

RESTRICTED

DEPARTMENT OF THE ARMY TECHNICAL MANUAL
TM 9-392A

4.5-INCH
MULTIPLE
ROCKET LAUNCHER
T123



DEPARTMENT OF THE ARMY

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BY ORDER OF THE SECRETARY OF THE ARMY:

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the information and guidance of personnel to whom this matériel is issued. They contain information on the operation and organizational maintenance of the 4.5-inch multiple rocket launcher T123 (figs. 1, 2, 3, and 4), ammunition, and associated on-carriage equipment.

b. The appendix contains a list of current references, including supply catalogs, technical manuals, and other available publications applicable to the matériel.

c. This first edition manual is published in advance of complete technical review. Any errors or omissions will be brought to the attention of the Chief of Ordnance, Washington 25, D. C., Attention, ORDFM-Pub.

2. Organizational Maintenance Allocation

In general, the prescribed organizational maintenance responsibilities will apply as reflected in the allocation of tools and spare parts in the appropriate columns of Department of the Army Supply Catalog ORD 7 SNL C-90 and in accordance with the extent of disassembly prescribed in this manual for the purpose of cleaning, lubricating, or replacing authorized spare parts. In all cases where the nature of repair, modification, or adjustment is beyond the scope or facilities of the using organization, the supporting ordnance maintenance unit should be informed in order that trained personnel with suitable tools and equipment may be provided or other proper instructions issued.

3. Forms, Records, and Reports

a. GENERAL. Forms, records, and reports are designed to serve necessary and useful purposes. Responsibility for the proper execution of these forms rests upon commanding officers of all using organizations operating and maintaining this matériel. It

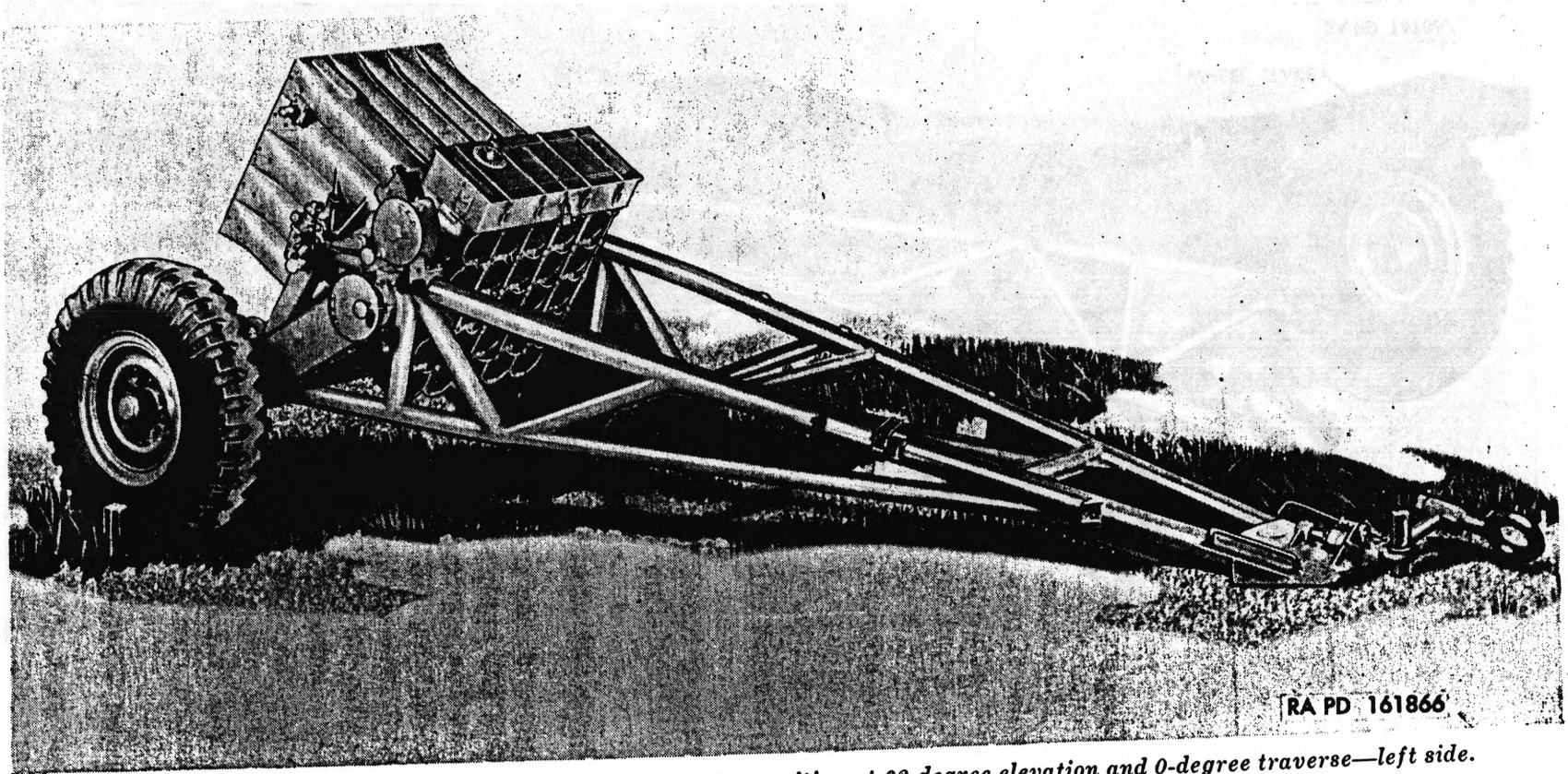


Figure 1. 4.5-inch multiple rocket launcher T123 in firing position at 32-degree elevation and 0-degree traverse—left side.

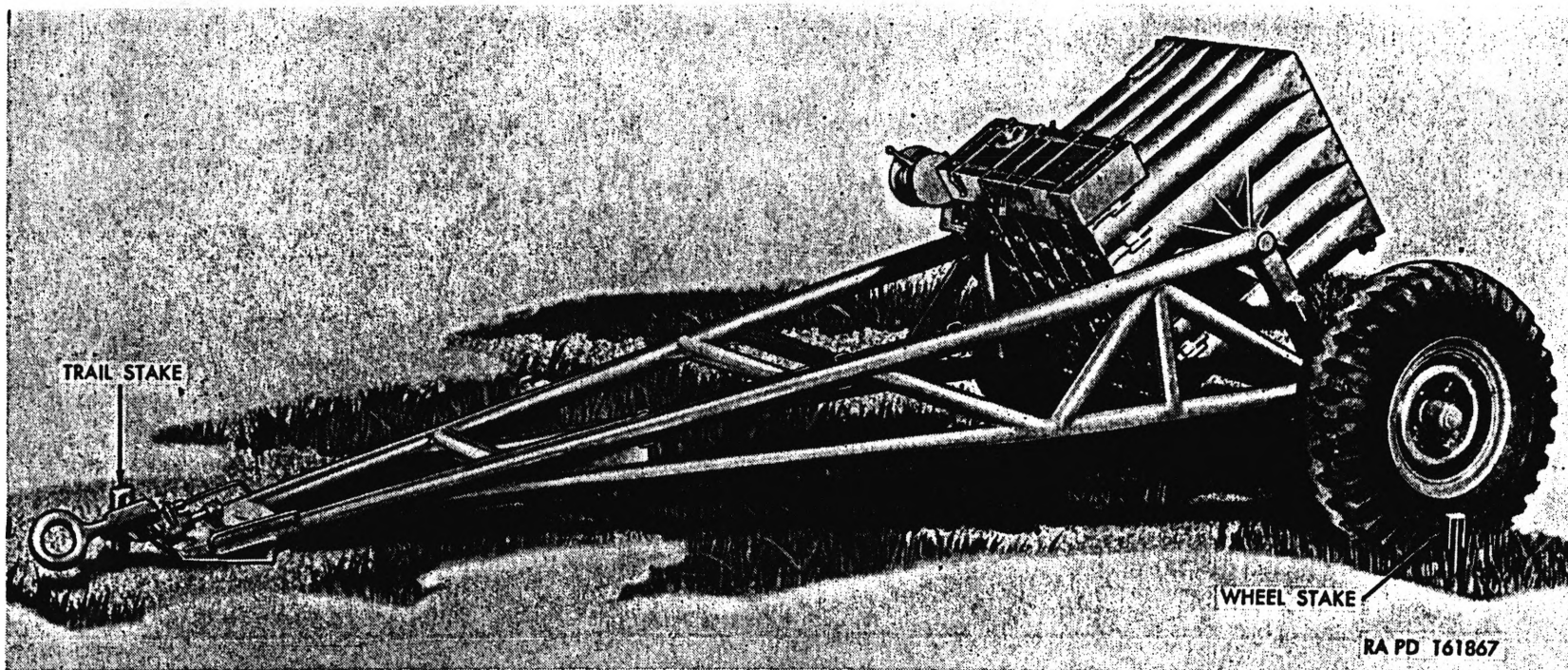


Figure 2. 4.5-inch multiple rocket launcher T123 in firing position at 32-degree elevation and 0-degree traverse—right side.

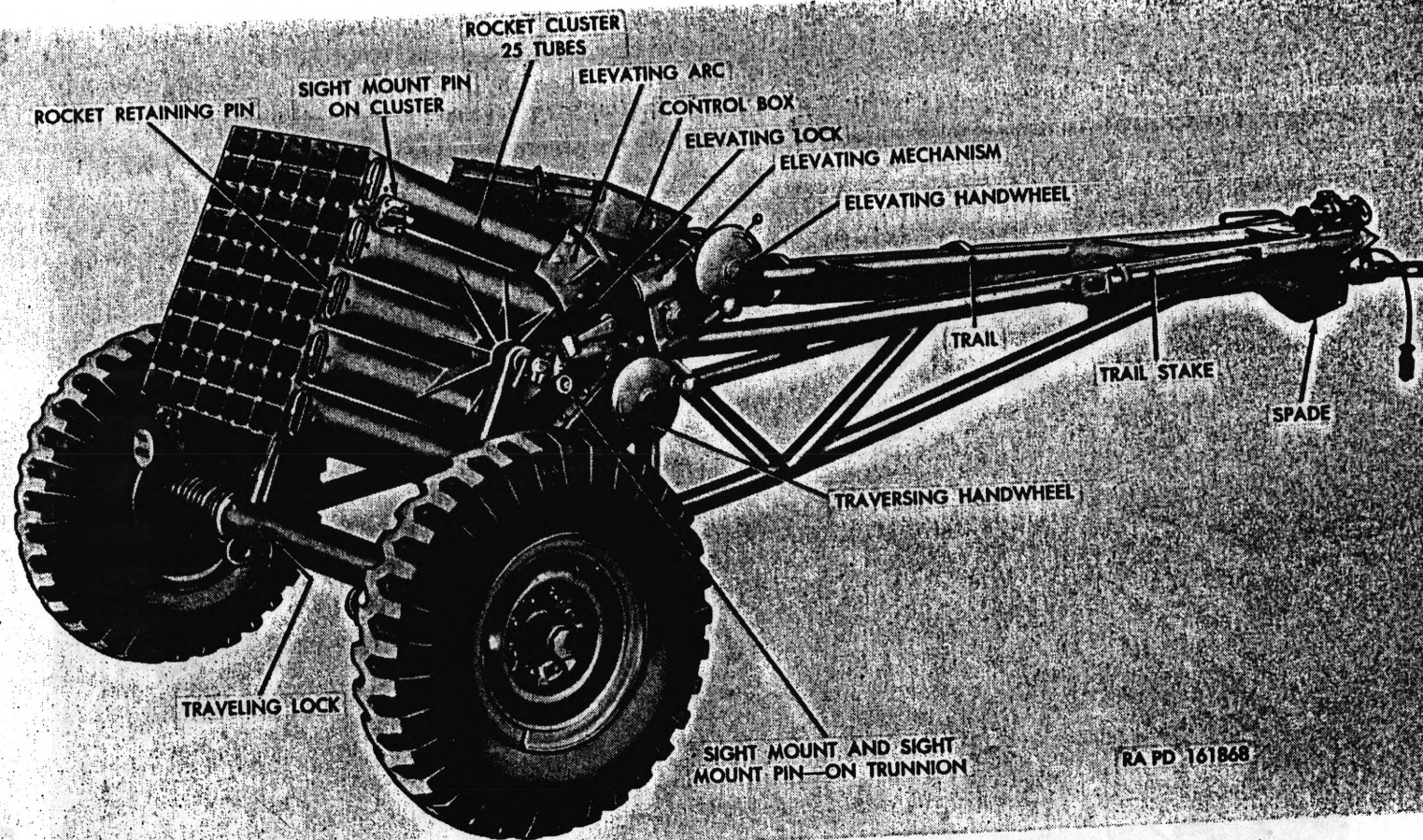


Figure 3. 4.5-inch multiple rocket launcher T123 in traveling position—left side (w/o cover).

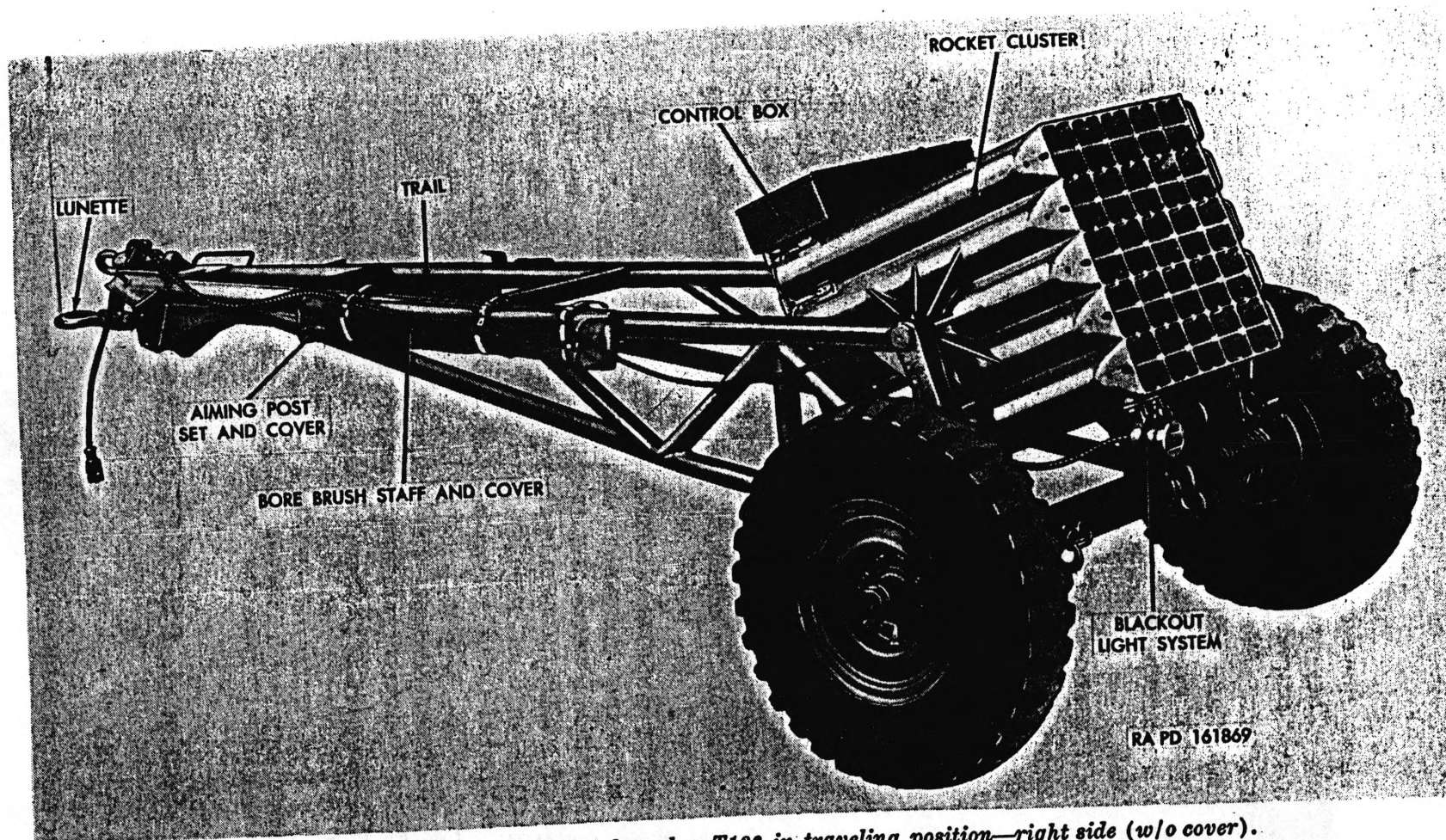


Figure 4. 4.5-inch multiple rocket launcher T123 in traveling position—right side (w/o cover).

is emphasized, however, that forms, records, and reports are merely aids. They are not a substitute for thorough practical work, physical inspection, and active supervision.

b. **AUTHORIZED FORMS.** The forms generally applicable to using organizations are listed in the appendix. No forms other than those approved for the Department of the Army will be used. For a current and complete listing of all forms, see current SR 310-20-6.

c. **FIELD REPORT OF ACCIDENTS.**

(1) *Injury to personnel or damage to matériel.* The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in the SR 385-10-40 series of special regulations. These reports are required whenever accidents involving injury to personnel or damage to matériel occur.

(2) *Ammunition.* Whenever an accident or malfunction involving the use of ammunition occurs, firing of the lot which malfunctions will be immediately discontinued. In addition to any applicable reports required in (1) above, details of the accident or malfunction will be reported as prescribed in SR 385-310-1.

d. **REPORT OF UNSATISFACTORY EQUIPMENT OR MATERIALS.** Any suggestions for improvement in design and maintenance of equipment, safety and efficiency of operation, or pertaining to the application of prescribed petroleum fuels, lubricants, and/or preserving materials, will be reported through technical channels as prescribed in SR 700-45-5 to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, using DA AGO Form 468, Unsatisfactory Equipment Report. Such suggestions are encouraged in order that the other organizations may benefit.

Note. Do not report all failures that occur. Report only REPEATED or RECURRENT failures or malfunctions which indicate unsatisfactory design or material. However, reports will always be made in the event that exceptionally costly equipment is involved. See also SR 700-45-5 and the printed instructions on DA AGO Form 468.

Section II. DESCRIPTION AND DATA

4. Description

a. The 4.5-inch multiple rocket launcher (figs. 1, 2, 3, and 4) is a multiple rocket launcher having 25 tubes or stations. The carriage (fig. 3) is a two-wheeled solid wish-bone trail type carriage with pneumatic tires and hand-operated parking brakes. A

1/4-ton 4 x 4 vehicle is used for traveling, and a 2 1/2-ton vehicle is provided for ground transport of the matériel. An elevating lock prevents movement of the rocket cluster, and a traveling lock prevents movement of the trail on the axle while traveling.

b. The rocket cluster (fig. 3) is balanced in trunnions in the trail without mechanical equilibration. Elevating and traversing handwheels and the sight for direct and indirect fire are grouped at the left side of the carriage for one-man control. Elevation of the cluster is accomplished through operation of a worm and worm wheel type elevating mechanism and an elevating arc on the cluster. Traversing is accomplished by handwheel operation which moves the trail on the carriage axle. Elevating and traversing handwheel brakes prevent a change in position of the cluster during firing.

c. Rockets are muzzle-loaded in the cluster and are electrically fired by single rounds in a preset sequence. The rate of fire is limited only by the operator's speed in operation of the firing mechanism switch. The firing mechanism located in the control box contains a lanyard-operated magneto. To prevent side deflection of the carriage when firing with the lanyard-operated firing switch, wheel stakes are provided to be driven in the ground at each carriage wheel (fig. 2). The spade and trail stake prevents movement of the trail during firing.

d. The rocket launcher is used to launch smoke rockets and high-explosive rockets against ground targets. The primary function of the launcher is to ignite the propellant and to guide the rocket in its initial flight. Since the rocket is supported and guided in a little more than its own length, the launcher is used for area targets where dispersion of rockets is desirable. Range of the weapon is dependent on the type of rocket used and the maximum elevation of the cluster allowed for that particular type rocket (par. 78). Reactive forces on the launcher are slight since the propulsion of the rocket is accomplished by the jet action of the propellant powder in the motor body of the rocket and does not depend upon gas pressure built up inside the launcher tube.

e. When the propellant is ignited, gases, flames, and unburned pieces of propellant are blown at high velocity from the rocket. The area around the launcher must be clear of personnel and any inflammable material. A blast deflector in the form of a mat placed on the ground beneath the rocket cluster can be used to lessen the dust cloud raised in firing and to prevent blowing large holes in the earth. In normal use of the launcher, from one to three salvos would be fired, and then the launcher would be towed

to a new site. The launcher can be moved when fully loaded; rocket retaining pins (fig. 3) are used in the cluster to prevent movement of the rockets when traveling.

f. The launcher is sighted on a target by means of an elbow telescope. The telescope is used for direct and indirect fire (pars. 70-76). Two positions for mounting the sighting equipment are provided, one on the cluster trunnion pin and one on the left side of the cluster (fig. 3). Instruments and equipment are contained in the control box, mounted on the cluster (fig. 4). Aiming posts and the bore brush staff are strapped onto the trail.

5. Name, Caution, and Instruction Plates

a. The rocket launcher serial number, name, model number, manufacturer, and year of manufacture are provided on a name plate (fig. 5) attached to the drawbar mounting plate at the spade end of the trail.

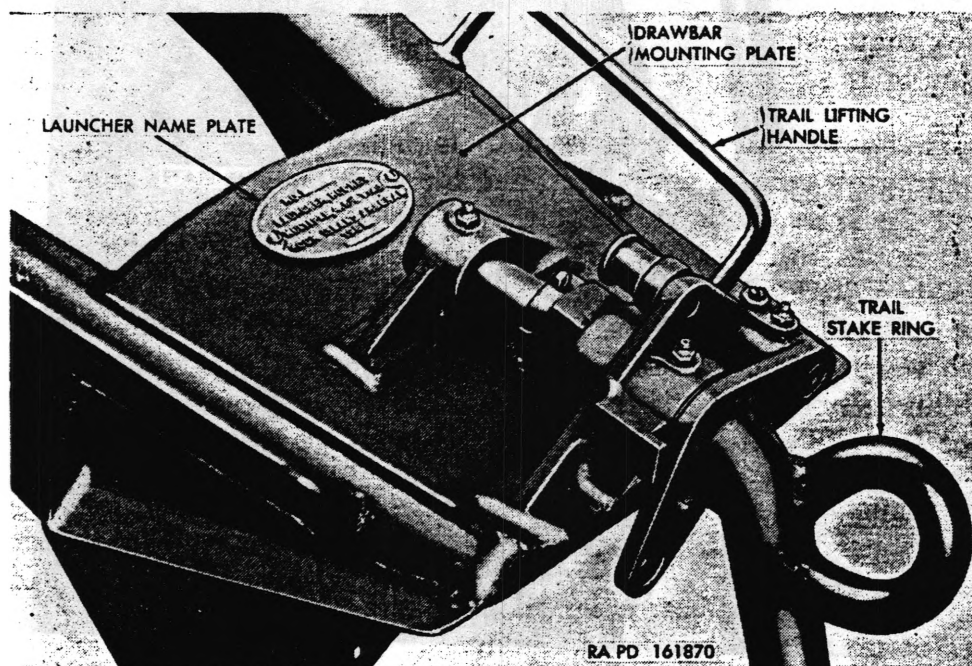


Figure 5. Location of Launcher name plate.

b. The rocket firing switch T14 name, model number, manufacturer, year of manufacture, serial number, and instructions for closing the control box cover (par. 31b) are provided on a name plate (fig. 6) attached to the cover of the firing switch.

c. The sight mount serial number is provided on a name plate (fig. 7) attached to the retainer of the sight mount.

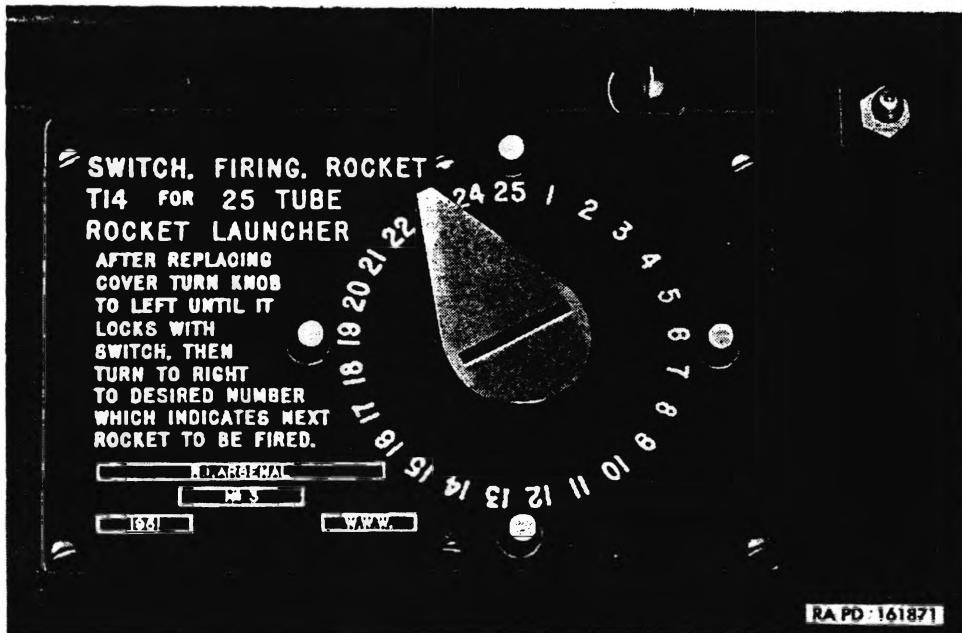


Figure 6. Location of rocket firing switch T14 name plate.

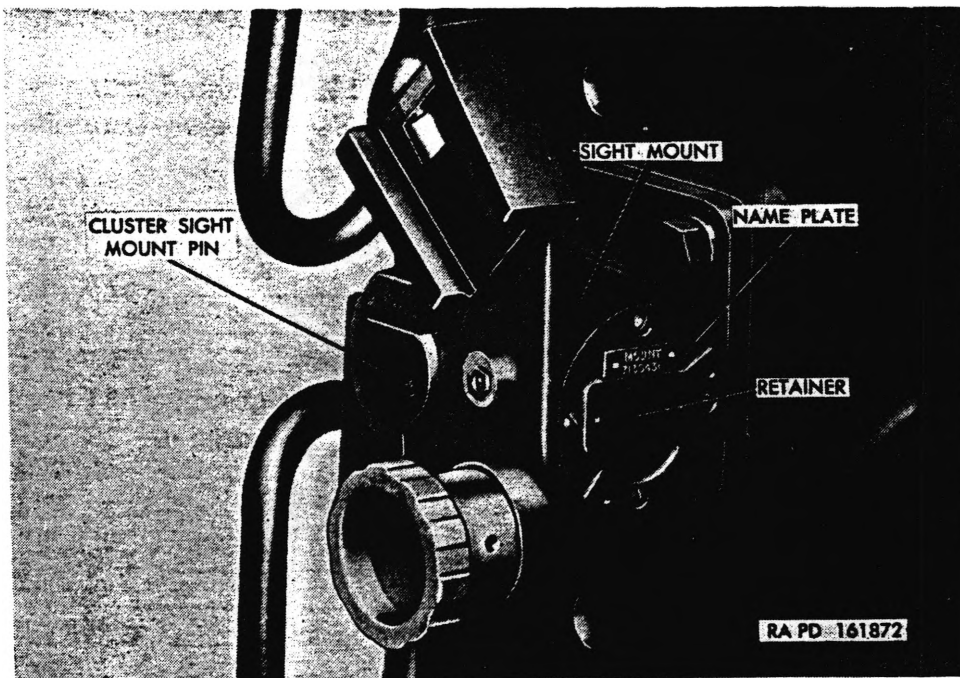


Figure 7. Location of cluster sight mount name plate.

d. The elbow telescope name, model number, stock number, and serial number are stamped on the right side prism plate of the telescope (fig. 50).

e. The telescope adapter name, model number, stock number, and serial number are provided on a name plate attached to the top of the adapter (fig. 50).

f. The telescope mount name, model number, and serial number are provided on a name plate attached to the elevation scale plate of the mount (fig. 50).

6. Tabulated Data

a. DIMENSIONS.

(1) *Traveling position.*

Over-all width	79 $\frac{1}{2}$ in
Over-all height	57 $\frac{5}{8}$ in
Over-all length	179 in
Lunette to ground	31 $\frac{1}{2}$ in
Centerline of wheel to lunette	161.82 in
Tread (center to center of tires)	70 in
Ground clearance (without spade plate)	13 $\frac{3}{8}$ in
Center of gravity:	
Horizontal	11 $\frac{3}{4}$ in behind trunnion
Vertical	8 $\frac{1}{2}$ in below trunnion

(2) *Firing position.*

Over-all width	79 $\frac{1}{2}$ in
Over-all height:	
Maximum elevation	57 $\frac{7}{16}$ in
0-deg elevation	53 $\frac{15}{16}$ in
Over-all length at 0-deg elevation	174 $\frac{1}{4}$ in
Height (trunnion pins centerline to ground)	34.9 in
Length (muzzle to centerline of trunnion pins).	19.6 in

(3) *Rocket cluster.*

Diameter of rocket tube (nominal)	4.537 in
Length of rocket tube	36 in
Centerline to centerline of adjoining tubes	5.375 in
Number of rocket tubes	25

b. WEIGHTS.

Launcher w/equipment	1,530 lb
Trail w/drawbar and lunette	436 lb
Wheel assembly w/tire and tube	122 lb
Axle	121 lb
Traversing nut and balls	21 lb
Brake drums, brakes, and spindles	94 lb
Elevating mechanism	56 lb

Rocket cluster w/control box, firing mechanism, trunnion pins, and sight mount. 530 lb

At left wheel:

Firing position----- 658 lb

Traveling position----- 678 lb

At right wheel:

Firing position----- 584 lb

Traveling position----- 600 lb

At spade (firing position)----- 264 lb

At lunette (traveling position)----- 228 lb

c. MANEUVERING LIMITS.

Elevation----- 75 deg

Depression----- 0 deg

Traverse (right)----- 3 deg 34 min

Traverse (left)----- 3 deg 14 min

d. ELEVATING HANDWHEEL.

Complete range of elevation----- 75 deg

To elevate 75 deg----- 135 turns

One handwheel turn----- 10 mils

Handwheel torque (at knob)----- 1 lb

e. TRAVERSING HANDWHEEL.

Complete range of traverse----- 7 deg

Traverse (right and left of center)----- 3½ deg

To traverse 7 deg----- 24 turns

One handwheel turn----- 5 mils

Handwheel torque (at knob)----- 4 lb

f. CARRIAGE TIRES.

Type----- pneumatic, truck, and bus

Size----- 9.00 x 16

Air pressure----- 25 to 40 psi

g. SIGHTING AND FIRE CONTROL EQUIPMENT. For data on sighting equipment and fire control instruments listed below, see chapter 4, section I. On-carriage equipment is as follows:

ADAPTER, telescope, M9E4

LIGHT, aiming post, M14, green filter

LIGHT, aiming post, M14, red filter

LIGHT, instrument, M42

MOUNT, telescope, M79

POST, aiming, M1, set

QUADRANT, gunner's, M1

TELESCOPE, elbow, M62

h. AMMUNITION DATA. For data on authorized ammunition, see paragraphs 77-86.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATÉRIEL

7. General

a. When a new or reconditioned rocket launcher is first received by the using organization, it is the responsibility of the officer in charge to determine whether the matériel has been properly prepared for service by the supplying organization and to be sure it is in condition to perform any mission to which it may be assigned when placed in service. For this purpose, inspect all assemblies, subassemblies, and accessories to be sure they are properly assembled, secure, clean, and correctly adjusted and/or lubricated. Check all tools and equipment against ORD 7 SNL C-90 to be sure every item is present and determine that they are in good condition, clean, and properly mounted or stowed.

b. A record should be made of any missing parts and of any malfunctions. Any such conditions should be corrected as quickly as possible.

c. Attention should be given to small and minor parts as these are the more likely to become lost and may seriously affect the proper functioning of the launcher.

d. The rocket launcher should be cleaned and prepared for service in accordance with instructions given in paragraphs 8 and 9.

8. New Matériel

a. REMOVE PRESERVATIVE COMPOUND.

- (1) After removal of barrier material from the launcher, remove preservative compound from unpainted surfaces with waste, wiping cloths, or a brush saturated with volatile-mineral-spirits-paint thinner. After complete removal of preservative compound, dry and lubricate as specified in the lubrication chart (fig. 35).

Caution: Paint used on the rocket launcher is heat and flame resistant. Volatile-mineral-spirits-paint thin-

ner will remove this special paint. For cleaning painted surfaces, use only a mixture of soap and water (par. 48). Use volatile-mineral-spirits-paint thinner only for removing preservative compound from unpainted surfaces.

- (2) All new matériel or component parts of matériel received from storage and intended for immediate use, which are coated with rust-preventive compound, will be cleaned thoroughly with waste, wiping cloths or a brush saturated with volatile-mineral-spirits-paint thinner, or with one part of grease-cleaning compound to four parts of volatile-mineral-spirits-paint thinner. After complete removal of the compound, dry and lubricate as specified in the lubrication order.
- (3) Remove preservative compound from the drawbar flange and latch parts. Remove paint from the launcher name plate (fig. 5) so that stampings are legible.
- (4) Wrap the bore brush (fig. 39) in wiping cloths and dampen with volatile-mineral-spirits-paint thinner, and push it through each cluster tube to remove preservative compound and accumulations of paint. Examine each of the firing mechanism electrical contacts in the cluster and, if necessary, clean preservative compound from the contacts. It is important that the contacts be clean to prevent grounding the live contact to the cluster through bridges of preservative compound, paint, or dirt. Scrape paint or preservative compound from the leveled surface at the top of the cluster (fig. 38).
- (5) Remove preservative compound from latches, hinges, chain, and lock of the control box (fig. 4). Remove accumulations of paint, oil, preservative compound, etc., from the bottom of the control box. Do not use any fluid in the control box that can enter the inside of the firing mechanism conduit assemblies. Remove preservative compound from the sight mount (fig. 21) and the control box sight mount bracket. Apply oil to the bracket dove-tail slides to prevent corrosion.
- (6) Remove preservative compound with volatile-mineral-spirits-paint thinner from the elevating arc and elevating mechanism pinion, and apply oil to prevent corrosion. Remove preservative compound and paint from the sight mount pins (fig. 38) to permit installation and accurate positioning of the sight mount.

b. CHECK GENERAL CONDITION AND APPEARANCE OF MATÉRIEL. Check to see that a $\frac{3}{4}$ -inch red circle has been painted around all lubrication fittings and oil plugs (par. 44b), and that matériel is painted in accordance with regulations (par. 46). Note any gloss on finish or any unnecessary bright metal that would affect camouflage value. Note that name plates (par. 5) are clean and legible and not painted over. Inspect condition of welds, rivets, plates, and castings for cracks and breaks. Check for loosened, broken, or missing bolts, nuts, screws, or cotter pins. Inspect hinges, latches, clamps, pins, and other moving parts for proper lubrication and evidence of rust or corrosion.

c. SET UP MATÉRIEL.

- (1) Remove sighting equipment and fire control instruments from shipping containers. Procure and install batteries to the aiming post lights and the instrument light (par. 75d). Place the instrument light in the control box clip (fig. 8). Pull the shields off the aiming post lights, place the lights in control box clips (fig. 8) and lay the shields

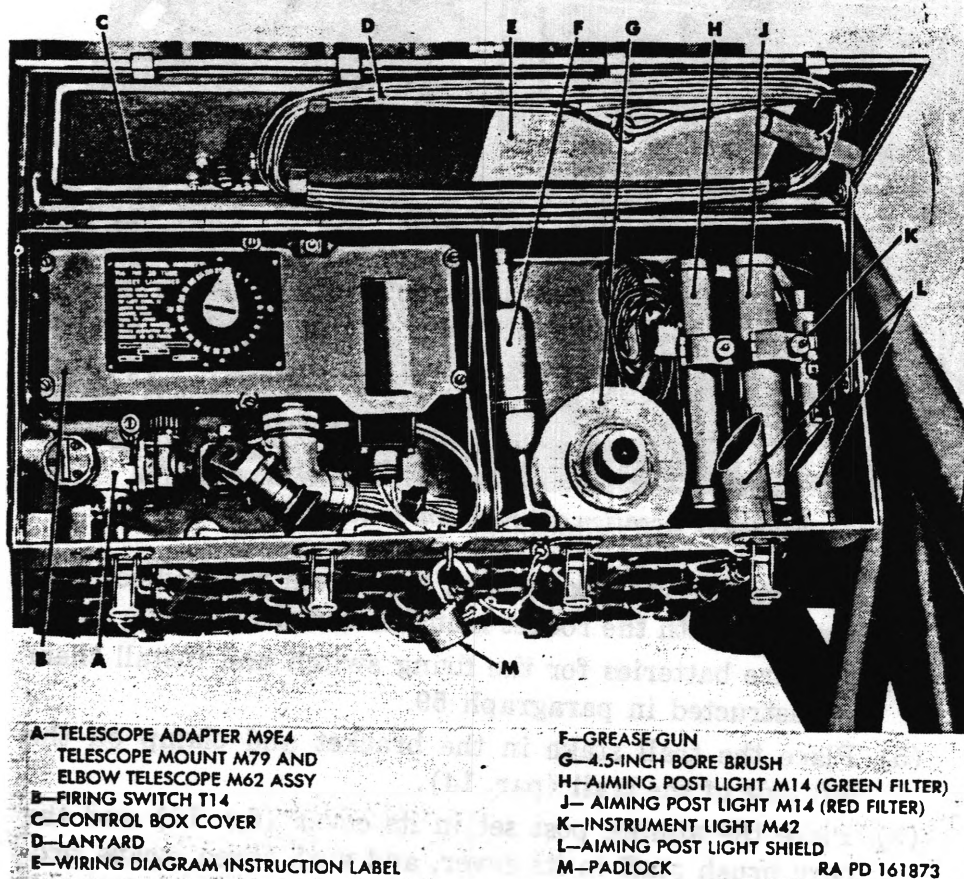


Figure 8. Location of equipment in control box.

in the control box. Install the bore brush to the upright support pin provided in the control box. Install the grease gun to clip in control box (fig. 8). Wrap the lanyard around the supports provided on the inside of the control box cover (fig. 8). Install the sighting equipment in the control box (par. 76).

- (2) Place the firing circuit tester in its cover (fig. 33), and place the covered circuit tester in the control box (fig. 9).

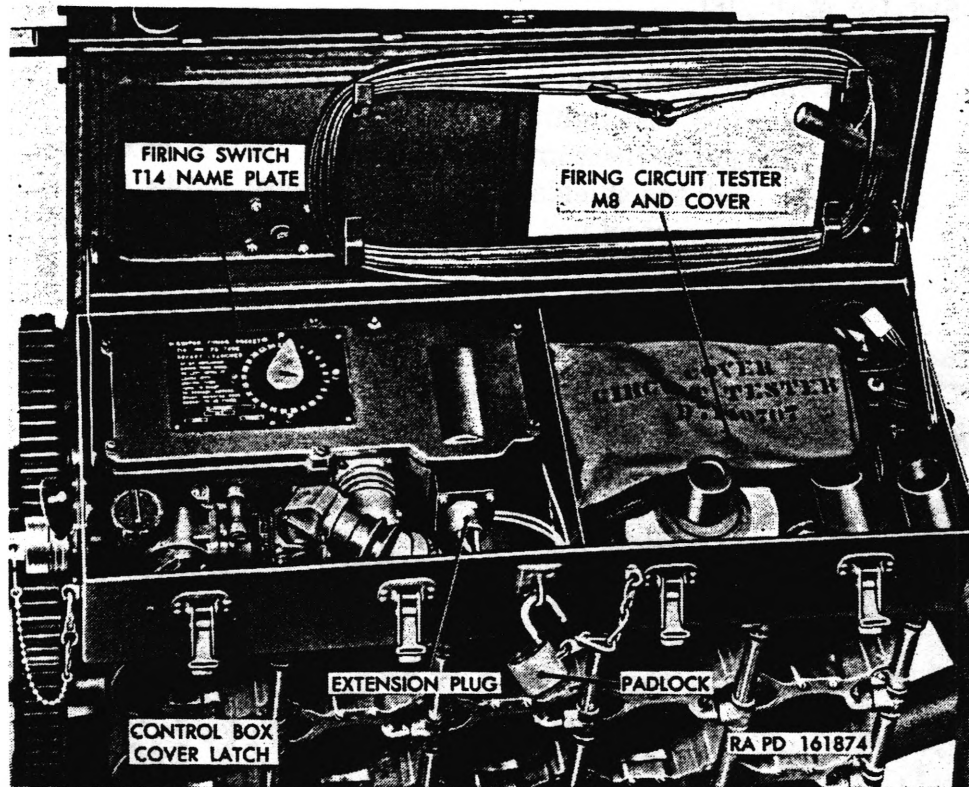


Figure 9. Location of equipment in control box.

- (3) Remove control box padlock keys from the padlock and tag them with the rocket launcher serial number.
- (4) Procure batteries for the firing switch and install them as instructed in paragraph 59.
- (5) Place the trail stake in the bracket and clamp on the left side of the trail (par. 14).
- (6) Place the aiming post set in its cover (fig. 10) and the bore brush staff in its cover, and with three straps provided, strap the two items to the right side of the trail as shown in figure 10. When the launcher is to be transported, the straps are also used to hold the blackout light-system cable to the trail (par. 33i).

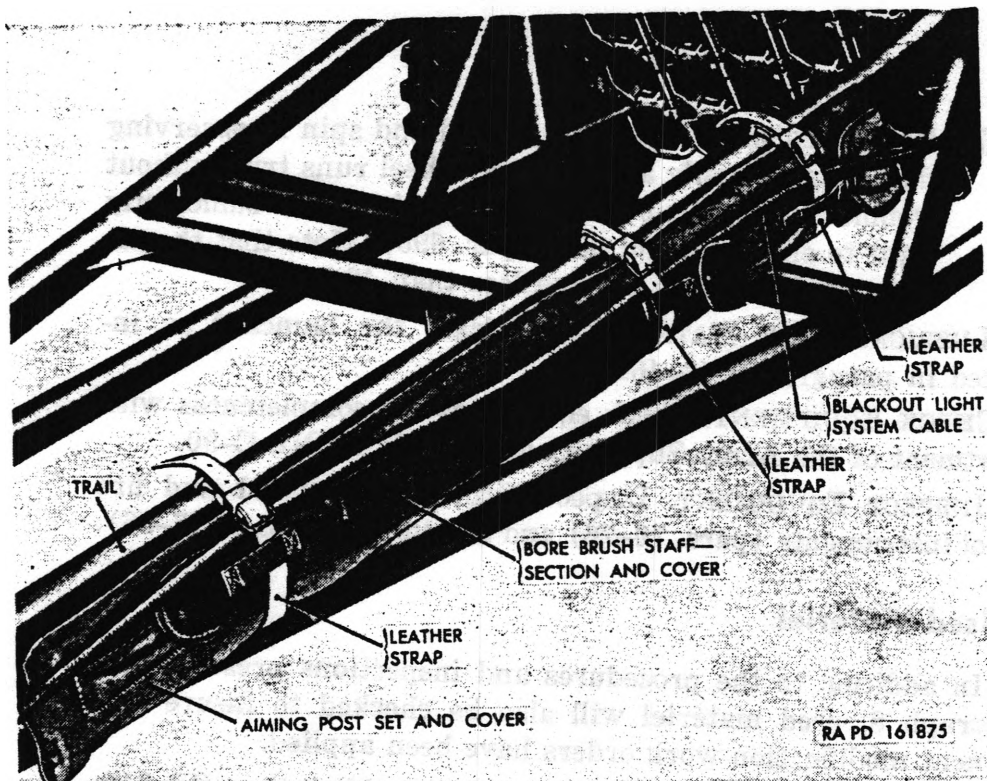


Figure 10. Aiming post set and bore brush staff attached to trail for transport.

d. **MAKE OPERATIONAL CHECK.** Make an operational check as follows:

- (1) Operate the lunette assembly (par. 11) and see that the drawbar rotates freely and that the lock shaft works properly (fig. 11).
- (2) Try the trail stake clamp to see that it operates to retain the stake to the trail (fig. 15) and that it releases the trail stake properly (par. 14).
- (3) Pull out the elevating lock (par. 16) and elevate and depress the cluster (par. 17). Note that the operation of the elevating mechanism is smooth. Handwheel effort is not to exceed 1 pound.
- (4) Pull out the traveling lock (par. 15) and traverse the carriage (par. 18). Note that the carriage traverses smoothly and that handwheel effort does not exceed 4 pounds. See that the traveling lock operates freely.
- (5) Load a dummy rocket into each of the 25 cluster tubes (par. 30) to insure that the rocket moves easily in each tube and that it seats properly at the stop.
- (6) Test the operation of the firing switch (par. 58).

(7) Raise each wheel from the ground and spin it, observing that it spins easily and that the wheel runs true without wobble. Verify that the wheel bearings are sufficiently tight to eliminate end play (par. 69b). Note that the air pressure is over 25 psi and less than 40 psi.

e. LUBRICATE THE MATÉRIEL. Lubricate the launcher as instructed in paragraphs 43-46.

f. CHECK EQUIPMENT. Check equipment for completeness with Department of the Army Supply Catalog ORD 7 SNL C-90.

g. INSPECT EQUIPMENT. Inspect sighting equipment and fire control instruments (pars. 70-76) and ammunition (pars. 77-86).

9. Used Materiel

a. In addition to the procedures and inspections prescribed in paragraph 8, used matériel will also be checked to insure that pertinent modification work orders have been applied.

b. A list of modification work orders is published in SR 310-20-4. If any pertinent modification work order has not been applied, the local ordnance officer must be notified promptly.

Section II. CONTROLS AND INSTRUMENTS

10. General

This section describes, locates, and illustrates the controls and instruments provided for the operation of rocket launchers T123. This section does not include information on the controls and instruments for sighting equipment and fire control instruments. Sighting equipment and fire control instruments are covered in paragraphs 70-76.

11. Lunette and Drawbar Lock Shaft

a. The drawbar (fig. 11) is rotated to place the lunette in its lower position for attachment to the prime mover in traveling, and to its upper position to clear the ground when in the firing position. The trail stake ring is provided for the trail stake (fig. 29). The drawbar is locked in either position by a manually operated drawbar lock shaft.

b. To rotate the drawbar, pull out on the lock shaft knob (fig. 11) and rotate the drawbar lock shaft counterclockwise. This movement causes the lock shaft to move out of engagement with the drawbar flange and allow rotation of the drawbar. Rotate

the drawbar and swing the drawbar lock shaft back to its latched position, and see that the plunger of the knob engages the hole in the trail plate.

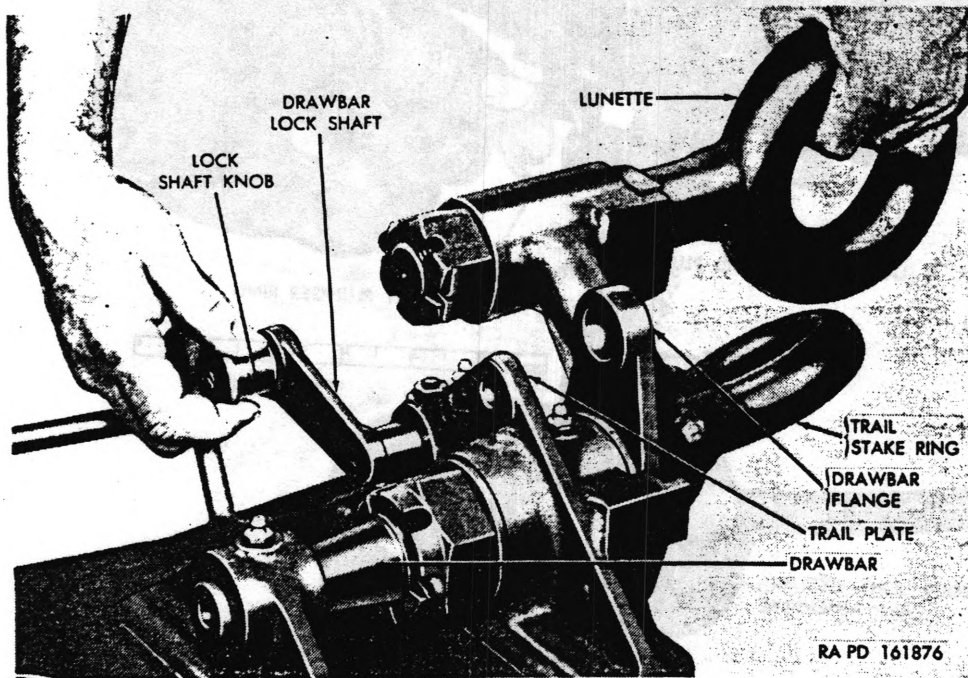


Figure 11. Rotation of drawbar and lunette to firing or traveling position.

12. Blackout Light-System Bracket and Plunger, Cable Plug, and Cable Spring

a. The blackout light-system consists of a blackout light-system lamp assembly (fig. 12), an 18-foot length of cable, a cable plug, and a cable tension spring (fig. 13). The blackout lamp bracket and plunger (fig. 12) is attached to the lower right-hand side of the rocket cluster for attaching the blackout lamp assembly for traveling. The cable plug (fig. 13) is placed into the prime mover receptacle which provides power for the blackout light-system. The cable tension spring is provided to support the cable loop.

b. To remove the blackout light-system lamp assembly (fig. 12), pull out the bracket plunger ring and pull the lamp assembly down and away from the bracket. The lamp support is notched for proper alinement of the support in the lamp bracket and plunger.

c. The blackout light-system cable plug (fig. 13) is keyed to enter the prime mover receptacle in one position. To place it in the receptacle, aline the key and push in the plug.

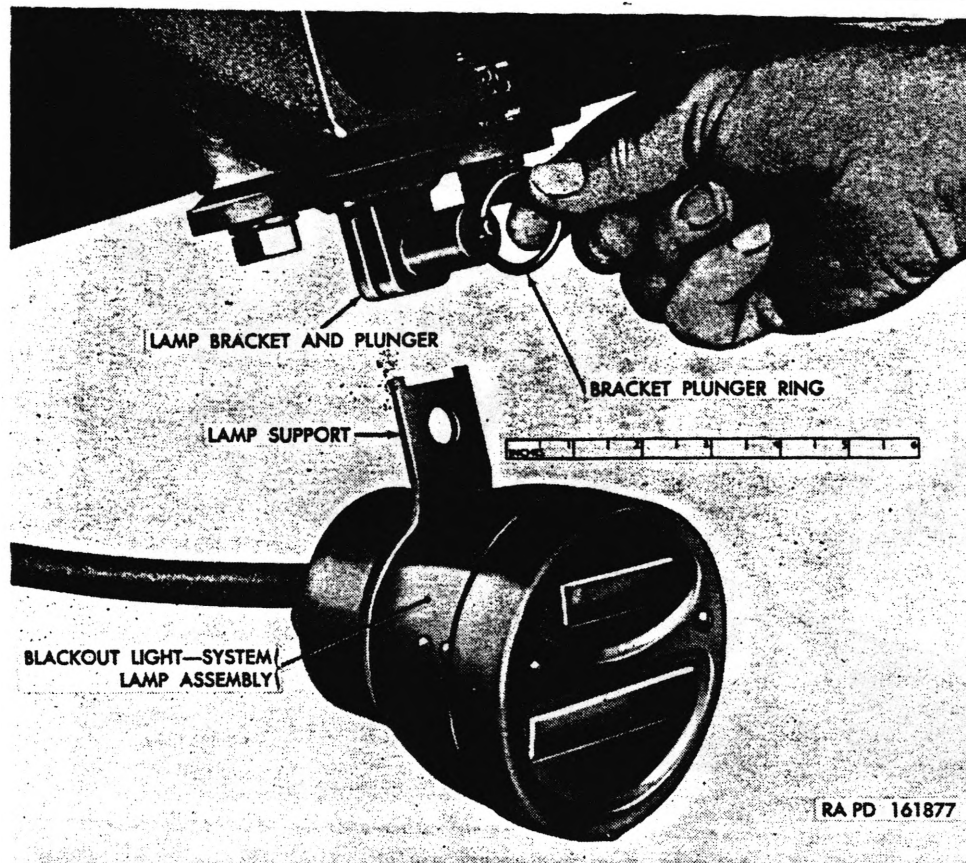


Figure 12. Removal of blackout light-system lamp assembly from bracket and plunger.

d. The cable tension spring (fig. 13) has two coiled eyes; one end is clipped around the cable and the other end is clipped around an eye or fitting on the prime mover. When not in use, the cable tension spring may be attached to the lifting handles on the trail.

13. Parking Brakes

a. Each wheel of the carriage is provided with a mechanical brake operated by a clasp type hand parking brake (fig. 14). The parking brakes ordinarily are set only when the carriage is unlimbered from the prime mover, and when the weapon is parked.

b. To set the parking brake, pull the parking brake handle (fig. 14) rearward as far as possible. A spring in the handle will cause the parking brake pawl to engage the rack to hold the parking brake in the "set" position.

c. To release the parking brake, disengage the pawl from the rack (fig. 14) by squeezing the handle and pawl together and pushing the handle as far forward as it will go.

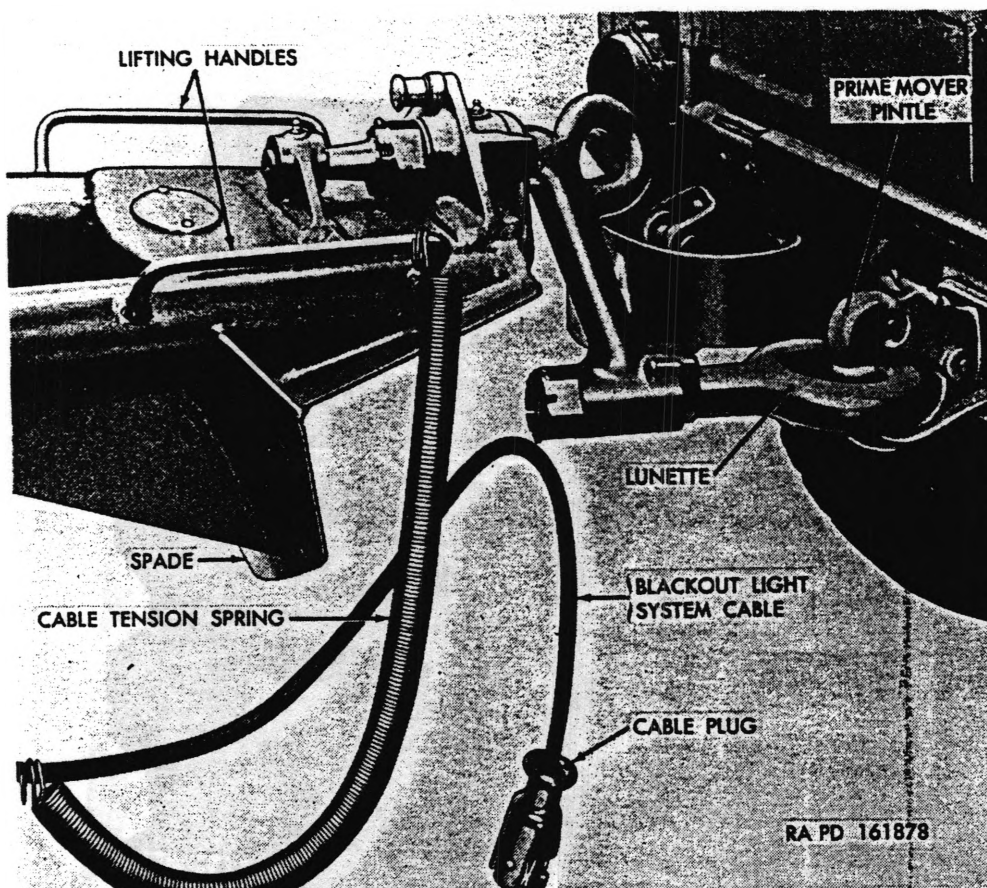


Figure 13. Blackout light-system cable plug and cable spring—rocket launcher attached to prime mover pintle.

14. Trail Stake Clamp

a. The trail stake (fig. 15) is attached to the left side of the trail by the stake bracket and the stake clamp.

b. To release the trail stake, pull the clamp lever forward, pull the clamp spring forward and raise it, then remove the trail stake from the trail.

c. To attach the trail stake, place the pointed end of the stake into the stake bracket, hold the stake up to the stake clamp body and place the spring around the stake to hook onto the lower part of the clamp body, then rotate the clamp lever to its clamped position.

15. Traveling Lock

a. The traveling lock (fig. 16) is located on the carriage axle housing. It is used to lock the axle housing to the axle in its centered position for traveling.

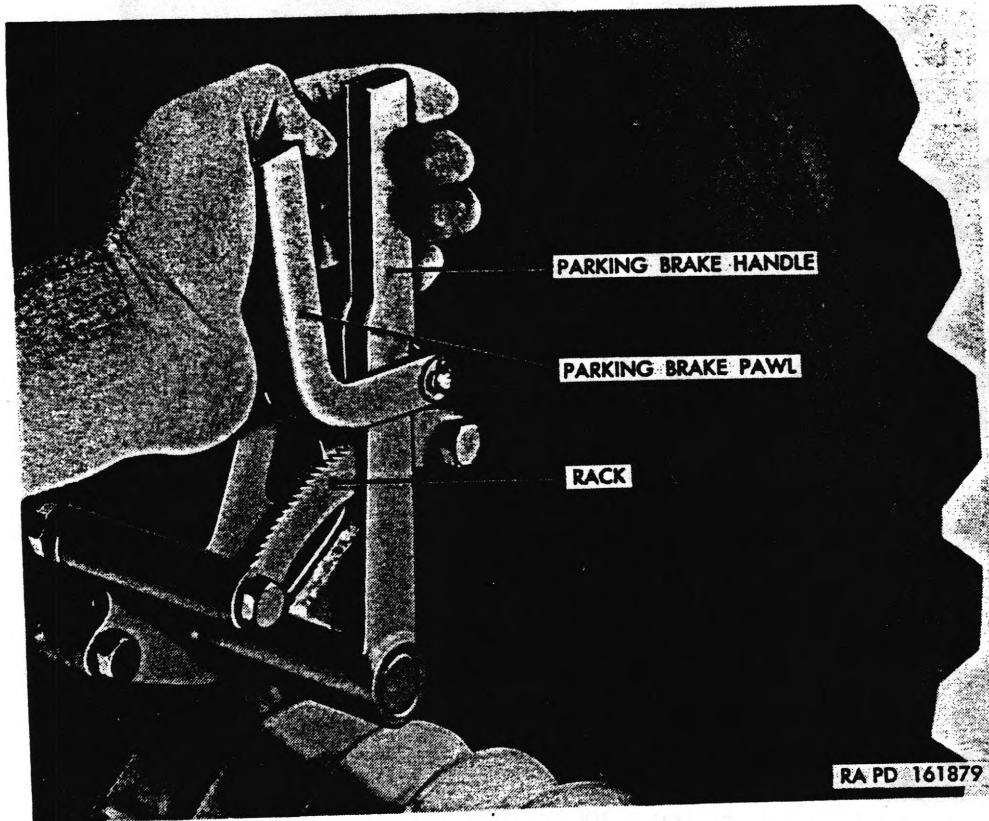


Figure 14. Operation of parking brake.

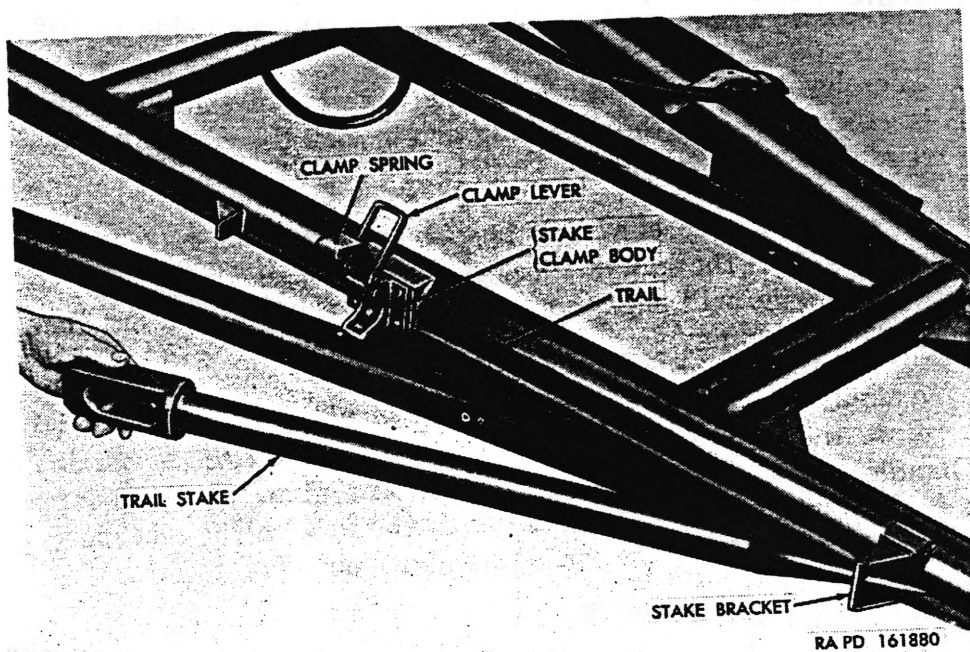


Figure 15. Removal of trail stake from trail.

b. To unlock the axle housing and axle, pull out the traveling lock handle and rotate the handle to its vertical position.

c. To lock the axle housing and axle, rotate the traveling lock handle to its horizontal position and traverse the carriage (par. 18) slowly towards the center position. A spring in the traveling lock will force the lock plug into a hole in the axle.

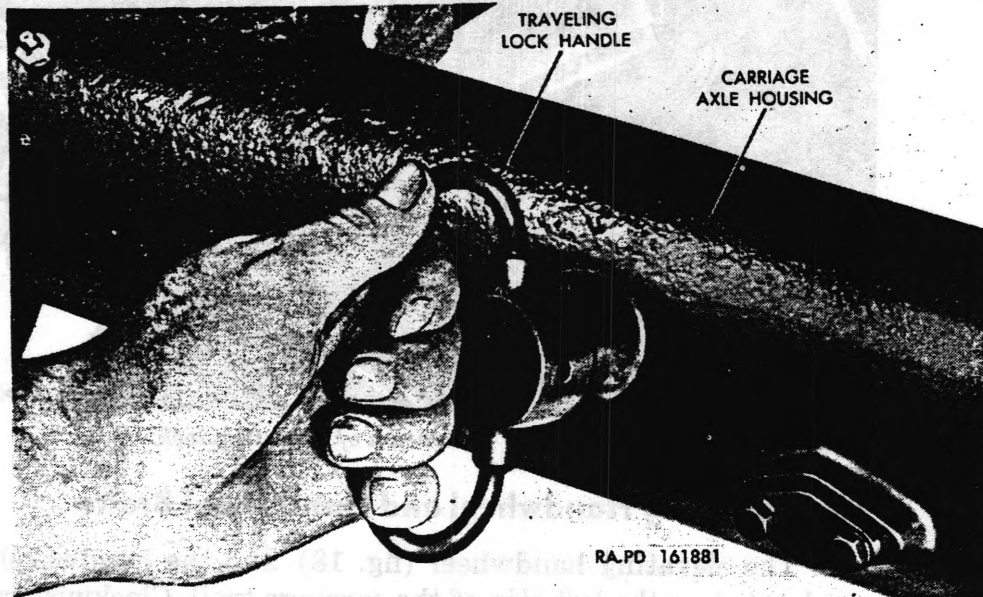


Figure 16. Operation of traveling lock.

16. Elevating Lock

a. The elevating lock, located on the left side of the trail (fig. 17), engages a hole in the elevating arc to lock the rocket cluster for traveling.

b. To disengage the elevating lock, pull out the elevating lock handle and rotate the handle clockwise to its vertical position. A pin in the handle, will engage a notch in the trail to hold out the elevating lock plunger.

c. To engage the elevating lock with the elevating arc for traveling, rotate the elevating lock handle counterclockwise. A pin in the handle will engage a slot in the trail and allow the elevating lock plunger to move in to engage with the hole in the elevating arc. Elevate or depress the rocket cluster (par. 17) to aline the hole and plunger.

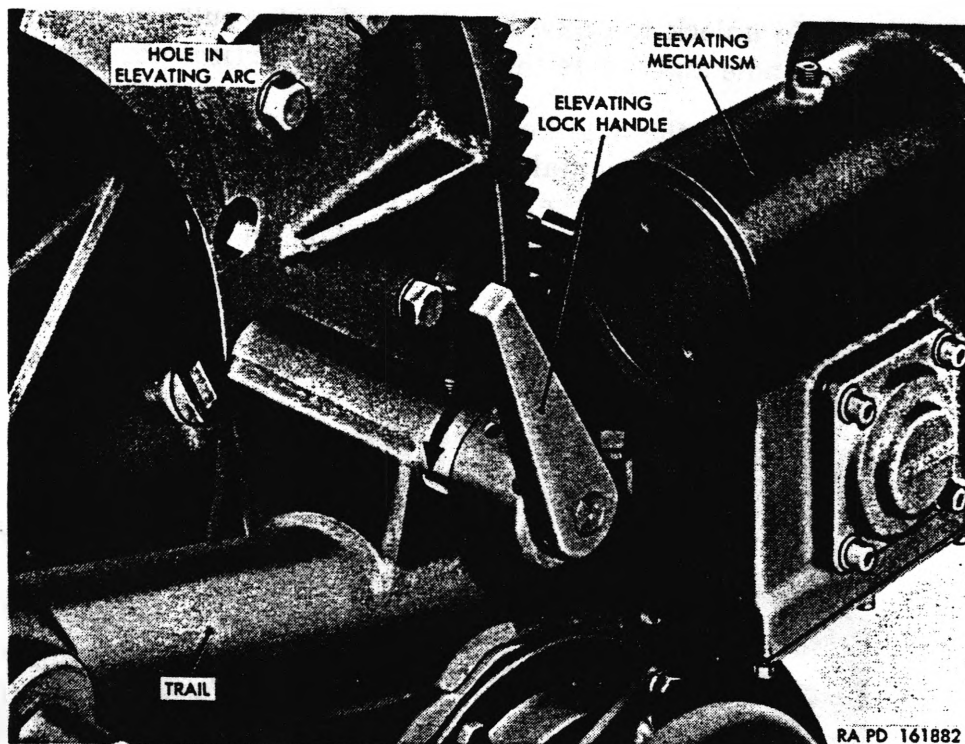


Figure 17. Operation of elevating lock.

17. Elevating Handwheel and Handwheel Brake

a. The elevating handwheel (fig. 18) and the handwheel brake are located on the left side of the carriage trail. Clockwise rotation of the handwheel by the handwheel knob elevates the rocket cluster and counterclockwise rotation depresses it.

b. The handwheel brake lever is used to operate the brake. The brake is set to prevent change in elevation and range during firing and released after firing for change in elevation. To set the brake, move the brake lever to the right; to release the brake, move the lever to the left.

18. Traversing Handwheel and Handwheel Brake

a. The traversing handwheel (fig. 19) and the handwheel brake are located on the left side of the carriage trail. Clockwise rotation of the handwheel by the handwheel knob traverses the carriage to the right (fig. 20), and counterclockwise rotation traverses the carriage to the left.

b. The handwheel brake lever (fig. 19) is used to operate the brake. The brake is set to prevent change in azimuth during firing and released after firing for change in azimuth. To set the brake, move the brake lever to the right; to release the brake, move the lever to the left.

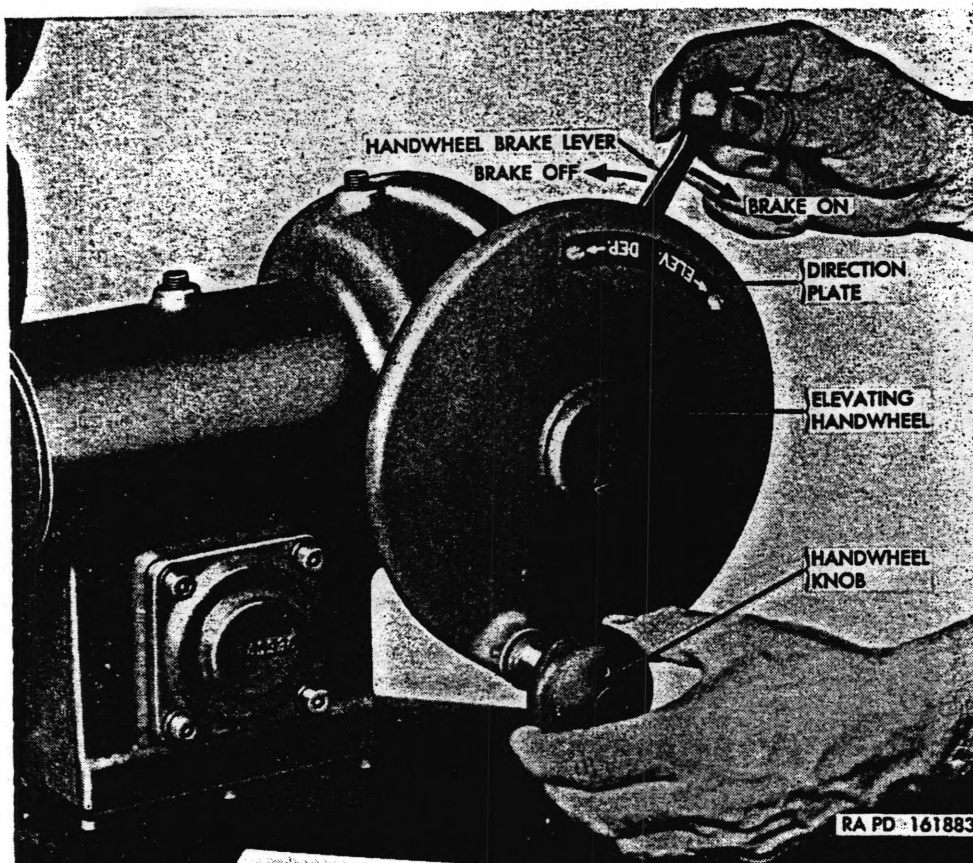


Figure 18. Operation of elevating handwheel and handwheel brake.

19. Sight Mount Clamp Screw

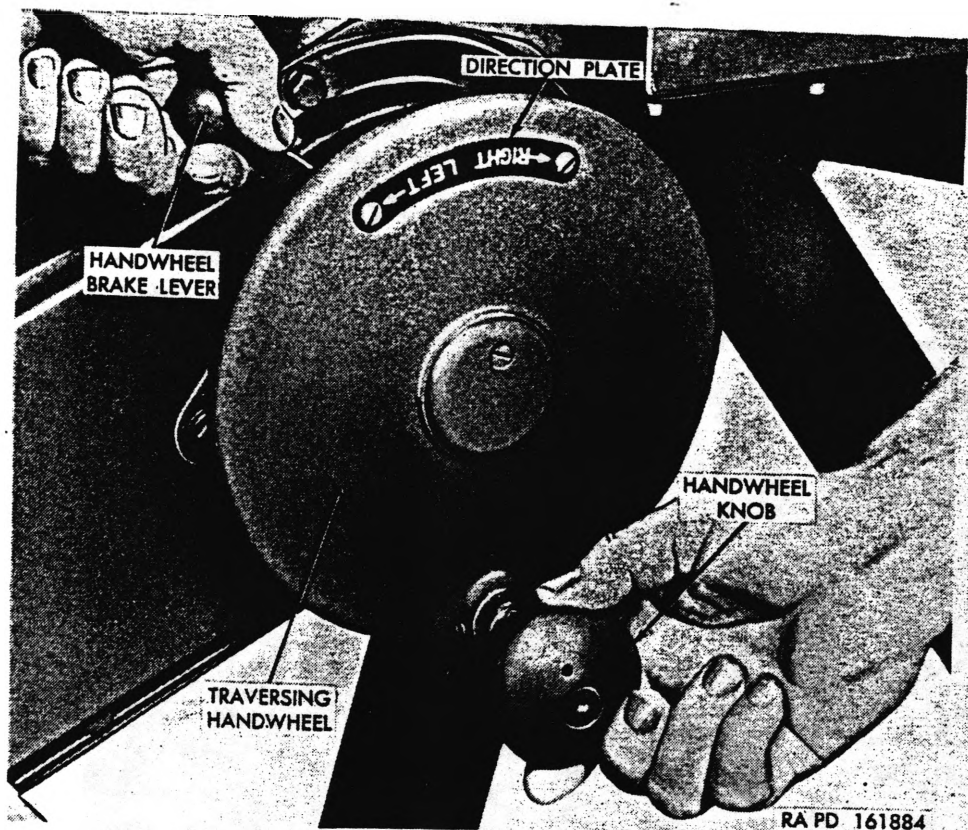
The sight mount clamp screw (fig. 21) is used to clamp the sight mount to the sight mount pin on the rocket cluster or on the left side pin in the trunnion pin. The screw has a right-hand thread.

20. Sight Mount Housing Adjusting Knob (Cross Leveling)

The sight mount housing adjusting knob (fig. 21) is used for cross leveling the sight (par. 73f).

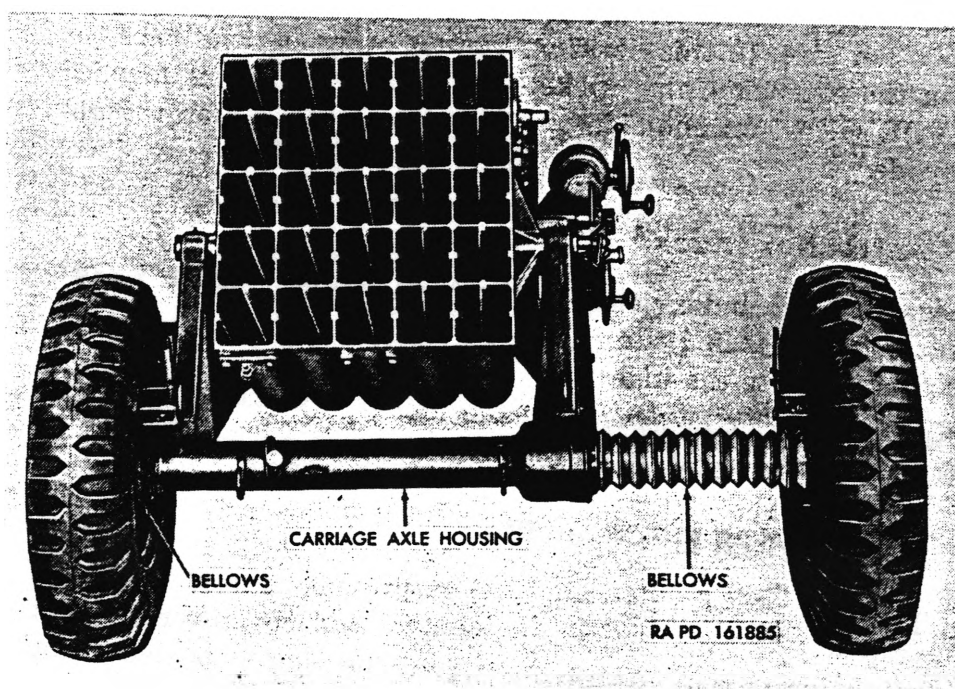
21. Firing Switch Extension Plug

a. The firing switch extension plug (fig. 22) is used to change the firing circuit from generator power to battery power in event of failure of the firing switch generator. The plug is located in the control box where it is plugged into the extension plug socket.



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Figure 19. Operation of traversing handwheel and handwheel brake.



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Figure 20. Carriage traversed to extreme right position.

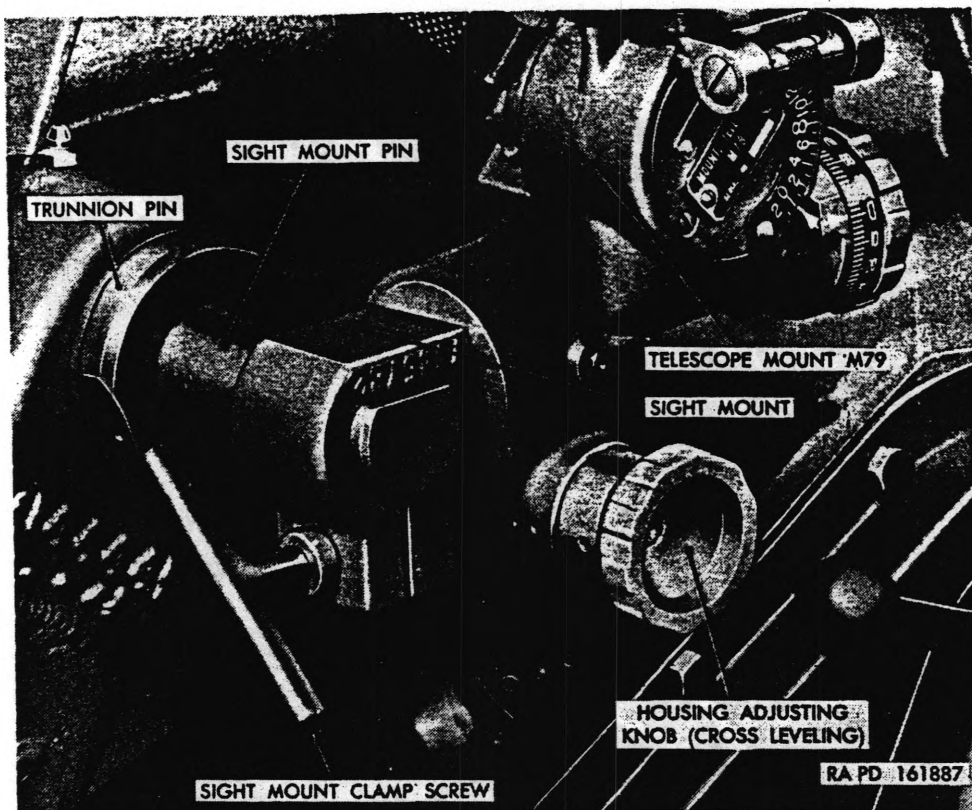


Figure 21. Sight mount controls.

b. A key screw serves as a key in the plug. To change from generator power to battery power, pull out the extension plug from the plug socket and with a screw driver, turn the screw in until its head is flush with the plug. This will bring out the soldered nut on the other side. In this position, the nut is the key. Replace the plug in the extension plug socket. The extension plug is marked "UP FOR GEN" on one side, and "UP FOR BATT" on the opposite side.

22. Control Box Index Pointer

The control box index pointer (fig. 23) is provided for positioning the firing switch pointer without opening the cover of the control box. Rotate the index pointer to engage its shaft with the firing switch pointer, then rotate the index pointer clockwise to the tube number on the index dial which is to be fired first.

23. Firing Switch Pointer

The firing switch pointer (fig. 24) is provided for setting the firing switch distributor when the control box cover is opened.

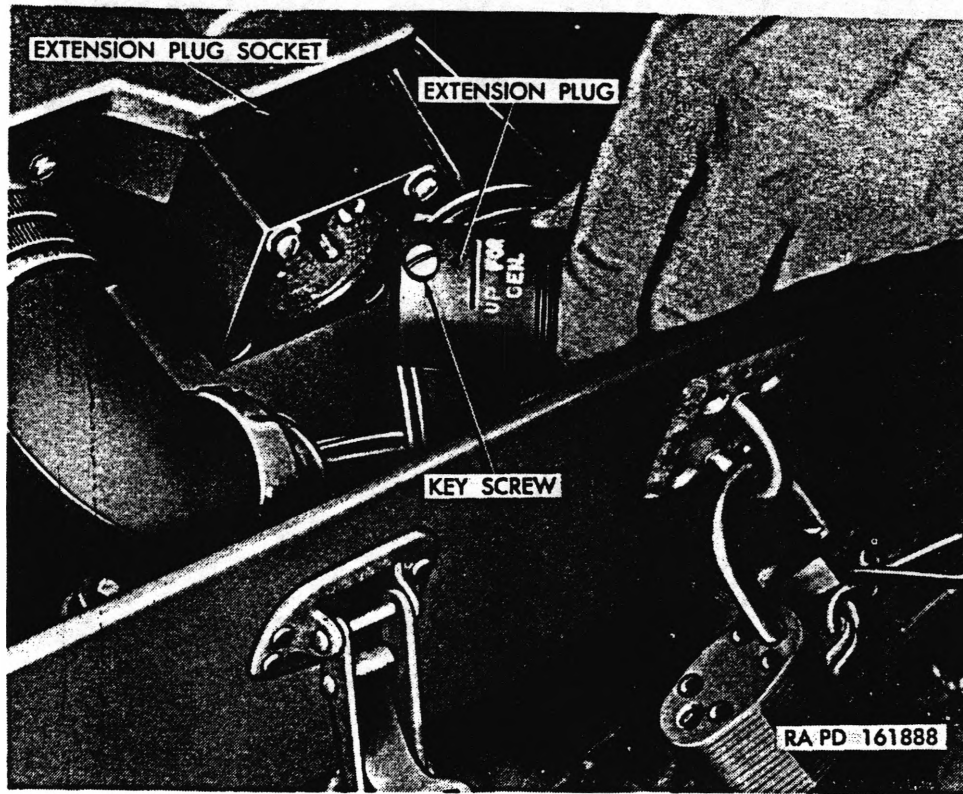


Figure 22. Installation of firing switch extension plug.

This pointer is normally used in testing the firing switch and the wiring circuit. To set the pointer, rotate it clockwise only. A pair of pawls prevents counterclockwise rotation.

24. Firing Switch Safety Plug

a. The safety plug (fig. 25) is provided to prevent accidental firing of the rockets. When the safety plug is removed, the firing circuit is broken and rockets cannot be fired. The safety plug socket is located at the left side of the control box. In traveling, the safety plug is carried in the control box, when in use, the safety plug is attached to the control box by means of a short beaded chain and chain clip. The socket spring cover is for the protection of the safety plug socket.

b. The safety plug is a "twist-lock" type. To install it, push in the plug and twist it to the right. To remove the safety plug, twist it to the left and pull out.

25. Firing Switch Lanyard

a. The firing switch T14 is lanyard-operated and is semiautomatic. Each pull of the lanyard fires one rocket and indexes the



Figure 23. Rotation of control box index pointer.

firing switch into position for firing the next round on the next pull of the lanyard. The rate of fire is dependent only upon the speed with which the operator can pull the lanyard.

b. The lanyard is carried in the control box, wound around supports on the inside of the control box cover (fig. 8). The lanyard may be used on either the right or left side of the rocket launcher. To prepare the lanyard for use, remove it from the control box cover. For use of the lanyard on the left side of the launcher, clip the lanyard (fig. 26) to the upper hole in the firing switch lever, and place the cable in the left-hand guide. For use of the lanyard on the right side of the launcher, clip the lanyard to the lower hole in the firing switch lever, and place the cable in the right-hand guide.

c. The lanyard must be given a quick pull to operate the firing switch generator fast enough to provide current for firing, and each pull of the lanyard must operate the firing switch lever to its stopping point to assure proper firing switch contact closing and proper indexing of the firing switch distributor.

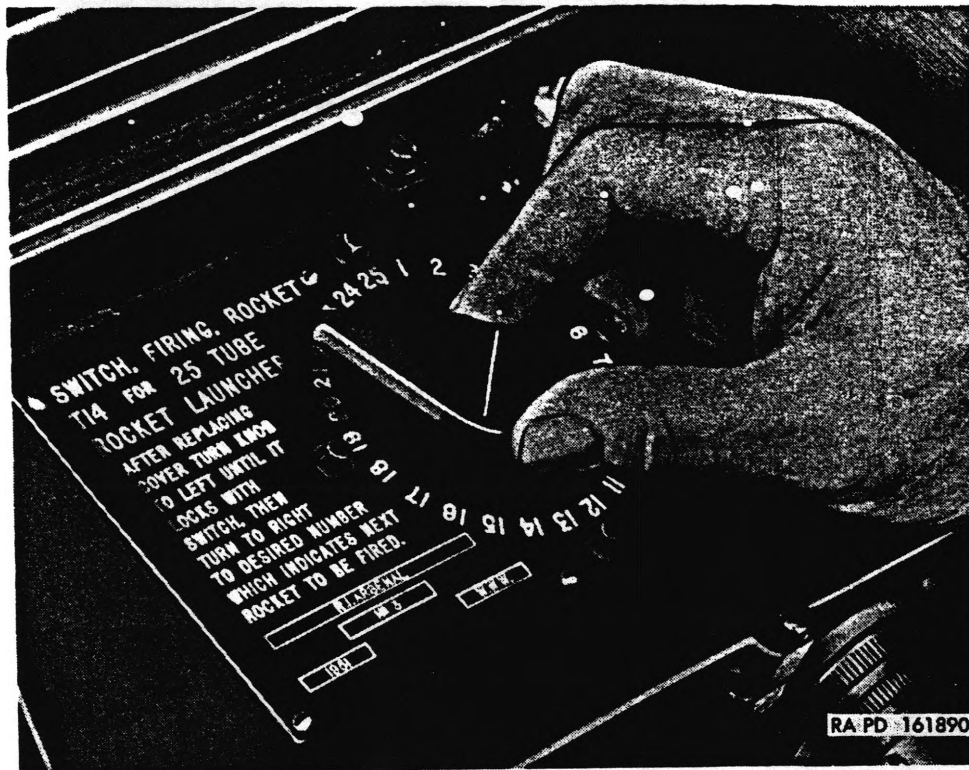


Figure 24. Rotation of firing switch pointer.

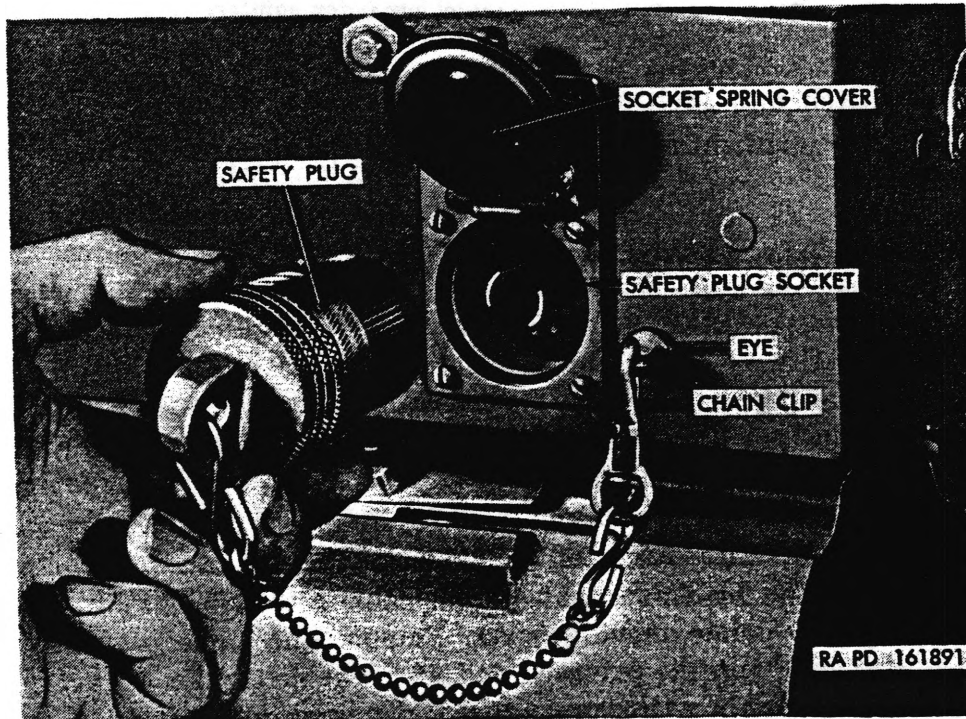


Figure 25. Installation of firing switch safety plug.

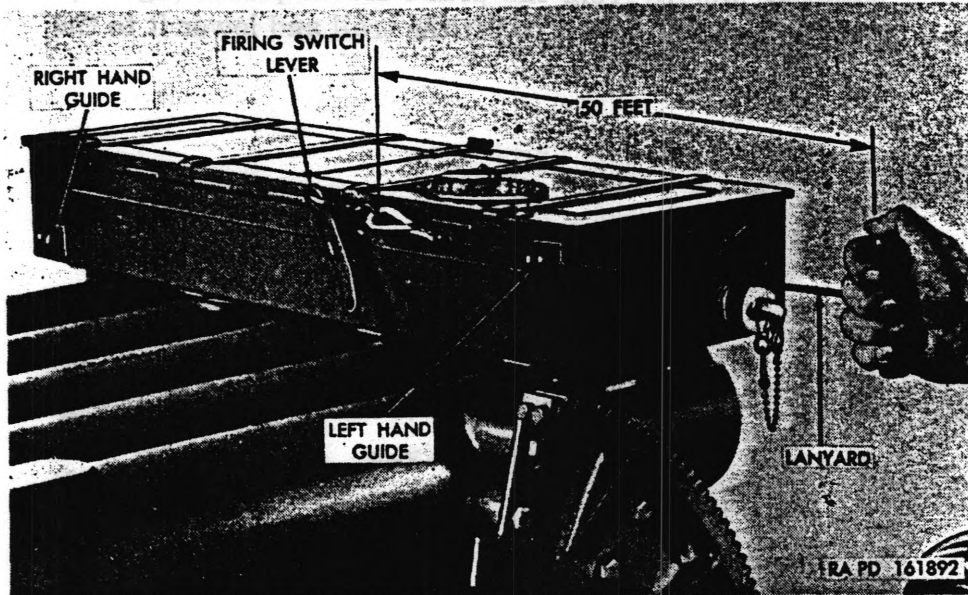


Figure 26. Operation of firing switch lanyard.

Section III. OPERATION UNDER USUAL CONDITIONS

26. General

This section contains instructions for the mechanical steps necessary to operate the rocket launcher T123 under usual conditions. For operation under unusual conditions, refer to paragraphs 34-38.

27. Preparation of Launcher for Operation and Firing

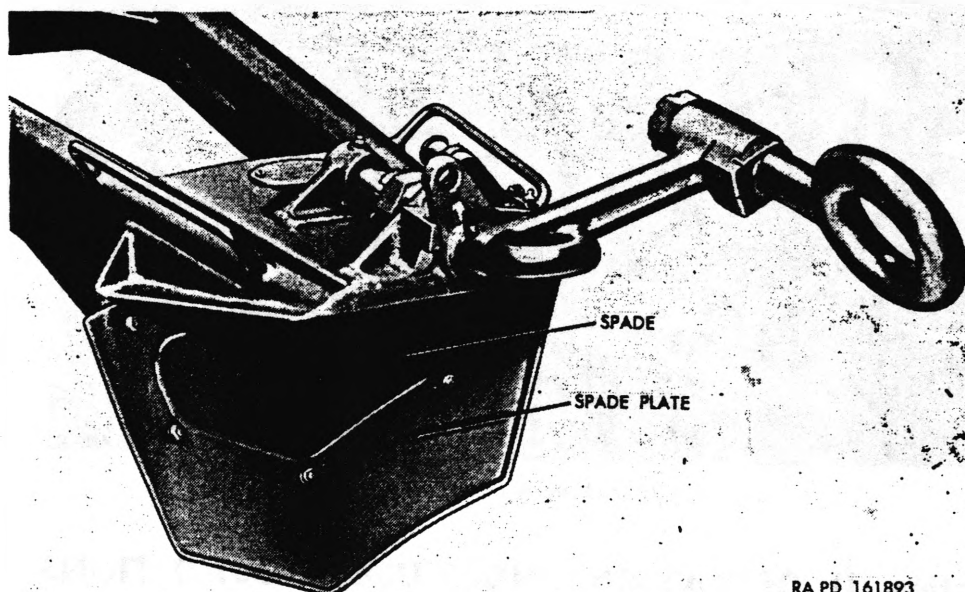
a. **SELECT LAUNCHER SITE.** Whenever possible, select a site for the launcher that is level and clear of dry vegetation. The blast of hot gases and flame from the rockets will ignite dry material at the front and rear of the launcher. Dry vegetation should be cleared for a distance of approximately 100 feet from the front and rear of the launcher.

b. **UNLIMBER LAUNCHER FROM PRIME MOVER.**

- (1) Pull the blackout light-system cable plug (fig. 13) out of the prime mover socket. Remove the cable tension spring from the prime mover. If the cable tension spring is to remain with the launcher, clip it to the lifting handles on the trail.
- (2) The spade plate (fig. 27) is used to increase the spade area when the launcher is to be emplaced in light, sandy soil. Attach the spade plate to the spade with six cap

screws, lock washers, and nuts before uncoupling the launcher from the prime mover.

- (3) Set the parking brakes (par. 13) and uncouple the launcher lunette from the prime mover pintle (fig. 13). Use the lifting handles to lift the trail and lower it to the ground.



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Figure 27. Spade plate attached to increase spade area.

c. REMOVE BLACKOUT LIGHT-SYSTEM, AIMING POST SET, AND BORE BRUSH STAFF-SECTION.

- (1) Remove the three leather straps which attach the aiming post set, bore brush staff-section, and the blackout light-system cable to the trail (fig. 10).
- (2) Remove the blackout light-system lamp from the bracket on the cluster (par. 12).

d. REMOVE LAUNCHER COVER.

- (1) Untie the rope at each side of the cover (fig. 28) and pull the rope through the metal eyes. Unfasten the three straps at the rear of the cover and remove the cover.
- (2) Allow cover to dry before folding. Fold the cover into a compact bundle and stow it in the prime mover.

e. ROTATE LUNETTE TO FIRING POSITION. Unlock the drawbar lock shaft and rotate the lunette up to its firing position (par. 11).

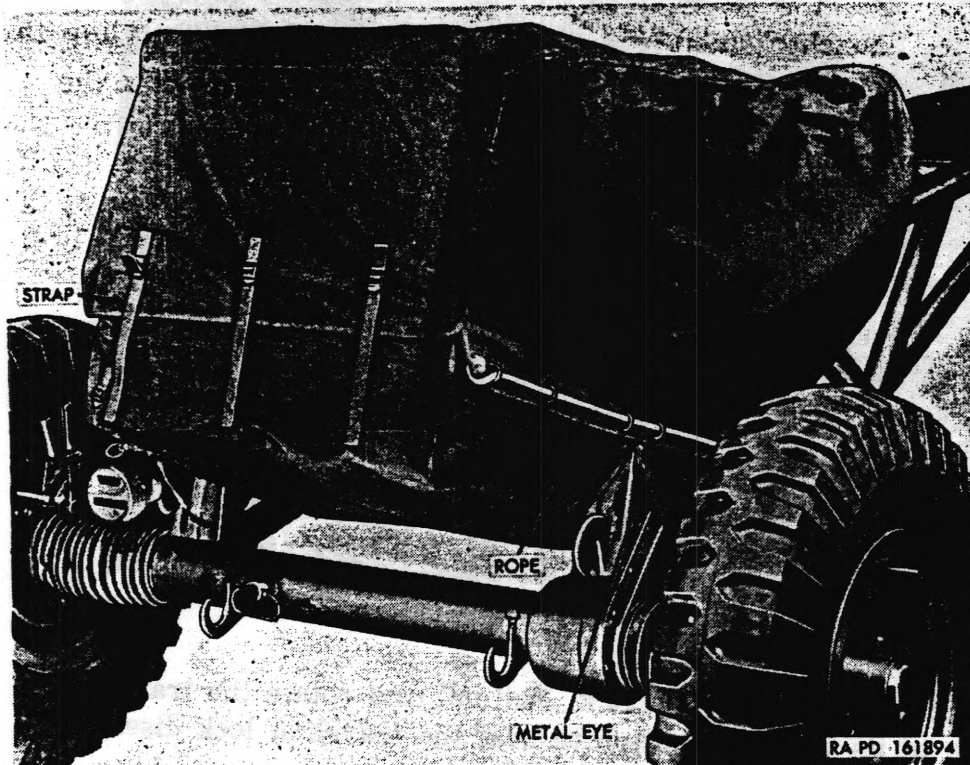


Figure 28. Launcher with cover.

f. **EMPLACE SPADE.** Dig hole for the spade. This will be necessary even when the soil is light and sandy as there is little reaction on the launcher in firing. Loosen only as much soil as is necessary for the spade. The blast from the rockets will blow loosened soil away. A blast deflector welded to the trail helps to deflect the blast away from the spade.

g. **DRIVE IN TRAIL STAKE.**

- (1) Remove the trail stake from the trail (par. 14).
- (2) Place the trail stake in the stake ring and drive the stake into the ground (fig. 29).

h. **DRIVE IN WHEEL STAKES.** The wheel stakes (fig. 34) are provided to prevent side movement of the launcher during firing. The wheel stakes are ordinarily carried in the prime mover. Drive a stake in the ground as close as possible to the tire. Approximately 8 inches of the stake should remain above ground (fig. 2).

i. **POSITION BLAST DEFLECTOR UNDER LAUNCHER.** If a blast deflector is to be used, place the blast deflector under the launcher, and wrap the attaching chains around the axle housing and hook them to prevent movement.

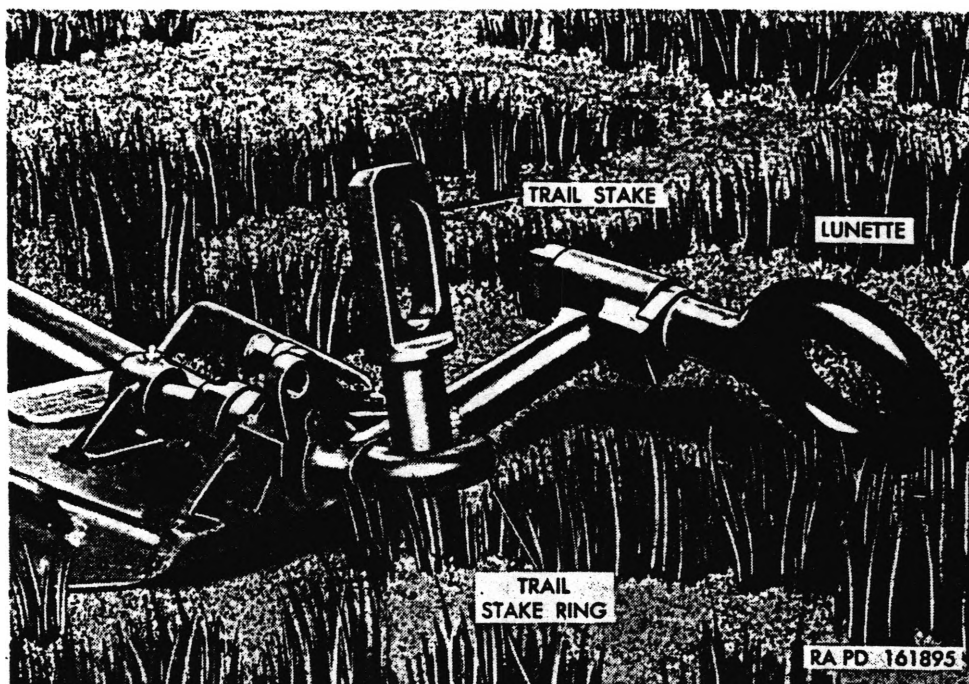


Figure 29. Position of trail stake in ring.

j. **DISENGAGE TRAVELING LOCK.** Pull out and rotate the traveling lock to its vertical position to hold the traveling lock disengaged.

k. **DISENGAGE ELEVATING LOCK.** Pull out and rotate the elevating lock clockwise to hold the elevating lock disengaged.

l. **REMOVE ROCKET RETAINING PINS.** Pull the rocket retaining pins out of the rocket cluster and store them in the prime mover.

m. **INSTALL SIGHT MOUNT AND SIGHTING EQUIPMENT.** The sight mount is ordinarily installed on the sight mount pin located on the left trunnion pin. A secondary position is provided on the rocket cluster (fig. 3) for use when the target is to the right of the launcher and obscured by the rocket cluster. Install the sight mount (par. 20) and the sighting equipment (par. 73b).

28. Elevating

a. Operate the brake lever to release the elevating handwheel brake and rotate the elevating handwheel to position the rocket cluster at 5- to 10-degree elevation for loading rockets into the cluster (par. 30).

b. Rotate the elevating handwheel to position the rocket cluster at the desired elevation. Set the elevating handwheel brake to prevent movement of the cluster during firing.

c. When elevating or depressing the rocket cluster to its maximum elevation or depression, approach the stops slowly to prevent possible damage to the launcher when the stops on the elevating arc engage the elevating mechanism pinion gear.

Warning: Elevation of the loaded launcher for firing must not exceed the elevation indicated in firing tables FTR 4.5-D-3 (par. 78) for the rocket to be fired. Elevation of the launcher is greater than the maximum elevation for stable flight of the rocket. Rockets in unstable flight will tumble, have a shorter range, and may drop among friendly troops.

29. Traversing

a. Release the parking brakes (par. 13).

b. Operate the brake lever to release the traversing handwheel brake. Rotate the traversing handwheel to position the launcher carriage according to fire control data and sighting through the sighting equipment, then set the traversing handwheel brake to prevent movement of the carriage during firing.

30. Loading the Launcher

a. Inspect each tube before loading to be sure that the tubes are clear and clean and that firing contacts are clean.

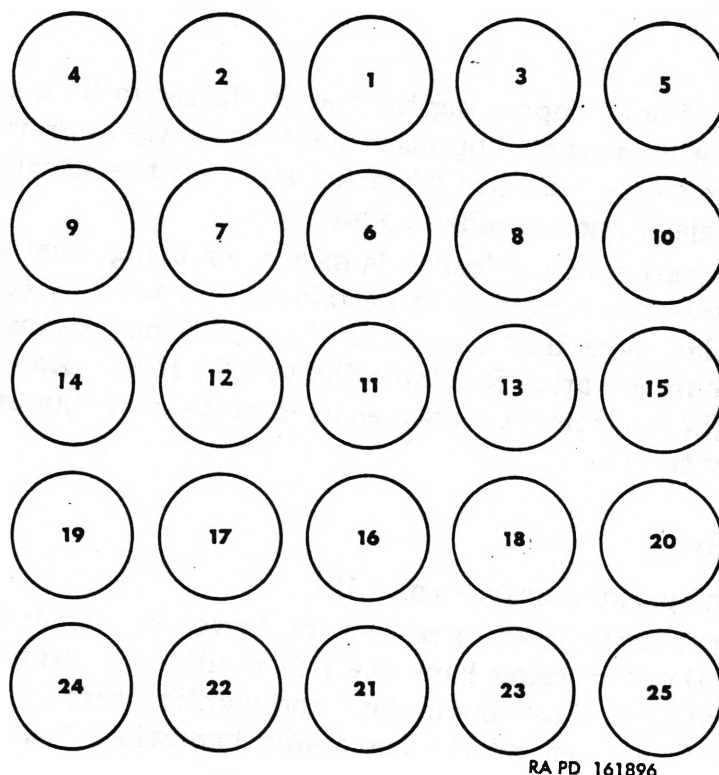
b. Check firing circuit with circuit tester (par. 58) to prevent misfires due to shorted or open circuits. Remove safety plug after testing firing circuit.

c. Prepare ammunition for firing as outlined in paragraph 83.

Warning: Do not load rockets when the firing switch safety plug is installed in its socket. Always remove this plug immediately after firing and check to see that it is removed before loading.

d. The launcher may be fully loaded with 25 rockets, or loaded with any lesser number. Insert the rockets in the rocket cluster. There will be some resistance to seating the rockets when the ground and live contacts engage the rockets. Do not ram them in, but push them in slowly and firmly to seat against the stops at the rear of the cluster. When partially loading the launcher, load them in the order of firing sequence. The firing order of tubes is shown in figure 30 and on the wiring diagram label at the inside of the control box cover (fig. 8). It is also stamped in the cluster casting at each tube.

e. When the launcher is to be moved to the site of firing after loading rockets, install the rocket retaining pins (fig. 32) and elevate the rocket cluster to engage the elevating lock (par. 16).



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Figure 30. Firing order of tubes—rear view of rocket cluster.

31. Firing the Launcher

a. Remove the sighting equipment from the sight mount (par. 74h) and place it in the control box (fig. 8).

Caution: Allowing the sight to remain on the launcher during firing will damage the optical system of the elbow telescope.

b. Remove the lanyard and close the control box cover and secure all latches. Rotate the firing switch index pointer to engage the shaft and set the pointer to the number one rocket position (par. 22). Firing may be started or stopped at any point in the cycle, but with a fully loaded launcher firing should start with number one rocket. This is done to increase the firing stability. If all the rockets have not been fired in the previous firing cycle, the firing switch index pointer may be manually reset to any desired position in the sequence.

c. Attach the lanyard to the firing switch lever (par. 25). Extend the lanyard off to the side of the launcher. It must be used at its full length of 50 feet.

Warning: Before installing the firing switch safety plug, make sure that the area ahead of and behind the launcher is clear of personnel, equipment, and inflammable material by a distance of

50 yards (fig. 31) and a distance of at least 50 feet from each side of the launcher. The danger zone is designated as a triangular area with a base and height of 50 yards, the apex of the triangle being the rear of the launcher and its height an extension of the launcher axis.

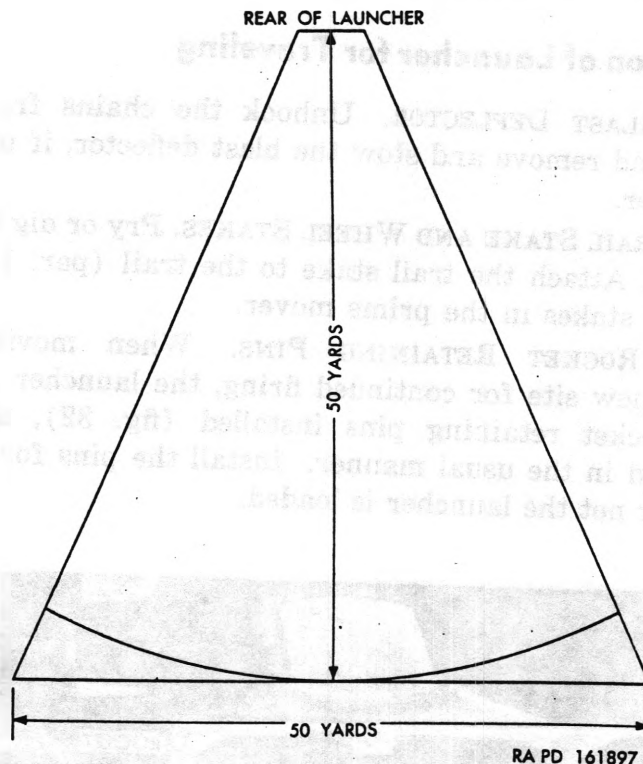


Figure 31. Danger zone to rear of launcher.

- d. Install the firing switch safety plug to its socket on the control box (par. 24).
- e. Pull the lanyard (par. 25) to fire. A single rocket is fired for each pull of the lanyard.
- f. If a misfire occurs, proceed as instructed in paragraph 53.
- g. Care will be exercised when firing through brush and trees since impact with a twig or branch may deflect the rocket. A heavy branch may detonate the rocket. Refer to paragraph 53 for other precautions to be observed in firing.

32. Unloading the Launcher

- a. Remove the firing switch safety plug from the control box socket (par. 24) to prevent accidental firing.

b. After firing a number of rockets from a fully loaded launcher, the rocket cluster may be heated above the safe temperature limit of the remaining rockets. If the remaining rockets are not to be fired, wait 15 seconds, then remove them from the rocket cluster.

c. Depress the rocket cluster to approximately 5-degree elevation (par. 17).

d. Push at the base of each rocket and force it forward until it can be grasped at the muzzle of the cluster and withdrawn. Prepare the rockets for repacking (par. 86).

33. Preparation of Launcher for Traveling

a. REMOVE BLAST DEFLECTOR. Unhook the chains from the axle housing, and remove and stow the blast deflector, if used, in the prime mover.

b. REMOVE TRAIL STAKE AND WHEEL STAKES. Pry or dig out the stakes (fig. 2). Attach the trail stake to the trail (par. 14) and stow the wheel stakes in the prime mover.

c. INSTALL ROCKET RETAINING PINS. When moving the launcher to a new site for continued firing, the launcher may be loaded, the rocket retaining pins installed (fig. 32), and the launcher moved in the usual manner. Install the pins for traveling whether or not the launcher is loaded.

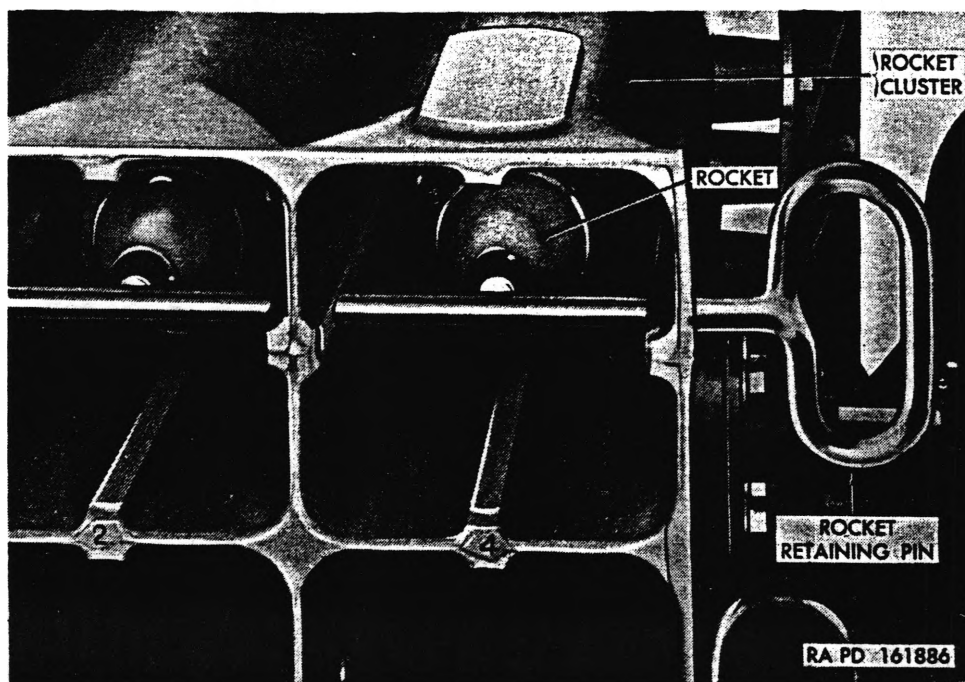


Figure 32. Rockets and rocket retaining pins installed in rocket cluster.

d. **ENGAGE TRAVELING LOCK.** Release the parking brakes. Turn the traveling lock to its horizontal position, release the traversing handwheel brake, and operate the traversing handwheel to move the carriage on the axle to the center position when the traveling lock plunger will snap into its locked position. Set the traversing handwheel brake.

e. **ENGAGE ELEVATING LOCK.** Place the elevating lock handle in its horizontal position, release the elevating handwheel brake, and operate the elevating handwheel to elevate or depress the rocket cluster to engage the lock with the hole in the elevating arc. Set the elevating handwheel brake.

f. **STOW EQUIPMENT IN CONTROL BOX.**

- (1) Unclip the lanyard from the firing switch lever and wind the lanyard around the supports on the control box cover (fig. 8).
- (2) Disconnect the instrument light and coil the wire into the control box. Remove the sighting equipment and stow it in the control box (par. 76).
- (3) Remove the aiming post lights from the aiming posts and stow the lights in the control box (par. 8).
- (4) Unclip the firing switch safety plug chain clip from the eye in the control box and place the safety plug in the control box.
- (5) Install the bore brush to its support pin in the control box. Place the grease gun (fig. 8) and circuit tester (fig. 9) in the control box.
- (6) Close the control box cover, secure with latches, and place padlock in hasp.

g. **INSTALL LAUNCHER COVER.** Place the cover on the launcher as shown in figure 28. Fasten the three straps, place the cover bottom grommets over the metal eyes, and thread the two side ropes through the eyes. Tie the ropes at the rear.

h. **INSTALL BLACKOUT LIGHT-SYSTEM.** Open the cover flap at the lower right side of the cover for installation of the blackout lamp. Attach the blackout lamp to the bracket (par. 12).

i. **ATTACH THE AIMING POST SET AND BORE BRUSH STAFF TO THE TRAIL.** Separate the aiming posts and place them in the cover. Place the bore brush staff-section in its cover and attach the aiming post set, bore brush staff, and the blackout light-system to the trail with the three leather straps as shown in figure 10.

j. **COUPLE LAUNCHER TO PRIME MOVER.**

- (1) Unlock the drawbar lock shaft and rotate the lunette to its traveling position.

- (2) Raise the trail and place the lunette in the prime mover pintle (fig. 13).
- (3) Clip the brake cable tension spring to the cable and to the prime mover and place the cable plug into the prime mover socket.
- (4) Release parking brakes.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

34. General

a. The mechanical steps of operation under unusual conditions are the same as for operation under usual conditions which are covered in paragraphs 26-33. The only difference in procedure is in the servicing of the launcher with regard to cleaning and lubrication, to insure proper functioning in locations where the atmosphere is salty, or where extremes in temperature and humidity of the atmosphere occur. Special care will be observed with regard to cleaning and lubrication of the launcher as explained below. Such care is necessary to insure proper operation and functioning of the weapon and to guard against excessive wear of the moving parts. Proper care prevents deterioration of the matériel.

b. See paragraph 85 for temperature limitations of firing of the rockets.

35. Cold Weather Operation

a. PREPARATION FOR COLD WEATHER OPERATION. When it is anticipated that the launcher will be operated in cold climates, it will be necessary to lubricate the weapon with the lubricants prescribed for the expected temperature of operation (fig. 35). When it is necessary to change grade of lubricant it is imperative that the parts receiving the lubrication be completely disassembled and cleaned before the new lubricant is applied (par. 48).

b. COLD WEATHER OPERATING INSTRUCTIONS AND DAILY CARE.

- (1) Refer to TM 9-2855 for instructions on operation and maintenance of ordnance matériel in extreme cold weather.
- (2) Do not let snow or ice collect on moving parts or in bores of launcher. Remove snow and ice before attempting to move parts.
- (3) Inspect matériel thoroughly and provide as much protection as possible for all parts. See that covers are

properly installed and securely fastened. If moisture or ice is found, the surface must be thoroughly cleaned and dried and coated sparingly with a light oil.

c. PREVENTION OF CONDENSATION.

- (1) Do not bring the matériel indoors unless absolutely necessary, but cover to protect it from snow and ice.
- (2) If necessary for matériel to be brought indoors, the launcher will be immediately cleaned, dried, and lubricated. After it has reached room temperature, again clean, dry, and lubricate the launcher.

d. CARE OF DRY CELL BATTERIES AND EQUIPMENT.

- (1) Dry cell batteries will not provide sufficient current for operation of lamps and the firing switch, and they may freeze and burst their cases at extremely low temperatures. To prevent damage to the material by corrosion caused by the salammoniac electrolyte, remove all dry cell batteries after using the launcher.
- (2) Remove the two dry cell batteries from the firing switch (par. 58) and keep them in a warm place.
- (3) Remove dry cell batteries from the instrument light and from the two aiming post lights (par. 75d) and keep them in a warm place.

36. Tropical Climates

In tropical climates where temperature and humidity are high or where salt air is present, and during rainy seasons, the launcher will be inspected and thoroughly cleaned daily. In humid, salty atmosphere, lubricate the bores and all unpainted metal surfaces as prescribed in lubrication order (fig. 35) daily. Inspect equipment, replacing dry cell batteries frequently to prevent damage to equipment through corrosion.

37. Operation in Sandy or Dusty Conditions

In hot dry climates where sand and dust are apt to get into the bores, all moving parts including the bores will be wiped clean daily or more often if necessary. When the surfaces are dry, there is less wear than when coated with lubricants contaminated with grit. During sand or dust storms, the launchers will be kept covered as much of the time as operating conditions permit. Increase in effort required to traverse the carriage may be due to dirt in the axle housing. Report to ordnance maintenance personnel for disassembly and cleaning.

38. Fording Operations

a. During fording operations, water will enter the brake drums, wheel bearings, axle housing, and the traversing sprocket and chain cover. Disassembly will be required for removal of water and for lubrication to prevent rusting of parts.

b. Report to ordnance maintenance personnel as soon as possible after each fording for removal of water and lubrication of the launcher.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL SPARE PARTS, TOOLS, AND EQUIPMENT

39. General

- a. Spare parts, tools, and equipment are issued to the using organization for using and maintaining the matériel.
- b. Organizational spare parts, tools, and equipment supplied for the rocket launcher T123 are listed in Department of the Army Supply Catalog ORD 7 SNL C-90, which is the authority for requisitioning replacements.
- c. Tools and equipment should not be used for purposes other than prescribed, and, when not in use, should be properly stored in the control box provided for them.

40. Spare Parts

Spare parts are supplied to the using organization for replacement of those parts likely to become worn, broken, or otherwise unserviceable provided such operations are within the scope of organizational maintenance functions.

41. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to this matériel are listed for issue in ORD 7 SNL C-90 and in T/A and T/O&E's but are not specifically identified in this manual.

42. Special Tools and Equipment

Certain special tools and equipment for organizational maintenance, repair, and general use with the matériel are listed in table I for information only. This list is not to be used for requisitioning replacements.

Table I. Special Organizational Tools and Equipment

Item	Identifying number	References		Use
		Fig	Par	
BRUSH, bore, 4.5-inch	7134860	33, 39	56b, and c	Used with staff-section to clean rocket tubes.
COVER, canvas, circuit tester	7140707	9, 33	-----	--
COVER, canvas, over-all	-----	28, 33	27d, 33g	--
COVER, staff-section	-----	10, 33	8c (6)	Used with bore brush.
LIGHT-SYSTEM, blackout, 6-8 v, 18-ft cable, complete	7138427	12, 33	12	
PLATE, spade	-----	27, 34	27b (2)	Used to increase area of spade.
PLATE, spade	-----	27, 34	27b (2)	Used to increase area of spade.
SPRING, tension, S, 0.080 diam stock, 1 1/8 OD, 26 1/2 in over-all lgh.	5173394	13, 33	12	Used to hold and support the blackout light-system cable.
STAFF-SECTION	7134829	33, 39	56b and c	Used with bore brush to clean rocket tubes.
STAKE, trail, 35 1/2 in long	7135096	29, 33	14, 27g	Used to hold trail in emplaced position.
STAKE, wheel	-----	2, 34	27h	Used at wheels to prevent side motion of launcher.
TESTER, circuit, M8	7136682	33, 41	58	Used to test and check continuity of firing mechanism circuit.

Section II. LUBRICATION AND PAINTING

43. Lubrication Chart

a. The lubrication chart (fig. 35) prescribes organizational maintenance lubrication for this equipment. Lubrication to be performed by ordnance maintenance personnel also is covered in notes.

b. Service intervals specified on the lubrication chart are for normal operating conditions and during active service. These intervals will be reduced under extreme conditions, such as exces-

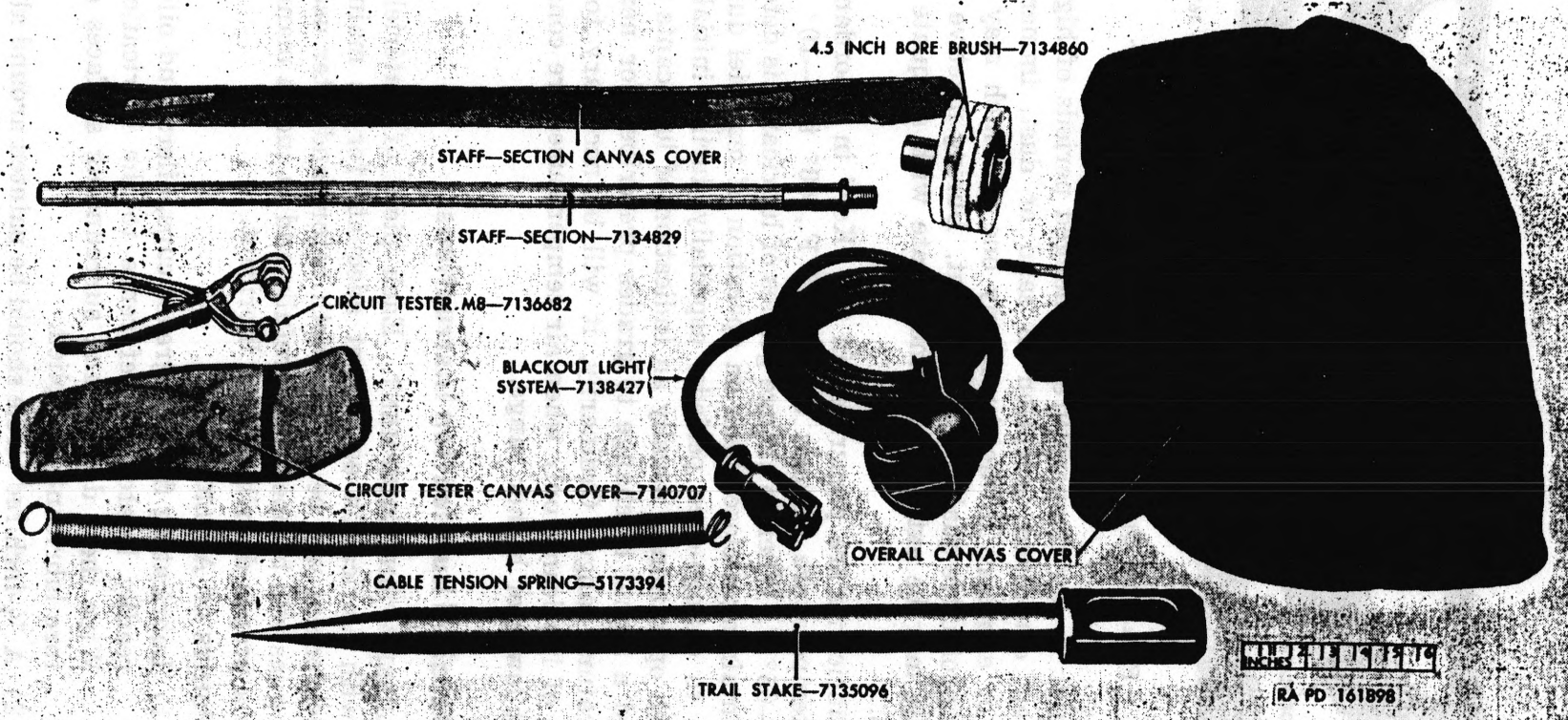


Figure 88. Special organizational tools and equipment.

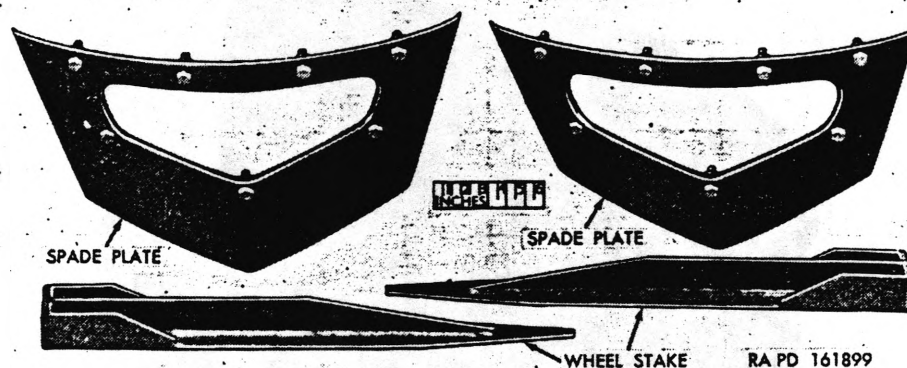


Figure 34. Special organizational tools and equipment.

sively high or low temperatures, prolonged periods of high-speed operation, continued operation in sand or dust, immersion in water, or exposure to moisture; any one of which may quickly destroy protective qualities of lubricant. During inactive periods, intervals may be extended commensurate with adequate preservations.

c. Lubricants are prescribed in the "Key" in accordance with three temperature ranges: above 32° F., 40° to —10° F., and 0° to —65° F. When to change grades of lubricants is determined by maintaining a close check on operation of matériel during approach to change-over periods, especially during initial action. Sluggish operation is usually an indication of lubricants thickening and a signal to change to grades prescribed for next lower temperature range. Ordinarily, it will be necessary to change grades of lubricants only when air temperatures are consistently in next lower or higher range.

44. Detailed Lubrication Instructions

a. LUBRICATION EQUIPMENT. Each piece of matériel is supplied with lubrication equipment adequate for its maintenance. This equipment will be cleaned both before and after use. Lubrication guns will be operated carefully and in such a manner as to insure a proper distribution of lubricant.

b. POINTS OF APPLICATION.

- (1) Lubricating fittings, grease cups, oilers, and oilholes are readily located by reference to the lubrication chart. Wipe these devices and surrounding surfaces clean before lubricant is applied.
- (2) A $\frac{3}{4}$ -inch red circle should be painted around all lubrication fittings and oilholes.

LUBRICATION ORDER

LAUNCHER, ROCKET, 4.5 INCH, T 123

References TM9-392A, ORD 7 SNL C-90

Intervals are based on normal operation. Reduce to compensate for abnormal operation and severe conditions. During inactive periods intervals may be extended commensurate with adequate preservation. Relubricate after

washing or fording. Clean fittings before lubricating. Clean parts with THINNER, paint, volatile mineral spirits. Dry before lubricating.

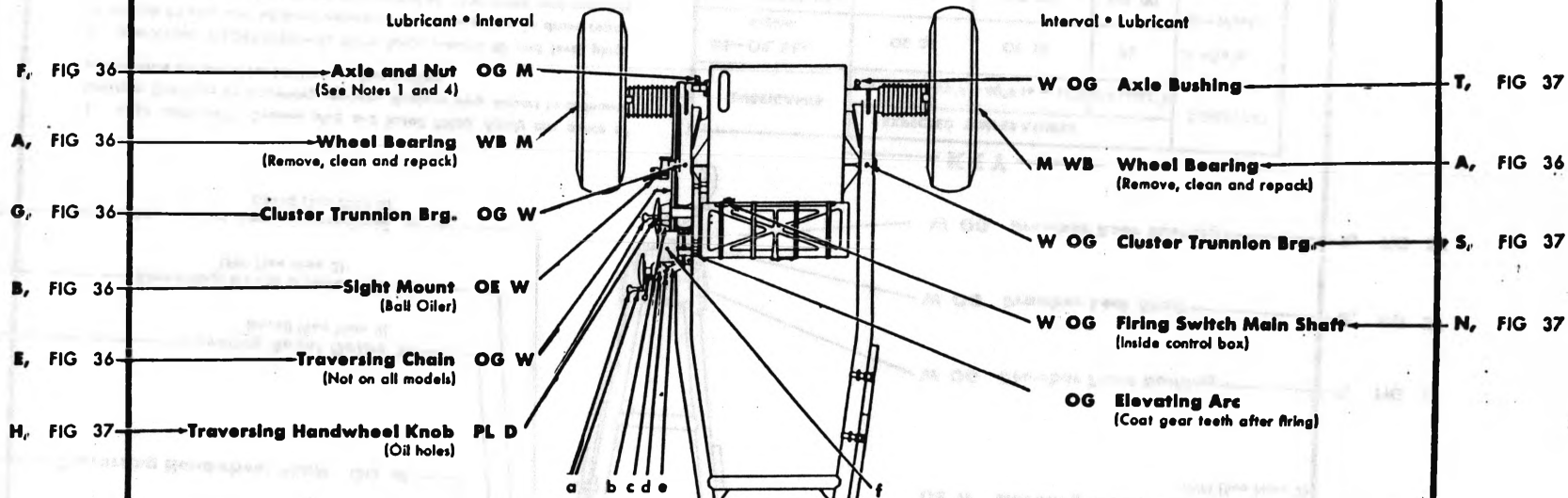
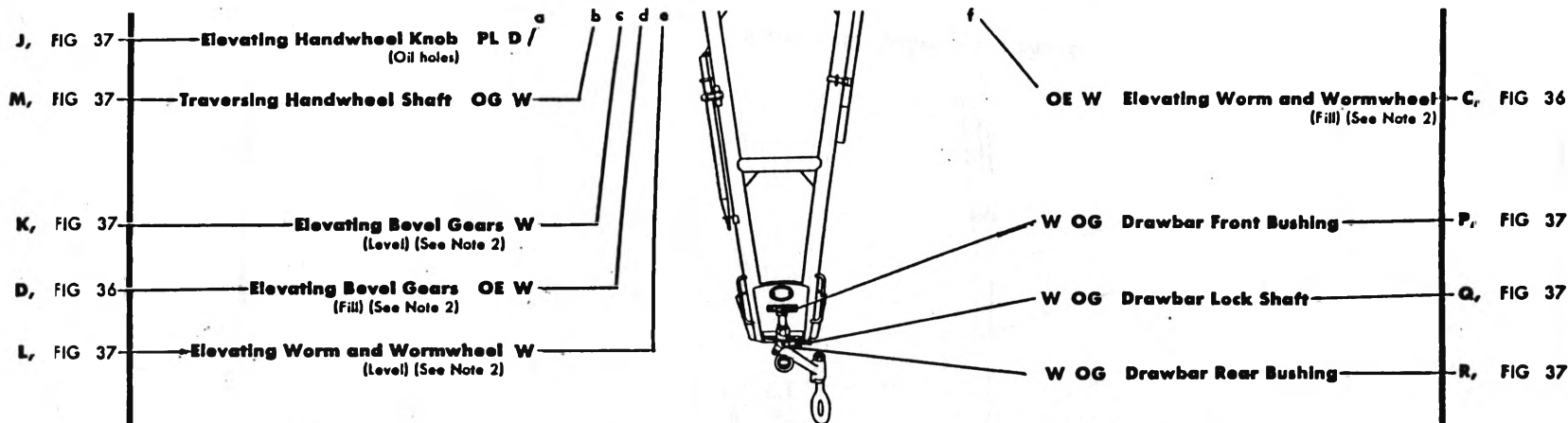


Figure 35. Lubrication chart.



1. **AXLE AND NUT**—Remove plug and install fitting. Apply one ounce of lubricant. Distribute by traversing carriage. Replace plug. Report to ordnance maintenance personnel for lubrication after fording.

2. **ELEVATING MECHANISM**—To fill to level, remove fill and level plugs, fill through fill plug until lubricant appears at level plug hole. To drain, report to ordnance maintenance personnel for removal of cover plates and complete removal of lubricant.

3. **OIL CAN, POINTS**—Daily, lubricate the elevation lock, traveling lock, lunette lock, parking brake levers, and other moving parts for which no lubrication fittings are provided, with PL.

4. **DISASSEMBLED FOR LUBRICATION BY ORDNANCE PERSONNEL**—Axle and axle nut, elevating mechanism.

KEY

LUBRICANTS	EXPECTED TEMPERATURES			INTERVALS
	Above +32°F	+40°F to -10°F	0°F to 65°F	
OE—Oil, lubr. engine.	OE 30	OE 10	PL	D—Daily
OG—GREASE, lubr. Ord. Dept.	OG 0	OG 00	OG 00	W—Weekly
WB—GREASE, lubr. general purpose, No. 2.				M—Monthly
PL—Oil, lubr. preservative				

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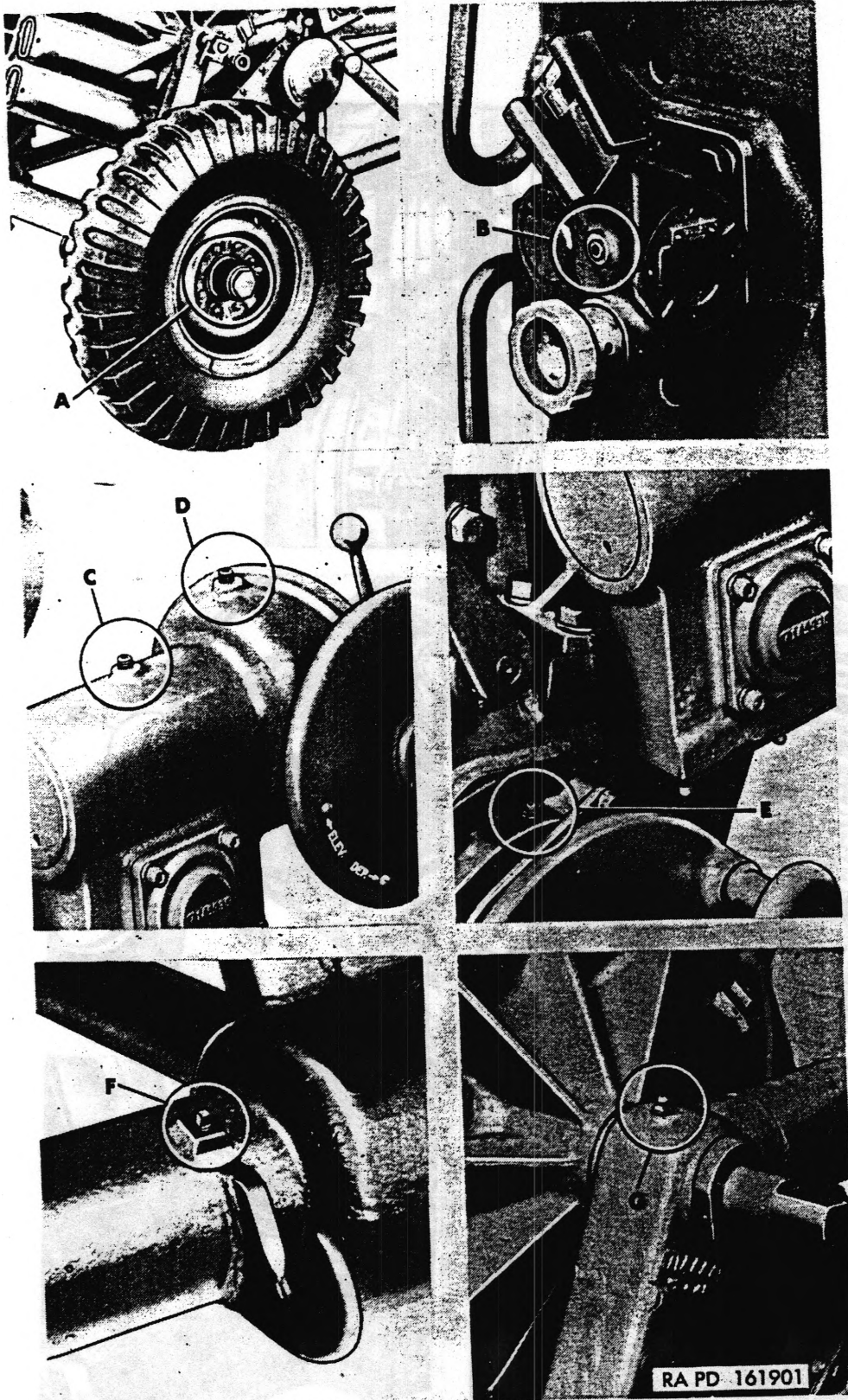


Figure 36. Localized lubrication points (points A through G).

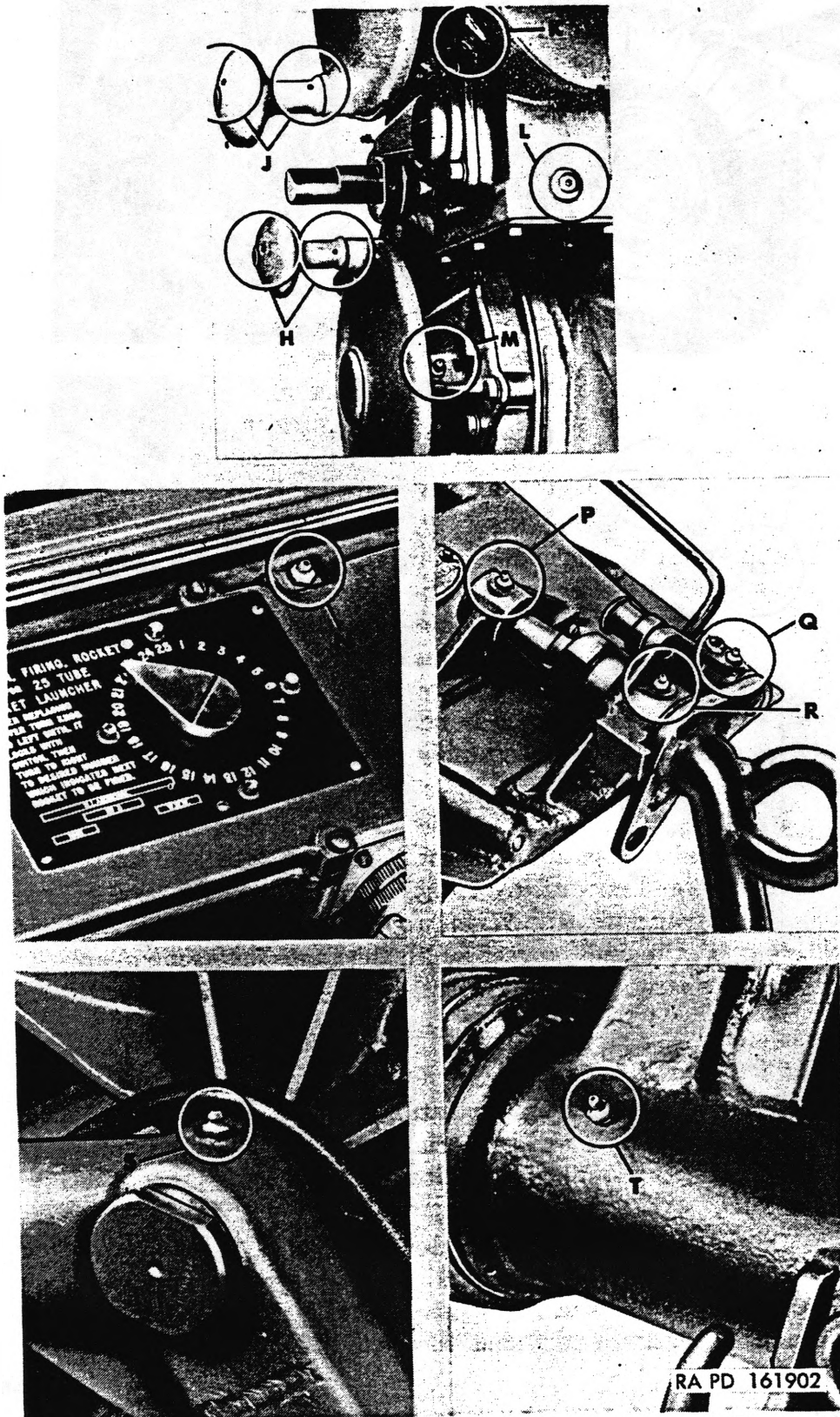


Figure 37. Localized lubrication points (points H through T).

c. REPORTS AND RECORDS.

- (1) Report unsatisfactory performance or defects in the application or effect of prescribed lubricants and preserving material in accordance with paragraph 3d.
- (2) A record of lubrication may be maintained in Preventive Maintenance Roster (DA AGO Form 460).

45. Special Lubrication Instructions

a. AXLE AND NUT. The axle and the traversing nut, the steel balls, and the nut supporting roller bearings are sealed to exclude dust and moisture; however, the bellows which protect the axle are made of a porous material and will leak water after prolonged immersion. After fording or immersion in water and mud, the axle nut should be removed by ordnance maintenance personnel for the removal of water. Change of lubricant for a lower temperature range will also necessitate disassembly of the axle and nut for complete removal of heavy lubricant.

b. ELEVATING MECHANISM. Plugs for draining the elevating mechanism are not provided. Draining the elevating mechanism is accomplished by removal of the cover plates. Since removal of the plates may damage the gaskets, this operation should be performed by ordnance maintenance personnel. When changing lubricant for lower temperature operation, partial disassembly of the elevating mechanism is necessary for complete removal of heavy lubricant. This disassembly is to be performed by ordnance maintenance personnel.

c. WHEEL BEARINGS. Removal of the wheel bearings is required for periodical lubrication and for change of lubricant for operation in a lower temperature range. Instructions for removal are given in paragraph 67. When repacking wheel bearings, only sufficient grease shall be used to fill the space between rollers. Do not fill the space in the hub with grease.

46. Painting

a. Instructions for the preparation of the matériel for painting, methods of painting, and materials to be used are contained in TM 9-2851. Camouflage painting information is contained in FM 5-20D.

b. Do not paint over name plates or serial numbers or working surfaces which are lubricated in accordance with the lubrication chart. Name plates will be kept coated with clear lacquer; if they have become rusty or corroded, they will first be carefully cleaned.

c. Sighting and fire control instruments will not be painted by the using organization.

Section III. PREVENTIVE MAINTENANCE SERVICES

47. General

Preventive maintenance services are the responsibility of the using organization. These services consist of before-firing, after-firing, daily, weekly, and before-traveling services performed by the section personnel (1st echelon) and the scheduled services to be performed at monthly and semiannual intervals by mechanic or maintenance crews of the using organization (2d echelon). Note that these intervals are based on normal operations. Reduce intervals for abnormal operations or severe conditions. Intervals during inactive periods may be extended accordingly.

48. Cleaning

a. GENERAL. Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section in this manual.

b. CLEANING MATÉRIEL OR PARTS COATED WITH RUST-PREVENTIVE COMPOUND.

- (1) All new matériel or component parts of matériel received from storage and intended for immediate use which are coated with rust-preventive compound will be thoroughly cleaned with waste, wiping cloths, or a brush saturated with volatile-mineral-spirits-paint thinner, or with one part of grease-cleaning compound to four parts of volatile-mineral-spirits-paint thinner. After complete removal of the compound, dry and lubricate as specified in the lubrication chart.
- (2) Component parts of each weapon should be cleaned separately where practicable. Although like parts are interchangeable, the parts originally assembled work best together.

c. CLEANING MATÉRIEL IN USE.

- (1) Use rifle-bore cleaner to clean all parts which have been exposed to powder fouling during firing.

Note. Rifle-bore cleaner is not a lubricant. After cleaning, parts which require lubrication will be wiped dry and oiled.

- (2) Use volatile-mineral-spirits-paint thinner to clean parts which have been greased or oiled. Do not use this solvent

to clean parts which have been exposed to powder fouling during firing because it will not readily dissolve the corrosive salts from powder and primer compositions.

- (3) Use clean water, or a soap solution of one-fourth pound of soap chips to a gallon of hot water, for all rubber parts and overall general cleaning of painted surfaces.
- (4) After the parts are cleaned, rinse and dry them thoroughly. Take care to keep the parts clean. Apply a preservative lubricating oil to all polished metal surfaces (other than optical instruments) to prevent rusting.
- (5) Before installing new parts, remove any preservative materials (*b* above), such as rust-preventive compound, protective grease, etc.; prepare parts as required (oil seals, etc.); and for those parts requiring lubrication, apply the lubricant prescribed in the lubrication chart.

d. GENERAL PRECAUTIONS IN CLEANING.

- (1) Volatile-mineral-spirits-paint thinner is inflammable and should not be used near an open flame. Fire extinguishers should be provided when this material is used. In addition, it evaporates quickly, has a drying effect on the skin, and if used without gloves may cause cracks in the skin and in some individuals a mild irritation or inflammation. Use only in well-ventilated places.
- (2) Avoid getting petroleum products, such as volatile-mineral-spirits-paint thinner or lubricants on rubber parts, as they will attack the rubber and destroy its characteristics.
- (3) The use of Diesel fuel oil, gasoline, or benzene (benzol) for cleaning or the use of high-pressure water, steam, or air for cleaning the weapon is prohibited.
- (4) Under no circumstances will a water hose, either normal or high pressure, be used in cleaning any sighting or fire control instruments. Remove the instruments from their mounts before washing the weapon.

e. CLEANING UNDER UNUSUAL CLIMATIC CONDITIONS.

- (1) Do *not* dilute rifle-bore cleaner or add an antifreeze.
- (2) Store cleaners in a warm place, if practical. Shake rifle-bore cleaner well before using.

49. Basic Preventive Maintenance

Inspect and service the weapon as described in paragraphs 8

and 9 at least every 6 months and after any extended travel with the weapon, as the tactical situation permits.

a. Rust, dirt, grit, gummed oil, and water cause rapid deterioration of all parts of the weapon. Particular care should be taken to keep all bearing surfaces and exposed unpainted parts clean and properly lubricated. Wiping cloths, rifle-bore cleaner, volatile-mineral-spirits-paint thinner, and lubricants are furnished for this purpose. Remove all traces of rust from surfaces with crocus cloth which is the coarsest abrasive to be used by organizational personnel for this purpose. Take care not to change the shape or dimensions of part.

b. Retouch painted surfaces as required to cover nicks, scratches, and worn spots which expose bare metal (par. 46).

c. Tighten loose parts, as necessary.

d. Each time a weapon is disassembled for cleaning or repair, carefully inspect all parts for cracks, excessive wear, rust, and like defects which might cause malfunction of the launcher. Refer to paragraphs 52-54 on trouble shooting for information on certain parts which when worn, damaged, or improperly adjusted cause definite malfunctions. Thoroughly clean and properly lubricate all parts before assembly.

e. Use only tools that are provided and see that they fit properly. Tools that do not fit will fail and may cause damage to parts.

f. At least every 6 months, check to see that pertinent modification work orders have been applied. A list of current modification work orders is published in SR 310-20-4. No alteration or modification will be made by organizational personnel, except as authorized by official publications.

g. When the matériel is not in use, install the proper covers.

h. When a canvas or other type cover is used during periods of inactivity, moisture may form on metal surfaces by condensation. To prevent rusting, remove the covers at least weekly, and dry all surfaces thoroughly. Coat unpainted surfaces with the prescribed lubricant. In cold weather, apply lubricant sparingly.

50. Preventive Maintenance Schedules (Crew)

a. To insure continued performance, it is necessary that the weapon be systematically inspected in order that defects may be discovered and corrected before they result in serious damage or failure. Any defects or unsatisfactory operating characteristics beyond the scope of correction by the operator must be reported

at the earliest opportunity to the designated individual in authority.

b. The services set forth in table II are to be performed by the operator.

Table II. Preventive Maintenance Schedules (Crew)

Point	Preventive maintenance	Detailed instructions
	<i>Before firing</i>	
Rocket cluster-----	Clean and dry-----	Par. 56.
Firing switch batteries--	Test circuit using battery power to be sure that the batteries have sufficient power for firing in the event of failure of the generator during firing.	Par. 58.
Aiming post light and instrument light batteries.	Check operation of lamps.	Install batteries and see that lamps light.
Firing mechanism live contacts.	Clean and dry-----	Clean area around contacts to prevent shorts and misfire.
	<i>After firing</i>	
Elbow telescope M62----	Clean optical parts----	Par. 75c.
Rocket cluster-----	Clean and oil-----	Par. 56.
Elevating arc-----	Clean and oil-----	Lubrication chart (fig. 35).
Overall cover-----	Install cover-----	Par. 33g.
Equipment-----	Place all equipment in control box.	Par. 8.
Bellows-----	Examine for cracks and holes.	If damaged report to ordnance personnel.
	<i>Daily</i>	
Oiler lubrication points	Lubricate-----	Lubrication chart.
	<i>Weekly</i>	
Rocket cluster-----	Clean and oil-----	Par. 56.
Elevating mechanism--	Check level and lubricate.	Lubrication chart.
Traversing chain-----	Lubricate-----	Lubrication chart.
Drawbar lock shaft----	Lubricate-----	Lubrication chart.
Drawbar bushings-----	Lubricate-----	Lubrication chart.
Rocket cluster trunnion bearings.	Lubricate-----	Lubrication chart.
Axle bushing-----	Lubricate-----	Lubrication chart.
Traversing handwheel shaft.	Lubricate-----	Lubrication chart.

Table II. Preventive Maintenance Schedules (Crew)—Continued

Point	Preventive maintenance	Detailed instructions
	<i>Monthly</i>	
Firing switch batteries	Test circuit-----	Par. 58.
Aiming post light and instrument light batteries.	Test batteries-----	Install batteries and see that lamps light.
Traversing axle and nut	Lubricate-----	Lubrication chart.
Elevating mechanism--	Measure effort, at handwheel, to operate.	Handwheel effort should be approximately 1 pound.
Carriage-----	Measure effort, at handwheel, to traverse.	Handwheel effort should be approximately 4 pounds.
Eyeshield of elbow telescope M62.	Clean and dust-----	Clean with soap and water, dry and dust with talc.
Telescope mount M79 housing dovetail.	Clean and lubricate---	Apply a thin film of lubricant to the dovetail slide of the telescope mount and to the sight mount.
	<i>Semiannually</i>	
Elevating mechanism--	Lubricate-----	Lubrication chart.
Bellows-----	Examine for cracks and holes.	If damaged, report to ordnance personnel.
Parking brakes-----	Operate to check for proper adjustment.	The parking brake handle should be approximately at the center of the rack when the parking brake is set. Readjust if necessary (par. 68b).
	<i>Before traveling</i>	
Tires-----	Check air pressure and condition of tires.	Air pressure is to be between 25 and 40 psi.
Elevating lock-----	Determine that elevating lock is engaged.	Try elevating lock and see that the plunger is in the elevating arc.
Traveling lock-----	Determine that traveling lock is engaged.	Turn traveling lock handle to horizontal position.
Lunette-----	Determine that drawbar is locked.	See that knob locks the drawbar lock shaft.
Overall cover-----	Check installation----	Par. 33g.
Equipment-----	Check all equipment and see that it is properly installed to the launcher.	Par. 8.

51. Preventive Maintenance Schedules (Mechanic)

a. The battery mechanic is issued necessary tools and either performs or supervises all authorized disassembly, maintenance, and adjustments. Service by battery mechanic includes a systematic check to see that all crew preventive maintenance (table II) has been properly performed at the prescribed intervals and that the matériel is in the best possible operating condition. The crew should have the material in a reasonably clean condition for scheduled maintenance service by battery mechanic.

b. The services set forth in table III are to be performed or supervised by the battery mechanic at the designated intervals in addition to any preventive maintenance required as a result of the checks and services by the crew.

Table III. Preventive Maintenance Schedules (Mechanic)

Point	Preventive maintenance	Detailed instructions
	<i>Before firing</i>	
Firing mechanism	Check and test the firing circuit.	Par. 58.
Elevating mechanism ..	Check operation	Par. 8.
Carriage	Check operation in traversing.	Par. 8.
	<i>Monthly</i>	
Wheel bearings	Lubricate	Lubrication chart.
Firing switch	Replace batteries	Par. 59.

Section IV. TROUBLE SHOOTING

52. General

A malfunction is an improper or faulty action of some component part of the weapon or ammunition that may result in failure to fire, other stoppage, or damage to the launcher.

53. Failure to Fire

a. MISFIRE. A misfire is a *complete failure to fire* which may be due to a faulty firing mechanism or a faulty element in the propelling charge explosive train. A misfire in itself is not dangerous but since it cannot be immediately distinguished from a delay in the functioning of the firing mechanism or from a hang-fire (*b* below), it should be considered as a possible delayed firing

until such possibility has been eliminated. Such delay in the functioning of the firing switch, for example, could result from the presence of foreign matter such as grit, sand, frost, ice, or improper or excessive oil or grease, which might create initially a partial mechanical or electrical restraint which, after some indeterminate delay, is overcome as a result of additional attempts to fire. In this connection, no round should be left in a hot weapon any longer than the circumstances require due to the possibility of a cook-off (c below).

b. **HANGFIRE.** A hangfire is a delay in the functioning of a propelling charge explosive train at the time of firing. The amount of the delay is unpredictable but in most cases will fall within the range of a split second to several minutes. Thus, a hangfire cannot be distinguished immediately from a misfire and therein lies the principal danger—that of assuming that a failure of the weapon to fire immediately upon actuation of the firing mechanism is a misfire whereas in fact it may prove to be a hangfire. It is for this reason that the time intervals prescribed in d below should be observed after a failure to fire. These time intervals, based on experience and considerations of safety, have been established to minimize the danger associated with a hangfire and to prevent the occurrence of a cook-off.

Caution: During the prescribed time intervals, the weapon will be kept trained on the target and all personnel will stand clear of the muzzle and the path of the back-blast.

c. **COOK-OFF.** A cook-off is a functioning of any or all of the explosive components of a round chambered in a very hot weapon due to heat from the weapon. The igniter and propelling charge, in that order, are in general more likely to cook off than the projectile or the fuze. If the igniter or the propelling charge should cook off, the projectile *may* be propelled (fired) from the weapon with normal velocity even though no attempt was made to fire the igniter by actuating the firing switch. In such a case, although there may be uncertainty as to whether or when the round will fire, the precautions to be observed are the same as those prescribed for a hangfire (b above). *However, should the bursting charge explosive train cook off, injury to personnel and destruction of the weapon may result.* To prevent a cook-off, a round of ammunition, which has been loaded into a very hot weapon, should be fired or removed within the time prescribed in d below, to prevent heating to the point where a cook-off may occur.

Caution: In case of an explosive round, chambered in a very hot weapon which can neither be fired nor removed as prescribed below, all personnel will stand clear of the weapon until such time as the weapon and chambered round are cool, to avoid the danger from a possible cook-off of the explosive projectile.

d. PROCEDURES FOR REMOVING A ROUND.

(1) *General.* After a failure to fire, due to the possibility of a hangfire or cook-off (*b* and *c* above), the following general precautions, as applicable, will be observed until the round has been removed from the weapon and the cause of failure determined:

(a) Keep the weapon trained on the target and all personnel clear of the muzzle and path of back-blast.

(b) In case of an explosive round chambered in a very hot weapon, which can neither be fired nor removed as prescribed below, all personnel will stand clear of the weapon until such time as the weapon and the chambered round are cool, to avoid the danger from a possible cook-off of the explosive projectile.

(c) Make additional attempts to fire as prescribed in (2) below.

(2) *Before removal of round.* Definite intervals for waiting after failure to fire and additional attempts to fire have been established on the basis of experience and characteristics of the weapon.

Warning: After a failure to fire, actuate the firing switch two additional times in attempts to fire. If the launcher still fails to fire, wait 15 seconds from the last attempt to fire, then check the electrical circuit for breaks, shorts, and poor contacts before another attempt to fire. After making any necessary adjustments, again actuate the firing switch three times. If the launcher still fails to fire, wait 15 seconds after the last attempt to fire before again checking the electrical circuit. After making any other necessary adjustments, again actuate the firing switch three times in attempts to fire and if the weapon still fails to fire, wait 15 seconds before removing the round, which is to be considered at fault unless subsequent examination reveals a defective electrical circuit not previously detected.

(3) *After removal of round.* The round, after removal from the weapon, will be kept separate from other rounds until it has been determined whether the round or the

firing switch was at fault. If the round is determined to be at fault, it will continue to be kept separate from other rounds until disposed of. On the other hand, if examination reveals that the firing switch was at fault, the round may be reloaded and fired after correction of the faulty firing switch.

54. Malfunctions of Launcher

In table IV, the probable causes of malfunctions of the launcher are listed and corrective measures are indicated.

Table IV. Trouble Shooting

Malfunction	Probable causes	Corrective action
Firing mechanism fails to operate.	Rockets not properly seated against stops.	Seat rockets (par. 30).
	Lanyard clipped to wrong end of firing switch lever.	Install lanyard correctly (par. 31).
	Firing switch restrained or jammed.	Lubricate in accordance with lubrication chart and free the shaft. If it still does not operate, report to ordnance personnel.
	Defective firing switch.	Test circuit (par. 58). Report to ordnance personnel.
	Contacts shorted to ground.	Clean contacts and area around the contacts.
	Contacts corroded and dirty.	Clean contacts and area around the contacts.
	Firing circuit open----	Test circuit (par. 58). Report to ordnance personnel.
	Generator defective--	Change to battery power (par. 21). Report to ordnance personnel.
	Parking brakes set----	Release parking brakes (par. 13).
	Traversing handwheel brake not adjusted properly.	Adjust handwheel brake (par. 63).
Effort to traverse excessive.	Lack of lubrication---	Lubricate in accordance with lubrication chart.
	Traversing nut and balls dirty or corroded.	Report to ordnance personnel.
	Traversing chain corroded.	Report to ordnance personnel.
Backlash in traversing handwheel excessive.	Backlash in chain----	Adjust chain idler (par. 63).

Table IV. Trouble Shooting—Continued

Malfunction	Probable causes	Corrective action
Effort to elevate excessive.	Lack of lubrication---	Lubricate the cluster trunnion bearings and elevating mechanism in accordance with lubrication chart.
	Dirt between elevating arc and pinion.	Clean and lubricate (par. 43).
	Elevating handwheel brake not adjusted properly.	Adjust handwheel brake (par. 61).
Effort to tow launcher excessive.	Elevating mechanism damaged.	Report to ordnance personnel.
	Parking brakes dragging.	Adjust parking brakes (par. 68).
	Lack of lubrication---	Lubricate wheel bearings in accordance with lubrication chart.

Section V. ROCKET CLUSTER

55. General

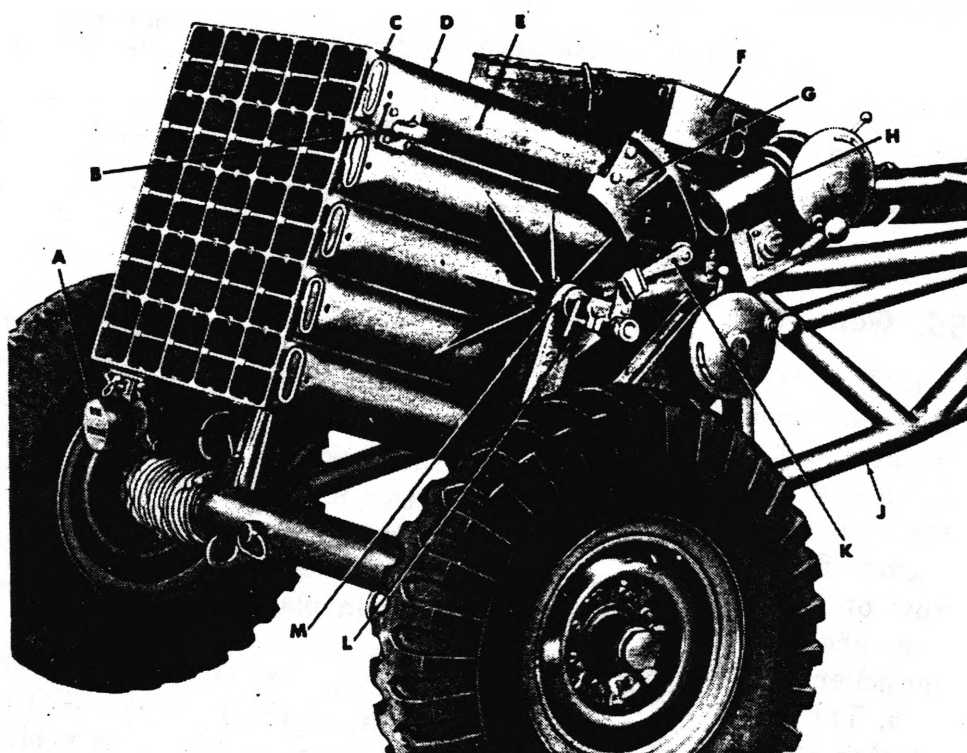
a. The rocket cluster (fig. 38) consists of a single aluminum base alloy casting having five rows of five rocket tubes. Each tube is flared out to lessen the frontal area. Each rocket tube is provided with four lands which guide the rocket in its travel through the tube. A stop is provided at the rear of each tube to locate the rocket. Two holes are bored through the horizontal center of each row of tubes for installation of the rocket retaining pins. The pins are provided for holding rockets in place when moving the launcher short distances to a firing site.

b. The elevating arc is attached to the left side of the rocket cluster (fig. 38). A hole is provided in the arc to engage the elevating lock plunger which locates and locks the cluster in position for traveling. The cluster is pivoted at its center and mounted on the trail with trunnion pins and bushings. The cluster is balanced and requires no mechanical equilibrator.

c. Two positions are provided for the sight mount (fig. 38). The sight mount pin on the left side trunnion pin is ordinarily used, as it is closest to the operator; the cluster sight mount pin is provided for use when the aiming posts or other orienting object is to the right of the cluster. A level surface at the left side on top of the cluster is provided for use of the gunner's quadrant.

d. The control box which contains the firing mechanism and equipment is mounted at the top rear of the cluster (fig. 38). The blackout light-system lamp is attached to the cluster by a bracket and plunger assembly (fig. 12).

e. The spring-type ground and live contacts of the firing mechanism (fig. 40) are attached to the rear of each rocket tube. The conduits, of the firing mechanism, which contain the wiring to each live conduit are attached by clips to the rear of the rocket cluster.



A—BLACKOUT LIGHT-SYSTEM LAMP ASSY
B—CLUSTER SIGHT MOUNT PIN
C—ROCKET RETAINING PIN
D—LEVEL SURFACE FOR GUNNERS QUADRANT
E—ROCKET CLUSTER
F—CONTROL BOX

G—ELEVATING ARC
H—ELEVATING MECHANISM
J—TRAIL
K—ELEVATING LOCK
L—SIGHT MOUNT
M—TRUNNION PIN

RA PD 161903

Figure 38. Rocket cluster.

56. Maintenance of Rocket Cluster

a. GENERAL. No disassembly is authorized to be performed by the using organization. Organizational maintenance of the launcher, therefore, includes cleaning, inspecting, and lubricating.

b. **BEFORE FIRING.** Before firing the launcher, any oil in the rocket cluster tubes must be wiped dry. Remove the bore brush staff-section from the trail and the bore brush from the control box (fig. 8). Screw the staff into the bore brush (fig. 39). Wrap the bore brush in clean dry cloth and wipe out each tube.

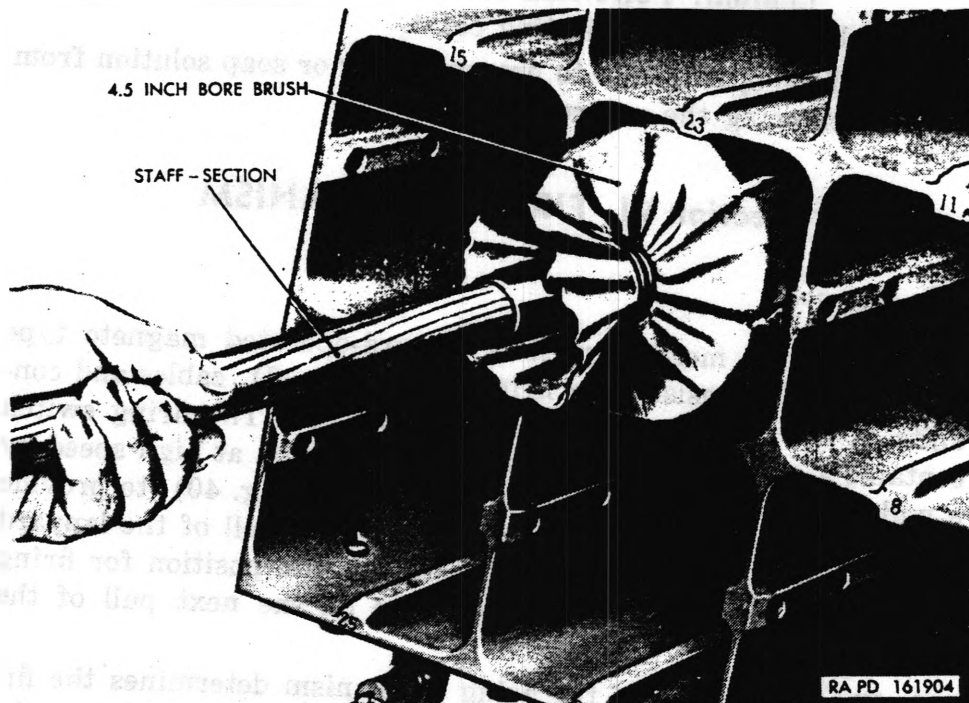


Figure 39. Use of bore brush.

c. **AFTER FIRING.**

- (1) Wrap the bore brush in a cloth which has been wet with rifle-bore cleaner and wrung out. Push the bore brush through each tube until clean. Use a cloth dampened with rifle-bore cleaner to clean the firing mechanism live and ground contacts and the clearance holes at each contact.
- (2) For 3 consecutive days after firing, clean the rocket cluster tubes as described in (1) above.

d. **PERIODICAL CLEANING.**

- (1) When the launcher is not being fired, clean the rocket tubes each week as described in c(1) above.
- (2) The gear teeth of the elevating arc and pinion (fig. 38) are closely meshed and must be kept clean to assure ease of operation in elevation. Conditions of dust and moisture will determine the frequency of cleaning. Keep the

teeth clean at all times and lubricated with a film of oil to prevent corrosion.

- (3) Clean the outer painted surfaces of the rocket cluster with a solution of soap and water ($\frac{1}{4}$ pound soap chips to 1 gallon of water).

Caution: Petroleum solvents will remove the special heat and flame resisting paint.

Take special care to prevent water or soap solution from entering the control box.

Section VI. FIRING MECHANISM

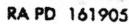
57. General

a. The firing mechanism is a lanyard-operated magneto type mechanism. It consists of a firing switch (fig. 8), cables and conduits to the rocket contacts, and the lanyard. The firing switch contains a generator which is driven in rotation at high speed by a pull of the lanyard, through a gear system (fig. 40), to provide electrical current for igniting a rocket. Each pull of the lanyard fires one rocket and indexes a distributor into position for firing the next rocket in the firing sequence on the next pull of the lanyard.

b. The distributor of the firing mechanism determines the firing sequence of the launcher. An index pointer is provided on the control box cover (fig. 23) for setting the first rocket to be fired. In a fully loaded launcher, this would be number 1 on the dial. In a partially loaded launcher, the distributor can be set at the first loaded tube. The index pointer on the control box cover positions the pointer on the firing switch cover, which in turn positions the distributor brush (fig. 40) in the firing switch. With each pull of the lanyard the distributor brush advances to fire the next rocket in the firing sequence.

c. The distributor brush connects the output of the generator to one of the 25-rocket tube contacts. It is driven by a pawl and ratchet and is held by a holding pawl (fig. 40). To prevent firing or flow of current when setting the distributor, the firing circuit is open through use of a brush and insulator until the firing lever is operated by the lanyard.

d. To prevent accidental firing, a safety plug is provided. When the safety plug (fig. 40) is removed, the firing circuit is open and rockets cannot be discharged. The safety plug is connected to the firing switch through an extension plug.



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e. An emergency source of power is provided through the use of two 7½-volt stand-by dry cell batteries, connected in series. The circuit of the batteries to the firing switch distributor is open when the firing switch extension plug is in its normal position of "UP FOR GEN" and is closed when in the position "UP FOR BATT." The battery source of power is intended for use only in the event of failure of the generator.

f. The firing current (generator or battery) is conducted from the distributor to the live contact fingers at each rocket tube through the cable and conduit assemblies (fig. 40). The live contact fingers contact and discharge the rockets.

58. Test of Firing Circuit

a. The firing circuit can be tested with the plier type circuit tester M8 (fig. 33) to determine that current is flowing to each rocket tube live contact.

b. Set the index pointer of the firing switch at the number 1 position. See wiring diagram instruction label (fig. 8) for location of tube number 1 and the firing order of tubes. Tube numbers are also stamped on the cluster (fig. 41).

c. Remove the circuit tester from the control box (fig. 9) and from its cover. Clasp the handles of the tester and place the lamp side contact of the tester over the live contact of tube number 1 (fig. 41), and allow the tester to open and make ground contact of the set screw against the opposite side of the tube.

d. Remove the lanyard from the control box (fig. 8) and attach it to the firing switch lever (par. 25). Pull the lanyard once while watching the lamp. A flash of the tester lamp indicates a completed circuit. When testing in bright daylight, the flash can more easily be seen if the lamp cover (fig. 41) is screwed off. Install the tester to tube number 2 and pull the lanyard once again while watching for flash. Continue until all tubes have been tested.

e. Testing to determine the cause of misfires may be started at any point in the firing order by setting the index pointer at the number of tube to be tested and installing the tester in the corresponding tube.

f. In the event that any tube or group of tubes indicate an incomplete circuit (no flash of the tester lamp), proceed as follows:

- (1) Examine the contacts, and clean if necessary. Water, dirt, or ice between the contacts and the clearance holes in the cluster will cause shorting.

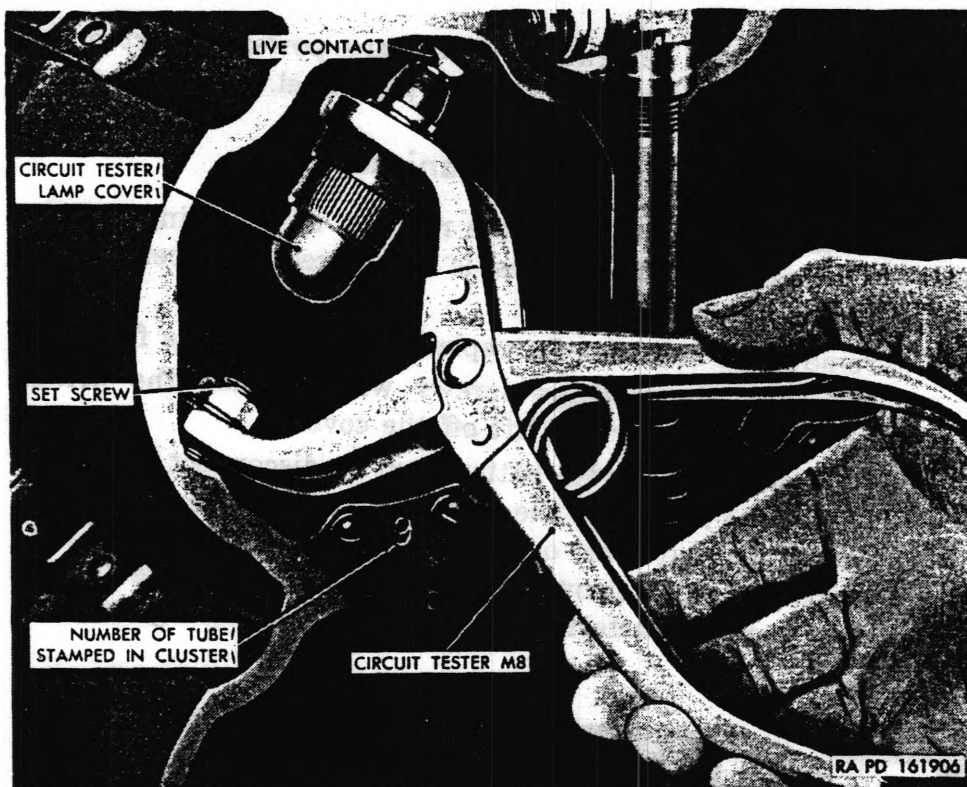


Figure 41. Use of circuit tester M8.

- (2) Check for bent or broken contact fingers. See that the bent end of the contact fingers contact the cluster when the circuit tester is removed from each rocket tube.
 - (3) Examine exposed wiring in the control box for broken wires, broken insulation, and for corroded or loose connections.
 - (4) If defects cannot be located or corrected by using organization, report to ordnance personnel.
- g. If all tubes indicate incomplete circuits, proceed as follows:
- (1) Remove the tester lamp cover (fig. 41) and examine the tester lamp. A broken filament can usually be detected. Replace lamp if necessary.
 - (2) Change from generator power to battery power (par. 21).
 - (3) Check all tubes with circuit tester as described in d above.

h. If circuit tester lamp indicates that all circuits are incomplete, replace batteries (par. 59) and recheck all circuits. If one or more circuits are complete with battery power, report malfunction of generator to ordnance personnel. If all circuits are

incomplete with both generator and battery power, report malfunction of wiring circuit to ordnance personnel.

59. Maintenance of Firing Mechanism

a. No disassembly, other than the removal of the firing switch cover for replacement of batteries, is authorized to be performed by the using organization.

b. To remove the batteries for replacement, proceed as follows:

- (1) Remove six machine screws which attach the firing switch box cover and lift off the cover.
- (2) Remove the knurled battery nut to disconnect the positive wire lead from the positive post (fig. 42). Carefully work the batteries out of the firing switch box. When partially out, remove the ground connection screw, then remove the batteries, two spacers, and sponge rubber pad.

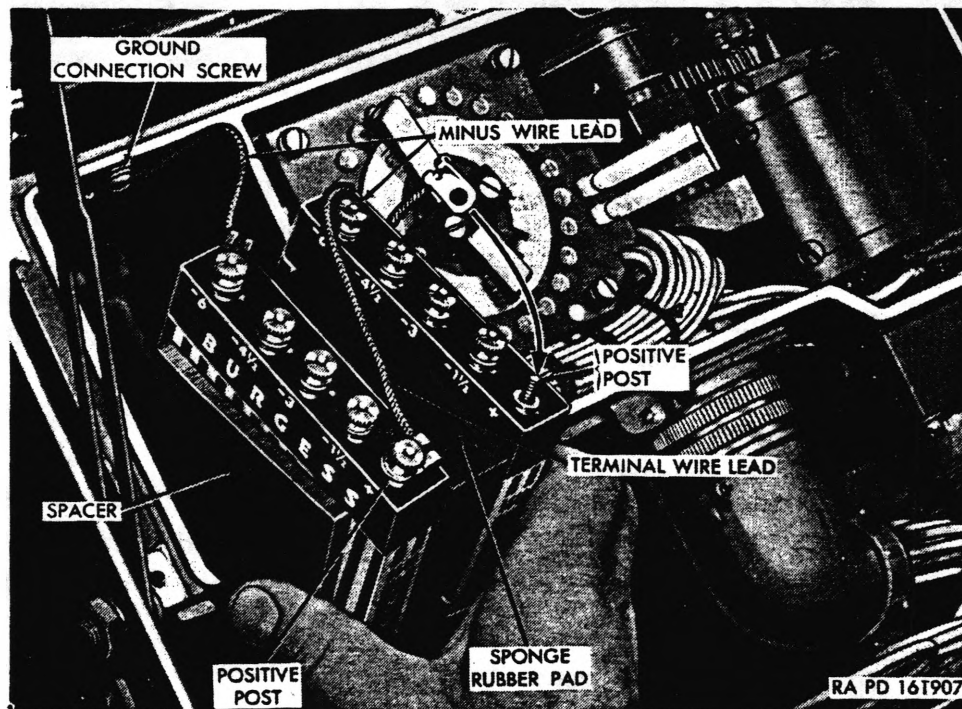


Figure 42. Removal of firing switch batteries.

c. To replace the batteries, proceed as follows:

- (1) Connect terminal wire lead from minus post of one battery to the positive post of the other (fig. 42). Place the sponge rubber pad between the two batteries and a spacer at each side.

- (2) Place the batteries and spacers in the box together, and before seating them, connect the minus wire lead to the firing switch box with the ground connection screw (fig. 42), then carefully push the batteries down into the box.
- (3) Connect the positive wire lead to the positive post.
- (4) Install the firing switch cover and attach with six machine screws. Rotate the firing switch index to engage the distributor arm.

Section VII. ELEVATING MECHANISM

60. General

a. The elevating mechanism (fig. 43) is manually operated to elevate and depress the rocket cluster from approximately 0- to 75-degree elevation. The mechanism is an assembly attached to the left side of the trail (fig. 38) with the pinion closely meshed with the elevating arc. Rotation of the elevating handwheel turns the bevel gear pinion and worm bevel gear which turns the worm and worm wheel and drives the shaft and pinion (fig. 43).

b. A hand-operated brake is provided inside the handwheel to prevent rotation of the handwheel during firing and while traveling. The brake is adjustable for the initial adjustment of parts and to compensate for wear in the brake shoes.

c. The elevating mechanism housing is divided into two sections to form pockets for lubricant at the bevel gears and at the worm wheel. Separate level and fill plugs are provided for each section. Drain plugs are not provided. It is necessary to remove the bevel gear cover and the worm wheel cover to remove lubricant.

61. Maintenance of Elevating Mechanism

a. GENERAL. No disassembly is authorized to be performed by the using organization. Organizational maintenance includes inspecting (b below), adding lubricant (fig. 35), and adjusting the handwheel brake (c below).

b. INSPECTING. Inspection of the elevating mechanism will be to determine that the mechanism operates smoothly through its entire range and that the effort to rotate the handwheel is approximately 1 pound at the handwheel knob. Set the handwheel brake and try turning the handwheel by hand, noting that the brake effectively holds the handwheel.

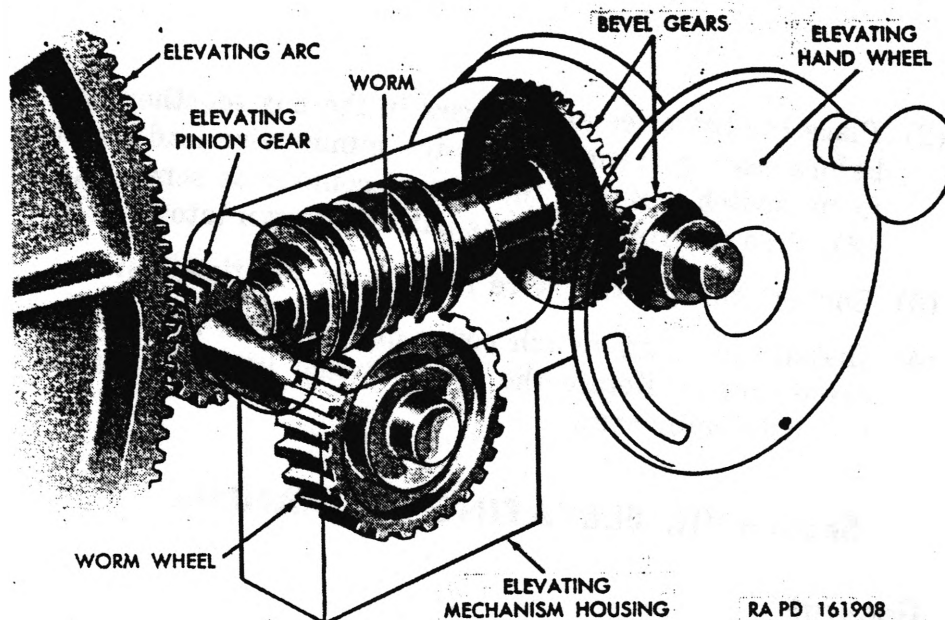


Figure 43. Elevating mechanism—pictorial diagram.

c. **ADJUSTING HANDWHEEL BRAKE.** The adjuster of the handwheel brake is located at the rear of the handwheel brake of the elevating mechanism and at the bottom of the housing. To increase the braking effort, turn the adjuster to the right, a “click” at a time, and try the handwheel brake lever and handwheel. If the brake is adjusted too tightly, the brake lever will not “toggle” over to hold the brake engaged. Release the brake and turn the adjuster to the left to decrease the braking effort.

Section VIII. CARRIAGE

62. General

a. The carriage consists of the trail, traversing parts (figs. 44 and 45), traveling lock (fig. 16), and axle key. The carriage is traversed on an axle traverse type of mechanism by the traversing handwheel (fig. 44) which drives a frictionless nut through sprockets and roller chain.

b. The traversing nut (fig. 45) is rotated in tapered roller bearings, and being held in the axle housing, screws itself along the threaded axle which is keyed to prevent its rotation. The action of the threaded axle and the nut is the same as an ordinary screw and nut; however, balls interposed between the threaded axle and nut provide a frictionless rolling contact. The balls in their

movement roll in a continuous line and are carried from one end of the nut to the other by the guide (fig. 45). The nut is sealed by a rubber traversing nut seal, which wipes the axle threads, and by a felt seal in the roller bearing cover. A bellows at each end of the axle provides protection and a seal for the axle.

c. The tension of the roller chain is adjustable by means of cam and roller. The cam bolt (fig. 44) is keyed to the cam and locked after adjustment by the cam bolt locking nut. A handwheel brake is provided to hold the traversing handwheel and prevent movement of the carriage during firing.

d. The traveling lock is a plunger which seats in a bored hole in the axle to locate the carriage at the axle center and to lock it in position during travel.

63. Maintenance of Carriage

a. GENERAL. No disassembly is authorized to be performed by the using organization. Organizational maintenance includes lubri-

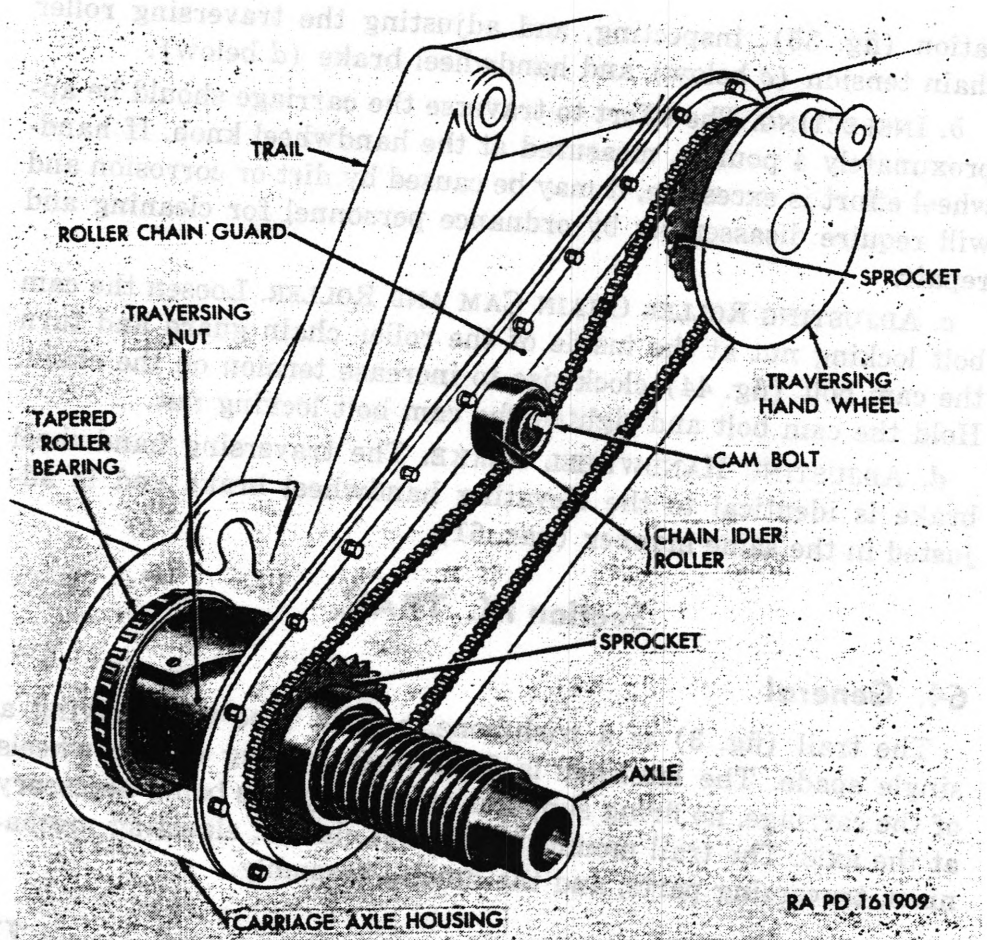


Figure 44. Carriage traversing parts—pictorial diagram.

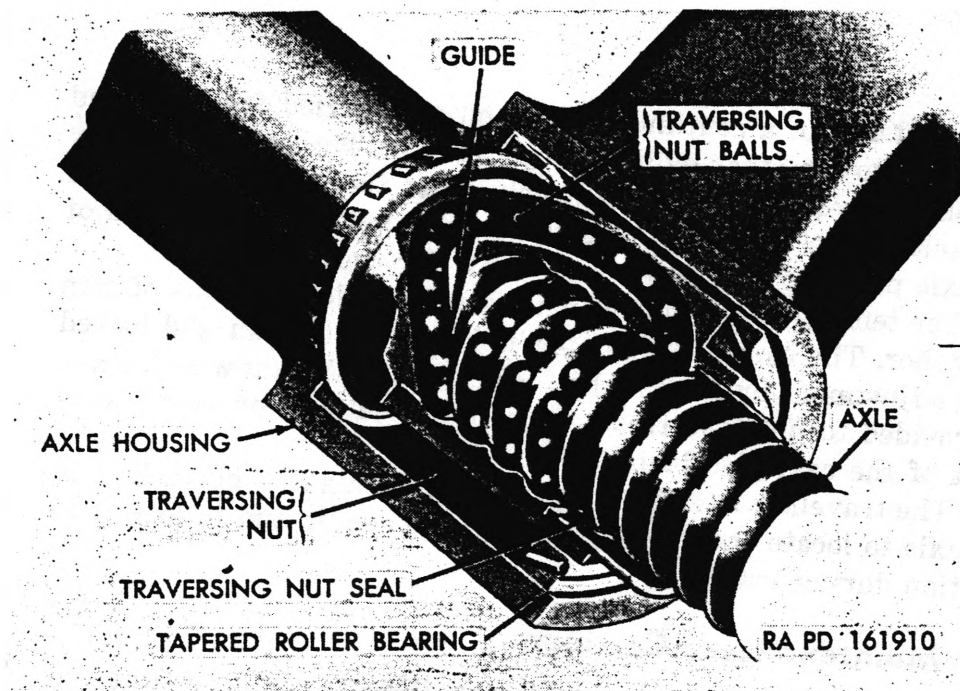


Figure 45. Traversing nut—pictorial diagram.

cation (fig. 35), inspecting, and adjusting the traversing roller chain tension (*c* below) and handwheel brake (*d* below).

b. INSPECTING. The effort to traverse the carriage should be approximately 4 pounds, measured at the handwheel knob. If handwheel effort is excessive, it may be caused by dirt or corrosion and will require disassembly by ordnance personnel for cleaning and repair.

c. ADJUSTING ROLLER CHAIN CAM AND ROLLER. Loosen the cam bolt locking nut at the inside of the roller chain guard and turn the cam bolt (fig. 44) clockwise to increase tension on the chain. Hold the cam bolt and tighten the cam bolt locking nut.

d. ADJUSTING HANDWHEEL BRAKE. The traversing handwheel brake is identical to the elevating handwheel brake and is adjusted in the same manner (par. 61).

Section IX. TRAIL

64. General

The trail (fig. 3) is a wish-bone, a solid type trail, having a single spade. The launcher is fired when resting on the wheels of the carriage, no firing supports or spade plates being necessary at the axle. The trail mounts the rocket cluster, elevating mechanism, traversing parts, and the lunette assembly.

65. Maintenance

No disassembly is authorized to be performed by the using organization. Organizational maintenance includes lubricating (fig. 35), and inspecting for broken welds and completeness of matériel.

Section X. WHEELS, BRAKES, AND TIRES

66. General

a. The wheels are of the steel disk and rim type equipped with 9.00 by 16 pneumatic tires.

b. Each wheel consists of the hub parts, disk and ring, pneumatic tire, inner tube, and a locking ring.

c. The wheels rotate on tapered roller bearings. Wheel stud and nuts on the right side of the launcher have left-hand threads, while studs and nuts on the left side have right-hand threads. The wheels are sealed against loss of lubricant and the entrance of dust and moisture by an oil seal (fig. 46) and hub cap.

d. The parking brakes are ordinarily used only for holding the launcher while unlimbering from the prime mover and for parking. They are the mechanical type and hand-operated. The parking brake lever at each wheel rotates a shaft which moves a cam to expand the two brake shoes against the brake drum (fig. 46).

67. Removal

a. REMOVAL OF DISK, RIM, AND TIRE ASSEMBLY.

- (1) Loosen the eight wheel stud nuts with wheel stud nut wrench.
- (2) Set the parking brakes.
- (3) Jack up the wheel with the jack from the prime mover.
- (4) Remove the stud nuts and lift the disk, rim, and tire assembly from the hub.

b. REMOVAL OF HUB AND DRUM ASSEMBLY AND WHEEL BEARINGS.

- (1) Remove disk, rim, and tire assembly (a above).
- (2) Screw off the hub cap (fig. 46).
- (3) Remove the cotter pin and the slotted nut from the wheel spindle.
- (4) Remove the bearing thrust washer and the outer tapered roller bearing cone after starting by pulling out on the hub slightly.

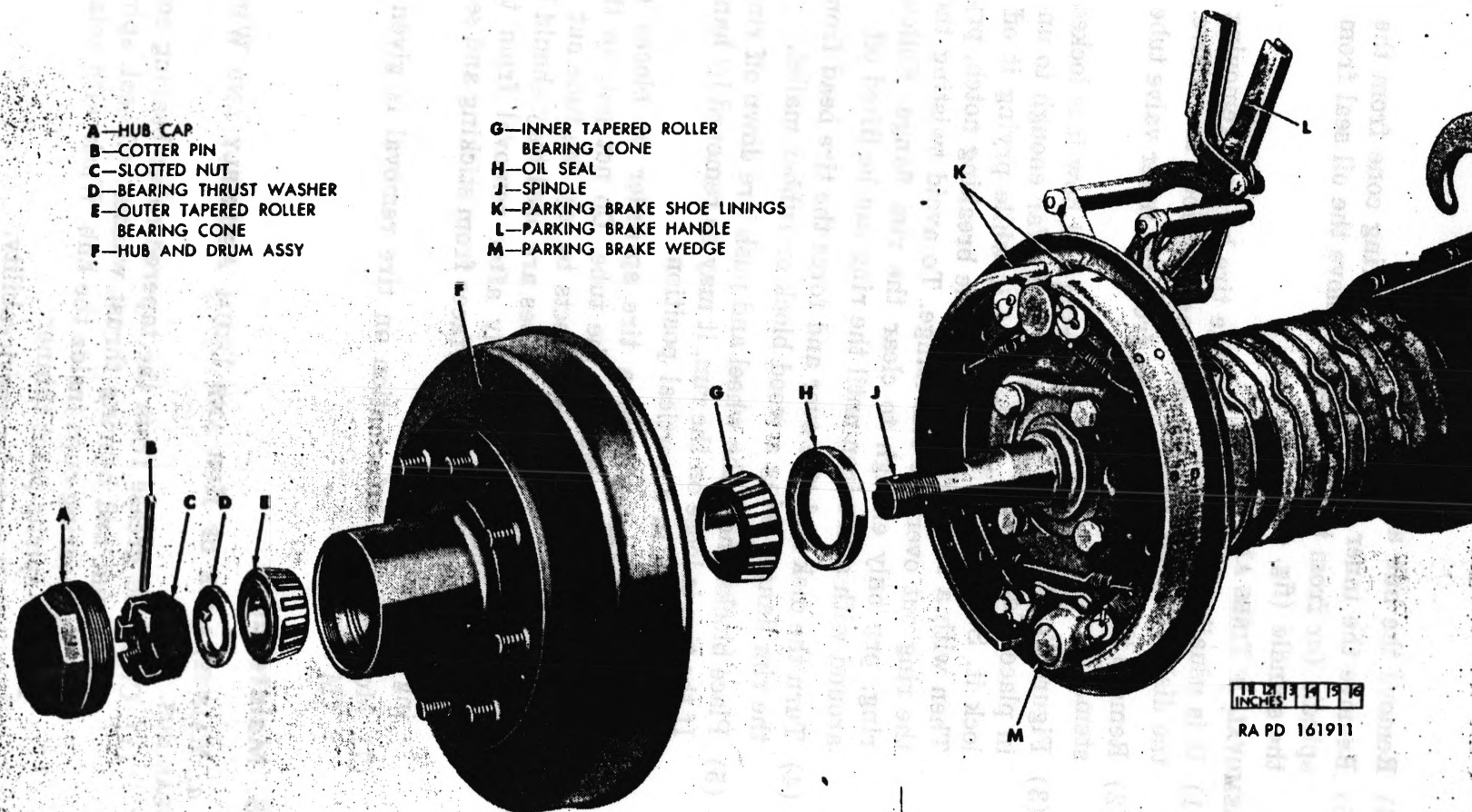


Figure 46. Wheel hub and drum assembly and wheel bearings—exploded view.

- (5) Remove the hub and drum assembly.
- (6) Remove the inner tapered roller bearing cone from the spindle (or from the hub), and remove the oil seal from the spindle (fig. 46).

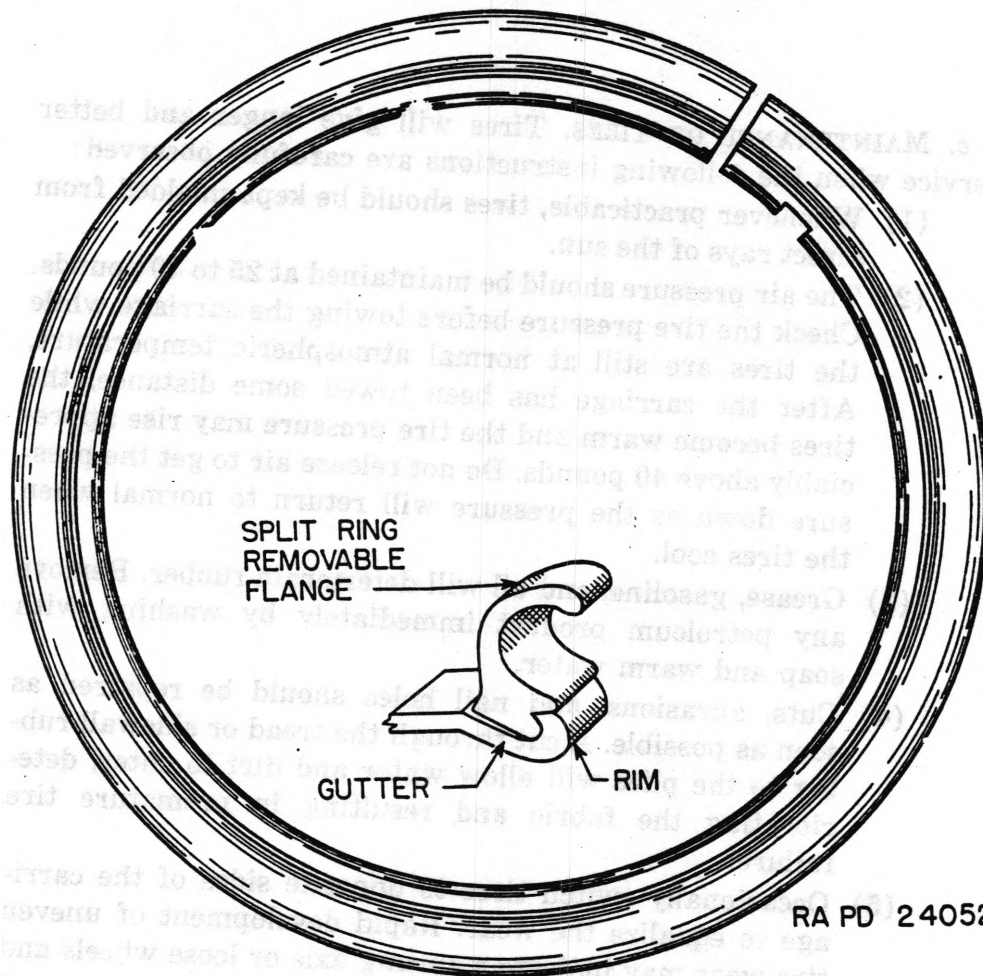
c. REMOVAL OF TIRES AND TUBES.

- (1) It is usually easier to remove the tire by first removing the disk, rim, and tire assembly as described in *a* above.
- (2) Remove the valve cap and core from the inner valve tube stem.
- (3) Figure 47 shows a tire locking ring and how it is locked in place. Force the locking ring down far enough to unlock it. Step on the ring to hold it while prying it off. Then with a ring tool or bar in the breaking notch, pry the ring out over the rim flange. To avoid twisting the ring, pry only enough to clear the rim flange. Follow around with a tire iron until the ring can be lifted off.
- (4) Turn the disk and tire over and force the tire bead from the rim flange, using a wood block or rubber mallet.
- (5) Place blocks under the wheel and push tire down off rim. If the tire is loose on the rim, it may be removed by hand with the disk in a vertical position.
- (6) Spread the casing with a tire spreader or blocks of wood, to permit removing the tube. Do not pull on the valve stem nor use sharp objects to pry the tube out of the tire. If bullet-resisting tubes are used they should be partially inflated immediately after removal from the tire to prevent the inside surfaces from sticking and sealing together.
- (7) More detailed information on tire removal is given in TM 31-200.

68. Maintenance

a. MAINTENANCE OF HUB AND DRUM ASSEMBLY AND WHEEL BEARINGS.

- (1) Clean old grease from the tapered roller bearing cones, slotted nut and bearing thrust washer, oil seal, spindle, and the bearing cups inside the hub. Wash with volatile-mineral-spirits-paint thinner.
- (2) Inspect all parts for serviceability.
- (3) Thoroughly dry all parts.
- (4) Repack the tapered roller bearing cones with the pre-



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Figure 47. Tire locking ring.

scribed lubricant (fig. 35), using just enough grease to fill the spaces between the rollers.

- (5) Check condition of parking brake shoe linings and brake mechanism before installing hub and drum assembly. If repairs are needed, notify ordnance personnel.

b. MAINTENANCE OF BRAKES.

- (1) No disassembly is authorized to be performed by the using organization. Organizational maintenance will be the adjustment of the brakes.
- (2) After installation of the hub and drum assembly (par. 69b), adjust brakes. To increase braking effort, release the parking brake handle and turn the parking brake wedge (fig. 46) to the right, one "click" at a time. Set the parking brakes and repeat adjustment until the parking brake pawl is near the center of the rack.

c. **MAINTENANCE OF TIRES.** Tires will give longer and better service when the following instructions are carefully observed:

- (1) Whenever practicable, tires should be kept shielded from direct rays of the sun.
- (2) The air pressure should be maintained at 25 to 40 pounds. Check the tire pressure before towing the carriage while the tires are still at normal atmospheric temperature. After the carriage has been towed some distance, the tires become warm and the tire pressure may rise appreciably above 40 pounds. Do not release air to get the pressure down as the pressure will return to normal when the tires cool.
- (3) Grease, gasoline, and oil will deteriorate rubber. Remove any petroleum product immediately by washing with soap and warm water.
- (4) Cuts, abrasions, and nail holes should be repaired as soon as possible. A cut through the tread or sidewall rubber to the plies will allow water and dirt to enter, deteriorating the fabric and resulting in premature tire failure.
- (5) Occasionally switch tires to opposite sides of the carriage to equalize the wear. Rapid development of uneven tire wear may indicate a sprung axle or loose wheels and action should be taken immediately to determine and correct the cause.
- (6) Inspect tire and tube for wear or damage and replace when necessary.
- (7) For more detailed tire maintenance and repair information see TM 31-200.

69. Installation

a. INSTALLATION OF TIRES AND TUBES.

- (1) To install the inner tube in the tire casing, spread the casing with a tire spreader or wood blocks. Deflate the inner tube and install it in the tire with the valve stem opposite the red dot on the side wall of the tire. Insert the valve core.

Note. After installing the tube, partially inflate and deflate several times to remove all kinks and folds.

- (2) To install the tire and tube on the rim, proceed as follows:
 - (a) Insert the valve stem in the wheel slot, working the tire into position on the wheel. Talcum or a soap solu-

tion may be used as a lubricant to aid in slipping the tire onto the disk.

- (b) Lay the tire and wheel on a flat surface (gutter side of the rim up) with suitable blocking under the wheel to raise the tire just clear of the floor. Place the locking ring in approximate position above the rim gutter. Pry the locking ring into the rim gutter, a little at a time, locking the notched end last.
- (c) Partially inflate the tire and, at the same time, tap the locking ring at points around the rim to seat it properly. Do not overinflate the tire at this time; just a few pounds pressure is enough to seat the locking ring in position.
- (d) Place tire in normal vertical position and complete inflation from the side opposite the tire locking ring.

Caution: Stand on the side of the wheel, away from the tire locking ring, to avoid injury in case improper installation causes the locking ring to blow off.

b. INSTALLATION OF HUB AND DRUM ASSEMBLY, AND WHEEL BEARINGS.

- (1) Install the oil seal with the lip edge facing outward (fig. 46).
- (2) Install the grease packed inner tapered roller bearing cone on the spindle. Place the hub and drum assembly on the spindle, and install the grease packed outer tapered roller bearing cone on the spindle and in the hub.
- (3) Install the bearing thrust washer and screw on the slotted nut. Tighten the nut until a drag is felt when turning the hub. Back off the nut just enough to allow the hub to rotate freely, one-sixth turn usually suffices.
- (4) Insert the cotter pin through the slotted nut and spindle and spread the split ends. Screw on the hub cap.

c. INSTALLATION OF DISK, RIM, AND TIRE ASSEMBLY.

- (1) Lift the disk, rim, and tire assembly onto the wheel studs and install the wheel stud nuts.
- (2) Lightly tighten the alternate nuts, then advance one stud and repeat on the alternates to insure even tightening and a true running wheel. Use the wheel stud nut wrench to tighten all nuts securely. Lower the carriage and remove jack.

CHAPTER 4

MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM

Section I. SIGHTING AND FIRE CONTROL INSTRUMENTS

70. General

This section contains essential information necessary for the crew to properly identify, connect, operate, and protect this equipment while being used or transported with the weapon as well as necessary instructions covering maintenance authorized to organizational personnel. Instructions covering off-carriage items are contained in separate technical manuals which are listed in the appendix.

71. Arrangement and Use

a. GENERAL. The sighting and fire control equipment for the 4.5-inch multiple rocket launcher T123 (fig. 48) is used for direct and indirect fire.

b. DIRECT AND INDIRECT FIRE GROUP. The elbow telescope M62, telescope adapter M9E4, and telescope mount M79 mounted on the multiple rocket launcher T123 are used for direct and indirect fire. The elbow telescope, telescope adapter, and telescope mount are carried in the launcher control box (figs. 8 and 9). The sighting equipment is mounted in either of two positions on the launcher for aiming the rocket launcher in azimuth and elevation. The trunnion sight mount pin (fig. 53) is ordinarily used; the upper position (fig. 48) is used when the aiming point is to the right of the rocket launcher.

Caution: Remove the sighting equipment during firing to prevent damage caused by the back-blast of the rockets.

c. MISCELLANEOUS EQUIPMENT. The elbow telescope M62 is illuminated for night operation by the instrument light M42 (fig. 49). The instrument light and aiming post lights are carried in supports in the launcher control box (fig. 8). The aiming posts are strapped in the trail (par. 4f).

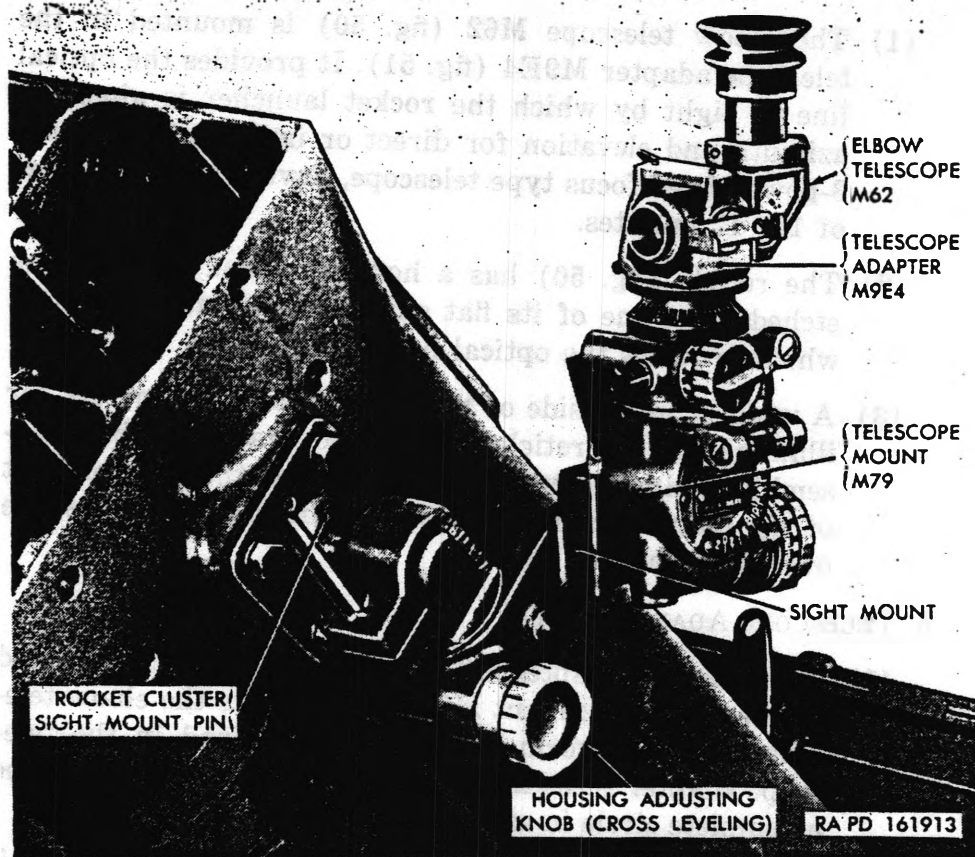


Figure 48. Sighting equipment mounted in upper position.

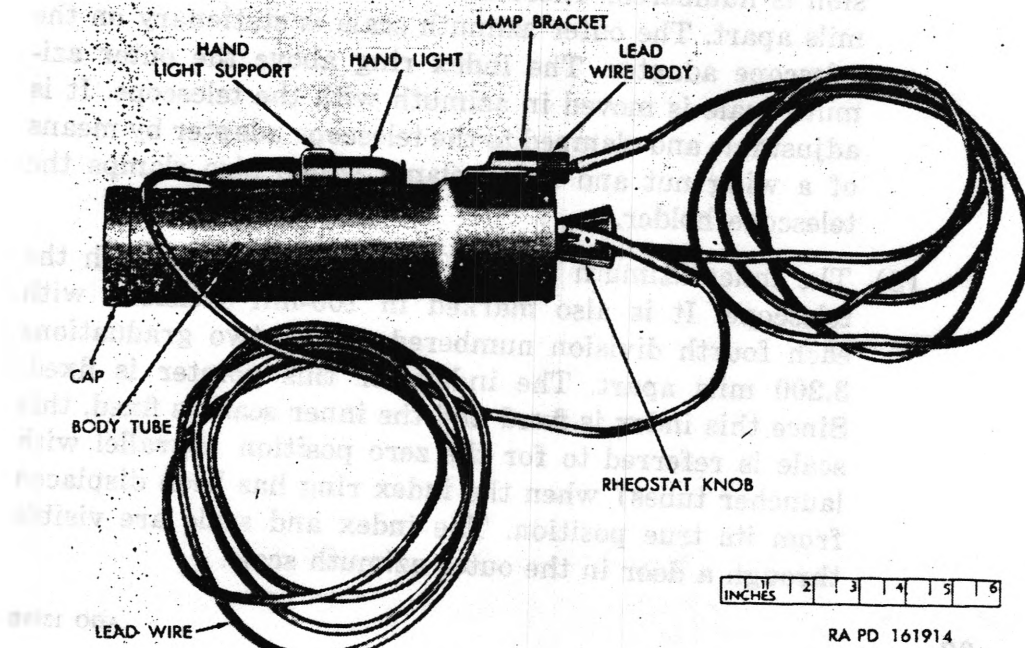


Figure 49. Instrument light M42.

72. Description and Data

a. ELBOW TELESCOPE M62.

- (1) The elbow telescope M62 (fig. 50) is mounted in the telescope adapter M9E4 (fig. 51). It provides the optical line of sight by which the rocket launcher is aimed in azimuth and elevation for direct or indirect fire. It is a 3-power fixed-focus type telescope, having a field of view of 12° 12 minutes.
- (2) The reticle (fig. 50) has a horizontal and vertical line etched upon one of its flat surfaces, the intersection of which provides the optical line of sight.
- (3) A window in the side of the elbow telescope provides for illuminating the reticle for night operation. A band assembly having a dovetail slot to position the lamp bracket of the instrument light M42 is mounted on the telescope over the window (fig. 51).

b. TELESCOPE ADAPTER M9E4.

- (1) The telescope adapter M9E4 (figs. 50 and 51) is mounted on the telescope mount M79 and supports the elbow telescope M62. A worm mechanism contained in the telescope adapter is the means of rotating the elbow telescope a complete circle in azimuth.
- (2) The outer azimuth scale is graduated into 64 equal divisions, each division equaling 100 mils. Each fourth division is numbered. There are two zero graduations 3,200 mils apart. The outer azimuth scale is stationary on the telescope adapter. The index ring above the outer azimuth scale is moved in azimuth with the telescope. It is adjustable and clamped to the telescope adapter by means of a wing nut and index clamp which also clamps the telescope holder.
- (3) The inner azimuth scale is moved in azimuth with the telescope. It is also marked in 100-mil divisions with each fourth division numbered and in two graduations 3,200 mils apart. The index for this pointer is fixed. Since this index is fixed and the inner scale is fixed, this scale is referred to for the zero position (parallel with launcher tubes) when the index ring has been displaced from its true position. The index and scale are visible through a door in the outer azimuth scale.

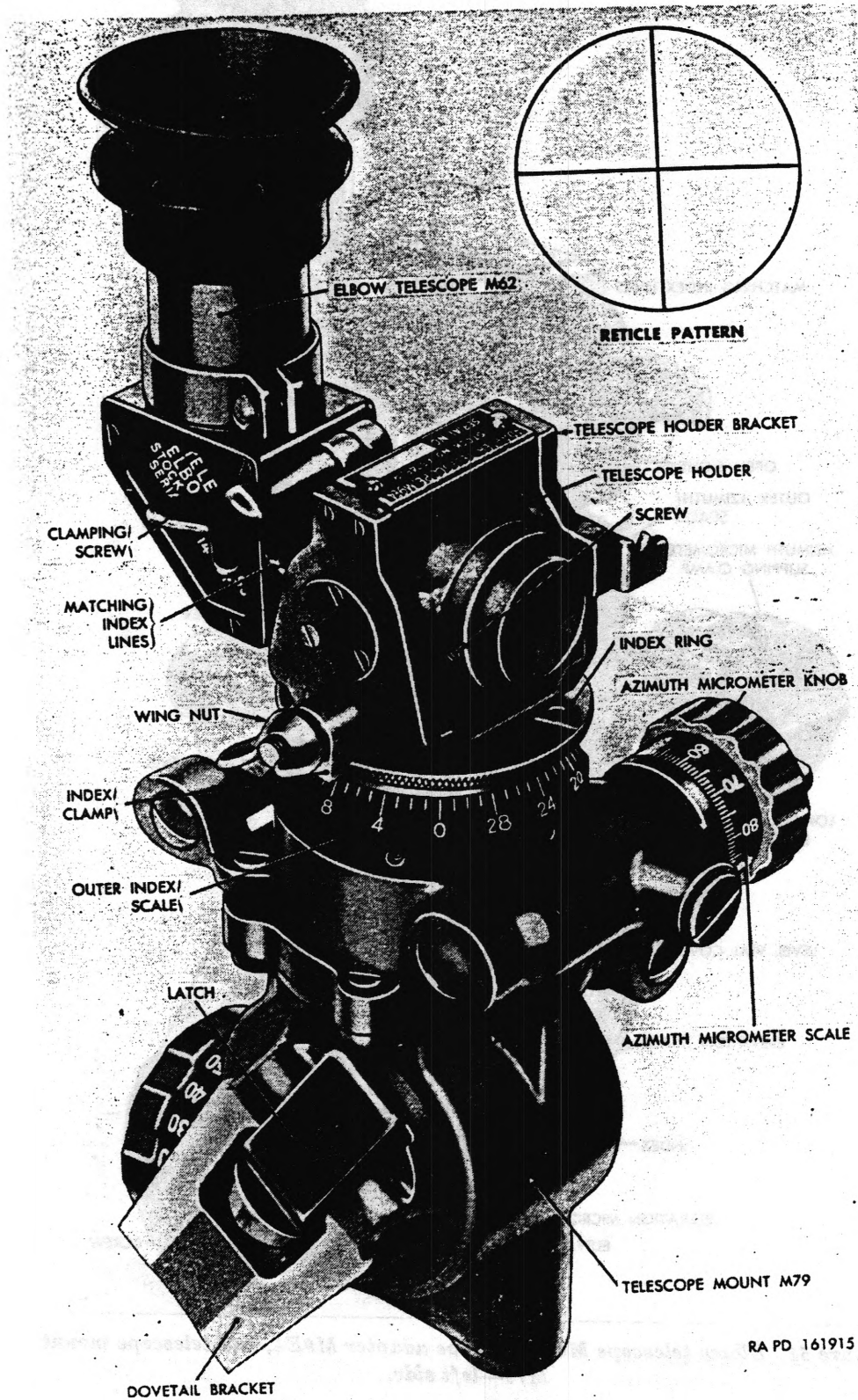


Figure 50. Elbow telescope M62, telescope adapter M9E4, and telescope mount M79—right side.

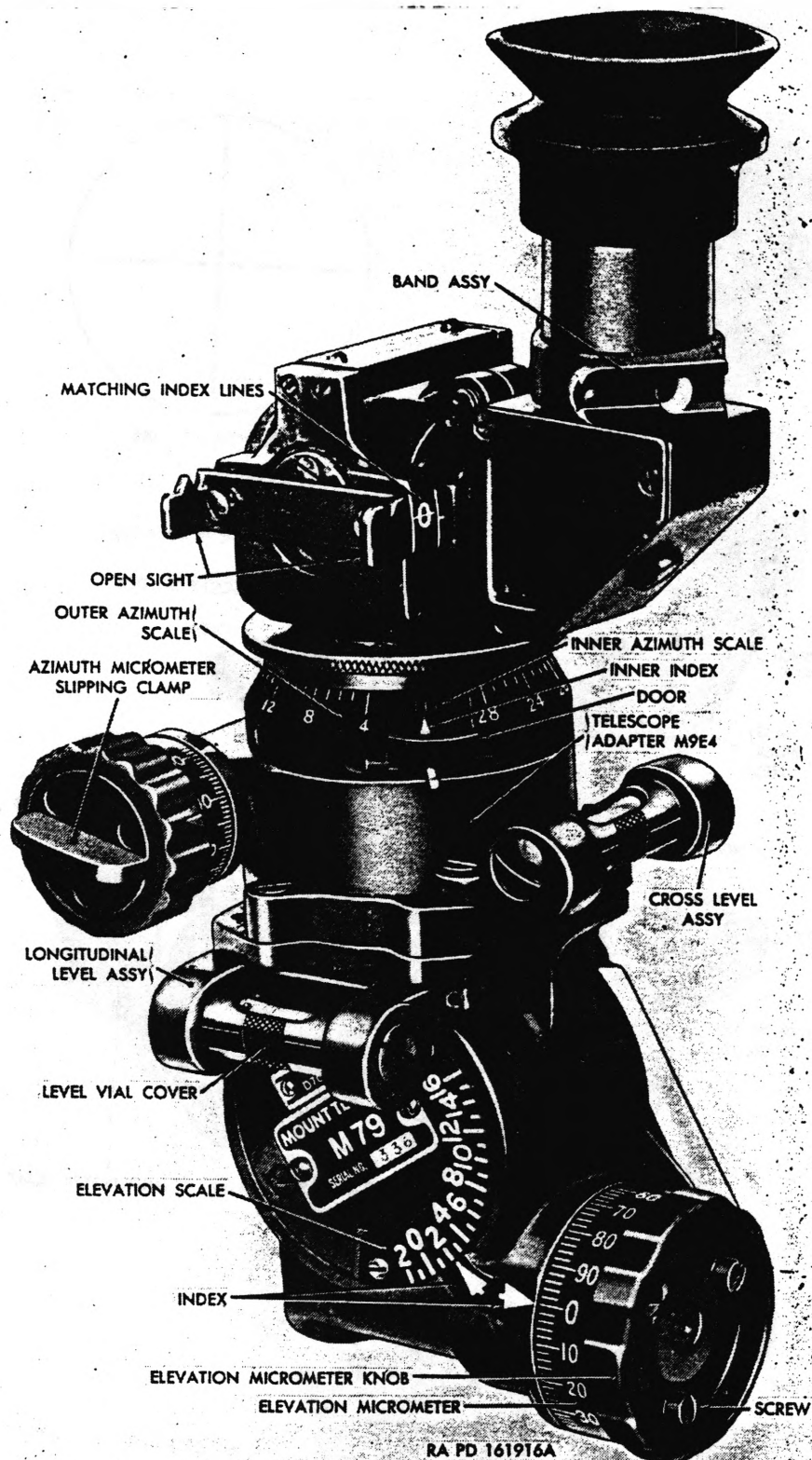


Figure 51. Elbow telescope M62, telescope adapter M9E4, and telescope mount M79—left side.

- (4) The azimuth micrometer is graduated into 100 equal divisions each representing 1 mil. Each tenth division is numbered. For rapid orientation of the elbow telescope, the worm of the azimuth micrometer adjustment can be disengaged from the worm gear. The micrometer scale can be quickly displaced through use of the azimuth micrometer slipping clamp.
- (5) The telescope holder can be rotated approximately 30° in a vertical plane to facilitate sighting on aiming points within limits of 15° above or below the level line. Matching index lines (fig. 51) indicate the level setting of the elbow telescope.
- (6) The elbow telescope can be rotated in the telescope holder. Matching index lines (fig. 50) indicate the level position of the elbow telescope in the telescope holder. The elbow telescope should be level and erect during sighting.
- (7) The open sight (fig. 51) mounted on the telescope holder bracket remains fixed and parallel to the level line of sight of the elbow telescope. It is used for rapidly bringing telescope to bear on the target.

c. TELESCOPE MOUNT M79.

- (1) The telescope mount M79 (figs. 50 and 51) is mounted and latched in a dovetail socket in the sight mount of the multiple rocket launcher T123 and supports the telescope adapter M9E4. A worm mechanism provides the means of directing the line of sight of the elbow telescope in elevation.
- (2) The elevation scale (fig. 51) is graduated in 100-mil intervals from minus 200 mils to plus 1,600 mils. The elevation micrometer is graduated into successive half circles with fifty 2-mil divisions.
- (3) A cross level assembly, furnished with the telescope mount, is attached to the telescope adapter M9E4. Cross leveling of the sighting equipment is accomplished by turning the housing adjusting (cross leveling) knob (fig. 21) of the rocket launcher sight mount to center the bubble of the cross level assembly (fig. 51).
- (4) A longitudinal level assembly (fig. 51) indicates when the rocket launcher has been elevated to the position set on the elevation scale and the elevation micrometer. The elevation scale is adjustable on the telescope mount and the elevation micrometer scale is adjustable on the knob.

d. INSTRUMENT LIGHT M42.

- (1) The instrument light M42 (fig. 49) is a self-contained light source for illuminating the reticle in the elbow telescope and for a hand light which is used for illuminating the scales of the sighting equipment.
- (2) The lamp bracket is placed into a dovetail slide on the band assembly of the elbow telescope for illumination of the reticle. When not in use, the lamp bracket is placed in a similar dovetail slide on the instrument light body tube. A rheostat knob turns the battery power on or off and is used to regulate the brilliance of illumination to the reticle.
- (3) The hand light is carried in clips on the instrument light body tube when not in use. The hand light is turned on or off by the rheostat knob.

73. Preparation for Firing

a. REMOVE SIGHTING EQUIPMENT FROM LAUNCHER CONTROL BOX. Unlatch and open the rocket launcher control box (fig. 8). Remove the telescope mount M79, elbow telescope M62, and telescope adapter M9E4 as a unit. Press out on the latch (fig. 52) and lift out the sighting equipment.

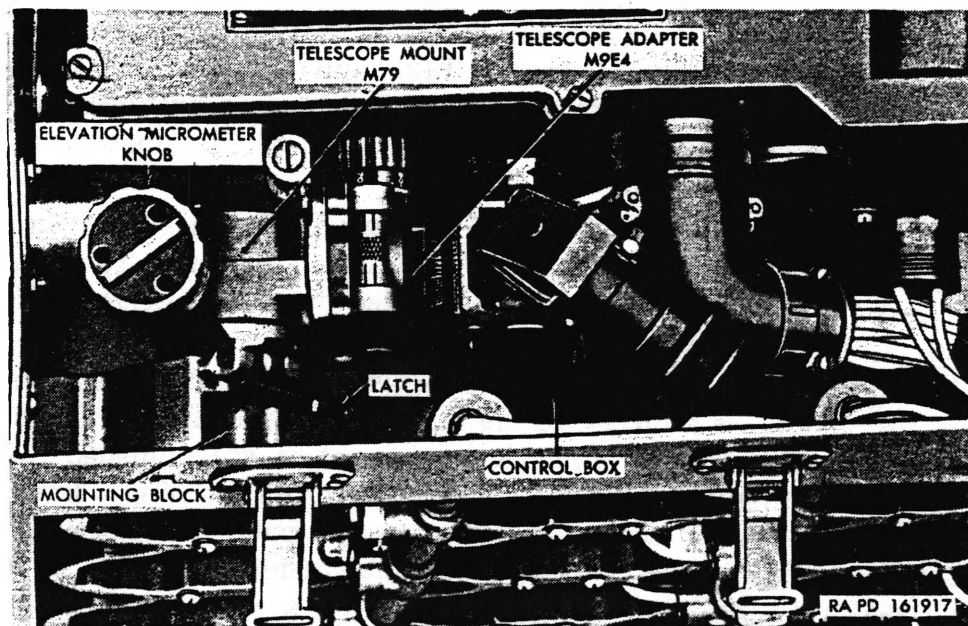


Figure 52. Sighting equipment in launcher control box.

b. **INSTALL SIGHTING EQUIPMENT ON LAUNCHER SIGHT MOUNT.** Attach the telescope mount M79, elbow telescope M62, and telescope adapter M9E4, as a unit, to the rocket launcher by inserting the dovetail bracket of the telescope mount into the dovetail socket on the rocket launcher sight mount (fig. 48 or 53). Press the telescope mount down firmly, with the latch pressed outward, until it is fully seated in the sight mount socket and the latch is engaged.

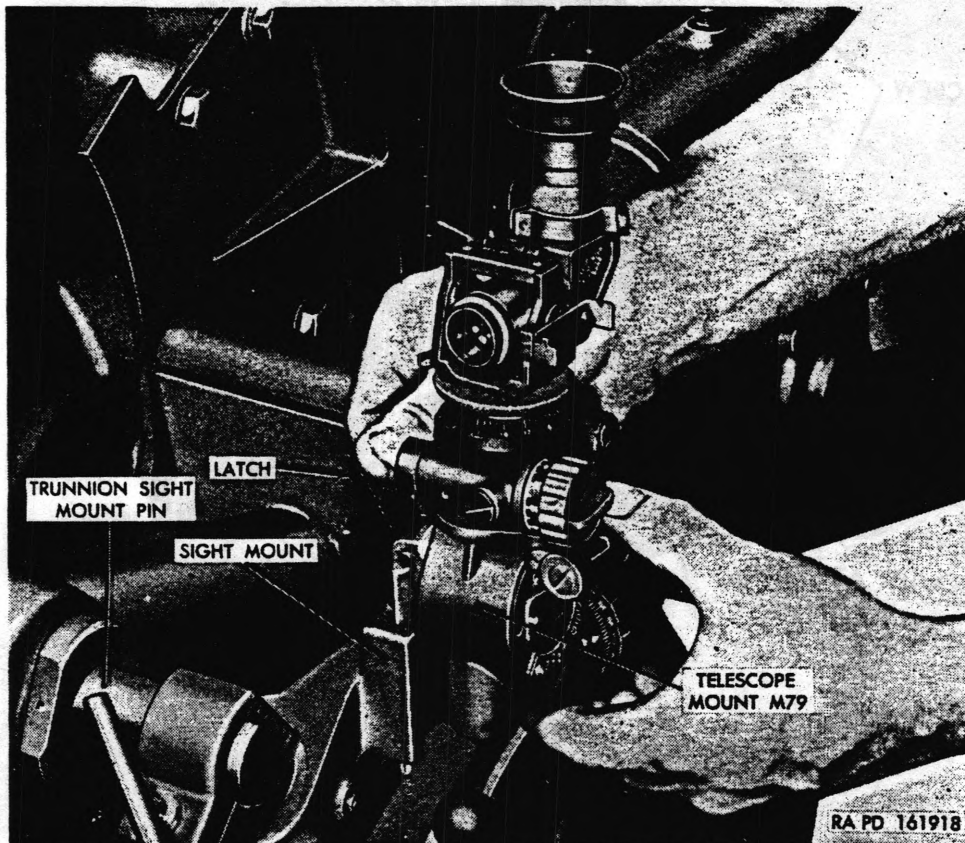


Figure 53. Installing sighting equipment.

c. **ASSEMBLE SIGHTING EQUIPMENT.** The sighting equipment will ordinarily be assembled as a unit when received. If the telescope mount M79, elbow telescope M62, and telescope adapter M9E4 are not already assembled together, proceed as follows:

- (1) Install the telescope adapter M9E4 in place on the telescope mount M79. Secure with two fillister-head screws (fig. 54).
- (2) Install the cross level assembly (fig. 54) in place on the telescope mount M9E4. Secure with two fillister-head screws, a nut, and cotter pin as shown in figure 54.

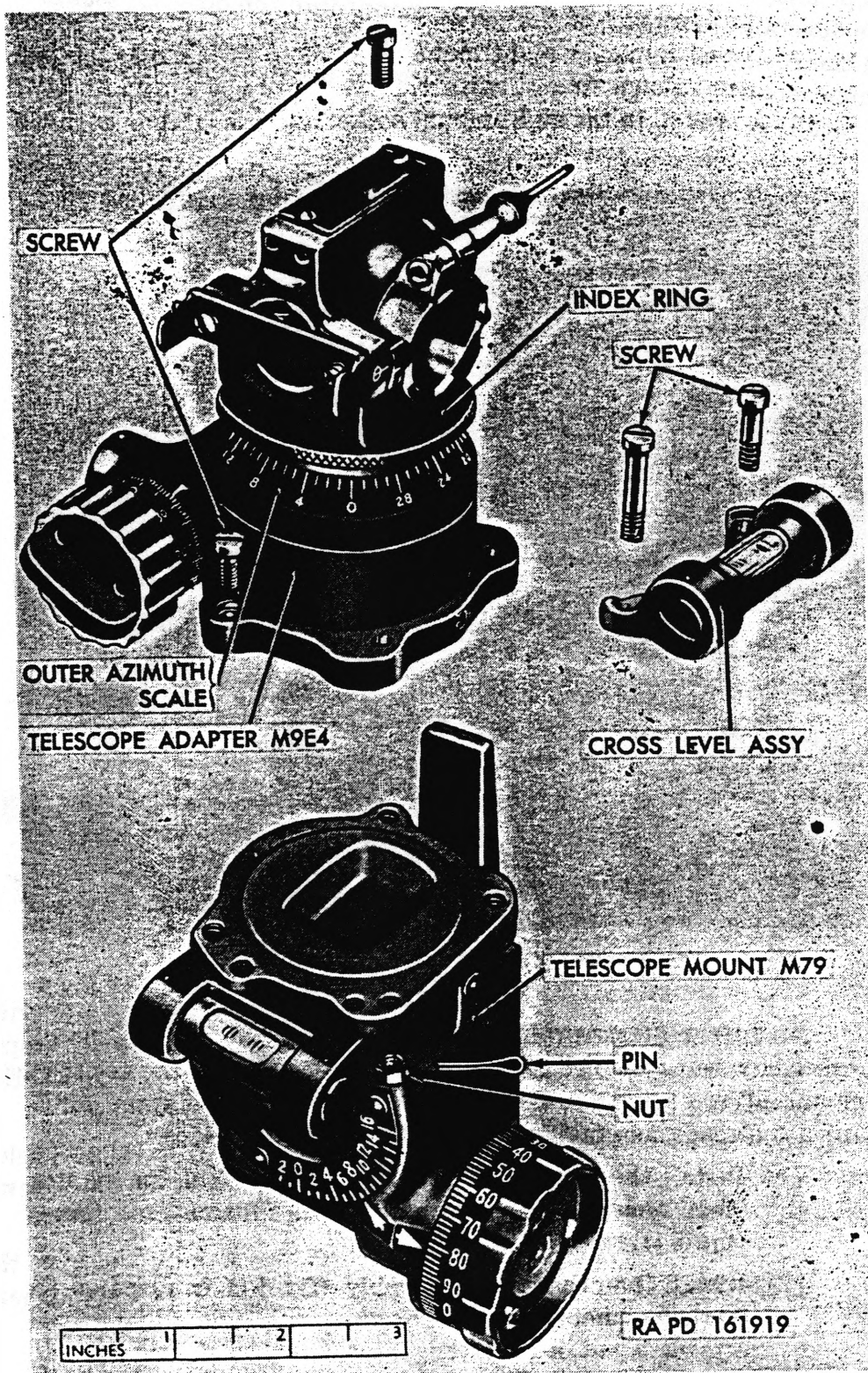


Figure 54. Assembling telescope adapter M9E4 to telescope mount M79.

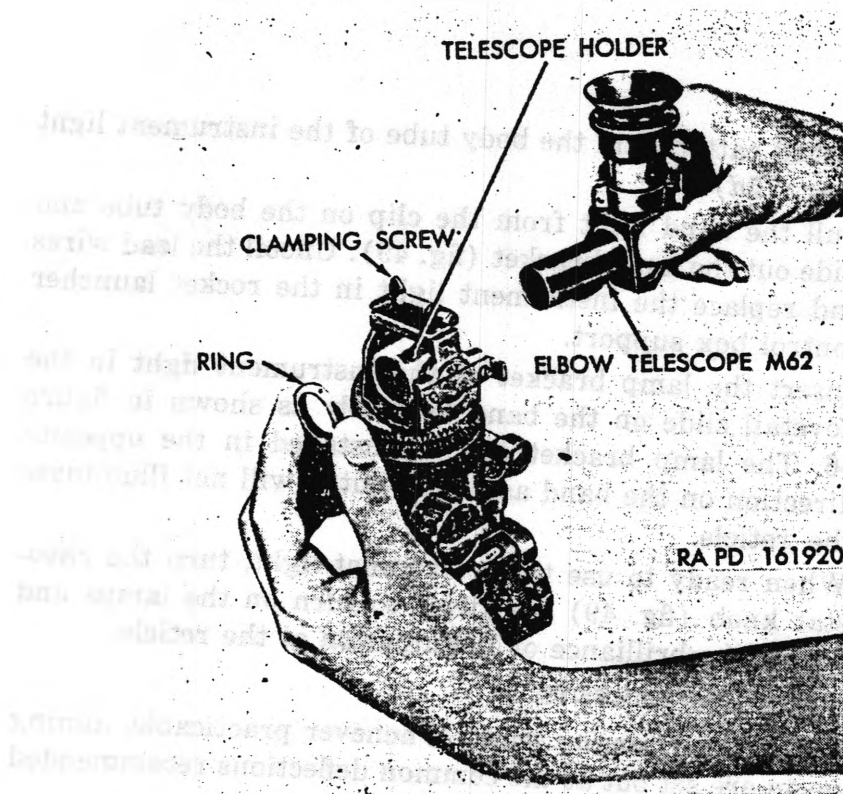


Figure 55. Installing elbow telescope M62 in telescope adapter M9E4.

- (3) Loosen the three headless set screws which secure the ring to the elbow telescope (fig. 55). Remove the ring.
- (4) Loosen the clamping screw and slide the objective end of the elbow telescope into the telescope holder far enough to allow the ring to be installed (fig. 55).
- (5) Install the ring on the elbow telescope. Secure in place with three headless set screws previously loosened. Rotate the elbow telescope to align the matching index lines (fig. 50) then tighten the clamping screw.
- (6) Install telescope mount M79, elbow telescope M62 and the telescope mount M9E4 on the launcher as outlined in b above.

d. UNCOVER LEVEL VIALS. Rotate the covers of the cross level and longitudinal level assemblies (fig. 51) to uncover the level vials.

e. INSTALL INSTRUMENT LIGHT M42. If night operation is required, proceed as follows:

- (1) Remove the instrument light from the support in the rocket launcher control box (fig. 8).

- (2) Install batteries in the body tube of the instrument light (par. 75d).
- (3) Pull the hand light from the clip on the body tube and slide out the lamp bracket (fig. 49). Uncoil the lead wires and replace the instrument light in the rocket launcher control box support.
- (4) Insert the lamp bracket of the instrument light in the dovetail slide on the band assembly as shown in figure 56. The lamp bracket can be installed in the opposite direction on the band assembly but it will not illuminate the reticle.
- (5) When ready to use the instrument light, turn the rheostat knob (fig. 49) clockwise to turn on the lamps and adjust the brilliance of illumination at the reticle.

f. TESTS AND ADJUSTMENTS.

- (1) *Selection of aiming point.* Whenever practicable, aiming posts are set out at the common deflections recommended

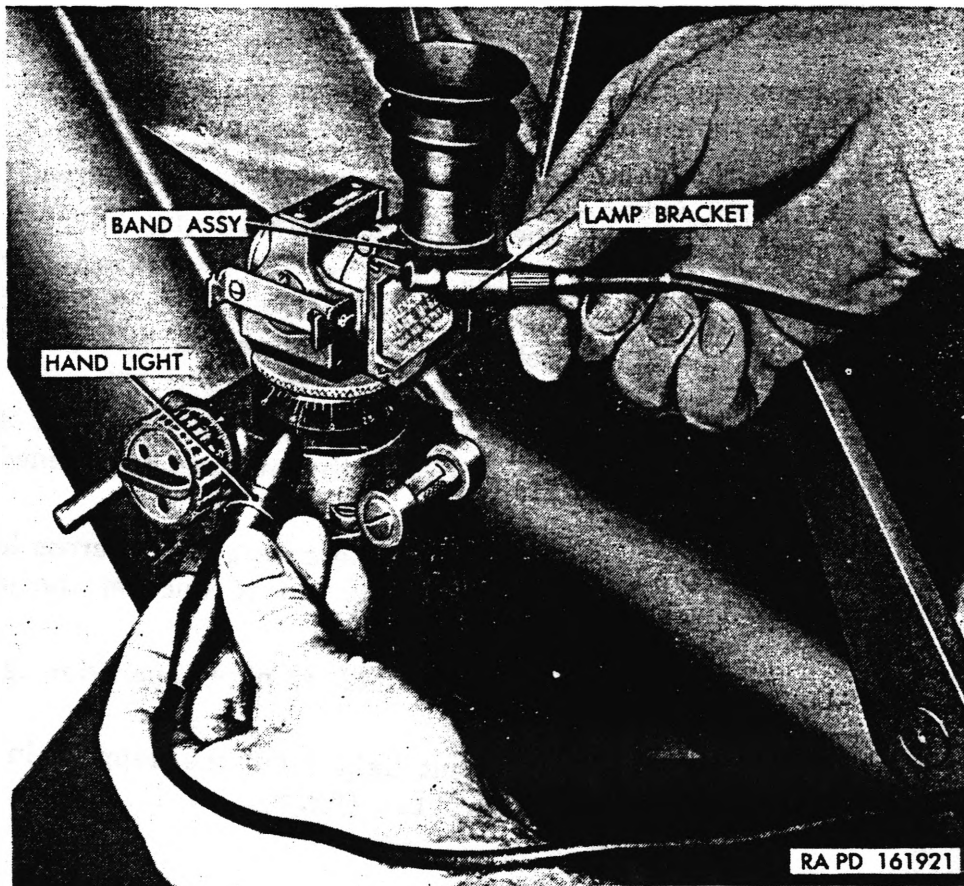


Figure 56. Use of instrument light M42.

in FM 6-140. If aiming posts cannot be set out at the common deflection, the aiming posts are set out at some multiple of 100 mils. If it is desired, a distant aiming point can be used.

- (2) *Emplacement.* Select a site for the launcher on ground as level as possible.
- (3) *Adjustment of elevation scale and elevation micrometer of telescope mount M79.*
 - (a) Set the gunner's quadrant M1 (fig. 57) to 800 mils and operate the elevating mechanism to elevate the rocket cluster until the level vial bubble of the gunner's quadrant is centered.

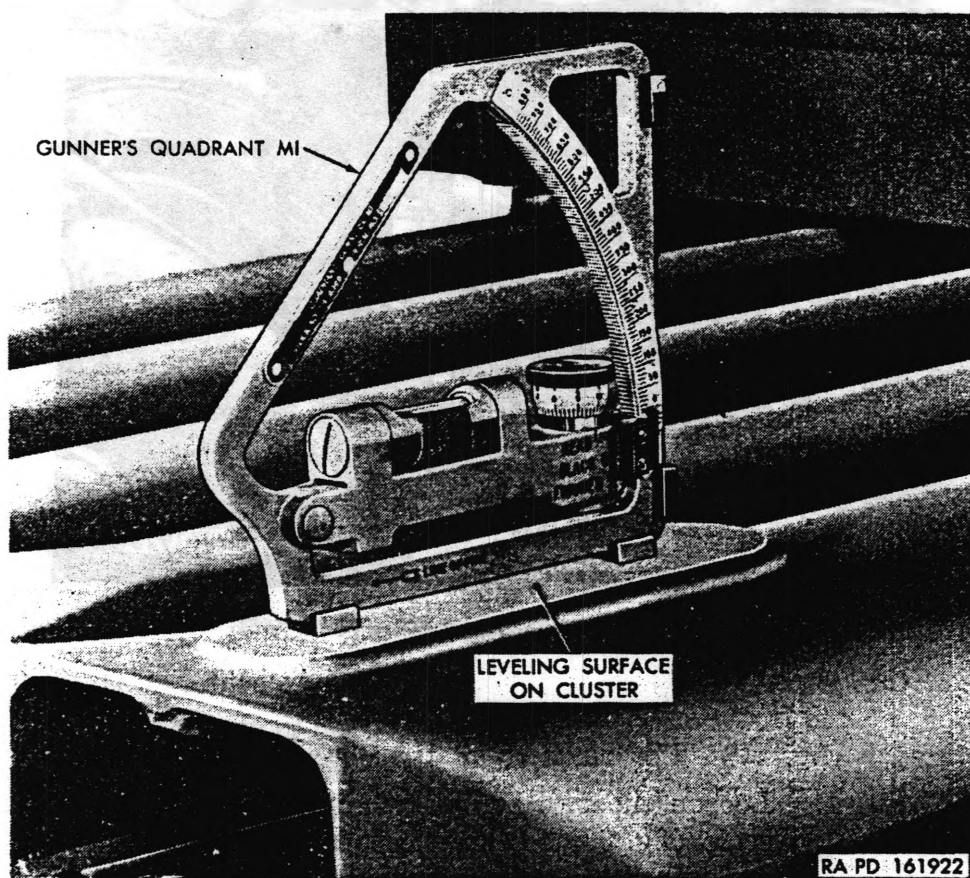


Figure 57. Position of gunner's quadrant M1 on rocket cluster.

- (b) Turn the sight mount housing adjusting (cross leveling) knob to center the bubble in the level vial of the cross level assembly (fig. 58).

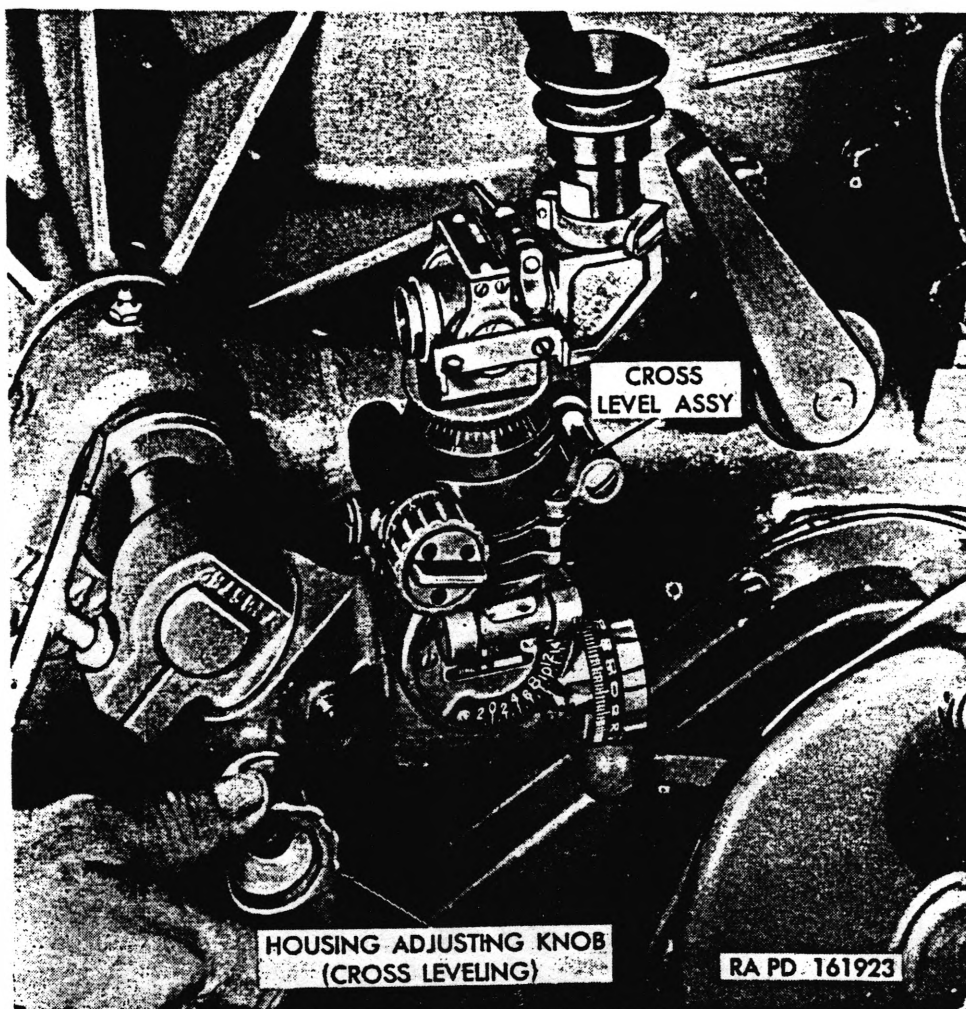


Figure 58. Cross leveling the sighting equipment.

- (c) Turn the elevation micrometer knob to center the bubble in the level vial of the longitudinal level assembly (fig. 59). The reading on the elevation scale should be 800 mils, and the reading on the elevation micrometer should be zero. If not, adjust as follows:
1. Loosen the two screws which secure the elevation scale (fig. 60) to the telescope mount, and shift the scale until the 800-mil mark on the scale is opposite its index. Tighten the two screws.
 2. Loosen the three screws in the end of the elevation micrometer knob (fig. 60). Hold the knob and turn the elevation micrometer until the zero is opposite the index. Tighten the three screws.

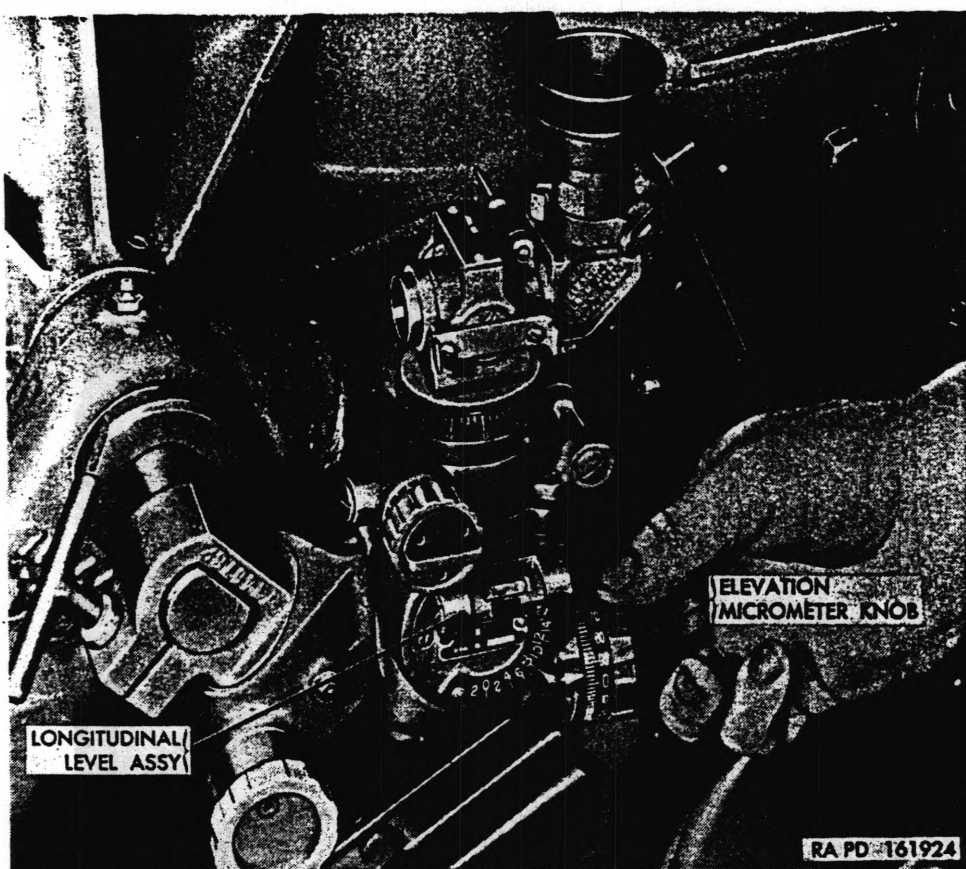


Figure 59. Elevating telescope mount M79 to center bubble in longitudinal level assembly.

- (4) *Adjustment of outer azimuth index ring and azimuth micrometer.*
 - (a) Open the door in the outer azimuth scale and turn the azimuth micrometer knob (fig. 50) to index the inner azimuth scale to zero.
 - (b) Loosen the wing nut which clamps the index ring and the telescope holder and turn the index to the zero on the outer azimuth scale.
 - (c) Aline the elbow telescope holder and the telescope holder bracket matching index lines (fig. 51) then tighten the wing nut (fig. 50) to clamp the index ring and the telescope holder.
 - (d) If the azimuth micrometer is not indexed at zero, hold the azimuth micrometer knob and loosen the azimuth micrometer slipping clamp. Hold the knob and turn the azimuth micrometer to index to zero, then tighten the slipping clamp (fig. 61).



Figure 60. Setting elevation micrometer to zero.

- (5) *Adjustment of elbow telescope in telescope holder.* Loosen the clamping screw (fig. 50). Look through the elbow telescope and rotate it about the objective axis until the entire vertical line of the reticle remains on target or aiming point as the elevation micrometer knob is turned (fig. 62). Tighten the clamping screw.

74. Operation

- a. Turn the sight mount housing adjusting (cross leveling) knob (fig. 58) to center the bubble in the level vial of the cross level assembly.
- b. For direct fire, the outer azimuth scale and the azimuth micrometer are to be indexed at zero (par. 73f(4)).
- c. For indirect fire, adjust the index ring to the common deflection (par. 73f(1)), then adjust the azimuth micrometer to zero (par. 73f(4)). The elbow telescope may be moved rapidly in azi-

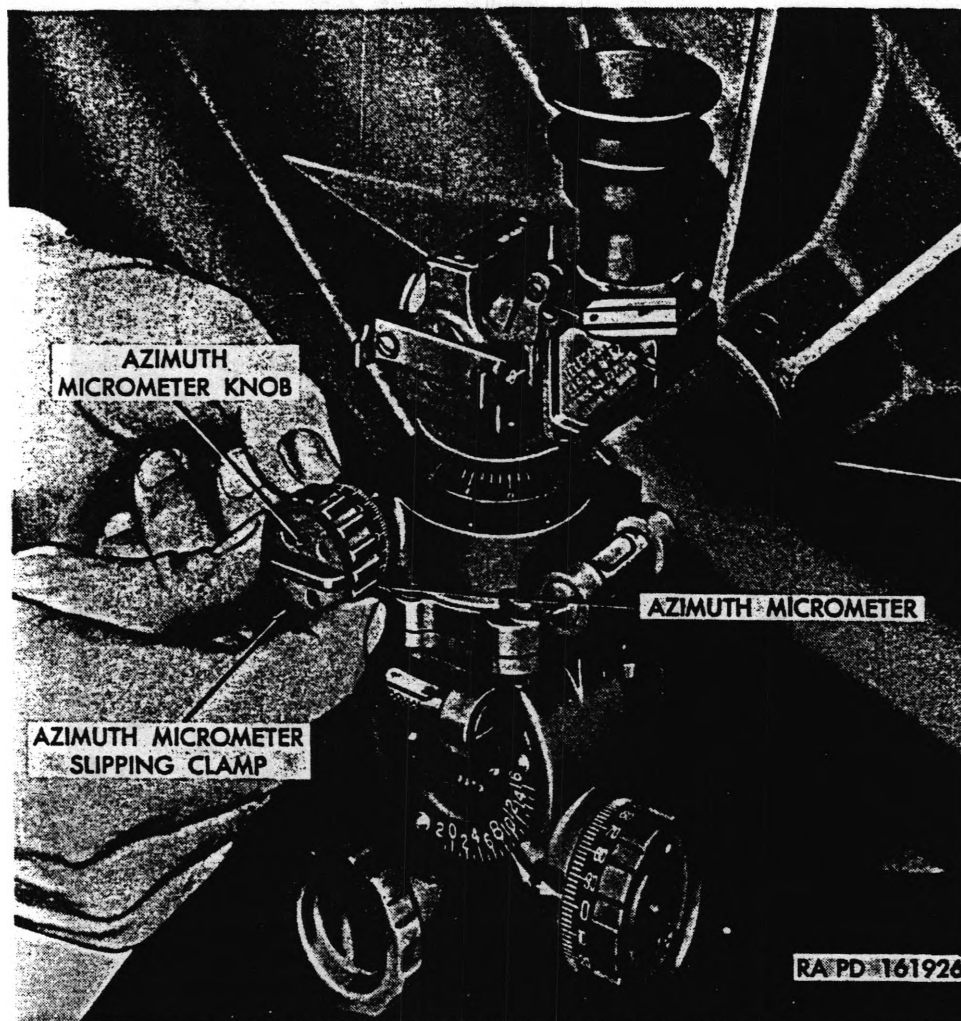


Figure 61. Setting azimuth micrometer to zero.

imuth by pushing forward on the azimuth micrometer knob and rotating the telescope adapter by hand (fig. 63). Release the knob to engage the worm and worm gear.

d. Loosen the wing nut (fig. 50), elevate or depress the elbow telescope, and traverse the launcher until the image of the target or aiming point is superimposed on the cross formed by the intersection of the lines of the reticle. Tighten the wing nut.

e. Turn the elevation micrometer knob and set the required elevation angle on the elevation scale and micrometer (fig. 51). Operate the elevating mechanism to elevate the rocket launcher to center the bubble in the level vial of the longitudinal level assembly.

f. If night operation is required, turn the rheostat knob (fig. 49) on the instrument light until the reticle pattern is seen clearly

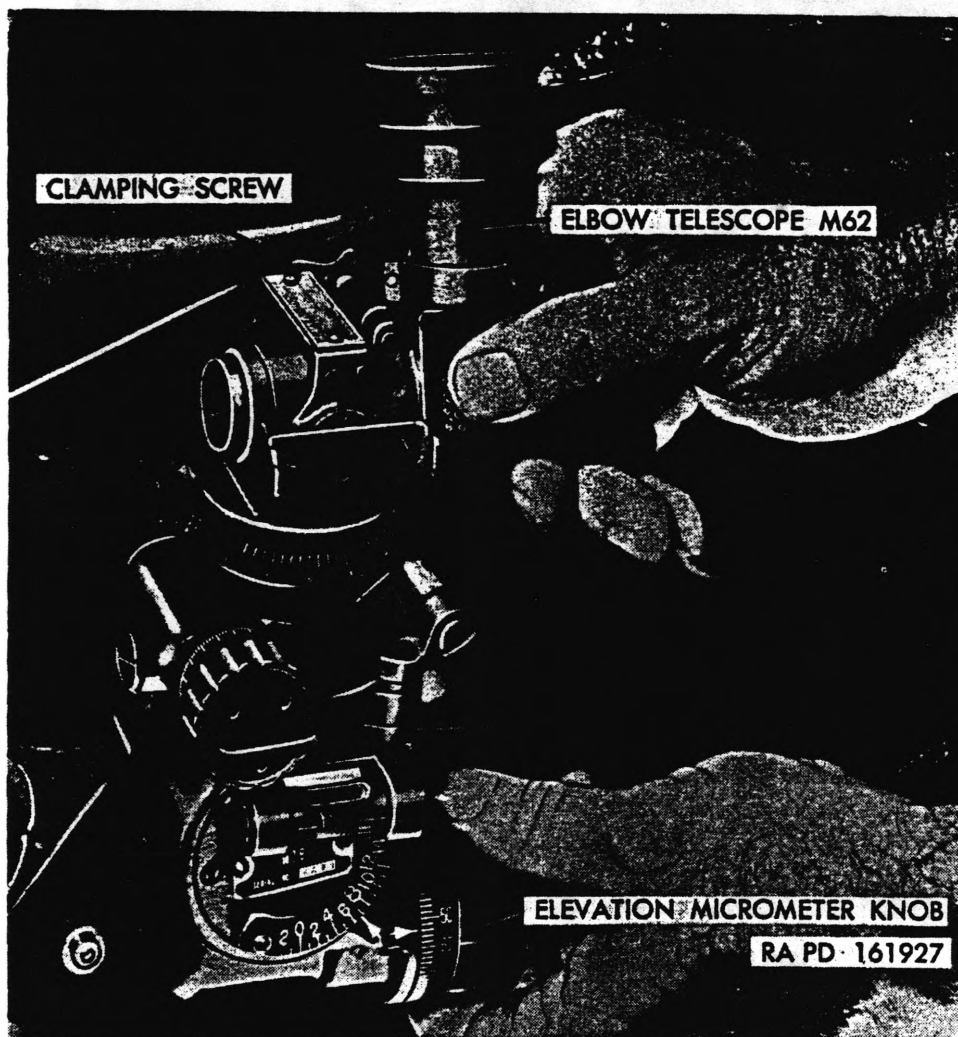


Figure 62. Plumbing reticle of elbow telescope M62.

through the eyepiece. Use the hand light to illuminate the levels, scales, and micrometers. Turn the rheostat knob counterclockwise to turn off the lamps.

g. If the aiming point is to the right of the launcher, it will be necessary to remove the sight mount and sighting equipment from the sight mount pin on the trunnion and place it on the sight mount pin mounted on the rocket cluster (fig. 48). Loosen the sight mount clamp screw, pull off the sight mount and place it on the cluster sight mount pin. Tighten the clamp screw.

h. The sighting equipment must be removed from the rocket launcher before firing. Remove the instrument light lamp bracket from the band assembly (fig. 56). Coil and stow the lead wires in the control box. Press outward on the latch and lift the sighting equipment out of the sight mount socket (fig. 53).



Figure 63. Disengaging worm from worm gear for rapid orientation of elbow telescope.

75. Maintenance

a. GENERAL. Intervals for servicing sighting and fire control equipment will be found in the preventive maintenance schedule (par. 50). The maintenance prescribed below is preventive in nature.

b. CARE IN HANDLING SIGHTING AND FIRE CONTROL INSTRUMENTS.

- (1) Sighting and fire control instruments are, in general, rugged and suited for the designed purposes. They will not, however, stand rough handling or abuse. Inaccuracy or malfunctioning will result from mistreatment.
- (2) Unnecessary turning of screws, or other parts not incident to the use of the instruments, is forbidden.
- (3) Stops are provided on instruments to limit the travel of the moving parts. Do not attempt to force the rotation of any knob beyond the stop limit.

- (4) Keep the instruments as clean and dry as possible. If an instrument is wet, dry it carefully before placing it in its carrying case.
- (5) When not in use, keep the instruments in the launcher control box or covered and protected from dust and moisture.
- (6) Any instruments which indicate incorrectly or fail to function properly, after the authorized tests and adjustments have been made, are to be turned in for repair by ordnance personnel. The authorized tests and adjustments are those for which tools and parts have been provided. Adjustments other than those expressly authorized are not the responsibility of organizational personnel (see par. 2).
- (7) No painting of sighting and fire control equipment by organizational personnel is permitted.
- (8) Do not point any optical instrument directly at the sun unless a filter is used to prevent possible damage to optical elements.
- (9) Leveling and clamping screws must not be tightened beyond a snug contact. Excessive wear of threads and other damage to the instruments are thereby eliminated.

c. OPTICAL PARTS.

- (1) To obtain satisfactory vision, it is necessary that the exposed surfaces of the lenses and other parts be kept clean and dry. Corrosion and etching of the surfaces of the glass, which interfere with vision, can be prevented or greatly retarded by keeping the glass clean and dry.
- (2) Under no circumstances should polishing liquids, pastes, or abrasives be used for polishing lenses and windows.
- (3) For wiping optical parts, use only lens tissue paper, especially intended for cleaning optical glass. Use of cleaning cloths in the field is not permitted. To remove dust, brush the glass lightly with a clean artists's camel's-hair brush, and rap the brush against a hard body in order to knock out the small particles of dust that cling to the hairs. Repeat this operation until all dust is removed.
- (4) Exercise particular care to keep optical parts free from oil and grease. Do not wipe lenses or windows with the fingers. To remove oil or grease from optical surfaces, apply liquid lens cleaning soap with a tuft of lens tissue

paper, and wipe gently with clean lens tissue paper. If liquid soap is not available, and if the surrounding temperature is above 32° F., breathe heavily on the glass and wipe off with clean lens tissue paper. Repeat this operation until clean.

(5) Below freezing temperature, clean optics by rubbing gently with dry lens tissue paper. To remove oil film, take the instrument into a warm enclosure and allow it to reach room temperature before applying liquid lens cleaning soap.

(6) Moisture may condense on the optical parts of the instrument when the temperature of the parts is lower than that of the surrounding air. This moisture, if not excessive can be removed by placing the instrument in a warm place. Heat from strongly concentrated sources should not be applied directly, as it may cause unequal expansion of parts, thereby resulting in damage to optical parts and inaccuracies of functioning.

d. BATTERIES.

(1) Batteries will not be packed, stored, or shipped in equipment in which they are used; the batteries are not part of the equipment but are used with it. Batteries used in the instrument light M42 should be removed whenever the light is not in use. Chemical reactions set up in an exhausted battery will damage the tube. Signal Corps batteries BA-130 (3A130) are used with this equipment.

(2) The batteries in the instrument lights are replaced as follows: Turn the cap on the end of the body tube to disengage the two bayonet slots in the tube, and pull off the cap. Remove the two batteries. When replacing the batteries in the body tube, be sure they go back in the same position as when removed. See that the pins in the cap engage the bayonet slots in the body to assure a tight contact with battery terminals.

e. ELECTRIC LAMP REPLACEMENT IN INSTRUMENT LIGHT M42.

(1) Hold the body of the lead wire and screw off the lamp bracket (fig. 49). Screw the 3-volt electric lamp out of its socket. Install a new lamp and replace the lamp bracket.

(2) Hold the body of the hand light (fig. 49) and screw off the cap. Screw the 3-volt electric lamp out of its socket. Install a new lamp and replace the cap.

f. LUBRICATION.

- (1) Lubricants for sighting and fire control instruments function also as rust-preventives. It is important that they be applied carefully and effectively. Extreme care should be taken not to apply lubricants excessively. Excessive lubrication of certain parts may be as damaging as the absence of any lubricant.
- (2) Excessive lubricants should be wiped off to prevent the accumulation of dust and dirt.
- (3) Monthly apply a thin film of aircraft and instrument lubricating grease to the dovetail bracket of the housing of telescope mount M79 and the dovetail socket on the launcher sight mount.

g. EYEPiece. Monthly remove the eyeshield (fig. 64) and wash it in mild soap and water, dry and dust with talc. After cleaning the optical system, install the eyeshield.

76. Preparation for Traveling

a. Remove the instrument light from its support in the launcher control box and remove the batteries (par. 75d). Place the bat-

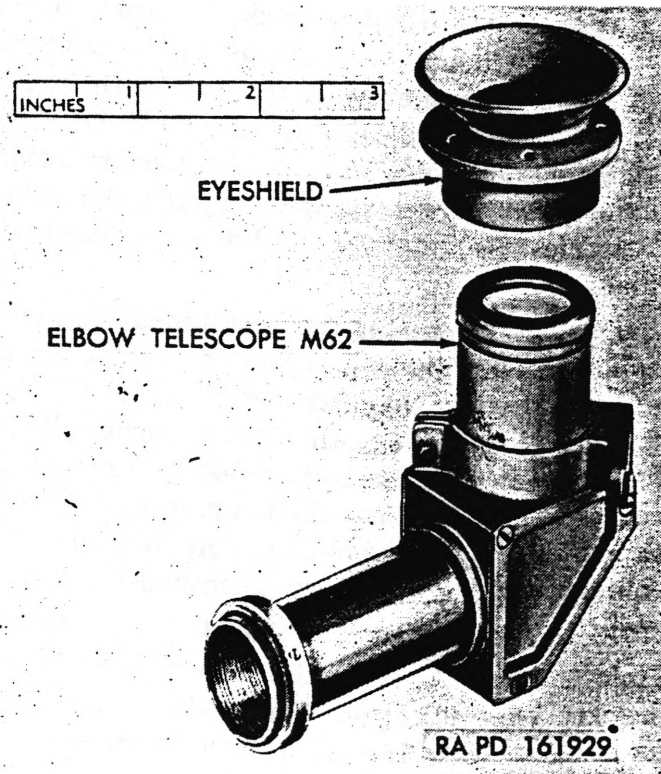


Figure 64. Installing eyeshield on elbow telescope M62.

teries in the control box. Remove the lamp bracket (fig. 49) from the band assembly on the elbow telescope, coil the lead wires, and place the instrument light in its support in the launcher control box (fig. 8).

b. Remove the telescope mount M79, telescope adapter M9E4, and the elbow telescope M62 as a unit and stow it in the launcher control box (fig. 52) as follows:

- (1) Press outward on the latch (fig. 53) to disengage the telescope mount from the sight mount dovetail socket.
- (2) Slide the dovetail bracket of the telescope mount out of the dovetail socket on the sight mount.
- (3) Turn the azimuth micrometer knob to set the telescope at zero. Turn the elevation micrometer knob to index a zero on the elevation scale. Loosen the elbow telescope clamping screw.
- (4) Attach the telescope mount to the mounting block in the rocket launcher control box by inserting the dovetail bracket into the dovetail socket of the mounting block. Press the telescope mount in firmly with the latch pressed outward, until it is securely seated in the mounting block socket and the latch is engaged (fig. 52).

Section II. AMMUNITION

77. General

Ammunition for the 4.5-inch multiple rocket launcher T123 is of spin-stabilized type and is issued in the form of unfuzed complete rounds of fixed ammunition (fig. 65). The term "fixed," used in conjunction with ammunition, signifies that the propelling charge is fixed (not adjustable) and that the round is loaded into the launcher as a unit. The complete round consists of a rocket head, a fuze, and a rocket motor which contains the propellant and its igniter. A nozzle plate is threaded to the base end of the motor. It is propelled by reaction to a jet of gas produced within the rocket motor and ejected through eight nozzles in the base. The nozzles are inclined at an angle to the axis of the rocket.

78. Firing Tables

Firing data for the 4.5-inch multiple rocket launcher T123 are published in FTR 4.5-D-3 and changes thereto. An index of firing tables is maintained in SR 310-20-3.

79. Classification

Ammunition for this multiple rocket launcher consists of the following types which are classified according to the rocket head as high-explosive (HE), practice, and drill. The same motor is used for all types except that the motor for the drill rocket is inert.

a. The head of the high-explosive rocket is comparatively thin-walled and contains a high-explosive bursting charge. It is intended principally for fragmentation or blast effect.

b. The head of the practice rocket, which is used for training purposes, is completely inert. It is of the same size, shape, and weight as the high-explosive head. A dummy fuze is assembled to the head.

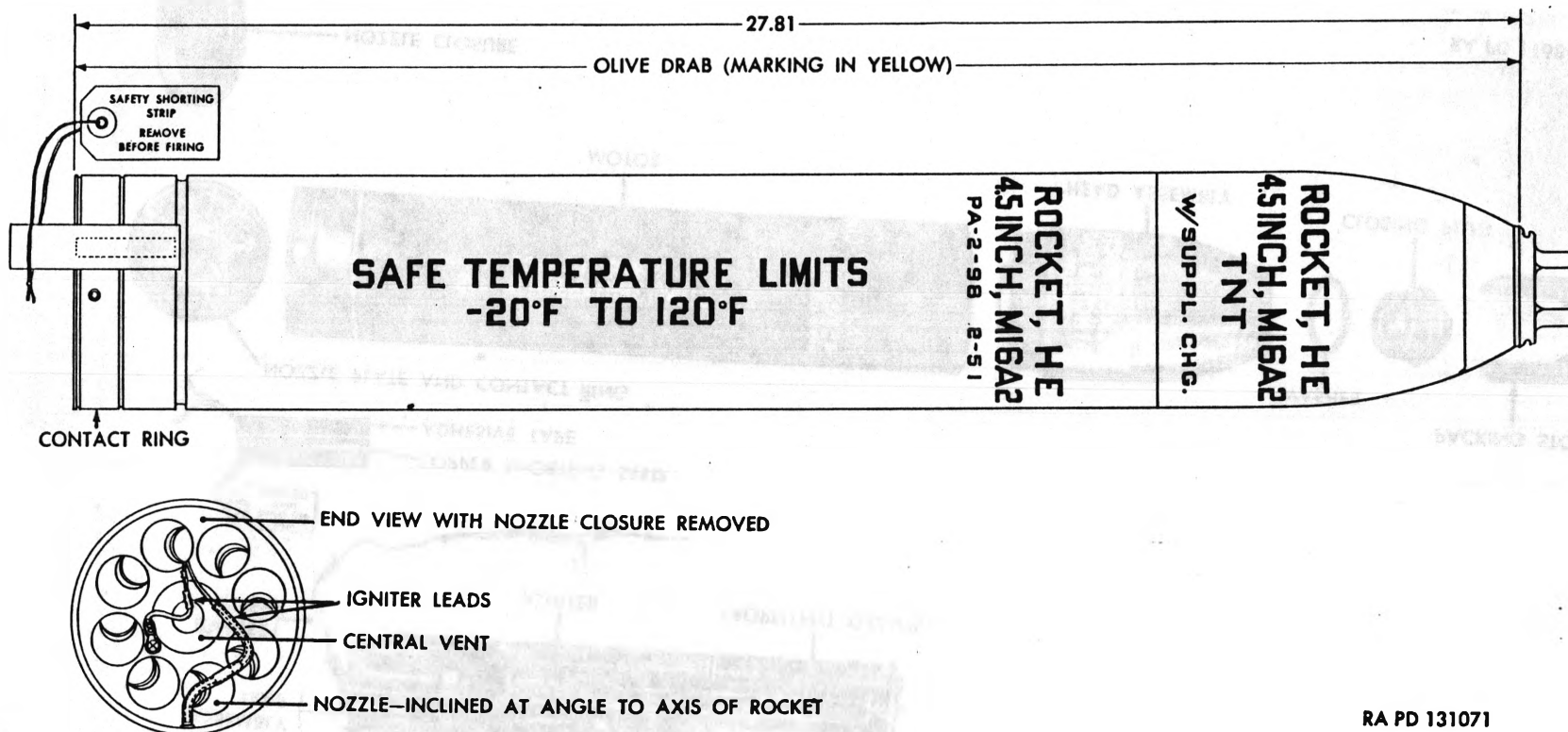
c. The head of the drill rocket consists of an empty service rocket head filled with an inert material. A dummy fuze is assembled to the head.

80. Identification

a. GENERAL. Ammunition and ammunition components are completely identified by the painting and marking (including an ammunition lot number) on the ammunition items and on all original packing containers. Refer to figures 65 and 66.

b. MODEL. To identify a particular design, a model designation is assigned at the time the item is classified as an adopted type. This model designation becomes an essential part of the standard nomenclature and is included in the marking on the item. The present system of model designation for a standard item consists of the letter "M" followed by an Arabic numeral, for example, "M1." Modifications are indicated by adding the letter "A" and the appropriate Arabic numeral. Thus, M16A2 indicates the second modification of an item for which the original model designation was "M16." Similarly, a system applied to development items involves the use of a "T" designation to indicate the basic design and an "E" to indicate modifications thereof. Thus, T38E2 would indicate the second modification of a development item originally designated T38.

c. AMMUNITION LOT NUMBER. When ammunition is manufactured, an ammunition lot number, which becomes an essential part of the marking, is assigned in accordance with pertinent specifications. This lot number is stamped or marked on every loaded complete round and on all packing containers. It is required for all purposes of record, including reports on condition, functioning, or accidents in which the ammunition may be in-



RA PD 131071

Figure 65. Rocket, HE, 4.5-inch, M16A2.

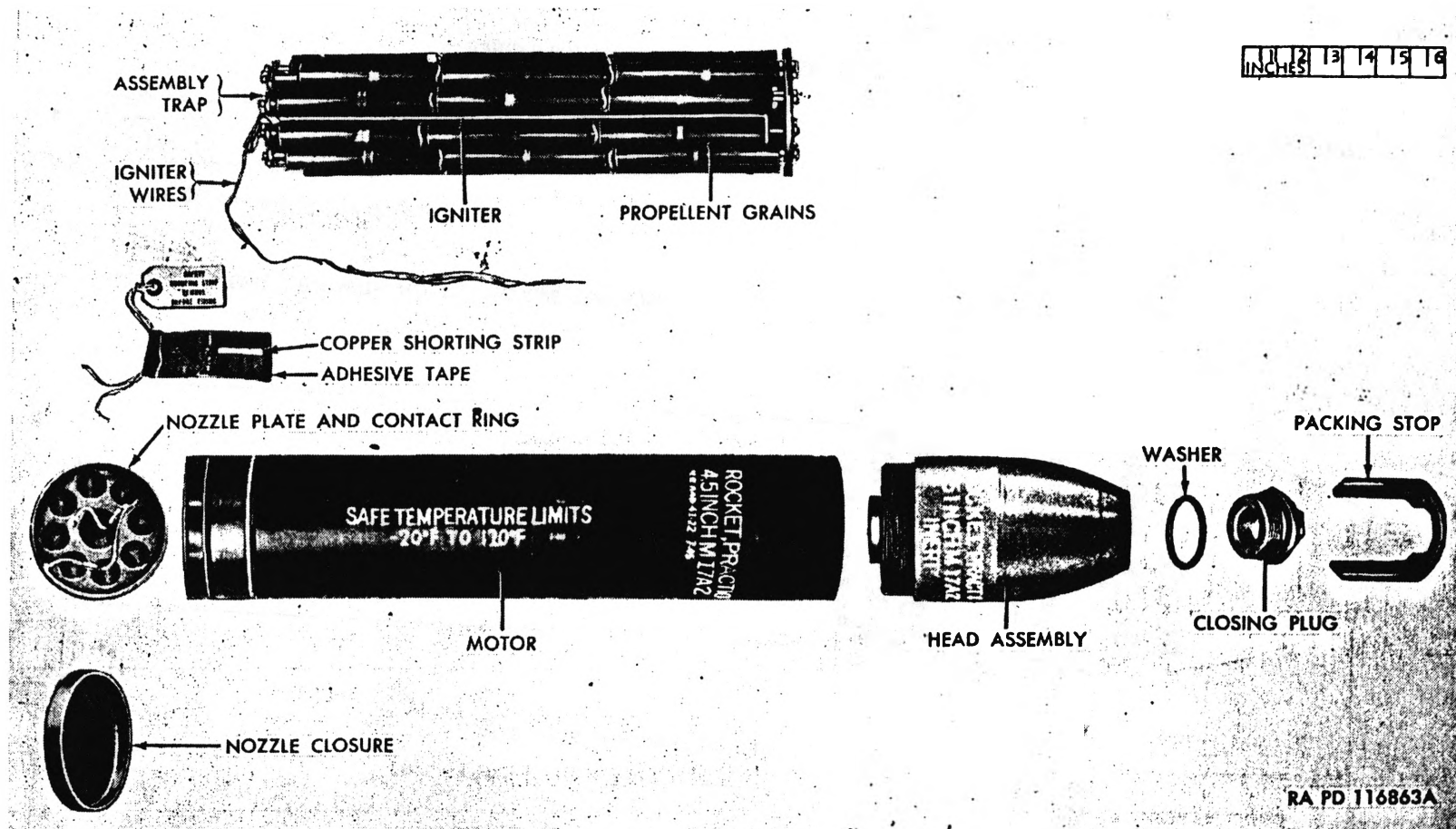


Figure 66. Rocket, practice, 4.5-inch, M17A2—partially disassembled view.

involved. In any one lot of ammunition, the components used in the assembly are manufactured under as nearly identical conditions as practicable. To obtain the greatest accuracy when firing, successive rounds should consist of one ammunition lot whenever practicable.

d. PAINTING. Rocket ammunition is painted primarily to prevent rust and to provide, by the color, a ready means of identification as to type. Lusterless paint is used to meet requirements for camouflage. The color scheme is as follows:

ROCKET HEAD:

HE _____ Olive drab, marking in yellow.
Practice _____ Blue, marking in white.
Drill (dummy) _____ Black, marking in white.

MOTOR:

HE _____ Olive drab.
Practice _____ Olive drab.
Drill _____ Black, marking in white.

e. MARKING. Standard markings are stenciled on the rocket in the appropriate color in accordance with the color scheme described in d above. These markings include the following:

- (1) *On the rocket head (stenciled unless otherwise indicated).*

Type, size, and model of rocket.

The metal parts lot number and date (month and year) of manufacture of the head assembly is stamped in the metal on the base of the head. The letter "H" is stamped on the ogive to indicate that the rocket head passed has the prescribed hydrostatic pressure test.

- (2) *On the fuze (stamped in the metal).*

Fuze nomenclature.

Loader's lot number and date (month and year) loaded.

- (3) *On the motor (stenciled unless otherwise indicated).*

Type, size, and model of rocket.

Metal parts lot number and date (month and year) of manufacture.

Ammunition lot number which consists of the loader's initials or symbol and the loader's lot number and the date (month and year) of loading.

Temperature limitations within which it is safe to fire the rocket.

The letter "H" is stamped on the base of the motor body to indicate that the rocket motor body has passed the prescribed hydrostatic pressure test.

81. Care, Handling, and Preservation

Warning: Explosive ammunition and components containing explosives must be handled with appropriate care at all times. The explosive elements in igniters and fuzes are particularly sensitive to undue shock and high temperature. Boxes containing ammunition should not be dropped, thrown, tumbled, or dragged.

a. Ammunition is packed to withstand conditions ordinarily encountered in the field. Care must be observed to keep packings from becoming broken or damaged. All broken packings must be repaired immediately and careful attention given to the transfer of all marking to the new parts.

b. When it is necessary to leave ammunition in the open, raise it on dunnage at least 6 inches from the ground and cover it with a double thickness of paulin, leaving enough space for the circulation of air. Where practicable, dunnage strips should be placed under each layer of boxes and other ammunition components. Suitable trenches should be dug to prevent water from running under the pile.

c. Since explosives, especially rocket propellants, are adversely affected by moisture and high temperature, due consideration should be given to the following:

- (1) Do not break the moisture-resistant seals until ammunition is to be used. Ammunition removed from airtight containers, particularly in damp climates, it is apt to corrode, thereby rendering the ammunition unserviceable.
- (2) Protect ammunition, particularly fuzes, from high temperature and direct rays of the sun. Rockets should never be stored where the temperature may exceed 120° F. Rockets should not be exposed to extreme, rapid, and recurrent variations in temperature which exceed the temperature limits prescribed for them (—20° to 120° F.)
- (3) *Do not attempt to disassemble any rocket or fuze.* Do not remove safety devices from rocket until just before use.
- (4) Rockets should be free of foreign matter, sand, mud, moisture, frost, snow, ice, or grease. If rounds become dirty or wet, they should be wiped off at once with a clean, dry, wiping cloth.
- (5) Double base rocket propellants are sensitive and on strong initiation may detonate rather than burn. If the

head detonates, the motor will usually detonate. Therefore, the weight of the propellant powder must be considered as high-explosive for storage and handling purposes.

- (6) In handling and storage, complete rounds should at all times be kept pointed in that direction which would result in the least damage should the propellant be accidentally ignited.
- (7) Rockets, components of which are issued separately, should not be assembled in advance of anticipated requirements. Rockets prepared for firing but not fired will be returned to their original condition and packings and will be appropriately marked. Such ammunition will be used first in subsequent firings in order that stocks of opened packages may be kept at a minimum. Rockets should be kept out of the back blast.
- (8) Do not handle duds. Because their fuzes may be armed, duds are extremely dangerous. They will not be moved or touched but will be destroyed in place in accordance with TM 9-1900.
- (9) The following information pertains to the storage and handling of VT fuzes:
 - (a) In addition to the usual care in handling explosive ammunition, VT fuzes and VT-fuzed rounds should be protected from long exposure to high humidity, temperatures below -20° and above 130° F, and excessive jolting and shocks, which may result in improper fuze action.
 - (b) In temperate climates, the fuzes may be expected to remain serviceable for 2 months after removal from their original sealed containers. The fuzes should not be removed from their original sealed containers, particularly in tropical climates, until just before use. Exposure to rain or immersion in water will result in accelerated deterioration.
 - (c) VT fuzes will withstand normal handling without danger of detonation or damage when in their original packing containers or when assembled to projectiles. However, care should be taken not to strike or drop fuzes or fuzed rounds as these actions may increase the number of duds. A drop of 4 feet may cause the electrolyte vial in the fuze battery to break thus creating

a dud. Excessive rough handling will not decrease fuze safety but may increase the number of duds.

- (d) Supplementary charges which have been removed from shell, prior to assembling VT fuzes, will be packed in the containers from which the VT fuzes have been removed. The containers should be properly marked and returned to ordnance personnel for disposition.
- (e) VT-fuzed ammunition may be safely transported short distances with normal care and handling. However, when such ammunition is to be transported considerable distances, it is advisable to remove the fuze from the shell and return the fuze to its original marked container. The supplementary charge and original fuze or closing plug (with gasket and spacer) should be reassembled to the shell, making certain that the supplementary charge is properly inserted (felt-pad end innermost).
- (f) If rounds on which fuzes have been changed are returned to their original packing, care must be taken to change markings on the containers and boxes to show the fuze actually on the shell.
- (g) Rounds fuzed with VT fuzes must be adequately padded if temporarily placed in fiber containers.
- (h) VT fuzes of certain lots, as issued, have a wax coating on the plastic ogive. This wax coating is necessary for the proper functioning of the fuzes of such lots. Removal of this coating will usually result in malfunctioning of the fuze. VT fuzes should be used as issued; that is, with the wax coating on the plastic ogive if so issued, or without a wax coating if issued without the coating.
- (i) In view of the security classification of VT fuzes, special precautions will be observed in connection with their storage and use to prevent any possible breach of security.

82. Authorized Rounds

The ammunition authorized for use in the 4.5-inch multiple rocket launcher T123 is listed in table V. Standard nomenclature, which is used in the listing, completely identifies the ammunition except for ammunition lot number.

Table V. Authorized Rounds

STANDARD NOMENCLATURE OF COMPLETE ROUND	COMPLETE ROUND		ROCKET HEAD			ROCKET MOTOR			FUZE		SPECIAL- PURPOSE FUZE
	Length unfuzed (in)	Weight fuzed (lb)	Type of filler	Kind of filler	Weight of filler	Model of igniter	Model of propellent	Weight of propellent (lb)	Model of fuze	Action	
SERVICE AMMUNITION											
ROCKET, HE, 4.5-in, M16 (T38E3).	29.05 ¹	42.5	HE	TNT	5.1	M18	M13 (T1)	4.75	M81	SQ or 0.05 sec delay	
ROCKET, HE, 4.5-in, M16A1 (M16E5).	28.98 ¹	42.5	HE	TNT	3.7 ²	M18	M13 (T1)	4.81	M81	SQ or 0.05 sec delay	VT M402
ROCKET, HE, 4.5-in, M16E1 (T38E2).	28.98 ¹	42.5	HE	TNT	3.7 ²	M18	M13 (T1)	4.75	M81	SQ or 0.05 sec delay	VT M402
ROCKET, HE, 4.5-in, M16E1 (T38E8), w/ supplementary charge.	28.98 ¹	42.5	HE	TNT	3.7 ²	M18	M13 (T1)	4.75	M81	SQ or 0.05 sec delay	VT M402
ROCKET, HE, 4.5-in, M16A2 (M16E4), w/ supplementary charge.	28.98 ¹	42.5	HE	TNT	3.7 ²	M18	M13 (T1)	4.81	M81	SQ or 0.05 sec delay	VT M402
ROCKET, HE, 4.5-in, T160E2, w/supple- mentary charge.	30.0 ¹	43.0	HE	TNT	6.05 ²	T14E1	T6	7.6	M81	SQ or 0.05 sec delay	VT M402

HE—high-explosive in—inch lb—pound

¹Length of round with closing plug.²Weight does not include supplementary charge of TNT; weight of supplementary charge 0.33 pound.

Table V. Authorized Rounds

STANDARD NOMENCLATURE OF COMPLETE ROUND	COMPLETE ROUND		ROCKET HEAD			ROCKET MOTOR			FUZE		SPECIAL- PURPOSE FUZE
	Length unfuzed (in)	Weight fuzed (lb)	Type of filler	Kind of filler	Weight of filler	Model of igniter	Model of propellent	Weight of propellent (lb)	Model of fuze	Action	
PRACTICE AMMUNITION											
ROCKET, practice, 4.5-in, M17 (T39E3).	29.05 ¹	42.5	inert	3	5.1	M18	M13 (T1)	4.75	M73	inert	
ROCKET, practice, 4.5-in, M17A1 (T17E5).	28.98 ¹	42.5	inert	3	3.7	M18	M13 (T1)	4.81	M73	inert	
ROCKET, practice, 4.5-in, M17E1 (T39E2).	28.98 ¹	42.5	inert	3	3.7	M18	M13 (T1)	4.75	M73	inert	
ROCKET, practice, 4.5-in, M17E1 (T39E8).	28.98 ¹	42.5	inert	3	3.7	M18	M13 (T1)	4.75	M73	inert	
ROCKET, practice, 4.5-in, M17A2 (T17E4).	28.98 ¹	42.5	inert	3	3.7	M18	M13 (T1)	4.81	M73	inert	
ROCKET, practice, 4.5-in, T161E2.	30.1	43.0	inert	3	6.05	T6	T6	7.6	M73	inert	
DRILL AMMUNITION											
ROCKET, drill, 4.5-in, M24.	31.44	42.5	inert	3	5.1	None	-----	-----	M73	inert	

¹Length of round with closing plug.³Practice heads are filled with an inert material.⁴Length of round with M73 dummy fuze.

a. ROCKET HEADS.

- (1) The heads of the high-explosive rockets (M16 series) and practice rockets (M17 series) have the same contour (figs. 65 and 66). The heads of the HE rocket T160E2 and the practice rocket T161E2 are longer than the heads of the M16 and M17 series of rockets and contain more filler. Earlier HE models of the M16 series of rockets have a burster tube which extends into the center of the motor where it is surrounded by the grains of the propellant charge. Later models do not have the burster tube; the bottom of the head is plugged or made solid in the process of manufacture. The deep fuze well (deep-cavity) in the nose of the HE rocket heads of later manufacture is designed for assembly with artillery-type PD fuzes or proximity (VT) fuzes (fig. 67).
- (2) The practice heads of the M17 series rockets are of the same size, shape, and weight as the corresponding models of the M16 series rocket heads but are inert loaded.
- (3) The drill head is made up of metal parts of the M16 rocket head, the head being filled with inert material. The head is used in the M24 drill rocket which is provided for training in handling and firing operations.

b. MOTOR ASSEMBLY.

- (1) *Description.* The rocket motor assembly (partially disassembled view shown in fig. 66), consists of the propellant and igniter housed in a cylindrical steel tube. The tube is threaded at the rear end for assembly of the nozzle plate and at the other end for assembly to the head. The nozzle plate is a thick steel plug containing eight nozzles near the outer edge and a central vent which is normally closed by a safety blow-out plug. The nozzles are inclined at an angle to the axis of the rocket to impart rotation as well as driving thrust. The safety blow-out plug in the central vent is designed to blow out should the motor pressure exceed the safe limit. A contact ring assembly with its shorting strip is secured to the rear of the nozzle plate. The contact ring assembly, which encircles the nozzle plate, consists of three concentric rings: a steel support ring, a plastic insulating ring, and a steel contact ring. The support ring, which is innermost, has a diameter of 4.49 inches. The contact ring is mounted on, but insulated from, the support ring by means of the plastic insulating ring. A plastic closing disk (closure),

cemented to the contact ring assembly, seals the motor against moisture.

(2) *Propellant.* The M13 (T1) propelling charge consists of 30 sticks of double-base powder. Each grain is approximately $5\frac{1}{4}$ inches long and $\frac{7}{8}$ inch in diameter. The propelling charge is mounted on the wires of a cagelike support. This consists of 10 wires attached to a trap (base) ring and a trap plate which is slotted to receive the forward ends of the wires. The trap plate rests on a seat formed by a shoulder in the forward end of the motor body. Since the rate of burning increases with the initial temperature, it is important not to fire rockets at temperatures beyond the limits marked on each rocket. Firing at temperatures below the minimum (-20° F) will give erratic ranges and excessive back blast of powder particles; firing at temperatures above the maximum ($+120^{\circ}$ F) will cause dangerous pressures to build up within the motor. The propellant is ignited by the igniter ((3) below).

(3) *Igniter.* The igniter consists of a charge of black powder and an electric squib assembled in a long flat plastic tube. The igniter is suspended parallel and adjacent to the propellant sticks. The front end of the igniter is hung from the trap wire by means of an anchor; the rear end of the igniter is supported by means of the squib leads which pass through a hole in the trap ring. One squib lead is crimped to the nozzle plate by means of a copper rivet; the other lead passes through but is insulated from the support ring and is soldered to the contact ring. The contact ring lead is insulated from the nozzle plate by means of a short length of insulating elastic tubing assembled over the lead wire.

83. Preparation for Firing

a. HE ROCKET WITH NORMAL-CAVITY FOR FIRING PD FUZE. After removal from packing materials, rounds are prepared for firing as follows:

(1) Examine the rocket to see that the plastic closing disk is in place. If the disk is loose, it may be replaced and the rocket fired if it can be ascertained that no moisture or foreign material has entered the motor.

(2) Place the rocket to be refuzed on its side.

- (3) The set screw in the adapter, when present, must be loosened by means of a screwdriver which fully fits the screw slot.
- (4) Unscrew the nose plug from the rocket head using an appropriate fuze wrench or other suitable wrench.
- (5) Examine the fuze threads and cavity in the rocket head.
- (6) Remove the PD fuze M81A1 or M81 from its packings and examine the fuze threads to insure that they are in good condition. Do not use components with damaged threads.
- (7) Screw in the fuze by hand. If binding occurs, inspect the fuze cavity and threads of both rocket head and fuze. Reject whichever is at fault.
- (8) Tighten the fuze securely to the shell using fuze wrench M7A1 or M18. Make sure the shoulder seats firmly against the nose of the rocket head. Do not stake the fuze to the shell. Tighten firmly the set screw in the adapter, if one is present.
- (9) To set the PD fuze M81A1 or M81 for the required action, refer to paragraph 84d.
- (10) Remove the shorting strip from the contact ring when loading the rocket into the launcher.
- (11) If not fired, the round and the fuze should be returned to their original condition and packings.

b. HE ROCKET WITH DEEP-CAVITY FOR FIRING PD FUZE. After removal from packing materials, rounds are prepared for firing as follows:

- (1) Perform the operations as indicated in a(1), (2), (3), (4), and (5) above.
- (2) Examine for presence of supplementary charge. If none is present, properly insert the charge (felt-pad end innermost and lifting cloth tape loop outermost).
- (3) Proceed as in a(6), (7), (8), (9), (10), and (11) above.

c. HE ROCKET WITH DEEP-CAVITY FOR FIRING VT FUZES. After removal from packing materials, rounds are prepared for firing as follows:

- (1) Perform the operations as indicated in a(1), (2), (3), (4), and (5) above.
- (2) Remove the VT fuze from its packings and examine the fuze threads to insure that they are in good condition. Do not use components with damaged threads.
- (3) Remove the supplementary charge, if one is present, by means of its cloth tape loop.

(4) Screw in the VT fuze by hand. If binding occurs, inspect the fuze cavity and threads of both rocket head and fuze. Reject whichever is at fault.

(5) Tighten the fuze to the head using special fuze wrench M18 issued with boxes of VT fuzes. Use only such force as can be applied by hand to the fuze wrench handle. If the fuze cannot be tightened to form a good seat between the shell and fuze, reject the component at fault. *Do not use a hammer or an extension handle on the fuze wrench. Do not attempt to stake the fuze to the shell under any circumstances.* If not fired, the round and the fuze should be returned to their original condition and packings.

d. PRACTICE ROCKETS FOR FIRING WITH DUMMY FUZE M73. Practice rounds are prepared for firing in the same manner as HE rounds (as indicated in a above) except that the dummy fuze M73 is used with the practice rocket.

84. Fuzes

a. GENERAL. A fuze is a device used with a projectile to explode it at the time and under the circumstances required. The fuzes used with ammunition for this rocket launcher are assembled to the rounds as issued.

b. CLASSIFICATION. Fuzes are classified according to their manner of functioning as "time and impact," or "time," or "impact." Impact fuzes function upon striking a resistant object. They are classified according to the time of functioning after impact, as superquick, nondelay, or delay. Point detonating (PD) and base detonating (BD) fuzes, which are impact fuzes, are so called because of their location on a projectile. Time fuzes are designed to function primarily while the projectile is still in flight. Certain time fuzes are also provided with an impact element. Such time or airburst fuzes are also provided with an impact element and are of three types; mechanical time, powder train time, and VT. Powder train time fuzes differ essentially from mechanical time fuzes in that the former uses a compressed black powder time train to delay functioning for a pre-set length of time whereas the mechanical time fuze uses a clockwork mechanism to achieve the same result. VT fuzes are radio-actuated point fuzes which function on approach to the target.

c. BORES SAFE AND NONBORESAFE. A boresafe (detonator-safe) fuze is one in which the explosive train is so interrupted that, while the rocket is still in the bore of the launcher, premature

action of the bursting charge is prevented should any of the more sensitive elements (primer or detonator) function. The fuzes used with the ammunition described herein are considered bore-safe.

Caution: Fuzes will not be disassembled. Any attempt to disassemble fuzes in the field is dangerous and is prohibited except under specific directions from the Chief of Ordnance.

d. FUZE, PD, M81A1, 0.05-SECOND DELAY.

- (1) *Description.* This fuze is an impact type of artillery fuze which may be adjusted prior to firing to function with superquick action or with a delay action of 0.05 second. The delay is marked on the fuze. It should be noted that if the fuze is set for superquick action, and this action fails, the projectile will be detonated with delay action rather than become a dud. The PD M81A1 fuze consists of the PD fuze M48A3 fitted with the booster M24, which is a component of the fuze, and is assembled at the time of manufacture. As shipped, the fuze is set for superquick action; that is, the slot in the head of the setting sleeve is parallel to the vertical axis of the fuze and is aligned with the index mark for superquick ("SQ") action as shown in figure 67. Dependent upon the source of components, the earlier model of fuze which is now limited standard, may be marked M81 or M48A2. The fuze PD M48A2 with booster M21A1 may be used as a substitute for these fuzes. For precautions in firing this fuze, refer to paragraph 85.
- (2) *Setting.* To set the fuze for delay action, it is only necessary to turn the slot 90 degrees to align with the index mark for delay ("DELAY") action. The setting may be changed at will (with the screwdriver end of fuze wrench M7A1 or M18 or a similar tool) at any time before firing; this can be done even in the dark by feeling the position of the slot.

e. FUZE, ROCKET, VT, M402. This fuze (fig. 67) is a proximity fuze and is provided for ground-to-ground use in the 4.5-inch HE rockets M16A2, M16E1 (T38E2 and T38E8), M16A1, and T160E2. It is essentially a self-powered radio transmitting and receiving unit. In flight, the armed fuze transmits radio waves. When any part of the radio wave front is reflected back from the target, it interacts with the transmitted wave. The ripple or beat caused by this interaction trips a switch which closes an electric circuit and initiates detonation of the fuze explosive train, which

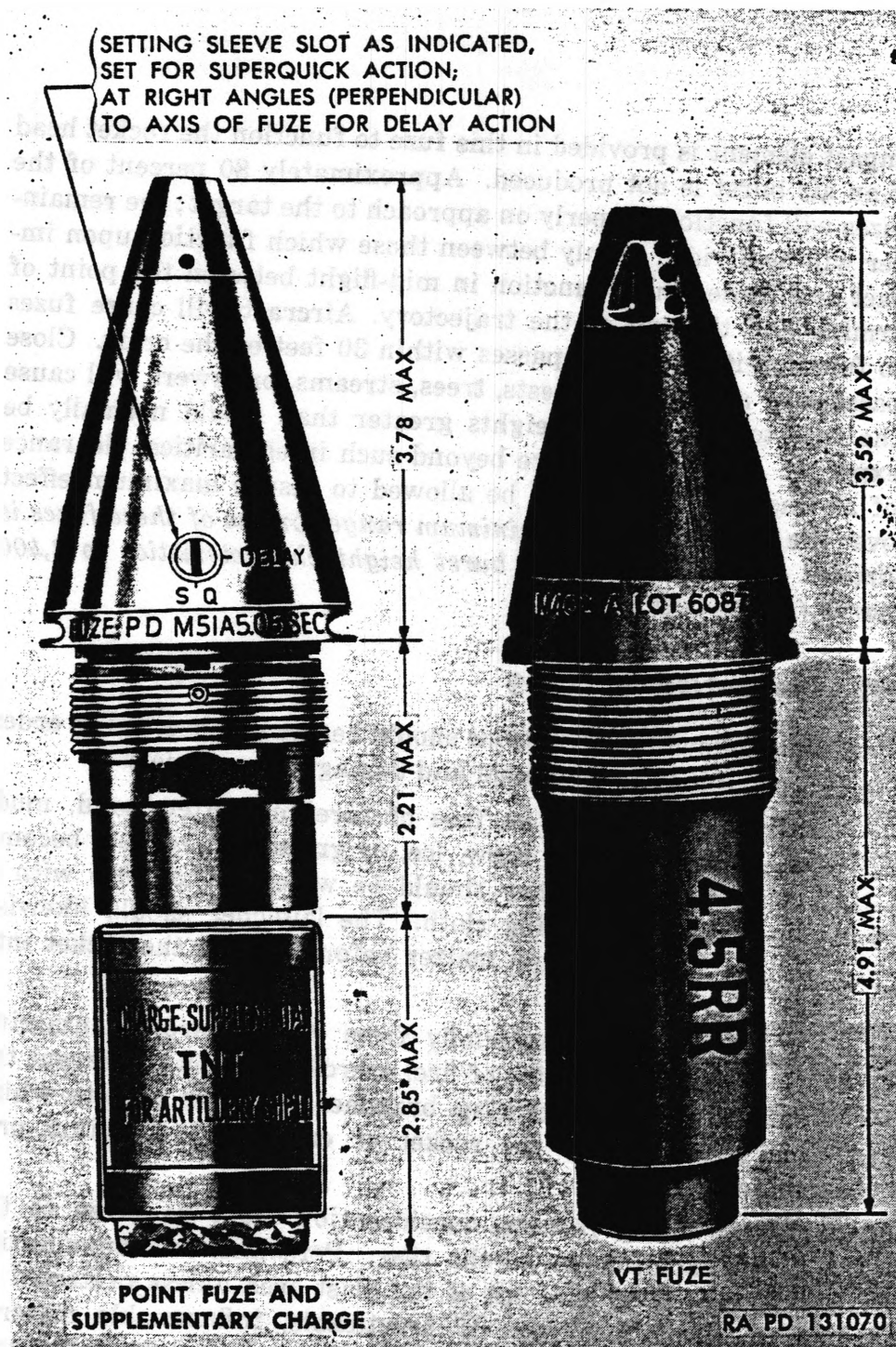


Figure 67. PD and VT rocket fuzes.

causes the rocket head to detonate when at optimum distance from the target. Boresafety is provided by an arming switch which delays arming of the fuze for from 4.0 to 8.0 seconds. A non-delay

impact element is provided in this fuze to function the rocket head if an air burst is not produced. Approximately 80 percent of the fuzes will function properly on approach to the target; the remainder will be divided evenly between those which function upon impact and those which function in mid-flight between the point of arming and the end of the trajectory. Aircraft will cause fuzes to function if the rocket passes within 30 feet of the craft. Close passage or approach to crests, trees, streams, or towers will cause the fuze to function at heights greater than would normally be expected. When targets are beyond such irregularities, clearance of at least 250 feet should be allowed to insure maximum effect over the target area. *The minimum range for use of these fuzes is limited by the arming and burst height characteristics to 2,400 yards (212 mils QE).*

85. Precautions in Firing

a. The following precautions should be closely observed in order to prevent injury to personnel and damage to matériel:

- (1) Rockets should be free of foreign matter, sand, mud, moisture, frost, snow, ice, or grease. If rockets become dirty or wet, they should be wiped off at once with a clean, dry, wiping cloth. The launcher should likewise be free of foreign matter before loading the rocket into the launcher.
- (2) When firing, especially from wooded areas containing objects in the line of fire, exercise caution to prevent the rocket from striking branches or other objects which might deflect the rocket or cause it to function prematurely.
- (3) In firing rockets, consideration must be given to the blast of flame to the rear. Personnel and ammunition should be kept out of the blast area unless protected by adequate shelter. If practicable, inflammable material such as dry vegetation should be cleared from the area before firing. Refer to paragraph 27.
- (4) Rockets which are known to have been exposed to a temperature lower than -20° or higher than 120° F, the firing temperature limits (marked on rocket), for more than 2 hours will not be fired until they have been brought into the permissible temperature range. They will be placed in an appropriate type of storage until they have returned to a safe temperature.

- (5) If fired at temperatures above 120° F, pressures will be produced which exceed the design strength of the metal parts. If fired at temperatures below -20° F, the flight of the rocket may not be regular and dependable.
- (6) Rockets which show signs of deterioration, as a result of exposure to extremes of temperature, will not be fired.
- (7) Do not break the moisture resistant seals on ammunition containers until the components of the rocket are required for use or inspection.
- (8) Do not remove protective or safety devices from the rocket until just before use.
- (9) Do not fire rockets with dented motors. Serious dents may cause dangerous pressures to be built up within the rocket motor.
- (10) Assembled rockets should not be stood on their bases as this may damage the closing disk and electrical connections.
- (11) To avoid possible injury through accidental ignition of the rocket during loading, personnel should not stand directly behind the launcher tube and rocket.
- (12) Misfires will be handled in accordance with paragraph 53 and SR 385-310-1.

b. If the PD fuze M81A1 or M81 is fired during extremely heavy rainfall, premature functioning may occur. The rainfall necessary to cause malfunctioning is comparable to the exceedingly heavy downpours which occur during summer thundershowers. Such prematures may be prevented by setting the fuze for delay action, thus making the "SQ" action inoperative.

c. The following additional precautions will be observed in firing rockets in freezing weather:

- (1) *General.* Rockets will function normally at any temperature between the temperature limits marked thereon. However, there are certain precautions which should be observed to insure more reliable functioning when the atmospheric temperature is below 32° F, particularly during rainstorms, snowstorms, or in atmosphere sufficiently humid to cause icing or frost. When rockets are subjected to temperature fluctuations that may loosen the motor closing disk, moisture may enter and subsequently form ice or frost within the motor.

- (2) *Protect the fuze cavity.* During fuzing operations, the entry of moisture or snow may prevent insertion or full seating of the fuze in the rocket head. Therefore, it is important that the nose plug be removed only *just before fuzing* the rocket and that the rocket be kept dry.
- (3) *Prevent accumulation of ice or frost on rockets.* Accumulation of ice or frost on the rocket may cause freezing of the rocket to the launcher. If the ice on the rocket appreciably affects its weight and balance, accuracy of flight and range will be affected adversely.
- (4) *Handle rockets carefully.* Care should be exercised to prevent subjecting an unpacked rocket to severe impacts or drops at temperature below -40° F. Rough handling may cause breakage of the propellant and subsequent bursting of the motor body when the rocket is fired.

86. Packing and Marking

a. PACKING.

- (1) Service rockets are packed one per fiber container, one container per metal container or two containers per wooden box. The volume of the one round metal container is 0.8 cubic foot; weight with unfuzed round, 70 pounds; dimensions (in) of the container are $37\frac{1}{8} \times 6\frac{1}{8} \times 6\frac{1}{8}$. The volume of the 2-round wooden box is 1.85 cubic feet; weight with 2 unfuzed rounds, 110 pounds; dimensions (in) of the wooden box are $34\frac{5}{8} \times 12\frac{1}{8} \times 7\frac{3}{4}$. Complete data are published in Department of the Army Supply Catalog ORD 11 SNL S-9.
- (2) Fuzes are packed as published in Department of the Army Supply Catalog ORD 11 SNL R-3.

b. MARKING.

- (1) The following information is marked in black on wooden packing boxes of 4.5-inch rocket ammunition, and in yellow on metal containers:
 - (a) Interstate Commerce Commission (ICC) shipping designation.
 - (b) Ammunition Identification Code (AIC) symbol.
 - (c) Ammunition lot number.
 - (d) Gross weight of package and contents.
 - (e) Cubical displacement of the package.
 - (f) Bursting charge in head.

- (g) Date loaded.
 - (h) Descriptive nomenclature of packed item.
 - (i) Position of rocket in package.
 - (j) Ordnance insignia.
 - (k) Inspector's stamp.
- (2) Yellow sealing tape is used to seal fiber containers containing HE rockets; blue for practice ammunition.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE AND DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

87. Domestic Shipping Instructions

a. PREPARATION FOR SHIPMENT IN ZONE OF INTERIOR. When shipping the 4.5-inch multiple rocket launcher T123 interstate or within the zone of interior, except directly to port of embarkation, the officer in charge of preparing the shipment will be responsible for furnishing weapons to the carriers for transport in a serviceable condition, properly cleaned, preserved, painted and lubricated, as prescribed in SB 9-65.

Note. For loading and blocking instructions of weapons on freight cars, refer to paragraphs 89 and 90.

b. PREPARATION FOR SHIPMENT TO PORTS.

(1) *Inspection.* All used weapons destined for oversea use will be inspected prior to shipment in accordance with TB ORD 385.

(2) *Processing for shipment to ports.* All weapons destined to ports of embarkation for oversea shipment will be further processed in accordance with SB 9-65.

Note. Ports of embarkation will supplement any necessary or previously omitted processing upon receipt of weapons.

c. REMOVAL OF PRESERVATIVES FOR SHIPMENT. Personnel withdrawing weapons from a limited storage status for domestic shipment *must not remove preservatives*, other than to insure that the weapons are complete and serviceable. If it has been determined that preservatives have been removed, they must be restored prior to domestic shipment. The removal of preservatives is the responsibility of depots, ports, or field installations (post, camps, and stations) receiving the shipments.

d. ARMY SHIPPING DOCUMENTS. Prepare all Army shipping documents accompanying freight in accordance with TM 38-705.

88. Limited Storage Instructions

a. GENERAL.

- (1) Rocket launchers received for storage already processed for domestic shipment must not be reprocessed unless the inspection performed on receipt of weapons reveals corrosion, deterioration, etc.
- (2) Completely process weapons upon receipt directly from manufacturing facilities, or if the processing data recorded on the tag indicates that weapons have been rendered ineffective by operation or freight shipping damage.
- (3) Weapons to be prepared for limited storage must be given a limited technical inspection and be processed as prescribed in SB 9-65.

b. RECEIVING INSPECTIONS.

- (1) Report of weapons received for storage in a damaged condition or improperly prepared for shipment will be reported on DD Form 6 in accordance with SR 745-45-5. Report of weapons received in an unsatisfactory condition (chronic failure or malfunction of the weapon or equipment) will be reported on the Unsatisfactory Equipment Report, DA AGO Form 468, in accordance with SR 700-45-5.
- (2) When weapons are inactivated, they are to be stored in a limited storage status for periods not to exceed 90 days. Stand-by storage for periods in excess of 90 days will normally be handled by ordnance maintenance personnel only.
- (3) Immediately upon receipt of weapons for storage, they must be inspected and serviced as prescribed in chapter 2, section I. Perform a systematic inspection and replace or repair all missing or broken parts. If repairs are beyond the scope of the unit and the weapon will be inactivated for an appreciable length of time, store them in a limited storage status and attach tags to them specifying the repairs needed. The reports of these conditions will be submitted by the unit commander for action by an ordnance maintenance unit.

c. INSPECTIONS DURING STORAGE. Perform a visual inspection periodically to determine general condition. If corrosion is found on any part, remove the rust spots, clean, paint, and treat with the prescribed preservatives.

Note. Touch-up painting will be in accordance with TM 9-2851.

d. REMOVAL FROM LIMITED STORAGE.

- (1) If the weapons are not shipped or issued upon expiration of the limited storage period, they may either be processed for another limited storage period or be further treated for standby storage (weapons inactivated for periods in excess of 90 days up to 3 years) by ordnance maintenance personnel.
- (2) If weapons to be shipped will reach their destination within the scope of the limited storage period, they need not be reprocessed upon removal from storage unless inspection reveals it to be necessary according to anticipated in-transit weather conditions.

Note. All weapons being reissued through the depot supply system to troops within the continental limits of the United States must meet the requirements of TB ORD 385. This is NOT required for so-called reissues, exchanges or redistribution among troop units, where the depot supply system is not involved.

- (3) Deprocess weapons when it has been ascertained that they are to be placed into immediate service. Remove all rust preventive compounds and thoroughly lubricate as prescribed in chapter 3, section II. Inspect and service weapons as prescribed in chapter 2, section I.
- (4) Repair and/or replace all items tagged in accordance with b(3) above.

e. STORAGE SITE. The preferred type of storage for weapons is under cover in open sheds or warehouses whenever possible. Where it is found necessary to store weapons outdoors, the storage site must be selected in accordance with AR 700-105 and protected against the elements as prescribed in TB ORD 379.

89. Loading The 4.5-Inch Multiple Rocket Launcher T123 on Railroad Freight Cars

a. PREPARATION.

- (1) When weapons are shipped by rail, every precaution must be taken to see that they are properly loaded and securely fastened and blocked to the floor of car. All on vehicle matériel (OVM) will be thoroughly cleaned, preserved, packed, and securely blocked to floor of car for transit.
- (2) Prepare all weapons for rail shipment in accordance with paragraph 87.
- (3) Increase tire pressure slightly higher than normal except where shipment is to be exposed to extremely hot weather conditions.

- (4) Place weapon in traveling position when located on freight car for blocking. Make certain that the traveling lock on the trail is securely engaged for shipment.

b. TYPE OF CARS. Instructions contained herein pertain to the loading of weapons in boxcars (cars equipped with side or side and end doors), gondola cars (an open-top car having fixed sides, fixed or drop ends, and solid bottom), and flatcars (cars with wooden floors laid over sills and without sides and ends but equipped with stake pockets).

c. METHOD OF LOADING WEAPONS ON FREIGHT CARS.

(1) *Flatcar loading.*

- (a) When suitable hoisting equipment is not available for loading weapons on or for subsequent unloading from a flatcar, an end ramp must be used in cases where the weapon is not on a level with the flatcar deck. Weapons on a warehouse platform or loading dock can be pivoted over spanning platforms aboard a flatcar adjacent to the platform, then again pivoted into lateral position on the flatcar.
- (b) When unboxed weapons must be loaded from ground level, a ramp may be improvised by borrowing railroad ties normally found stacked in railroad yards and by procuring necessary planking.
- (c) To accomplish loading, the weapon is towed or pushed onto the improvised apron at the base of ramp. While the weapon is moving up the ramp, follow up forward movement by chocking behind on wheel of the weapon. This will prevent undesirable rearward travel and assist loading.
- (d) After the first weapon is loaded on the flatcar, additional weapons may be similarly hauled aboard and located on flatcars. When a train of flatcars is being loaded, steel or wooden spanning platforms or bridges are used to cover the gap between cars. Flatcar brake wheels must first be lowered to floor level to permit passage. These spanning platforms are moved along the train by hand as the trailer advances.
- (e) The above method of train loading requires careful advance planning as to the order of loading, so that trailers are arranged on each flatcar under prescribed methods and combinations.

(2) *Gondola car loading.*

- (a) Fixed-end gondola cars may only be loaded when hoist-

ing facilities are available for initial loading and for unloading at destination. Hopper- or drop-bottom gondola cars without false flooring and hoisting facilities are not to be used for shipments of unboxed weapons.

- (b) Drop-end gondola cars may be loaded exactly as described for flatcars ((1) above). Height of fixed sides is immaterial. Weapons may progress through a gondola car by passing over the two inwardly-dropped ends and over spanning platforms. Weapons selected to remain in a gondola car are first moved to the *closed* end of the car, then spread out for blocking after the remaining end is closed and latched.

Note. Do not block weapons flush against ends of gondola car. When ordering gondola cars, specify inside width required as some may be received with gussets along the inner sides which affect clearance.

(3) *Boxcar loading.*

- (a) End-door boxcars are spotted with the door end toward the ramp and loaded as described for flatcars ((1) above). When the height of the matériel to be loaded is close to the inside height limits of the boxcar, it will be necessary to first load the weapon on an adjacent flatcar. The two end doors must be opened *before* the flatcar is coupled to the door end of the boxcar.

Note. When ordering end-door boxcars, it must be remembered that some automobile boxcars may be received with an overhead built-in rack which affects inside height calculations. Specify inside height required. Keep open end doors clear of traffic on adjacent tracks.

- (b) Side-door boxcars are provided with either single or double rolling doors at each side and must be loaded from a platform of about the same level as the boxcar floor or from an adjacent flatcar. Automobile cars of this type have large side door openings and present less difficulty in loading. Steel plates or spanning platforms must be used to bridge the gap between platform and car.

(4) *Loading ramp.*

- (a) A ramp for end-loading of weapons on open top freight cars may be improvised when no permanent ramps or hoisting facilities are available. The width of the ramp for loading weapons may be constructed to provide two double-plank runways, each cleated together.

Length of planking must be determined with consideration to underchassis clearance, in order to clear the hump at the upper end of ramp.

Caution: Personnel guiding the weapon up the ramp must exercise care when working close to the edges of the ramp planking.

- (b) The car bearing the ramp must be securely blocked against rolling, particularly when the car brakes are not applied as in train loading. Successive cars must remain coupled and be additionally chocked at several points along the train if ground towing of weapons aboard the train is being effected.
- (c) Whenever the freight cars are not on an isolated track or blocked siding, each end approach to the train must be posted with a blue flag or light to advise that men are at work and that the siding may not be entered beyond those points.
- (d) Upon completion of the loading operation, the ramp planks and bridging devices should be loaded on the train for use in unloading operations. Random sizes of timbers used in building the approach apron up to rail level should be included. All materials should be securely fastened to the car floors, after weapons are blocked in place, and entered upon the bill of lading (B/L). Railroad ties if borrowed for the operation should not be forwarded to the unloading point unless specifically required and only with the consent of the owner.

d. LOADING RULES. For general loading rules pertaining to rail shipment of ordnance weapons, refer to TB 9-OSSC-C.

Warning: The height and width of vehicles when prepared for rail transportation must not exceed the limitations indicated by the loading table as prescribed in AR 700-105, section II. Whenever possible, local transportation officers must be consulted about the limitations of the particular railroad lines to be used for the movement to avoid delays, danger, or damage to equipment.

90. Blocking The 4.5-Inch Multiple Rocket Launcher T123 on Railroad Freight Cars

a. GENERAL. All blocking instructions specified herein are minimum and are in accordance with the Association of American Railroads "Rules Governing the Loading of Commodities on Open

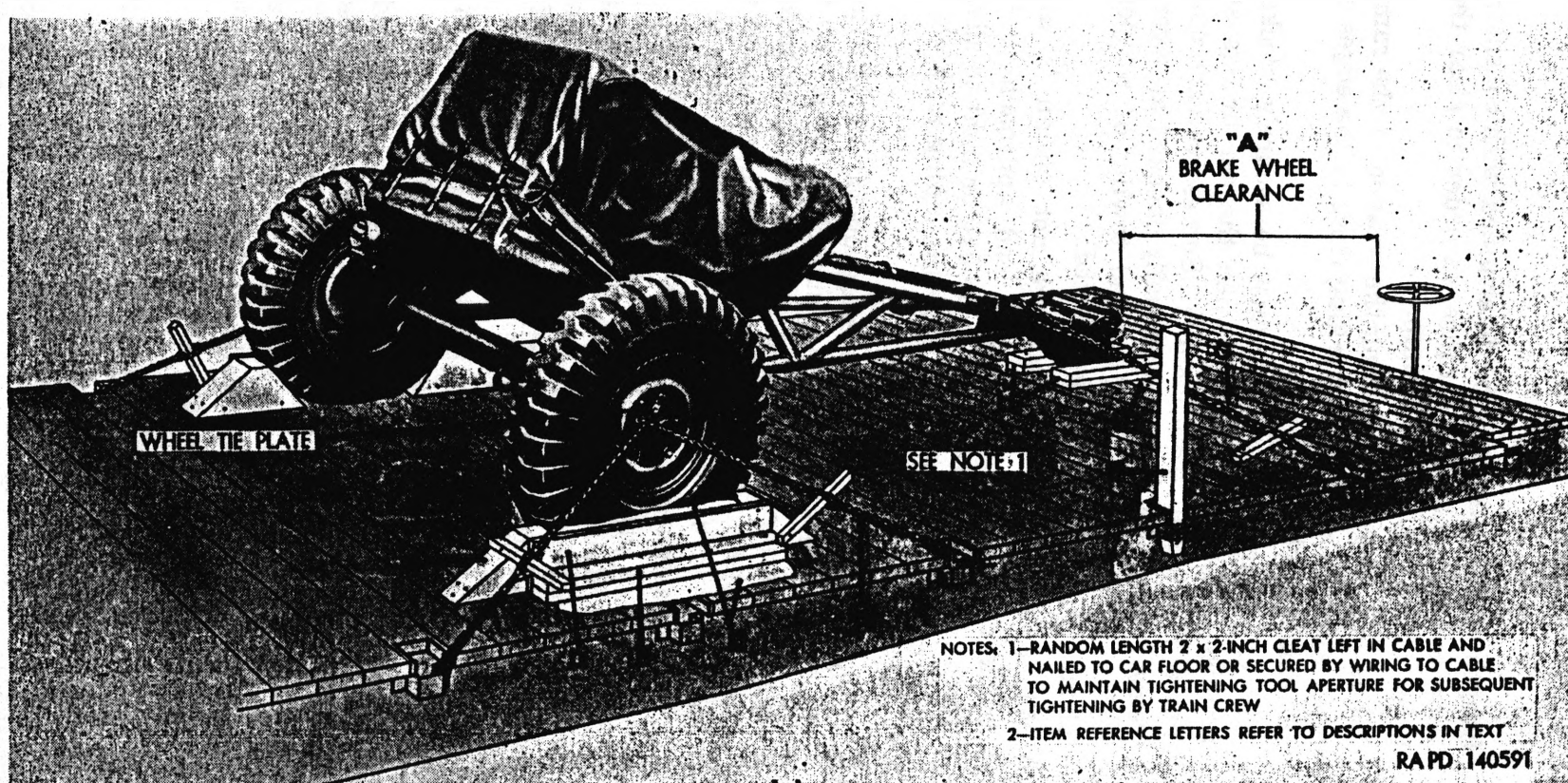


Figure 68. Method of blocking the 4.5-inch multiple rocket launcher T123 on railroad freight cars.

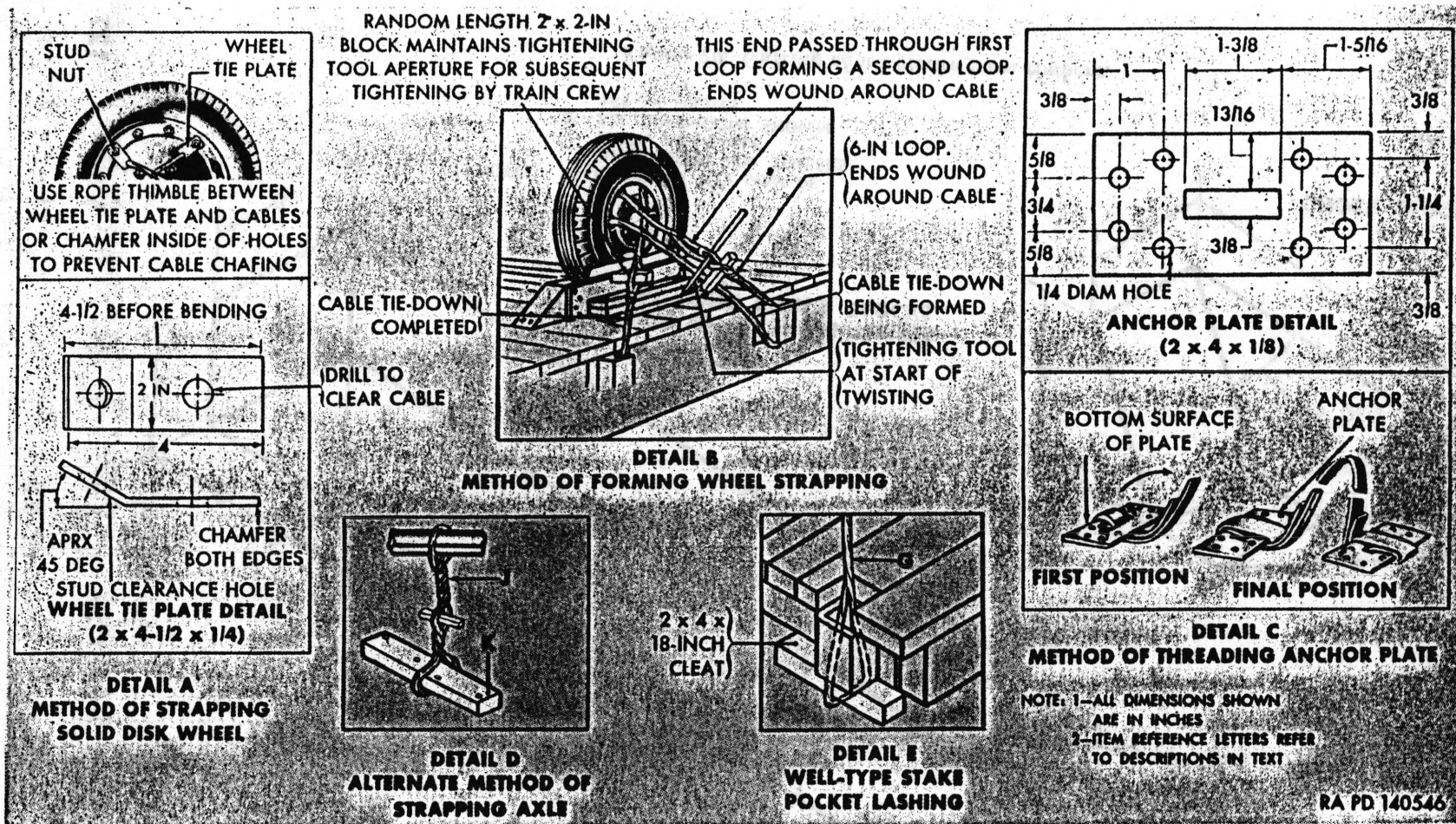
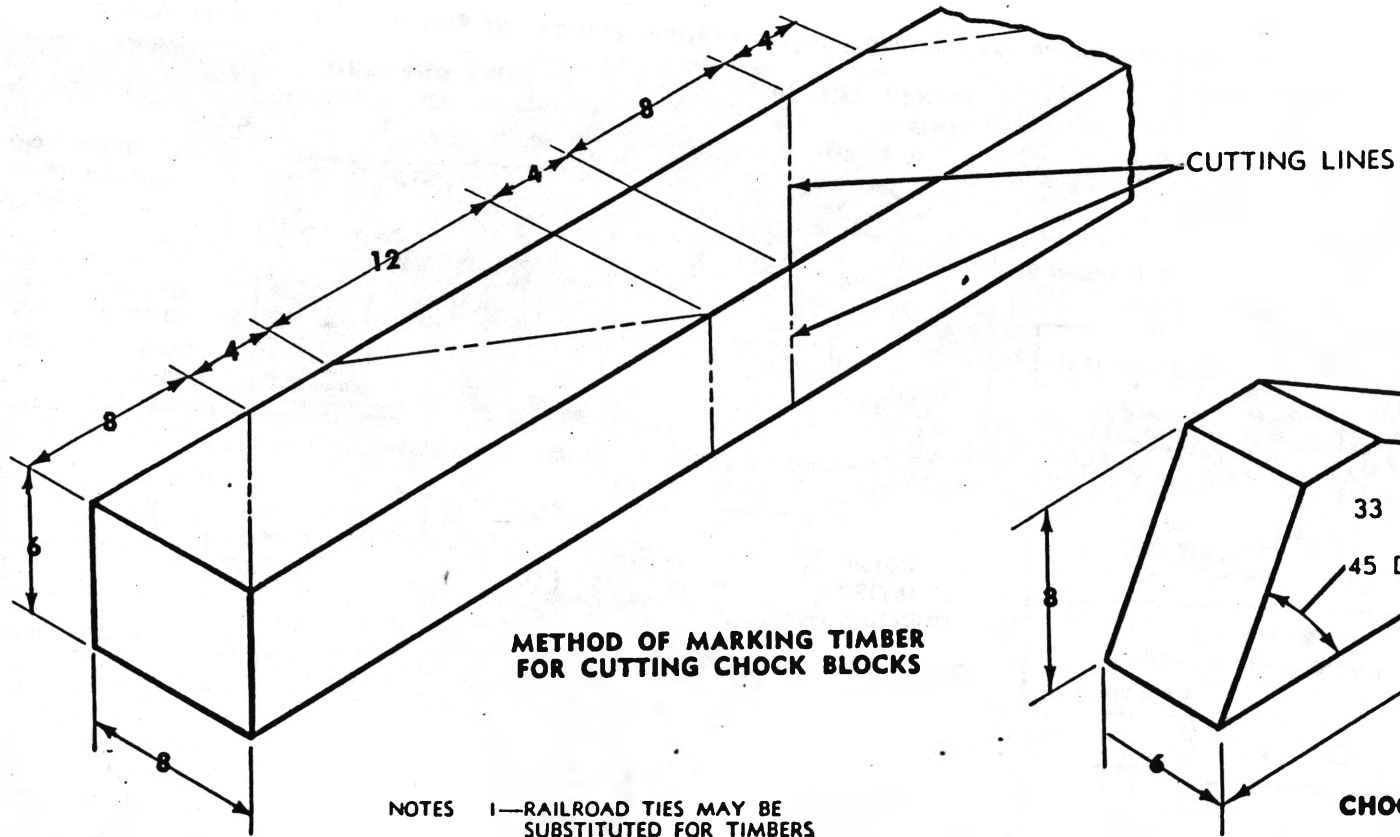


Figure 69. Method of blocking the 4.5-inch multiple rocket launcher T123 on railroad freight cars.



- NOTES
- 1—RAILROAD TIES MAY BE SUBSTITUTED FOR TIMBERS WHEN AVAILABLE
 - 2—ALL DIMENSIONS SHOWN ARE IN INCHES

RA PD 115824C

Figure 70. Cutting chock blocks from timbers.

Top Cars." Additional blocking may be added as required at the discretion of the officer in charge. Double-headed nails may be used if available, except in the lower piece of two-piece cleats. All item reference letters given below refer to the details and locations as shown in figure 68.

Note. Any loading methods or instructions developed by any source which appear in conflict with this publication or existing loading rules of the carriers, must be submitted to the Chief of Ordnance, Washington 25, D. C., for approval.

b. BRAKE WHEEL CLEARANCE "A." Load weapons on flatcars with a minimum clearance of at least 4 inches below and 6 inches above, behind, and to each side of the brake wheel (fig. 68). Increase clearance as much as is consistent with proper location of load.

Note. Weapons should be laterally spotted on flatcar so that wheels are centrally positioned between stake pockets in order that wheel strapping "G" (h(1)(a) below) provides uniform cross-wiring.

c. CHOCK BLOCKS "B" (6 x 8 x 24 IN; 4 REQUIRED PER WEAPON). Locate the 45-degree face of blocks against the front and rear of each wheel. Blocks are to be positioned in such a manner as to allow flush application of wheel side cleats "D" (e below) when nailed to chock blocks. Nail heel of blocks to car floor with three forty-penny nails and toenail both sides of blocks to car floor with two forty-penny nails each.

Note. Filler cleats may be used between chock blocks and side cleats to centrally locate the chock block against tires. These cleats are not shown in figure 68. Chock blocks may be cut from timbers (or railroad ties, when available) as shown in figure 70.

d. CUSHIONING MATERIAL "C." Locate suitable cushioning material, such as waterproof paper or burlap between tires and cleats "D." The cushioning material should protrude beyond cleats "E" at floor and above cleats "D."

e. WHEEL SIDE CLEATS "D" (1 x 8 IN, LENGTH TO SUIT; 2 REQUIRED PER WEAPON). Locate and nail cleats to chock blocks "B" with ten-penny nails at each end.

f. FLOOR SIDE CLEATS "E" (2 x 4 IN, LENGTH TO SUIT, 4 REQUIRED PER WEAPON). Locate two side cleats against wheel side cleats "D" with cushioning material protruding underneath. Nail the lower cleats to car floor with thirty-penny nails and upper cleats to lower cleats and car floor with forty-penny nails, staggered.

g. TRAIL BLOCKING.

(1) *Strapping "H"* ($1\frac{1}{4} \times 0.035$ in, length to suit, hot-rolled steel strapping). Locate steel strapping "H" through eye

of lunette and nail ends of strapping to car floor with large headed nails.

- (2) *Cleats "F" (2 x 4 x 18 in, 4 required per weapon).* Locate two cleats "F" along each side of spades on top of strapping "H" (fig. 68). Nail lower cleats to car floor with thirtypenny nails, and upper cleats to lower cleats and car floor with fortypenny nails, staggered.

h. WHEELS AND TRAIL TIE-DOWN.

(1) Flatcars only.

(a) Wheel strapping "G" (No. 8 gage black annealed wire or equivalent).

1. Cut four strands of wire to length required according to location of stake pockets. Twist-tie wires together to form a single cable.

Note. If perforated disk wheels (ventilating type) are used (detail B, fig. 69) insert cable through an upper ventilating hole then out an adjoining hole. If solid disk wheels are used, remove two upper stud nuts slightly forward and rearward of wheel center. Insert a wheel tie plate on each stud for cable (detail A, fig. 69). Install stud nuts and tighten securely.

2. Insert the cable through a ventilating hole (or wheel tie plate), then out an adjacent hole at upper part of wheel slightly forward of center, for a length beyond half the distance to a stake pocket.
3. Pass the other end of cable through a stake pocket rearward of wheel and form a 6-inch loop in end, winding *each* of the four wires tightly around the cable a few turns. Make certain the loop is positioned well above the span of the cable.
4. Pass the free end of cable through this loop, hand tight, and again wind end of each wire around cable *tightly* (detail B, fig. 69).
5. Position a random length 2 x 2-inch cleat between cables.
6. Insert end of a tightening tool at approximate center of cables and twist-tie cables just taut enough to remove all slack, retaining cleat in its position between cables. Nail this cleat to car floor or secure by wiring to cable to prevent dislodgment during transit.
7. Form another cable and pass end through a ventilating hole (or wheel tie plate) then out an adjacent

hole at upper part of wheel slightly *rearward* of center, crossing initial cable (3 above).

8. Pass other end of cable through a stake pocket *forward* of wheel and complete and twist-tie as described above.

9. Repeat above operations for the other wheel on opposite side of weapon.

Note. During transit, cables will be checked for looseness and retightened if necessary by train personnel.

10. Cables are passed through stake pockets so that the cable loop butts against the car frame. A short stake driven into each stake pocket will protect the cable loop from chafing and loosening. (These stakes are not shown in figure 68). If flatcars are received where flooring is flush against the top of the well-type stake pockets, a loop of cable is passed through the stake pocket, and a short cleat about 2 x 4 x 18 inches is inserted in the loop below the stake pocket. Subsequent tightening of the cable will cause it to draw the wooden cleat securely against the bottom of stake pocket (detail E, fig. 69).

(b) *Trail strapping "G"*. Insert cable "G" around each trail and attach to stake pockets on each side of flatcar in the same fashion as prescribed for wheel strapping ((a) above).

(c) *Stakes "L" (4 x 5 x 48 in, 2 required per weapon)*. Locate in stake pocket of car one-third the distance from the end of the trail to the center of the wheels. Stake will extend 4 inches below pocket of car. Drive one fortypenny nail into stake directly below stake pocket and clinch the head of nail over outside of the stake (fig. 68).

(2) *Gondola or boxcar only.*

(a) *Wheel strapping.* Strapping of wheels is not required for gondola or boxcar blocking.

(b) *Axle strapping.* Locate two pieces of 1 1/4 x 0.035-inch hot-rolled steel strapping over axle (do not locate strapping over bellows). Coil strapping around steel anchor plates as shown in detail C, figure 69. Secure by nailing anchor plates to car floor with not less than six twentypenny nails (double-headed nails preferred). As an alternate method of securing axle, form and substitute a cable "J" (consisting of four

strands of No. 8 gage black annealed wire or wires of equivalent strength) at each location for steel strapping. Pass cables over axle and around wooden cleats "K" (2 x 4 x 18 in). Locate cleats lengthwise of car and nail to car floor with thirtypenny nails in each cleat. Join both ends of cable together as prescribed in (1) (a) above, and twist taut with tightening tool just taut enough to take up slack (detail D, fig. 69).

- (c) *Trail strapping.* Apply strapping in a similar fashion as prescribed in (1) (b) above, except secure to the floor of car by 2 x 4 x 18-inch cleats. If flat metal strapping is used, secure to car floor by using anchor plates as prescribed in (2) (b) above.

Section II. DESTRUCTION OF MATÉRIEL TO PREVENT ENEMY USE

91. General

a. Destruction of the multiple rocket launcher, when subject to capture or abandonment in the combat zone, will be undertaken by the using arm only when, in the judgment of the unit commander concerned, such action is necessary in accordance with orders of, or policy established by, the army commander.

b. The information which follows is for guidance only. Certain of the procedures outlined require the use of explosives and incendiary grenades which normally may not be authorized items for the multiple rocket launcher. The issue of these and related materials, and the conditions under which destruction will be effected, are command decisions in each case, according to the tactical situation. Of the several means of destruction, those most generally applicable are:

Mechanical	—	Requires axe, pick mattock, sledge, crowbar, or similar implement.
Burning	—	Requires gasoline, oil, incendiary grenades, or other inflammables.
Demolition	—	Requires suitable explosives or ammunition.
Gunfire	—	Includes artillery, machine guns, rifles using rifle grenades, and launchers using antitank rockets. Under some circumstances hand grenades may be used.

In general, destruction of essential parts, followed by burning will usually be sufficient to render the multiple rocket launcher and related matériel and equipment useless. However, selection of the particular method of destruction requires imagination and resourcefulness in the utilization of the facilities at hand under the existing conditions. Time is usually critical.

c. If destruction to prevent enemy use is resorted to, the multiple rocket launcher and related matériel must be so badly damaged that they cannot be restored to a usable condition in the combat zone either by repair or cannibalization. Adequate destruction requires that all parts essential to the operation of the matériel, including essential spare parts, be destroyed or damaged beyond repair. However, when lack of time and personnel prevents destruction of all parts, priority is given to the destruction of those parts most difficult to replace. Equally important, the same essential parts must be destroyed on all like matériel so that the enemy cannot construct one complete unit from several damaged ones.

d. If destruction is directed, due consideration should be given to—

- (1) Selection of a point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments of ricocheting projectiles which may occur incidental to the destruction.
- (2) Observance of appropriate safety precautions.

92. Destruction of Sighting and Fire Control Instruments and Equipment

All items of sighting and fire control instruments and equipment, especially such items as sighting equipment, gunner's quadrants, binoculars, and similar items are costly, difficult to replace, yet relatively light; hence, they should be conserved and evacuated whenever practicable. In the event evacuation is impracticable, the equipment will be destroyed completely; all optical elements and mountings will be smashed; firing tables and other inflammable items will be burned.

93. Destruction of the Rocket Launcher (Rocket Cluster and Mount)

a. GENERAL. If time, personnel, and materials are available, the destruction of the mount should be accomplished in conjunction with the destruction of the rocket cluster by means of demolition

materials, burning, or gunfire (*b*, *c*, or *d* below). If time, personnel, or materials are limited, priority should be given to the destruction of the rocket cluster by means described in paragraph 94. Pneumatic tires should be destroyed in conjunction with the rocket cluster and mount as described in paragraph 96.

b. METHOD NO. 1—BY DEMOLITION.

- (1) Planning for simultaneous detonation, prepare and place the charges of EXPLOSIVE, TNT (using 1-lb blocks or equivalent together with the necessary detonating cord to make up each charge) as indicated below:

- | | |
|------|--|
| 1-lb | Insert the charge into the middle tube to a distance of approximately 18 inches. |
| 2-lb | Place the charge on the axle adjacent to the <i>left</i> wheel. |
| 2-lb | Place the charge on the axle adjacent to the <i>right</i> wheel. |
| 1-lb | Place the charge on the trail spade. |

- (2) Connect these charges for simultaneous detonation with detonating cord. For methods of detonating these charges, refer to paragraph 95. The danger area is approximately 200 yards. Elapsed time: about 5 minutes.

c. METHOD NO. 2—BY BURNING. Destruction of essential parts such as the rocket cluster, battery, generator, firing switch, and cables, followed by burning in an intense fire will render the rocket cluster and carriage useless. Since the multiple rocket launcher and carriage are almost entirely of metal, except for pneumatic tires (par. 96), sufficient quantities of combustible should be used to insure a very hot fire. However, if combustible is not available, the use of incendiary grenades as indicated in (1) and (2) below will render the matériel useless.

- (1) With the rocket cluster at approximately 0-degree elevation, place an incendiary grenade in the control box. Using two incendiary grenades, place one in each of two upper tubes of the rocket cluster. Also place an incendiary grenade on the elevating mechanism.
- (2) After placing the grenades, first ignite the one on the elevating mechanism, then the two in the rocket cluster, and then the one in the control box. Elapsed time: about 4 minutes.

d. METHOD NO. 3—BY GUNFIRE. This method cannot be relied upon to destroy the same parts of all multiple rocket launchers or to produce the same degree of destruction. From an adjacent weapon, fire on the launchers to be destroyed. A few well-placed

direct hits will be necessary to completely destroy the rocket cluster and the carriage. Unless evacuated, destroy the last multiple rocket launcher by the best means available.

Caution: Firing at ranges of 500 yards or less should be from cover.

Elapsed time: about 2 minutes.

94. Destruction of the Rocket Cluster

a. METHOD NO. 1—BY DEMOLITION. Perform the operations as indicated in paragraph 93, but exclude the charges placed on the axle and trail spade. Elapsed time: about 3 minutes.

b. METHOD NO. 2—BY BURNING. Perform the operations as indicated in paragraph 93c, but exclude the incendiary grenades placed in the control box and on the elevating mechanism. Elapsed time: about 2 minutes.

95. Priming and Detonating Demolition Charges

Charges should be connected for simultaneous detonation with detonating cord. Provide for dual priming to minimize the possibility of a misfire. For priming, either a nonelectric blasting cap crimped to at least 5 feet of safety fuse (safety fuse burns at the rate of 1 foot in 30 to 45 seconds; test before using), or an electric blasting cap and firing wire may be used. Safety fuse, which contains black powder, and nonelectric blasting caps must be protected from moisture at all times. The safety fuse is ignited by a fuse lighter or a match before taking cover; the electric blasting cap requires a blasting machine or equivalent source of electricity and is fired after taking cover.

Caution: Keep the blasting caps, detonating cord, and safety fuse separated from the charges until required for use.

Note. For the successful execution of methods of destruction involving the use of demolition materials, all personnel concerned will be thoroughly familiar with the pertinent provisions of FM 5-25. Training and careful planning are essential.

96. Destruction of Pneumatic Tires

a. GENERAL. An attempt must always be made to destroy pneumatic tires even if time will not permit destruction of the remainder of the carriage. The destruction of tires by means of incendiary grenades should be accomplished in conjunction with the destruction of the weapon (par. 93).

b. METHOD NO. 1—WITH INCENDIARY GRENADES.

(1) Ignite an incendiary grenade under each tire.

- (2) When this method is combined with the destruction of matériel by means of demolition materials, the detonation of explosive charges should be delayed until the incendiary fires are well started to offset the possibility of the flames being extinguished by the blast of the explosion. Elapsed time: about 2 minutes.

c. METHOD No. 2—BY SLASHING. Slash tires. If tires are inflated, exercise care to prevent injury should the tire blow out while being slashed. Whenever practicable, it is usually preferable to deflate tires before slashing. Elapsed time: about 3 minutes.

APPENDIX

REFERENCES

1. Publication Indexes

The following publication indexes and lists of current issue should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to matériel covered in this manual:

Index of Administrative Publications (Army Regulations, Special Regulations, Readjustment Regulations, Joint Army-Air Force Adjustment Regulations, General Orders, Bulletins, Circulars, Commercial Traffic Bulletins, Joint Procurement Circulars, Department of the Army Pamphlets, and ASF Manuals). SR 310-20-5

Index of Army Motion Pictures and Film Strips SR 110-1-1

Index of Army Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications). SR 310-20-3

Index of Blank Forms and Army Personnel Classification Tests. SR 310-20-6

Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment. SR 310-20-4

Introduction and Index (supply catalogs)----- ORD 1

Military Training Aids----- FM 21-8

2. Supply Catalogs

The following catalogs of the Department of the Army Supply Catalog pertain to this matériel:

a. AMMUNITION.

Ammunition Instruction Material for Aircraft Bombs, Grenades, Pyrotechnics, and Rockets. ORD 11 SNL S-6

Rockets, All Types and Components----- ORD 11 SNL S-9

Service Fuzes and Primers for Pack, Light and Medium Field, Aircraft, Tank, and Antitank Artillery. ORD 11 SNL R-3

b. ARMAMENT.

Launcher, Rocket, Multiple, 4.5-Inch, T123. ORD 7 SNL C-90

c. DESTRUCTION TO PREVENT ENEMY USE.

Land Mines and Fuzes, Demolition Material, and Ammunition for Simulated Artillery and Grenade Fire. ORD 11 SNL R-7

d. MAINTENANCE AND REPAIR.

Cleaners, Preservatives, Lubricants, Recoil Fluids, Special Oils, and Related Maintenance Materials. ORD 3 SNL K-1

Items of Soldering, Metallizing, Brazing, and Welding Materials; Gases and Related Items. ORD 3 SNL K-2

Lubricating Equipment, Accessories, and Related Dispensers. ORD (*) SNL K-3

e. SIGHTING AND FIRE CONTROL EQUIPMENT.

Light, Aiming Post, M14; Light Instrument M1, M2, M3, M4, M5, M6, M7, M8, M9, M10, M12, M13, M15, M16, M17, M18, M19, M20, M21, M22, M23, M24, M25, M26, M27, M28, M29, M30, M31, M32, M33, M34, M35, M36 (T10), M39C, T9, and T16. ORD (*) SNL F-205

Mount, Telescope, M79----- ORD (*) SNL F-323

Posts, Aiming----- ORD (*) SNL F-35

Quadrant, Gunner's, M1 (mils)----- ORD (*) SNL F-140

Telescope, Elbow, M62----- ORD (*) SNL F-262

* See ORD 1 for published catalogs of the ordnance section of the Department of the Army Supply Catalog.

3. Forms

The following forms are applicable to this matériel:

DA AGO Form 9-3, Processing Record for Storage and Shipment (Tag)
DA AGO Form 468, Unsatisfactory Equipment Report
DA AGO Form 811, Work Request and Job Order
DA AGO Form 811-1, Work Request and Hand Receipt
DA AGO Form 867, Status of Modification Work Order
DD Form 6, Report of Damaged or Improper Shipment

4. Explanatory Publications

The following explanatory publications contain information pertinent to this matériel and associated equipment:

a. AMMUNITION.

Allocation and Distribution of Training SR 710-60-50
Ammunition and Explosives within the Zone of Interior.

Ammunition, General----- TM 9-1900

Ammunition Inspection Guide----- TM 9-1904

Qualification in Arms and Ammunition AR 775-10
Training Allowances.

Regulations for Firing Ammunition for SR 385-310-1
Training, Target Practice, and Combat. AFR 50-13

Rockets ----- TM 9-1950

b. CAMOUFLAGE.

Camouflage ----- TM 5-267

Camouflage, Basic Principles----- FM 5-20

Camouflage of Individuals and Infantry FM 5-20A
Weapons.

c. DECONTAMINATION.

Decontamination ----- TM 3-220

Defense Against Chemical Attack----- FM 21-40

d. DESTRUCTION TO PREVENT ENEMY USE.

Explosives and Demolitions----- FM 5-25

e. GENERAL.

Accounting for Lost, Damaged, or De- SR 735-150-1
stroyed Property.

Instruction Guide: Operation and Maintenance of Ordnance Matériel in Extreme Cold (0° to -65° F.). TM 9-2855

Mountain Operations-----	FM 70-10
Operations in Snow and Extreme Cold----	FM 70-15
Preparation of Ordnance Matériel for Deep- Water Fording.	TM 9-2853
Reports of Accident Experience-----	SR 385-10-40
Supplies and Equipment: Unsatisfactory Equipment Report.	SR 700-45-5
Targets, Target Material, and Training Course Lay-outs.	TM 9-855
<i>f.</i> MAINTENANCE AND REPAIR.	
Basic Maintenance Manual-----	TM 9-650
Cleaning, Preserving, Sealing, and Related Materials Issued for Ordnance Matériel.	TM 9-850
Lubrication -----	TM 9-2835
Maintenance and Care of Hand Tools-----	TM 9-867
Maintenance and Care of Pneumatic Tire and Rubber Treads.	TM 31-200
Maintenance Supplies and Equipment: Maintenance Responsibilities and Shop Operations.	AR 750-5
Painting Instructions for Field Use-----	TM 9-2851
<i>g.</i> SHIPMENT AND LIMITED STORAGE.	
Army Shipping Document-----	TM 38-705
Inspection, Preservation and Maintenance In Storage of Small Arms Matériel.	SB 9-65
Instruction Guide: Ordnance Packing and Shipping (Posts, Camps, and Stations).	TM 9-2854
Marking and Packing of Supplies and Equip- ment: Marking of Oversea Supply.	SR 746-30-5
Ordnance Storage and Shipping Chart— Group C.	TB 9-OSSC-C
Preparation of Ordnance Matériel for Deep- Water Fording.	TM 9-2853
Protection of Ordnance General Supplies in Open Storage.	TB ORD 379
Shipment of Supplies and Equipment-----	SR 745-45-5
Standards for Oversea Shipment and Do- mestic Issue of Ordnance Matériel Other Than Ammunition and Army Aircraft.	TB ORD 385
Supplies and Equipment—Motor Vehicles--	AR 700-105
<i>h.</i> SIGHTING AND FIRE CONTROL EQUIPMENT.	
Auxiliary Sighting and Fire Control Equip- ment.	TM 9-575

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