TM 9–1674

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

TELESCOPE MOUNT M20

August 22, 1942

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TECHNICAL MANUAL
No. 9–1674

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1942

WAR DEPARTMENT,
WASHINGTON, August 22, 1942.

ORDNANCE MAINTENANCE
TELESCOPE MOUNT M20

*This pamphlet supersedes so much of TM 9–2674, August 30, 1941, as pertains to telescope mount M20.

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SECTION I

GENERAL

1. Scope.—This manual is published for the information and guidance of ordnance maintenance personnel. It contains detailed instructions for inspection, disassembly, assembly, maintenance, and repair of the telescope mount M20 supplementary to those in the Field and Technical Manuals prepared for the using arm. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the matériel.

NOTE.—Information on packing, storage, and shipment; and preparation of matériel for use under unusual conditions is not available at present, but will be included in a revision of this manual.

2. Characteristics.—The telescope mount M20 and panoramic telescope M8 (figs. 1 and 2) are used with the 8-inch gun, railway mount M1A1, for aiming the gun in azimuth only. The telescope mount is secured to the left trunnion of the gun and the left side of the top carriage. It supports the telescope in a true vertical position. This position is maintained by adjustment of cross level knobs and is indicated by the centering of bubbles in level vials. An azimuth compensating device, forming part of the mount, corrects

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RA PD 17094

FIGURE 1.—Telescope mount M20.

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for any error in azimuth developed in elevating the gun with the trunnions out of level. (See fig. 3.)

3. Panoramic telescope M8.—The panoramic telescope M8 (figs. 2 and 4) is a 6-power telescope and forms the optical element of the sighting equipment. It is provided with a prism erecting system, separate azimuth micrometers for case II and case III pointing, ray filters, and a diopter adjustment for focusing the telescope to suit the eye of the user. The reticle pattern consists of a horizontal cross line and a vertical cross line. The micrometers and the reticle are illuminated for night use.

SECTION II

DESCRIPTION

4. General.—The telescope mount M20 consists principally of the bracket and support assembly, telescope socket assembly, leveling mechanism assembly, and cross level assembly. Figure 5 shows assembled views; figures 6 through 9 show sectioned views.

5. Bracket, with support assembly.—The bracket and support assembly includes the bracket (D28908), tee assembly (C69546), support (D28909), and wiring for illumination. (See fig. 6.)

a. The bracket is fastened to the left trunnion of the gun with four screws (BCAX2BD) and washers. Two horizontal keys on the mating surface of the bracket engage a keyway on the trunnion for alinement. The bracket includes a long bearing which supports the tee.

b. The tee assembly (C69546) has a long arm retained by the bracket and a short arm which is alined with the trunnion axis when the trunnion axis is level. The short arm serves as a pivot for the support (D28909) and is kept level during operation by the cross leveling mechanism of the telescope mount. The intersection of the long and short arms remains alined at all times with the trunnion axis.

c. The support (D28909) with the tee and bracket forms a universal joint. This construction permits the support to be erect when the gun carriage is not precisely leveled, due to irregular terrain. The support carries the telescope socket and the longitudinal level vial and cross level vial. In the body of the support are the wiring

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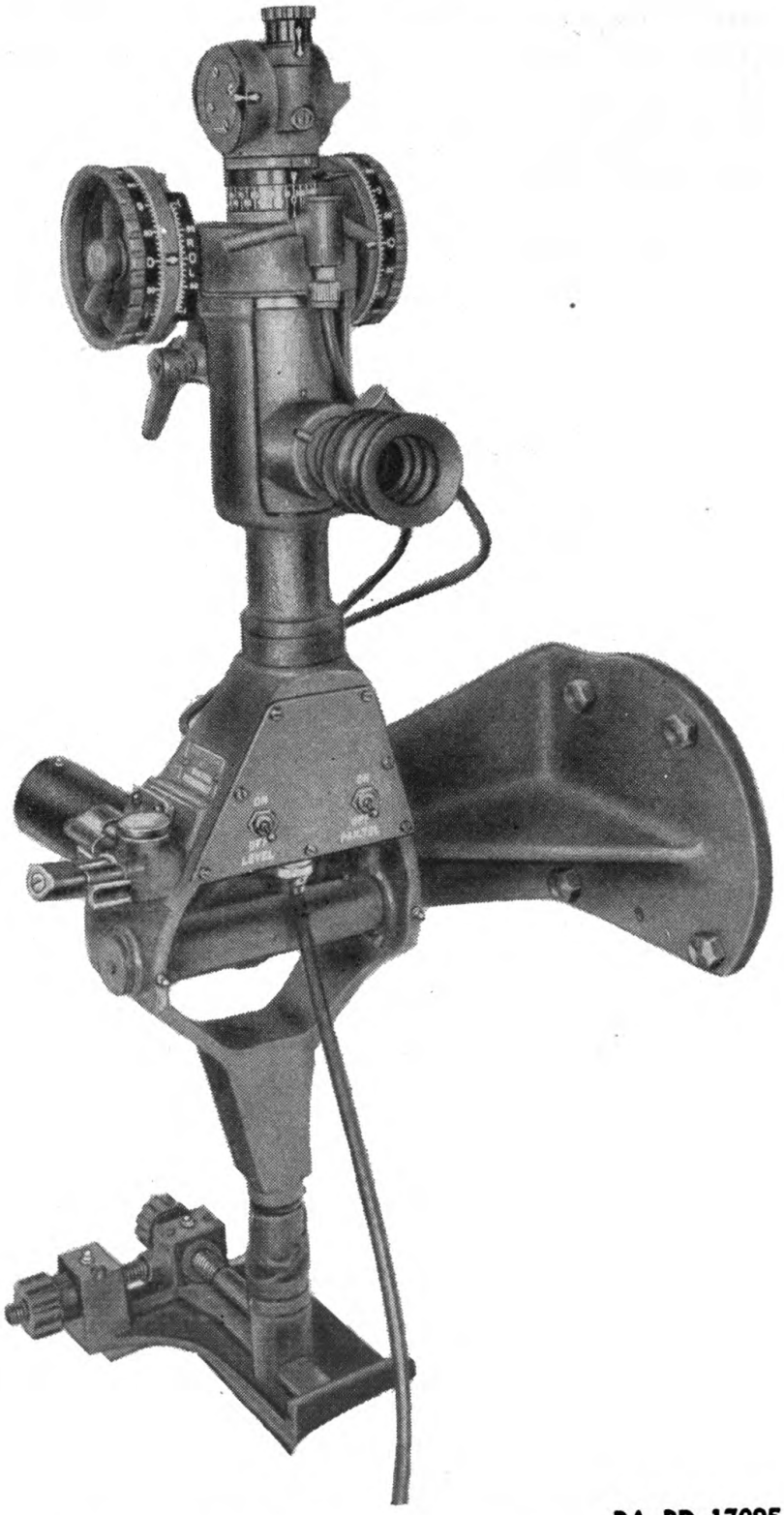

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FIGURE 2.—Telescope mount M20 with panoramic telescope M8.

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and lamp sockets, and the lamp well for illumination. The lower end of the support slides within the ball and socket of the longitudinal and cross level mechanism.

d. The longitudinal level and cross level are contained in the cross level bracket (C69542, figs. 5 and 9) which is mounted on the support.

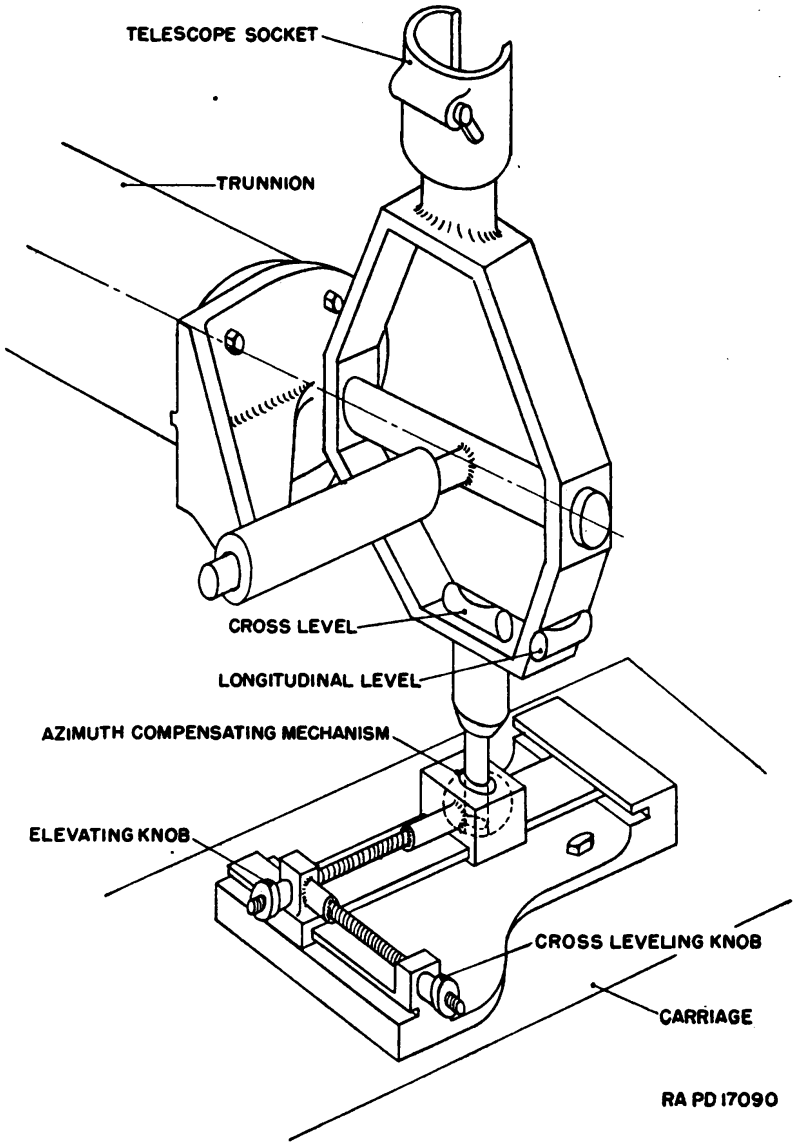

FIGURE 3.—Schematic diagram of telescope mount M20.

e. Wiring and fixtures for illumination are also included in the body of the support. A pocket in the support contains a socket (A34791, fig. 7) for the cable assembly (C70198) from the power source. Two sockets (A41452) marked "T" on the front of the support connect to the trouble lamp socket and telescope lamp socket.

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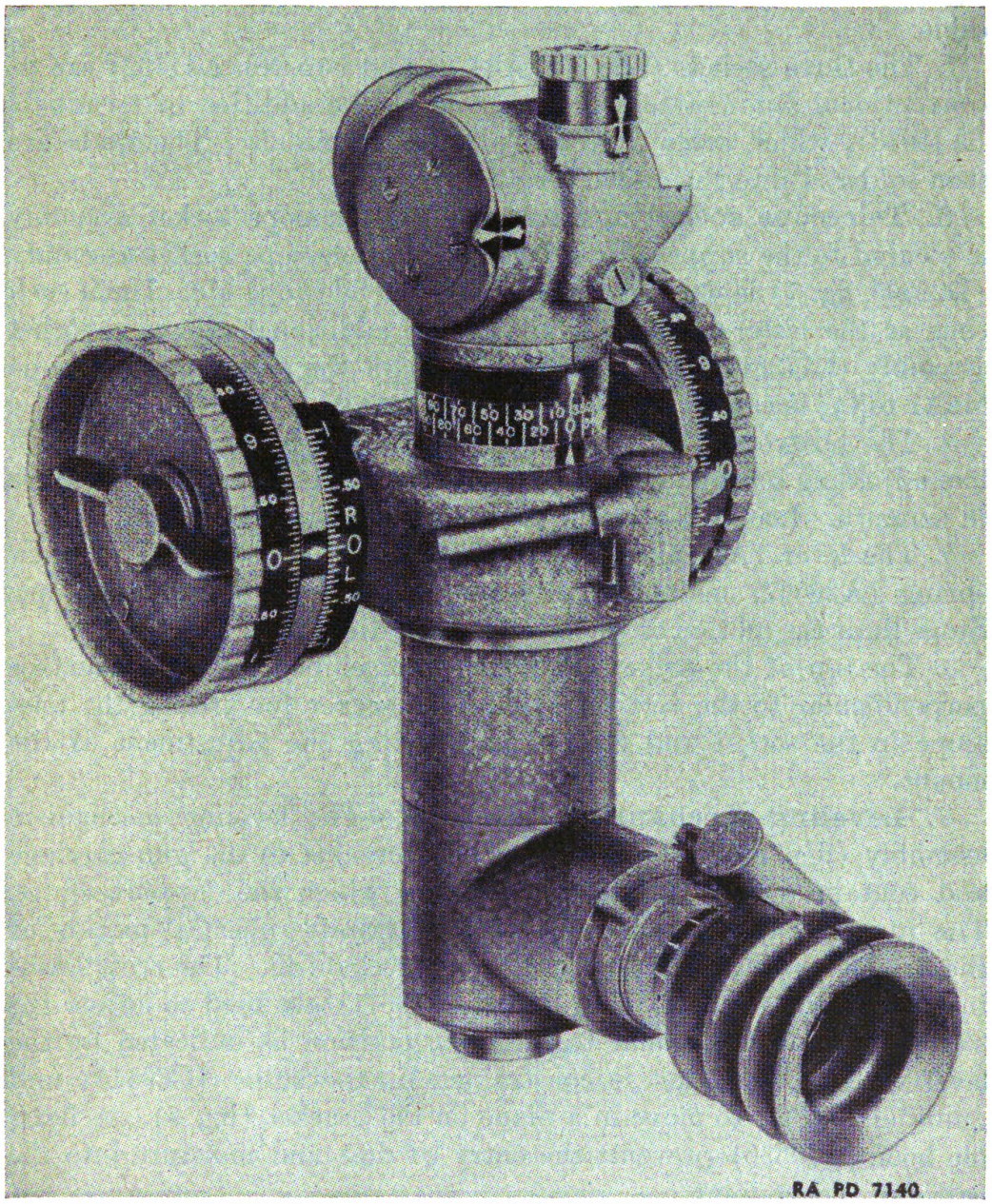

FIGURE 4.—Panoramic telescope M8.

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Two toggle switches on the switch cover (B138798, figs. 5 and 7) control—

(1) The lighting of the panoramic telescope scales and reticle.

(2) The level vial illumination and the socket for the trouble lamp cable.

f. The three sockets (one No. A34791 and two No. A41452) are of conventional automotive type, modified by the addition of terminals (A43910), which screw into the original terminals. The leads are then soldered into the added terminals.

6. Telescope socket assembly.—The telescope socket assembly is secured to the support by a rivet. (The telescope socket assembly (D28905, fig. 7) is used with the panoramic telescope M8. Until such time as the latter becomes available, an additional telescope socket assembly (C77981) will be utilized to adapt the panoramic telescope M5A2 to the telescope socket assembly (D28905).)

a. The telescope socket (D28905, figs. 7 and 8) is provided with two adjusting screws (A46233) which are used to adjust the telescope in azimuth. Lock screws hold these screws against shifting.

b. The lever (A178127) locks the telescope in place. A trunnion spring (A38067) maintains pressure of the level on the telescope. Stops limit the motion of the lever in both directions.

c. The top of the socket is accurately machined to form a surface perpendicular to the vertical axis of the socket for alining the telescope in the socket and for use in checking the adjustment of the mount.

7. Leveling mechanism assembly.—The leveling mechanism assembly (figs. 6 and 7) is secured by a bracket to the gun carriage and contains a ball and socket joint in which the support slides. The funnel shaped retainer (A178253) permits spherical motion of the support with respect to the leveling mechanism. The cross leveling and longitudinal leveling knobs (A48671) are used to adjust the socket to bring the mount to the erect position as indicated by the level vials. The socket is constrained by the slider (C69544) and guide (B138765) to move in a plane on the bracket (fig. 3). A flexible boot (A49396) prevents the entry of dust and moisture into the ball and socket joint.

8. Cross level assembly.—*a.* Both the cross level vial assembly and the longitudinal level vial assembly are contained in the cross level bracket (C69542, fig. 9) which is mounted on the support.

b. Each level vial (A31314) is held in its tube (A33994) by plaster of paris (gypsum, calcined, fine, grade 1). Each tube has four adjusting screws (BCUX2CB) at one end and is locked in place by a plug (A34057). The plug is secured by the pin (BFDX3.1A).

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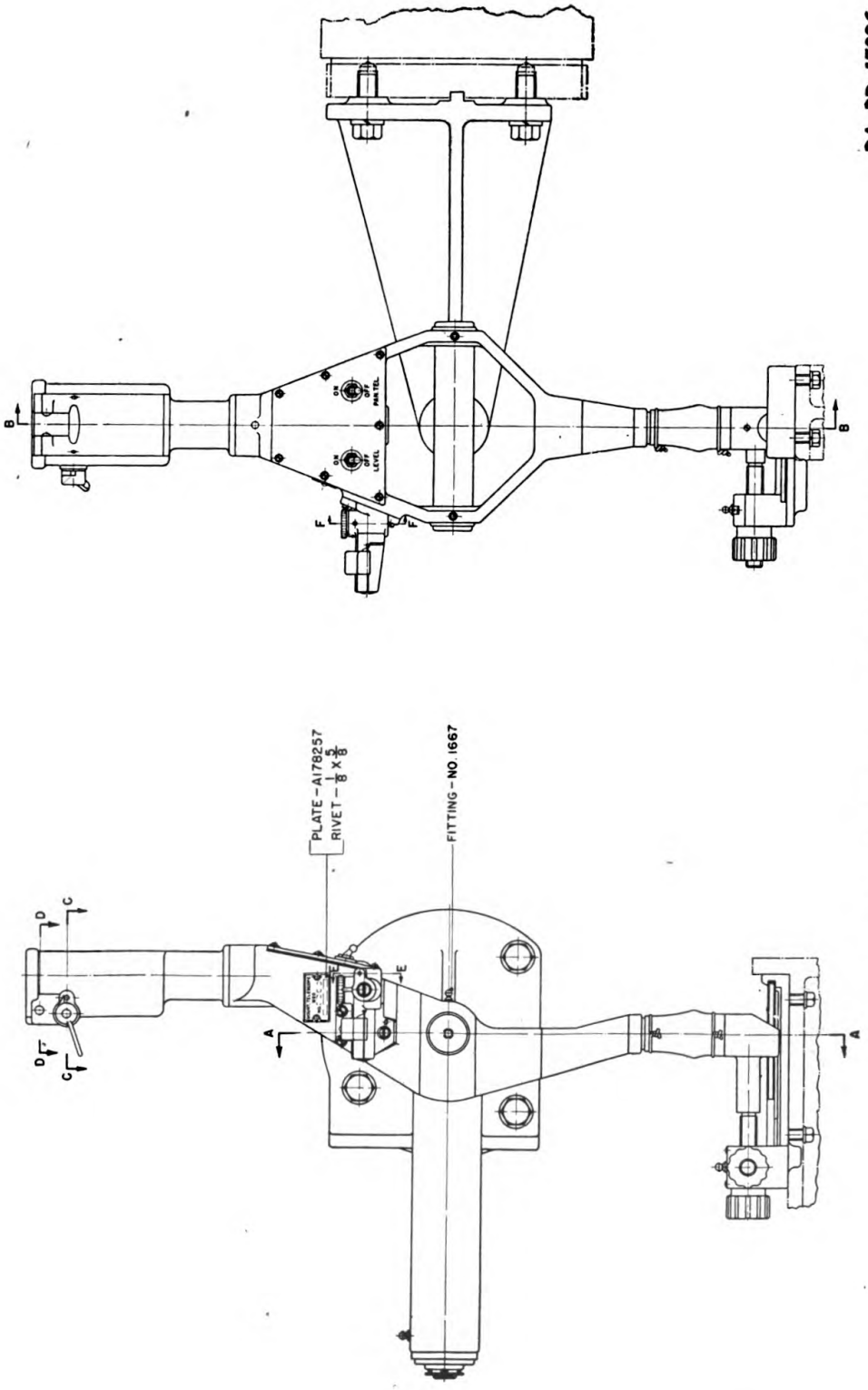

FIGURE 5.—Panoramic telescope M8, assembled views.

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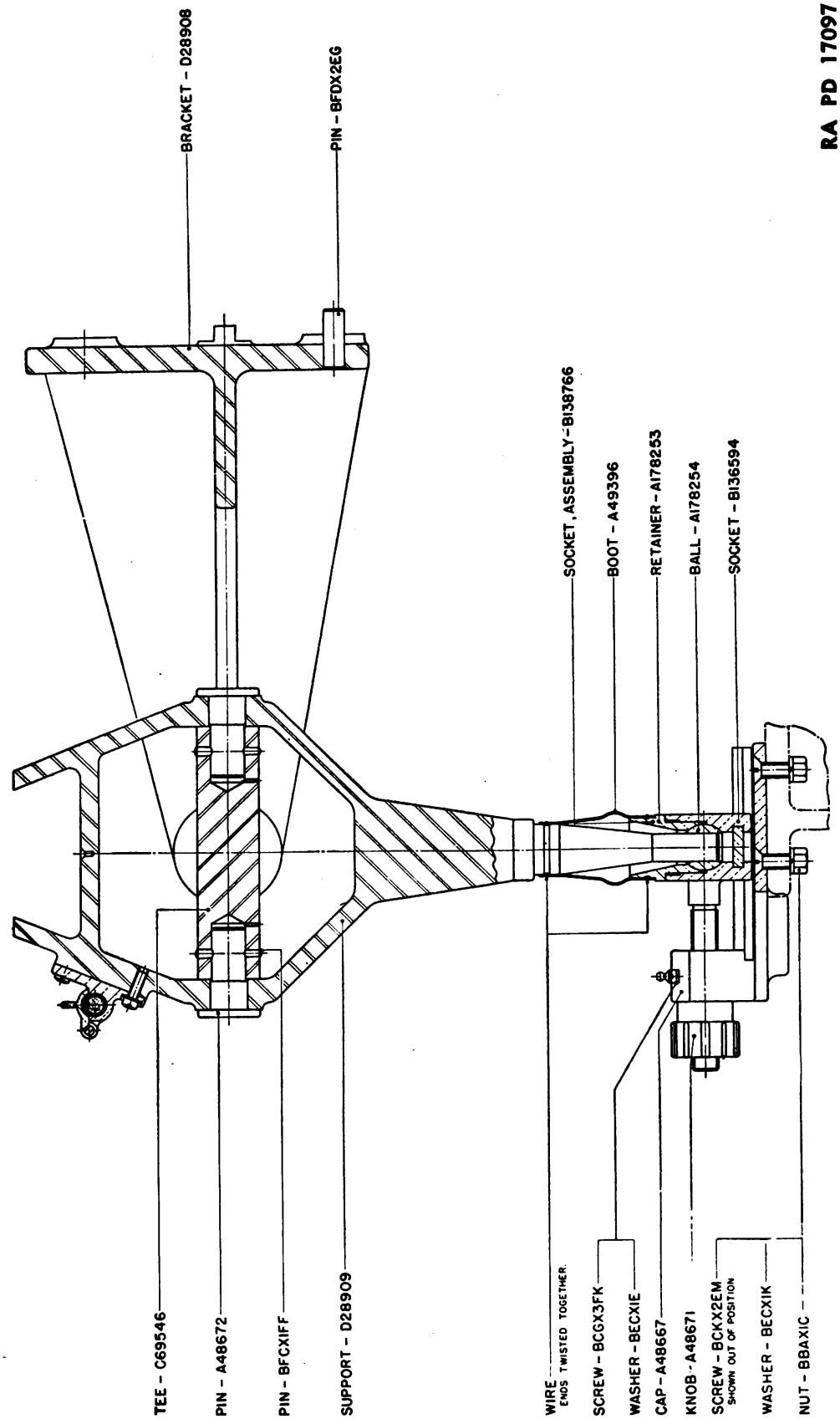

FIGURE 6.—Leveling mechanism assembly—Section A–A.

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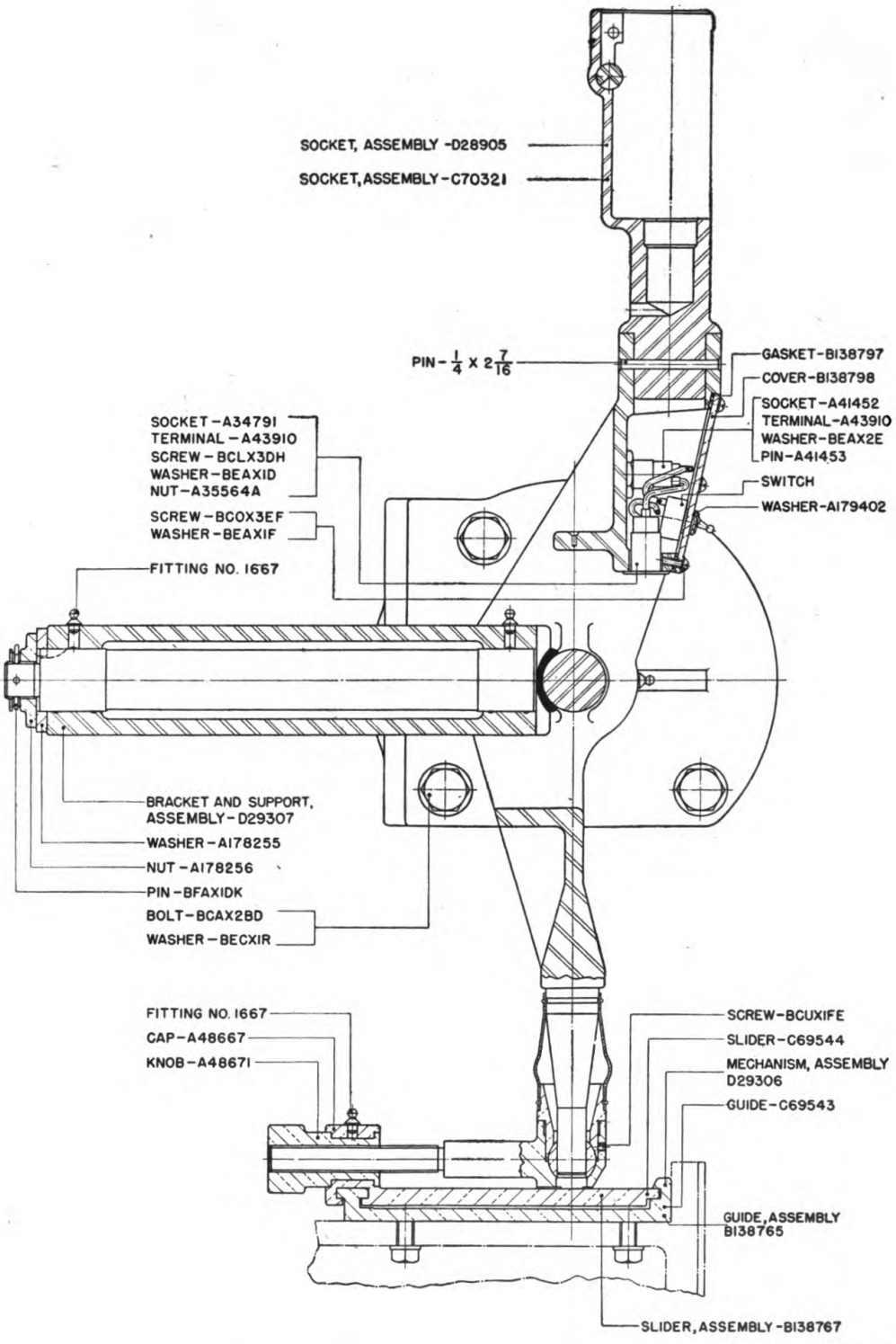

FIGURE 7.—Leveling mechanism assembly—Section B–B.

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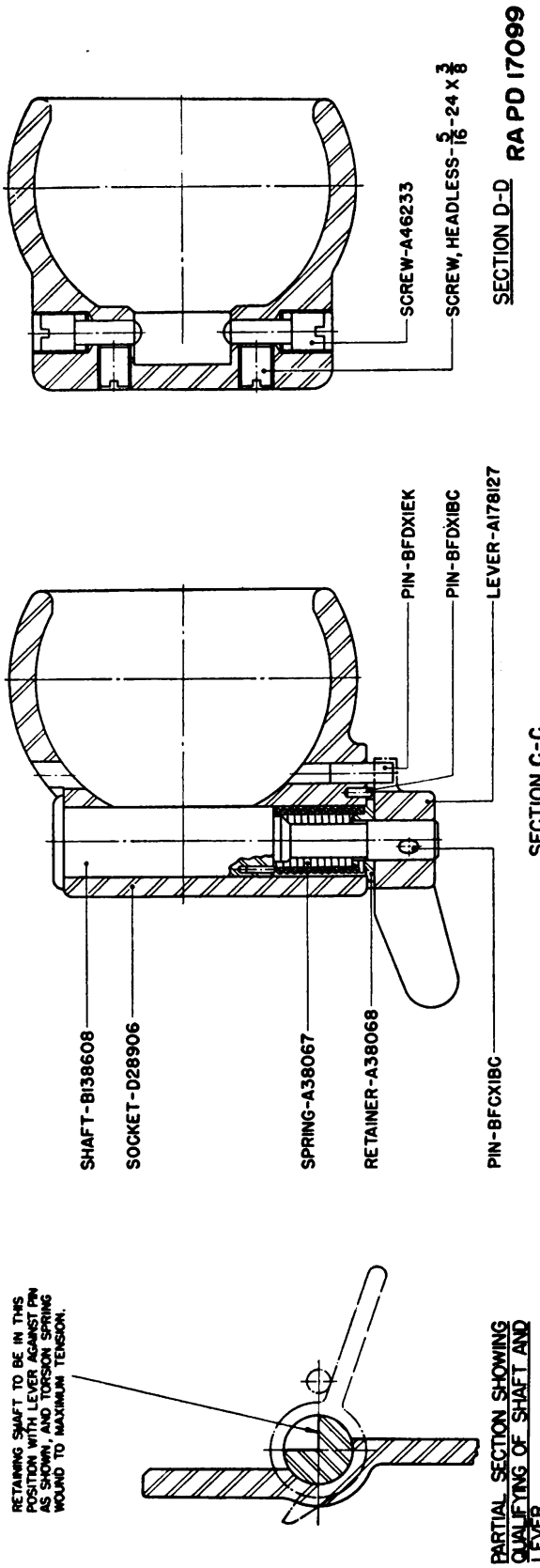

FIGURE 8.—Leveling mechanism assembly—Sections C–C and D–D.

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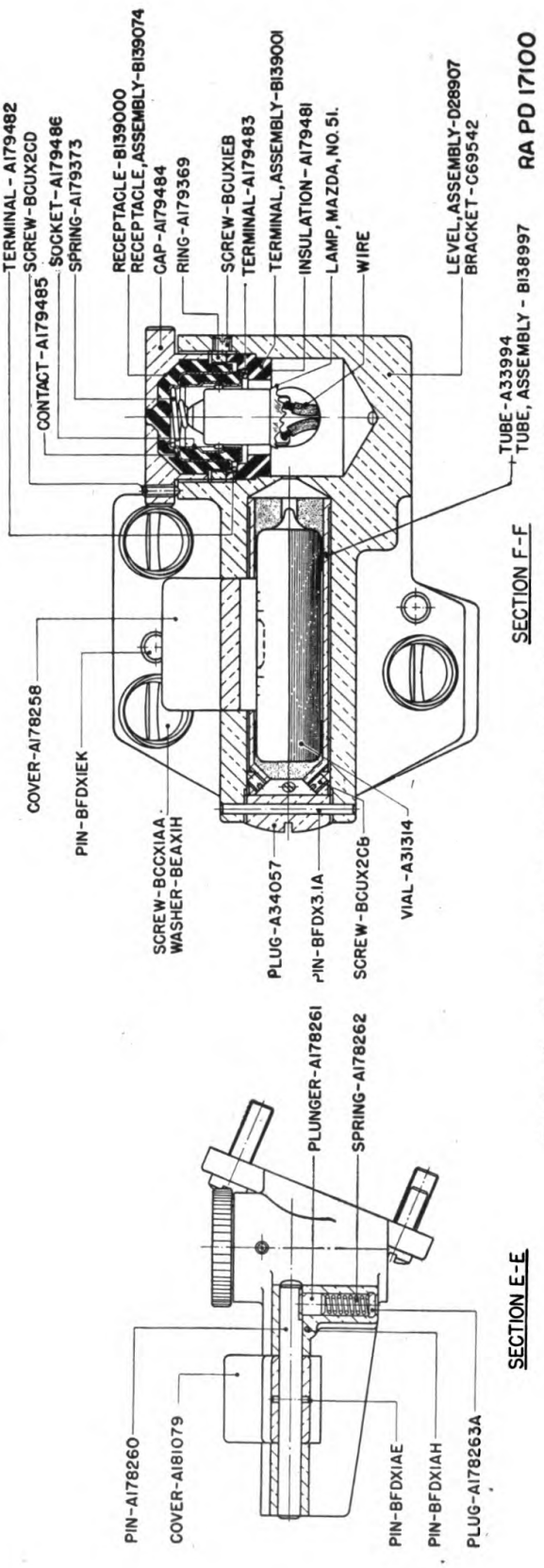

FIGURE 9.—Leveling mechanism assembly—Sections E–E and F–F.

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c. A spring-loaded cover (A178258) protects the levels against damage during idleness.

d. The lamp well in the bracket furnishes illumination to both levels. The lamp (No. 51) has a bayonet type base which fits the receptacle assembly (B139074). Leads from the support extend to the terminal assembly (B139001) which is secured to the bracket casting by lock ring (A179369) and lock screw (BCUX1EB). Electrical contact is established with the lamp when the cap (A179484) is screwed into place.

e. The bracket is fastened to the support by three screws (BCCX1AA) and washers. Two pins (BFDX1EK) accurately locate the bracket.

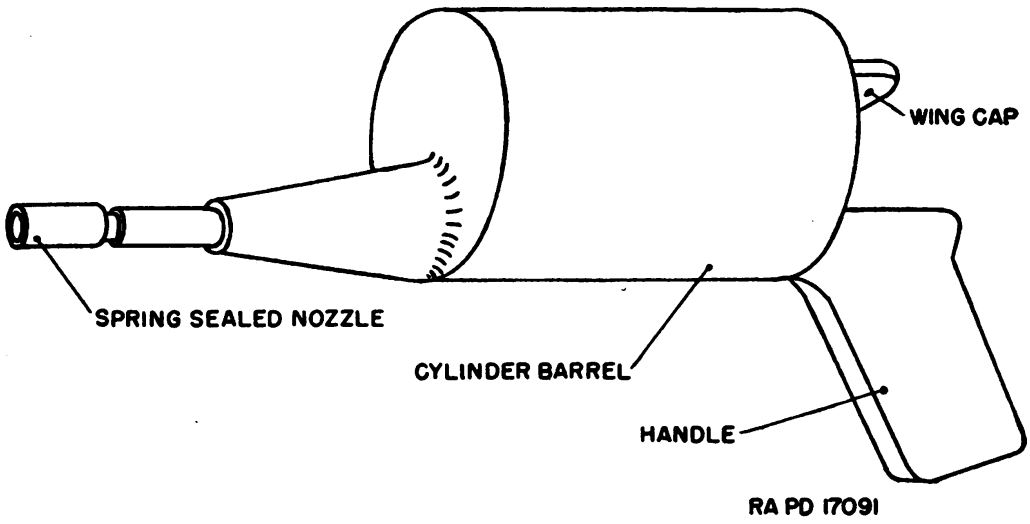

FIGURE 10.—Lubricating gun.

SECTION III

ACCESSORIES

9. Tool chest.—The following accessories are contained in the tool chest which may be attached to the gun carriage:

Screw driver, common, 3-inch blade.
Screw driver, jeweler's, all-metal, blade 0.07 inch wide.
Gun, lubricating, vacuum type, 4½-ounces (for oil). (See fig. 10.)

10. Electrical equipment.—*a.* Two cables (C70139), 2-conductor, 22 inches long, with plugs, are furnished (fig. 11). These are plugged into the sockets (A41452, fig. 7). One cable connects to

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the scale lamp bracket socket (A179212) of the panoramic telescope M8. The other cable connects to the reticle lamp bracket socket (A179212) of the same telescope.

b. One cable (C70198), 2-conductor, 4 feet 2 inches long with plugs, is furnished (fig. 12). This cable plugs into the socket (A34791) and connects to the source of power.

c. A trouble lamp (B135896) is furnished (fig. 13). This has a 3 cp, 6- to 8-volt double contact lamp (No. 64), a lamp guard, a handle, approximately 9 feet of cable, and a plug for plugging into socket (A41452).

SECTION IV

CARE AND PRESERVATION

11. Cleaning and preserving materials.—*a.* The authorized lubricants are—

(1) Oil, lubricating, for aircraft instruments and machine guns (for all lubrication where oil is required).

(2) Grease, lubricating, special (for all lubrication where grease is required).

b. Material used for cleaning is solvent, dry-cleaning (for cleaning metal components).

12. Care in handling.—*a.* Keep the boot secure and intact at all times to avoid the entry of dust. Replace at once if it becomes torn or perforated.

b. Keep the level vials covered when the telescope mount is not in use. Avoid damage to the level vial graduations.

c. Keep the mount covered when not in use.

d. Avoid nicking or scratching of the locating surfaces. Keep a light film of oil or grease on these surfaces to prevent corrosion.

13. Lubrication.—*a.* Lubrication points are indicated in figure 14.

b. The lubricating fittings on the telescope mount are circled in red for rapid location. The lubricating gun for these fittings is carried in the tool chest.

c. In using the lubricating gun, avoid overfilling the oil reservoir.

d. After filling the fittings, operate the telescope mount through its entire range and then wipe off excess lubricant.

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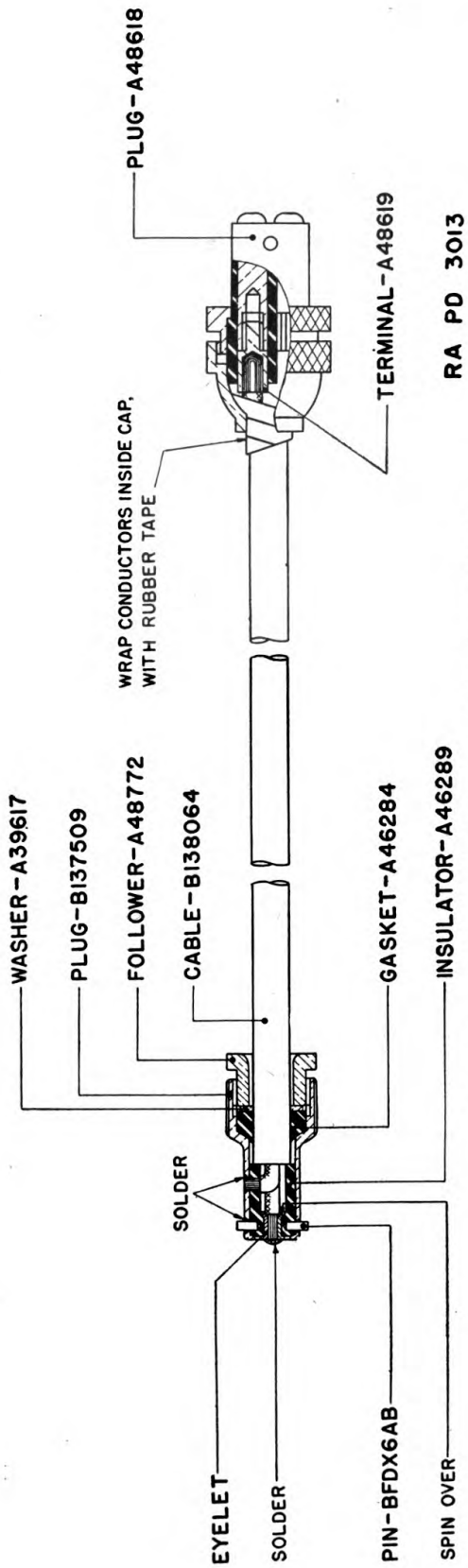

FIGURE 11.—Cable, 2-conductor, 22 inches long with plugs.
(Connects to telescope reticle lamp and telescope micrometer lamp.)

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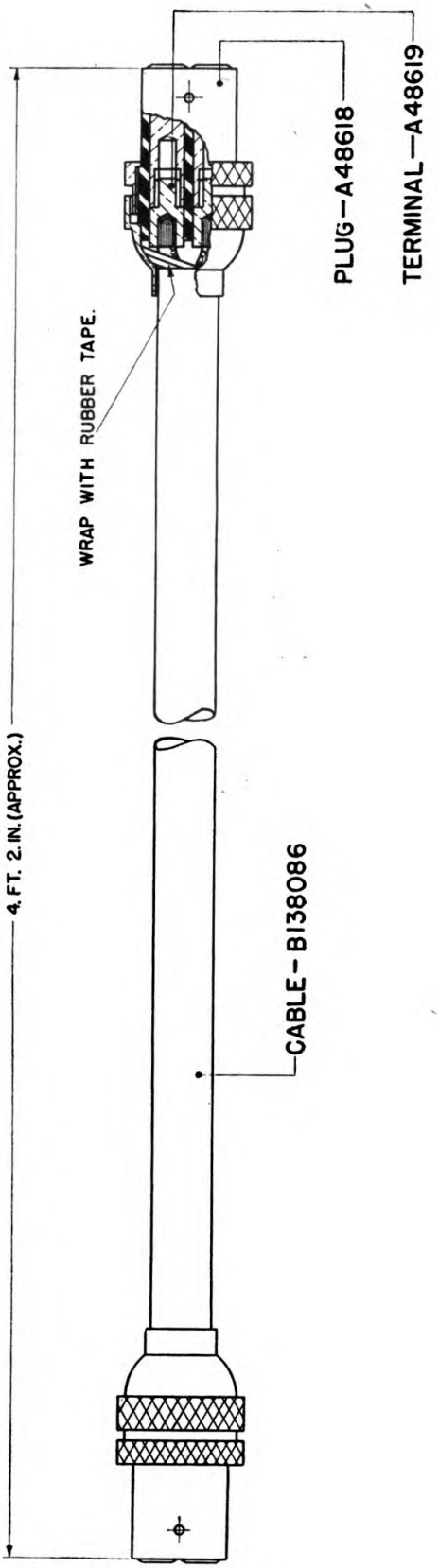

FIGURE 12.—Cable, 2-conductor, 4 feet long with plugs.
(Connects to source of power.)

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e. The slides and worms are to be lightly greased and then moved through their entire range. Excess lubricant should then be wiped off.

f. Avoid getting oil or grease on the glass of optical parts if the mount is lubricated with the telescope installed.

g. When lubrication has been completed, the telescope mount should be allowed to stand for several hours and then any excess lubricant which has leaked out should be removed to avoid accumulation of grit and dirt.

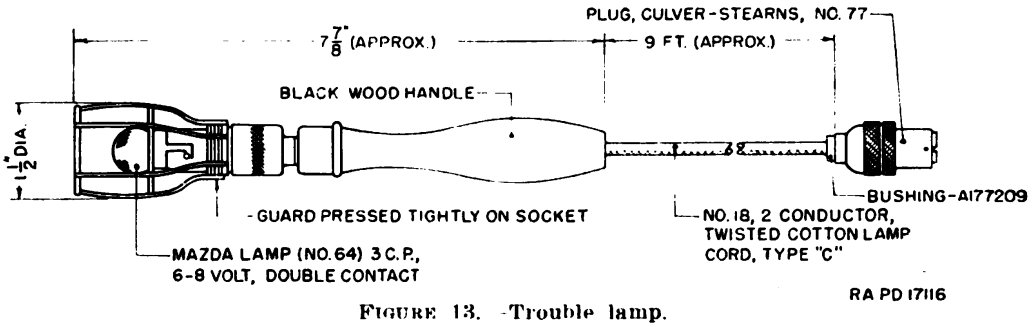

FIGURE 13. Trouble lamp.

h. When the telescope mount is idle for protracted periods, it should be operated at regular intervals to spread the lubricant.

i. Avoid contaminating the oil in the lubricating gun by mixture with other oils or an accumulation of water.

j. When the lubricating gun is not in use it should be kept in the tool chest. It should not be used for purposes other than specified.

k. The prescribed lubricants must function also as rust-preventives. It is important that they be be applied carefully and sparingly.

SECTION V

INSPECTION

14. Purpose.—*a.* Inspection is for the purpose of determining the condition of the instrument, whether repairs or adjustments are required, and the action necessary to place the instrument in serviceable condition. This action may consist of adjustment of parts where

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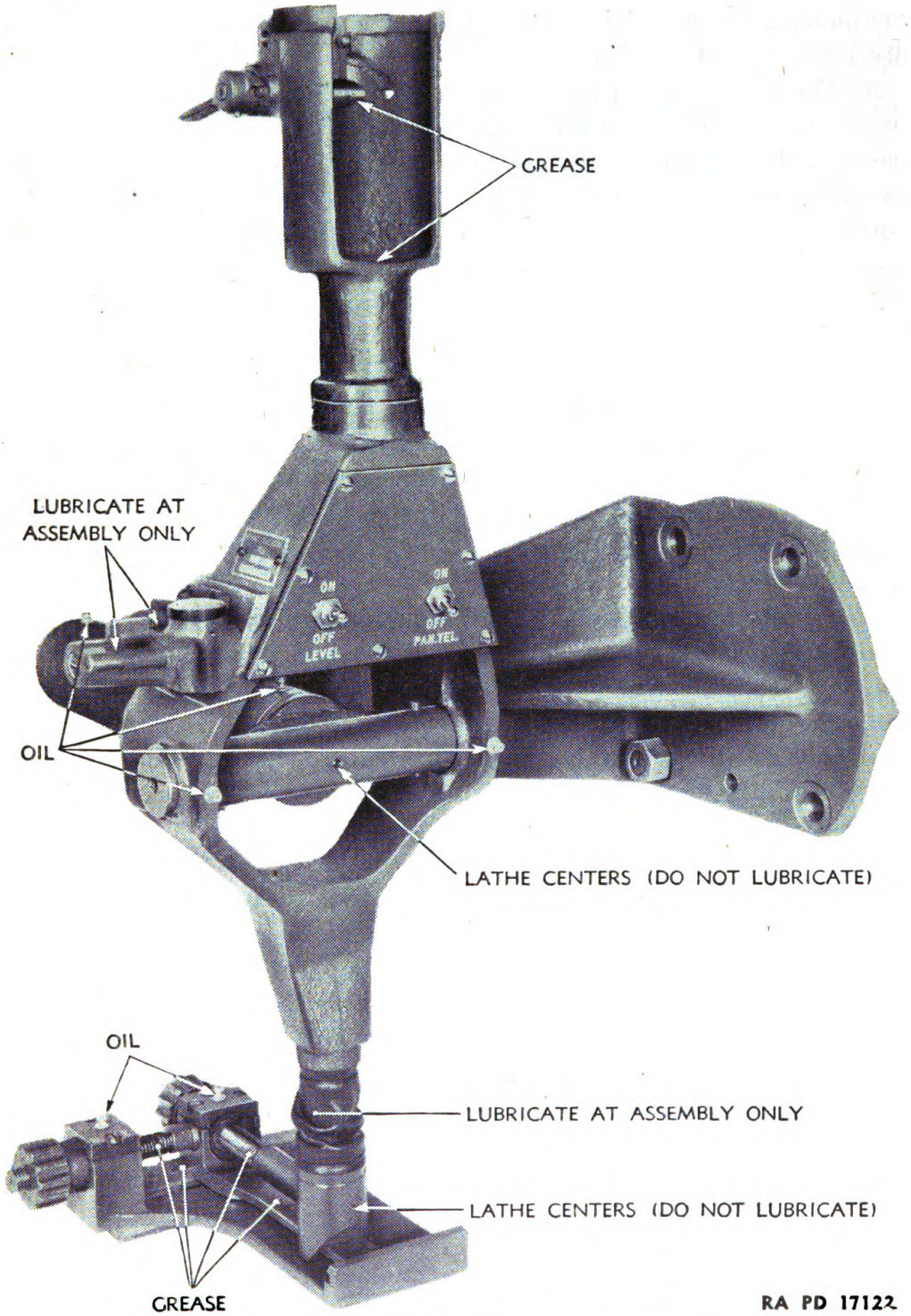

FIGURE 14.—Lubrication of telescope mount.

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provided for or by the replacement of worn and broken parts. Adjustment is described in section VI. Disassembly and assembly are described in section VII.

b. The first inspection performed on an instrument is a preliminary inspection to determine the condition of the instrument and to locate basic faults. As a result, proper disposition of the instrument can be made and necessary action taken or recommended. Inspection forms similar to O. O. F. 7228 and O. O. F. 7229 (fig. 15) may be prepared locally for recording the results of the inspection. Instructions concerning the entries to be made are printed on the back of the form.

c. The detailed inspection is performed by the instrument repairman. The purpose of this inspection is to determine the specific repair required to place the instrument in serviceable condition. The inspection procedure may vary with each instrument, depending on the faults indicated by the preliminary inspection. Inspection forms and methods used in connection with the detailed inspection are described in TM 9–2602.

15. Tools for inspection and repair.—An instrument repair kit containing common tools and supplies for instrument inspection and repair is furnished to ordnance maintenance companies. (This kit, repair, instrument, replaces kits previously issued as kit, repair, optical, for Field Artillery, and kit, repair, optical, for harbor defense.) The items in the kit, required for inspection of the telescope mount need no description, as their uses are self-explanatory.

16. Tolerances.—Tolerances, or allowable errors, are specified where necessary to indicate the degree of accuracy required in performing certain adjustments. In general, an instrument is considered unserviceable if the error in any part exceeds the specified tolerance. However, it must be realized that the specified tolerance is intended to serve mainly as a guide for the inspector, and must be supplemented by good judgment on the part of the inspector. The instrument repairman should attempt to reduce the errors to lower limits if time and conditions permit.

17. Inspection requirements.—Check telescope mount M20 for—

Name plate data.
Completeness.
Appearance.
Condition of paint.
Condition of level vials and covers.
Condition of oil fittings.

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O. O. F. 7229

INSPECTION OF ORDNANCE MATERIAL

Sheet No._____

Organization_____ Date of inspection_____

Station_____ Inspected by_____

Organization commander_____

Item and Serial No.	Defects noted	Action to be taken

RA PD 9693

FIGURE 15.—Inspection of ordnance material.

(O. O. F. 7228 is the same as O. O. F. 7229 except that it is not ruled. Instructions are printed on the back.)

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Condition of machined locating surfaces on mounting bracket and telescope holder.
Action of telescope socket clamp.
Smoothness of tee movement.
Condition of switches, sockets, wires.
Proper adjustment of longitudinal level and cross level.
Detection of backlash and binding in leveling mechanism.
Proper adjustment of azimuth locating screws in telescope socket.
Location of defects in electrical components.

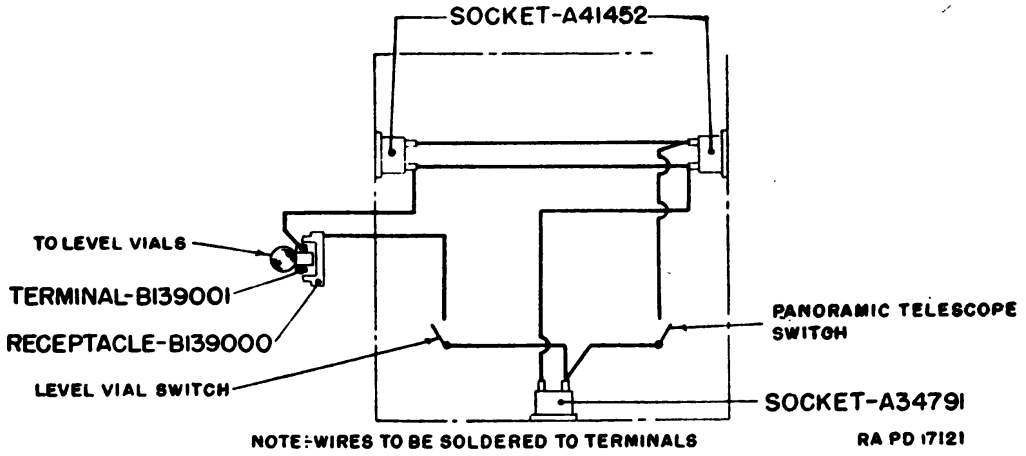

FIGURE 16.—Wiring diagram.

18. Facilities needed for inspection.—*a.* Sturdy workbench, affording clear vision to the front.

b. Sensitive spirit level.

c. A 6- to 8-volt test circuit including a test lamp or a buzzer, battery, or other source of power, and suitable leads.

19. Preliminary inspection.—*a.* Record name and serial number from name plate.

b. Examine the telescope mount for completeness, appearance, condition of paint, and for bent or broken parts. The mounting screws, nuts, and washers (fig. 21) are part of the telescope mount and should be accounted for. The level vials and oil fittings should be undamaged. Check action of spring loaded level vial covers. If they are not held open and locked shut by action of the spring and plunger, a replacement of worn or broken parts is necessary (par. 30*f*).

c. Machined locating surfaces on the mounting bracket and telescope socket should be smooth and clean. The panoramic telescope should fit easily into the telescope socket when the socket lever is swung to clear the catch. The telescope should be held securely when

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the lever is released and the detent of the lever bears against the stop.

d. Rotate the bracket and support around the tee pivot bearings and note any binding or play. If either is noticed, a replacement of worn or damaged parts is necessary (par. 30*e*).

e. Connect the wiring to the source of power, operate switches, and check lighting for defective lights or wiring. If a light is out, the lamp may be burned out. If a light flickers, there may be a loose connection (par. 32).

20. Detailed inspection.—The repairman will use only the portions of detailed inspection that are indicated by the results of the preliminary inspection.

a. Test for adjustment of longitudinal level and cross level.—(1) Set the mount up as shown in the assembled views (figs. 1 and 5) with the mounting surface of the bracket in a vertical plane and the locating keys horizontal. This test may be made on the gun mount. Use a sensitive level and square, if necessary for leveling.

(2) Place a sensitive level on the finished top surface of the telescope socket and in a position roughly parallel to the gun bore axis. Turn the longitudinal level knob to center the bubble of the sensitive level. Note the position of the longitudinal cross level bubble. If it is not centered, an adjustment is necessary (par. 24).

(3) Turn the sensitive level 90° so that it is roughly parallel to the gun trunnion axis. Turn the cross level knob to center the bubble of the sensitive level. Note the position of the cross level bubble. If it is not centered, an adjustment is necessary (par. 24).

b. Test for backlash in the leveling mechanism.—(1) Set the mount up as in *a*(1) above.

(2) Level the mount by turning the longitudinal and cross level knobs, centering both bubbles in the leveling vials. Scribe a light reference line on the hub of each knob and continue it onto the pertaining bearing cap.

(3) Rotate the longitudinal level knob approximately one revolution further in the direction last used in centering the bubble. Center the bubble again by rotating the knob in the opposite direction, being careful not to allow the bubble to pass beyond its center point. Note the position of the scribed line on the knob in relation to its continuation on the cap. If the distance between the lines exceeds ⅛ inch, backlash is excessive and must be corrected (par. 27).

(4) Apply the same procedure as in (3) above using the cross level knob to test for backlash in the cross level mechanism.

c. Test for binding in leveling mechanism.—(1) Set up the mount as in *a*(1) above.

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(2) Operate the longitudinal and cross level knobs through their entire range and note any binding. The knobs should turn smoothly without undue effort and without noticeable change in the amount of effort required to turn them through their entire range. If binding occurs, correction is necessary (par. 27).

d. Test for adjustment of azimuth locating screws in telescope socket.—This test is required only when the telescope mount is assembled on its gun carriage.

(1) Level the gun and boresight it on the testing target furnished with the gun.

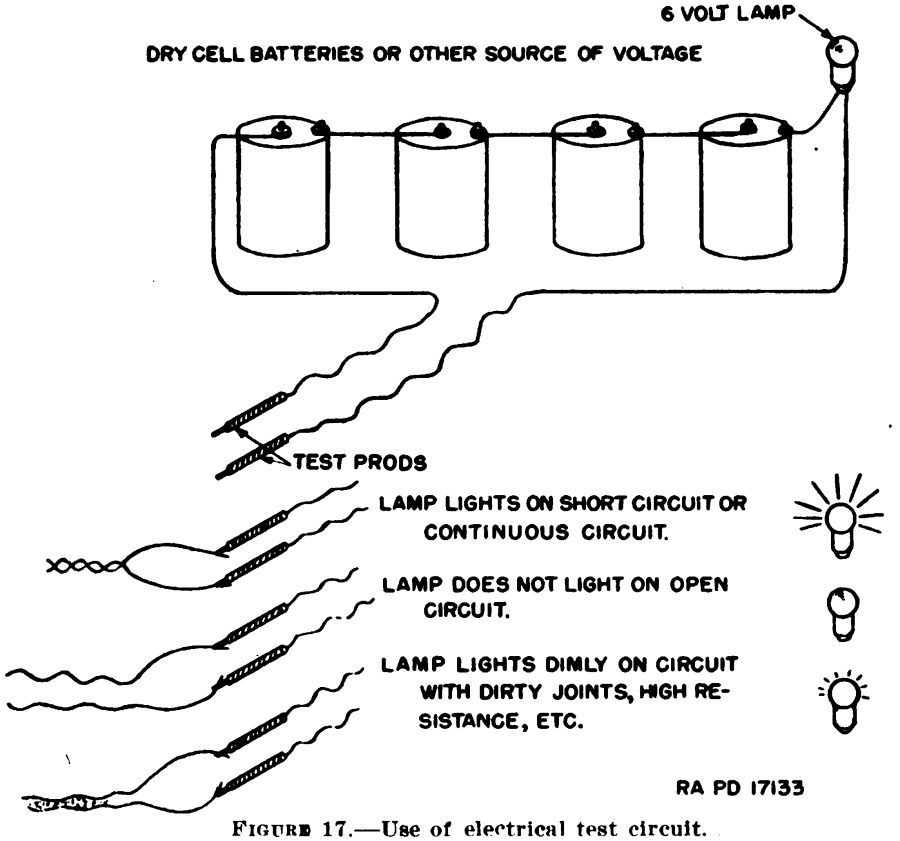

FIGURE 17.—Use of electrical test circuit.

(2) Place the panoramic telescope in the telescope holder and set the azimuth scale, deflection scale, and micrometers to zero.

(3) The adjustment of the locating screws is correct if the line of sight of the telescope is parallel with the line of sight through the gun bore.

(4) Error in excess of 0.025° (indicated on the panoramic telescope) requires adjustment (par. 25).

e. Location of defects in electrical components.—(1) Refer to the wiring diagram in figure 16.

(2) Remove the cover (B138798, fig. 7) and, if necessary, the cap (A179484, fig. 9).

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(3) Using the test circuit (fig. 17) check the sockets, switches, receptacle, and wires for short or interrupted circuits. If short or interrupted circuits are found they must be corrected (pars. 32 and 33).

21. Action to be taken.—Instruments found defective must be repaired or adjusted to render them serviceable. Defects noted and action to be taken must be entered on the inspection form for each instrument. The action to be taken will be governed by the facilities available. If the facilities of the section do not permit satisfactory accomplishment of the repair or adjustment, the unserviceable instruments will be passed on to a higher maintenance echelon; replacement items should then be issued to the using arm.

SECTION VI

ADJUSTMENT

22. General.—This section deals with the correction of those defects in the telescope mount which may be remedied by adjustment of parts. Other defects may be corrected by the replacement of worn and broken parts, as described in section VII. The adjustments may be performed only by qualified ordnance personnel.

23. Facilities necessary for making corrections.—The facilities necessary for making corrections are generally the same as those required for inspection, with the addition of facilities to permit sealing and touch-up painting of the instrument after correction.

24. Adjustment of level vials.—If the inspection described in paragraph 20*a* indicates that one or both of the levels of the telescope mount do not agree with the sensitive level then adjustment is necessary.

a. Leave the mount set up as in paragraph 20*a*.

b. Drive out the pin (BFDX3.1A) and unscrew the plug (A34057, fig. 9).

c. Raise or lower the end of the level vial tube by turning the adjusting screws (BCUX2CB, figs. 9 and 18) until the level agrees with the sensitive level.

d. Make sure that no looseness or play exists. This may be done by pressing with a match stick or orange stick on the level vial and tube. Replace the plug and pin.

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e. Turn the telescope mount about 90° in azimuth (it may be necessary to traverse the gun mount) and recheck the levels against the sensitive level.

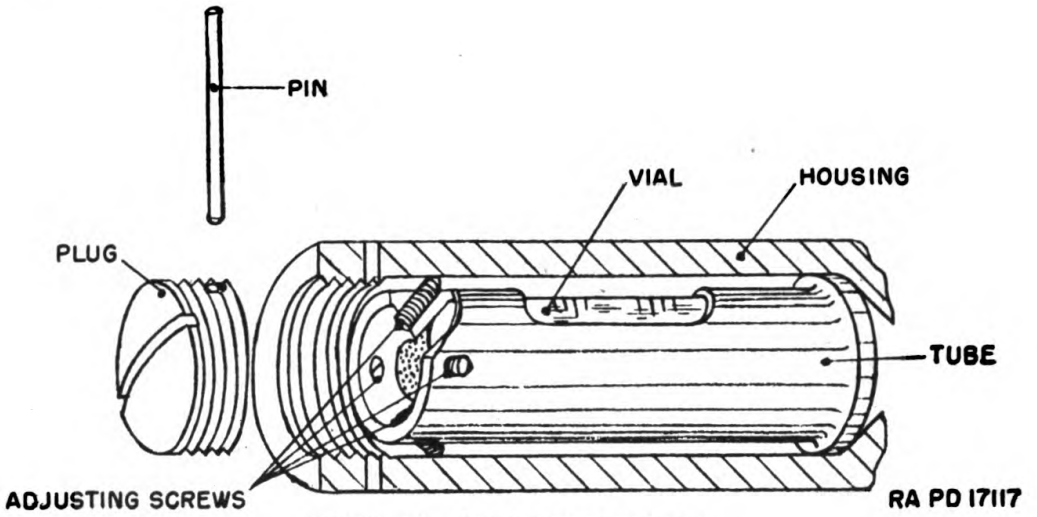

FIGURE 18.—Level vial adjustment.

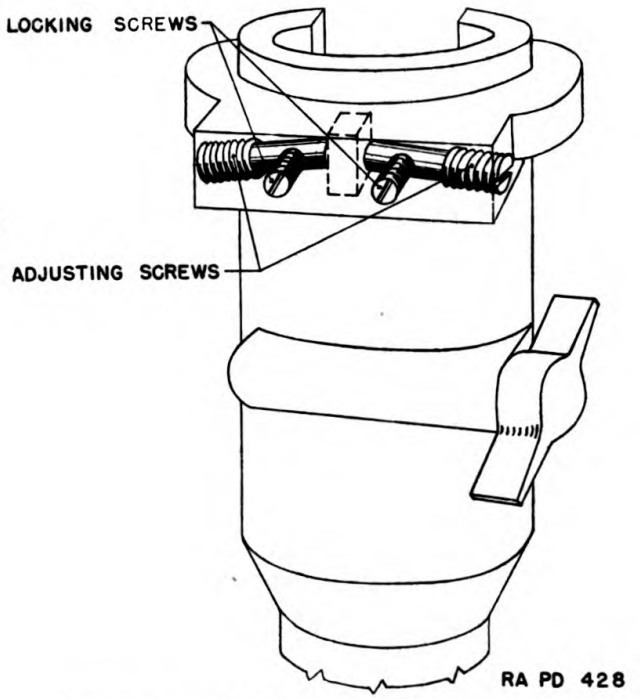

FIGURE 19.—Adjustment of telescope socket.

25. Adjustment of telescope socket.—If inspection of the alinement in azimuth of the telescope socket as described in paragraph 20*d* indicates excessive error the telescope socket should be adjusted.

a. Leave the mount set up as in paragraph 20*d*.

b. Loosen the two locking screws (fig. 19).

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c. Loosen one adjusting screw and tighten the other. This will turn the telescope slightly in azimuth. Bring the telescope reticle to bear exactly on the target.

d. Tighten the lock screws and note whether tightening has shifted the setting. It may be necessary to alternate the final tightening, bearing gradually more and more on each screw until the screws are home and the alinement is maintained.

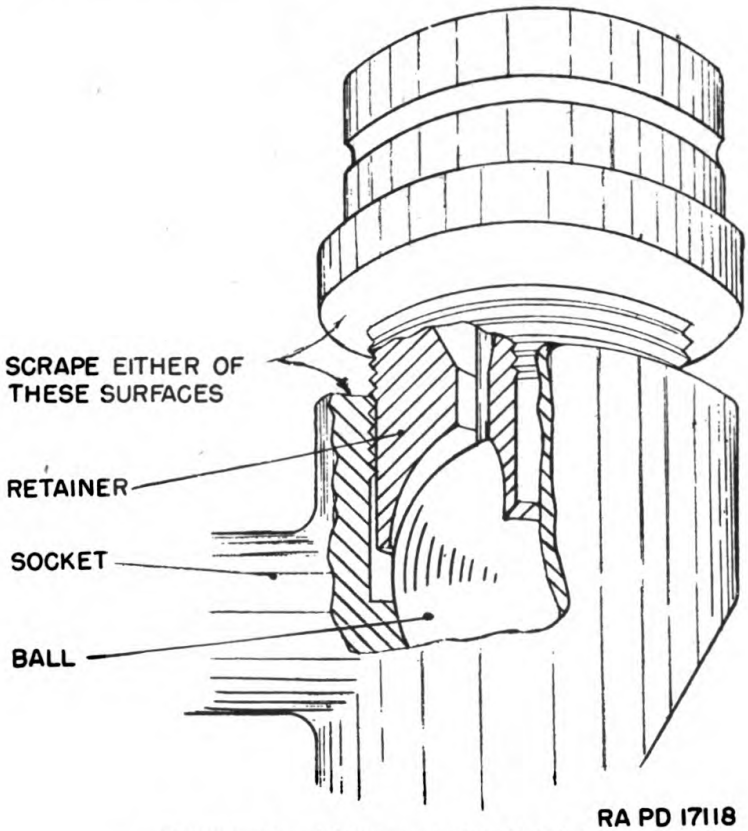

FIGURE 20.—Adjustment of ball joint.

26. Adjustment of ball joint.—*a.* No provision for adjustment of the ball joint has been made. If the ball joint is too stiff in action, release the locking screw, back off the retainer (A178253, fig. 6) slightly, and lock again. In the original assembly the retainer has been fitted.

b. If the ball joint is too loose in action, face off the shoulder of the retainer or socket until the ball is properly seated (fig. 20). If this does not correct the action, scrap the part at fault and replace it.

27. Adjustment of leveling mechanism.—*a.* If backlash occurs as determined in paragraph 20*b*, remove looseness in the ball joint as described in paragraph 26*b*. If all clearance in the ball joint has been

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taken up and backlash still persists, it can only be corrected by the replacement of worn parts (par. 30*d*).

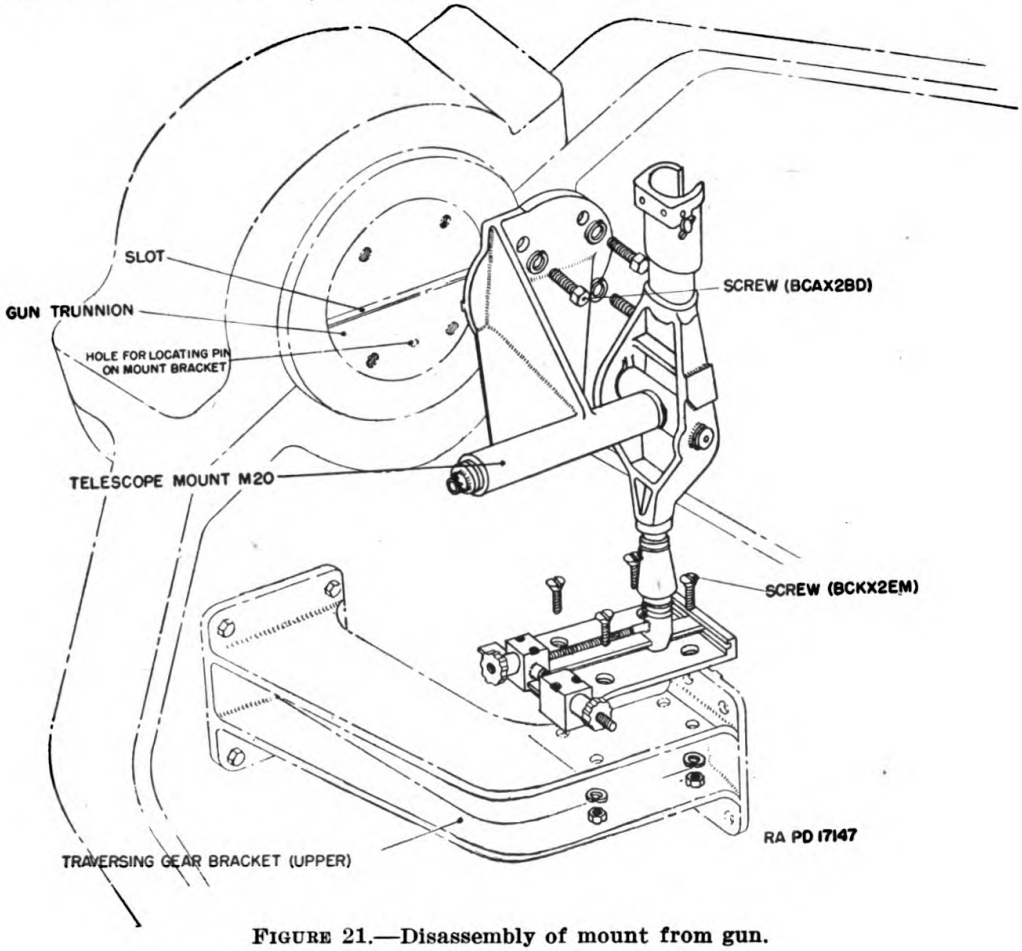

FIGURE 21.—Disassembly of mount from gun.

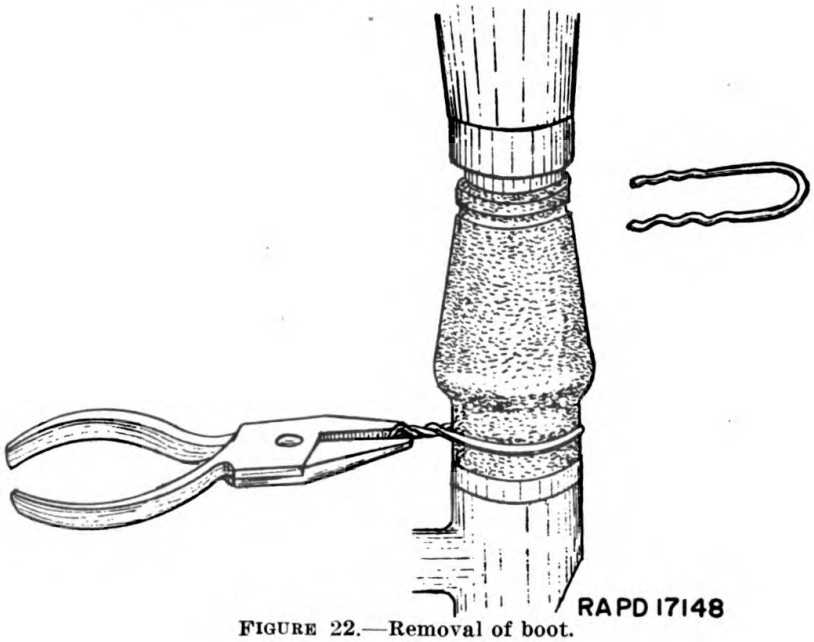

FIGURE 22.—Removal of boot.

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b. If binding occurs as determined in paragraph 20*c*, remove stiffness from the ball joint as described in paragraph 26*a*.

(1) If binding still persists, dissassemble the leveling mechanism assembly (par. 30*d*) and remove nicks or burs from the tongues and

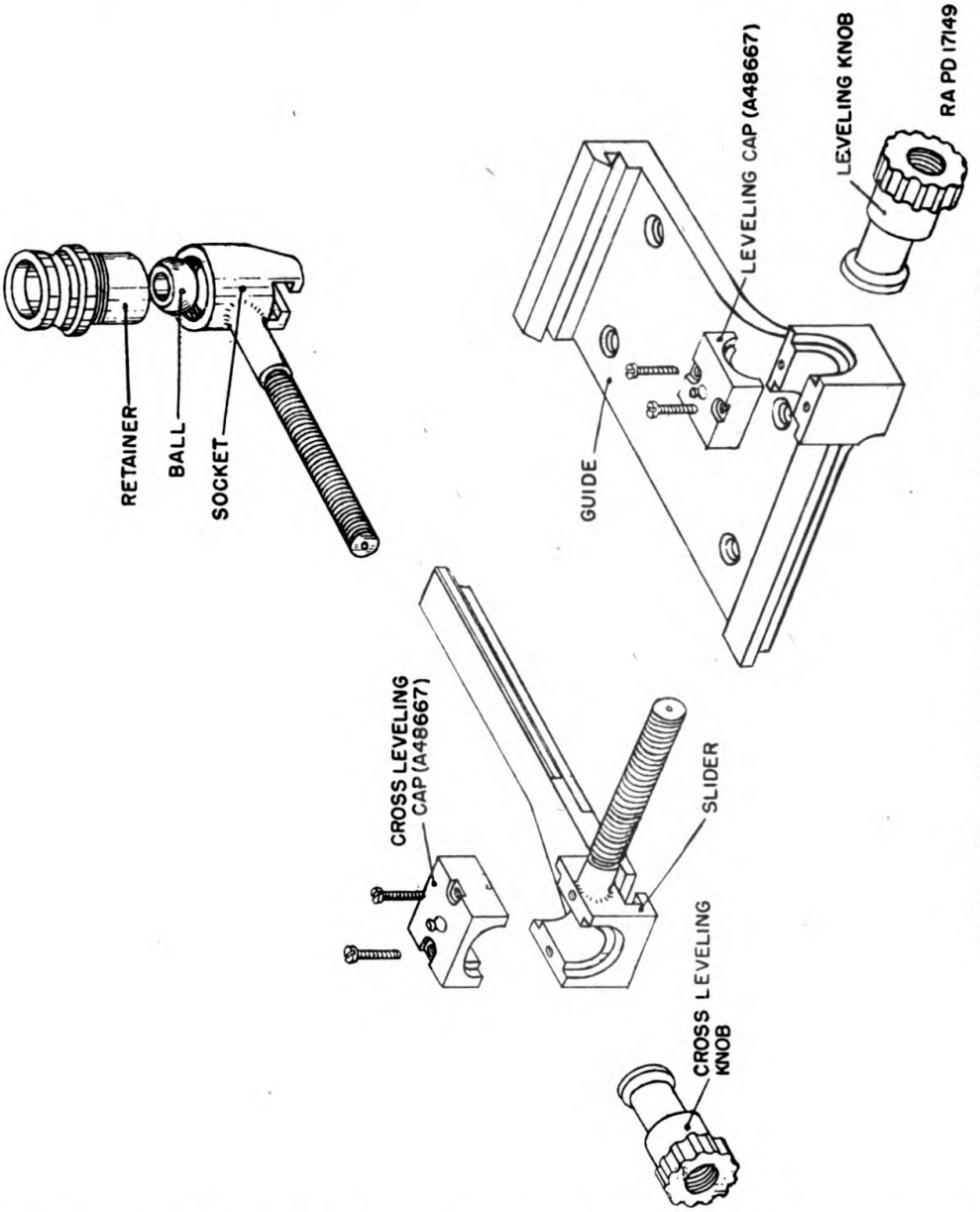

FIGURE 23.—Disassembly of leveling mechanism assembly.

slots of the guide, slider, or socket with a fine file. Thoroughly clean and oil the bearing surfaces of the knobs, slider, and guide.

(2) If binding still persists, replacement of parts is necessary (par. 30*d*).

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SECTION VII

MAINTENANCE AND REPAIR

28. Precautions.—*a.* The following operations may be performed only by qualified ordnance personnel; the using arm is prohibited from attempting them.

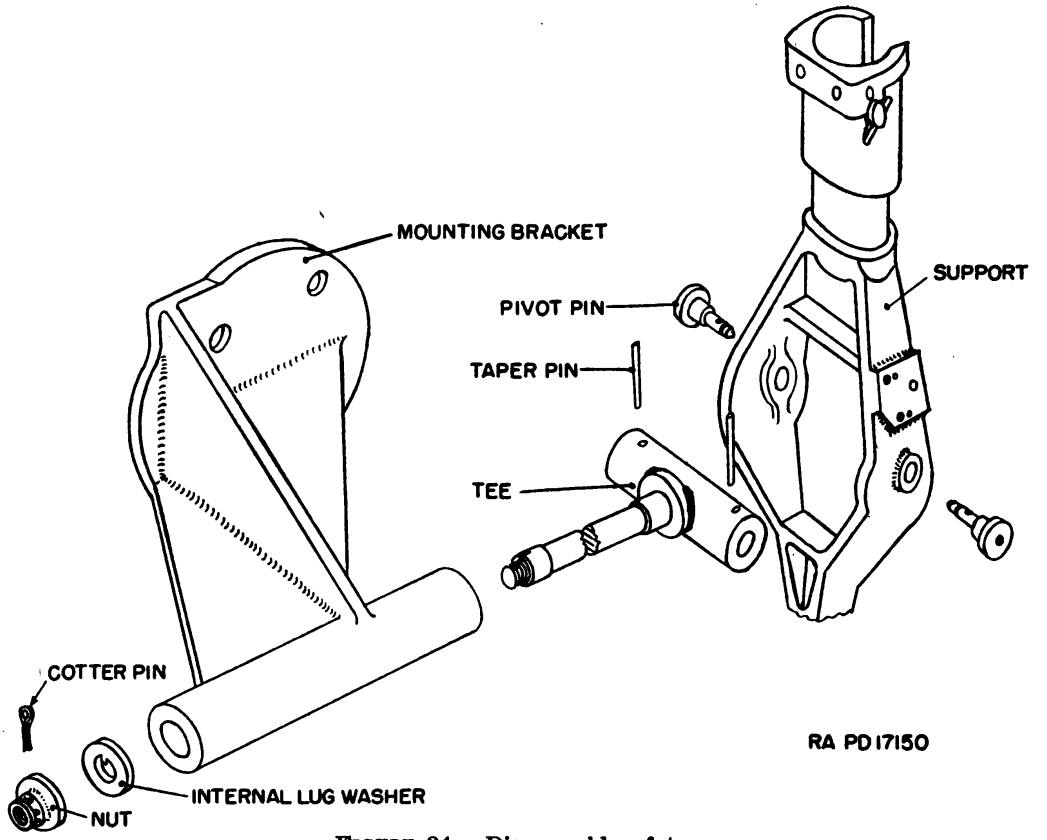

FIGURE 24.—Disassembly of tee.

b. To preserve the parts of the instrument, it is necessary to exercise care and close attention during disassembly, cleaning, and adjustment. The extent of disassembly for any certain repair job is determined by the repairman when he makes his detailed inspection.

c. Defective parts should be replaced from stock. Replacement of components is easily accomplished for the most part, since the components are all standardized and available as replacements. Some

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parts require fitting. It is therefore essential that the relationship of these parts be carefully studied before assembly is attempted. Parts should be marked before disassembly to indicate original settings.

29. Facilities for making repairs.—*a. Disassembly.*—Improvised jack.

b. Level vials.—()1 Plaster of paris (gypsum, calcined, fine, grade 1).

(2) Dowell, ⅛-inch diameter.

(3) Paper for packing.

c. Electrical repair.—(1) Soldering iron.

(2) Solder, tin-lead, grade A.

(3) Paste, soldering.

30. Disassembly.—The extent of disassembly for any certain repair job is determined by the repairman when he makes his detailed inspection. It may be necessary to remove only the leveling mechanism; it may be more expedient to keep the mount on the gun while making partial disassembly and repair. This is left to the judgment of the repairman as it will also be governed by the facilities available to him at the time.

a. Preliminary.—Disconnect the cables from the source of power, from the telescope, and from the mount. Remove the telescope from the socket.

b. Disassembly of mount from gun.—In removing mount from gun the leveling mechanism assembly should be removed from the carriage before bracket is detached from the trunnion (fig. 20).

(1) Remove the four screws (BCKX2EM), washers, and nuts securing the leveling mechanism assembly to the top carriage.

(2) Remove the four screws (BCAX2BD) and washers securing the bracket with support assembly (D29307) to the gun trunnion. In pulling the bracket from the trunnion, care should be taken to avoid damaging the locating pin (BFDX2EG) and the two horizontal keys which are cast with the bracket and fit the slots in the trunnion.

c. Removal of boot.—(1) Untwist the wires retaining the boot. Cutting the wires is undesirable for it involves the possibility of gashing or puncturing the boot (fig. 21).

(2) If the leveling mechanism assembly is loose, it may be disengaged and the boot pulled clear.

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(3) In reassembling use fresh wire wherever possible and after twisting the ends bend them to lie on the boot neatly and out of the way.

d. Disassembly of leveling mechanism assembly.—(1) Remove the four screws (BCGX3FK) and washers. Remove the two caps (A48667). (See figs. 6, 7, and 23.)

(2) Slide the slider (C69544) and the socket (B138766) off the guide (C69543).

(3) Remove the locking screw (BCUX1FE) and unscrew the retainer (A178253). The ball (A178254) may then be withdrawn.

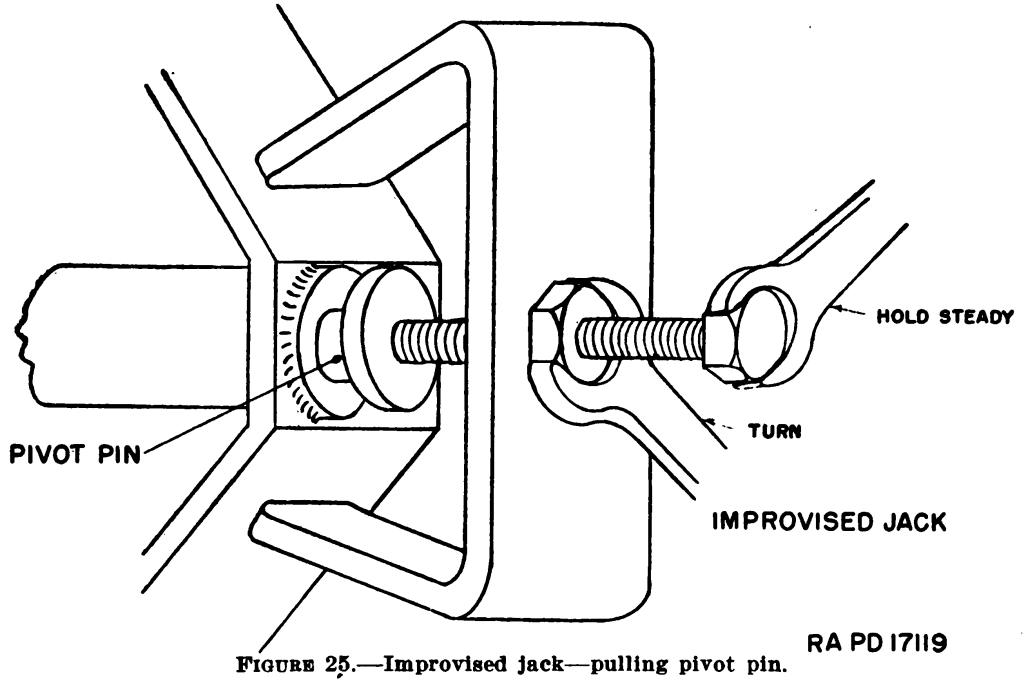

FIGURE 25.—Improvised jack—pulling pivot pin.

(4) Unscrew the knobs.

(5) The Alemite No. 1667 type lubrication fittings are not to be removed from the caps except for replacement. These fittings are drive fit and will not hold if taken out and reinserted repeatedly.

e. Disassembly of tee.—(1) Disassembly of the tee (C69546) from the support (D28909) is not to be attempted except at a base shop or arsenal. The parts are held together by a press fit between the special pins (A48672) and the tee (figs. 6, 7, and 24).

(2) To disassemble (at a base shop or arsenal), drive out taper pins (BFCX1FF). Screw a bolt (⅜–16NC–2–thread), with at least ¾ inch length of thread, into the threaded hole in each of the two

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special pivot pins (A48672). Employ some method of pulling, such as the improvised jack shown in figure 25.

(3) To disassemble the tee from the bracket, mark the location of the nut (A178256), remove the cotter pin (BFAX1DK), and remove the nut and the keyed washer (A178255). Slide the tee out of the bracket. The lubricating fittings need not and should not be removed (see *d*(5) above).

f. Disassembly of cross level assembly.—The cross level assembly, including the cross level bracket, may be removed entirely from the support or may be disassembled with the bracket (C69542) remaining on the support (figs. 9 and 26).

(1) To remove the bracket it is first necessary to open the lamp well by unscrewing the cap (A179484). Then loosen the locking screw (BCUX1EB) and unscrew the ring (A179369). Pull the terminal assembly (B139001) out to expose the terminals and unsolder the leads from the terminals (A179482 and A179483). Remove the three screws (BCCX1AA) and washers (BEAX1H) and lift the bracket off the support.

(2) To remove each level vial, drive out the pin (BFDX3.1A) and unscrew plug (A34057). Unscrew two adjacent screws (BCUX2CB) a turn or two and gently withdraw the level vial tube assembly. For repair and replacement of level vials see paragraph 31.

(3) To remove a level vial cover, drive out the staked cover retaining pin (BFDX1AE). Turn the cover and hinge pin (A178260) until the plunger (A178261) is depressed, thus clearing the flats of the hinge pin, then drive out the hinge pin. Care must be taken in this step to avoid damage to the hinge pin or plunger.

(4) To remove the plunger (A178261) or spring (A178262) it is necessary to remove the plug (A178263A) which has been staked in place. The staked metal must be cut away carefully to leave enough for restaking. This disassembly should be avoided as far as possible.

g. Disassembly of telescope socket.—(1) The telescope socket is secured to the support by a rivet. Normally disassembly is not necessary. To remove the socket it is necessary to drill out the countersunk rivet.

(2) To disassemble the locking shaft and lever (figs. 8 and 27), hold the lever firmly and drive out the stop pin (BFDX1EK). Turn the lever slowly until all tension in the spring has been released. Drive out the pin (BFCX1BC) and push the shaft (B138608) out

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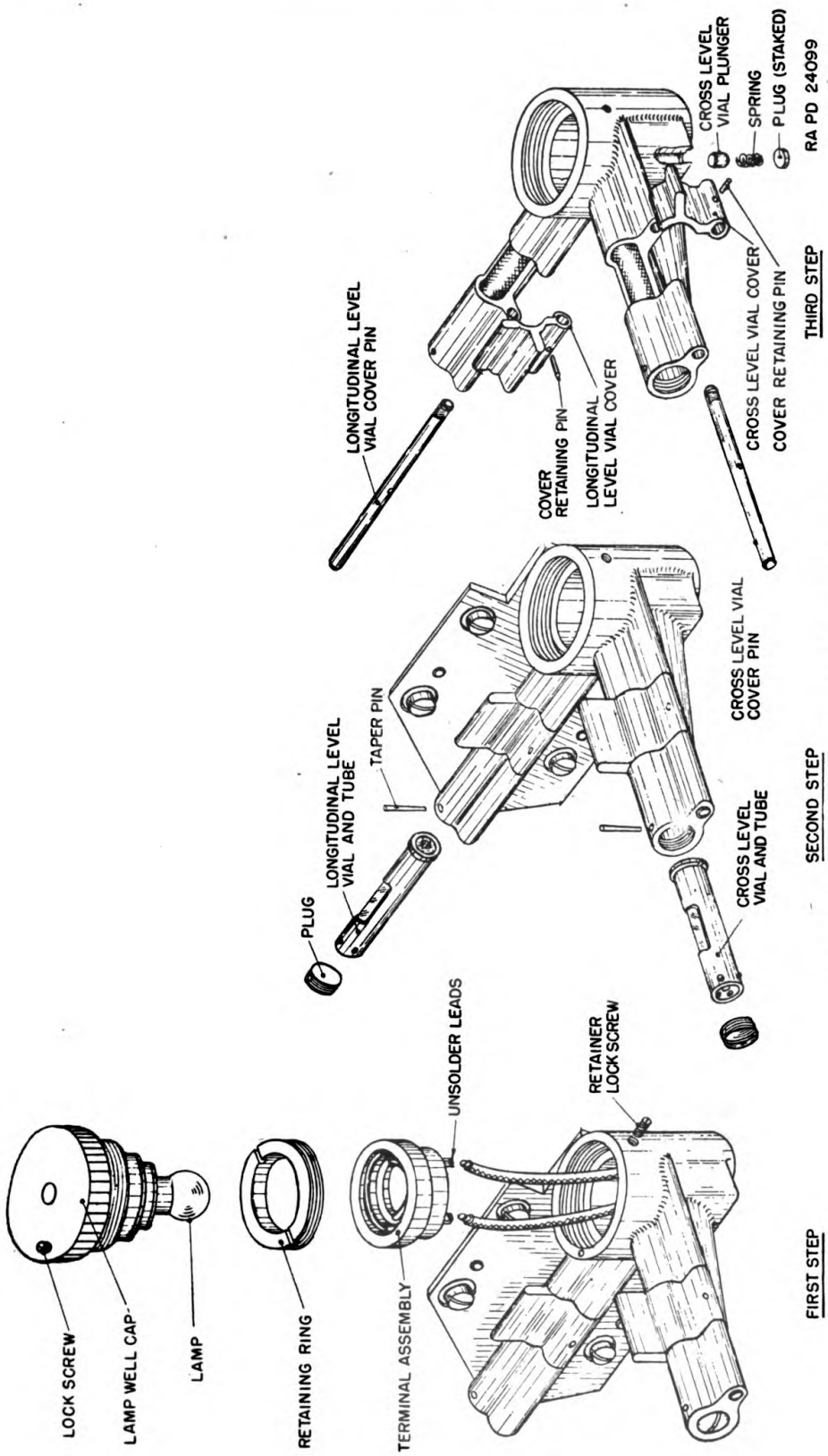

FIGURE 26.—Disassembly of cross level assembly.

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through the far side of the socket. The spring (A38067) and retainer (A38068) may be removed. In reassembling, follow figure 8 for the setting of the spring.

31. Replacement of level vials.—When the level vials are broken or otherwise unserviceable replacement should be made as follows:

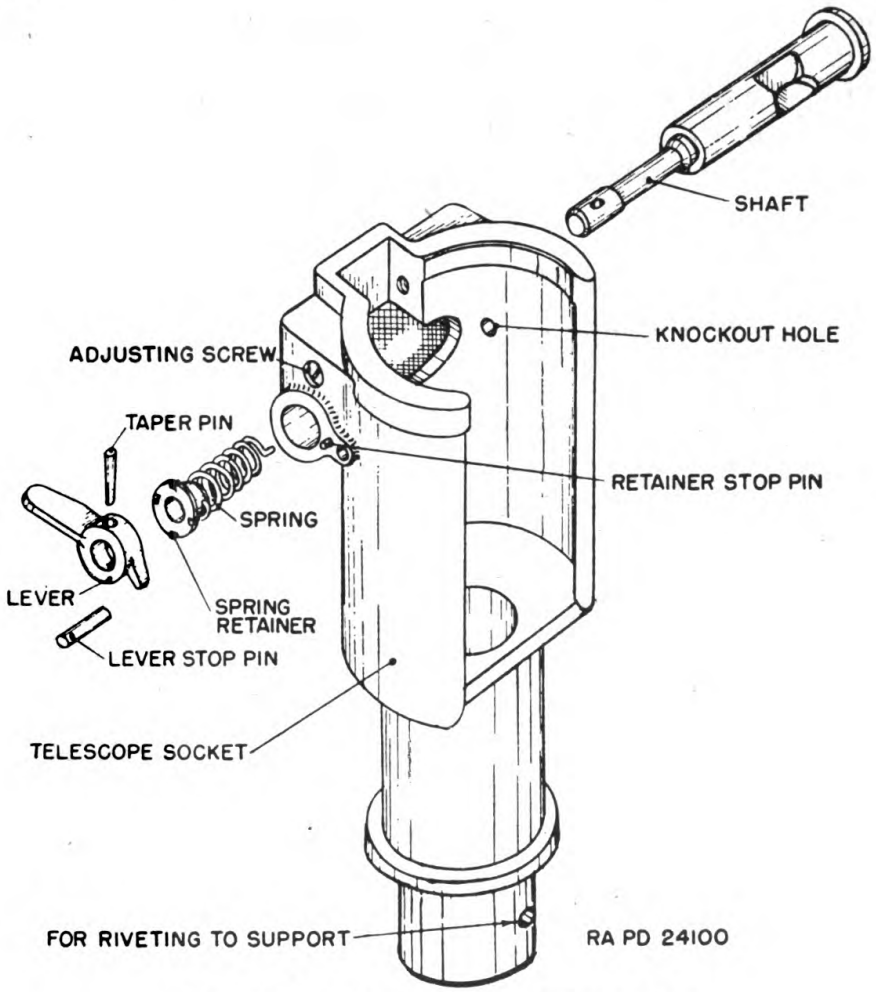

FIGURE 27.—Disassembly of telescope socket.

a. Push the old level vial out of the tube (B138997) and clean out any broken glass or old packing (figs. 9 and 28).

b. Remove the silver coating and covering from the tip of a new level vial (A31314, type L). This will permit illumination of the vial after assembly. A knife may be used. Take care to avoid scratching the glass.

c. Locate new level vial in level vial tube with tip towards large end of tube and graduations centered in the opening. Use paper strips to position the vial, if necessary.

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d. Prepare a short wooden dowel, ⅛-inch diameter, wrap one or two turns of paper around to form a tube long enough to inclose the tip of the vial. In this way a passage is left for illumination of the vial.

e. Hold the dowel over the tip and pack the tube with plaster of paris (gypsum, calcined, fine, grade 1) which has been mixed to medium consistency. Hold the dowel on a block or by some other means until the plaster has hardened.

f. After the plaster has set, pull out the dowel and leave the paper tube in or pull the tube out if it is readily removable. Clean excess plaster from the surface of the tube. The four adjusting screws should be clean.

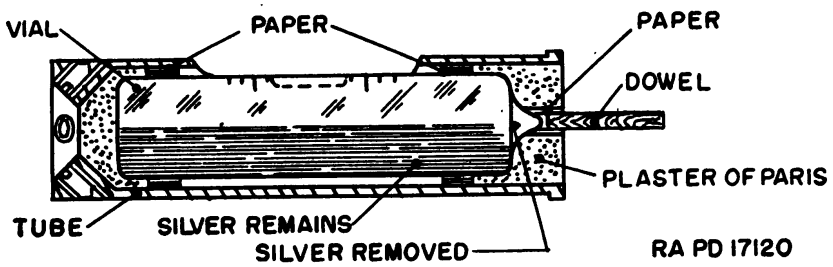

FIGURE 28.—Replacement of level vial.

32. Electrical repair.—*a. Lamp.*—Burning out of the lamp will probably be the chief electrical trouble. Replacement of the lamp is made as follows:

(1) Unscrew the lock screw (BCUX2CD) several turns to unlock the cap (A179484, figs. 9 and 26). Then unscrew the cap completely and pull it clear of the lamp well.

(2) Press the lamp inward against its retaining spring and give it a quarter turn counterclockwise to clear the bayonet type socket.

(3) Examine the old lamp to see if it was burned out or broken. The lamp may be all right and the reason for its not lighting may be elsewhere.

(4) Replace if the lamp was burned out and check by connecting up the entire circuit to a source of power.

b. Switch.—(1) To replace a defective switch, remove the cover (B138798, figs. 7 and 29). Unsolder the wires from the switch terminal lugs (par. 33).

(2) Remove the nut and washer securing the switch to the cover and remove the switch. Fasten the new switch in place.

(3) Solder the wires to the terminal lugs.

(4) Test the circuit and then replace the cover.

c. Sockets.—(1) To replace a defective socket remove the cover (B138798). Unsolder the wire leads (par. 33).

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(2) To remove sockets (A41452) unscrew the hexagon nuts and pull the sockets out.

(3) To remove socket (A34791) remove the two screws (BCLX3DH) and nuts (A35564A).

(4) Install the new socket, check the wiring against the wiring diagram (fig. 16), and solder the wires to the terminals.

d. Wires.—(1) Wires to be attached to the switch terminal lugs should have the insulation stripped back about ¼ inch from the end.

(2) Wires to be soldered into socket or receptacle terminals should be stripped back about ½ inch and then doubled over smoothly for insertion in the terminal hole.

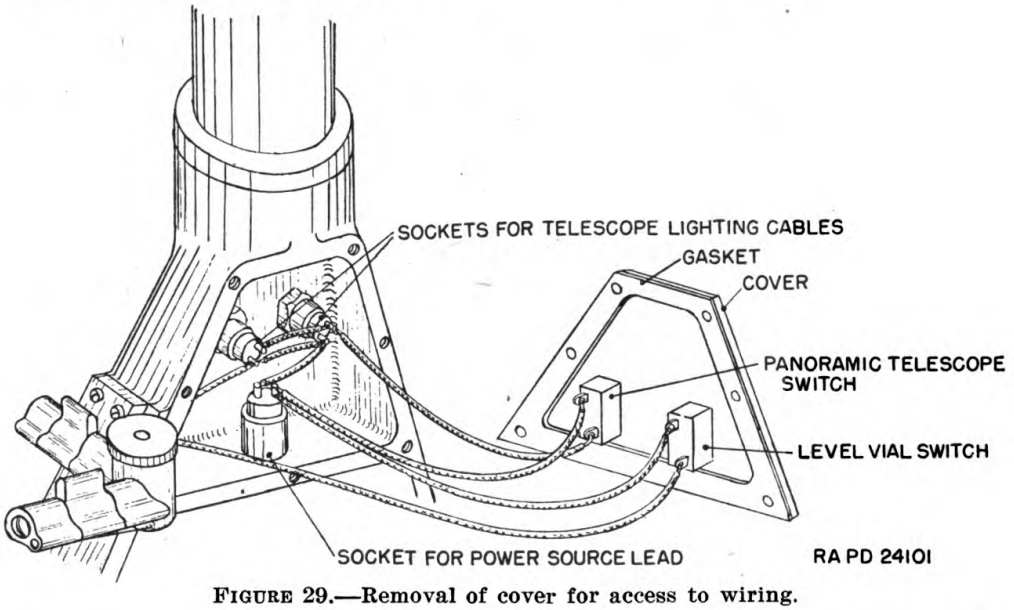

FIGURE 29.—Removal of cover for access to wiring.

(3) Wires should not be cut so short as to make disassembly difficult.

33. General instructions for soldering.—*a.* Thoroughly clean or scrape the surfaces to be soldered. Copper and brass will show a bright surface when properly cleaned.

b. Use rosin flux, either in paste form or in the self-contained core form in which some solders are furnished. When using paste, dab a very small amount of the paste on the cleaned surfaces. Flux in self-contained cores needs no special application, as it will flow properly when the soldering iron is applied.

c. The solder is intended, primarily, to provide electrical contact, and is not intended to withstand mechanical strain. Where possible, wrap the wire around the terminal device. Where two wires are to be soldered, first twist them to obtain a mechanically strong joint.

d. Heat the joint with the point of a hot soldering iron, and flow the solder smoothly into the joint. Remove the soldering iron and

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allow the joint to cool. A good joint should show a thin continuous film of solder, with no lumps or excess of solder. If too much solder has been applied, reheat the joint with the soldering iron and allow the excess to flow onto the iron.

e. In order to separate soldered parts apply a hot soldering iron to the joint until the solder flows, then pull the parts away from each other.

34. Assembly.—*a.* Assembly is performed in the reverse order of disassembly. Precautions to be taken in reassembly are noted in several of the disassembly descriptions. Necessary adjustments are performed as indicated in previous portions of this manual.

b. All parts which have been removed from the instrument should be carefully cleaned before assembly.

c. Metal components should be cleaned in solvent, dry-cleaning, and allowed to dry in the air.

d. See paragraph 13 for lubrication instructions before proceeding with assembly.

e. After reassembly is complete, plug the recesses above the various adjusting screws with plugging cement of the same color as the instrument. Smooth the cement to hide the openings as completely as possible. Paint over the openings and flush screws in accordance with instructions in section IX.

f. After assembly and adjustment, the various parts and mechanisms should be inspected according to the procedure given in section V.

Section VIII

ASSEMBLING TELESCOPE MOUNT TO GUN

35. Procedure.—*a.* Inspect the keys of the telescope mount bracket and the keyway in the gun trunnion for nicks or burs. Grease slightly the mating surfaces and engage the bracket with the trunnion. Take care to avoid bending the dowel pin. Bolt securely. Do not force the keys or dowel if they do not fit smoothly.

b. The upper bracket (D41705, fig. 21) for the traversing gear *may have been drilled at a previous assembly* to fit the guide (C69543) of the leveling mechanism assembly. If this is the case, bolt the guide loosely to the upper bracket. Level and cross level the gun with a clinometer. Turn the knobs of the telescope mount leveling mechanism assembly to center the ball and retainer approximately in their travel. Place a sensitive level on the finished top surface of the telescope socket. Check for level readings parallel to

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the gun bore and parallel to the gun trunnion. Push the guide slightly as required to obtain level readings. Tighten the bolts and check again.

c. The upper bracket (D41705) for the traversing gear *may not have been drilled to fit the guide* (C69543) of the leveling mechanism assembly. If this is the case, clamp the guide to the upper bracket after the telescope mount has been leveled, and transfer the position of the holes in the guide to the upper bracket. After the holes are transferred and drilled, assembly should follow the procedure indicated in *b* above.

d. When the telescope mount has been secured to the gun trunnion and gun mount, test the orientation of the telescope in azimuth (par. 20*b*).

SECTION IX

PAINTING

36. Touch-up painting.—Small scratches or worn spots, as well as unavoidable blemishes caused by assembly or adjusting operations, should be touched up with an air-drying enamel of a practical color match of the original finish.

37. Over-all painting.—*a. General.*—(1) Occasionally instruments are received at the arsenals for repairs which malfunction because excessive paint has entered bearings and bearing surfaces. The effect of paint on bearing surfaces and in bearings is obvious.

(2) In order to eliminate the conditions described above, the painting of fire control instruments by the using arm is prohibited.

(3) The painting of instruments, when done by ordnance personnel, must be supervised by someone who is familiar with the functioning of the instruments, and who is in a position to caution against the application of paint to bearing surfaces, machined locating surfaces, etc. The paint to be required will be governed by the instrument to be serviced.

b. Preparing for painting.—(1) All surfaces to be painted must be dry and free of dirt, oil, grease, and rust. For cleaning use solvent, dry-cleaning, and rinse with hot water. Dry in an air stream. It must be remembered that frequent washing of metal components in the same batch of solvent will soon render it unfit for further use, since it easily becomes saturated with grease, oil, and dirt. The solvent must be changed frequently.

(2) Remove loose paint around marred parts by rubbing those parts with paper, flint, No. 1. Dust off all loose sand and paint flakes.

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c. Painting.—Apply the paint with a brush or spray gun. Exercise care to avoid splashing or spraying paint on parts which are not to be painted. Finished colors must match authorized or prescribed hues. Minor deviations of pigment proportions are permissible, if necessary to match colors. The exterior parts will be universally painted olive-drab.

APPENDIX

LIST OF REFERENCES

1. Standard Nomenclature Lists.

a. Cleaning and preserving.

Cleaning, preserving, and lubricating materials	SNL K–1
Special oils, greases, and welding compounds	SNL K–2

b. Fire-control matériel.

Instrument repair kit	SNL F–206
Mount, telescope, M20	SNL F–186
Optical repair kit for harbor defense	SNL F–93
Telescope, panoramic, M8	SNL F–196

c. Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index" (OPSI).

2. Explanatory publications.

a. Cleaning, preserving, and lubricating materials	TM 9–850

b. Fire-control matériel.

(1) *Direct references.*

Instruction guide, the instrument repairman	TM 9–2602
Instruction guide, telescope mount, M20; panoramic telescope M8; elevation quadrant, M1	TM 9–2674
Telescope, panoramic, M8	TM 9–1582

(2) *Related references.*

8-inch railway matériel; gun, Mk. VI mod. M3A2, carriage M1A1	TM 9–463

[A. G. 062.11 (6–8–42).]

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(For explanation of symbols see FM 21–6.)

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