Observes fire by sensing shots and calling sensings to gunner.
   c. Observes field of fire for next target and for approach of other hostile elements that might endanger the destroyer.

2. Gunner
   a. Repeats fire orders; calls out CHECK when he identifies target.
   b. Commences tracking.
   c. After assistant gunner has called SET, and when gun is laid correctly on target, he calls READY, FIRE. THIS COMMAND IS NEVER GIVEN UNTIL AFTER LOADER HAS CALLED CLEAR.

Figure 53

d. Repeats READY, FIRE in case assistant gunner does not fire on first command.
e. Observes results of fire and makes necessary corrections.
f. Commands SHIFT RIGHT (LEFT) when limit of traverse is about to be reached.

3. Assistant gunner
a. With lanyard in right hand, moves body to extreme right out of path of recoil (fig. 53).
b. At gunner's command READY, draws lanyard back; on command FIRE releases it.
Note 1: Assistant gunner must be very careful to keep shoulder out of path of recoil, especially when gun is traversed toward left traversing limit.
Note 2: If for any reason assistant gunner fails to fire exactly at the command FIRE, he will not fire at all, but will call out MISS, and will be prepared to fire at the next command.
c. Opens breech (BOTH PALMS UP) with sufficient force to eject shell (fig. 54); closes breech when gun is reloaded (fig. 55), and calls SET when he is ready.

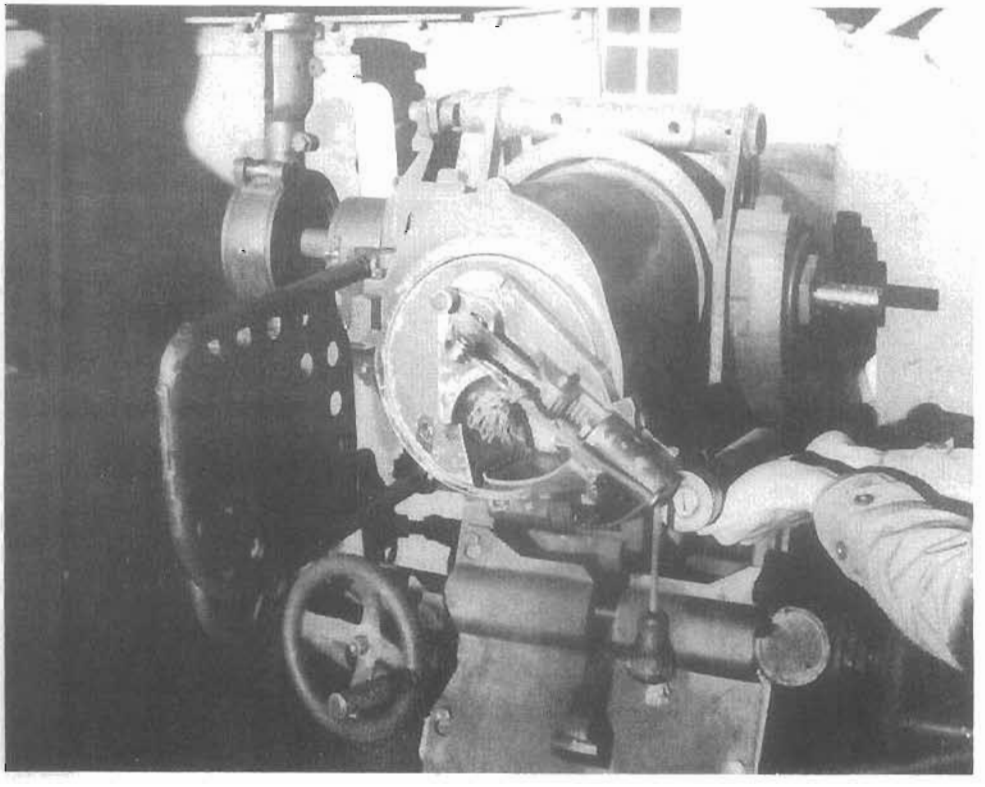


Figure 54

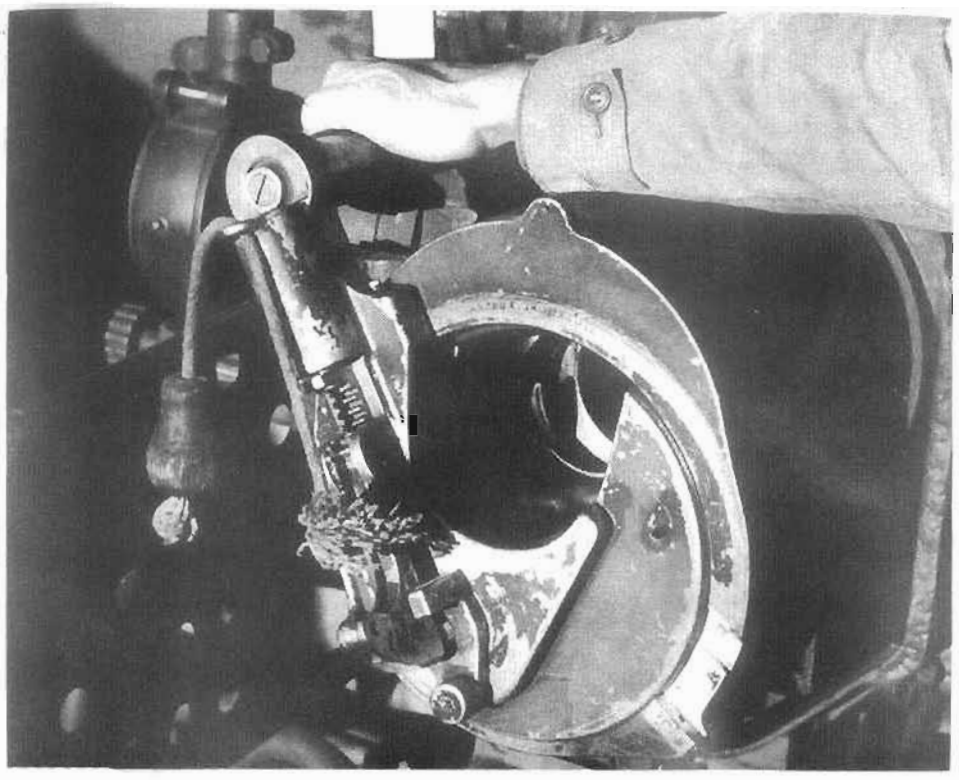


Figure 55

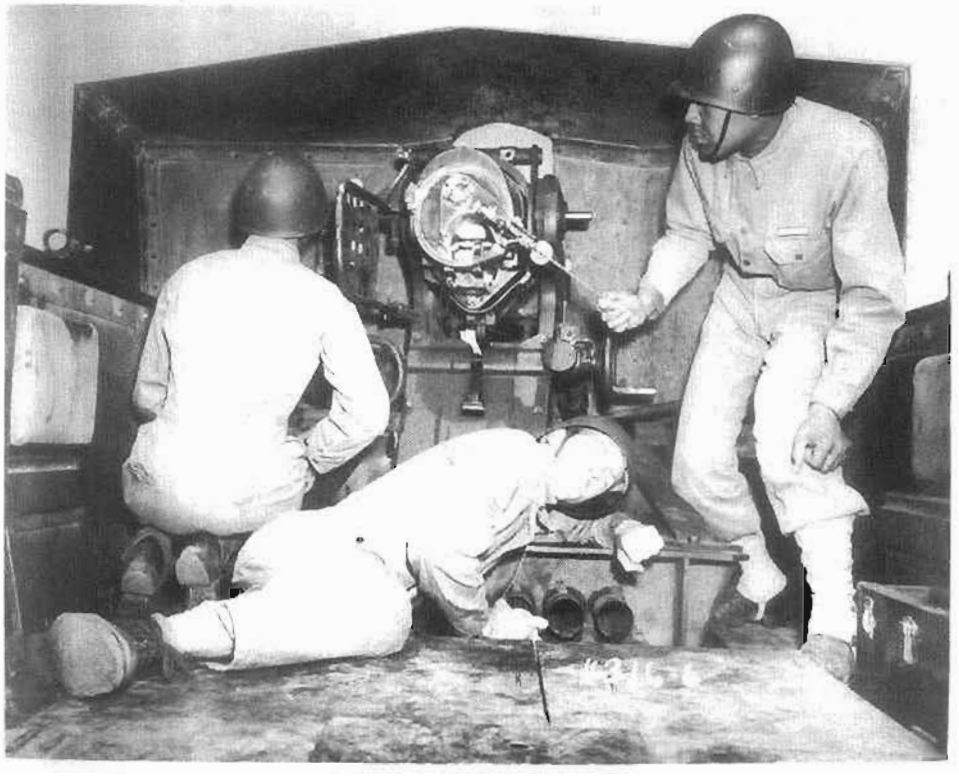


Figure 56

d. Inspects bore during lulls; cleans bore when time permits.
e. Observes assigned sector during lulls in firing.

4. Loader
   a. Reloads quickly as possible; crouches quickly in well; calling CLEAR when clear of path of recoil (fig. 56).
   b. Throws empty shell cases overboard during lulls in firing.
   c. Observes assigned sector between rounds.

5. Driver
   a. Applies foot brake during firing; accelerates engine slightly when gun is fired so that it will not stall.
   b. At command SHIFT RIGHT, moves vehicle forward about two yards; at command SHIFT LEFT, backs vehicle about two yards.
   c. Observes assigned sector.

F. To change targets

1. Command is NEW TARGET, followed by appropriate command, such as LEFT FLANK, FIRST TANK, 600. . . (see E 1 a above). . .TWO LEADS.

2. Gunner shifts to new target and calls out CHECK when he identifies it.

3. Gunner gives order to fire <u>after</u>:
   a. Loader has called CLEAR.
   b. Assistant gunner has called SET.
   c. Gun is laid correctly on target.

G. To effect short-distance changes of position

1. Command is SUSPEND FIRING, MOVE TO THE RIGHT (LEFT) (FORWARD) (REAR).

2. Assistant gunner sets safety piece on SAFE.

3. Gun is unloaded during practice firing only. Usual commands for going into position and firing are given.

H. To change locality of destroyer, command is CEASE FIRING, PREPARE TO MOVE.

1. Destroyer commander
   a. Orders gun locked in traveling position and sight removed, if combat situation permits.
   b. Opens radiator shutters.
   c. When all members of squad have taken their seats, commands MOVE OUT, indicating the direction of movement.

2. Gunner
   a. Centers and levels gun.
   b. Takes his post in left rear seat.

3. Assistant gunner
   a. If combat situation permits, opens breech and. if it contains a round, hands it to loader; inspects bore quickly for any obstructions, and closes breech.
   b. Sets safety piece on SAFE.
   c. Takes his post in right rear seat.

4. Loader
   a. Receives round from assistant gunner and replaces it in rack.
   b. Throws out empty shell cases.
   c. Closes rear door.
   d. Takes his post on deck near door.
   e. At first opportunity, refills ammunition rack from floor boxes.

5. Driver
   a. Reports to destroyer commander amount of gas and oil and other factors affecting operation of vehicle.
   b. Releases brakes, and moves on gun commander's order.

I. To return to march order, command is MARCH ORDER.

1. Destroyer commander
   a. Supervises duties of squad.
   b. With driver, lowers front shield; lowers right side shield.
   c. Replaces muzzle cover and sets respirator at zero.
   d. Inspects materiel, checking to see gun is not loaded.
   e. When operations are completed, reports (if possible) to his superior: "No. — in order," or reports any defects the squad cannot correct without delay.

2. Gunner
   a. Centers and depresses gun so that traveling lock can be engaged.
   b. Places sight in case; locks it.
   c. Takes his post.

3. Assistant gunner
   a. Inspects chamber to see that gun is unloaded; reports BORE CORRECT when gun is unloaded; closes breech.
   b. Sets safety piece on SAFE.
   c. Checks recoil oil; refills, if necessary and the situation permits.
   d. Replaces breech cover.
   e. Disassembles and secures rammer staff.
   f. Takes his post.

4. Loader
   a. Places any loose rounds in rack.
   b. Throws out empty shell cases.
   c. Closes rear door, if destroyer has been firing previous to MARCH ORDER.
   d. Takes his post.

5. Driver

a. Secures traveling lock.
b. With destroyer commander, lowers front shield; lowers left side shield.
c. Releases brakes, and moves on destroyer commander's order.

J. Duties after firing

1. Destroyer commander
   a. Supervises duties of squad.
   b. Inspects for lubrication, mechanical condition and cleanliness; sees that all possible repairs and adjustments are made.

2. Gunner
   a. Inspects gun and mounting for any failures or looseness.
   b. Helps clean gun.
   c. If sight has not been accurate during firing, reports condition.

3. Assistant gunner
   a. Swabs bore of gun.
   b. Checks recoil oil; refills or drains, if necessary.

4. Loader
   a. Checks and reports ammunition to gun commander.
   b. Refills ammunition rack, inspecting rounds carefully for burrs, dents and other imperfections.

5. Driver--inspects vehicle for any failure or looseness. Rest of squad will assist driver in making necessary adjustments or repairs.

III. DETAILED DESCRIPTION OF CERTAIN DUTIES

A. General

1. The following matter, which coincides closely with Field Artillery practice, is offered merely as a means to an end.

2. The material is general, and should be used as a guide to a common sense solution of minor points not covered specifically.

3. Avoid discussion over trifles, and encourage subordinates to make minor adjustments without consulting higher authority for interpretation.

B. To open the breech

1. Cocking the latch
   a. First round--assistant gunner cocks latch by pushing plunger forward.
   b. Subsequent rounds--recoil of gun automatically cocks the latch.

2. Assistant gunner grasps operating handle (BOTH PALMS UP) and with a quick upward movement flips breech open, using sufficient force

to eject empty shell case (see fig. 54).

CAUTION: Care must be taken that fingers are not caught between breech hoop and end of cradle. If fingers are caught in this manner, tube must be uncoupled and moved to rear; if fingers are caught in such a manner that breechblock can not be rotated, lug of safety bolt must be sheared off.

C. To close breech

1. Assistant gunner grasps operating handle with right hand and moves handle downward, holding lanyard in right hand (see fig. 55).

2. Use of right hand is advocated to insure assistant gunner's left arm and shoulder will be clear of recoiling gun at any position of traverse from which it might be fired.

D. To load gun

1. Loader
   a. Grasps round with right hand at base of cartridge case, left hand in rear of ogive. Round rests in palm of left hand, and heel of right hand is held against base, with fingers over top of rim (fig. 57).
   b. Inserts round in breech, removes his left hand and rams round home with his right (fig. 58).
   c. Gives final impetus to round, when about one-third of cartridge case still extends beyond breech face, until his hand is about to come into contact with breech; at this point, continuing the motion, he moves his hand upward and away, clearing breech.

   Note: Constant practice is required to gain proficiency in loading quickly and smoothly. The loader should first be taught the necessity of placing the round accurately within the breech before ramming it home. Unless the round is firmly seated, accuracy will be impaired. If fuzed ammunition is used, the loader must be especially careful to avoid striking the fuze against any portion of the breech. Similar care must be taken that the round to be loaded be held well out of the path of recoil. The loader may wear a glove on his right hand to protect his fingers.

2. Assistant gunner
   a. Having opened breech, rests his right hand, palm open, lightly on the operating handle.
   b. With his right hand, maintains rotation of breechblock which has been started by loader's pushing the round home, pulls downward and closes breech.
      (1) If assistant gunner resists the impulse of rotation, the round will rebound, preventing breech from being closed.
      (2) If this occurs, the assistant gunner will reseat the round.

E. To unload gun

Figure 57

Figure 58

1. Breech is opened smartly by assistant gunner, and shell is ejected.

2. In case extractor fails to eject round, assistant gunner does so with rammer staff.

3. When drill ammunition is used, loader stands at breech and receives ejected round with both hands.

F. To fire gun

1. At gunner's command READY, assistant gunner pulls lanyard (with right hand) to the rear and as far downward as possible.

2. At gunner's command FIRE, he releases lanyard instantly.

3. If order to use long lanyard is given, assistant gunner attaches long lanyard to firing link, steps clear and fires as directed.

G. To unload misfired rounds

1. If a misfire occurs during practice firing, three more attempts should be made to fire gun.

2. If gun still fails to fire, assistant gunner will wait at least TWO MINUTES before opening breech.

Section 8

REFERENCES

TM 9-305 75-mm Gun Materiel, M1897, and Modifications.

TM 9-705 Scout Cars, M3, M3A1 and 4.2 Mortar Motor Carriage, M2.

IM-Mat-3 Construction of Field Artillery Materiel (Field Artillery School).

IM-Mat-9 Gun and Carriage, 75-mm, M2A1 and M2A2 (Field Artillery School).

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