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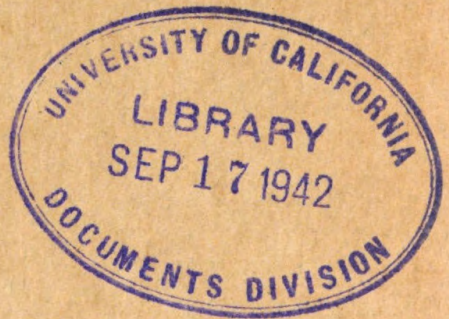
U.S. Dept. of Army

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE
AZIMUTH INSTRUMENT
M1918 AND M1918A2

June 11, 1942



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TECHNICAL MANUAL |
No. 9-1680 |

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WAR DEPARTMENT,
WASHINGTON, June 11, 1942.

ORDNANCE MAINTENANCE

AZIMUTH INSTRUMENT M1918 AND M1918A2

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SECTION I

GENERAL

| | |
|------------|----------------|
| Scope..... | Paragraph 1 |
|------------|----------------|

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 azimuth instrument, M1918 and M1918A2, supplementary

*This manual supersedes TM 9-1680, July 8, 1941.

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to those in the Fields Manuals and Technical Manuals prepared for the using arms. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the matériel.

SECTION II

DESCRIPTION

| | Paragraph |
|----------------|-----------|
| General..... | 2 |
| Mount..... | 3 |
| Telescope..... | 4 |
| Tripod..... | 5 |

2. General.—*a. Azimuth instrument M1918.*—The azimuth instrument M1918 is an observing instrument used in base-end observing and spotting, with, for example, 155-mm gun M1917, M1918, and modifications when used by the Coast Artillery Corps. It measures horizontal angles from 0 to 6,400 mils and vertical angles from -300 mils to +500 mils. The principal parts are the mount, the telescope M1918, the tripod, type H, and accessories. Figure 1 shows the azimuth instrument assembled.

b. Azimuth instrument M1918A2.—The azimuth instrument M1918A2 (fig. 9) is a modification of the azimuth instrument M1918 and is used strictly by Field Artillery organizations (battalion and regimental headquarters batteries and sound and flash-ranging batteries) as an observing and spotting instrument for accurate measurements in azimuth. It differs from the azimuth instrument M1918 in the following respects:

(1) Only the 10-power eyepiece is furnished.

(2) The splash pointer mechanism of the telescope M1918 is omitted.

(3) The new reticle, having a grid scale, replaces the old reticle which had only an azimuth deflection scale.

(4) A longitudinal level vial has been mounted on the telescope to insure a zero datum plane for vertical measuring.

(5) Tripod, type A, is used in place of tripod, type H.

(6) Carrying case M12 is provided for the telescope.

3. Mount.—The mount supports the telescope and contains leveling, elevating, and azimuth mechanisms.

a. The mount is secured to the tripod by means of the leveling plate, B129179 (fig. 3), which has an internal screw thread fitting the tripod head, B129178.

b. The azimuth worm gear (wheel, C44567) is attached to the leveling plate, B129179, by a leveling ball, A38249, and four leveling

screws, A36371 (fig. 3, sec. B-B-B-B). The azimuth scale is engraved on the upper surface of the worm gear, graduated at 10-mil intervals and numbered at 100-mil intervals. The inner row of graduations, 0-64, forms the main azimuth scale. The outer row

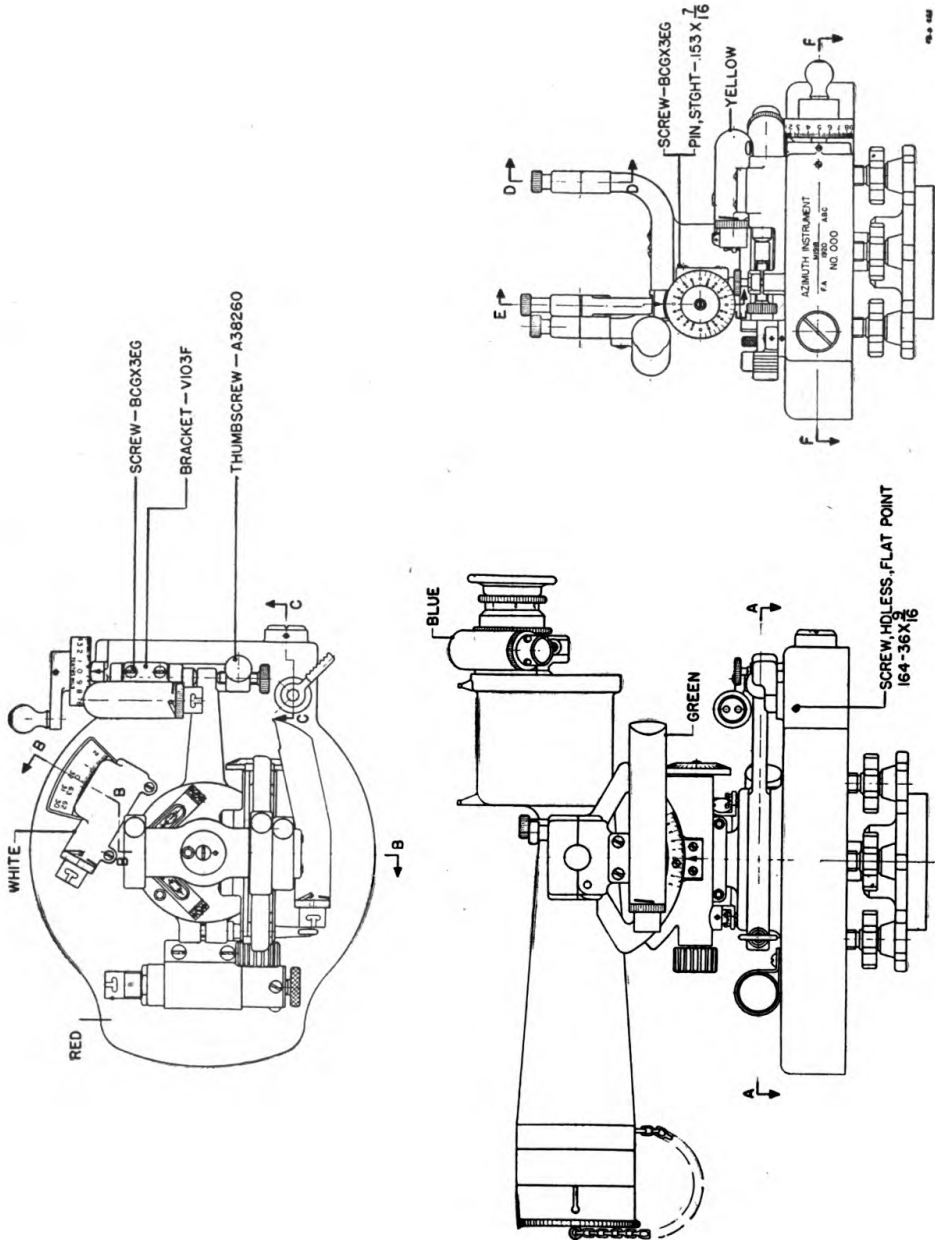


FIGURE 1.—Azimuth instrument M1918, assembled view.

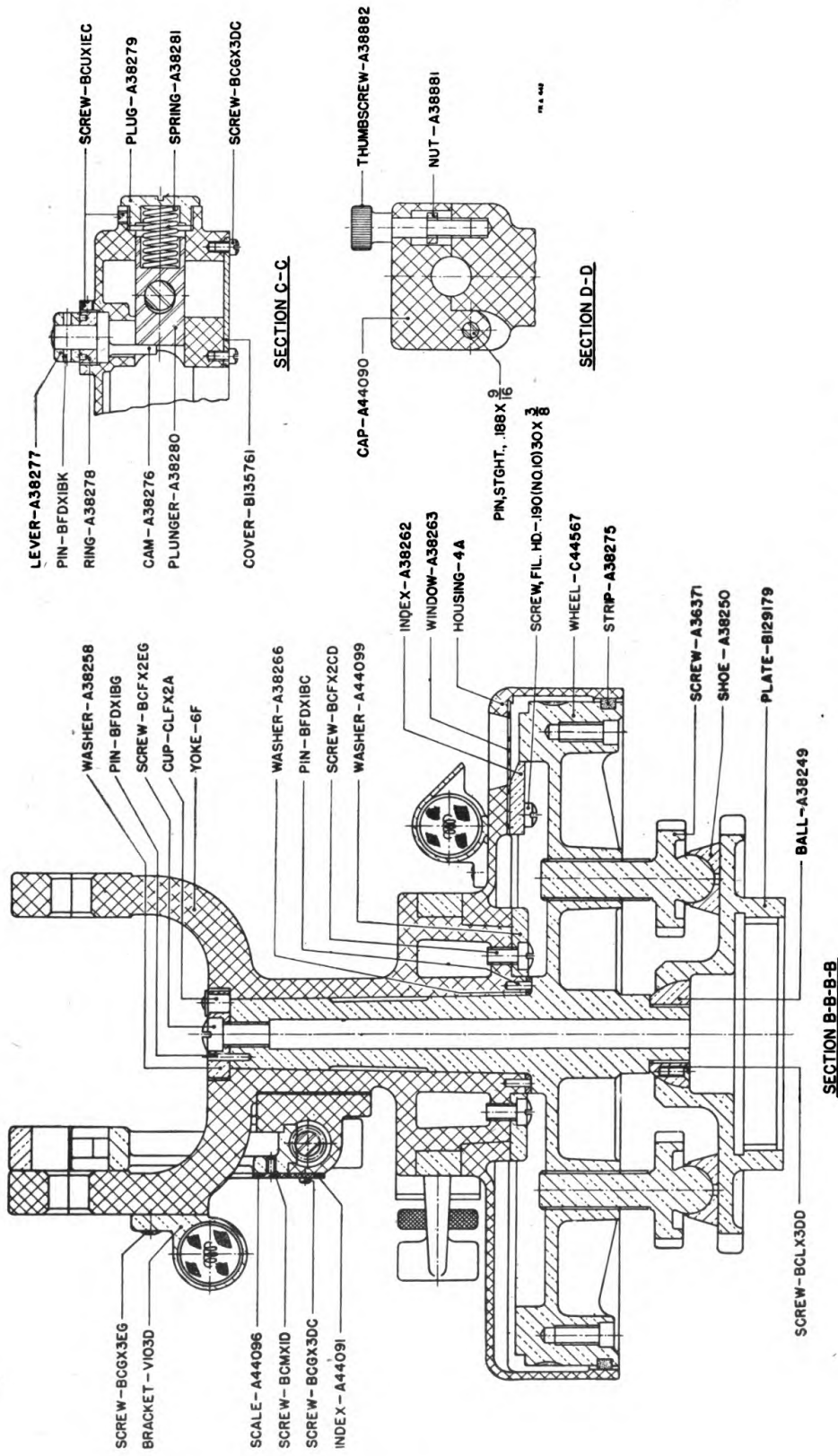


FIGURE 3.—Mount for azimuth instrument M1918, sectioned view.

c. The yoke, 6F, and azimuth housing, 4A, pivot on the worm gear spindle. Telescope trunnions fit into bearings on the yoke and are retained by caps. The worm gear segment, 6E (fig. 4, sec. E-E), moves the telescope in elevation. The scale, A44096, attached to the segment indicates 10-mil intervals and is numbered at 100-mil intervals from -300 to +500. Micrometer indications at 0.2-mil intervals supplement the coarse scale indications. Minus portions of the scale and corresponding portions of the micrometer are red; plus portions are white. The lower portion of the yoke carries two level vials, A31322 (figs. 1 and 4).

d. The azimuth mechanism is contained in the housing, 4A (fig. 4, sec. F-F), and turns the azimuth worm gear (wheel, C44567). The azimuth mechanism includes the azimuth worm, B129181, the crank, A38879, which is keyed to the worm shaft and the micrometer, A38728. The micrometer registers fine indications of azimuth when read in conjunction with the azimuth scale. It is graduated in 0.1 mils and is numbered at 1-mil intervals. The throw-out lever, A38277, permits rapid traverse of the instrument. It operates a cam, A38276, which shifts the plunger, A38280. This plunger, backed by a spring, A38281, normally holds the worm in mesh with the worm gear and takes up backlash.

e. The azimuth slow motion arm, B129177 (fig. 2), provides rotation of the housing with respect to the yoke. Thumbscrews permit adjustment and locking.

f. Illumination is provided for the telescope reticle and for the azimuth and elevation scales and micrometers.

(1) A rheostat assembly, 14-4-99, is provided to adjust the illumination of the telescope reticle. This type of rheostat affords smooth control of the illumination.

(2) One lamp bracket is provided in each location listed below:

(a) On the telescope M1918.

(b) Above the azimuth scale.

(c) Above the azimuth micrometer.

(d) Above the elevation scale and elevation micrometer.

(3) The electric lamps, A35189, provided are all 3-cp, 6-8 volt miniature lamps, Mazda G-6, hayonet base, double contact type.

(4) The rheostat and lamp brackets are color coded as shown in figure 1. The plugs attached to the various leads which connect to these parts are colored correspondingly.

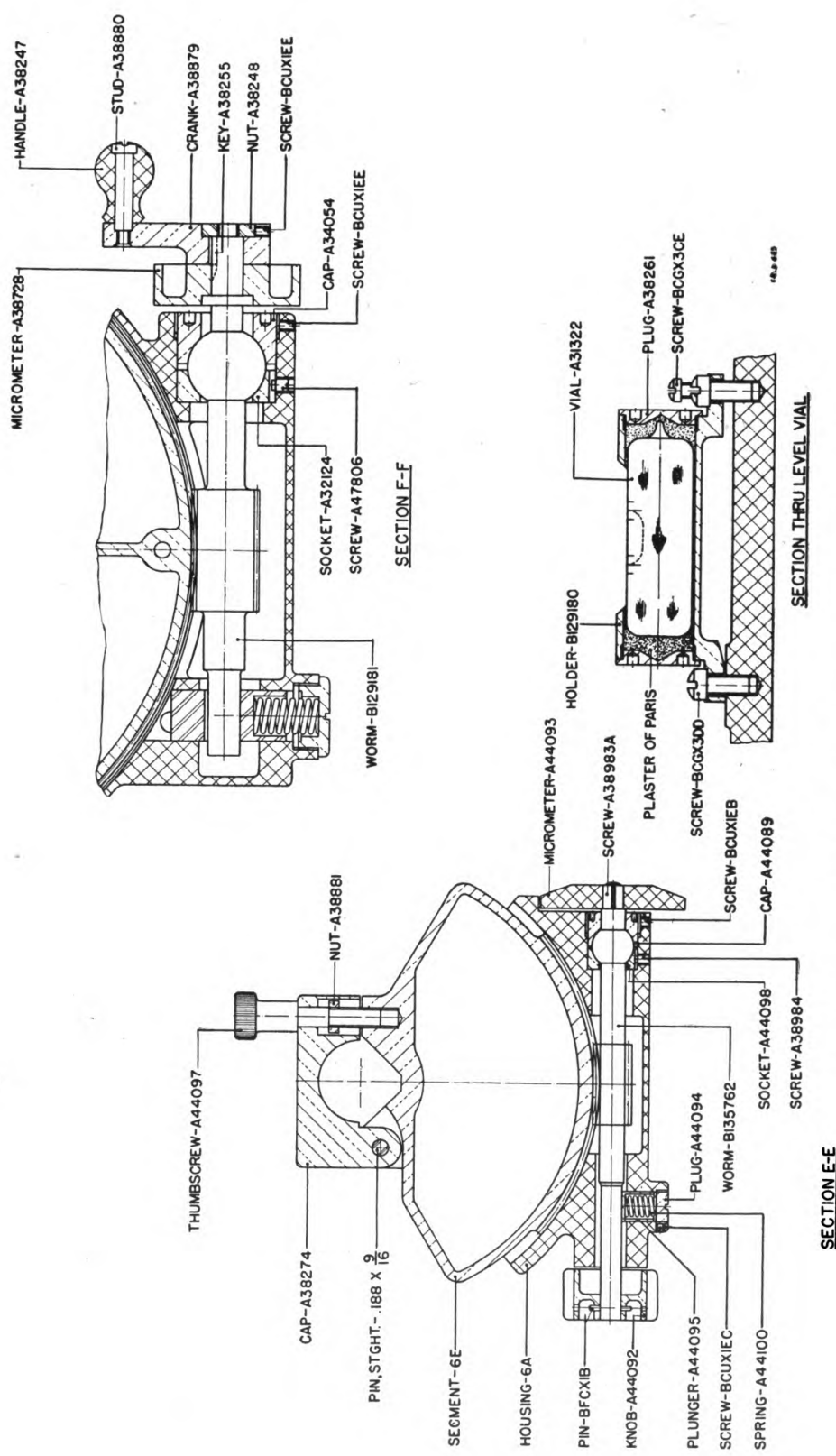


FIGURE 4.—Mount for azimuth instrument M1918, sectioned view.

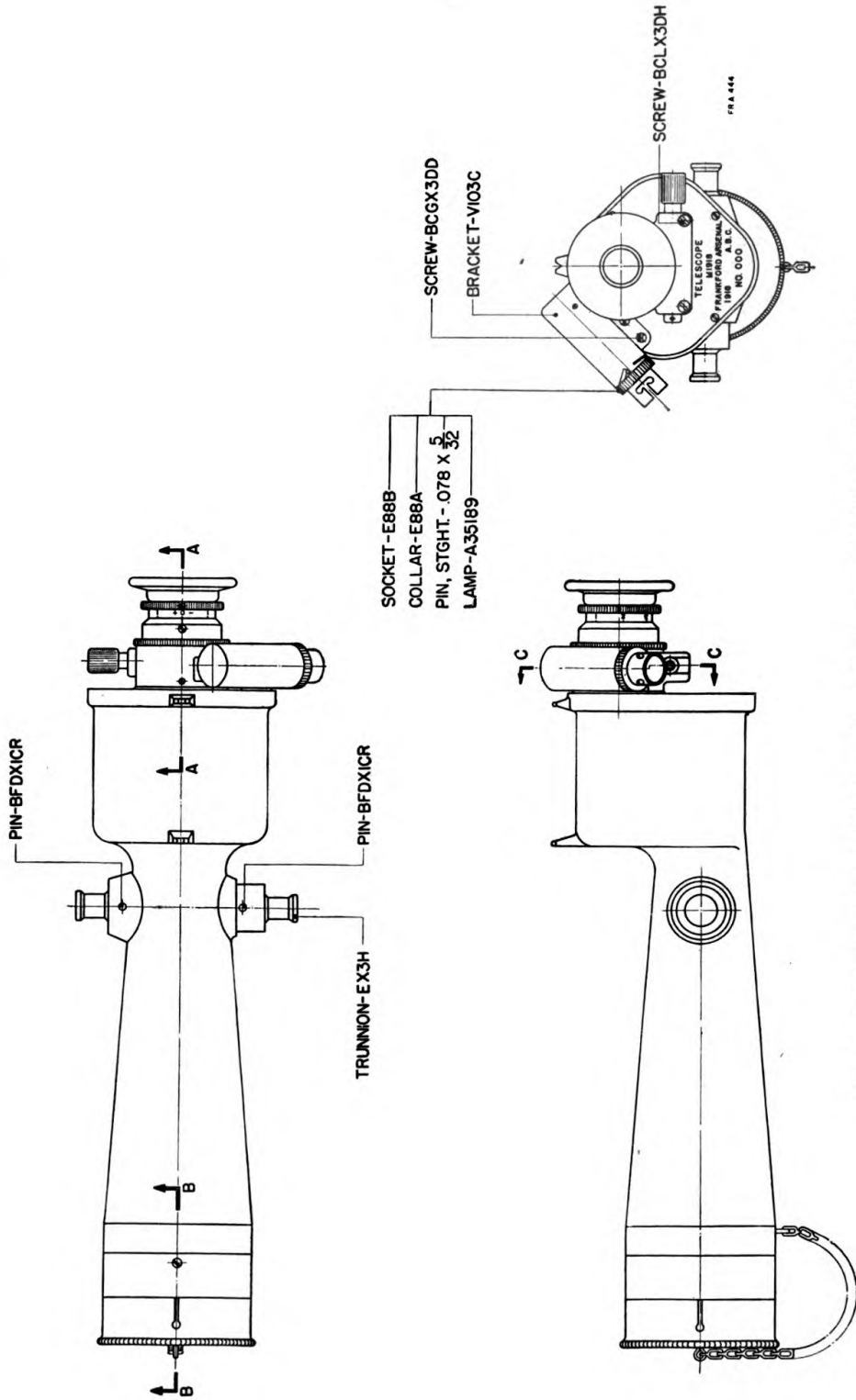


FIGURE 5.—Telescope M1918 for azimuth instrument M1918, assembled view.

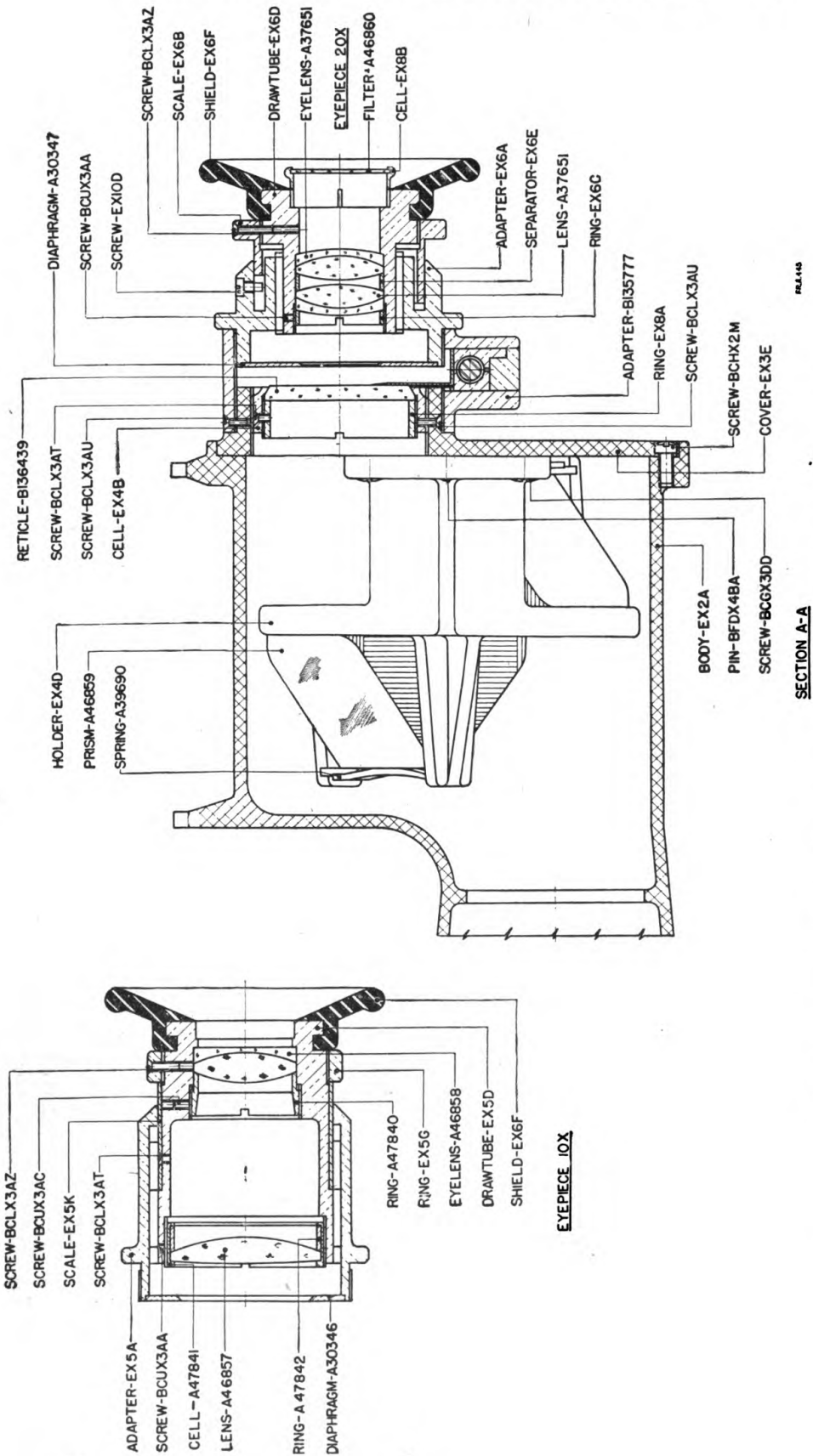
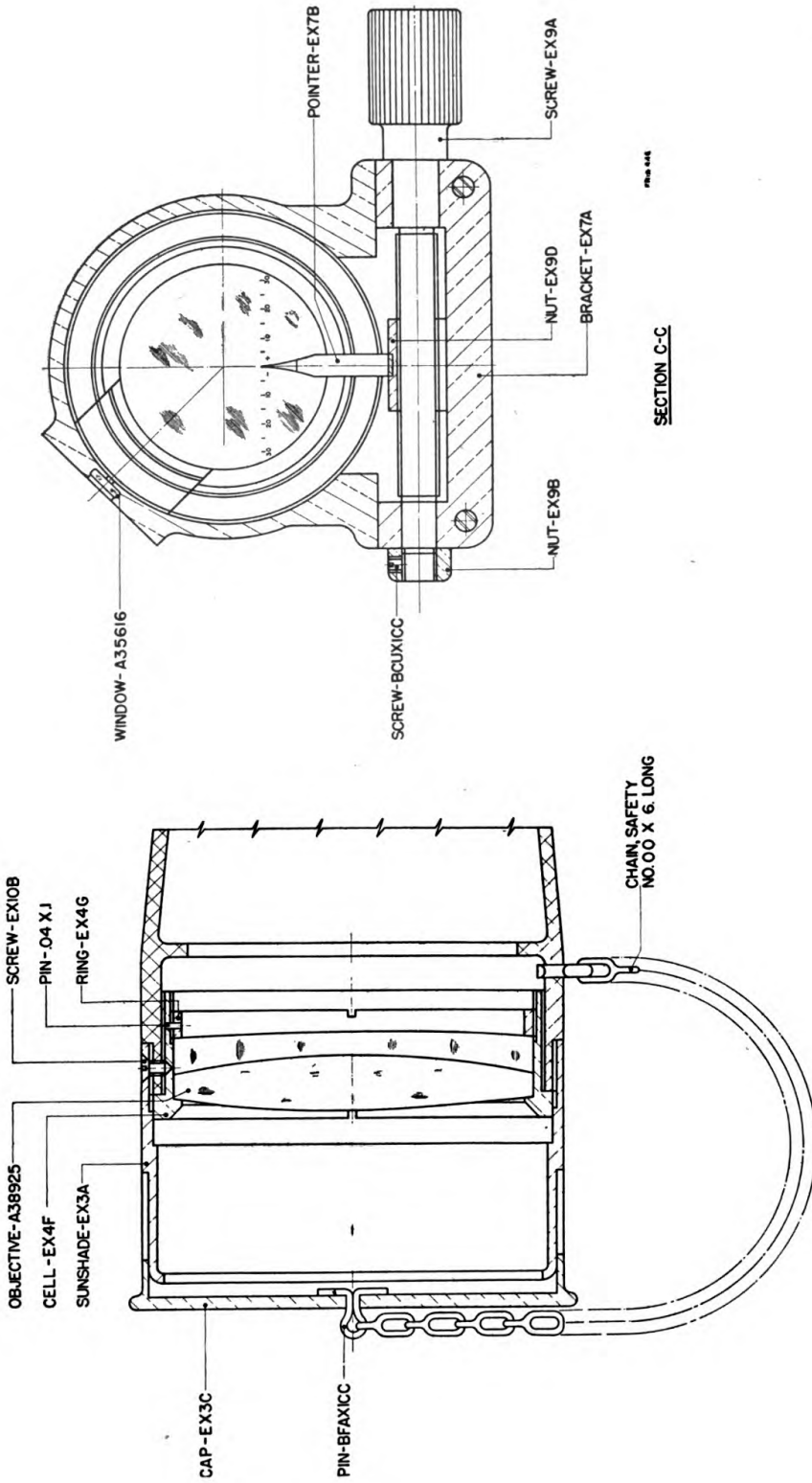


FIGURE 6.—Telescope M1918 for azimuth instrument M1918, sectioned view.



SECTION B-B
FIGURE 7.—Telescope M1918 for azimuth instrument M1918, sectioned view.

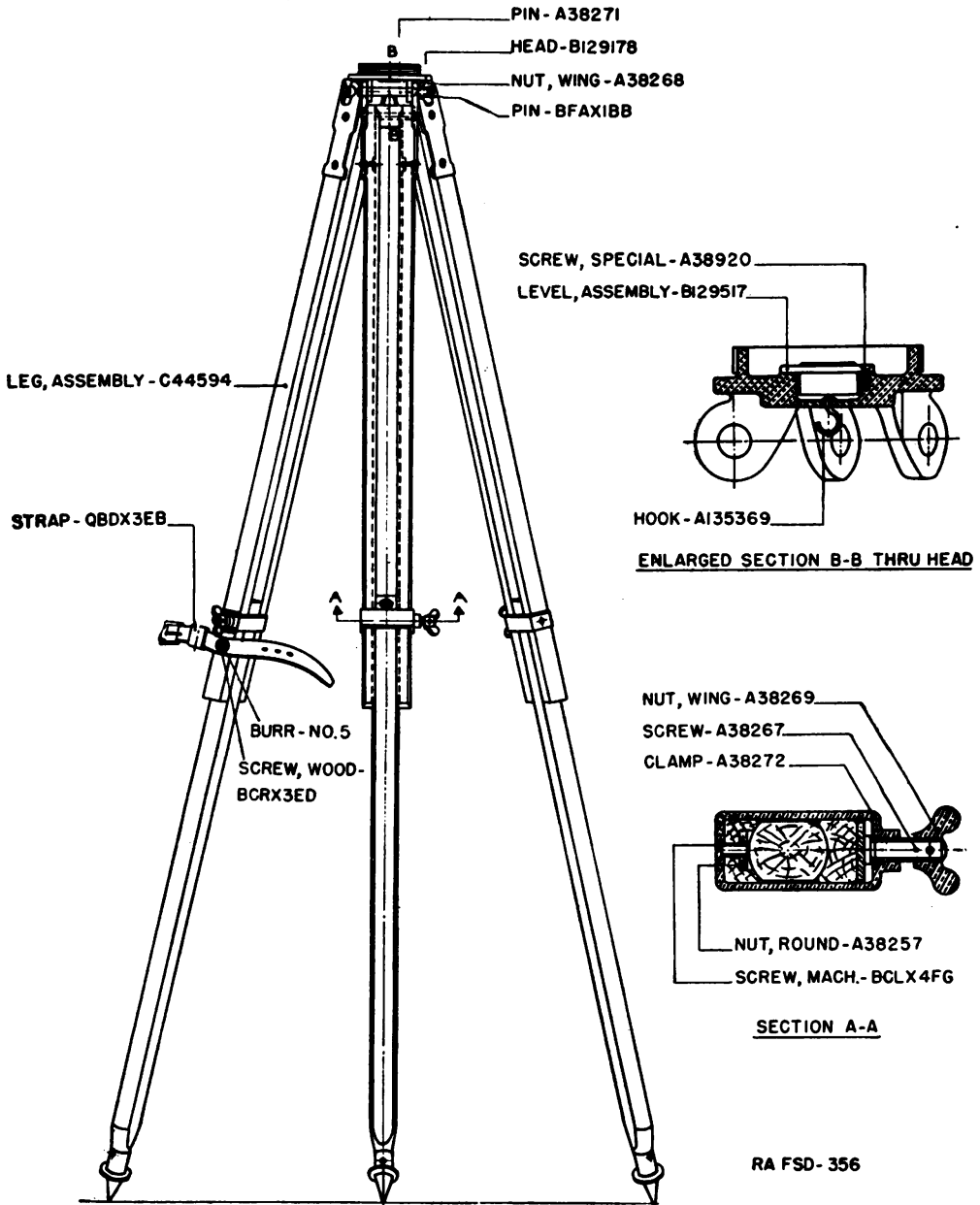


FIGURE 8.—Tripod, type H, assembled and sectioned views.

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4. **Telescope.**—*a. Telescope M1918.*—(1) The telescope is furnished with two interchangeable eyepieces. The optical characteristics of the eyepieces furnished are as follows:

| | | |
|------------------------------------------|--------------|-------------|
| Magnification..... | 10X | 20X |
| Field of View..... | 4° | 2° |
| Diameter of exit pupil..... | 0.25 inch | 0.125 inch |
| Effective focal length of objective..... | 16.0 inches | 16.0 inches |
| Effective focal length of eyepiece..... | 1.603 inches | 0.784 inch |
| Apparent field of view..... | 40° | 40° |

(2) The telescope body contains the objective lens, two porro prisms, and the reticle. The body also includes trunnions for mounting and V-shaped surfaces for positioning on the mount.

(3) The pointer, EX7B, travels across the face of the reticle when operated by the lead screw, EX9A. It indicates lateral deviation of fire by marking the location of the burst on the scale of the reticle. The scale is graduated at 5-mil intervals (fig. 7).

(4) Two interchangeable eyepiece assemblies with indicated magnifying powers (10X and 20X) are furnished. The knurled ring of the adapter, EX5A or EX6A, of each eyepiece assembly facilitates removal from and replacement in the eyepiece adapter, B135777, of the telescope. The diopter scale on the drawtube, EX5D or EX6D, permits rapid focusing when the observer has determined the proper setting for his eye.

(5) The ray filter, A46860, contained in cell, EX8B, offers protection against excessive light. Soft rubber eyeshields, EX6F, are mounted on the drawtubes.

(6) The objective cap, EX3C (fig. 7, sec. C-C), protects the objective from injury when the telescope is not in use.

(7) For illumination of the reticle, when necessary, a 3-cp. 6-8 volt miniature electric lamp with G-6 bulb and double contact base is provided. The light opening is sealed by a window, A35616.

(8) Instrument light M10, when available, will replace the lamp bracket shown in figure 5. See figure 14 for arrangement of instrument light M10 on the azimuth instrument M1918.

b. Telescope M1918A2.—(1) The telescope M1918A2 has only the 10-power eyepiece. Optical characteristics with this eyepiece are the same as those obtained by the telescope M1918 and its 10-power eyepiece.

(2) The telescope body contains the objective lens, two porro prisms, and a reticle with a grid pattern (fig. 11). The body supports

a longitudinal level (fig. 9) and includes trunnions for mounting and V-shaped surfaces for positioning the telescope on the mount.

(3) The ray filter, A46860, offers protection against excessive light. A soft rubber eyeshield is mounted on the drawtube.

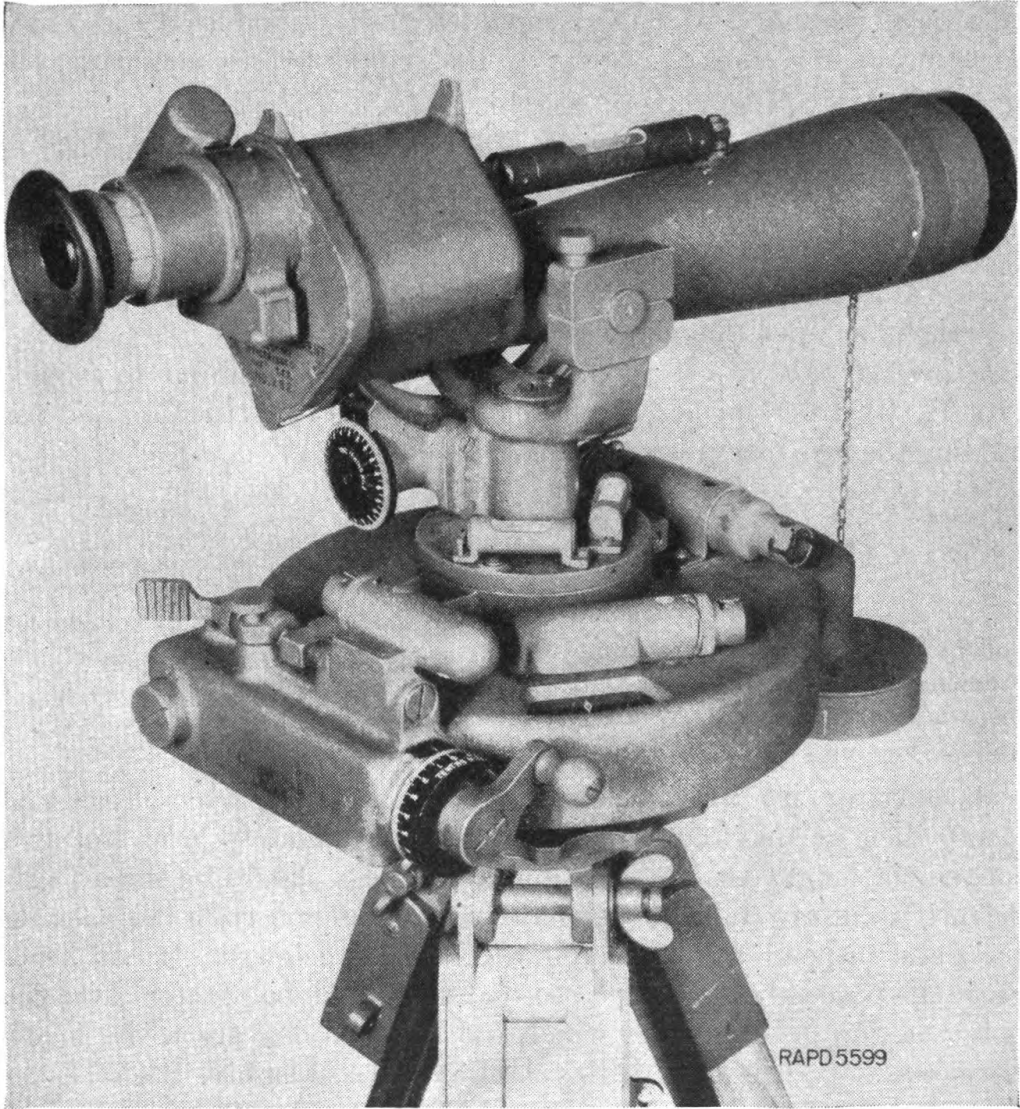


FIGURE 9.—Azimuth instrument M1918A2.

(4) The objective cap, B139279 (fig. 11, sec. C-C), protects the objective from injury when the telescope is not in use.

(5) The reticle is illuminated at present by a lamp bracket and a 3-cp, 6-8 volt miniature electric lamp with G-6 bulb and double contact base. The light is transmitted through a window sealed in the telescope body. Instrument light M10 will be attached, when available, in lieu of the above. (See fig. 15.)

5. Tripod.—*a. Tripod, type H.*—(1) The tripod, type H (fig. 8), consists essentially of a metal head and three telescoping wood legs.

(2) The tripod head, B129178, is provided with male threads to engage the leveling plate, B129179, of the mount. A plumb bob hook, A135369, is fastened to the under surface of the tripod head. A circular level assembly, B129517, is mounted in the tripod head and serves as a means for rough leveling of the tripod before mounting the instrument.

(3) The legs are hinged to the tripod head by hinge pins, A38271, and clamped thereto by wing nuts, A38268.

(4) The tripod legs are extensible, being secured in the desired position by the clamps, A38272, and wing nuts, A38269.

(5) A leather strap, QBDX3EB, is provided for tying the tripod legs together when the tripod is not in use.

b. Tripod, type A.—Tripod, type A, is generally similar to tripod, type H. It differs principally in having braces for stiffening and for holding the legs in a given position. (See fig. 13.)

SECTION III

OPERATION

| | Paragraph |
|------------------------------|-----------|
| Setting up and leveling..... | 6 |
| Focusing..... | 7 |
| Orientation..... | 8 |
| Observations..... | 9 |

6. Setting up and leveling.—*a.* Extend the tripod legs and clamp them so that the tripod head is approximately level and at a convenient height above the ground. The legs should be spread sufficiently to insure stability. Remove the plumb bob from the packing chest and suspend it from the plumb bob hook below the tripod head. Shift the position of the tripod so that the plumb bob centers over the point on the ground from which the observations are to be made. Level the tripod head with the circular level assembly, B129517, re-adjusting the legs as required.

b. Remove the mount from its packing chest and thread the leveling plate, B129179, carefully onto the tripod head. Extreme care must be exercised at this point to engage the threads properly. Approximately four turns are required securely to mount this leveling plate, which should be rotated using only the serrations on the periphery thereof, not by twisting other parts of the mount.

c. Remove the telescope from its carrying case and place it on the mount, securing it in place with the thumbscrews, A38882 and A44097.

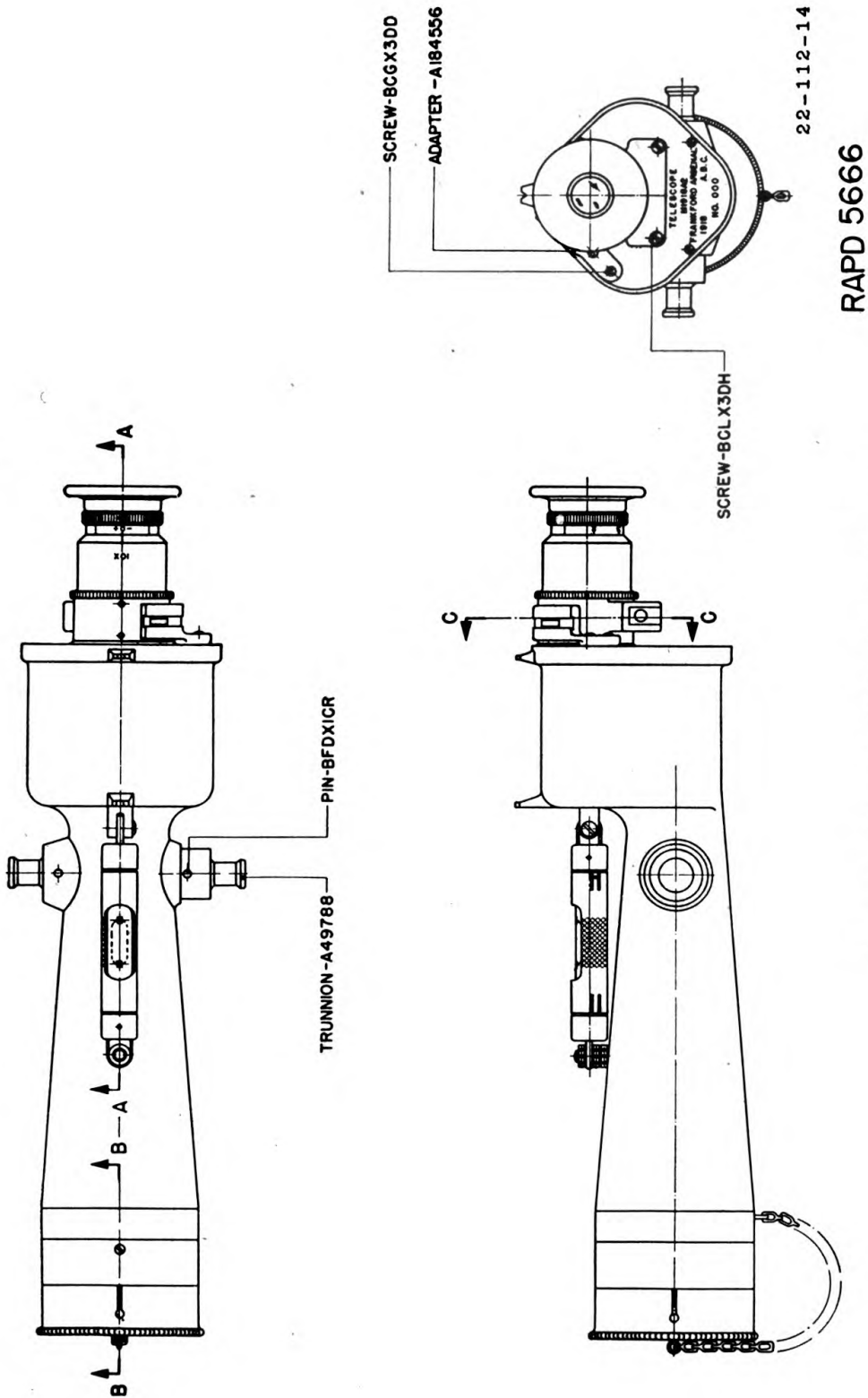


FIGURE 10.—Telescope M1918A2, assembled views.

The V-shaped locating surface of the left-hand trunnion seat should fit the corresponding surface of the worm gear segment, 6E. Remove the objective cap, EX3C, from the sunshade, EX3A, of the telescope.

d. Make the necessary electrical connections, as described in paragraph 17*b*, if illumination is required.

e. Level the instrument, using the two level vials, A31322, and the four leveling screws, A36371. To obtain best results in leveling, orient the level vials so that each is parallel to a pair of diagonally opposite leveling screws. Each level is then affected only by the corresponding pair of leveling screws. Operate the leveling screws by turning each of the screws of a diagonally opposite pair so that one screw is lowered as the other is raised. The screws are tightened only until a snug contact is made.

f. If conditions permit, test the adjustment of the level vials as described in paragraph 13.

7. Focusing.—The use of the lower power eyepiece results in a wider field of view and a brighter, steadier image than that obtained with the higher power eyepiece, but with either eyepiece the focusing procedure is the same. To focus, rotate the diopter scale until the reticle markings appear clear and distinct; if the correct diopter setting for the observer is known, it may be set directly. At normal ranges, targets will then be sharply defined, and there will be no parallax between the target image and the reticle.

8. Orientation.—*a.* Set the azimuth slow motion thumbscrew, A38729, so that the slow motion arm, B129177, is approximately in midposition. This thumbscrew is clamped or unclamped by the clamping thumbscrew, A38260.

b. If necessary, loosen the arm clamping screw, A38251, and rotate the yoke relative to the azimuth housing so that the telescope is in the position shown in figure 1. This places the azimuth worm crank convenient to the right hand of the observer.

c. Select a datum point of known azimuth and, by means of the azimuth worm crank, set the azimuth scale and micrometer to indicate the exact number of mils and tenths of mils of this azimuth. This setting should not be disturbed during the remaining orienting operations.

d. Release the four leveling screws, A36371, and rotate the entire upper part of the mount relative to the leveling plate, B129179, exercising care not to unscrew the leveling plate from the tripod head until the datum point appears approximately in the center of the field of view of the telescope.

e. Level the instrument again (par. 6*e*), loosening the clamping screw, A38251, and rotating the yoke relative to the azimuth housing if necessary properly to align the level vials. After leveling, return the yoke to its previous position and tighten the clamping screw. The vertical line of the reticle should appear approximately on the datum point.

f. By means of the azimuth slow motion thumbscrew, A38729, unclamped by the clamping thumbscrew, A38260, bring the vertical line of the reticle to appear exactly on the datum point. If additional travel is required, the clamping screw, A38251, may be loosened temporarily to permit moving the azimuth slow motion arm, B129127, a small distance. It should be noted, however, that a large amount of motion at this point will result in a position of the azimuth worm crank inconvenient to the right hand of the observer. Except for this difficulty, this motion alone could be used for orientation purposes instead of loosening the leveling screws.

g. Ascertain that the clamping screw, A38251, clamping thumbscrew, A38260, and leveling screws, A36371, are properly tightened. Once the instrument is properly oriented, these screws must not be disturbed. Verify the azimuth indication and the centering of the datum point of the reticle.

h. If the longitudinal level of the telescope, M1918A2, is to be used, verify its accuracy by elevating or depressing the telescope to set the scale and micrometer at zero. If the mount is level the bubble of the longitudinal level of the telescope will then be centered in the level vial.

9. Observations.—*a.* Motion of the telescope in azimuth is obtained by means of the azimuth worm crank, A38879, and the indications are read on the azimuth scale (coarse, 10-mil divisions) and azimuth micrometer (fine, 0.1-mil divisions). The azimuth worm crank may be disengaged, if desired, by means of the azimuth worm throw-out cam lever, A38277, so as to permit rapid traversing of the instrument, but the final setting and reading should be made with the worm in mesh.

b. The pointer, EX7B, is moved across the face of the reticle by rotating the knurled portion of the lead screw, EX9A. The pointer indicates lateral deviation of fire by marking the point of burst, which can then be referred to the graduated scale on the reticle.

c. With the telescope, M1918A2, the burst is observed against the reticle grid with the center cross lines of the reticle superimposed on the target. The graduations and numbers on the grid are used for determining the deviation of the burst.

d. Motion of the telescope in elevation is obtained by means of the elevating worm knob, A44092, and the indications are viewed on the elevation scale, A44096 (coarse, 10-mil divisions), and micrometer, A44093 (fine, 0.2-mil divisions). The inner and outer sets of graduations on the micrometer are colored to correspond to the elevation (white) and depression (red) portions of the elevation scale. The graduations of corresponding color are to be read in conjunction with each other and are not to be confused with those of opposite color.

SECTION IV
INSPECTION

Inspection..... Paragraph 10

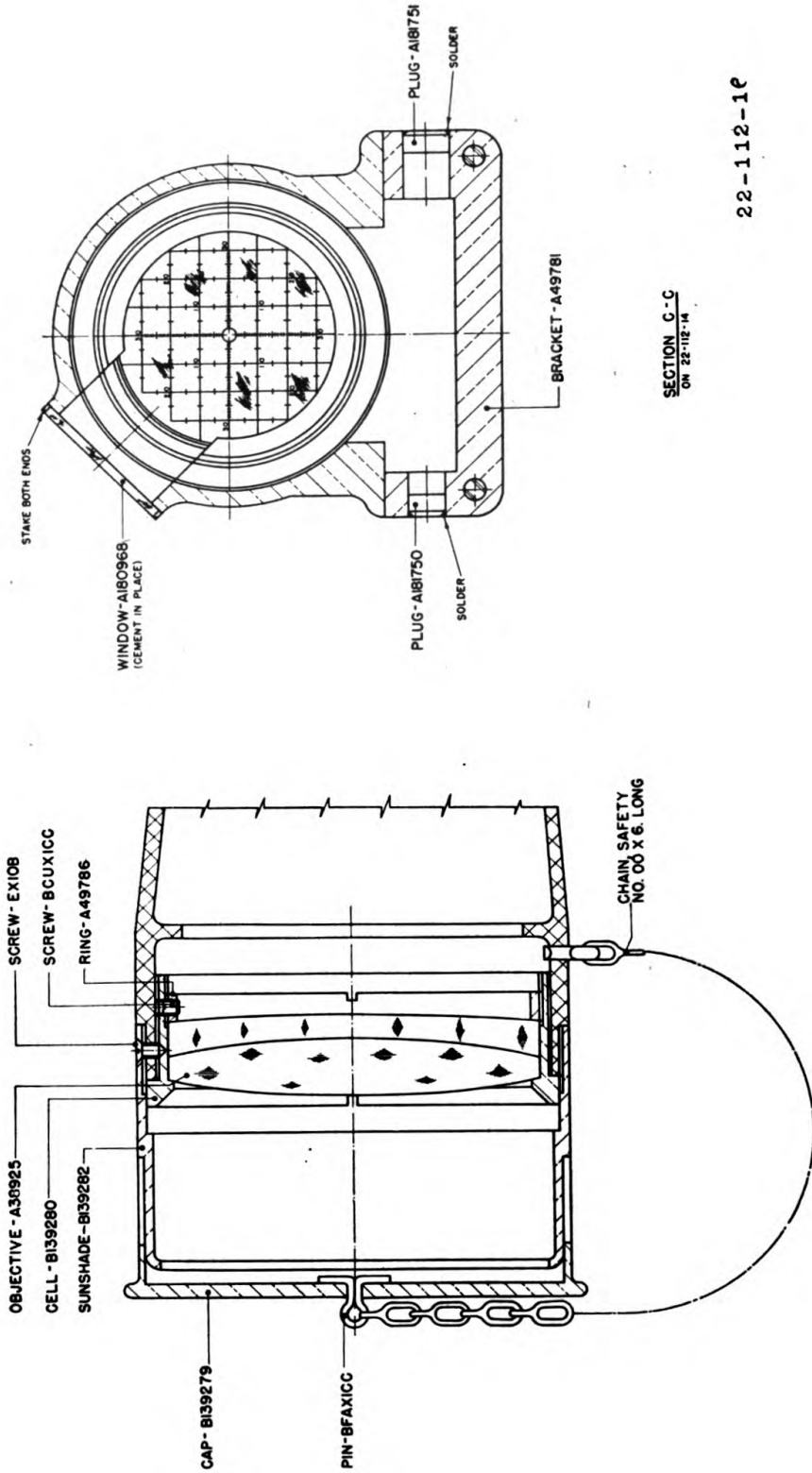
10. Inspection.—Inspection is made for the purpose of determining the condition of the azimuth instrument, whether repairs or adjustments are required, and the remedies necessary to insure serviceability and proper functioning.

a. Telescope.

Parts to be inspected

Points to be observed

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>(1) Exposed mechanical parts.</p> <p>(2) Open sight.</p> <p>(3) Optical system.</p> <p>(4) Reticle.</p> <p>(5) Eyepiece assemblies.</p> | <p>(1) Observe general appearance and bent or missing parts.</p> <p>(2) The line of sight should intersect the optical line of sight within approximately 5 mils.</p> <p>(3) Note if checks or frost patterns appear in the field of view. Such defects are evidence of loosening of the balsam used in cementing lenses and, if severe, require the return of the instrument to an arsenal or base shop. Note presence of objectionable scratches on lenses.</p> <p>(4) Test for verticality and horizontality of the cross lines of the reticle by sighting on a vertical line, such as a plumb line, with the instrument level.</p> <p>(5) Using the collimating telescope (No. 90, optical repair kit), focus the eyepiece for sharpness and clearness of definition. The reading of the diopter scale at optimum focus should be approximately zero.</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



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FIGURE 11.—Telescope M1918A2, sectioned views.

SECTION B-B
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Parts to be inspected

- (6) Level (telescope M1918A2).

b. Mount.

- (1) Exposed mechanical parts.
- (2) Worm mechanisms.
- (3) Level vials.
- (4) Illumination.

Points to be observed

(6) The level should be secure in its housing and unbroken. Level the mount and observe whether or not the level is centered in the vial when the angle-of-site scale and micrometer are set at zero.

(1) Observe general appearance, smoothness of operation of knobs, etc., and any bent or missing parts. Graduations should be clearly legible.

(2) Operate the elevating worm knob, A44092, and the azimuth worm crank, A38879, throughout their entire ranges and check for backlash and longitudinal play. The azimuth throw-out lever should function properly.

(3) See that the two level vials, A31322, are secure in their housings and unbroken. Level the instrument and observe whether the bubbles remain central when the yoke is slowly rotated through 360°. If bubble moves more than one division on the vial glass, the vial holders require adjustment.

(4) Check rheostat and sockets for secure electrical and mechanical connections. Test rheostat by turning knob and noting dimming and brightening of reticle lamp. Leads should have secure fittings and should not be frayed. Identifying color bands should not be obscured. (See sec. VII.)

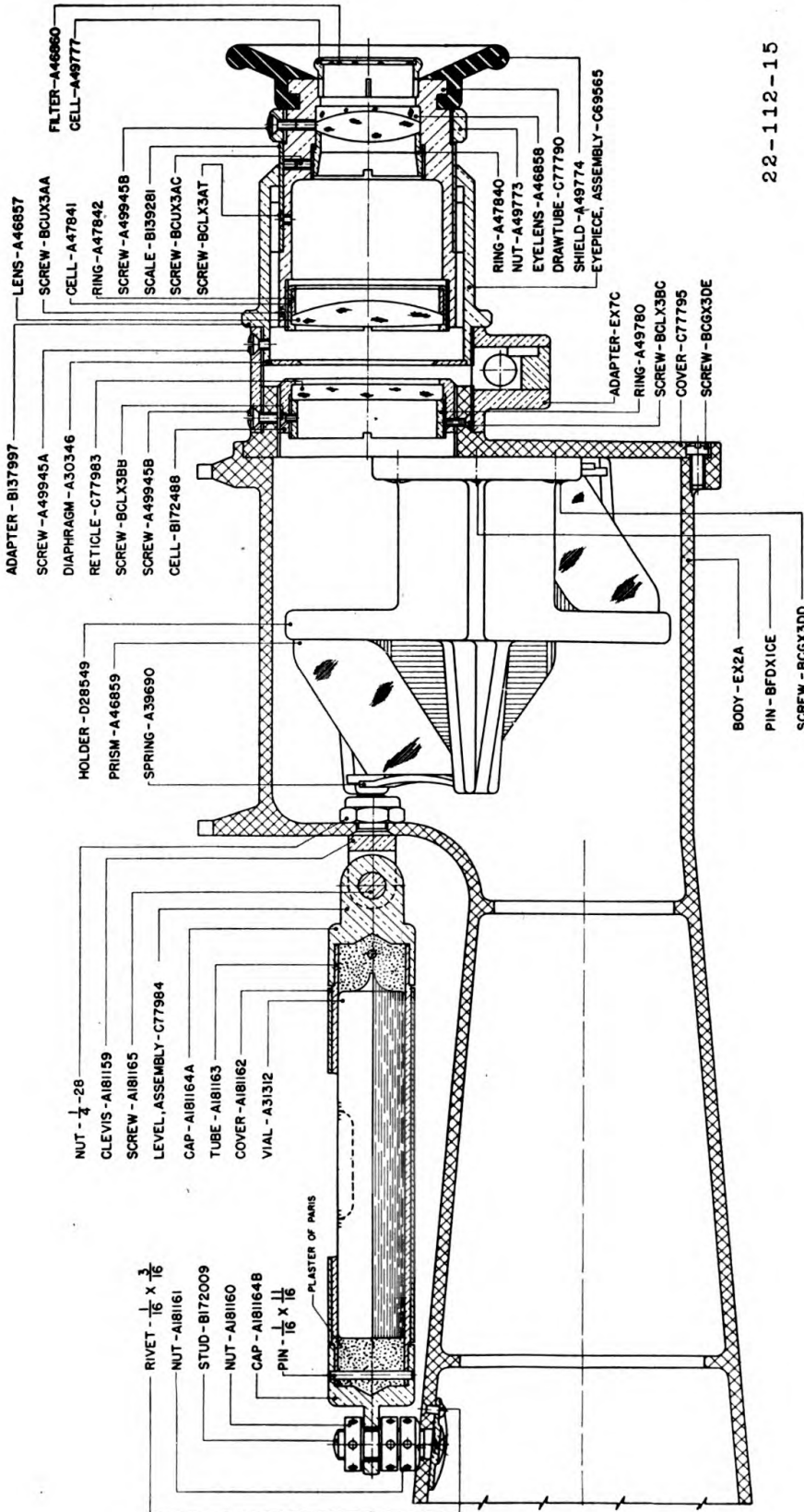
If instrument light M10 is used the battery tube should be examined for evidence of deterioration due to corrosion.

c. Tripod.

- (1) Exposed mechanical parts.
- (2) Circular level.

(1) Observe general appearance, smooth working of legs, wing nuts, clamps, etc.

(2) The circular level should be secure and unbroken.



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SECTION A-A

FIGURE 12.—Telescope M1918A2, sectioned view.

SECTION V

MAINTENANCE AND REPAIR

| | Paragraph |
|--------------------------------------|-----------|
| Tools for inspection and repair..... | 11 |
| Disassembly and assembly..... | 12 |
| Adjustment..... | 13 |

11. Tools for inspection and repair.—*a.* 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.) Most of the items in the kit, such as screw drivers, etc., require no description, as their uses are self-evident. The collimating telescope which is furnished with the kit is a small cylindrical pre-focused telescope. It is used for inspecting the optics of a telescope and for setting up test fixtures. The collimating telescope does not require adjustment in use, and is not to be disassembled in the field.

b. Other tools required for this instrument are listed in section VII.

12. Disassembly and assembly.—Disassembling of the instrument may be required for cleaning or repair purposes. Repairs which necessitate disassembling and assembling are limited to those which do not affect the optical alinement of the instrument. Repairs involving realinement, removal, or replacement of optical parts, or other repairs which cannot be made with the facilities available, will require that the instrument be turned in to the base shop or arsenal. Assembly may be made by reversing steps taken in disassembly except where indicated.

a. Telescope.—(1) *Body.*—If repair or replacement of parts within the body of the telescope is indicated, return the telescope to the base shop or arsenal.

(2) *Eyepiece assemblies.*—Repair of the eyepieces is limited to removal and cleaning of the shield, EX6F. The shield can be removed by stretching it over the shoulder by which it is retained on the drawtube.

(3) *Reticle pointer.*—To adjust the reticle pointer screw for longitudinal play, loosen the screw, BCUX1CC (fig. 7), and tighten the nut, EX9B. To withdraw the pointer mechanism, remove the two flathead screws in the lower part of the adapter, B135777. The mechanism may then be withdrawn from the adapter, care being taken to avoid scratching the reticle or bending the pointer. After withdrawing the screw, BCUX1CC, and the nut, EX9B, remove the split nut, EX9D, by turning the screw, EX9A.

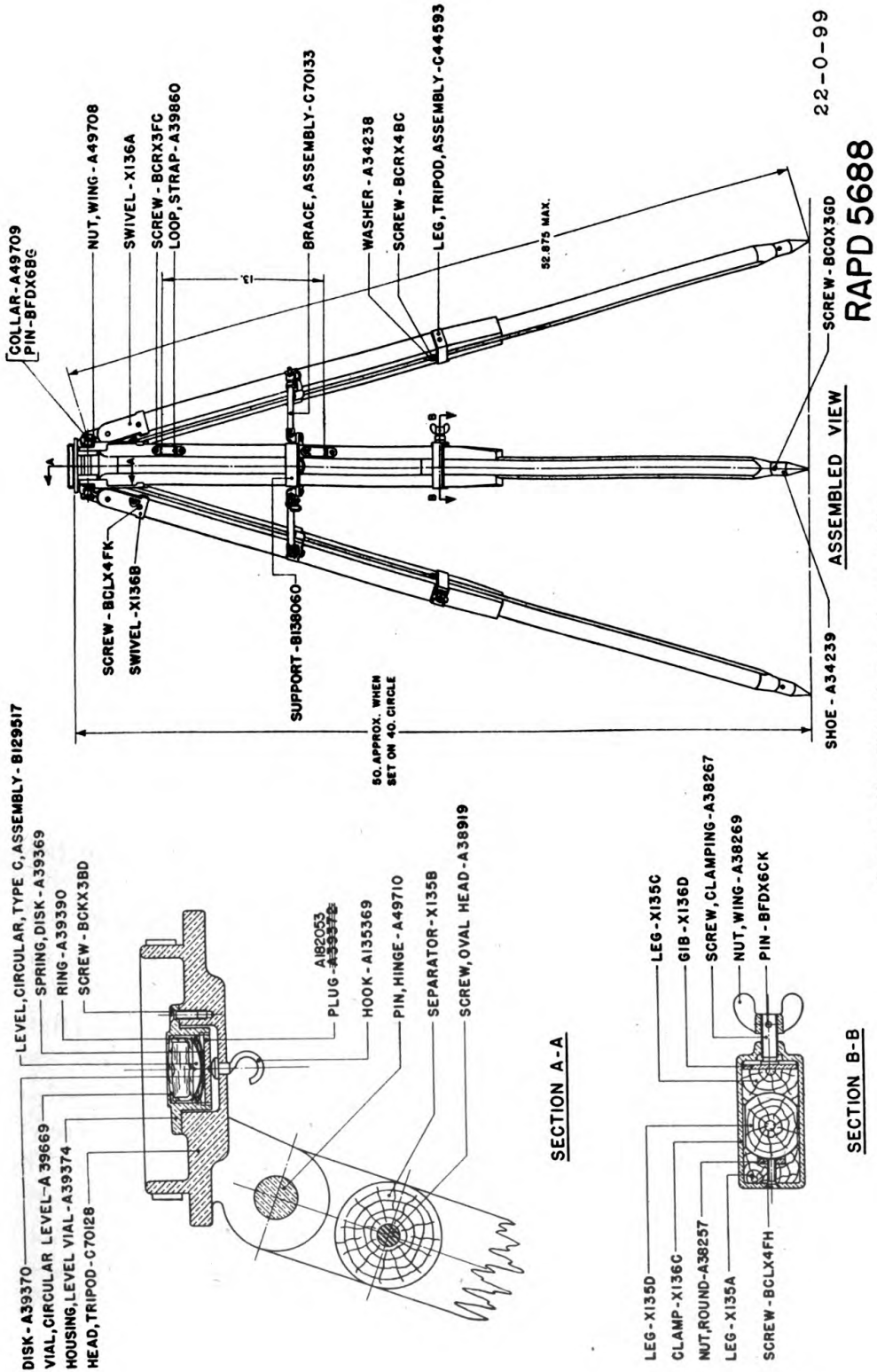


FIGURE 13.—Tripod, type A, assembly.

(4) *Longitudinal level.*—To remove the level vial, A31312, for replacement from telescope M1918A2, disassemble the caps, A181164A and A181164B, from the stud, B172009, and clevis, A181159 (fig. 12). Drive out the $\frac{1}{16}$ by $1\frac{1}{16}$ pins and unscrew the caps from the tube, A181163. Remove any broken glass and old packing from the tube. Place the new vial in position, center graduations in opening, and pack level vial lightly in position with paper strips. Secure with calcined gypsum (plaster of paris) which has been mixed to medium consistency. Replace caps and pins. Remove excess plaster after plaster has set. For adjustment after reassembly to mount, see paragraph 13.

b. *Mount.*—(1) *Yoke and housing.*—To disassemble the yoke and housing from the worm gear (wheel, C44567, fig. 3) remove the screw, BCFX2EG, in the washer, A38258. Move the throw-out lever until the worm and gear are disengaged and then pull yoke up over worm gear spindle. In reassembly, make sure the gear clears the index, A38262. To disassemble the slow motion arm, remove the washer, A44099, which is secured to the yoke by four fillister head screws. Lift the yoke from its tapered seat in the housing and remove the slow motion arm. Remove the window, A38263, if necessary for cleaning or replacement after disassembly of the housing, 4A, and the worm gear.

(2) *Leveling plate.*—After loosening the leveling screws, A36371, remove the flathead screw in the leveling ball, A38249, and unscrew the ball from the worm gear. The leveling plate, B129179, and the leveling screws are then accessible. The shoes, A38250, have been spun onto the screws and should not be removed.

(3) *Elevating worm housing.*—To remove the elevating worm housing, 6A (figs. 3 and 4), withdraw the two screws located in the lower part of the housing.

(4) *Elevating worm* (fig. 4, sec. E-E).—Remove the knob, A44092, and its taper pin. Remove the plug, A44094, its retaining screw, and the spring, A44100. Remove the micrometer, A44093, and its retaining screw, A38983A. After removing the retaining screws, BCUX1EB and A38984, unscrew the cap, A44089. Pull the worm out at the micrometer end, turning if necessary, to clear the teeth. In reassembly, when sliding the worm back, make sure that the small notch in the ball socket, A44098, is alined with the screw, A38984. Adjust the cap to eliminate backlash and longitudinal play. A zero on the micrometer scale should be alined with the micrometer index when a graduation on the coarse elevation scale is exactly alined with the elevation index. Coat the worm lightly with Royco 6A before reassembly.

(5) *Worm gear segment.*—Disassembly of the worm gear segment, 6E, is possible after the telescope and elevating worm have been removed. Slide the segment along the curved track in the housing, 6A (fig. 4, sec. E-E). Coat the segment teeth and the track lightly with Royco 6A or specified lubricating oil before reassembly.

(6) *Azimuth worm.*—Unscrew the plug, A38279, its retaining screw, and the spring, A3828 (figs. 3 and 4). Remove the crank, A38879, and micrometer, A38728, after removing the screw, BCUX1EE, and nut, A38248. The crank is keyed to the worm. After removing the retaining screws, BCUX1EE and A47806, unscrew the cap, A34054. Pull the worm, B129181, out at the crank end. If necessary the throw-out lever may be operated to disengage the worm and worm gear. In reassembly, align the small notch in the ball socket, A32124, with the screw, A47806. Adjust the cap to eliminate backlash and longitudinal play. A zero on the micrometer scale should be aligned with the micrometer index when a graduation on the azimuth scale is exactly aligned with the azimuth index. Coat the worm lightly with Royco 6A before reassembly.

(7) *Throw-out lever.*—Disassemble the throw-out lever, A38277, and cam, A38276, by driving the pin, BFDX1BK (fig. 3, sec. C-C), and lifting the lever. Unscrew the ring, A38278, and its retaining screw and pull the cam out. Before reassembly, remove the plug, A38279, and its retaining screw to allow the cam to clear the plunger, A38280.

(8) *Thumbscrews.*—To remove the thumbscrews (figs. 3 and 4) unscrew the round retaining nut in the counterbored pocket on the underside of the cap. When reassembling make sure that the nut is snug against the shoulder of the thumbscrew.

(9) *Level vials.*—To remove the level vials, A31322, for replacement, disassemble the holder, B129180, from the mount (fig. 4). Unscrew the plugs, A38261, and remove any broken glass and old packing from the cavity. Place new vial in position, center graduations in opening, and pack level vial lightly in position with paper strips. Secure with calcined gypsum (plaster of paris) which has been mixed to medium consistency. Replace plugs. Remove excess plaster from surfaces after plaster has set. For adjustment after reassembly to mount, see paragraph 13.

13. Adjustment.—*a.* The levels are in correct adjustment when the bubbles are midway between the lines on the vials with the azimuth axis of the instrument vertical.

(1) This condition can be readily verified when the instrument is set up and leveled by observing the level bubbles as the instrument

is rotated slowly in azimuth. If they remain central, no adjustment is required.

(2) If the bubble of one or both levels does not remain central, adjustment is performed as follows:

(a) Set the level to be adjusted parallel to a pair of diagonally opposite leveling screws, A36371, and level the instrument so that the bubble is midway between the lines.

(b) Turn the instrument 180° (3,200 mils) in azimuth.

(c) Return the bubble *halfway* to its original central position, using the group of three screws, BCGX3CE and BCGX3DD, located at one end of the level vial holder, B129180. The two outer screws of this group are operated as a pair and act in opposition to the central screw so that each screw locks the others. In the final adjustment, care should be taken that each of the screws is set up tight, but not overstrained.

(d) Level the instrument again and repeat the above procedure if necessary.

b. The azimuth micrometer, A38728, should read zero when the azimuth scale is set to indicate exactly on a graduation line. Adjustment, when required, is effected by loosening the retaining nut, A38248, on the end of the azimuth worm, B129181, using the pin face adjustable teat wrench provided, and turning the micrometer relative to the worm. The retaining nut should be tightened securely when adjustment is completed.

c. The elevating mechanism is in correct adjustment when the elevation scale, A44096, and micrometer, A44093, indicate zero with the instrument level and the line of sight of the telescope horizontal. The longitudinal level on the telescope is used as a check on the adjustment of the elevation scale and micrometer.

(1) The horizontal position of the line of sight may be determined by sighting on a distant point at the same height, as determined by a level or other instrument of known accuracy. If no such instrument is available, the horizontal position may be determined by marking an improvised rod to show the height of the objective above the ground, then placing the rod at a distance of 200 yards or more from the instrument and measuring the angle of site to the mark on the rod. The instrument and the rod should then be interchanged in position and a new angle of site measurement taken. The average of the two measurements, taking plus and minus signs into account, gives the setting of the scale and micrometer which will result in a horizontal position of the line of sight. If this setting is zero, no correction adjustment is required.

(2) With the instrument properly leveled, and with the line of sight set to the horizontal position, as determined above, correction adjustments are applied as follows:

(a) Adjust the longitudinal level of the telescope if necessary and relock the lock nuts.

(b) Hold the elevating worm knob, A44092, stationary, loosen the micrometer retaining screw, A38983A (fig. 4, sec. E-E), turn the micrometer, A44093, until a zero coincides with the index line, and tighten the retaining screw.

(c) Loosen the two index retaining screws, BCGX3DC (fig. 3, sec. B-B-B-B), move the index, A44091, until the point of the arrow coincides with the zero of the elevation scale, A44096, and tighten both retaining screws.

(3) If more convenient, the elevation adjustment may be performed by using a datum point of known elevation, making the elevation scale and micrometer read accordingly.

SECTION VI

CARE AND PRESERVATION

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14. Care in handling.—*a.* The instrument contains highly accurate mechanisms and the telescope contains precise and delicate optical parts. Careful handling is imperative to avoid damage by unnecessary shocks, etc. When not in use the telescope and mount should be kept in the chests provided.

b. The azimuth instrument should never be sighted directly at the sun, as the heat of the focused rays may melt the balsam cement between the lenses.

c. Leveling and clamping screws must not be tightened beyond a snug contact. Excessive wear of threads and other damage to the instrument is thereby avoided.

d. The azimuth throw-out lever must not be snapped into mesh. When disengaging the worm and worm gear, move the lever sufficiently to allow the teeth to clear. With this procedure excessive wear and burring of the teeth can be avoided.

e. One of the eyepieces should be kept in the telescope at all times to avoid unnecessary entry of dust and dampness.

f. When storing the instrument light M10, or whenever it is not in use, the dry cells should be habitually removed from the battery tube

to avoid damage to the tube due to the chemical reaction taking place as the dry cells deteriorate.

15. Lubrication.—The mount should be lubricated occasionally with lubricants furnished by the Ordnance Department for fire-control instruments.

a. The lubricants to be used are oil, lubricating, for aircraft instruments and machine guns, and grease, special, low temperature.

b. Only a few drops of oil at long intervals are required in the oil cups provided.

c. The leveling screw threads should be lightly oiled.

d. The worms are lightly greased with grease, special, low temperature, prior to reassembly and normally need no further lubrication by the using arm. Access to the azimuth worm and worm wheel is obtained when the instrument is assembled by removing the cover, B135-761 (fig. 3, sec. C-C). The throw-out cam and plunger may be lubricated through this opening.

e. Before the telescope is assembled in the yoke, the trunnions and bearings should be wiped clean and lightly coated with oil.

f. Parts of the telescope should not be oiled. Any excess oil or grease on the mount should be wiped off.

16. Optical parts.—*a.* To obtain satisfactory vision, it is necessary to keep the exposed surfaces of the lenses and other parts clean and dry. Corrosion and etching of the glass surfaces can thus be prevented or retarded.

b. Moisture due to condensation may collect on the optical parts of the instrument when the temperature of the instrument is below that of the surrounding air. This may be removed by placing the instrument in a warm place. Heat from strongly concentrated sources should not be applied direct as it may cause unequal expansion of parts with resulting inaccuracies in observation.

c. For dusting optical parts use only a clean camel's-hair brush. For wiping, use only lens paper which is prepared for cleaning optical glass.

d. To remove oil or grease from optical surfaces, apply ethyl alcohol with a clean camel's-hair brush and rub gently with clean lens paper. If alcohol is not available, breathe on the glass and wipe off with clean lens paper; repeat this operation several times until clean.

e. To remove dust, brush the glass lightly with a clean camel's-hair brush and rap the brush against a hard body in order to knock out dust particles clinging to the hairs. Repeat until dust is removed.

f. Do not wipe lenses or windows with the fingers.



FIGURE 14.—Azimuth instrument M1918 with instrument light M10.

NOTE.—The instrument light shown here is not the final design. The reticle lamp bracket and the battery tube have been modified and a shield for the hand light has been riveted to the tube. (See fig. 15.)

SECTION VII

ACCESSORIES

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17. Electrical equipment.—*a.* The electrical equipment furnished with this instrument consists of a battery box, battery, socket wrench, and disconnecting jack for terminal thereof, book of instructions for battery, lead wire for connection to the instrument, seven spare lamps, and two double end sockets.

(1) The battery box (Edison B-4 type) is a metal box which houses the battery. It is fitted with two receptacles, internally connected to the battery, either of which may be used to plug in the lead wire which connects to the instrument. A compartment is provided within the box for carrying the disconnecting jack, socket wrench, book of instructions, and three spare electric lamps.

(2) The battery is an alkaline storage battery M1 (Edison B-2, type M1) consisting of five separate cells connected in series by connectors and supported in a wooden tray. The characteristics of the battery are listed below :

| | |
|----------------------------------------------|-----------------|
| Rated capacity, ampere-hour..... | 37.5 |
| Number of cells, in series..... | 5. |
| Discharge rate (8 hours), amperes..... | 4.7 |
| Discharge rate (5 hours), amperes..... | 7.5 |
| Average discharge voltage (8 hours)..... | 1.24 (per cell) |
| Average discharge voltage (5 hours)..... | 1.2 (per cell) |
| Normal charging rate (7 hours), amperes..... | 7.5 |
| Quantity of electrolyte, pounds..... | 1.1 (per cell) |
| Total weight, pounds..... | 29. |

(3) The book of instructions which accompanies each battery covers the care and preservation of the battery. The socket wrench and disconnecting jack are for removing the terminals from the terminal posts when necessary.

(4) The lead wire is provided to connect the various sockets of the instrument to the battery. It consists of several sections of twisted lamp cord properly connected together, each section terminating in a double contact plug. All plugs, except the one which connects to the battery, have a painted band 1/4-inch wide which serves to identify the plug for its particular use. The explanation of the colors is as follows:

White—Azimuth scale lamp.
 Green—Elevation scale lamp.
 Yellow—Azimuth micrometer lamp.
 Red—Rheostat.
 Blue—Reticle lamp.

The connections are so arranged that the rheostat controls only the reticle lamp.

(5) Three spare lamps are carried in the battery box and four in the telescope carrying case. These lamps are of the type described in paragraph 3f(3).

b. Connection of the electric equipment to the instrument is performed by inserting each lead wire plug into the corresponding colored socket and turning it until the bayonet pins hook into place. The battery plug of the lead wire should be connected last. Battery current may be conserved by disconnecting this plug whenever illumination is not actually required. The rheostat assembly, 14-4-99, mounted on the azimuth housing, 4A, of the instrument, controls the illumination of the telescope reticle. When disconnecting the electric equipment from the instrument, the battery plug should be removed first.

c. The instrument light M10 (fig. 15) includes a cell tube containing two flashlight cells, a reticle lamp bracket which contains a 3-volt lamp, and a hand light.

(1) An adapter containing a dovetailed groove is secured to the telescope cover. The reticle lamp bracket, A184557 (fig. 15), fits the dovetailed groove, locking the bracket in place. The lamp is connected in series with the rheostat switch for adjustment of illumination.

(2) The cell tube, secured by thumbscrew to one arm of the yoke, contains two standard flashlight batteries (Signal Corps BA-30) connected in series. A spring clip on the top of the tube clamps the hand light when not in use.

(3) The hand light contains a 3-volt special lamp and is connected directly across the battery through the switch. The lamp and contacts are contained in a soft rubber case to avoid damage. The top of the hand light can be unscrewed for replacement of the lamp.

18. Description.—*a. Packing chest for mount.*—A wooden packing chest is provided for the mount. This chest contains special blocking to prevent shifting of the mount when placed therein. The chest also contains compartments for the following items:

Bob, plumb.
 Brush, camel's-hair.

Brush, sash tool, oval, No. 1.

Screw driver (3-inch).

Wrench, teat, adjustable.

Pin, adjusting.

(1) The plumb bob is used for locating the instrument over a point on the ground. It is furnished with a 60-inch plumb line.

(2) The camel's-hair brush is used for removing dry dust from the lenses of the instrument. The bristles should be kept clean and dry and should not be allowed to come in contact with oil or grease.

(3) The sash tool brush is oval shaped and has the bristles laid to a chisel edge. It is used for cleaning dust from the dry metal surfaces of the instrument. It is not to be used on optical parts.

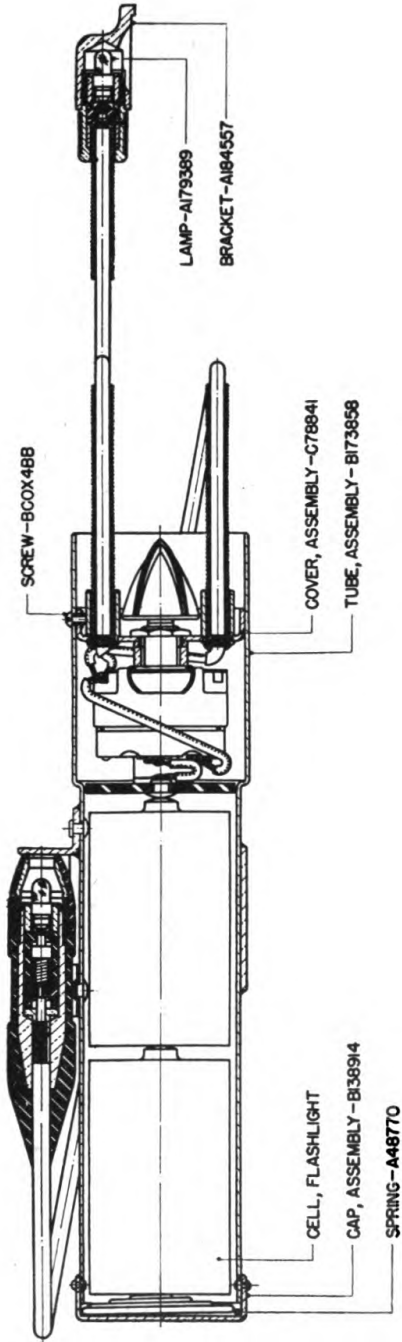
(4) The screw driver and adjusting pin are not to be used for performing operations other than authorized herein.

(5) The adjustable teat wrench fits the slots in the retaining nut, A38248 (fig. 4, sec. F-F), on the end of the azimuth worm. It is used in adjusting the azimuth micrometer, A38728.

b. Carrying case for telescope M1918.—A leather carrying case is provided for the telescope. This case contains special blocking and padding to prevent shifting of the telescope when placed therein. Pockets are provided within the case for the extra eyepiece assembly, four spare electric lamps, and two double end sockets. Provision is made for the instrument light M10, where available.

c. Carrying case M12 for telescope M1918A2.—The case is similar to the carrying case for telescope M1918 but provides for the longitudinal level.

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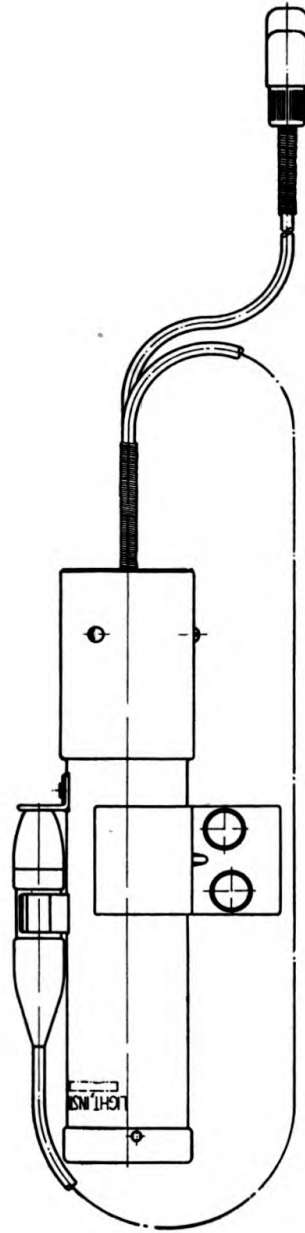
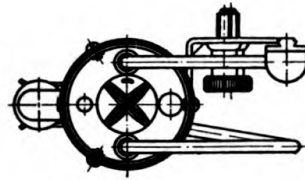


FIGURE 15.—Instrument light M10, assembled and sectioned views.

ORDNANCE MAINTENANCE

APPENDIX

LIST OF REFERENCES

1. Standard Nomenclature Lists.

| | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Azimuth instrument M1918..... | SNL F-149 |
| Cleaning, preserving, and lubricating materials..... | SNL K-1 |
| Optical repair kit for field artillery..... | SNL F-21 |
| Tripods (all active types)..... | SNL F-101 |
| 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.

| | |
|---------------------------------------------------------------|-----------|
| Cleaning, preserving, lubricating, and welding materials..... | TM 9-850 |
| 155-mm gun matériel, M1917, M1918 and modifications..... | TM 9-345 |
| Instruction guide—azimuth instrument M1918A2.... | TM 9-2680 |
| Matériel inspection and repair..... | TM 9-1100 |

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