DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DS, GS, AND DEPOT MAINTENANCE MANUAL

PERISCOPE, TANK: M28 (T46) (1240-00-346-8735),

M28C (1240-00-706-0794), AND M28D (1240-00-990-1851)

This copy is a reprint which includes current pages from Changes 1 and 2

HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1960

Changes in Force: C1 and C2

TM 9-1240-239-35
C2

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 28 March 1985

DS, GS, AND DEPOT MAINTENANCE MANUAL

PERISCOPE, TANK: M28 (T46) (1240-00-346-8735),

M28C (1240-00-706-0794), AND M28D (1240-00-990-1851)

TM 9-1240-239-35, 17 August 1960, is changed a follows:

The title is changed as shown above.

1. Page 48, paragraph 89, item number a(1),…"reticle line within 1 mil." will be changed to read …"2.5 mil."

2. Page 48, paragraph 89, item a(2), …"horizontal reticle line of the projector collimator within 1 mil." will be changed to read…"collimator within 2.5 mil."

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United State Army
Chief of Staff

Official:

DONALD J. DELANDRO
Brigadier General, United Sates Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-41, Direct and General Support Maintenance requirements for Periscope.

Change
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *15 December 1966*

DS, GS, and Depot Maintenance Manual

PERISCOPE, TANK: M8 (T46) (1240-346-8735)M28C (1240-706-0794), AND M28D (1240-990-1851)

TM 9-1240-239-35,17 August 1960, is changed a follows:

The title is changed as shown above.

Change the reference "'field maintenance" to "direct support and general support" wherever it appears throughout the manual.

Change the reference "periscope M28 (T46), M28C, and M28D" to "periscope M28 (T46), M28C, and M28D whenever it appears throughout the manual.

Change the reference "periscope mount M104A1" to "periscope mount M104A1 and M104A2" whenever it appears throughout the manual.

Change the reference "ORD 8 SNL F402," to TM 9-1240-239-35P wherever it appears throughout the manual.

Page 2.

1. Scope

* * * * *

c. The appendix contains *. *. * to the material. The maintenance allocation chart is contained in TM 9-7022, **TM 9-2350-215-20, and TM 9-2350-224-20.**

d. Operation, lubrication, and al maintenance operations allocated to using organizations in performing maintenance work within their scope for the periscope **M28, M28C, and M28D** are contained in TM 9-7022, TM 9-2300-203-12, **TM 9-2350-215-10, and TM 9-2350-224-10.**

e. (Superseded) Report errors, omissions and recommendations direct to Commanding Officer, Frankford Arsenal, ATTN: AMSWE-SMF-W3100, Philadelphia, Pa. 19137 on DA Form 2028 (Recommended Changes to DA Publications).

Page 3.

4. Description

a. (Superseded) Periscopes M28 (T46), M280, and M28D are monocular-type optical sighting instruments which serve as components of the fire control system for the following vehicles.

(1) Periscope, tank M28 (T46) is used with-
Carrier, personnel, full tracked, armored, M59 with preferred M13 cupola.
Mortar, 4.2-inch, self propelled, full tracked, M84.
Tank combat, full tracked, 90-MM gun, M48A1 and M48A2.

(2) Periscope, tank M280 is used with -
Flame thrower M67A1 (Army), Flame thrower M67A2 (USMC).
Tank combat, full tracked, 90-MM gun M48A20 and M48A3.
Tank combat, full tracked, 105-MM gun MA60 and M60A1.

(3) Periscope, tank M28D is used with flame thrower M132 and M132A1.

* * * * *

Page 4.

Change the nomenclature in figure 1, RA PD 257233, as indicated below.

From	*To*
CAUTION DECALCOMANIA 7687321 ----------	CAUTION DECALCOMANIA 7659440.
LINK ASSEMBLY 760651 or 8270686 ----------	LINK ASSEMBLY 7660651 (M28) (T46) and (M28C).
	LINK ASSEMBLY 8270686 (M28).
	LINK ASSEMBLY 8565380 (M28D).
	LINK ASSEMBLY 10516322 (M28C).

Page 5.

Change the nomenclature in figure 2, RA PD 257234, as indicated below.

From	*To*
EYEPIECE ASSEMBLY 8270647 ----------	EYEPIECE ASSEMBLY 8270647 (M28) (T46).
----------	EYEPIECE ASSEMBLY 8293430 (M28C).
----------	EYEPIECE ASSEMBLY 8565281 (M28D).
COVER and GASKET 8270698 and 8270697----------	COVER 7674684.

Page 7.

Change the nomenclature on figure 4, RA PD 378822A, as indicated below.

From	*To*
SIGHT LINK ASSEMBLY ----------	LINK ASSEMBLY.

Page 9.

Delete gasket 8270697, item J, from figure 6, RA PD 257236.

Change the nomenclature in figure 6, RA PD 257236, as indicated below.

From	*To*
E-EYEPIECE ASSEMBLY 8270647 ----------	EYEPIECE ASSEMBLY 820647 (M28) (T46). EYEPIECE ASSEMBLY 8293430 (M28C) EYEPIECE ASSEMBLY 8565261 (M28D).

Page 10.

Table 1. Special Tools and Equipment for Direct Support, General Support, and Depot Maintenance

Item	Federal stock No.	Reference		Use
		Fig.	Pars	
ADAPTER, nitrogen filling (7680682).	(4931-508-5453) 4931-508-5453	-------	96	Used to connect regulator 1240-558-0922 to nitrogen cylinder
* * * * *	*			* *
REGULATOR, PRESSURE w/ two gages, 0-15 lb and 0-3000 lb (558922).	(4931-508-5795) 1240-558-0922	-------	96	Used to control flow nitrogen when flushing and charging periscope, tank M28 (T46, M28C, and M28D.
(Added) TANK, nitrogen:	6830-264-9086	-------	96	Container for nitrogen used for purging and haring periscope tank M28 (T6), M28C, and 2M8D.
* * * * *	*	*	*	

Note. Parentheses ( ) indicate old tock number.

Page 11.

11. Collimating Telescope 4931-554-9108

a. The collimating telescope 4931-554-9108 (fig. 9) is a small straight tube telescope containing an objective lens, a reticle, and an eyelens. Since there is * * * by mechanical means.

* * * * *

Page 13.

13. Collimator 4931-757-3291

(fig. 11)

* * * * *

Page 27.

42. General

a. Organizational maintenance in TM 9-7022, TM 9-2300-203-12, **TM 9-2360-215-20, and TM 9-2350-224-20** covers preventative services, care in handling, lubrication and cleaning of accessible external mechanical parts, cleaning external optical elements, and serviceability tests pertinent to organizational maintenance.

b. (Superseded) This section provides direct support general support, and depot maintenance

personnel with complete information for the removal of periscopes M28 (T46), M28C, and M28D and link assembly (Fig. 1) from the on carriage position in cupola M13 on the fu tracked armored personnel carrier M59 and on the 4.2-inch full tracked self propelled mortar M84. It also describes removal of the periscope and link assembly from the Commander's cupola of the 90-mm gun full tracked combat tanks M48A2 and M48A3, 105-mm gun full tracked combat tanks M60 and M60A1, and flame thrower M67A1 and the complete disassembly of the periscopes, all subassemblies, and of the link assembly in proper sequence.

Note. (Superseded) Removal procedure described in a through d below is applicable for those periscopes installed in the cupola M13 on the M59 and M84 vehicles and for those periscope installed in the 90-mm gun tanks M48A2C and M48A3, the 105-mm gun tanks M60 and M60A1, and fame thrower M62A1.

43. Removal of Periscope M28 (T46), M28C and M28D from On-Carriage Position

Page 28.

Change the nomenclature in figure 15, RA PD 2572378, as indicated below.

From	*To*
NAMEPLATE 7687315	NAMEPLATE 8270323 (M28) (T46). NAMEPLATE 8270322 (M28C). NAMEPLATE 565800 (M28D).

Page 39.

Change the nomenclature in figure 27, RA PD 257250, as indicated below.

From	*To*
RETICLE 830613	RETICLE 8270618 (M28) (T46). RETICLE 8293434 (M28C). RETICLE 85601 (M28D).

Page 45.

80. Installation of Periscope M28 (T46), M28C and M28D in On-Carriage Position

* * * * *

c. (Superseded) Mount the rod end of sight link assembly (fig. 4) into cupola mounting fork and secure with 1/4-inch lockwasher and 1/4 x 15/16 hexagon-socket bolt (fig. 1). For adjustment of periscope link assembly 7660651, 8270686, 8565380 or 10516322, refer to TM 9-7022, TM 9-2300-203-12, TM 9-2350-215-10, or TM 9-2350-224-10.

84. Eyepiece Focus

a. Test.

* * * * *

(1) (Superseded) Set up projector collimator 4931-757-3291 so that the horizontal lines of the reticle will be parallel with the horizontal working plane. The projector collimator is collimated and set for infinity.

Page 46.

85. Parallax

a. (Superseded) Test. With the periscope M28 (T46), M28C, and M28D mounted in the improvised final inspection fixture (fig. 30), view image through eyepiece of periscope. Move the head about 1/4-inch from side to side and up and down at normal eye distance from the periscopes. If the image of the projector collimator reticle appears to move with respect to the periscopes parallax is present. The amount of parallax may be determined from the graduated projector collimator reticle or periscope reticle. Parallax must not exceed -.5 mil between the image of the projector collimator reticle and the periscope reticle at the center of the field.

* * * * *

Page 47.

86. Definition

a. Test. Install periscope **tank** in improvised final inspection fixture (fig. 30). Place a collimating telescope 4931-554-9108 (fig. 9), set for infinity, on the eyepiece. View through the * * * and well defined.

87. Image Tilt

a. Test.

(1) (Superseded) With the periscopes mounted in improvised final inspection fixture (fig. 30), sight through the periscope using collimating telescope 4931-554-9108 mounted so that its reticle lines are truly vertical and horizontal.

(2) (Superseded) View through the collimating telescope and through the periscope and bring one extreme edge of the horizontal line of the reticle of the collimator 4931-757-3291 into coincidence with the corresponding edge of the horizontal line on the collimating telescope reticle.

* * * * *

Page 48.

88. Reticle Plumb

a. Test.

* * * * *

(2) (Superseded) View through the eyepiece of the collimating telescope (fig. 9) and through the periscope and bring the extreme edge of the periscope reticle 400 meter reference line into coincidence with the corresponding edge of the horizontal line of the collimating telescope reticle.

(3) (Superseded) With one extreme end of the 400 meter reference line of the periscope reticle in coincidence with the horizontal line of the collimating telescope reticle as in (2) above, the opposite extreme end of the periscope reticle 400 meter reference line must not deviate from the horizontal reticle line, of the collimating telescope by more than the maximum thickness of a reticle line.

* * * * *

89. Collimation

a. Test.

* * * * *

(1) (Superseded) The vertical reticle line of the periscope boresight cross will coincide with the center vertical reticle line of the projector collimator within 1 mil.

(2) (Superseded) The horizontal reticle line of the periscope boresight cross will coincide with the center horizontal reticle line of the projector collimator within 1 mil.

* * * * *

Page 52.

96. Purging and Charging

Note

(Added) Subparagraphs (1) through (12) below pertains to direct support and general support, maintenance; (1) through (15) below pertain to depot maintenance.

a. Test.

* * * * *

(2) Obtain cylinder of dry technical nitrogen **6830-264-9086** and remove threaded protective cover from the valve outlet of the cylinder. Open the valve * * * any foreign matter.

(3) (Superseded) Check adapter 4931-508-5453 for cleanliness and proper sealing of gasket. Securely attach this adapter to the tank valve and then attach regulator 1240-558-0922 to the adapter.

(4) (Superseded) Connect the 25 foot hose assembly 4931-561-0713 to the low-pressure port of the regulator, and assure that all connections are tight enough to prevent any leakage.

* * * * *

(10) (Rescinded).

(11) (Superseded) Insert the gasket and the No. 8-36 x 1/6 setscrew (F and G, fig. 6). Continue to charge the periscope with nitrogen at 5 psi for 2 minutes.

* * * * *

(13) (Rescinded).

(14) (Superseded) Using $9^{1}/_{2}$ inch long hose assembly **4931-508-5546,** connect the test gage assembly **4931-546-9773** to the periscope outer valve.

(15) (Superseded) After a 5-minute period, the internal pressure of the periscope must not have dropped more than **0.10** psi as registered on the test gage assembly.

(16) If pressure drop exceeds **0.10** psi, remove the hose and proceed as in below. If pressure drop is less than **0.10** psi reduce pressure to between **0.10** and **0.25** psi, remove the hose and test gage assemblies, and install the air valve cap.

b. (Superseded) Adjustment. Pressure drop in excess of 0.10 psi indicates that improper or incomplete sealing had been accomplished in paragraph 95. Repeat procedures in paragraph 95, and repeat test in a above for depot maintenance only.

Page 54. APPENDIX REFERENCES.

4. Other Publications

* * * * *

d. Operation and Maintenance.

(Added) Operator's Manual: Tank, Combat, Full Tracked: 105-MM Gun, M60A1 W/E (2350-756-89) And Tank, Combat, Full Tacked: 105-MM Gun, M60 W/E (2350-679-5773).	TM 9-2350-215-10
(Added) Organizational Maintenance Manual: Tank, Combat, Full Tracked: 105-MM Gun, M60A1 W/E (350-75-8497) And Tank, Combat Full Tracked: 105-MM Gun, M6 W/E (2350-678-577).	TM 9-2350-215-20.
(Added) Operator's Manual: Tank, Combat, Full Tracked: 90-MM Gun, M48A3 W/E (2350-395-9154).	TM 9-2350-224-10.
(Added) Organizational Maintenance Manual: Tank, Combat, Full Tracked: 90-MM Gun, M48A3 W/E (2350895-9154).	TM 9-2350-224-20.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-41 direct and general support Maintenance for Periscope.

TECHNICAL MANUAL
No. 9-1240-239-35

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *17 August 1960*

PERISCOPE M28 (T46), M28C, AND M28D (T46)

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the information and guidance of personnel responsible for field and depot maintenance of periscope M28 (T46), M28C, and M28D (T46). This manual does not contain information which is intended primarily for the using organization, since such information is available to Ordnance maintenance personnel in the pertinent operator's technical manuals or organizational technical manuals.

b. This manual contains a description of and procedures for inspection, disassembly, repair and rebuild, and assembly of the periscope M28 (T46), M28C, and M28D, formerly (T46).

c. The appendix contains a list of current references, including supply and technical manuals, forms, and other available publications applicable to the material. The maintenance allocation chart is contained in TM 9-7022, TM 9-2350-215-20, and TM 9-2350-224-20.

d. Operation, lubrication, and al maintenance operations allocated to using organizations in performing maintenance work within their scope for the periscope M28, M28C, and M28D are contained in TM 9-7022, TM 9-2300-203-12, TM 9-2350-215-10, and TM 9-2350-224-10.

e. Report errors, omissions and recommendations direct to Commanding Officer, Frankford Arsenal, ATTN: AMSWE-SMF-W3100, Philadelphia, Pa. 19137 on DA Form 2028 (Recommended Changes to DA Publications).

2. Field and Depot Maintenance

The publication of instructions for complete disassembly and rebuild is not to be construed as authority for the performance by direct support and general support units of those functions which are restricted to depots and arsenals. In general, the prescribed maintenance responsibilities will apply as reflected in the allocation of maintenance parts listed in the appropriate columns of Department of the-Army Supply Manual ORD 8 SNL F-402 and tools listed in ORD 6 SNL J132. Instructions for depot maintenance are to be used by maintenance companies in the field only when the tactical situation makes the repair functions imperative. Provisions of parts listed in the depot stock guide column of ORD 8 SNL F-402 will be made to direct support and general support only when the emergency nature of the maintenance to be performed has been certified by a responsible officer of the requisitioning organization.

3. Forms, Records, and Reports

a. General. Responsibility for the proper execution of forms, records, and reports rests upon the officers of all units maintaining this equipment. However, the value of accurate records must be fully appreciated by all persons responsible for their compilation, maintenance, and use. Records, reports, and authorized forms are normally utilized to indicate the type, quantity, and condition of material to be inspected, to be repaired, or to be used in repair. Properly executed forms convey authorization and serve as records for repair or replacement of material in the hands of troops and for delivery of material requiring further repair to Ordnance shops in arsenals, depots, etc. The forms, records, and reports establish the work required, the progress of the work within the shops, and the status of the material upon completion of its repair or rebuild.

b. Authorized Forms. The forms generally applicable to units operating or maintaining this materiel are listed in the appendix. For instructions on use of these forms, refer to FM 94 and FM -4. For a listing of all forms, refer to DA Pam 310-2.

c. Field Reports of Accidents. The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in AR 385-40. These reports are required whenever accidents involving injury to personnel or damage to material occur.

d. Report of Unsatisfactory Equipment or Materials. Any deficiencies detected in the equipment covered

herein, which occur under the circumstances indicated AR 700-38, should be immediately reported in accordance with the applicable instructions in cited regulation.

Section II. DESCRIPTION AND DATA

4. Description

a. Periscopes M28 (T46), M280, and M28D are monocular-type optical sighting instruments which serve as components of the fire control system for the following vehicles.

(1) Periscope, tank M28 (T46) is used with-
Carrier, personnel, full tracked, armored, M59 with preferred M13 cupola.
Mortar, 4.2-inch, self propelled, full tracked, M84.
Tank combat, full tracked, 90-MM gun, M48A1 and M48A2.

(2) Periscope, tank M280 is used with -
Flame thrower M67A1 (Army), Flame thrower M67A2 (USMC).
Tank combat, full tracked, 90-MM gun M48A20 and M48A3.
Tank combat, full tracked, 105-MM gun MA60 and M60A1.

(3) Periscope, tank M28D is used with flame thrower M132 and M132A1.

b. The eyepiece of the sight, which contains the eyelens, center lens and field lens (fig. 3), is fixed and remains stationary relative to the vehicle. The prism rotates the line of sight from 15 degrees depression to 60 degrees elevation in maintaining the line of sight parallel to the line of fire of the machinegun throughout the gun's full range. Connection from the gun to the sight is made through a quick-release sight link assembly (fig. 4), movement of which is transmitted to the prism (fig. 2) through tape-connected pulleys. The sight link assembly (fig. 1) is not part of the periscope sight, but is issued as equipment with the sight.

c. Means for making azimuth boresighting adjustment is provided by azimuth adjustment pin (fig. 4) at the mounting flange of the sight. Elevation adjustment is provided at the connecting arm to which the sight link assembly connects.

d. A rubber eyeshield (fig. 5), mounted over the sight's eyepiece, serves to protect the eyelens and prevent injury to the machine gunner. A dovetailed lamp bracket slot in the plate (H, fig. 6) receives the lamp bracket of instrument light M50 which is furnished as equipment for periscope mount M104A1 and M104A2 in order that illumination of the sight's reticle (fig. 3) during night operations may be accomplished.

e. An adjusting wrench (fig. 1) is chained to the sight in order to provide the operator with a means of adjusting the azimuth adjusting pin (fig. 4) while boresighting the installed sight.

f. The sight is sealed against the entrance of moisture to the optical system and is filled with dry nitrogen gas.

5. Tabulated Data

a. The Periscope Sight Has the Following Optical Characteristics:

Magnification.....	1.5 power
Diameter of exit pupil	17 in.
Field of view	48 degrees
Vertical rotation of line of sight	76 degrees
Elevation (above 0)	60 degrees
Depression (below 0)	15 degrees

b. The Weight and Overall Dimension Are as Follows:

Weight without link assembly, eyeshield, 8 lb and clamp.

Length (front to back)	8 in.
Width (side to side)	5 1/2 in.
Height (without attached chain)	14 1/4 in.

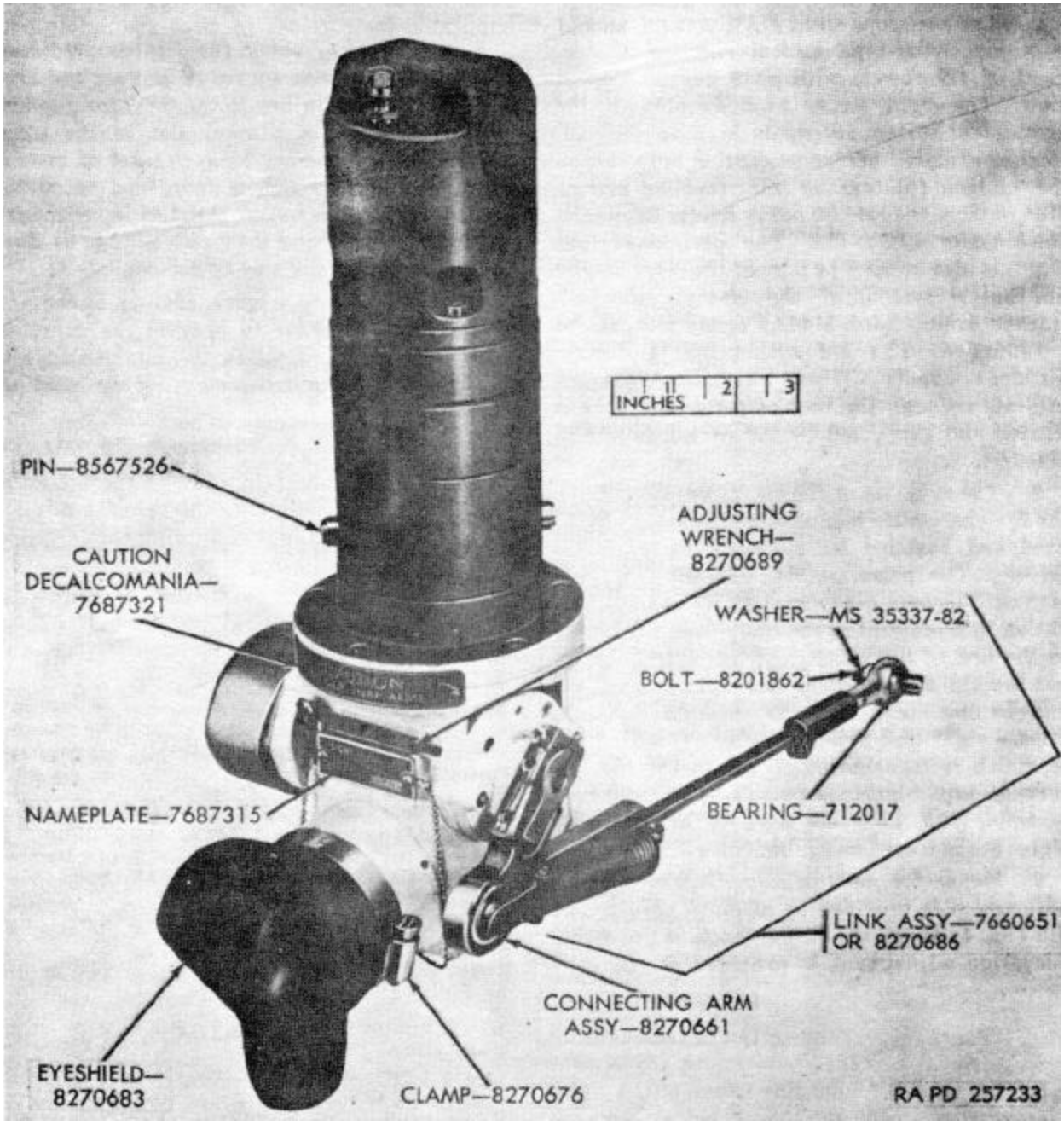

Figure 1. Complete periscope M28 (T46), M28C, and M28D with equipment.

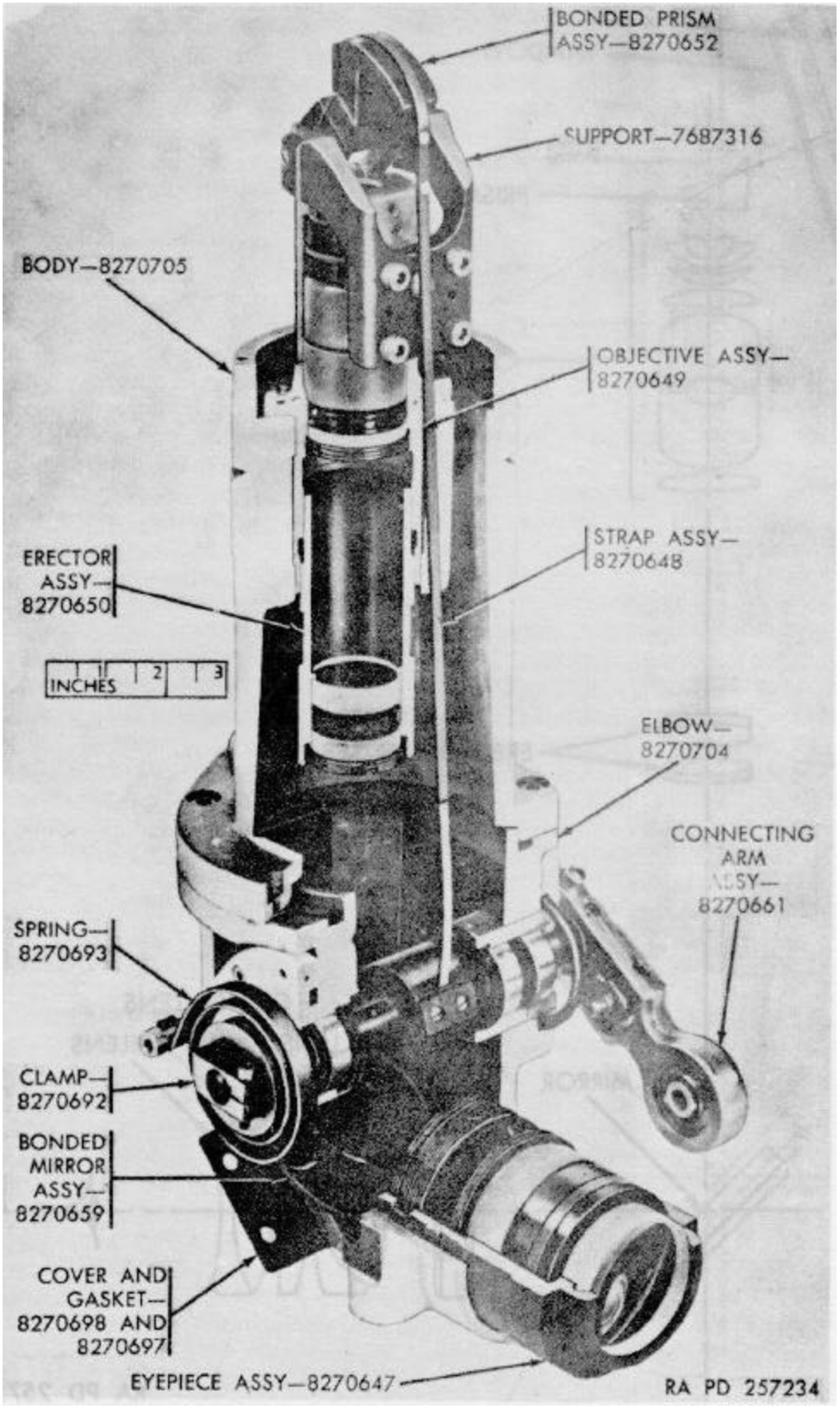

Figure 2. Periscope--cutaway view.

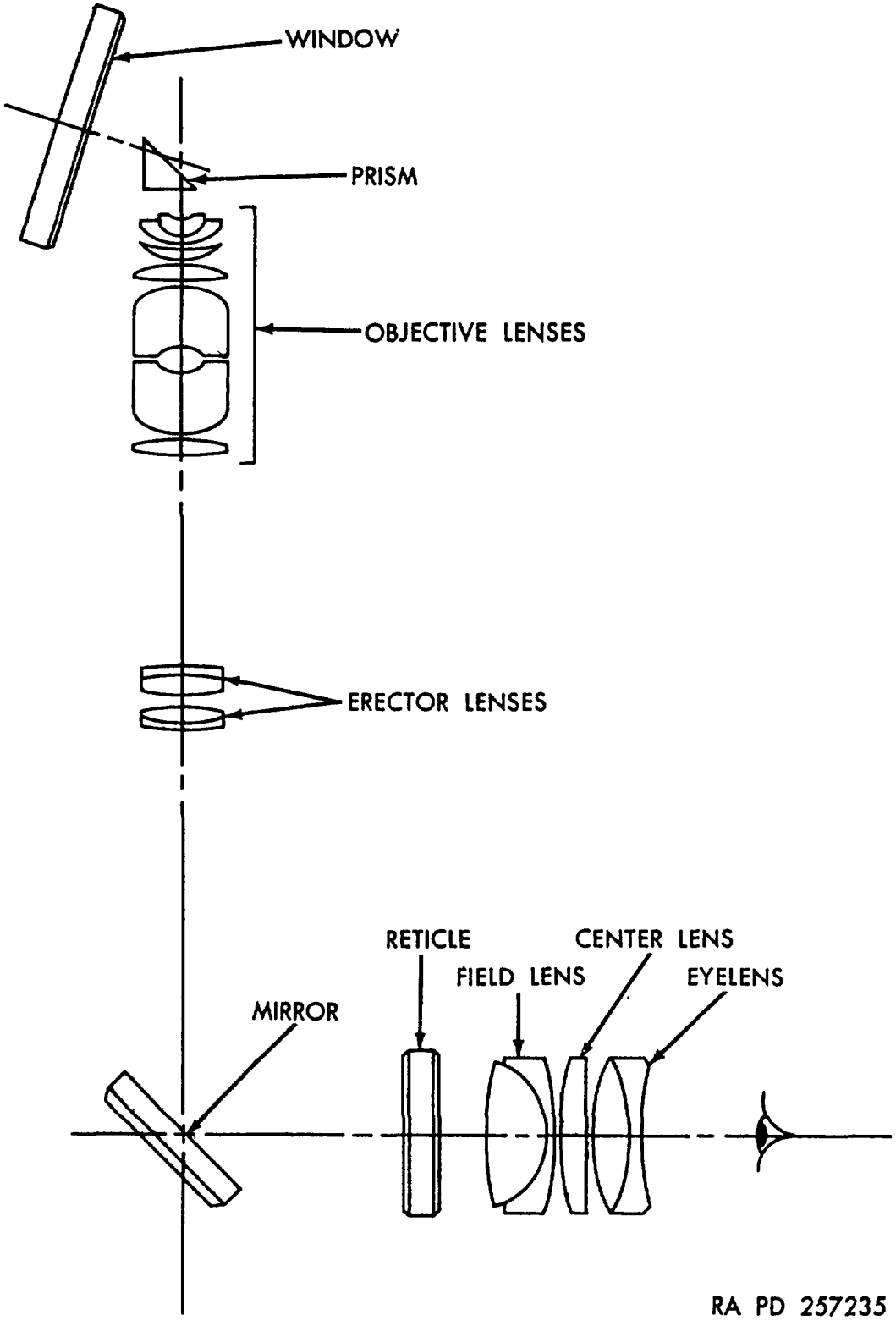

Figure 3. Diagram of optical system.

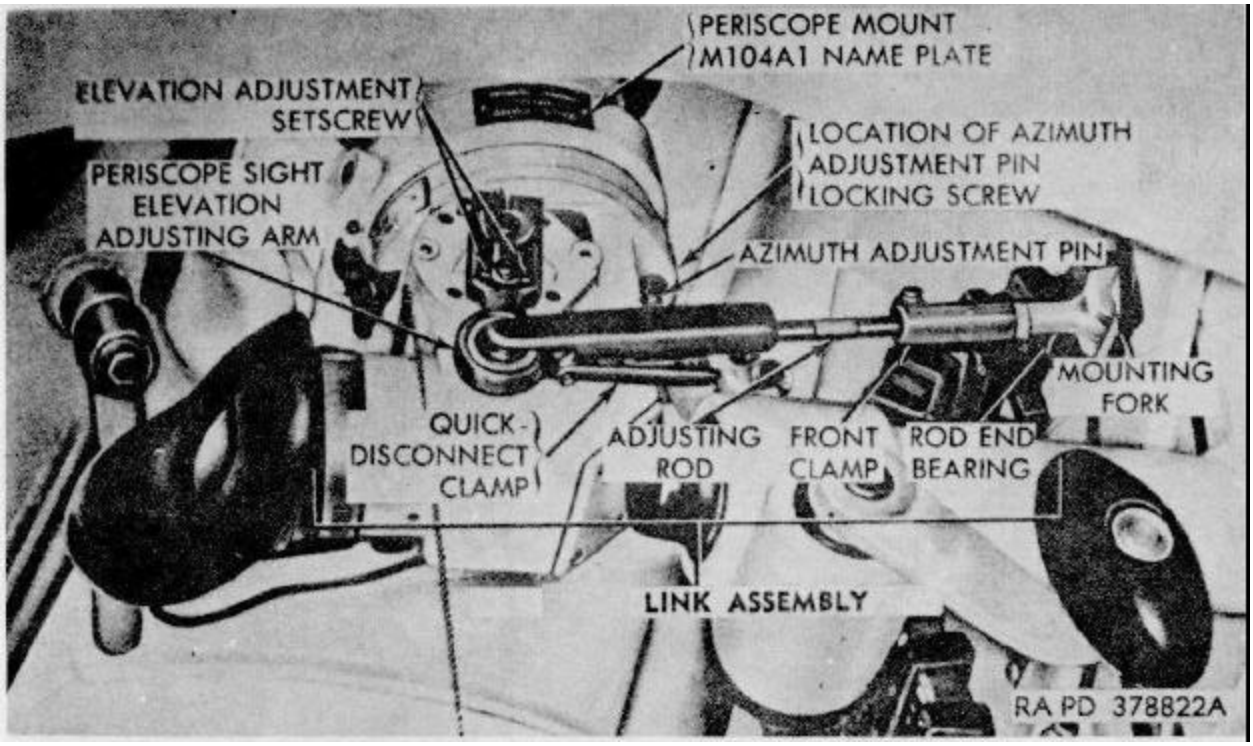

Figure 4. Periscope M28 (T46), M28C, and M28D with equipment shown mounted in mount M104A1.

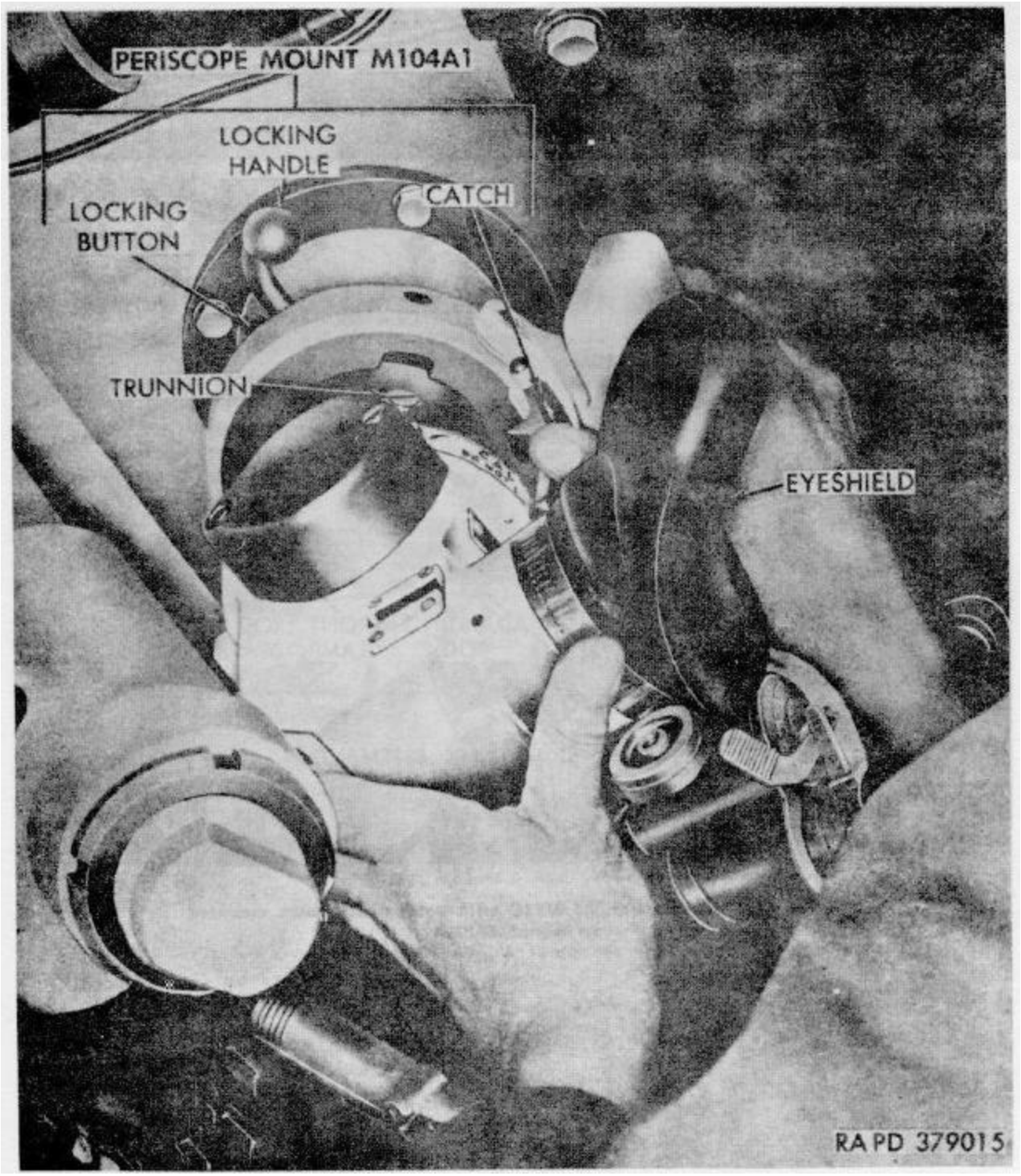

Figure 5. Periscope in locked position in mount M104A1.

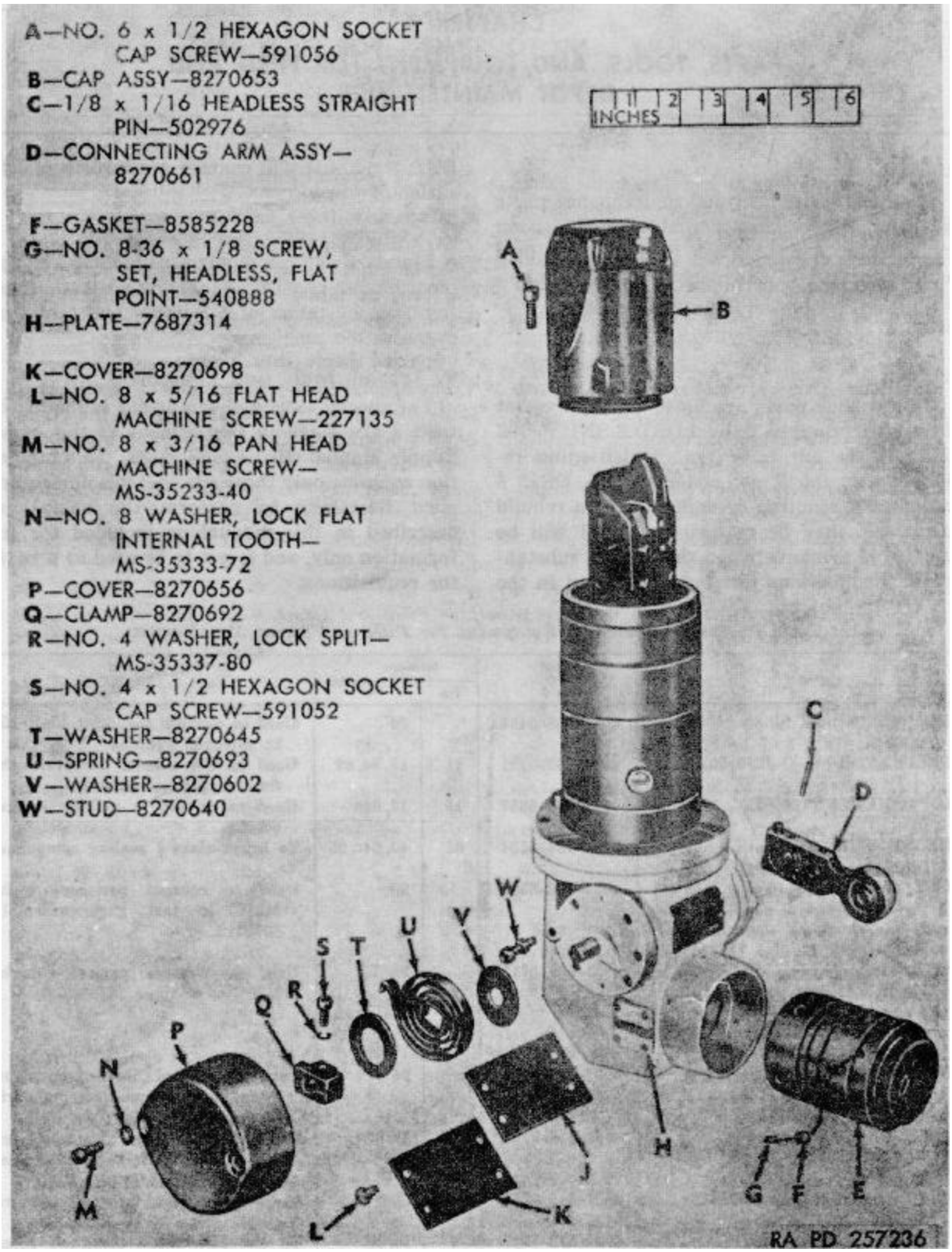

Figure 6. Periscope-exploded view showing cap, arm, and spring assemblies.

CHAPTER 2
PARTS, TOOLS, AND EQUIPMENT FOR FIELD AND DEPOT MAINTENANCE

6. General
Tools and equipment and maintenance parts over and above those available to the using organization are supplied to Ordnance direct support and general support units and depot shops for maintaining, repairing, and for rebuilding the material.

7. Parts
Maintenance parts are listed in Department of the Army Supply Manual ORD 8 SNL F-402 which is the authority for requisitioning replacements. Parts not listed in the ORD 8 manual, but required by depot shops in rebuild operations, may be requisitioned and will be supplied if available when the need is substantiated. Requisitions for parts not listed in the ORD 8 manual will contain a complete justification of requirements.

8. Common Tools and Equipment
Standard and commonly used tools and equipment having general application are authorized for issue by tables of allowance and tables of organization and equipment.

9. Special Tools and Equipment
The special tools and equipment tabulated in table I are listed in Department of the Army Supply Manual ORD 6 SNL J-32. This tabulation contains only those special tools and equipment necessary to perform the operations described in this manual, is included for information only, and is not to be used as a basis for requisitions.

Table I. Special Tools and Equipment for Direct Support, General Support, and Depot Maintenance

Item	Federal stock No.	Reference		Use
		Fig.	Pars	
ADAPTER, nitrogen filling (7680682).	(4931-508-5453) 4931-508-5453	-------	96	Used to connect regulator 1240-558-0922 to nitrogen cylinder.
COLLIMATOR (18-C-1279-50).....	4931-757-3291	11	13, 84, 89	Used as the infinite target in the final inspection fixture.
DIOPTOMETER (7680631)	4931-536-5557	10	12, 84*a*	Used as an aid in making optical checks.
GREASE GUN, pneumatic (7648134).	4931-764-8134	32	40, 64c, 95	To inject class I sealing compound.
HOSE, assembly, (3/16 id x 7/16 od x 3/8-24 threaded coupling one end; air chuck on opposite end; overall length 91/2-in.) (8572413).	4931-508-5546		96	Used to connect periscope M28 (T46), M28C, and M28D to test gage assembly 8672412.
HOSE, assembly, (1/4 id x 5/8 od x 9/16-18 NF-3 lb threaded coupling one end; 0.302-32 NS coupling opposite end; overall length 25 feet) (8572414).	4931-561-0713		96	Used to connect periscope M28 (T46), M28C, and M28D to adapter 7680682.
REGULATOR, PRESSURE: w/ two gages, 0-15 lb, and 0 to 3,000 lb (5580922).	(4931-508-5795) 1240-558-0922	--------	96	Used to control flow of nitrogen when flushing and charging periscope tank M28C (T46), M287C, AND M28D.
TANK, nitrogen:	6830-264-9086	--------	96	Container for nitrogen used for purging and charging periscope tank M28 (T46), M28C, and M28D
TELESCOPE, collimating (18-T-540-250).	4931-554-9108	9	11, 86*a*, 87*a*, 88	Can be used in place of dioptometer 7680631 to aid in making optical checks.
TEST GAGE, assembly (8572412).....	4931-546-9773		96	Used to measure internal pressure of periscope M28 (T46), M28C, and M28D.
TESTER, vibration, universal (7560085).	4931-536-5555	7	10, 82	To simulate shock condition after rebuild.
VIBRATION ADAPTER (8242789).....	4931-605-7764	8	10, 82	Used to mount periscope M28 (T46), M28C, and M28D to universal vibration tester.

Note. Parentheses ( ) indicate old stock number.

10. Universal Vibration Tester 7560085
(fig. 7)

a. General. A universal vibration tester is a motor-driven vibrator which is used with vibration adapter (fig. 8) to stimulate condition of shock and vibration that is normally encountered in the use and during the life of the periscope. Through its use, loose dirt and improperly secured components which would effect the efficient operation of the periscope are revealed.

b. Adjustments. Amplitude and frequency of the vibrator are adjusted as required by the specifications for the periscope sight (par. 82). Frequency of vibration is controlled by adjusting the speed of rotation of the tester as indicated on the frequency meter. This is accomplished by adjustment of the belt-driven variable speed pulley by means of a handwheel. Amplitude is adjusted by the tee-handled screw at the side of the tester. Refer to instruction plates and caution plates attached to the vibration tester. A timer switch, wired into the electrical circuit, is set for the time of vibration required.

11. Collimating Telescope 18-T-540-250

a. The collimating telescope 4931-554-9108 (fig. 9) is a small straight tube telescope containing an objective lens, a reticle, and an eyelens. Since there is no erecting system, an inverted mage is seen. The telescope is carefully adjusted so that its optical axis is coincident with the mechanical axis of the telescope tube. The fact that the optical axis of the collimating telescope is alined with its mechanical axis makes it possible to establish a line of sight to a distant target that is parallel to a line determined by mechanical means.

b. The collimating telescope also can be used to establish a horizontal or vertical line by means of its own reticle in order to test instruments for tilt of field of view or tilt of reticle. It also serves as a magnifier and reduces the effects of near or farsightedness in the eye when testing eyepiece focus. The collimating telescope is adjusted for the proper diopter setting by focusing the telescope on a target set exactly 45 inches from its objective lens. This focusing is achieved by positioning the objective in the telescope to the point where the target is seen at its greatest clarity and locking it in the position by tightening the setscrews.

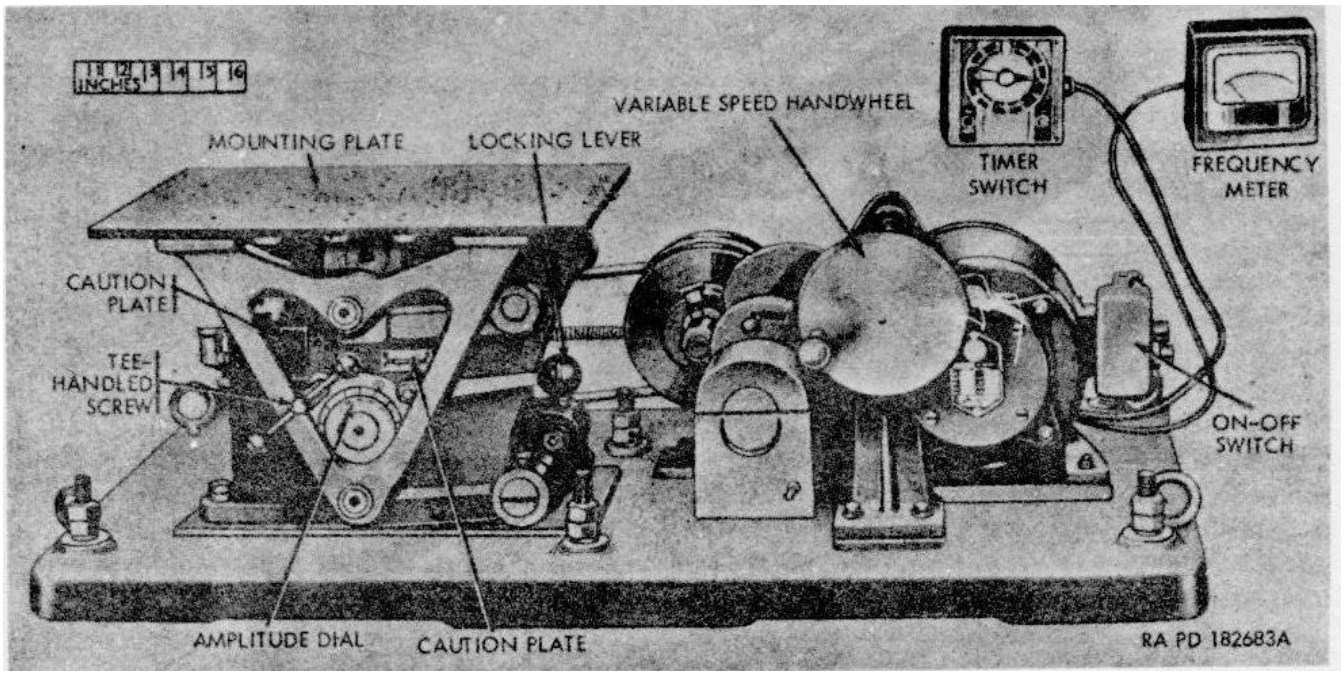

Figure 7. Universal vibration tester.

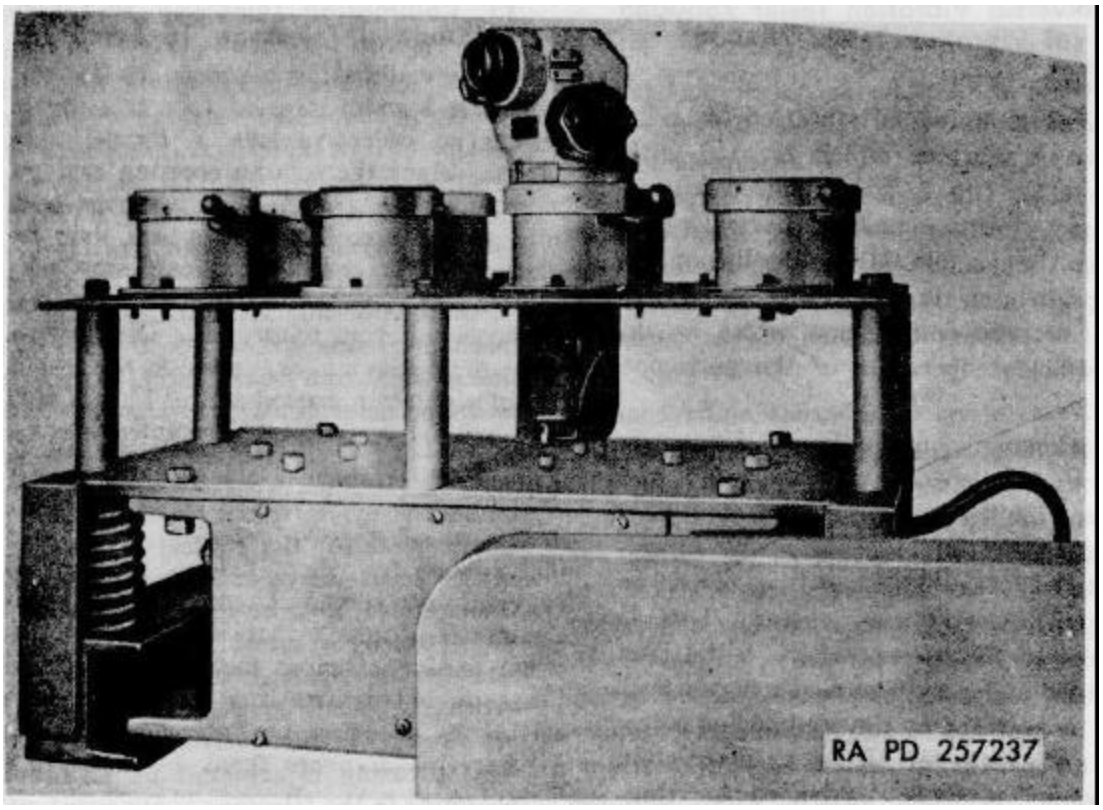

Figure 8. Vibration adapter.

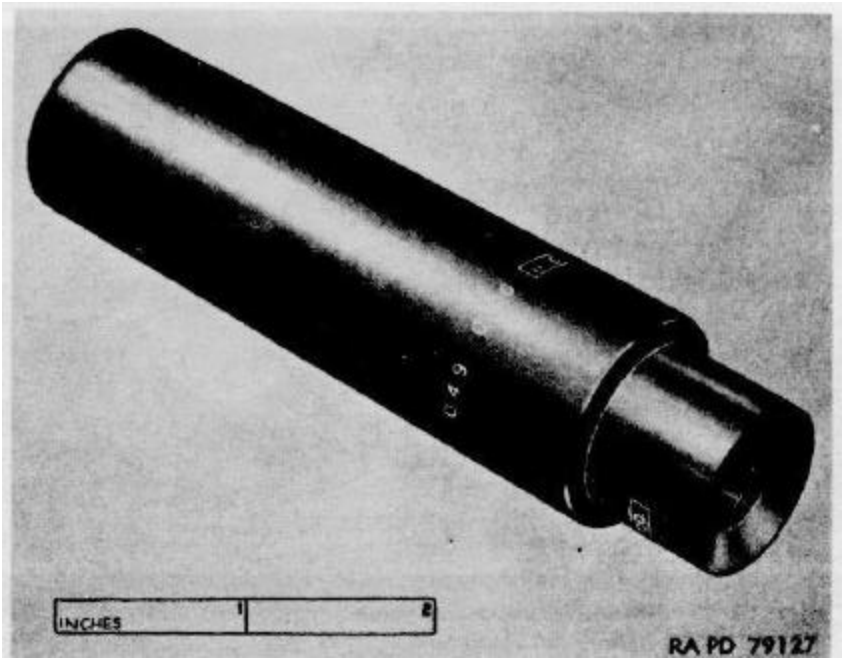

Figure 9. Collimating telescope.

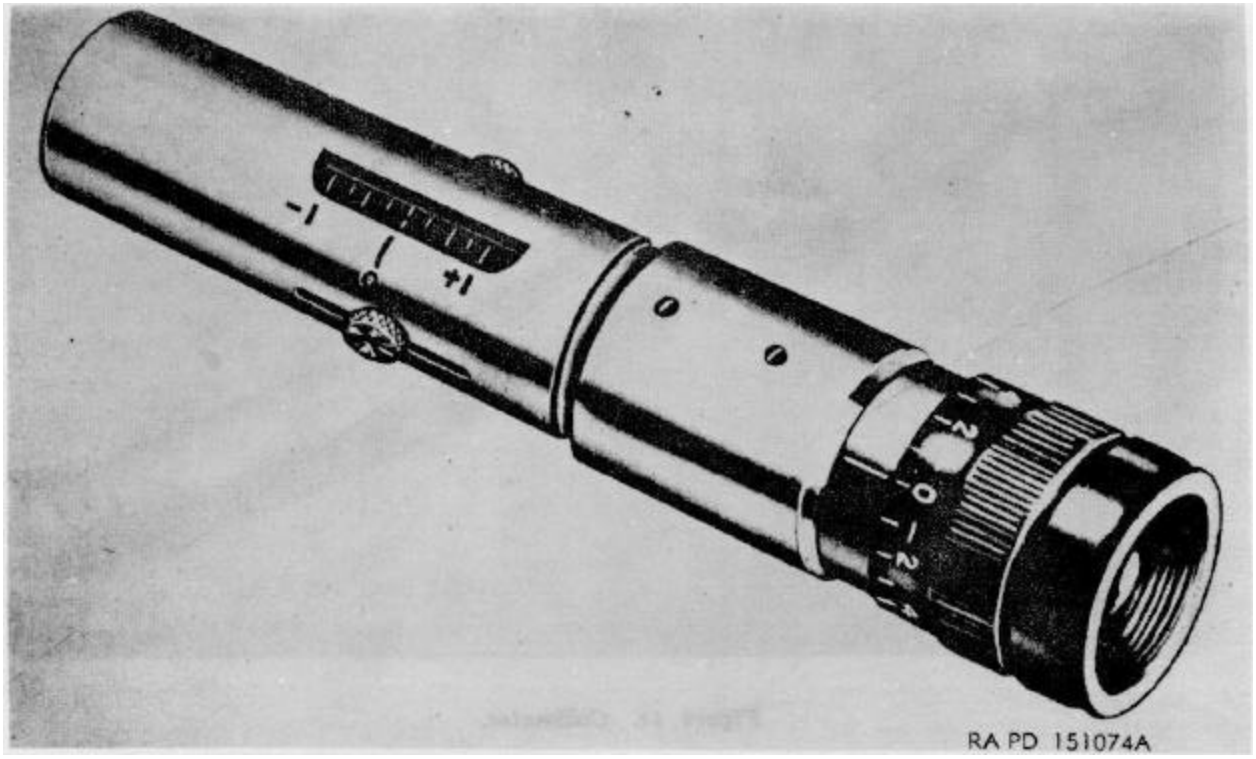

Figure 10. Dioptometer.

12. Dioptometer 7680631
(fig. 10)

The dioptometer is a small calibrated collimating telescope. It has a conventional type focusing eyepiece with an attached diopter scale, a stationary reticle pattern consisting of two lines crossing each other at right angles, and an adjustable objective with a diopter scale and attached index. The eyepiece diopter scale ranges from +4 to -4 diopters and the objective scale is graduated from +1 to -1 diopter. The objective scale indicates the various settings at which parallax is removed.

13. Collimator 4931-757-3291
(fig. 11)

a. The projector collimator is an optical device similar to an ordinary telescope except that it does not have an erecting system of either lenses or prism. It has an adjustable objective that can be positioned by rotating a graduated scale to obtain the required parallax distance and a removable lamp housing at the eyepiece and of the collimator, which contains a 7 1/2-watt lampand a plain glass reflector. The plain glass reflector is mounted at 45 degrees to the optical axis of the collimator.

b. The collimator serves as a convenient indoor testing target for use in connection with inspection and adjustment of the periscope sight (pars. 82*a* and 83-85). The reticle is included in the collimator so that the collimator may be used for checking definition, collimator, parallax, reticle plumb, etc. The collimator eliminates the need for outside testing targets and provides a target that is always uniform as far as intensity of illumination and clarity of image are concerned.

14. Improvised Tools

The improvised tools listed in table II apply only to depot organizations performing major rebuild work on the periscope sight. The chief value of these tools is to maintenance organizations engaged in rebuilding a large number of periscope sights. These tools are essential for rebuild but are not available for issue.

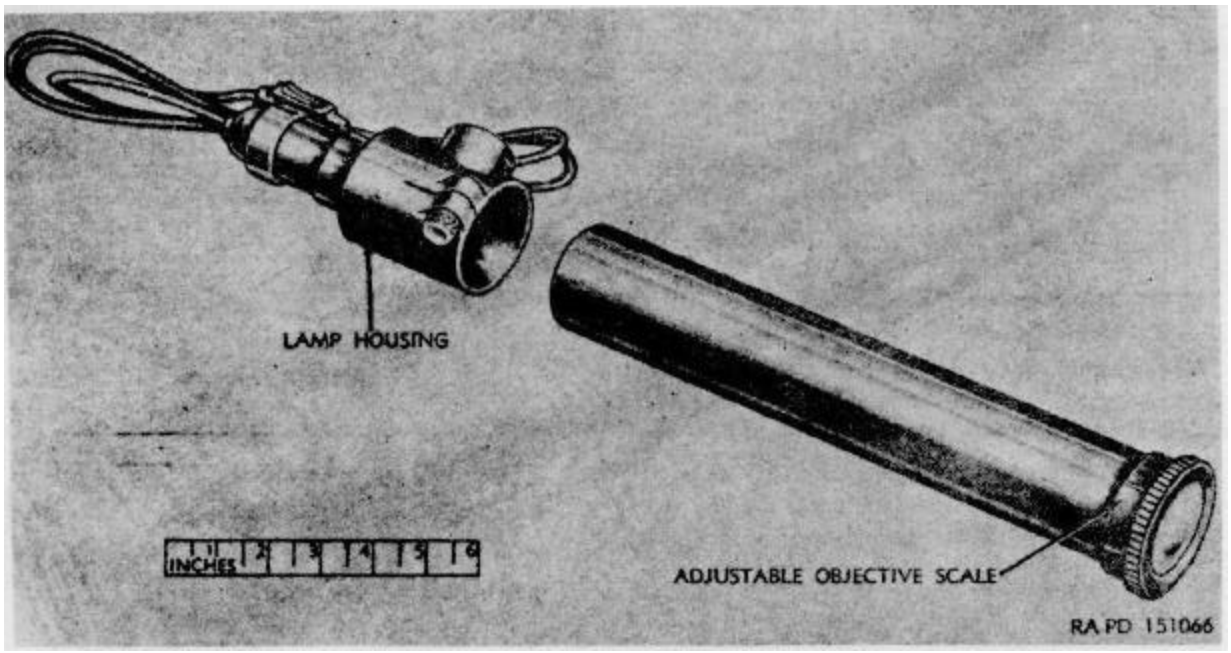

Figure 11. Collimator.

Table II. Improvised Tools for Depot Maintenance

Item	Reference		Use
	Fig.	Par.	
ADAPTER, pneumatic grease gun ...	33	40, 64c, 96	To inject class 1 sealing compound into injection sealing parts of body cover assembly and eyepiece assembly.
FIXTURE, plumb, final inspection	31	90, 91, 92	To hold periscope M28 (T46), M28C, and M28D in order to perform inspection test
FIXTURE, final inspection	30	84, 86, 87, 88, 89	To hold periscope M28 (T46), M28C, and M28D in order to perform inspection test.
FIXTURE, shaft, locking	29	79, 89a	To lock input shaft in position for drilling.
WRENCH, inner, air valve	19	51b, 76a	To remove and install inner air valve 8200526.

CHAPTER 3
INSPECTION

Section I. GENERAL

15. Scope

This chapter provides specific instructions for the technical inspections by Ordnance maintenance personnel of periscope M28 (T46), M28C, and M28D either in the hands of troops (pars. 19-22) or when received for repair in Ordnance shops (pars. 23 and 24). It also defines the in-process inspection of materiel during repair or rebuild and the final inspection after repair or rebuild has been completed.

16. Purposes of Inspection

Inspection is primarily for the purpose of (1) determining the condition of an item, i. e., serviceable or unserviceable, (2) recognizing conditions that would cause failure, (3) assuring proper application of maintenance policies at prescribed levels, and (4) determining the ability of a unit to accomplish its maintenance and supply missions.

17. Categories of Technical Inspections

In general, there are five categories on inspection performed by Ordnance maintenance personnel.

a. Overall Inspection. This is an overall inspection performed periodically on all materiel in the hands of troops. It also is performed on materiel received for repair in field or depot maintenance shops. Upon completion of an inspection for serviceability, materiel will be declared either serviceable or unserviceable. This inspection may be limited in scope, such as an inspection of materiel in the hands of troops, or detailed in scope, such as an Ordnance shop inspection. Detailed procedures are presented in paragraphs 19 through 26.

b. Preembarkation Inspection. This inspection is performed on materiel in the hands of troops alerted for oversea duty to insure that such materiel will not become unserviceable or worn out in a relatively short time. It prescribes a higher percentage of remaining useable life in serviceable materiel to meet a specific need beyond minimum serviceability.

c. In-Process Inspection. This inspection is performed by the repair technician and/or floor inspector in the process of repairing or rebuilding the materiel and its components. It insures that all parts conform to prescribed standards, that the workmanship is in accordance with approved methods and procedures, and that deficiencies not disclosed by the technical inspection are found and corrected. Detailed instructions are contained in paragraphs 29 through 96.

d. Final Inspection. This is an acceptance inspection performed by a final inspector after repair or rebuild has been completed, to insure that the materiel is acceptable according to established standards.

e. Spot-Check Inspection. This is an overall inspection performed periodically on only a percentage of the materiel in each unit to determine the adequacy and effectiveness of organizational and direct support and general support.

18. Classification of Materiel

All Ordnance materiel after inspection is classified as described in a and b below.

a. Serviceable. Serviceable property consists of all new or used supplies which are in condition for issue for the purpose intended and all supplies which can be placed in such condition through pressure tests or inspections, in storage deprocessing, installation of accessories, correction-of minor deficiencies which have developed since the item was last classified as serviceable, application of modification work orders for which parts are available, or assembly of available components.

b. Unserviceable. Unserviceable property consists of all supplies which are not serviceable (*a* above). The definition of unserviceable property is further broken down into the following subclassifications: property which is unserviceable but economically repairable and property which is unserviceable and not economically repairable.

Section II. INSPECTION IN THE HANDS OF TROOPS

19. General

This section provides specific instructions for the technical inspection by Ordnance maintenance personnel of periscope M28 (T46), M28C, and M28D in the hands of troops. Also, this section amplifies the general instructions contained in TM 9-1100 as far as the instructions pertain to inspection of periscope M28 (T46), M28C, and M28D. Personnel making these inspections will acquaint themselves with the malfunctions indicated in paragraph 28, which are the most common deficiencies of the periscope sight. In general, if the periscope sight is complete and performs its intended function properly, if all modification work orders classified as urgent have been completed, and if all defects as disclosed by the inspection have been corrected, the periscope sight may be considered serviceable.

20. Forms and Reports

Authorized forms and reports for technical inspections are prescribed in TM 9-1100. For additional forms and reports for field and depot maintenance, refer to paragraph 3.

21. Inspection of Mechanical Components

a. Completeness. Inspect the periscope sight carefully to be sure that all component parts are present. In particular, check to see that the rubber eyeshield, identification plate, caution decalcomania, adjusting wrench, mounting and adjusting pins, air valve assembly, and all screws and washers are present.

b. Appearance. The appearance of the periscope sight will indicate its general condition and will reflect the type of treatment it has received. Look for dents and cracks in the body, the cover, and the elbow. Inspect the window and eyelens for chips, cracks, or other damage. Check for evidence of moisture, rust or corrosion, fungicidal growth, or any other signs of external damage that would necessitate repair. Inspect the rubber eyepiece shield for tears and deterioration. There will be no paint, nicks, burrs, or other distortions on any/machined or mounting surfaces.

c. Functioning of Mechanical Components. Rotation of the connecting arm assembly will be transmitted through the internal strap assembly to elevate and/or depress the periscope sights line of sight smoothly without binding, excessive friction, looseness, or backlash throughout the limits of travel. Upon release of hand pressure, the internal antibacklash spring will immediately return the arm assembly to its original position.

Caution: **See caution decalcomania (fig. 1) and release pressure against the arm assembly gradually. Sudden release will permit the arm assembly to snap back and result in damage to the instrument.**

d. Sealing. Inspect the filter under the light source mounting plate and the sealed and painted portions of the instrument to determine whether sealing is complete. Dirt and/or moisture on optical elements may indicate improper sealing.

e. Modification Work Orders. All urgent modification work orders must have been applied. Check on application of all authorized modifications to see that no unauthorized alterations have been made or that work beyond the authorized scope of the unit is being attempted. No modification work orders have been issued at the time of preparation of this manual; however, check the index in DA Pam 310-4 and the current modification work order files for any modification work orders promulgated subsequent to date of this manual.

f. Lubrication. All moveable parts will be clean, properly lubricated, and free from rust or other foreign matter (TB 9-2835-1).

g. Identification Plate. Inspect the lettering on the identification plate to see that it is clearly defined and easily read.

h. Paint and Finish. The painted surfaces should not have bare spots or chipped or loose paint which will lead to corrosion. Determine whether touchup or complete refinishing is required (TM 9-2481).

i. Cracks. Castings should be inspected for cracks and breaks.

22. Inspection of Optical Components

a. Condition of Optical Elements. Lenses, prisms, reticles, mirrors, windows, etc., must be free from scratches, pits, dirt digs, condensate, fungus growth, fractures, ad chips, as they will interfere. with or affect

the optical performance of this instrument. Any breakdown or excessive discoloration of cement between elements of compound lenses which affects optical performance in the field will be cause for rejection of the instrument. Rejection is not to be based on the lack of reflection reducing coating for optical elements of instruments already in the field.

Note: **Rejection is to be based only on those defects that are apparent when the periscope sight is used in a manner simulating field conditions. The sight will not be rejected for defects that can be detected only by the shading or shadowing technique.**

Shadowing is the technique of looking through the eyepiece or objective end of an instrument obliquely so as to obtain reflections from a particular surface in the optical system. With this method, the surfaces of the optical elements are dark gray in appearance and all defects show up as white particles.

b. Adjustment of Optical Elements. Performance of the instrument must be such that image and reticle are properly defined and there is no evidence of parallax, double vision, or aberration (TM 9-2601).

Section III. ORDNANCE SHOP INSPECTION

23. General

Technical inspection performed by the Ordnance repair shop on receipt of materiel turned in for repair determines the extent of repairs required and provides the basis for requisitioning the parts, assemblies, or supplies necessary to accomplish the repairs. Often this inspection in the shop may be the same as that performed by inspectors in the field. It may disclose additional necessary repairs not indicated by the using organization during the field inspection (FM 9-3 and FM 9-4).

24. Inspection

The inspection performed by the Ordnance ship inspector will consist of (1) a check on the inspections performed in the hands of troops and (2) determining any additional defects not disclosed by the inspections performed in the hands of troops. Refer to table III for specific malfunctions, their probable causes, and corrective measures to be undertaken should they be encountered.

Section IV. PREEMBARKATION INSPECTION

25. General

Inspection for outward appearance of the periscope sight is of importance as well as inspection of mechanical condition. Where any doubt exists as to the utility of an assembly or of the periscope sight, that assembly or the periscope sight must be replaced by a serviceable item. Equipment when inspected must approach new equipment standards of operation and appearance, and the workmanship and quality of the end product must reflect the highest standards obtainable.

26. Inspection

a. General. The specifications, standards, and operations intended as a guide to insure satisfactory performance and acceptability of the periscope M28 (T46), M28C, and M28D are indicated in paragraphs 19 through 22.

b. Modification Work Orders. All modifications indicated in current DA Pam 310-4 or modification work order list other than those designated as optional will be applied during repair or rebuild.

CHAPTER 4
TROUBLESHOOTING

27. Purpose

Troubleshooting is the systematic isolation of defective components by means of symptoms, tests to determine the defective components, and application of remedies. The scope of the level of Ordnance maintenance will govern the tests and remedies which may be applied.

28. Procedure

The troubleshooting procedure outlined in table III is one of determining, upon occurrence of malfunctions noted, the probable cause, then taking the necessary corrective action.

Table III. Troubleshooting

Malfunction	Probable causes	Corrective Action
Moisture in periscope sight	*a.* Defective sealing	*a.* Disassemble and clean (par. 36) the periscope sight Assemble, seal (par. 95), and fill with dry nitrogen. (par. 96).
	b. Loose or defective valve	*b.* Disassemble and clean (par. 36) the periscope sight. Tighten or replace the valve. Assemble, seal(par. 95), adjust, and fill with dry nitrogen (par. 96).
Image poorly defined	*a.* Heavy condensate present	*a.* Refer to corrective action taken for moisture in periscope sight above.
	b. Objective lens assembly defective or improperly positioned	*b.* Move objective lens assembly toward or away from reticle or replace defective lens (par. 85).
Reticle poorly defined	a. Heavy condensate present	a. Disassemble and clean (par. 36) the periscope sight, Assemble, seal (par. 95), and fill with dry nitrogen (par. 96).
	b. Eyepiece incorrectly focused.	*b.* Screw eyepiece toward or away from reticle (par. 84).
Parallax exists	Objective lens assembly incorrectly positioned or contains a defective lens.	Move objective lens assembly toward or away from reticle or replace defective lens (par. 85).
Reticle is not plumb	Reticle incorrectly positioned.....	Adjust position of reticle (par. 88).
Reticle does not illuminate	*a.* Filter covered with dirt, moisture, or sealing compound.	*a.* Remove the light source mounting plate and clean the filter. Install the plate (par. 57*d*).
	b. Reticle improperly positioned in cell.	*b.* Position reticle properly an cell (par. 93*b*).
	c. Defective reticle	*c.* Replace reticle (par. 61a and b).
Line of sight does not elevate or depress when connecting arm assembly is actuated.	Loose, defective, improperly assembled or installed components.	Make corrections as indicated for excessive backlash (par. 91*b*).
Image is not plumb	Bonded prism assembly improperly positioned or defective.	Locate and properly install or replace the defective prism (par. 90).
Gun and periscope sight not ..... synchronized during elevation travel.	*a.* Link assembly loose	*a.* Adjust link (TM 9-7022 or TM 9-2300-203-12). Repair (fig. 2) (par. 74c).
	b. Broken strap assembly).....	*b.* Adjust link (TM 9-7022 or TM 9-2300-203-12). Repair (fig. 2) (par. 74*c*).
	c. Input arm loose	*c.* Adjust link (TM 9-7022 or TM 9-2300-203-12). Repair (fig. 2) (par. 74*c*.)

CHAPTER 5
REPAIR AND REBUILD

Section I. GENERAL MAINTENANCE

29. General

a. Information and instructions contained herein are, supplementary to instructions for the using organization contained in TM 9-7022 and TM 9-2300-203-12.

b. This chapter contains general and specific maintenance instructions for the repair and rebuild of each major component. In the following sections, specific repair and rebuild procedures and adjustments are described in order to restore each major component to a serviceable condition.

30. General Methods

a. Tools. Use only wrenches that fit snugly on parts. Tools that do not fit properly will fail or cause damage to the corners of bolt heads, nuts, screws, etc.

b. Preparation for Repair Work. When repairing periscope sights, clean the periscope sight body of oil, grease, and dirt to avoid soiling individual parts and cleaned subassemblies. If a replacement is indicated, salvage all serviceable parts from rejected subassemblies. If burs appear on threaded surfaces, the damaged threads must be smoothed with a thread chaser, tap, or die.

c. Handling of Disassembled Parts. A parts tray or suitable receptacle should be provided so that parts, as removed, can be placed in their respective positions in relation to the assembled periscope sight. Large assemblies should be carefully placed on a clean, dry workbench to prevent loss or breakage. Always keep the relative position of parts until the sight is completely assembled. This is especially important where the materiel is assembled by a technician other than the one who disassembled it When parts are to remain disassembled for any length of time, the bare metal surfaces must be kept clean and free from rust. Clean these surfaces with dry-cleaning solvent or mineral spirits paint thinner, wipe dry, and apply a light film of aircraft instrument lubricating oil. Before assembling parts, wipe off this oil, clean the parts, and lubricate in. accordance with paragraph 37.

d. Scribing Metal Parts. As each part is removed, its exact position in relation to the assembly should be established by suitably scribed reference marks if it is necessary to return it to its exact original position. Never scribe marks on threads or bearing surfaces.

e. Removal of Burs. Burs should be removed with a stone or fine file. Where burs are apparent on closely fitted mating surfaces, they can be removed by lapping the surfaces with abrasive grade pumice.

Note: **Under no circumstances should polishing liquids, pastes, or abrasives be used for polishing lenses, prism and windows.**

f. Removal of Corrosion or Rust. All metal parts should be inspected for corrosion or rust. If corrosion or rust are found, the parts should be polished immediately with crocus abrasive cloth and coated with a light film of aircraft instrument lubricating oil.

31. Removal of Setscrews

a. General. Mechanical components are frequently locked in position by the use of setscrews. Disassembly of components without first removing these setscrews is one of the greatest causes of damage to fire-control instruments. It is, therefore, necessary before the removal of any parts of the periscope sight to determine the presence of setscrews by reference to the pertinent disassembly instructions and illustrations.

b. Precautions. If the setscrew will not back out when normal pressure is applied with the screwdriver, do not force it. It may have been sealed in position with orange shellac varnish or another fixing agent If so, apply a few drops of alcohol to the setscrew head and allow it to soak for a few minutes. Again insert the screwdriver and exert a slight back and forth pressure. Repeat this process until the setscrew can be removed by normal pressure.

c. Removal of Undamaged Setscrews. When a setscrew is to be removed, it may be necessary

to dig out or scrape off dirt or covering paint. A sharpened piece of hardwood or brass wire are good tools for this purpose. Do not use a jeweler's screwdriver, as this action may damage both the screwdriver blade and the threads in the setscrew hole. When the head of the setscrew can be seen, insert a screwdriver of the proper size and remove the setscrew.

d. Removal of Damaged Setscrews.

(1) If the slot of a setscrew below the surface is damaged and the setscrew is not too small, it may be possible to drill a small hole in it and remove it with a screw extractor. If the setscrew is near the surface, it may be possible to slot it sufficiently with a Swiss-Pattern file or other sharp pointed instrument and remove it with a jeweler's screwdriver, thus saving time that would be spent in drilling.

(2) If the setscrew cannot be removed as in (1) above, usually the best method is to drill out the setscrew and tap the hole for the next larger size setscrew. To do this, set up the part to be drilled in a firm position on a drill press, with the drill parallel to the setscrew hole, and carefully drill out the setscrew. It is good practice to use the tap drill of the next larger setscrew that is to be used as a replacement.

(3) A setscrew that can be turned but which does not back out indicates a stripped thread condition. It may be possible to back out the setscrew if the part held in place by the setscrew can be turned enough to put slight stress on it, thus allowing those threads still undamaged to engage. It may then be possible to work the setscrew out of the hole.

32. Staking

Staking is a process employed to secure two parts together by striking one of the parts, adjacent to the part to be located in position, with a center punch and hammer. This forces surface metal against the part, thereby locking it in position. Staking should be accomplished with as light taps of the hammer as possible but with a heavy enough blow to prick the work and bring the metal to the desired shape.

33. Tapered Pins

a. Removal of Tapered Pins. To remove a tapered pin, determine which is the smaller of the two ends. Usually, the larger end is identified by a 0 mark. Mark the external part at the large end if it is not already so marked. Always brace the parts secured with a tapered pin to avoid bending or otherwise damaging them and remove the pin by one of the methods indicated in (1) and (2) below.

(1) If the small end of the pin is exposed, one sharp blow on that end of the pin with a soft hammer is usually all that is necessary.

(2) If the small end of the pin is below the surface, select a punch slightly smaller than that end. Use a straight pin punch, not a tapered one. Be sure to place the punch flatly against the small end of the pin. Strike the punch with one sharp hammer blow. Such a blow will usually remove the pin, whereas several haphazardly struck blows will damage it. Determine the size of the hammer according to the size of the job.

b. Installation of Tapered Pins. Before securing two parts with a tapered pin, always check the direction of the taper. Slip the pin loosely in the hole from either side. It should be driven into the side in which it enters more deeply. Failure to check the direction of taper in the parts may cause damage to the parts when the pin is driven in. A clean hole and a well-machined pin should fit together within 1/16 inch of the final position. If this is not the case, check the pin for burs and the hole for poor alinement of parts. When the pin is properly in place and the parts to be joined are securely braced to avoid bending or other damage, one sharp tap on the pin with a brass hammer is all that is needed to drive it into its final position. If a brass hammer is not available, an ordinary hammer and a brass drift may be used.

c. Preparation of New Parts to Receive Tapered Pins. A new part that is to be assembled to a shaft with a tapered pin is drilled and reamed for the tapered pin at assembly. The new part is already spotted to indicate the location where the part should be drilled prior to

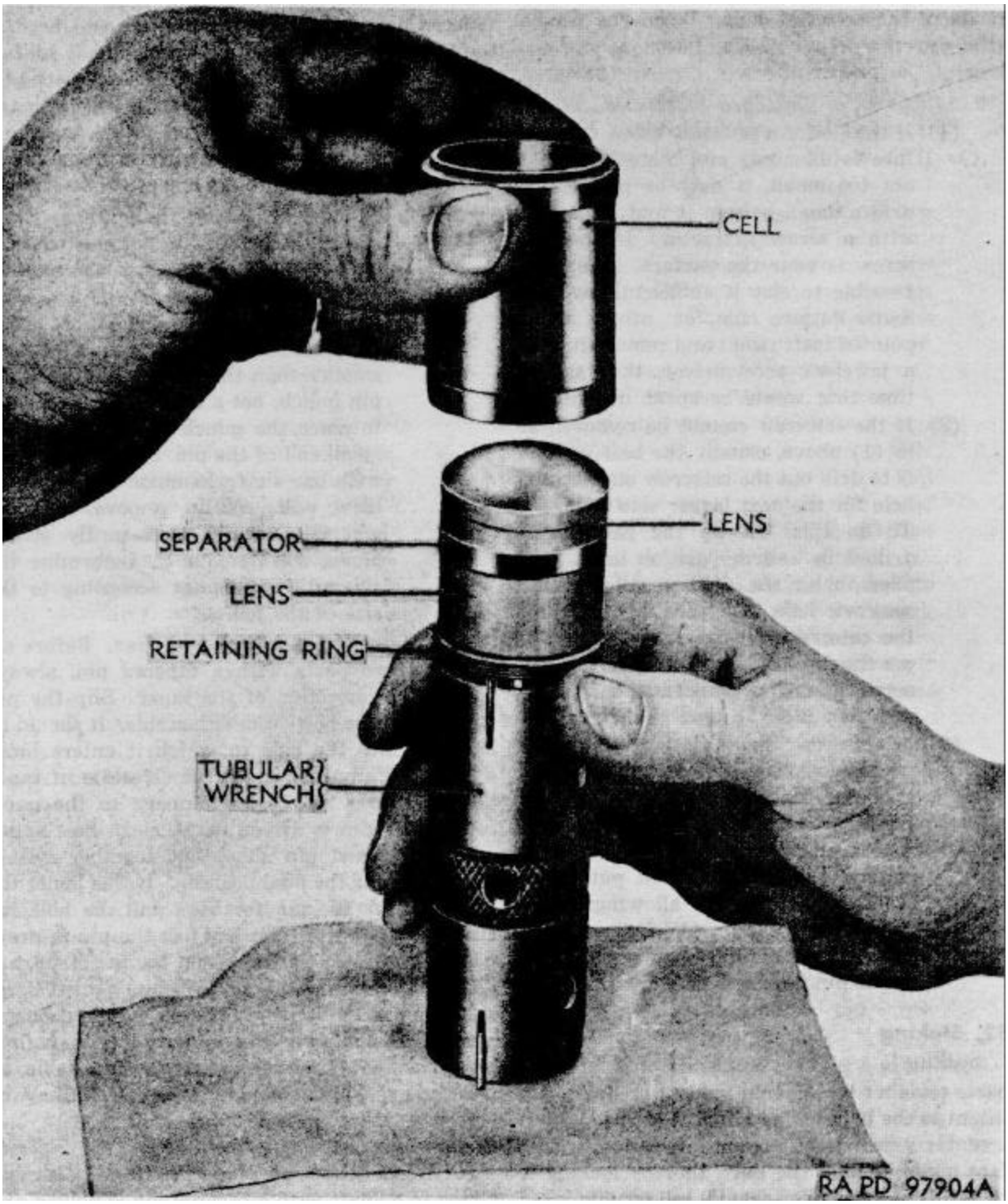

Figure 12. Removing optical elements from a cell.

reaming. Some parts also have a tapped hole to accommodate a setscrew which can hold the parts in their proper location during the drilling and reaming operations. After drilling and reaming, the setscrews or any other holding device used must be removed. The size of the drill and reamer is chosen in accordance with the size of the tapered pin.

34. Removal of Retainers and Cells

a. If a cell or lens retainer has been jammed beyond the point where it can be removed, it must be cut from the cell or tube. A thin, diamond point machinist's chisel should be used to make three cuts equidistant from each other in the retainer to the depth of the thread in the cell or tube. Care should be taken to hit the chisel properly and with the right weight so as not to damage the optical elements, the tube, or the cell. If it is possible to drill the retainer, it may assist in making the cuts. After cutting, the pieces of the retainer can be removed by prying them loose from the threads of the cell or tube. Before assembly is attempted, the thread of the cell or tube must be repaired with the proper thread chaser and a new retainer fitted.

b. Dents, bent or broken parts, and damaged cells, tubes, and separators should be repaired whenever possible. Parts should be replaced only when their use would impair the functioning of the periscope sight. Dented tubes may be repaired by using a mandrel of solid stock with an outside diameter slightly less than the inside diameter of the tube. The mandrel is inserted in the tube to the damaged section. The mandrel is then clamped in a vise and the tube is tapped with a soft mallet until the dent is pressed out and the tube returns to its proper shape.

35. Care of Optical Elements

a. General. Extreme care should be used when removing optical elements, since any slight damage to the element will make it unserviceable.

b. Removal of Lenses from Cells.

(1) To remove lenses from cells with threaded retainers, remove any setscrews securing the retainer, fit the proper size tubular .wrench to the retainer, and proceed to loosen it. When the retainer has made one revolution, turn the cell over and tap gently to allow the lens to drop onto the retainer. Maintain this inverted position while removing the retainer, and the lens will drop down evenly as the retainer is removed (fig. 12). This will prevent cocking of the lens in the cell and subsequent fracturing or chipping of the lens.

Figure 13. Applying pressure to loosen sealed lens.

(2) If the lens is sealed in the cell with either class 1 sealing compound 8030-275-8114 or adhesive sealing-compound 8030-275-8110, a shearing force is necessary to remove the lens. To greatly facilitate removal when class 1 sealing compound is used, apply-heat to the cell. Heat the cell only enough to soften the compound. Back off the retainer several turns, invert and place the cell upon clean lens tissue paper, and, utilizing several folds of lens tissue paper to prevent smudging, apply finger pressure to the top lens until the seal is broken. Finish the removal as described in (1) above (fig. 13).

c. Handling Optical Elements as Removed. Never touch the polished surface of an optical element. When optical elements are to be laid aside, each must be wrapped in a piece of clean lens tissue paper. When storing optical elements, always clean them and wrap them completely in lens tissue paper.

d. Marking of Optical Elements.

(1) Lenses. When removing lenses, each lens should be marked on an unpolished surface to show which direction it faces, what assembly it is from, and what position it occupies within the assembly (fig. 14).

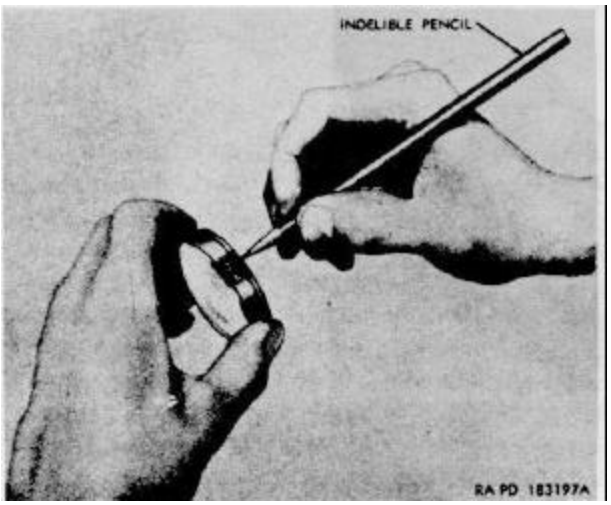

Figure 14. Lens making system.

(*a*) Designate direction of the lens when installed within the periscope sight by an arrow directed toward the objective end of the instrument.

(*b*) Show sequence and position of the lens by marking an E for eyepiece, O for objective, etc., and marking number 1, 2, 3, etc., starting from the innermost component of the assembly and ending with the retaining ring.

(*c*) In the case of uncemented compound lenses, mark lenses to retainers and to one another to insure alinement to axis to original position in assembly. Failure to do this may impair the efficiency of the system.

(2) *Prisms.* All markings on prisms are placed on the unpolished surfaces. In marking prisms, mark an arrow pointing toward the objective end of the periscope sight.

e. Cementing Compound Optical Elements. Refer to TM 9-1501 for correct procedures.

f. Coated Optical Elements. If the coating wears off, the optical elements should be coated at time of rebuild in accordance with. TM 9-1501.

g. Removal of Dirt Particles. Prior to final installation into the periscope sight of assembled optical subassemblies, tap them with a length of rubber hose to dislodge dirt particles. Examine interior and disassemble to remove dirt particles if required.

36. Cleaning

a. General. Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section. For general information regarding cleaning materials and services, refer to TM 9-1007. General cleaning instructions for periscope M28 (T46), M28C, and M28D are indicated in *b* through *e* below.

b. Metal Components. Use dry-cleaning solvent or mineral spirits paint thinner to clean or wash grease or oil from all metal parts of the periscope sight.

c. Optical Components.

(1) Clean optical elements in a dust-free atmosphere if possible. Remove all heavy surface dirt, such as smeared sealing compound and grease, with a

piece of clean surgical cotton rolled on a stick of pegwood and moistened with alcohol or acetone. If the optical element is coated, care must be exercised not to remove or damage this coating by applying excessive rubbing pressure.

(2) Wash the element in a pan of warm water containing liquid optical lens cleaning compound. With the optical element in the water, gently wipe its surfaces with a clean piece of cheesecloth or cotton until the entire dirt film has been removed.

(3) Remove the element from the pan, hold it at its polished edges, and rinse it thoroughly under warm running water until every trace of the cleaning compound is gone. Immediately pat the optical element thoroughly dry with a large piece of cheesecloth and wipe it gently with a piece of clean surgical cotton moistened with alcohol or acetone to remove any film left from the water.

(4) With lens tissue paper rolled on pieces of pegwood and moistened with acetone or alcohol, wipe away any film or particles of dust or lint remaining on the optic. It will be necessary to look at (or through) the element under a light source to see and remove these last particles.

(5) When the optical element is thoroughly clean, place it into its cell which has been cleaned previously (b above) and either return the assembly to the periscope sight or cover it so no additional dirt will fall on it.

Note. Always remember, a cleaned optical element will not stay clean if the cell or assembly into which it is placed is not just as clean as the element itself.

d. Cleaning Rules. Good general rules for cleaning optical elements are indicated in (1) through (6) below.

(1) For wiping optical elements, use only lens tissue paper, especially intended for cleaning optical glass. The use of cleaning cloths is not permitted.

(2) Use alcohol or acetone sparingly on cemented lenses, because they will penetrate the cementing compound if allowed to run over the edge of the lens.

(3) Clean installed optical elements with a piece of clean lens tissue paper fastened to a length of doweling or pegwood.

(4) Do not touch rubber to polished surfaces.

(5) in the case of coated optics, avoid repeated rubbing to prevent injury to the coating.

(6) Do not touch or handle the polished surfaces of any optical instrument.

e. General Precautions in Cleaning.

(1) Dry-cleaning solvent and mineral spirits paint thinner are flammable and should not be used near an open flame. Fire extinguishers should be provided when these materials are used. Use only in well-ventilated places. In addition, they evaporate quickly and have a drying effect on the skin. If used without gloves, they may cause cracks in the skin and, in the case of some individuals, a mild skin irritation or inflammation.

(2) The use of Diesel fuel oil, gasoline, or benzene (benzol) for cleaning is prohibited.

(3) Avoid getting petroleum products, such as dry-cleaning solvent or mineral spirits paint thinner, on rubber parts such as the eyepiece shield, because the petroleum product will deteriorate the rubber.

37. Lubrication

a. General. Lubrication of the periscope sight should be performed very carefully, as even a very slight amount of over lubrication often will render an item unfit for use. Excess lubricant may congeal and render close fitting parts inoperative. Lubricants for the periscope sight function also as rust preventives. It is important that they be applied carefully. It is essential that parts to be lubricated be cleaned thoroughly prior to the application of the lubricant, as corrosion may develop under grease if all foreign matter has not been removed. Specific lubrication instructions are contained in the assembly section.

b. Grease. For all parts of the periscope

sight for which grease has been indicated in the pertinent assembly instruction, aircraft and instrument grease 9150-261-8298 will be used. Normally, grease will be applied to all bearing or contact surfaces which move relative to one another and to all unprotected metal surfaces even though they are not working surfaces.

c. Oil. Use a general-purpose oil only to treat bare metal surfaces when parts are to remain disassembled for any length of time. Oil will not be used as a lubricant during assembly of periscope M28 (T46), M28C, and M28D.

38. Precautions Prior to Bonding and/or Sealing

a. Inspection of Parts.

(1) Polished surfaces of optical elements, whether they are glass, methylmethacrylate, or any other light transmitting material, which are part of the optical system must be properly cleaned (par. 36) prior to sealing.

(2) Check mating parts to see if they are within tolerance so as to give a proper fitting.

(3) Where possible, check the void formed to receive the sealer to insure against obstruction which will retard the flow of the sealing compound.

(4) Check the contact points between the component parts to make sure there is unrestricted sealing and freedom from strain through assembly of the integral parts.

(5) Where the compound is used as a cushion, check the assembly to assure sufficient clearance between parts for complete coverage with the compound. This prevents chipping and other types of failure induced by mechanical shock or temperature variations.

b. Clean Surfaces.

(1) Surfaces must be thoroughly clean before bonding or sealing, since the presence of a film of grease or oil reduces adhesion.

(2) Cleaning procedures (par. 36) approved for component parts of fire-control instruments should be sufficient to produce a surface conducive to a properly sealed joint.

(3) If non-adherence of the compound to metals is experienced, clean the surfaces with alcohol.

c. Assemble Parts.

(1) Assemble the parts to be bonded or sealed with great care.

(2) The parts should be in such a relative position that the injection of the compound will not create internal strain on any parts of the assembly or assembly as a whole.

39. Bonding and Sealing With Adhesive Sealing Compound 8030-275-8110

NOTE

Prior to bonding and sealing, the precautions stated in paragraph 38 should be observed.

a. Mixing Sealing Compound with Accelerator.

(1) Adhesive sealing compound is supplied in a two-compartment metal container. One compartment contains sealing compound and the other compartment contains accelerator. Mix the accelerator with the sealing compound in a ratio of 8 to 1, respectively, by weight.

(2) These proportions must be maintained for proper curing, regardless of the quantity being mixed.

(3) Mix only the quantity that can be used in a working period of approximately 2 hours.

b. Application of Sealing Compound. The adhesive sealing compound is used with periscope M28 (T46), M28C, and M28D only to seal the orange-red filter within the elbow group assembly. The compound may be applied with a sharpened dowel stick and packed tightly and carefully around the beveled edge of the filter.

c. Curing of Sealing Compound.

(1) Place the sealed assembly in an oven; within 2 hours, partial curing is observed.

(2) The curing time is from 4 to 8 hours at a temperature of 165° to 175° F.

NOTE

This is not the oven temperature but the temperature of the item being processed. Oven temperature should not exceed 170° F.

(3) The adhesive sealing compound can be cured by allowing the instrument to stay at a room temperature of approximately 80° F., from 72 to 96 hours. This is an alternate procedure to the accelerated heat method and can be applied when planning allocates the time.

40. Sealing with Class 1 Noncuring Sealing Compound 8030-275-8114

a. Sealing may be done with the pneumatic grease gun 7648134 (table I), using the improvised pneumatic grease gun adapter (table II). Approximately 1,500 psi is required to extrude the compound from the adapter.

b. Prevent air pockets from forming when loading the pneumatic grease gun with compound, to insure an even flow into the sealing cavities.

c. Hold the improvised pneumatic grease gun adapter tightly against the injection sealing port of the instrument.

d. Fill the cavity with the compound until it begins to appear in adjacent ports. These sealing ports are used for pressure relief or for progressive filling. Use only specified pressure to keep the mass moving.

CAUTION

Do not use excessive pressure in are effort to fill a large area without transferring the adapter. This will create unnecessary strain and may cause displacement of parts.

e. Do not use an overabundance of sealing compound, because in the final cleaning of the instrument all excess sealing compound must be removed.

41. Painting

Paint all exposed surfaces so that the equipment will have the appearance of a new item. Refer to TM 9-2851 for detailed information on painting.

Section II. REMOVAL AND DISASSEMBLY

42. General

a. Organizational maintenance in TM 9-7022, TM 9-2300-203-12, TM 9-2360-215-20, and TM 9-2350-224-20 covers preventative services, care in handling, lubrication and cleaning of accessible external mechanical parts, cleaning external optical elements, and serviceability tests pertinent to organizational maintenance.

b. This section provides direct support general support, and depot maintenance personnel with complete information for the removal of periscopes M28 (T46), M28C, and M28D and link assembly (Fig. 1) from the on carriage position in cupola M13 on the fu tracked armored personnel carrier M59 and on the 4.2-inch full tracked self propelled mortar M84. It also describes removal of the periscope and link assembly from the Commander's cupola of the 90-mm gun full tracked combat tanks M48A2 and M48A3, 105-mm gun full tracked combat tanks M60 and M60A1, and flame thrower M67A1 and the complete disassembly of the periscopes, all subassemblies, and of the link assembly in proper sequence.

43. Removal of Periscope M28 (T46), M28C, and M28D From On-Carriage Position

NOTE

Removal procedure described in a through d below is applicable for those periscopes installed in the cupola M13 on the M59 and M84 vehicles and for those periscope installed in the 90-mm gun tanks M48A2C and M48A3, the 105-mm gun tanks M60 and M60A1, and flame thrower M62A1.

a. Pull the lamp bracket of instrument light M50 from the dovetailed slot on the sight's light source mounting plate. Slide the lamp bracket into the lamp bracket block on the instrument light.

b. Hold the connecting arm assembly (fig. 1) and squeeze open the alligator jaws of the quick-release clamp to release the link assembly from the periscope sight. Allow the link assembly to rotate down and out of the way and gently allow the arm assembly to travel up against its stop.

CAUTION

See caution decalcomania (Fig. 1) and do not permit sudden release of the arm assembly, which will snap back and damage the periscope sight.

c. Depress and hold the locking button (fig. 5) of the periscope mount M104A1 and M104A2 and pull the locking handle counterclockwise to its limit of travel beyond the button.

NOTE

Utilize a screwdriver or other similar tool to depress the button, in order to avoid pinching the fingers as the locking handle is rotated.

d. Support the periscope sight to prevent it from dropping, lift the catch upward, and carefully lower the sight out of the mount.

44. Removal of Sight Link Assembly From Installed Position

a. After removal of the periscope sight as directed in paragraph 43, unscrew the 1/4 x 1 5/16 hexagon-socket bolt (fig. 1) and remove the bolt with the 1/4-inch lockwasher that secures the link assembly to the mounting fork

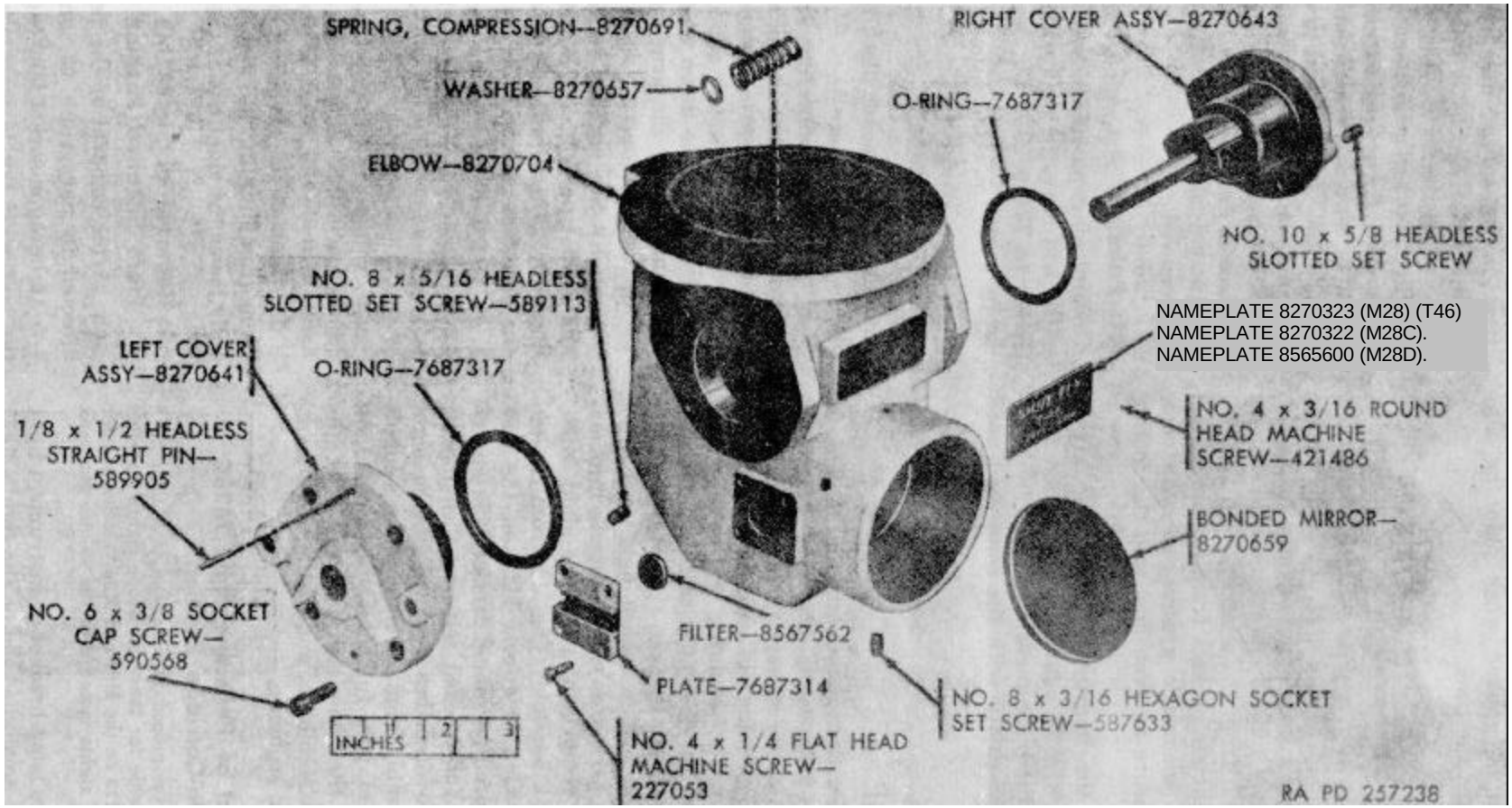

Figure 15. Elbow group - exploded view

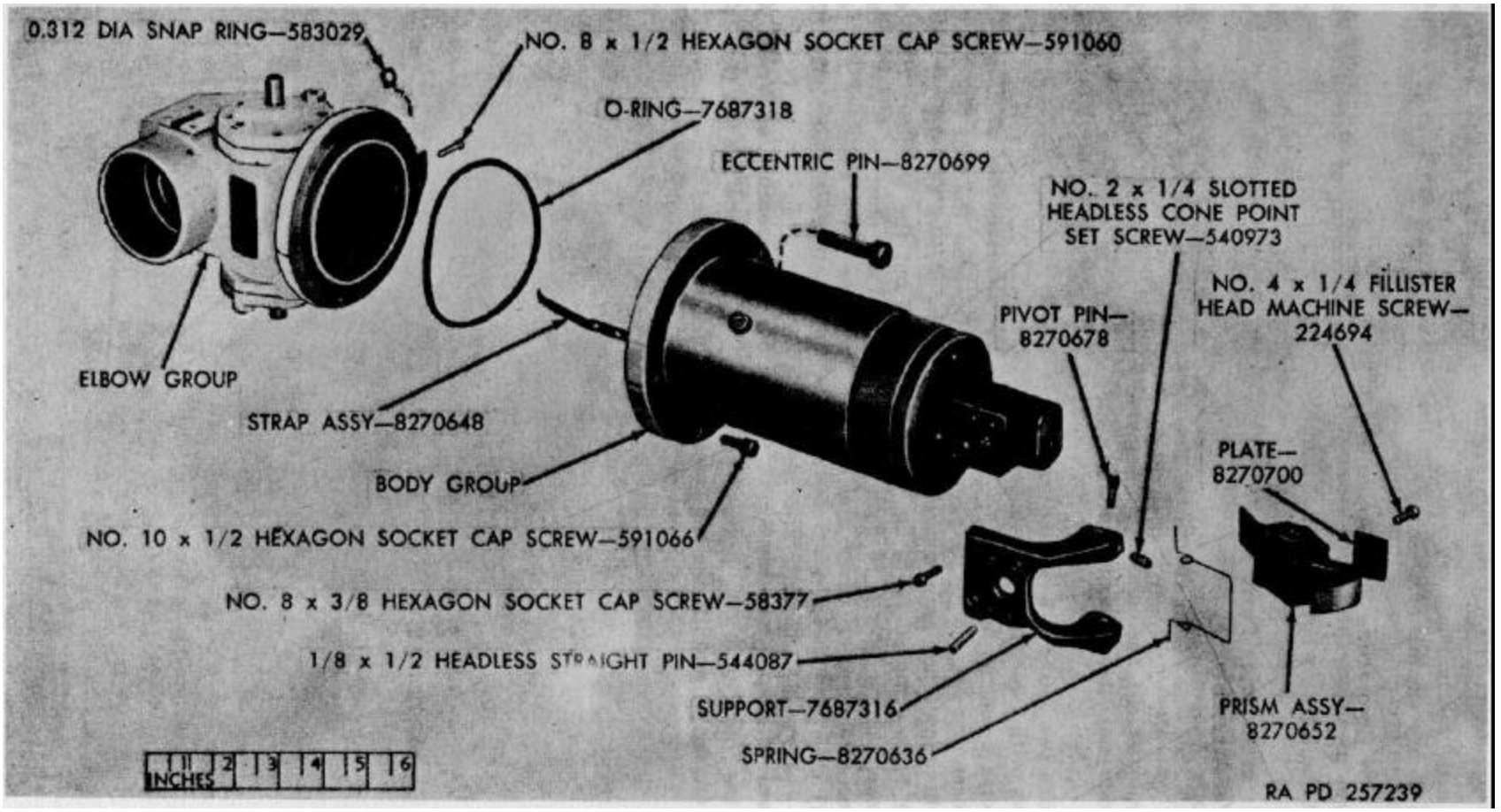

Figure 16. Body and elbow group assembly

(fig. 4) of the cupola. Lift out the link assembly.

b. Tape or tie the bolt and washer to the link assembly to prevent loss of these items.

45. Removal of Connecting Arm Assembly

Drive out one No. 1/8 x 1/16 headless straight pin (C, Fig. 6).

46. Removal of Exterior Parts from Periscope Assembly

a. Unscrew two No. 6 x 1/4 roundhead machine screws and lift the identification plate from the body and elbow group assembly (fig. 15).

b. Remove two No. 8 x 3/16 panhead machine screws with two No. 8 lockwashers and lift off cover (M and N, fig. 6).

c. Unloosen one No. 4 x 1/2 hexagon-socket capscrew, this allows the clamp, washer, spring, and washer to be removed (Q-S, fig. 6).

d. Remove four No. 8 x 5./16 flathead machine screws and remove cover and gasket (J-L, fig. 6).

47. Removal of Cap Assembly

Remove the four No. 6 x 1/2 hexagon-socket capscrews (A, fig. 6) and lift the cap assembly from the body and elbow group assembly.

NOTE

The cap assembly was sealed and the foul screws were locked to the body and elbow group assembly and extra care and effort will be required during removal.

48. Removal of Eccentric Pin

Remove 0.312-inch diameter snap ring and remove the No. 8 x 1/, hexagon-socket capscrew (fig. 16) and lift out the eccentric pin.

49. Removal of Eyepiece Assembly

Remove three No. 8 x 3/16 socket-type flat point setscrews. The sealing is broken by rotating the eyepiece. Once the seal is broken the eyepiece (E, fig. 6) is unscrewed from the elbow.

50. Disassembly of Cap Assembly

Unscrew the four No. 2 x 3/16 flathead machine screws and lift off the two clamps and push out the window. Unscrew valve assembly. Care must be taken because the window and the valve assembly are sealed in the ca; with sealing compound 8030-275-8110 (fig. 17)

51. Disassembly of Valve Assembly

a. Unscrew the cap (fig. 18) from the outer air valve.

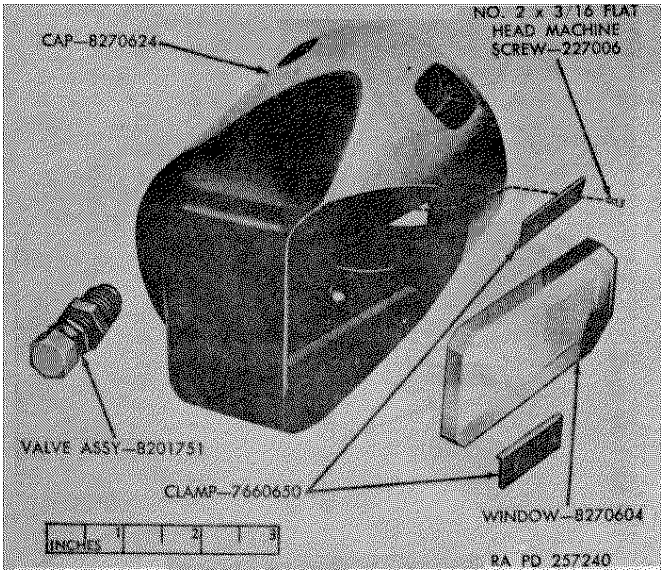

Figure 17. Cap assembly

b. Using the improvised inner air valve wrench (table II), unscrew the inner air valve from the outer air valve (fig. 19).

52. Disassembly of Body and Elbow Group Assemblies

CAUTION

The bonded prism assembly is spring-loaded and will rotate downward and strike the objective cell when the strap assembly is disconnected. It is necessary that cushioning material be inserted and that spring tension be gently released, as described below, in order to prevent breakage of the prism.

a. Insert a large tuft of lens tissue paper and/or cotton between the bonded prism assembly and the top of the objective cell (fig. 16). Hold the prism in a fixed position and unscrew the No. 4 x 1/4 fillister-head machine screw that secures the tape to the pulley surface of the body assembly. Gently release the spring tension of the bonded prism assembly so that it is cushioned on the paper and/or cotton.

b. Unscrew and remove the five No. 10 x 1/2, hexagon-socket capscrews and lift the body group assembly from the elbow group assembly, taking care not to damage the strap assembly projecting from the elbow group assembly.

c. Remove the 3.234-inch inside diameter preformed packing O-ring from its groove in the elbow group assembly (fig. 16).

53. Disassembly of Body Assembly

a. Remove two No. 2 x 1/4 headless-slotted cone-point setscrews, permitting removal of the two pivot pins. In removing the pivot pins, the bonded prism assembly and spring can be removed (fig. 16).

b. Remove three No. 8 x 9/16 fillister-head machine screws. This allows the removal of the cell assembly (fig. 20). Caution must be used because the cell assembly is pinned with two 1/8 x 5/8 headless straight pins.

c. Remove two 1/8 x 5/8 headless straight pins from the body.

d. Remove four No. 8 x 3/8 hexagon-socket capscrews from cell assembly and lift off support. Caution must be taken because support

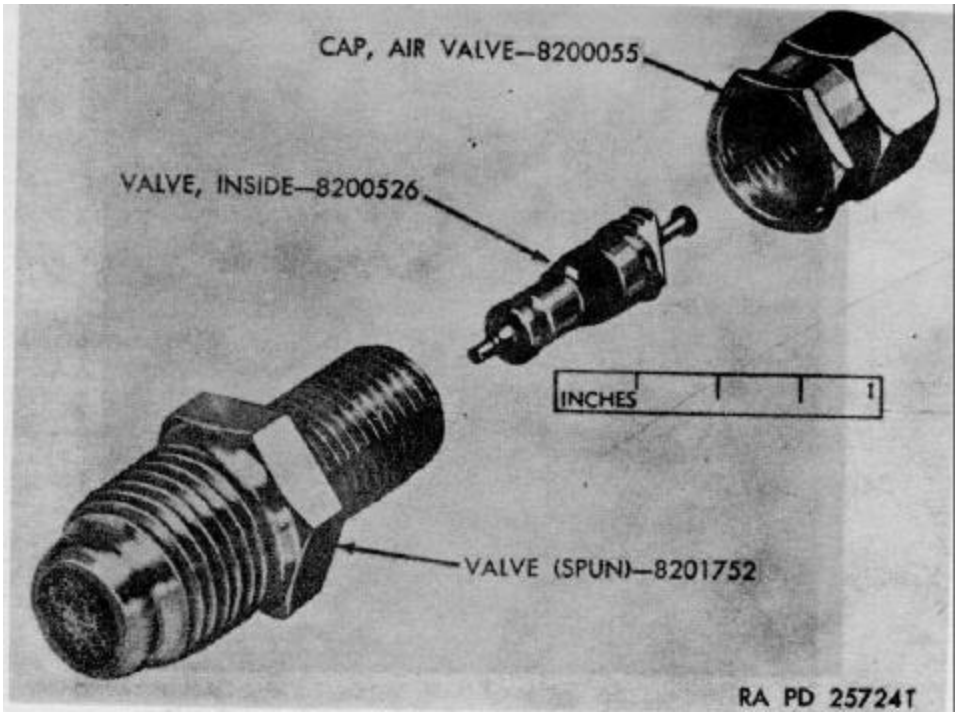

Figure 18. Valve assembly.

is pinned to cell assembly (fig. 20).

e. Remove the two 1/8 x 1/2 headless straight pins from cell (fig. 16).

54. Disassembly of Cell Assembly

Remove three No. 4 x 1/8 headless-slotted setscrews, permitting the removal of the erector assembly from the objective assembly (fig. 21).

55. Disassembly of Erector Assembly

Using T-wrench, unscrew retainer (fig. 22). Carefully remove two lenses and spacer from cell (par. 35*b*). Mark the optical elements immediately upon removal (par. 35*d*).

56. Disassembly of Objective Lens Assembly

a. Using T-wrench, unscrew retainer (fig. 23), carefully remove six lenses and five spacers from cell (par. 35*b*). Mark the optical elements immediately upon removal (par. 35*d*).

b. Remove one 5/16 x 1/2 headless straight pin.

57. Disassembly of Elbow Group Assembly

(fig. 15)

a. Unscrew four 6 x 3/8 hexagon-socket capscrews and pry off left cover assembly with O-ring carefully, because the cover is pinned in position with two 1/8 x 1/2 headless straight pins.

b. Remove the two 1/8 x 1/2 headless straight pins from the elbow only if they are damaged and need replacing.

c. Proceed as in *a* above to remove right cover assembly with O-ring.

d. Unscrew four No. 4 x 1/4 flathead machine screws and remove plate and filter. Care should be used in removing filter because of the sealing compound around the filter.

e. Unscrew three No. 8 x 5/16 hexagon-socket setscrews, this allows the bonded mirror assembly to be unscrewed and removed.

58. Disassembly of Left Cover Assembly

NOTE

Do not disassemble the left cover assembly (fig. 24) unless it is necessary to replace a worn or defective bearing.

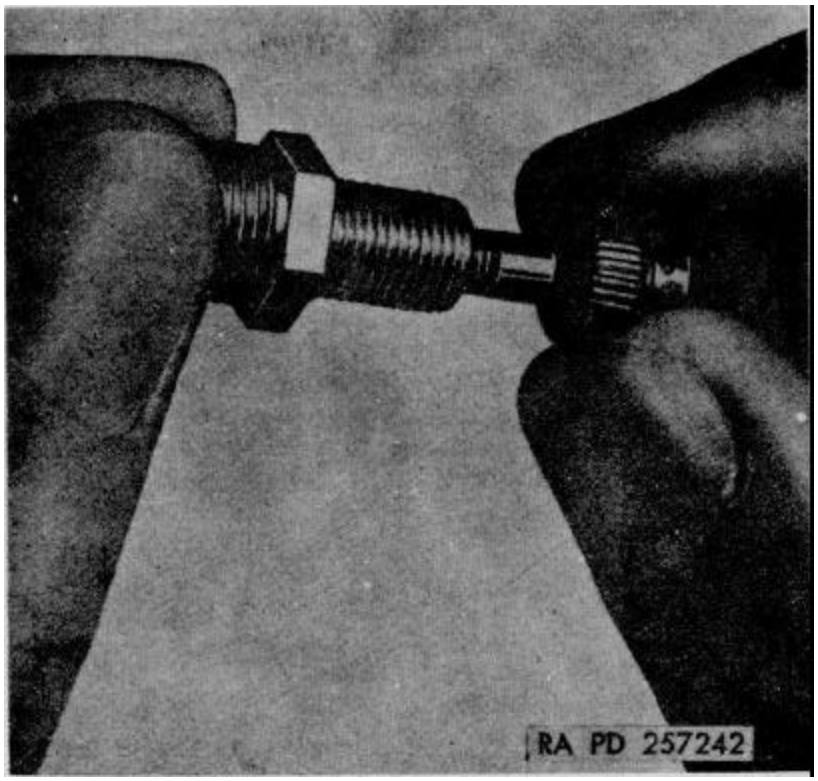

Figure 19. Improvised wrench to remove inner air valve.

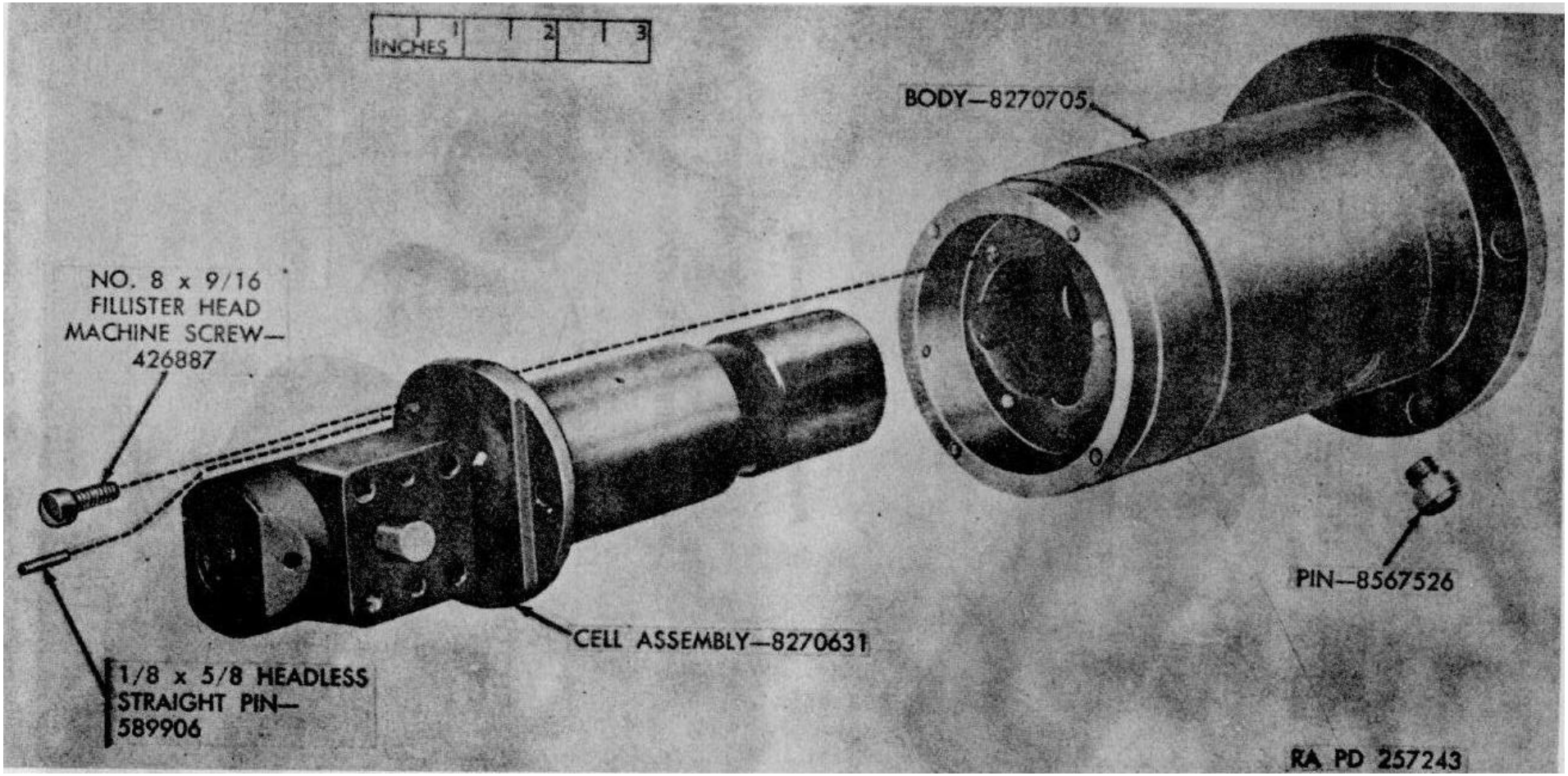

Figure 20. Body Assembly

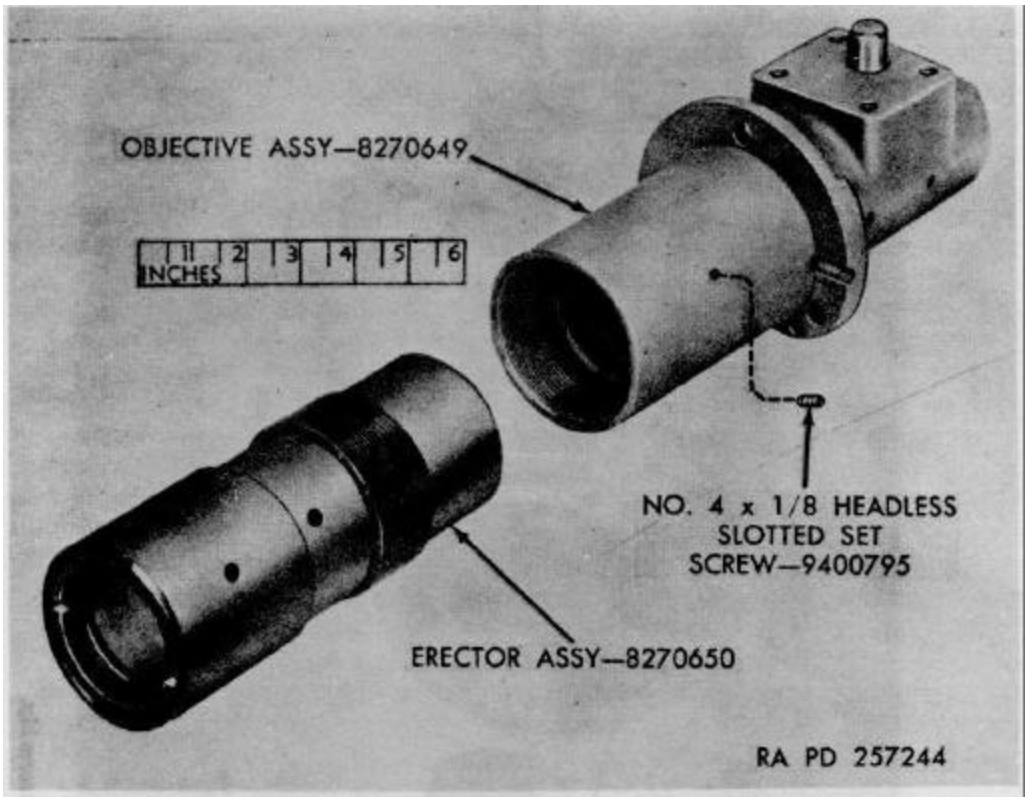

Figure 21. Cell assembly.

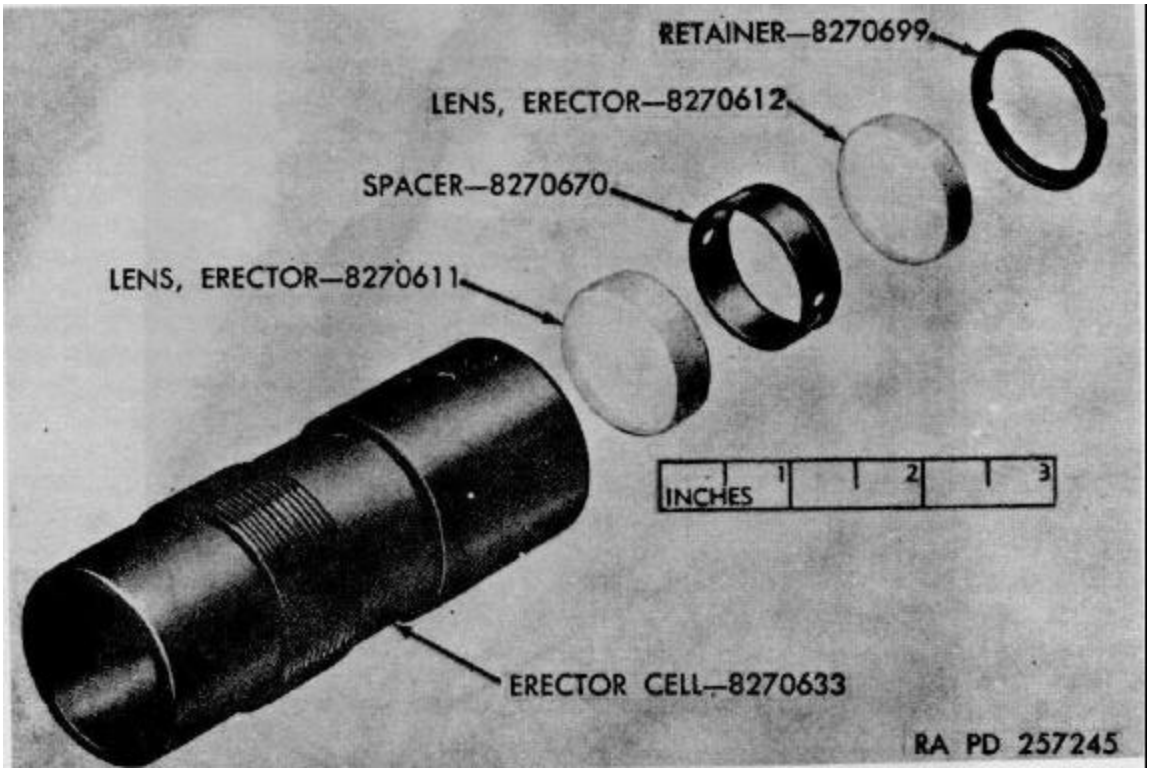

Figure 22. Erector assembly.

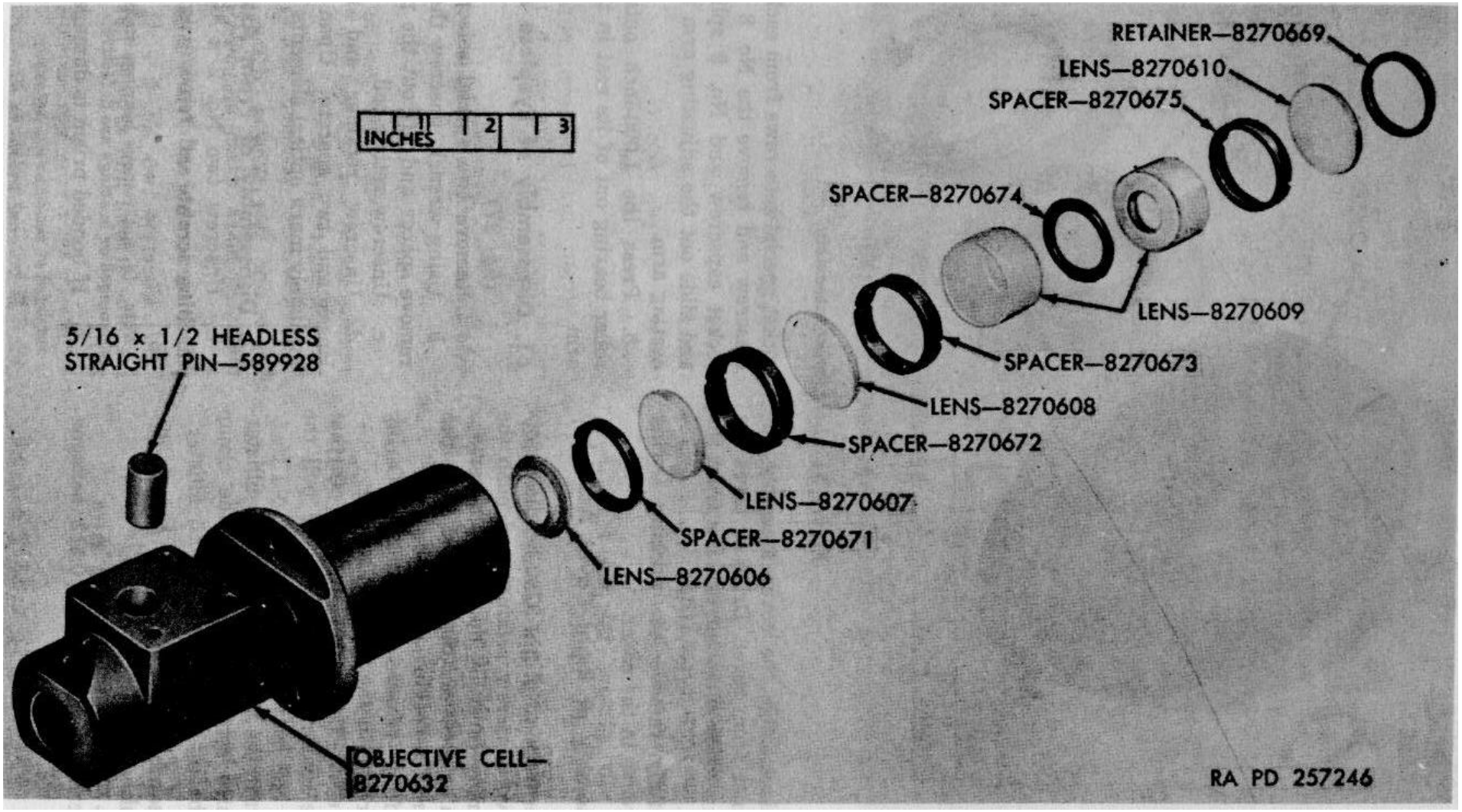

Figure 23. Objective assembly

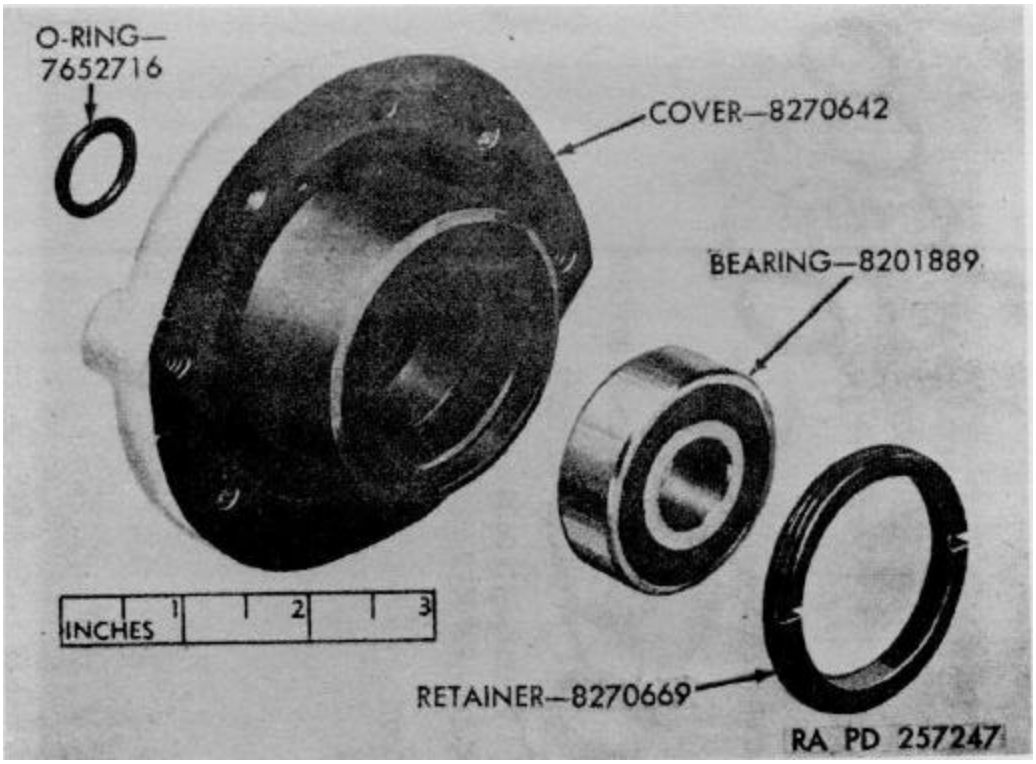

Figure 24. Left cover assembly.

a. To disassemble the cover assembly unscrew retainer from cover. Drive or press the 1.0236-inch outside diameter bearing from the cover.

b. Carefully remove the packing O-ring from its groove in the cover.

59. Disassembly of Right Cover Assembly
(fig. 25)

a. Unscrew one No. 2 x 3/32 headless-slotted setscrew. Unscrew retainer and push the shaft assembly carefully out of the cover.

b. Push or press out the second 1.0236-inch outside diameter bearing from the cover.

c. Carefully remove the packing O-ring from its groove in the cover.

d. Drive out the 6/0 x 1/2 tapered pin that secures the spacer to the shaft, and pull the spacer and ball bearing off the shaft.

e. Extract the two No. 4 x 5/16 fillister-head machine screws and remove the clamp from the shaft.

60. Disassembly of Connecting Arm Assembly
(fig. 26)

a. Unscrew the two 1/4 x 0.312 hexagon socket special setscrews from each side of arm Unscrew and remove the No. 8 x 1 hexagon-socket capscrew and No. 8 split lockwasher and slide out the adjusting arm from the connecting arm.

b. Press the 1.000-inch outside diameter roller bearing out of its seat in the connecting arm.

61. Disassembly of Eyepiece Assembly
(fig. 27)

a. Remove two special setscrews

b. Using wrench, unscrew the retainer ant remove spacer and lift out the reticle.

c. Unscrew reticle cell.

d. Unscrew retainer and remove three lenses and two spacers. Upon removal, immediately mark optical elements (par. 35*d*).

62. Disassembly of Prism Assembly

a. Unscrew two No. 2 x 1/8 fillister-head machine screws and remove light shield (fig. 28).

NOTE
Do not remove bearings unless bonded prism is damaged or bearings are defective.

b. If bonded prism is damaged in any way,

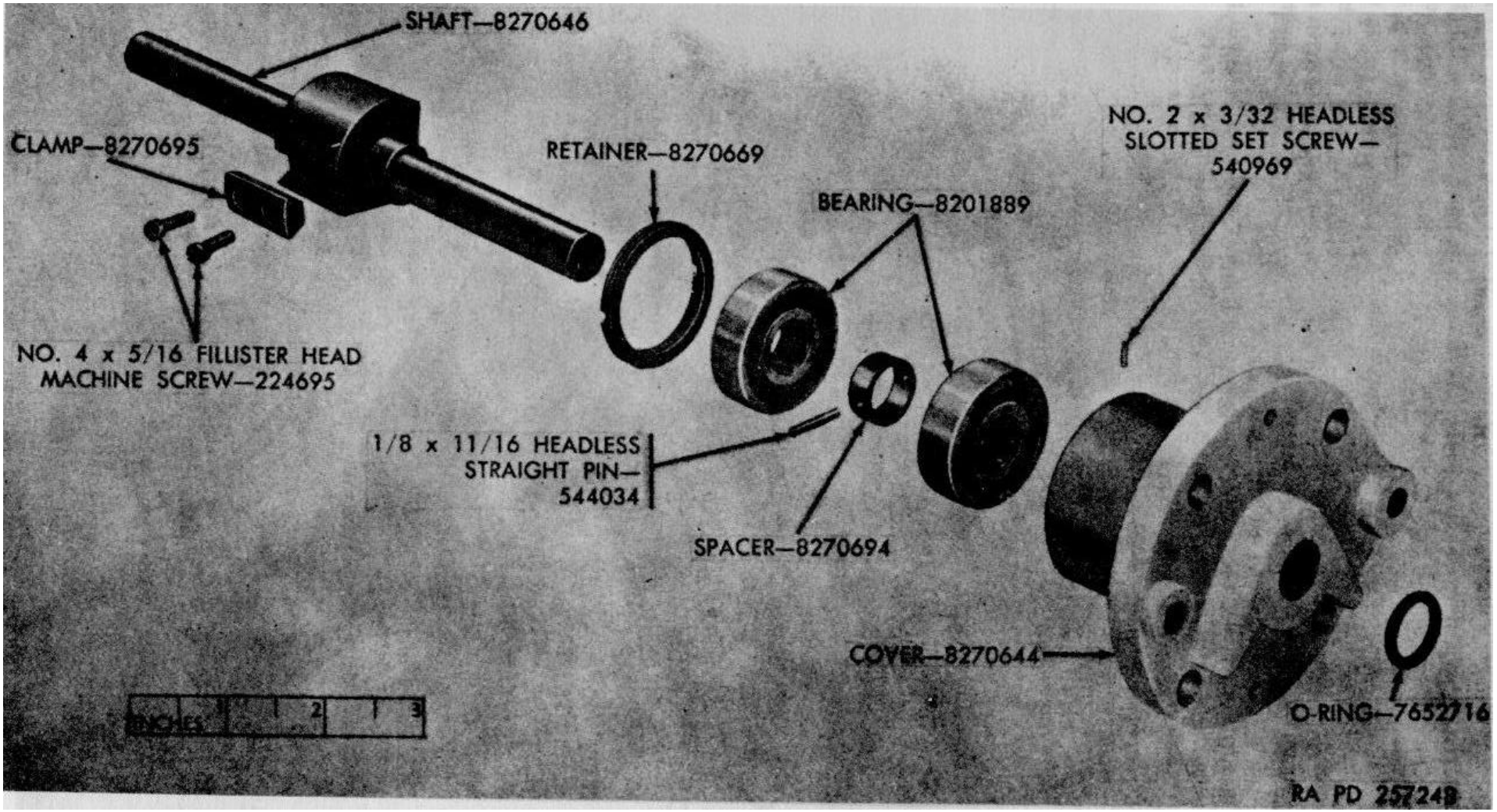

Figure 25. Right cover assembly

remove bearings by pushing out bearings with a piece of drill rod. Proceed to remove prism from mount by either one of the two methods described below.

(1) Heat bonded prism with a torch until the mount is heated to the point where the prism will move under pressure. With lens tissue paper as a protection for the prism, twist the prism loose from the mount.

(2) Place bonded prisms into oven and bake the bonded prism at 300° F., for 1 hour. Remove bonded prism from oven, placing lens tissue paper over prism. Hold prism with one hand and mount with other hand and separate the two parts with a twisting motion.

NOTE

Do not disassemble light shield unless necessary.

c. Drive out light shield pin (fig. 28). Separate shield from retainer.

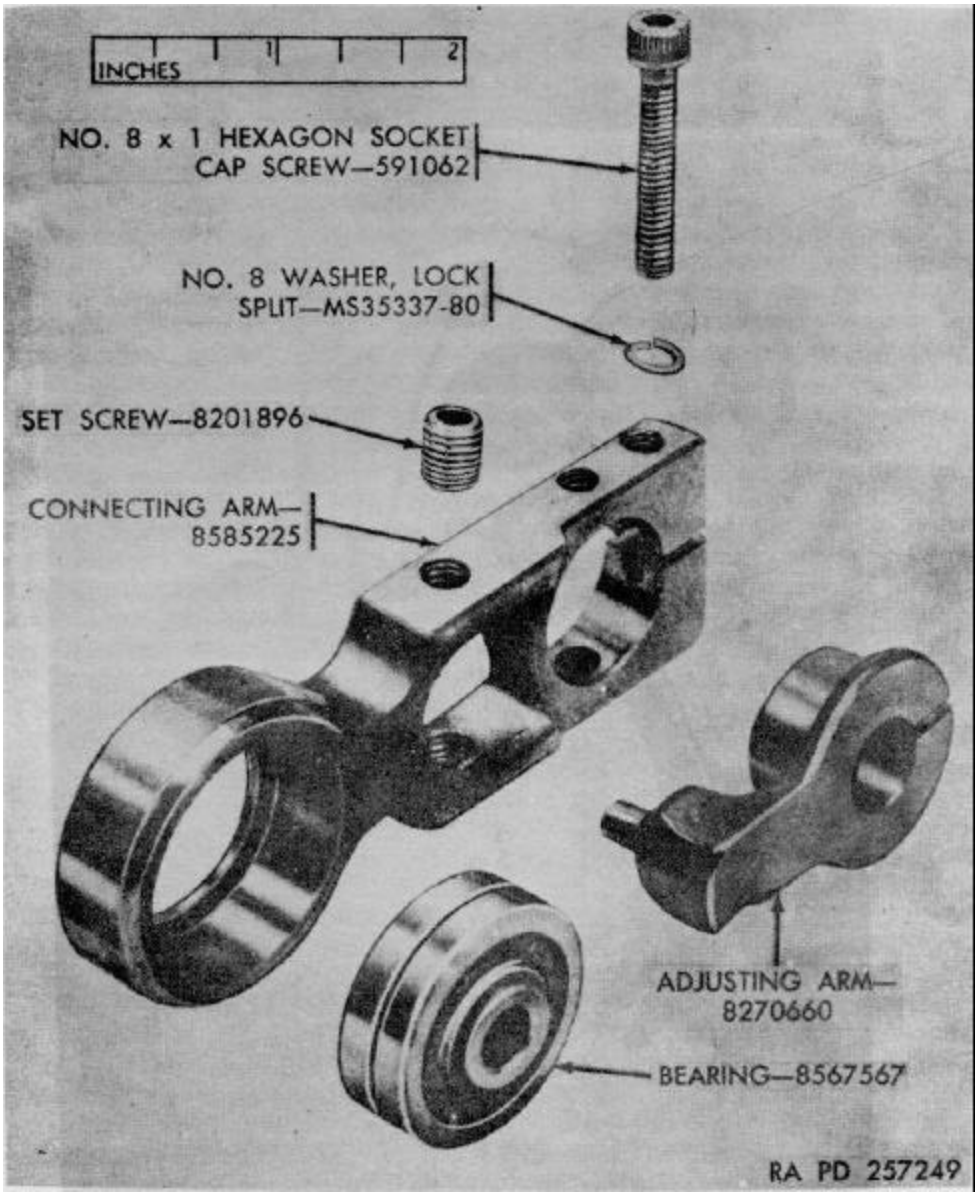

Figure 26. Arm assembly

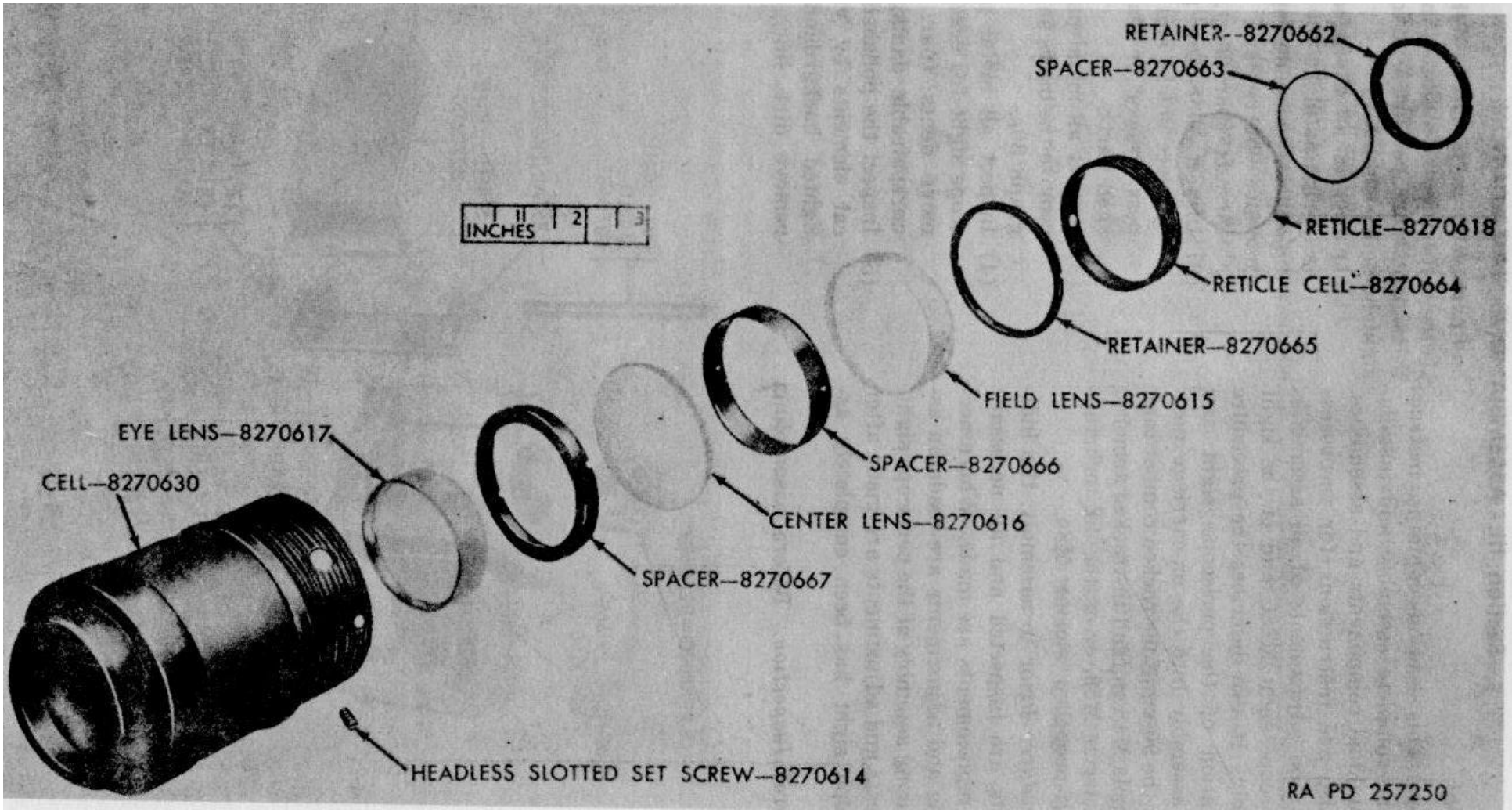

Figure 27. Eyepiece assembly

Section III. ASSEMBLY AND INSTALLATION

63. General

a. Scope. This section contains instructions for the complete assembly and installation of individual components and assemblies. Included also are instructions for in-process inspections and adjustments of all assemblies of the periscope M28 (T46), M28C, and M28D and of the sight link assembly. It also describes the procedure for installation of the periscope sight and sight link assembly into the on-carriage position within the 90-mm full-tracked combat tank M48A2, cupola M13 on the full-tracked armored personnel carrier M59, or on the 4.2 inch full-tracked self-propelled mortar M84.

b. Procedure. Prior to assembly, the individual parts are inspected and all necessary repairs or replacements are made. Where necessary, tests and adjustments are made on assemblies during assembly of the periscope sight. The final tests and adjustments are made after the periscope sight has been completely assembled.

c. General Inspection. Before assembling any part of the periscope M28 (T46), M28C, and M28D, complete the inspections as indicated in (1) through (11) below which are pertinent to that part of the sight being assembled.

(1) Inspect all threaded portions of the periscope sight for stripped, burred, or otherwise damaged threads. Remove burs and repair damaged threads (par. 30*e*).

(2) Inspect all rubber parts such as the eyepiece shield and packing for dryness, cracks, or tears. Replace damaged parts.

(3) Inspect all metal parts for burrs and remove the burrs as indicated in paragraph 30*e*.

(4) Inspect all metal parts of the periscope sight for cracks and dents. Remove dents (par. 34*b*) or replace unrepairable damaged parts.

(5) Inspect the polished surfaces of optical elements by viewing against a lighted background. Look for and remove dirt, lint, oil, grease, moisture

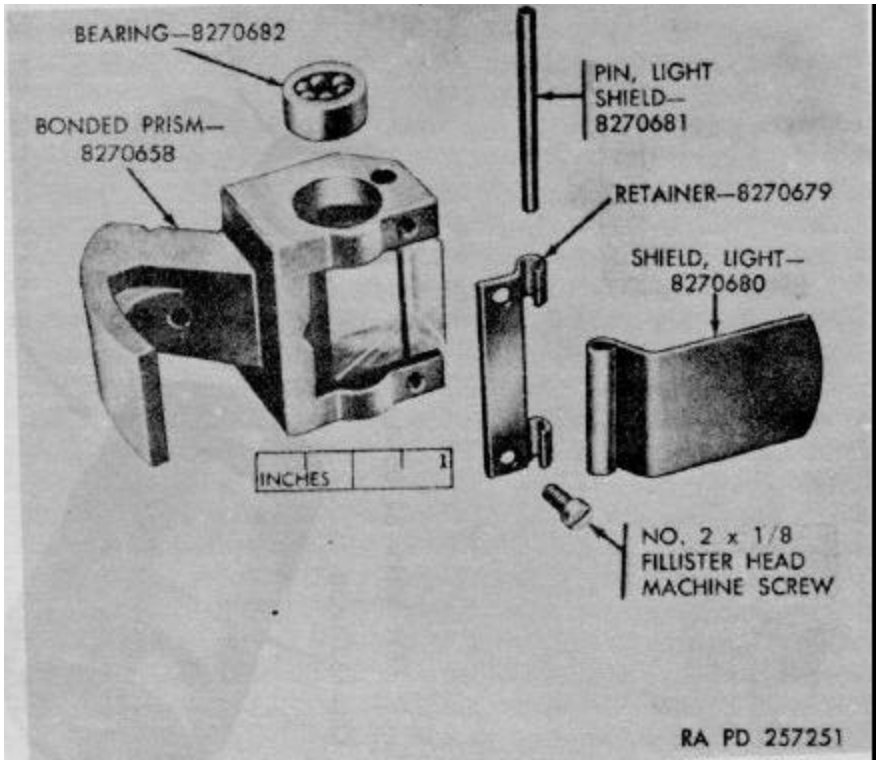

Figure 28. Prism assembly.

and sealing compound (pars. 35 and 36). Hold each element between a strong light and a dark background. Slowly rotate and tilt the element and visually inspect its polished surfaces. Replace any element that is chipped or cracked or is excessively scratched. Cement any compound lens (par. 35*e*) in which the cement shows signs of deterioration or breaking up. Re-coat the coated surfaces of optical elements (par. 35*f*) if the coating shows signs of deterioration or breaking up.

(6) Slots in the retainers, cells, and screw heads must be square and undamaged. Where slots are rounded or burred, restore to proper condition by filing.

(7) For general cleaning of the periscope sight, refer to paragraph 36.

(8) For all parts of the periscope sight requiring lubrication at the time of assembly, aircraft and instrument grease 9150-261-8298 will be used (par. 37). Oil will not be used during assembly for lubricating purposes.

(9) Inspect all metal surfaces for rust and corrosion. Remove rust and corrosion (par. 30*f*) if present.

(10) All pinholes must be clean and well-machined to allow the proper insertion of the pins.

(11) The inner or outer races of all bearings will rotate freely without binding or rough motion when the opposite race is held stationary.

64. Assembly of Eyepiece Assembly

a. Insert the eyelens, spacer, center lens, spacer, and field lens in that order as shown in figure 27 in the cell, making sure that each is seated in place. Correct assembly is made by following the markings made during disassembly.

b. Apply a very light coat of orange shellac varnish to the threads of the field lens retainer 8270665. Place the retainer on the interior of the cell and screw the retainer into the tube, then with a tubular wrench, tighten retainer until it rests snugly against the field lens. To prevent damage to the lens, hand tighten retainer ring against lens to prevent lens from shaking.

c. Seal the eyelens to the tube by injecting class 1 sealing compound (par. 40) into the four injection sealing ports of the cell, using the pneumatic grease gun (table I) and pneumatic grease gun adapter (table II).

d. Screw reticle cell into cell and place reticle and. ,spacer into reticle cell and place retainer on the interior threads of the cell. To prevent damage to the reticle, hand tighten retainer. The retainer will be locked in position after adjustment for collimation by two setscrews (fig. 27).

65. Assembly of Connecting Arm Assembly

a. Lubricate the 1.000-inch outside diameter roller bearing (fig. 26) and press it into its seat in the connecting arm.

b. Insert the adjusting arm into its hole in the connecting arm into the same side that the ball bearing (a above) was installed.

c. Secure the adjusting arm lightly with the No. 8 x 1 hexagon-socket capscrew and No. 8 split lockwasher and screw the two 1/4 x 0.312 hexagon-socket special setscrews into the connecting arm, one on each side, so they rest against the adjusting arm. By adjustment of the two setscrews, aline the adjusting arm centrally within the connecting arm. Tighten the No. 8 x 1 hexagon-socket capscrew.

66. Assembly of Right Cover Assembly

a. Place retainer on shaft (fig. 25). Lubricate (par. 37) the 1.0236-inch outside diameter bearing and place it on proper end of shaft, placing it far enough onto the shaft to permit assembly of the spacer.

b. Slide spacer onto the shaft until its tapered pin hole is alined with the tapered hole in the shaft. Secure spacer in place by installing one 6/0 x 1/2 taper pin (par. 33*b*).

c. Move the bearing back toward the spacer until its inner race is against the spacer.

NOTE

If new parts are used, locate them as shown in figure 25 and drill and ream for the 6/0 x 1/2 tapered pin, using the hole drilled through one side of the space as a guide.

d. Insert the preformed packing O-ring into the groove in the cover.

e. Lubricate (par. 37) the 1.0236-inch outside diameter bearing and insert it into the cover making sure the bearing is properly seated. Insert the shaft with spacer, bearing,

and retainer through the bearing and cover until the spacer is seated against the race of the bearing installed in *a* above.

f. Apply a light coat of orange shellac varnish to the threads of the retaining ring and screw it into the cover, thus securing the shaft into the cover. Secure retainer by use of one No. 2 x 3/32 headless-slotted setscrew.

67. Assembly of Left Cover Assembly

(fig. 24)

a. Lubricate (par. 37) the 1.0236-inch bearing and press the bearing into the cover, making sure it is properly seated in the cover. Secure the bearing in the cover with retainer.

b. Place preformed packing O-ring in the groove of the cover.

68. Assembly of Elbow Group

(fig. 15)

a. Place on preformed packing O-ring on the left cover assembly and one on the right cover assembly. Place the two cover assemblies into elbow and secure with eight No. 6 x 3/8 hexagon-socket capscrews.

b. Place red filter into recess, bevel edge facing in. Apply adhesive sealing compound 8030-275-8110 (par. 39) around the edge of the filter. Place light source mounting plate in position with notched edge to the right and secure to elbow with four No. 4 x 1/4 flathead machine screws.

c. Screw bonded mirror into elbow.

d. Screw three No. 8 x 5/16 socket-type setscrews into back of elbow.

e. Secure tape assembly to shaft with clamp and two No. 4 x 5/16 fillister-head machine screws.

69. Assembly of Objective Lens Assembly

a. Press 5/16 x 1/2 headless straight pin into objective cell.

b. Following the markings made during disassembly, insert six objective lenses and five spacers squarely into the objective lens cell (fig. 23). Make certain the surfaces of greatest curvature of the lenses face one another. Apply a light coat of orange shellac varnish to the threads of the objective lens retainer and screw the retainer in place against the outer lens. To prevent damage to the lenses, hand tighten the retainer to secure lenses.

70. Assembly of Erector Lens Assembly

Following the markings made during disassembly, insert two lenses and one spacer into the erector cell (fig. 22). Make certain the surfaces of greatest curvature of the lenses face one another. Apply a light coat of orange shellac varnish to the threads of the erector lens retainer and screw the retainer in place against the outer lens. To prevent damage to lenses, hand tighten retainer.

71. Assembly of Cell Assembly

Screw erector cell assembly into objective cell assembly. After assembly, cell assembly is collimated. Secure cells with three No. 4 x 1/8 headless-slotted setscrews (fig. 21).

72. Assembly of Prism Assembly

Press two bearings into bonded prism mount

73. Assembly of Body Group

a. Place cell assembly (par. 71) into body and secure with three No. 8 x 9/16 fillister-head machine screws (fig. 20).

b. Mount support to cell assembly, secure with four No. 8 x 3/8 hexagon-socket capscrew (fig. 16).

c. Assemble bonded prism assembly with spring and support with two pivot pins and lock pivot pins in position with two No. 2 x 1/4 headless-slotted cone-point setscrews (fig. 16)

d. Mechanically aline cell assembly (fig. 20) so that the two pivot pins (fig. 16) are parallel to the eccentric pinhole. Secure cell assembly by tightening the three screws in *a* above. Drill and ream two holes and drive in two 1/8 x 5/8 headless straight pins to secure the cell assembly to the body from rotating.

74. Assembly of Body and Elbow Group

a. Place the 3.234-inch inside diameter preformed packing 0-ring in its groove in the joint surface of the elbow (fig. 16).

b. Lower the body group (fig. 20) carefully onto the elbow group (fig. 15), making sure that the strap assembly is inserted through the body (fig. 16). Secure body to elbow with five No. 10 x 1/2 hexagon-socket capscrews. Apply orange varnish shellac to screws to lock in position.

c. Secure the strap assembly to the prism with a clamp and one No. 4 x 1/4, fillister-head

machine screw. Apply orange varnish shellac to screw to lock in position.

d. Insert the eccentric pin through hole in the flange of the body and elbow (fig. 16) and slip over end of pin a 0.312-inch snapring to secure pin from falling out. Position pin mechanically so that the hole in exposed end of the eccentric pin is parallel to the saw cut in the flange of the elbow. Secure eccentric pin in position with one No. 8 x 5/8 hexagon-socket capscrew.

e. Insert eyepiece into elbow and screw cell into position and secure with three No. 8 x 3/16 socket-type setscrews. Do not tighten screws. Screws will be tightened after unit is collimated (par. 84*b*).

f. Attach the identification plate and chain assembly and key to the elbow assembly with two No. 4 x 3/16 roundhead machine screws (fig. 15).

g. Unit is collimated (pars. 84-91) and then the support is pinned to objective cell with two 1/8 x 1/2 headless straight pins (fig. 16) and two cover assemblies are pinned in position with four 1/8 x 1/2 headless straight pins (fig. 15).

h. Mount light shield to the bonded prism with No. 2 x 1/8 fillister-head machine screws (fig. 28).

75. Assembly of Exterior Parts to Periscope

a. Mount two pins (fig. 20), one on either side of body, and lock in position with dab of orange shellac varnish on threads.

b. Mount two studs on cover (W, fig. 6), one on each side of shaft protruding from cover.

c. Mount washer, spring, washer, and clamp into shaft (fig. 6). Secure clamp with one No. 4 x 1/2 hexagon-socket capscrew and No. 4 split lockwasher (S and R, fig. 6).

d. After periscope M28C has been collimated and tested (pars. 84-93), mount cover and gasket to rear bottom of elbow and secure with four No. 8 x 5/16 flathead machine screws (L, fig. 6).

e. Mount cover (K, fig. 6) and secure with two No. 8 x 3/16 panhead machine screws (M, fig. 6) to studs after periscope M28C has been through tests (par. 94).

f. Apply decalcomania (fig. 1).

g. Remove the right-hand No. 4 x 3/16 roundhead machine screw and insert chain assembly with wrench. Then secure No. 4 screw (figs. 1 and 15).

76. Assembly of Valve Assembly

a. Using the improvised inner air valve wrench (fig. 19) screw the inner air valve (fig. 18) tightly into the outer air valve.

b. Screw air valve cap on to valve (spun)

77. Assembly of Cap Assembly

a. Apply sealing compound 8030-275-8110 to threaded portion of valve assembly. Screw valve assembly into cap (fig. 17).

b. Apply adhesive sealing compound 8030-275-8110 to cap and insert recess. Secure window to cap with two clamps and four No. 2 x 3/16 flathead machine screws. Secure machine screws with orange varnish shellac.

78. Installation of Cap Assembly

(fig. 6)

Set the cap assembly (B) down over the body and elbow group assembly until it contacts the shoulder on the body. Turn the cap to let the window face in the direction opposite to the eyepiece (E). Screw the four No. 6 x 1/2 socket-head capscrews (S) through the cover assembly (K) and into the body. The four screws will be locked in position with a dab of orange varnish shellac. The cap assembly will be sealed after the unit is collimated (pars. 84-91).

79. Installation of Connecting Arm Assembly

a. Mount the connecting arm assembly onto the end of the shaft and secure it by tightening one No. 8 x 1 hexagon-socket capscrew in arm assembly (D, fig. 6 and 26).

NOTE

When new components are used in shaft or arm assembly, the hole in the adjusting arm and/or input shaft must be drilled and reamed for 1/8 x 11/16 straight pin during testing and collimation.

b. Drill and ream a new hole for the 1/8 x 11/16 headless straight pin as described in (1) through (3) below. Using improvised locking shaft fixture (fig. 29).

(1) With the periscope sight mounted in a suitable inspection fixture setup (par. 84*a*(1) and (2)), secure the improvised work arm to the side of the input shaft on which the arm assembly connects. Rotate the input

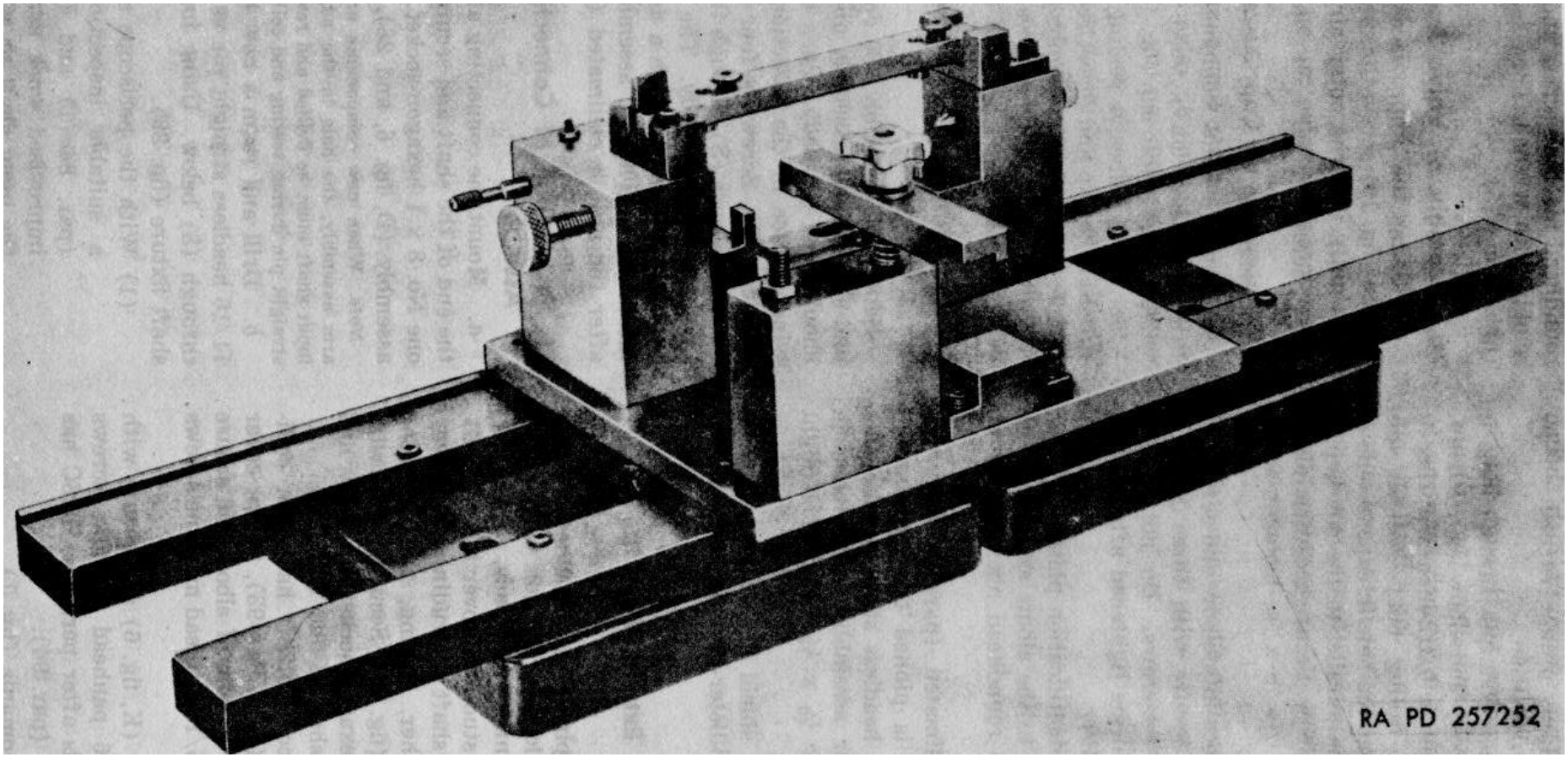

Figure 29. Improvised locking shaft fixture.

shaft by means of the work arm while sighting through the eyepiece to bring the line of sight to 0 position. Lock the input shaft in this position with arm assembly.

(2) Sight through the eyepiece of the periscope sight to make certain the line of sight has not shifted and drill and ream the No. 1/8 x 11/16 headless straight pin through the pinhole in the old adjusting arm and through the spot-drilled hole located in the new arm.

(3) Remove the periscope sight from the fixture, clean away nicks, burrs, and chips caused by drilling and reaming, and install the pin as in a above.

80. Installation of Periscope M28 (T46), M28C, and M28D in On-Carriage Position

a. Inspect the mating mounting surfaces of the periscope sight and installed periscope mount M104A1 and M104A2 to make certain they are free of burrs, nicks, dirt, paint, or other interference which would prevent proper seating of the periscope sight.

b. Move the mount barrel handle of the periscope mount M104A1 and M104A2 counterclockwise to the unlocked position. With its window facing the forward end of the cupola, push the periscope sight up through the bottom of the mount so that its cap assembly is within the guard of the gun mount. The eccentric pin on the periscope sight should register with the slot in the bottom of the mount. The pins on the periscope sight should enter the vertical slots in the mount barrel. With the sight pushed up into the mount as far as it will go, move the locking mount barrel handle clockwise to the locked position (figs. 4 and 5).

c. Mount the rod end of sight link assembly (fig. 4) into cupola mounting fork and secure with 1/4-inch lockwasher and 1/4 x 15/16 hexagon-socket bolt (fig. 1). For adjustment of periscope link assembly 7660651, 8270686, 8565380 or 10516322, refer to TM 9-7022, TM 9-2300-203-12, TM 9-2350-215-10, or TM 9-2350-224-10.

Section IV. TESTS AND ADJUSTMENTS

81. General

The tests and adjustments that follow are performed after the periscope sight has been completely assembled. The tools and equipment necessary to perform these tests and adjustments are listed in tables I and II.

82. Vibration Test

a. Using vibration adapter, mount the periscope sight on the universal vibration tester and vibrate the sight for not less than 2 nor more than 2 1/2 minutes at an amplitude equivalent to 1/16 inch (1/8-inch total movement) and at a frequency of 30 cycles per second.

NOTE

The vibration test should be performed with the link assembly (Fig. 4) disconnected.

b. After being subjected to the vibration test, the periscope should show no evidence of dirt, chips, fractures, or cement separation in the system when viewed through the eyepiece or objective end. If any of the faults above mentioned are present, the periscope must be disassembled and the fault corrected.

83. Condition of Optics

Viewing through the eyepiece and objective ends of the telescope, there will be no objectionable dirt, smears, scratches, digs, condensate, fungus growth, chips, fractures, or cement separation. The shading or shadowing technique will be used to determine the presence of objectionable condensate or smears. Shadowing is the technique of looking into the eyepiece or objective end of the sight obliquely so as to obtain reflections from a particular surface in the optical system. With this method, the surfaces of the internal optical elements are drab gray in appearance and all defects (condensate, scratches, etc.) show up as white particles.

84. Eyepiece Focus

a. *Test*. Place eyepiece assembly into a suitable inspection setup as described below.

(1) Set up projector collimator 4931-757-3291 so that the horizontal lines of the reticle will be parallel with the horizontal working plane. The projector collimator is collimated and set for infinity.

(2) The eyepiece assembly (E, fig. 6) is placed on the same level as the projector collimator so that the two centers (mechanical center of projector collimator and mechanical center of eyepiece) are in line.

(3) The distance between the projector collimator and eyepiece is attained by focusing the eyepiece assembly on the reticle of the projector collimator. When this is done, the eyepiece is set for infinity.

(4) Place the dioptometer (fig. 10) on the eyepiece assembly. The reticle of the eyepiece assembly must appear in sharpest focus at the center of the field of the eyepiece. At this point, the dioptometer should have a reading between -0.75 and -1.0 diopter.

b. *Adjustments*. The proper reading on the dioptometer is achieved by screwing the reticle cell with reticle in or out of the cell until the reticle is at its sharpest in viewing through the dioptometer.

85. Parallax

a. *Test*. With the periscope M28 (T46), M28C, and M28D mounted in the improvised final inspection fixture (fig. 30), view image through eyepiece of periscope. Move the head about 1/4-inch from side to side and up and down at normal eye distance from the periscopes. If the image of the projector collimator reticle appears to move with respect to the periscopes parallax is present. The amount of parallax may be determined from the graduated projector collimator reticle or periscope reticle. Parallax must not exceed -.5 mil between the image of the projector collimator reticle and the periscope reticle at the center of the field.

b. *Adjustment*.

(1) Parallax may be due to two causes, one being that the eyepiece is not properly focused or improper positioning of the objective lens assembly, which could include defective optical elements or poor assembly of the objective assembly.

(2) Remove eyepiece assembly (par. 49) and check if eyepiece is properly focused (par. 84). Install eyepiece (par. 74*e*) and check for parallax.

(3) If adjustment of the eyepiece does not remove parallax, the adjustment must be made in the objective assembly. Remove cap assembly (par. 47), and perform the operations in the following

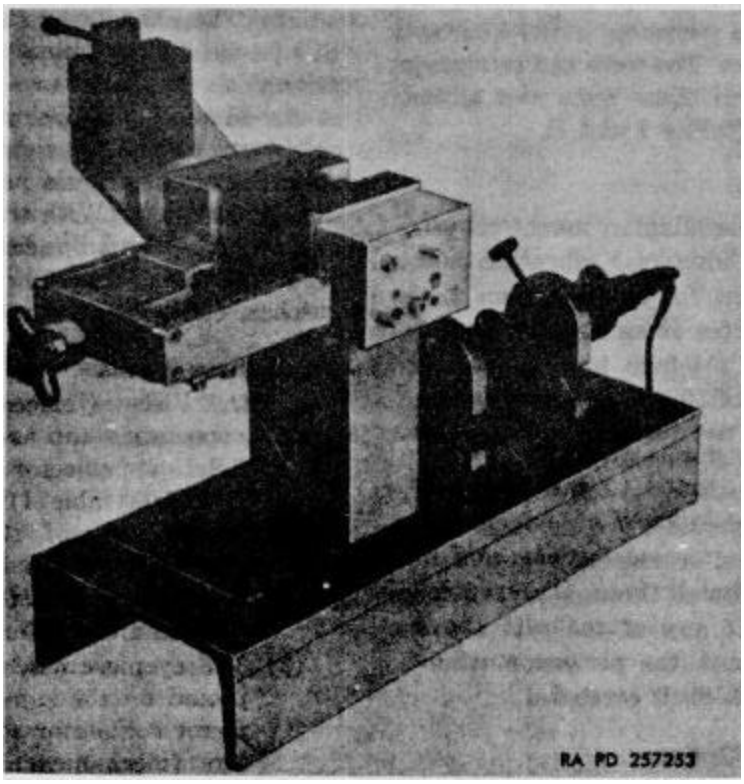

Figure 30. Improvised final inspection fixture.

paragraphs to remove the cell assembly (fig. 20) (pars. 52*a* and 53). Disassemble the objective assembly (pars. 54 and 56) and check all optical components and inspect all metal parts for dimensional or mechanical errors. Assemble objective assembly (pars. 69 and 71), assemble cell assembly (par. 73), and assemble cap assembly (par. 78) to body and check for parallax.

NOTE

It may be necessary to repeat (2) and (3) above several times to remove parallax.

86. Definition

a. *Test*. Install periscope **tank** in improvised final inspection fixture (fig. 30). Place a collimating telescope 4931-554-9108 (fig. 9), set for infinity, on the eyepiece. View through the collimating telescope and observe the reticle pattern of the projector collimator in the final inspection fixture. The pattern of the reticle should appear clear and well defined.

b. *Adjustments*.

(1) Poor definition may be due to one or more of several causes, namely: eyepiece not properly focused; all parallax not removed; inherent characteristics of the optical elements; defective optical elements; elements twisted, jammed, or strained in their supports; or elements incorrectly positioned along the optical axis of the instrument. Refer to the detailed illustration of the optical system (fig. 3).

(2) Adjustments of an instrument to improve definition of image is accomplished after determining the cause of defects. If the eyepiece is out of focus or parallax is present, repeat paragraph 84 or 85. Defective elements must be repaired or replaced. Elements improperly mounted in their cells must be removed and remounted, and those elements incorrectly positioned along the optical axis must be moved to the proper position. After any of the foregoing actions, any previous optical inspections should be repeated.

87. Image Tilt

a. Test.

(1) With the periscopes mounted in improvised final inspection fixture (fig. 30), sight through the periscope using collimating telescope 4931-554-9108 mounted so that its reticle lines are truly vertical and horizontal.

(2) View through the collimating telescope and through the periscope and bring one extreme edge of the horizontal line of the reticle of the collimator 4931-757-3291 into coincidence with the corresponding edge of the horizontal line on the collimating telescope reticle.

(3) With one extreme edge of the horizontal line of the collimator reticle in coincidence, the other extreme edge of the same line must not deviate from the corresponding line of the collimating telescope reticle by more than 1 degree.

NOTE

One degree tilt is equivalent to the angle subtended by 9.3 mils at the edge of the field of view when measured over the full field of view.

b. Adjustments.

(1) Image tilt in excess of the tolerance given in *a*(3) above is caused by angular deviation of either or both of the prism components in the periscope sight, due either to improper installation or to improper bonding of prism to its mounting surface.

(2) The improperly installed or bonded prism must be located by trial and error and must either be replaced or properly installed. Refer to paragraphs 47, 52*a*, 53*a*, 62, 72, 73*c*, 74*c* and *h*, and 78, for removal and installation of the body prism. Follow only the pertinent procedures in above referenced paragraphs.

(3) Repeat the test indicated in a above and in paragraphs 82 and 84 to make certain those adjustments have not been disturbed.

88. Reticle Plumb

a. Test.

(1) Follow the procedure indicated in paragraph 87*a*(1).

(2) View through the eyepiece of the collimating telescope (fig. 9) and through the periscope and bring the extreme edge of the periscope reticle 400 meter reference line into coincidence with the corresponding edge of the horizontal line of the collimating telescope reticle.

(3) With one extreme end of the 400 meter reference line of the periscope reticle in coincidence with the horizontal line of the collimating telescope reticle as in (2) above, the opposite extreme end of the periscope reticle 400 meter reference line must not deviate from the horizontal reticle line, of the collimating telescope by more than the maximum thickness of a reticle line.

b. Adjustments.

(1) Make certain the periscope M28 (T46), M28C, and M28D is properly mounted in the improvised final inspection fixture (par. 87*a*(1)). Check for dirt, burs, nicks, paint, and other deformities or obstruction on the mounting surfaces of the sight and/or fixture that could prevent proper seating of the periscope sight and would cause cant when it is installed.

(2) Loosen three No. 8 x 3/16 hexagon-socket setscrews and rotate eyepiece as required to bring the reticle into plumb.

NOTE

Rotation of the eyepiece assembly as described above should be performed only if a small amount of rotation is required. Excessive rotation will adversely effect the alinement of the illumination aperture with the light source mounting plate. If more rotation is required, remove the eyepiece and realine the reticle assembly (pars. 64*d* and 83) and install into the body and elbow group (par. 74*e*). Repeat test (pars. 84 and 87).

89. Collimation

a. Test. With the periscope sight installed in improvised final inspection fixture (fig. 30), which had been set up as directed in paragraph 85*a*, the periscope sight's line of sight will be in (1) and (2) below when the eccentric adjusting pin is in the center of its throw and the connecting arm assembly is secured at 67 degrees ±4 minutes.

NOTE

If new components were used during assembly as indicated in paragraph 79*a*, mount the periscope sight in the improvised locking shaft fixture (fig. 29) and drill and ream for the 1/8 x 11/16 tapered pin as indicated in paragraph 79*b*. Collimation will then be within the tolerances specified in (1) and (2) below.

(1) The vertical reticle line of the periscope boresight cross will coincide with the center vertical reticle line of the projector collimator within 2.5 mil.

(2) The horizontal reticle line of the periscope boresight cross will coincide with the center horizontal reticle line of the projector collimator within 2.5 mil.

b. Adjustment. Note whether the collimation error is in azimuth and/or elevation and proceed as in (1) through (4) below.

(1) Small amounts of elevation error may be eliminated by adjustment of the two 1/4 x 0.312 special setscrews in the connecting arm assembly (fig. 26). As one setscrew is tightened against the adjusting arm, the other must be loosened a similar amount.

(2) Azimuth error if not excessive may be .compensated for by loosening the No. 8 x 1/2 hexagon-socket capscrew, (fig. 16) and adjusting the alinement of the eccentric pin. When adjusting the eccentric pin to compensate for azimuth collimation error, the 3-degree tolerance must be maintained. Tighten the No. 8 x 1/2 hexagon-socket capscrew.

(3) If adjustment of the two special setscrews ((1) above) or realinement of the eccentric pin ((2) above) is not sufficient to correct the collimation error, remove the cap assembly (B, fig. 6, par. 47). Release strap assembly from bonded prism assembly (fig. 2, par. 52) and remove body group from elbow group. Check to see that the cam portions of the prism mount and shaft are clean and free from burs. Also, check to see if the strips on the strap are clean and free of burs.

Clean surfaces (par. 36*b*) and remove burs (par. 30*e*). Assemble the body and elbow group and install strap assembly (par. 74). Install cap assembly (par. 78).

(4) Repeat tests in paragraph 84*a*(4) and 85 through 88.

90. Plumb Travel

a. Test. With the periscope sight installed in improvised plumb fixture (fig. 31), the line of sight will be elevated 60 degrees and depressed 15 degrees from 0 position (par. 91*a*) and will be in coincidence with a plumb line. Deviations from this plumb line will not exceed those values indicated in (1) and (2) below.

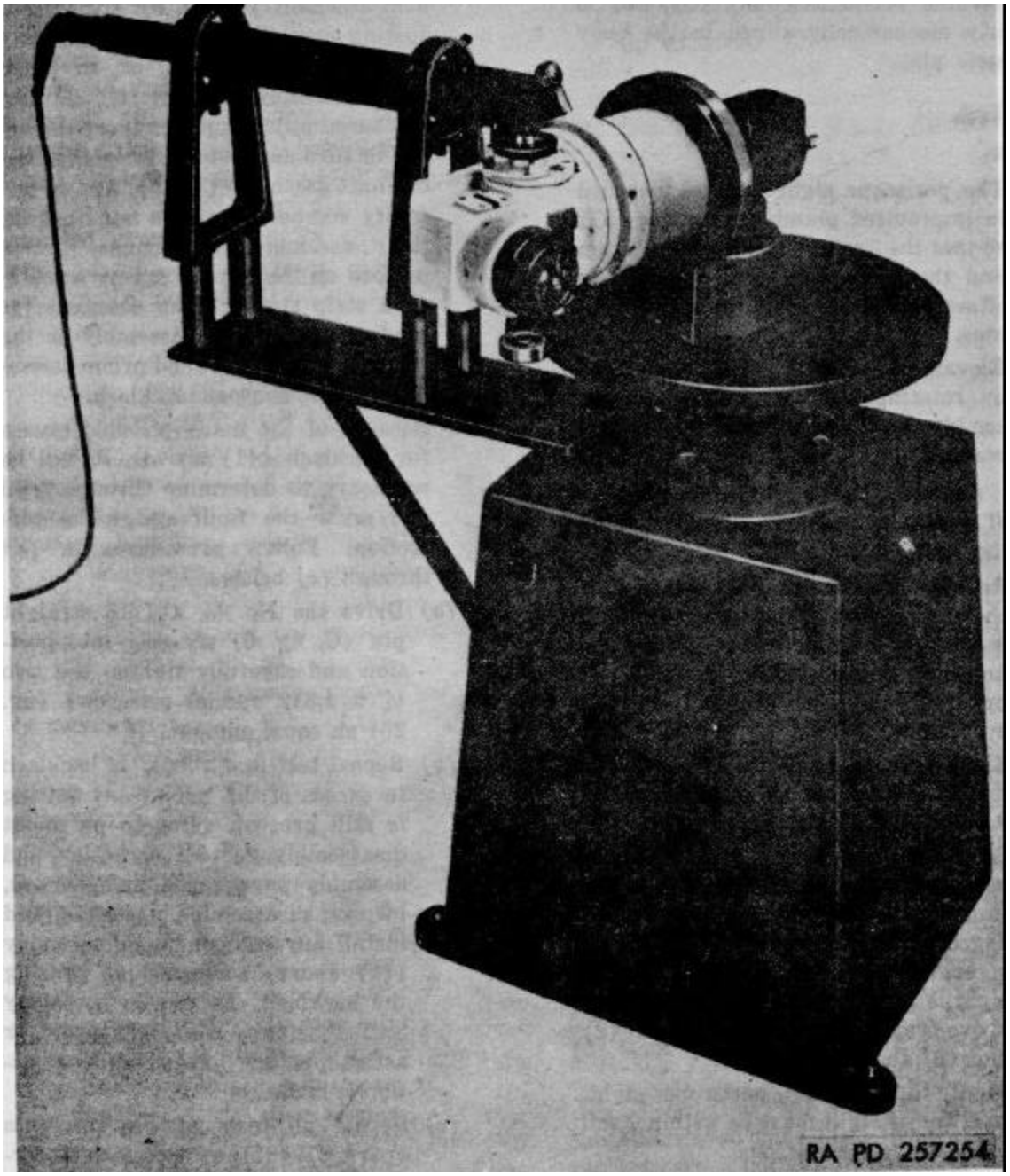

Figure 31. Improvised plumb fixture.

(1) The line of sight shall not deviate from the plumb line more than 1 mil at any other setting of the connecting arm assembly from 60 degrees elevation to 15 degrees depression.

(2) The total lateral deviation of the line of sight through the 75-degree movement will not exceed 1 mil.

b. Adjustment. Excessive plumb travel indicates that the prism assembly (fig. 28) is not properly mechanically alined to the body and eccentric pin.

91. Backlash

a. Test.

(1) The periscope sight will be installed in improvised plumb fixture (fig. 31) so that the line of sight is at 0 position and the connecting arm assembly is offset 67 degrees 30 minutes ±4 minutes.

(2) Elevate or depress the line of sight by rotating the connecting arm assembly until limit of movement is reached.

CAUTION

Do not force the rotation of the arm assembly after reaching its limit.

(3) Reverse the direction of rotation of the arm assembly and slowly bring it back to its exact original position. Do not bypass the original position. If bypassing is experienced, start test over again.

(4) Sight through the periscope sight. The line of sight must be within 1 mil of 0 position ((1) above).

(5) Offset the connecting arm assembly exactly 10 degrees from previous setting to elevate the line of sight 10 degrees. Sight through the periscope sight to determine that the line of sight is properly on target 10 degrees above previous position and repeat (2) and (3) above.

(6) Sight through the periscope sight. The line of sight must be within 1 mil of 10 degrees elevation.

(7) Repeat (5) and (6) above for at least five more positions of elevation (20, 30, 40, 50, and 60 degrees) and at least two positions of depression (7.50 and 15 degrees). At each position, backlash will not exceed 0.2 mil.

b. Adjustment.

(1) Backlash in excess of 0.2 rail at any elevation or depression setting may be due to a loosely pinned connecting arm assembly (D, fig. 6), a loose adjusting arm (fig. 26), or an improperly installed, secured, or stretched strap assembly (fig. 16). It can also be caused by an improperly assembled or installed support assembly (fig. 16) or shaft assembly (fig. 25) or because faulty components were used during their assembly. Insufficient torsion preload on the bonded prism, a weakened strip spring strap assembly, or binding of the shaft assembly or the bearings within the bond prism assembly will also show as blacklash.

(2) Because of the many possible causes for backlash ((1) above), it will be necessary to determine through trial and error the fault and make correction. Follow procedures in (*a*) through (*c*) below.

(*a*) Drive the No. 1/8 x 1/16 straight pin (C, fig. 6) securely into position and carefully tighten the two 14 x 1.312 special setscrews (fig. 26) an equal amount.

(*b*) Repeat test in a above. If backlash in excess of 0.2 mil at any setting is still present, refer to pertinent disassembly, general inspection, and assembly paragraphs and remove, inspect, disassemble, assemble, and install any component or assembly ((1) above) suspected of causing the backlash. Repeat as necessary until the faulty components and/or assemblies are located and correction is made.

(*c*) Repeat all tests and adjustments (pars. 81-91), as necessary to correct for adjustments disturbed by disassembly above.

92. Elevation Travel

a. Test. With the periscope sight mounted in improvised plumb inspection fixture (fig. 31), direct a light source into the objective end of the periscope sight and sight through the instrument. Rotate the connecting arm (D, fig. 6) through its full limits of movement. Throughout the full range of movement of the connecting arm, the field of view will not be cut off but will remain full and circular.

b. Adjustment. Cutoff of the field of view may be due to an improperly installed cap assembly or bonded prism assembly. It also may be due to overtravel of the connecting arm assembly (D, Fig. 6) and line of sight beyond the 60-degree elevation and 15-degree depression requirements caused by a bent or damaged 14 x 0.312 special screw (Fig. 26). To correct for this error, check (1), (2), or (3) below.

(1) Check connecting arm assembly and replace the damaged 1/4 x 0.312 screw and check as in a above.

(2) Remove cap assembly (par. 47) and check to see if the window was properly installed; mount cap assembly (par. 78) and recheck (par. 91a).

(3) Remove cap assembly (par. 47) and bonded prism assembly (par. 52a) and check to see if the prism is properly bonded and that there is no dirt present in the bearings and under the strap; check (par. 91a).

Note. **If in the adjustments made above there are parts which have been removed and reassembled the sight must be retested (pars. 81-91) prior to checking as indicated in a above.**

93. Reticle Illumination

a. Test. Connect an instrument light M50 to the light source mounting plate. Cover the window to block all light from entering the end of the sight and turn on the lamp of the instrument light.

NOTE

If instrument light M60 is not available, any other suitable source of light may be directed at the orange-red filter under the mounting plate. All reticle markings must then appear clearly defined and easily read when viewing through the eyepiece of the periscope sight.

b. Adjustment.

(1) Disconnect the instrument light or remove the light source. Clean any dirt, grease, or adhesive sealing compound 8030-275-8110 from the orange-red filter, repeat test a above.

(2) The porthole in the eyepiece cell may need to be placed in line with porthole in the elbow. To aline these two port- holes, loosen three No. 8 x 3/16 socket- type flat-point setscrews and rotate eyepiece checking to see if portholes are alined. Tighten the three screws and check to see if parallax was introduced (par. 85) and test as in a above.

94. Vibration After Adjustment

a. After the periscope sight has been completely assembled and adjusted, it must again be vibrated, as described in paragraph 82, to determine that no additional dirt has accumulated in the periscope sight and that the adjustments performed in paragraphs 84 through 93 will be maintained under operating conditions. A final check of the periscope sight should be made prior to the second vibration test, to determine that all accessible screws utilized in the adjustment of the various components are installed and tightened.

b. After the second vibration test has been completed, the adjustments of the periscope should be checked by performing the tests described in paragraphs 84 through 93 to make certain that all adjustments have been maintained and are within the required tolerances. In particular, check the amount of collimation error (par. 89). The amount of error must repeat within 0.5 mil with the amount noted before the second vibration in paragraph 89b (2) and total error must not exceed 1 mil.

95. Sealing

a. General. When it has been determined that the periscope M28 (T46), M28C, and M28D is in a serviceable condition, those assemblies not sealed during assembly should be sealed at this time. Refer to paragraph 38 for precautions prior to bonding and/or sealing.

b. Seal Cap Assembly. Using pneumatic grease gun 7684134 (Fig. 32) with improvised pneumatic grease gun adapter (Fig. 33), inject class 1 noncuring sealing compound (par. 40) into the two injection ports in the body (fig. 20).

c. Seal Eyepiece Assembly. With the same equipment used in *b* above, inject class 1 noncuring sealing compound (par. 40) into the three injection ports in the elbow (Fig. 15).

96. Purging and Charging

NOTE

Subparagraphs (1) through (12) below pertains to direct support and general support, maintenance; (1) through (15) below pertain to depot maintenance.

a. Test.

(1) Remove the No. 8-36 x 1/8 headless flat-point setscrew and extract the gasket from the hole in the eyepiece cell (Fig. 6). Remove the air valve cap (Fig. 18).

(2) Obtain cylinder of dry technical nitrogen 6830-264-9086 and remove threaded protective cover from the valve outlet of the cylinder. Open the valve momentarily to rid the valve seat of any foreign matter.

(3) Check adapter 4931-508-5453 for cleanliness and proper sealing of gasket. Securely attach this adapter to the tank valve and then attach regulator 1240-558-0922 to the adapter.

(4) Connect the 25 foot hose assembly 4931-561-0713 to the low-pressure port of the regulator, and assure that all connections are tight enough to prevent any leakage.

(5) Turn the pressure regulator valve counterclockwise to extreme closed position.

(6) Open the nitrogen cylinder valve slowly until the cylinder pressure is registered on the high-pressure gage.

NOTE

Cylinder pressure must exceed 100 psi. If the registered pressure is 100 psi oz less, obtain and use a replacement cylinder.

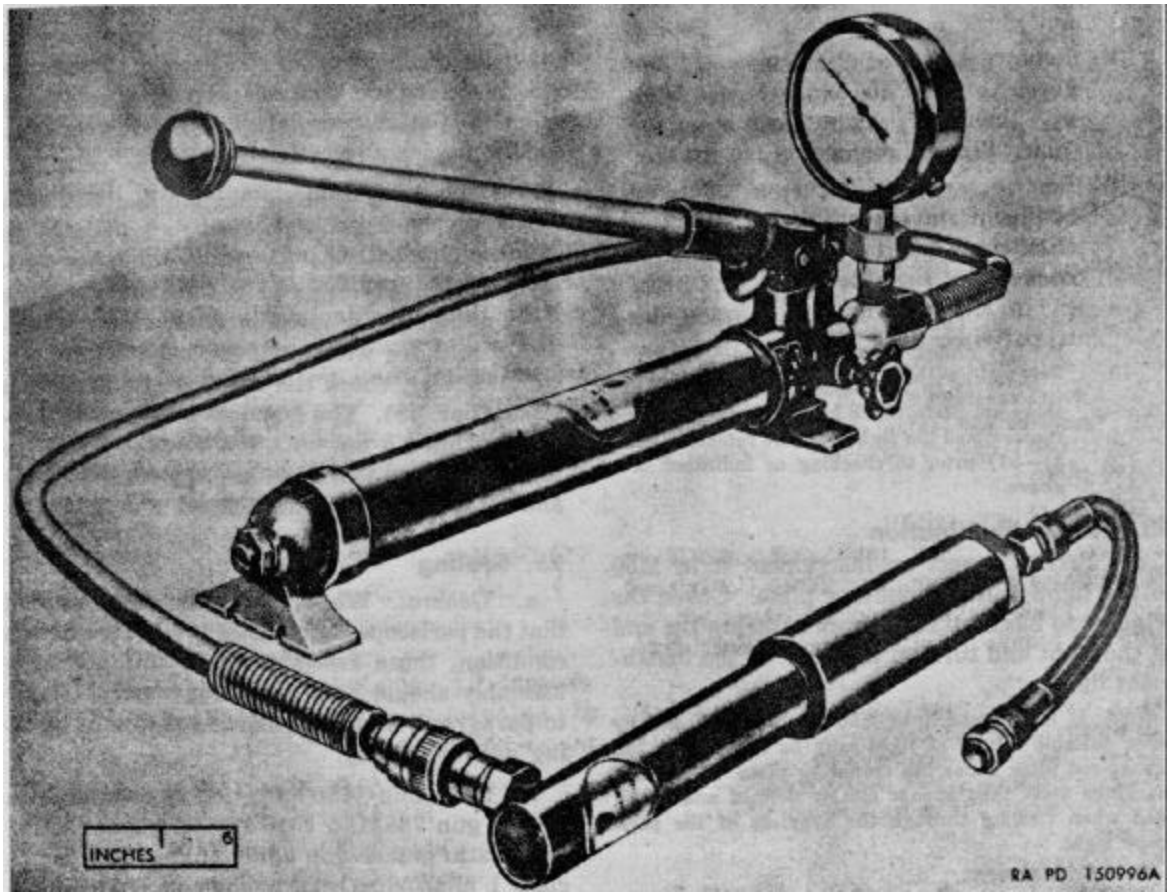

Figure 32. Pneumatic grease gun.

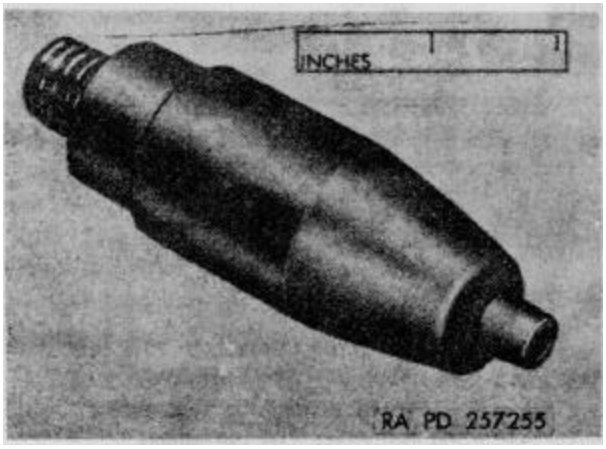

Figure 33. Improvised pneumatic grease gun adapter.

(7) Slowly turn the pressure regulator valve, handle clockwise until approximately 5 psi are registered on the regulator's low-pressure gage. Check the free end of the attached hose assembly 8572414 for free flow of nitrogen for approximately 1/2 minute. Close regulator valve.

(8) Securely attach the free end of the hose assembly to the periscope sights air valve (Fig. 18).

(9) Open pressure regulator valve until 5 psi are registered on the low-pressure gage. Allow this pressure to flush through the periscope sight for 5 minutes.

(10) (Rescinded).

(11) Insert the gasket and the No. 8-36 x 1/6 setscrew (F and G, fig. 6). Continue to charge the periscope with nitrogen at 5 psi for 2 minutes.

(12) Close the regulator valve. Close the nitrogen cylinder valve. Remove the hose assembly from the periscope sight's outer air valve.

(13) (Rescinded).

(14) Using 9 1/2 inch long hose assembly 4931-508-5546, connect the test gage assembly 4931-546-9773 to the periscope outer valve.

(15) After a 5-minute period, the internal pressure of the periscope must not have dropped more than 0.10 psi as registered on the test gage assembly.

(16) If pressure drop exceeds 0.10 psi, remove the hose and proceed as in below. If pressure drop is less than 0.10 psi reduce pressure to between 0.10 and 0.25 psi, remove the hose and test gage assemblies, and install the air valve cap.

b. Adjustment. Pressure drop in excess of 0.10 psi indicates that improper or incomplete sealing had been accomplished in paragraph 95. Repeat procedures in paragraph 95, and repeat test in a above for depot maintenance only.

APPENDIX
REFERENCES

1. Publication Indexes

The following publication indexes should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to materiel covered in this manual.

Index of Army Motion Pictures, Film Strips, Slides and Phono-Recordings.	DA Pam 108-1
Military Publications:	
Index of Administrative Publications	DA Pam 310-1
Index of Blank Forms	DA Pam 310-2
Index of Graphic Training Aids and Devices.	DA Pam 310-5
Index of Supply Manuals; Ordnance Corps.	DA Pam 310-29
Index of Tables of Organizations and Equipment, Tables of Organization, Type Tables of Distribution, and Tables of Allowances.	DA Pam 310-7
Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.	DA Pam 310-4
Index of Training Publications	DA Pam 310-3

2. Supply Manuals

The following supply manuals of the Department of the Army supply manual pertain to this materiel:

a. Destruction to Prevent Enemy Use.

Ammunition: Explosives, Bulk Propellants, and Explosive Devices.	SM 9-6-1875

b. General.

Brushes, Paints, Sealers, and Adhesives.	SM 5-1-8000 SM 9-1-8000 SM 10-1-8000
Chemicals and Chemical Products.	SM 5-1-6800 SM 9-1-6800 SM 10-1-6800
Containers, Packaging, and Packing Supplies.	SM 6-1-8100 SM 9-1-8100 SM 10-1-8100
Fuels, Lubricants, Oils, and Waxes.	SM 10-1-9100
Hardware and Abrasives	SM 9-1-5300
Introduction	ORD 1
Measuring Tools	SM 9-1-5200
Sight, Periscope, M28 (T46)	ORD 8 SNL F-402
Special Tool Sets for Sighting and Fire Control Materiel Used With Small Arms, Automatic Guns, Mortars, and Field Artillery (SNL Group F).	ORD 6 SNL J-32

3. Forms

The following forms pertain to this materiel:

DA Form 5-31, Shop Job Order Register
DA Form 9-79, Parts Requisition (cut sheet)
DA Form 9-80, Job Order File (envelope)
DA Form 9-81, Exchange Part or Unit Identification Tag (tag)
DA Form 421, Stock Record Card
DA Form 468, Unsatisfactory Equipment Report
DA Form 478, Organizational Equipment File
DA Form 811, Work Request and Job Order (4-part set)
DA Form 828, Job Time Ticket-Individual
DA Form 829, Rejection Memorandum
DA Form 1546, Request for Issue or Turn-In
DA Form 2028, Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9 (cut sheet)
DD Form 6, Report of Damaged or Improper Shipment

4. Other Publications

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

a. Decontamination.

Decontamination	TM 3-220

b. Destruction to Prevent Enemy Use.

Demolition Materials	TM 9-1946
Explosives and Demolitions	FM 5-25
Ordnance Service in the Field	FM 9-1
Safety: Regulations for Firing Ammunition for Training, Target Practice, and Combat.	AR 385-63 AFR 50-13

c. General.

Inspection of Ordnance Materiel in Hands of Troops.	TM 9-1100
Logistics (General):	
Malfunctions Involving Ammunition and Explosives (Reports Control Symbol ORD-43).	AR 700-1300-8
Unsatisfactory Equipment Report.	AR 700-38

d. Operation and Maintenance.

Operator's Manual: Tank, Combat, Full Tracked: 105-MM Gun, M60A1 W/E (2350-756-89) And Tank, Combat, Full Tacked: 105-MM Gun, M60 W/E (2350-679-5773).	TM 9-2350-215-10
Organizational Maintenance Manual: Tank, Combat, Full Tracked: 105-MM Gun, M60A1 W/E (350-75-8497) And Tank, Combat Full Tracked: 105-MM Gun, M6 W/E (2350-678-577).	TM 9-2350-215-20.
Operator's Manual: Tank, Combat Full Tracked: 90-MM Gun, M48A3 W/E (2350-395-9154).	TM 9-2350-224-10.
Organizational Maintenance Manual: Tank, Combat, Full Tracked: 90-MM Gun, M48A3 W/E (2350895-9154).	TM 9-2350-224-20.

Military Symbols	FM 21-30 AFM 55-3
Military Terms, Abbreviations, and Symbols:	
Authorized Abbreviations and Brevity Codes.	AR 320-50
Dictionary of United States Army Terms	AR 320-5
Military Training	FM 21-5
Safety: Accident Reporting and Records.	AR 386-40
Techniques of Military Instruction.	FM 21-6

d. Operation and Maintenance.

Cleaning and Black Finishing of Ferrous Metals.	TM 9-1861
Fire Control Materiel: Lubrication.	TB 9-2835-1
Instruction Guide: Elementary Optics and Applications to Fire Control Instruments.	TM 9-2601
Maintenance and Care of Hand Tools	TM 9-867
Maintenance of Supplies and Equipment: Spot Check Inspection and Reports, Ordnance Corps Materiel.	AR 750-925
Moisture and Fungus Proofing Treatment of Antiaircraft Artillery On-Carriage Fire Control Equipment and Associated Cable Systems.	TB ORD 350
Operator and Organizational Maintenance: Full Tracked Armored Personnel Carrier, M59 (T59) and 4.2-Inch Full Tracked Self-Propelled Mortar M84.	TM 9-2300-203-12
Operators and Organizational Maintenance Tank, Combat, Full Tracked: 90-MM Gun, M48A2 and M48A2C (FSN 2350-345-7560 and FSN 2350-679-4812) and Tank, Combat, Full Tracked: Flamethrower M67A1 (FSN 2350-663-2664).	TM 9-7022
Ordnance Direct Support Service -	FM 9-3
Ordnance General and Depot Support Services.	FM 9-4
Ordnance Maintenance: Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel, and Related Materials Including Chemicals, Lubricants, Indicators, and Hydraulic Fluids.	TM 9-1007
Ordnance Maintenance: Operation and Maintenance of Optical Coating Equipment.	TM 9-1501
Painting Instructions for Field Use.	TM 9-2851

e. Shipment and Storage,

Instruction Guide: Ordnance Preservation, Packaging, Packing, Storage and Shipping.	TM 9-1005
Issue of Supplies and Equipment: Preparation, Processing, and Documentation for Requisitioning, Shipping, and Receiving.	AR 725-5
Marking and Packing of Supplies and Equipment: Marking of Supplies for Shipment.	AR 746-80
Ordnance Operational List of Specifications and Instructions for Packaging and Processing General Supplies.	SB 9-156
Packaging and Shipping of Materiel: Preservation, Packaging, and Packing of Military Supplies and Equipment.	TM 38-230
Protection of Ordnance General Supplies in Open Storage.	TB ORD 379
Standards for Oversea Shipment and Domestic Issue of Ordnance Materiel Other Than Ammunition and Army Aircraft,	TB ORD 385
Storage and Materials Handling	TM 743-200-
Storage and Shipment of Supplies and Equipment: Preservation, Packaging, and Packing.	AR 740-15

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For explanation of abbreviations used, see AR 320-50.

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