TM 9-1695

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

DEPRESSION POSITION FINDER M1

November 21, 1941

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WAR DEPARTMENT,
WASHINGTON, November 21, 1941.

ORDNANCE MAINTENANCE

DEPRESSION POSITION FINDER M1

Prepared under direction of the
Chief of Ordnance

1. General.—*a. Purpose.*—This manual is published primarily for the information and guidance of ordnance maintenance personnel.

b. Scope.—This manual supplements the Technical Manuals which are prepared for the using arm. It contains general descriptive matter and detailed instructions for the maintenance and repair of the instrument by ordnance personnel. Figures which accompany the text show the placement and method of fastening of each of the component parts of the instrument.

c. References.—The appendix lists all Standard Nomenclature Lists and other publications pertaining to this instrument.

2. Description.—*a. General.*—(1) The depression position finder M1 is an instrument used for measuring from heights above sea level, between limits of 14 to 1,395 feet and 2,850 to 4,100 feet, the true horizontal range of an object on the surface of the sea and also the azimuth of the object from the azimuth reference line.

(2) The instrument consists essentially of a telescope, mount, and pedestal. The mount carries the telescope and contains mechanisms for directing it. The mount is accurately leveled on the pedestal by means of four leveling screws. When the telescope is directed on the water line of a target the depression angle is measured mechanically, and the corresponding horizontal range, corrected for curvature of the earth and normal atmospheric refraction, is read directly on a range scale graduated in yards. Internal correction adjustments compensate for tidal variations, abnormal atmospheric refraction, and

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for heights of instrument other than those for which the range scale is calibrated. Azimuths are read directly from an azimuth scale and mircrometer.

(3) The depression position finder M1 is the latest development in vertical base instruments. It supersedes the following:

Finder, depression position, Lewis, type A.
Finder, depression position, M1907.
Finder, depression position, Swasey, type A.
Finder, depression position, Swasey, type AII.

(4) Instruments are built in several classes and designated numerically as listed below to cover the varying needs of the service. The depression mechanism components and range scale supplied determine the class of the instrument.

Class	*Height of emplacement above sea level (feet)*	*Range (yards)*
1	74 to 135	1,500 to 20,000
2	100 to 182	2,000 to 24,000
3	150 to 272	2,500 to 30,000
4	260 to 475	2,500 to 38,000
5	350 to 650	2,500 to 45,000
6	450 to 810	5,000 to 50,000
7	575 to 1,045	5,000 to 55,000
*8	750 to 1,395	3,000 to 60,000
9	750 to 1,375	5,000 to 60,000
10	625 to 1,160	2,500 to 45,000
12	2,250 to 4,100	10,000 to 80,000

*Not to be used over 54,000 yards at heights below 1,000 feet and 56,000 yards at heights above 1,000 feet.

b. Telescope M1.—(1) The telescope M1 is shown in figures 1 to 5.

(2) The telescope may be set for magnification of from 10 to 30 power. It has the following optical characteristics:

Magnification	10×	30×
Field of view	6°9′	2°3′
Diameter of exit pupil	0.3 inch	0.1 inch
Effective focal length of objective.	15.746 inches	15.746 inches
Effective focal length of eyepiece.	0.802 inch	0.802 inch
Apparent field of view	61°30′	61°30′

(3) The optical system includes an objective (A35630), reticle assembly (A38003), collective lens (A38000), two erectors (A35644),

a blue and amber ray filter assembly (B16298), and an eyepiece assembly (C44090). The image produced is erect.

(4) The magnification may be changed by rotating the focusing collar (B16306, fig. 3). Graduations on the focusing collar indicate the magnification for which the telescope is set. As the total rotation of the collar is approximately one and one quarter revolutions, the graduations are engraved in part on the rearward rim of the collar and completed on the forward rim.

(5) The eyepiece assembly (C44090, fig. 3) can be focused by rotation in the eyepiece adapter (B16303). A diopter scale (A35677) graduated from +5 to −5 diopters enables the observer who knows the correction for his eye to quickly focus the eyepiece. The zero graduation is the setting for a normal eye.

(6) A ray filter assembly (B16298, figs. 5 and 1) containing an amber filter (A35663) and a blue filter (A35662) is contained within the eyepiece adapter (B16303). The levers which operate these filters are shown in the end view of figure 2. The long lever marked "A" controls the amber filter; the short lever marked "B" controls the blue filter.

(7) The reticle assembly (A38003) consists of a reticle frame (A38001) carrying a horizontal and a vertical cross wire. The cross wires intersect in the center of the field of view, and the point of intersection marks the optical axis of the telescope. For night illumination, a 3-candlepower, 6–8-volt, miniature electric lamp with G–6 bulb and double contact base is provided.

(8) A leather objective cap (B16853) is provided to protect the forward end of the telescope. This cap is attached by a strap riveted to the sunshade (B129035) which extends beyond the objective.

(9) The telescope is positioned in the mount by two telescope trunnions (A36122, fig. 6) and an accurately machined bar (B16304, fig. 5) on the under side of the body tube (C44091). The optical axis of the telescope is parallel to the lower surface of the bar.

(10) The mask (B16305, figs. 2 and 3) enables the observer to relax the eye that is not focused on the telescope, thereby minimizing the strain on the focused eye.

(11) The counterweight assembly (B129215, fig. 5) is adjustable to provide for proper balance of the telescope.

c. Mount.—(1) The mount for depression position finder M1 is shown in figure 1 and figures 6 to 12.

(2) The mount is attached to the pedestal by the leveling plate support (D9808, sec. R–R, fig. 12) and the leveling plate (D9807) which is bolted to this support. A socket within the leveling plate

contains a ball (A36045) about which the instrument centers for leveling. Four leveling screws (A36047) carry the weight of the instrument when leveled. The leveling screws thread into the lower portion of the body (D9806) and bear on the leveling plate through leveling screw shoes. One of these shoes (A36121) is formed with a lug which fits into a recess in the leveling plate and thereby prevents rotation of the body with respect to the leveling plate. For orienting purposes, the mounting bolt holes for the leveling plate are slotted and a projecting lug is provided, permitting movement of the leveling plate when actuated by the two hexagon head orienting bolts (A39510, fig. 1).

(3) The table (D9810, fig. 7) incloses the azimuth worm gear and other working parts of the instrument and contains the azimuth worm (B16421) which meshes with the worm gear and transmits motion in azimuth to the table. The table revolves on ball bearings about the vertical body spindle (B16422).

(4) The azimuth worm (fig. 11) is provided with a ball and socket mounting (sec. D–D) at one end and a compression spring (A7093) and plunger (A36104) at the other end to eliminate backlash. A throwout cam (A36102) operated by a lever (A36103) disengages the worm and permits rapid traversing of the instrument when required. Rotation of the azimuth worm handwheel, with the worm in mesh, causes rotation of the table about the azimuth worm gear. The coarse readings (1.0°) are viewed on the azimuth scale (C44133) through window (A36089). Fine reading (0.01°) are observed on the azimuth micrometer (A36056).

(5) Two level assemblies (C44202) are mounted on the table (D9810, figs. 6 and 12).

(6) The depression mechanism is operated by the drive shaft handwheel (B16426) and is adjusted for height of the instrument above sea level. It depresses the telescope and actuates the range scale and pointer.

(*a*) The drive shaft handwheel, through a system of gearing (fig. 9), drives the tangent screws at the front and rear of the tangent screw rail (C44132, fig. 7) thus raising or lowering the rail to which is fastened the height scale.

(*b*) The compensating screw nut (C44130, figs. 10 and 1) which slides along the rail and functions as the index on the height scale, carries the fulcrum pin (A36075) which supports and adjusts the telescope body tube bar (B16304) and the telescope. The adjusting screw (A36067) operated by the knob (A36066) provides a fine adjustment. Clamping thumbscrews are provided.

(*c*) The cam (fig 10) operating through the compensating bar (figs. 10 and 6) and rack (B16419) drives the pinion (A36077) which causes the fulcrum pin to rise or fall, applying correction for differences in effect of curvature of earth and normal refraction existing at any height except the initial height for which the scale was calibrated. The thumbscrew (A36072) clamps the compensating screw to the pinion and when released permits independent motion between these parts for initial setting.

(*d*) The range scale and pointer (B16424, fig 8) are operated by the gearing from the drive shaft, the pointer moving across the face of the range scale and registering on it. Corrections for curvature of the earth and normal atmospheric refraction are embodied in the calibration of the range scale graduations. A range scale magnifier assembly (C56654, fig. 9) provides accurate reading.

(7) The range scale, azimuth scale, azimuth micrometer, and the reticle in the telescope are electrically illuminated. A portable lamp is furnished for illuminating the height scale. A switch block (A36095, fig. 9) with sockets and switch is located on the right-hand side of the depression mechanism case (D9809). The wiring is fitted for double-contact bayonet-base sockets and plugs. Electrical equipment supplied with the instrument is described in paragraph 7. (See fig. 13.)

d. Pedestal.—The pedestal is a hollow column of cast iron having three feet and an accurately machined upper portion which receives the leveling plate support to which the mount is secured.

3. Operation.—*a. To set up instrument.*—(1) Bolt the pedestal securely to the floor or foundation. Place the mount on the pedestal. Bolt the leveling plate to the leveling plate support, with the fine adjustment approximately central.

(2) Install the telescope by unscrewing the trunnions sufficiently to allow clearance for the trunnion bearings. Hook the body tube bar (B16304) under the safety clip (A36073). Center the telescope trunnion bearings and screw in the trunnions, adjusting until there is neither play nor tightness and until the body tube bar is centered on the fulcrum pin. Adjust the counterweight assembly (B129215) until there is positive contact between the body tube bar and the fulcrum pin. Level the instrument as indicated in *b* below.

(3) Set the azimuth scale and micrometer to the desired azimuth of a datum point. Grasp the rims of the leveling plate support and leveling plate and rotate the table assembly until the vertical cross line in the telescope approximates the datum point. Tighten the clamping bolt of the leveling plate support and use the fine adjust-

ment to make the telescope cross line coincide with the datum point. Tighten all bolts.

b. To level instrument.—All observations are made with the instrument accurately leveled, according to the bubbles in the level vials. Best results in leveling will be obtained with the level vials oriented 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. The leveling screws are operated by lowering one and raising the other of a pair. In the final adjustment all screws should be tight but not strained.

c. To determine azimuth of target.—To determine the azimuth of a target, rotate the azimuth worm handwheel until the vertical cross line in the telescope falls on the target. Note the reading indicated on the azimuth scale (coarse, 1° divisions) opposite the azimuth scale index and on the azimuth micrometer (fine, 0.01° divisions) opposite the azimuth micrometer index. Rapid changes in azimuth can be made by rotating the azimuth worm throwout cam lever so as to disengage the azimuth worm, but final setting should be made with the worm in mesh.

d. To determine range of target.—(1) Before determining ranges it is essential to calibrate the instrument to secure accurate results. Three operations are necessary for complete calibration as described below. Reference should be made to the figures.

(*a*) Determine the height of tide and the corresponding height of the instrument above sea level, which height is the initial height of the instrument with the height of tide added or deducted. Slide the compensating screw nut along the tangent screw rail until the height scale index registers the height of the instrument above sea level and clamp the compensating screw nut to the tangent screw rail at this setting. Frequent check on tide should be made and the height corrected accordingly, as a small change in height setting will affect the range.

(*b*) Direct the telescope in azimuth on a datum point of known range near the maximum working range of the instrument and rotate the drive shaft handwheel until the range of the datum point is indicated by the pointer on the range scale. If the horizontal cross line in the telescope does not coincide with the water line of the datum point, unclamp the thumbscrew on the compensating screw and revolve the compensating screw, causing the raising or lowering of the fulcrum pin, until coincidence is obtained. The thumbscrew should then be tightened. This operation is termed "initial setting."

(*c*) After obtaining the initial setting of the instrument, direct the telescope in azimuth on a datum point of known range near the mini-

mum working range of the instrument and rotate the drive shaft handwheel until the horizontal cross line in the telescope coincides with the water line of the datum point. If atmospheric refraction is normal, the range indicated by the pointer on the range scale will be in agreement with the known range of the datum point. If atmospheric refraction is above normal, indicated range will be less than the known range; if atmospheric refraction is below normal, which is seldom the case, indicated range will be greater than known range. To make corrections for abnormal refraction, two datum points, one at short range and the other at long range, must be used successively, and a slightly different position of the compensating screw nut determined, which will enable the instrument to give correct ranges for the two datum points. When this is accomplished, readings at other ranges will be practically correct.

1. The compensating screw nut should be moved toward the telescope trunnions for refraction above normal, and away from the telescope trunnions for refraction below normal. The new position found will be only a very small distance from the true position indicated on the height scale. This small adjustment can be readily made by clamping the adjusting screw nut to the tangent screw rail and using the adjusting screw to move the compensating screw nut.

2. Best results will be obtained by selecting datum points having maximum range near the maximum limits of the range scale and minimum range near approximately one-third the maximum range. This gives closer calibration for maximum ranges and therefore greater accuracy at long ranges. Minimum ranges corresponding to the minimum on the range scale should not be used unless other datum points are not available.

(2) To determine the range of a target, rotate the drive shaft handwheel until the horizontal cross line in the telescope falls on the water line of the target. The range is then indicated on the range scale opposite the pointer.

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

a. Telescope M1.

Parts to be inspected	*Points to be observed*
(1) Exposed mechanical parts.	(1) Observe general appearance, smoothness of operation of

Parts to be inspected	*Points to be observed*
	eyepiece, focusing collar, filter levers, mask, etc. The bar (B16304) should be free of nicks and burs.
(2) Optical system.	(2) 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 telescope to an arsenal for overhaul.
(3) Eyepiece assembly.	(3) Using the collimating telescope (No. 98, optical repair kit), focus the eyepiece for sharpness and definition of the reticle. The reading of the diopter scale at optimum focus should be approximately zero.
(4) Reticle.	(4) Test for vertical and horizontal positioning of the reticle cross lines by sighting on a vertical line, such as a plumb line, with the instrument level. Sight on a true horizontal line (horizon, etc.) or upon a distant point, traversing the instrument to move the point horizontally across the field of view to check the horizontal cross line.
(5) Filters.	(5) The blue and amber eyepiece filters should operate smoothly and should be free of dust, stains, or cracks.
b. Mount.	
(1) Exposed mechanical parts.	(1) Observe general appearance, smoothness of operation of handwheels, levers, leveling screws, thumbscrews, etc. Graduations should be clearly legible.
(2) Trunnions.	(2) Lift the telescope slightly by the eyepiece end. Check for play or tightness between tele-

Parts to be inspected	*Points to be observed*
	scope bearings and trunnions. See that trunnion setscrews are secure. The telescope body bar (B16304) should be centered on the fulcrum pin.
(3) Worm mechanisms.	(3) Operate the azimuth and range handwheels through entire range to check for backlash or excessive tightness. The throw-out lever should function properly. Avoid snapping the teeth into mesh. In the "out" position the teeth should clear.
(4) Level vials.	(4) See that the two level vials are secure in their housings and unbroken. Level the instrument and observe whether the bubbles remain centered when the table is slowly rotated through 360°.
(5) Alinement of the instrument.	(5) With the instrument leveled and the telescope pointed at a plumb line, move the compensating screw and the range handwheel over the entire range. If the vertical cross wire varies to the right or left of the plumb line, the instrument is not in adjustment. The telescope may be incorrectly seated in the mount. The safety clip (A36073) may be bearing on the side of the bar (B16304). The bar or the tangent screw rail (C44132) may be distorted.
(6) Range mechanism.	(6) The effect of wear and possible misalinement may be observed by leveling the instrument and checking on known datum points representing extremes of the range and intermediate known ranges.

Parts to be inspected	*Points to be observed*
(7) Tangent screw rail.	(7) With the instrument level, check the tangent screw rail for horizontal operation throughout entire range, using a sensitive level.
(8) Rack and shoe.	(8) The rack (B16419) should have no play on the shoe (A36093). Try the plug (A36131). The shoe should have no side play in the slot of the compensating bar (C44129).
(9) Cam.	(9) The cam should be secure on its shaft and the plunger should keep the cam pin (A36088) in contact with the cam throughout the range of operation. Examine the cam surface for signs of excessive wear which might require return of the instrument to the base shop.
(10) Illumination.	(10) Check rheostat and sockets for electrical contact 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. (See par. 7.)
c. Pedestal.	
Exposed mechanical parts.	Observe general appearance, clamping of the level plate support.

5. Maintenance and repair.—*a. Tools.*—(1) *Optical repair kit for harbor defense.*—An optical repair kit containing the necessary tools, fixtures, cements, oils, etc., for use with this instrument is furnished to ordnance companies. A complete list of the items comprising the kit is contained in a blue print which is fastened in the cover of the chest. Every item in the kit is designated by a number equivalent to the compartment number. Most of the items as screw drivers, etc., require no description as their uses are self-explanatory. The collimating telescope (No. 98) which is furnished with the kit is an ordinary nonerecting type. It is adjusted for parallax by focusing

the eyepiece on the cross wires and then removing parallax by turning the focusing nut to focus the objective. The magnifying power of the collimating telescope is 8.13X; the field of view is 3°.

(2) *Other tools.*—Other tools required for this instrument are described in paragraph 7.

b. 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. Reference to the figures will indicate relationship of parts.

(1) *Telescope M1.*—(*a*) The telescope M1 may be removed from the mount by unscrewing the trunnions (A36122) secured by lock screws, and sliding the telescope until the bar (A16304) clears the safety clip (A36073). During this procedure the telescope should be supported to avoid danger of dropping on the mount or disturbing the alinement of the compensating screw.

(*b*) Further disassembly of the telescope is limited to removal of the counterweight assembly (B129215) secured by two nuts; removal of the socket assembly (B16139) used for illuminating the reticle; removal of the mask (B16305).

(2) *Mount.*—(*a*) *Azimuth worm.*—Unscrew the plug (A36099) and its retaining screw and withdraw the compression spring (A7093, secs. E–E and F–F, fig. 11). Unscrew the ball cap (A36058) and its retaining screw, turn the throwout lever to the disengaged position and withdraw the azimuth worm, handwheel, and micrometer. The ball socket (A36059) may be removed, if necessary, at this point after loosening its lock screw. In reassembly, make sure that the ball socket is alined with its lock screw. When replacing the worm bearing support in the ball socket, aline the Woodruff key. The ball cap (A36058) should be screwed into place until all longitudinal play disappears. Avoid binding.

(*b*) *Azimuth handwheel.*—Remove the three round head screws and pull the clamping plate (A36054, fig. 11) off the micrometer adapter (A36055). Withdraw the taper pin (BFCX1BC) and remove the micrometer adapter. To remove the ball bearings, after the azimuth worm and micrometer adapter have been disassembled, unscrew the round nut (A36061) and drive the worm shaft out of the worm bearing support.

(*c*) *Throwout mechanism.*—To remove the lever (A36103, fig. 11) drive out its securing taper pin. Remove the plug (A36099) and its locking screw and remove the compression spring (A7093). Unscrew the retaining ring (A36101) and lift out the throwout cam (A36102).

(*d*) *Range drive shaft assembly.*—Remove the range handwheel (B16426, fig. 9) after driving out its retaining taper pin, if the handwheel requires replacement or for access to the bearing. Unscrew the bracket (B16427). Mark the settings of the two retaining rings (A35147) for realinement and unscrew them, drawing the bevel pinion out of mesh. In reassembly, while pressing the ball bearing into its seat, make sure that the bevel pinion meshes with the gear. Tighten the retaining rings to original position. After replacing the range handwheel the bracket may be screwed to the table.

(*e*) *Compensating screw mechanism.*—To remove the compensating screw mechanism release the extension spring (A38071, fig. 10) and remove the two fillister head screws holding the compensating bar (C44129) to the bracket (A36049). Disengage the bar and the cam pin (A36088) from the shoe (A36093), the slot in the tangent screw rail (fig. 6), and the slot in the cam cover. Loosen the clamping thumbscrews on the side of the adjusting screw nut (A36050) and the compensating screw nut (C44130, fig. 10). Slide both nuts off the tangent rail after removing the stop studs. Further disassembly should be avoided.

(*f*) *Cam guard.*—Removal of the cam guard (B16420) may be required for cleaning. After the compensating bar has been removed as in (*e*) above, withdraw the three screws, lift up the guard, and withdraw the plunger.

(*g*) *Depression and range mechanisms.*—Repairs involving removal of the case (D9809, fig. 7) or table (D9810) for access to the depression and range mechanisms require return of the instrument to an arsenal or base shop. Exception to this may be made when a special request has been granted for conversion of the instrument from one class to another, and proper facilities and a qualified instrument mechanic are available.

(*h*) *Table assembly.*—This mount may be removed from the pedestal by disengaging the three hexagon-head bolts holding it to the leveling plate support. The leveling plate (D9807) may be removed by unscrewing the retaining ring (A36046, fig. 12). The ball (A36045) may be removed by driving out its retaining taper pin. The leveling screws (A36047) may be unscrewed for repair or replacement. The shoes (A36121 and A38250) are spun onto the screws and should not be separated. In reassembly, make sure that shoe

(A36121) which has a key on its face is placed on the proper pad of the leveling plate. Repairs requiring further disassembly should be made at an arsenal or base shop.

(*i*) *Level vials.*—To repair the level vials remove the assembly (fig. 12) from the table and disassemble by driving out the pins (BFDX1BP). Remove any broken glass and old packing. Place the new vial (type T, A31321) in position, center graduations in opening, and pack level vial lightly with paper strips. Secure with calcined gypsum (plaster of paris) which has been mixed to medium consistency. Replace cover, plugs, and pins. After plaster has hardened, remove excess from surfaces. For adjustment after reassembly to table see *c* below.

(3) *Pedestal.*—After the mount has been removed the leveling plate support (D9808) may be removed when its clamp is released.

(4) *Lamps.*—For replacement of lamps, each socket assembly may be unscrewed from its bracket after the lead wire plug has been disconnected.

c. Adjustment.—(1) *Levels.*—Level the instrument and observe the level bubbles as the instrument is slowly rotated 360° in azimuth. If they remain centered, the levels are in correct adjustment. If one or both bubbles move, the following adjustment is made.

(*a*) Set the level to be adjusted parallel to a pair of diagonally opposite leveling screws and level the instrument so that the bubble is centered.

(*b*) Rotate the instrument 180° in azimuth.

(*c*) By manipulation of the level adjusting nuts (A36107, sec. S–S, fig. 12), return the level bubble *halfway* to its original central position. Relevel the instrument, rotate it 180°, and again note the position of the bubble.

(*d*) Repeat the operation, if necessary, until the best possible adjustment is obtained.

(2) *Azimuth micrometer.*—The azimuth micrometer should read zero when the azimuth scale is set to indicate exactly on a graduation. If adjustment is required, loosen the three round head screws (BCNX2CE, sec. D–D, fig. 11) and move micrometer, holding the grip (A36120) steady. The screws should then be tightened securely. It should be noted that the orientation setting of the instrument is altered by this adjustment. To reorient the azimuth scale, follow the procedure described in paragraph 3*a*(3).

6. Care and preservation.—*a. Handling.*—(1)The instrument contains delicate and highly accurate mechanism and the telescope

contains precise optical parts. Careful handling is imperative to avoid damage caused by unnecessary shocks, straining, etc.

(2) Avoid forcing the range drive and compensating screw nut against the stops provided for limiting motion of tangent screws and compensating mechanisms.

(3) Avoid unnecessary motion of telescope between safety clip and fulcrum pin which might cause injury to the contact surfaces.

(4) The azimuth throwout lever must not be snapped into mesh. When disengaging the worm and worm gear move the lever sufficiently to allow the teeth to clear. In this way excessive wear and burring of the teeth can be avoided.

(5) Do not point the telescope directly at the sun or its reflection on the sea, as the heat of the focused rays may melt the balsam used in cementing the lenses.

(6) Leveling and clamping screws must not be tightened beyond a snug contact. Excessive wear of threads and other damage to the instrument are thereby eliminated.

(7) When the instrument is not in use, protect it with the canvas cover provided. If removed from the pedestal, the telescope and mount should be stored in the packing chests in which they are shipped.

b. Lubrication.—(1) Lubricants for fire control instruments function also as rust preventives. It is important that they be applied carefully and diligently. Extreme care should be taken not to apply lubricants excessively. Excessive lubrication of certain parts may be equally as damaging as the absence of any lubricant.

(2) Only the following lubricants will be used in the servicing of this matériel:

Grease, special, low temperature.
Oil, lubricating, for aircraft instruments and machine guns (U. S. A. Spec. No. 2–27).

(3) Only a few drops of oil at long intervals will be required in the oil cups provided.

(4) A light film of oil should be applied daily to the exterior contact surfaces and exposed parts.

(5) When the instrument is to be out of use for some time, the tangent rail should be elevated to its highest position and the tangent screws covered with grease, then lowered to its bottom position. Leave the excess lubricant on the tops of the round nuts. When the instrument is to be used, wipe off the old lubricant and oil the screws lightly but thoroughly.

(6) Avoid lubricating parts of the telescope other than the counterweight assembly.

(7) Excess lubricants should be wiped off to prevent accumulation of dust and grit.

c. Optical parts.—(1) 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.

(2) 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 never be applied directly as it may cause unequal expansion of parts with resulting inaccuracies in observation.

(3) For dusting optical parts use only a clean brush, camel's-hair. For wiping, use only paper, tissue, for cleaning optical glass.

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

(5) 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.

(6) Do not wipe lenses or windows with the fingers.

(7) Polishing liquids or pastes are not to be used for polishing lenses or windows.

7. Accessories.—*a. Accessory chest.*—Items contained in the wooden accessory chest supplied with this instrument include brushes, lamps, sockets and wire, an oiler, lens paper, screw drivers and wrenches.

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

(2) The varnish brush is used for removing dust from the dry metal surfaces of the instrument. It is not to be used on optical parts.

(3) The oiler is to be filled only with oil furnished by the Ordnance Department for fire control instruments.

(4) The tools supplied are not to be used for performing operations other than authorized herein.

(5) The two socket assemblies supplied are used as spares. Both are of the double end, double contact type, but differ in the positioning of the collar on the socket.

(6) The electric lamps are 3-candlepower, 6–8 volt, miniature lamps with G–6 bulb and double contact base.

(7) The method of connection of the several lead wire assemblies to the receptacles of the instrument is shown in figure 13. The plugs are of the bayonet type and are inserted into the socket by pressing them in and turning until the pins hook into place.

b. Packing chests for telescope and mount.—Separate packing chests are provided for the telescope and mount. Both packing chests have internal blocking to prevent shifting of the parts when packed therein.

c. Cover.—A canvas cover is furnished for protection of the instrument when it is mounted but not in use.

d. Electrical equipment.—The fuse and resistor unit and the rheostat shown in figure 13 are supplied with the instrument for connection to 110-volt or 220-volt power supply mains. The unit serves to reduce the supply voltage to the proper value for the instrument lamps. The rheostat controls the intensity of illumination.

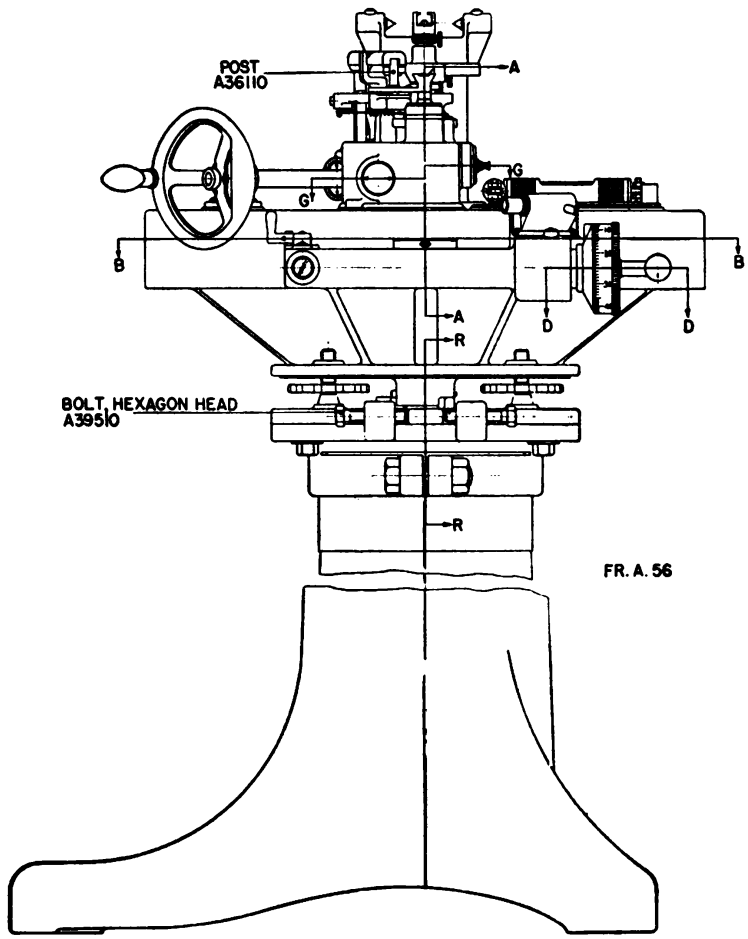


FIGURE 1.—Depression position finder M1—assembled views.

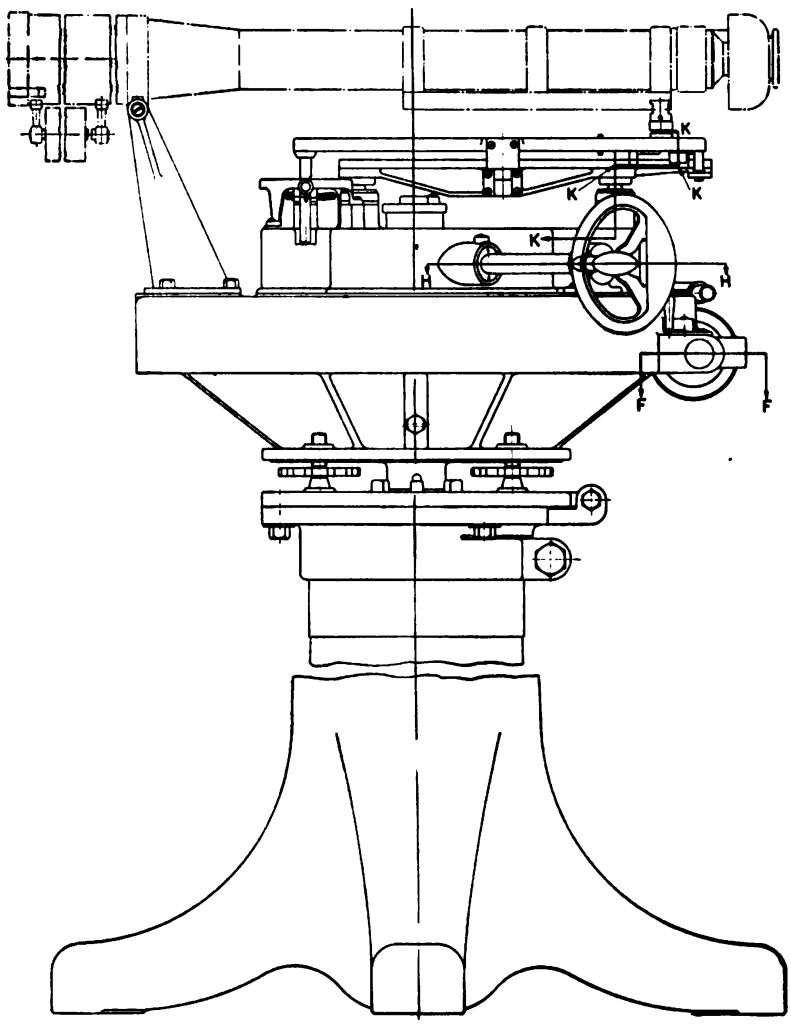


FIGURE 1.—Depression position finder M1—assembled views—Continued.

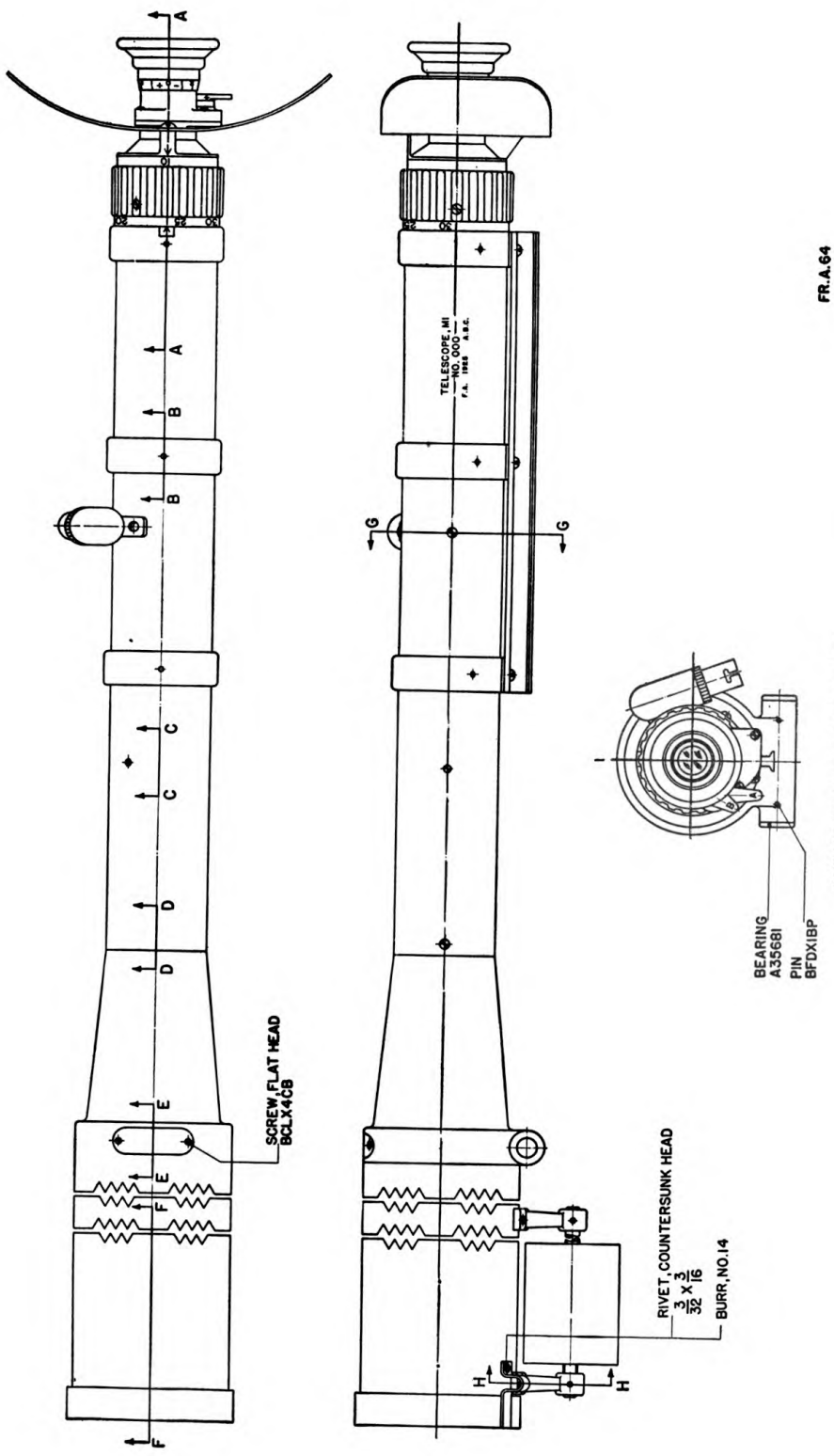
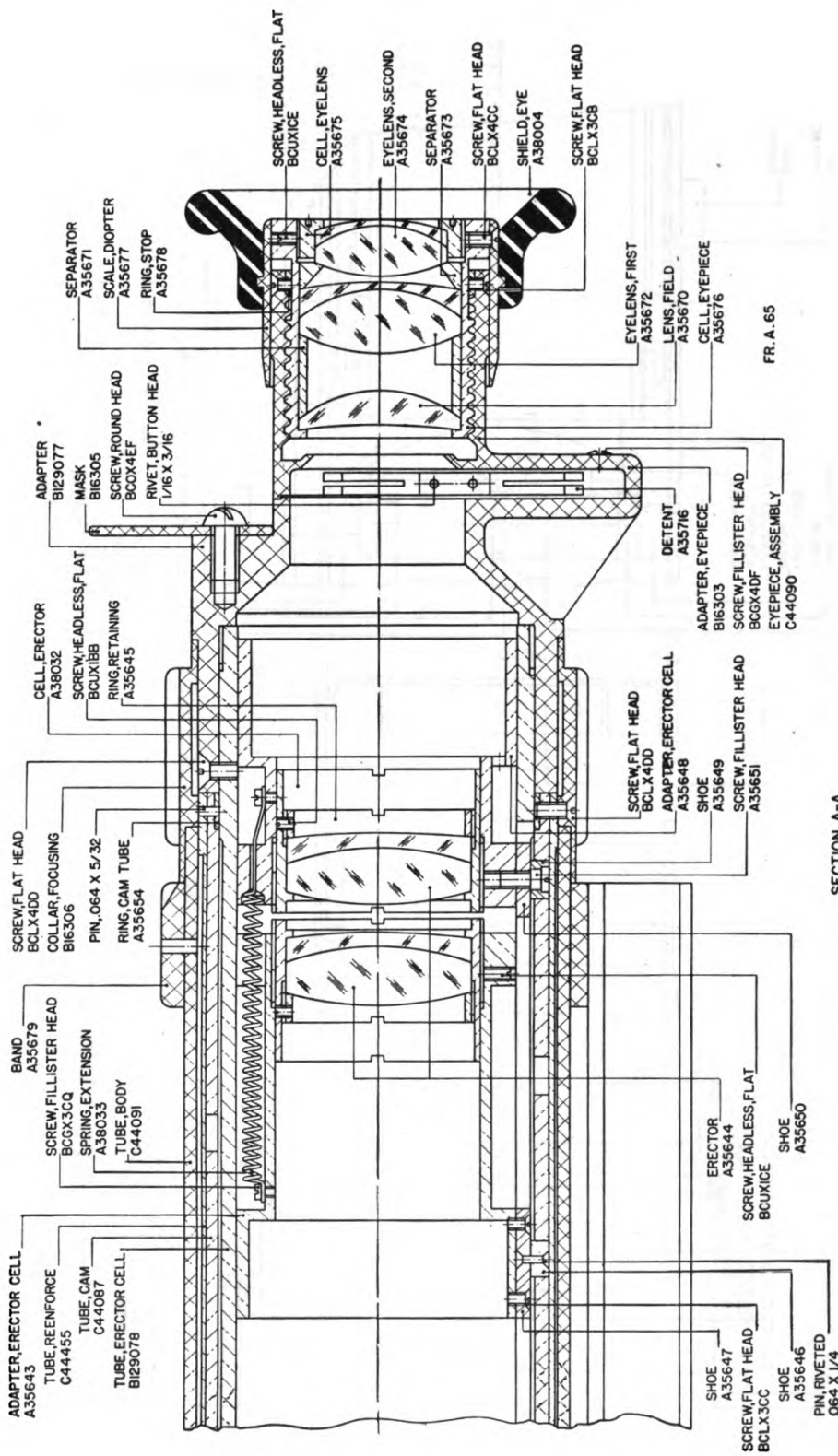


FIGURE 2.—Telescope M1—assembled views.

DEPRESSION POSITION FINDER M1



SECTION A-A

FIGURE 3.—Telescope M1—sectioned view.

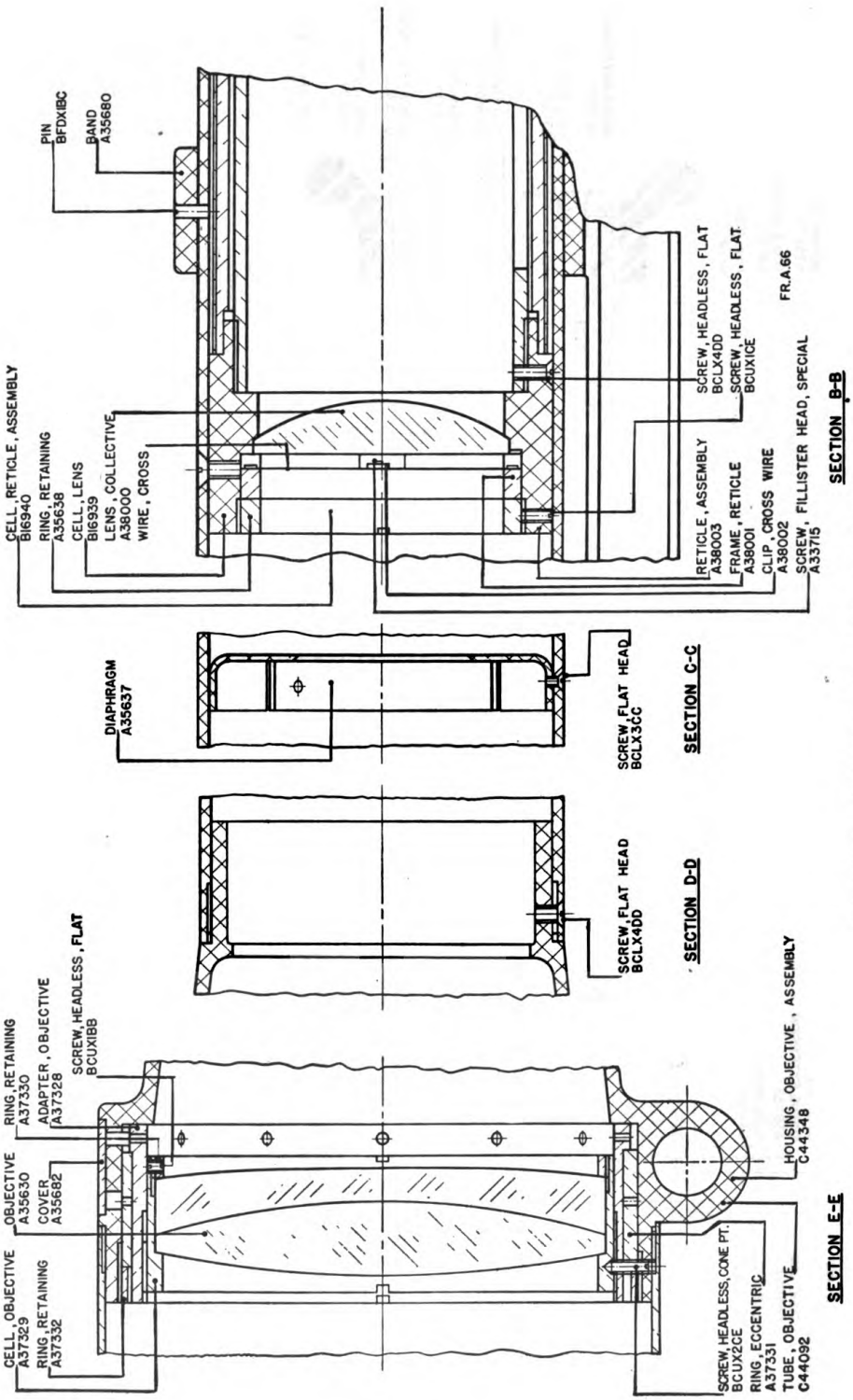


FIGURE 4.—Telescope M1—sectioned views.

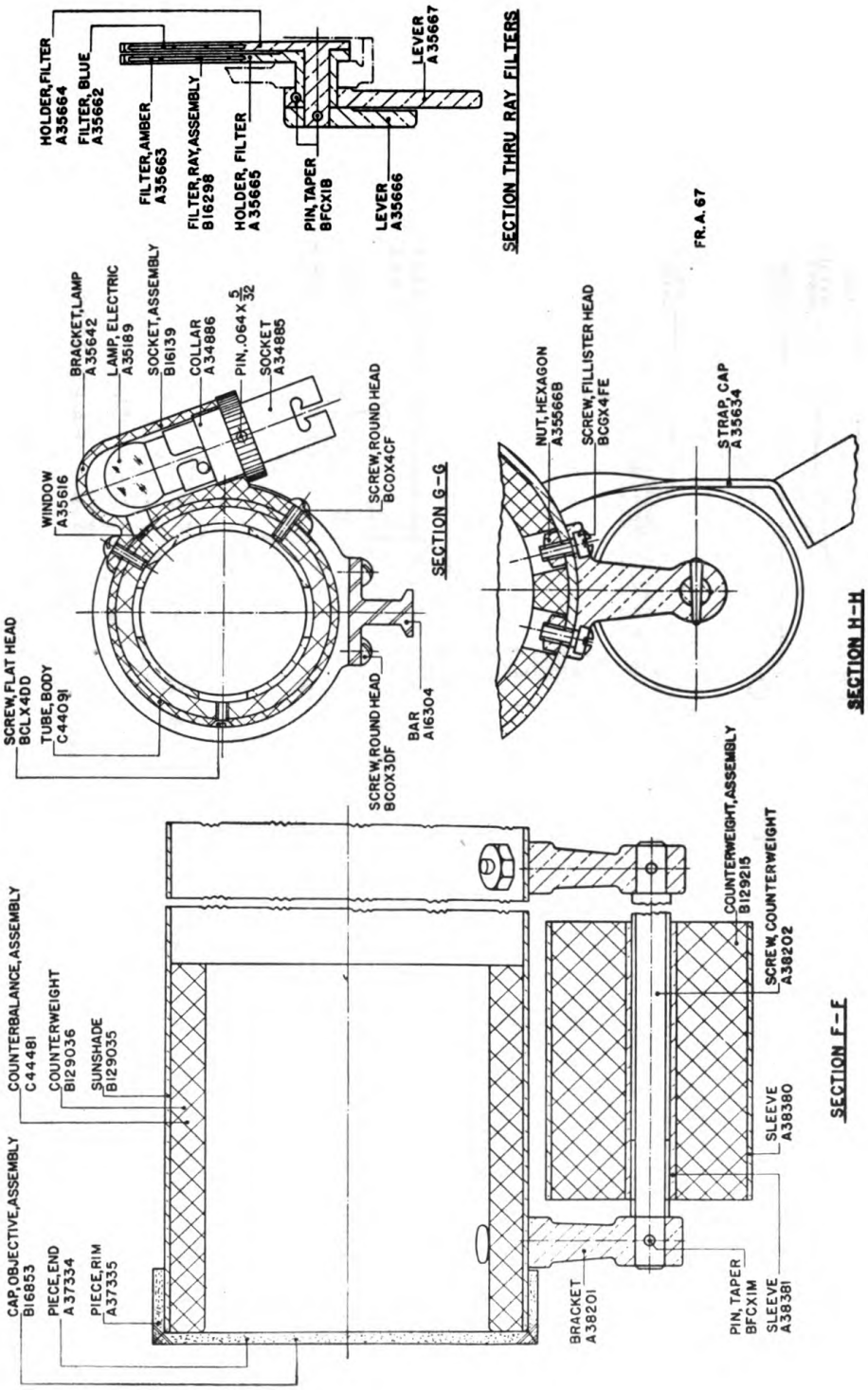


FIGURE 5.—Telescope M1—sectioned views.

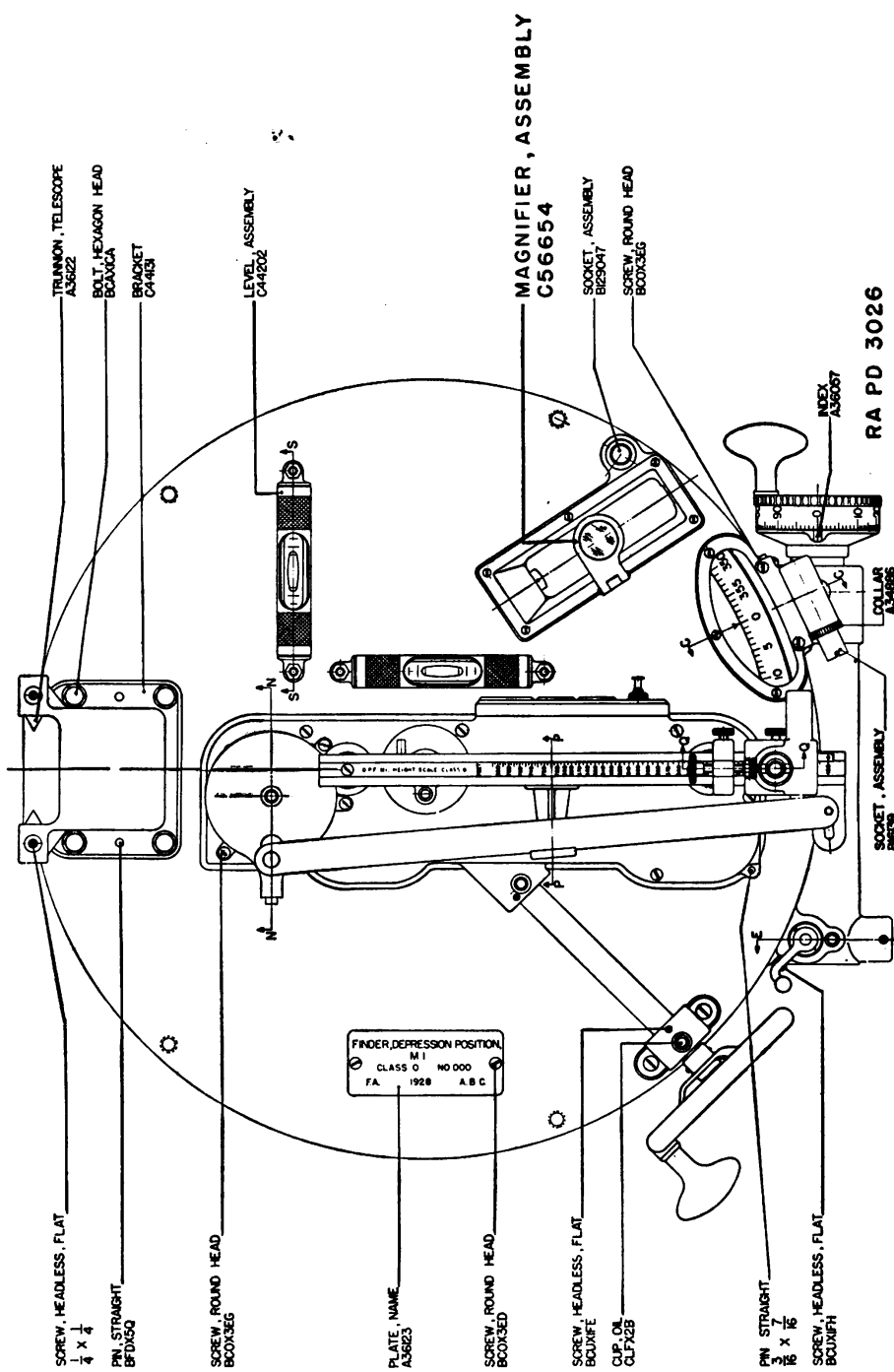


FIGURE 6.—Mount for depression position finder M1—plan view.

DEPRESSION POSITION FINDER M1

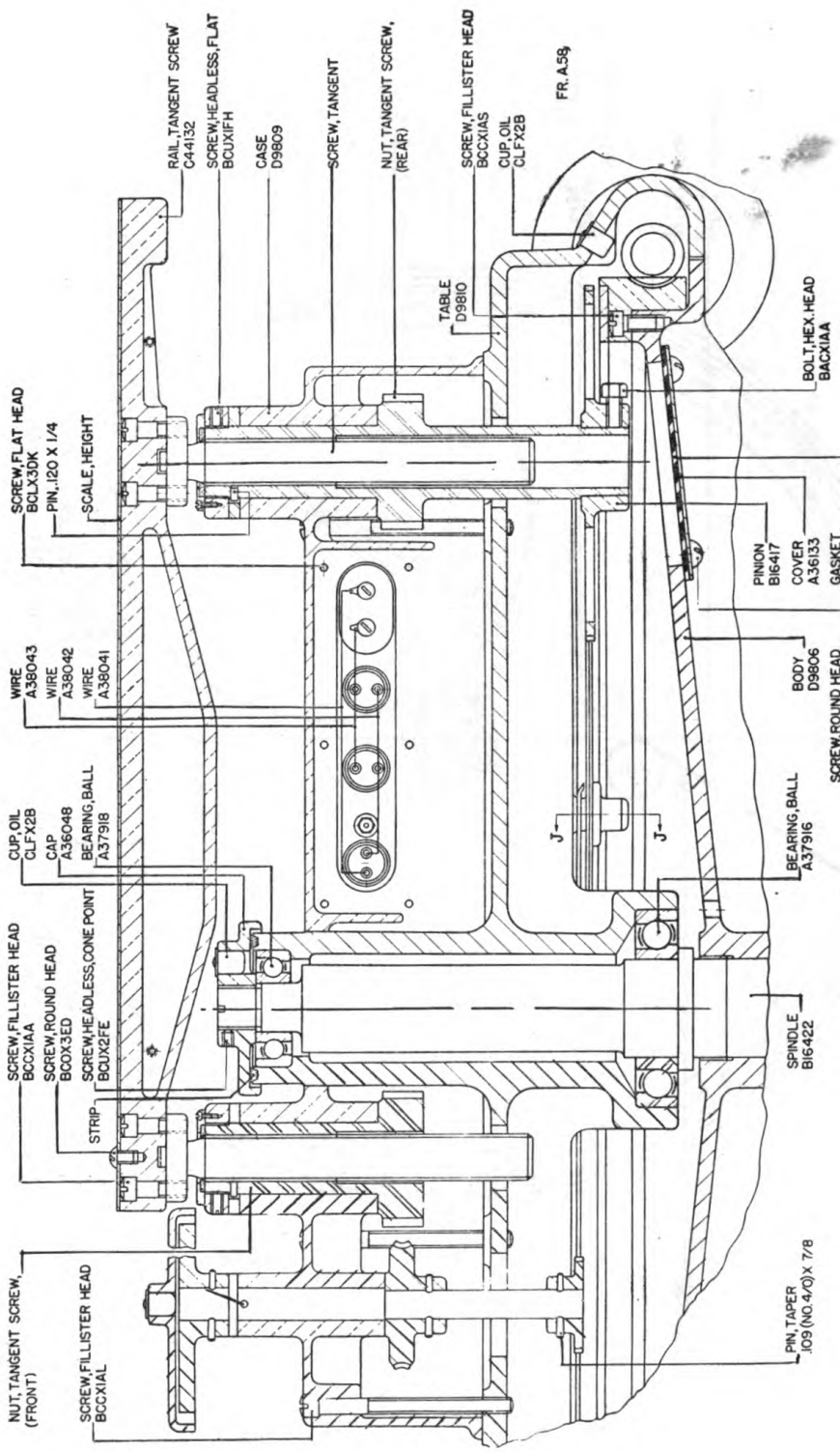


FIGURE 7.—Mount for depression position finder M1—sectioned view.

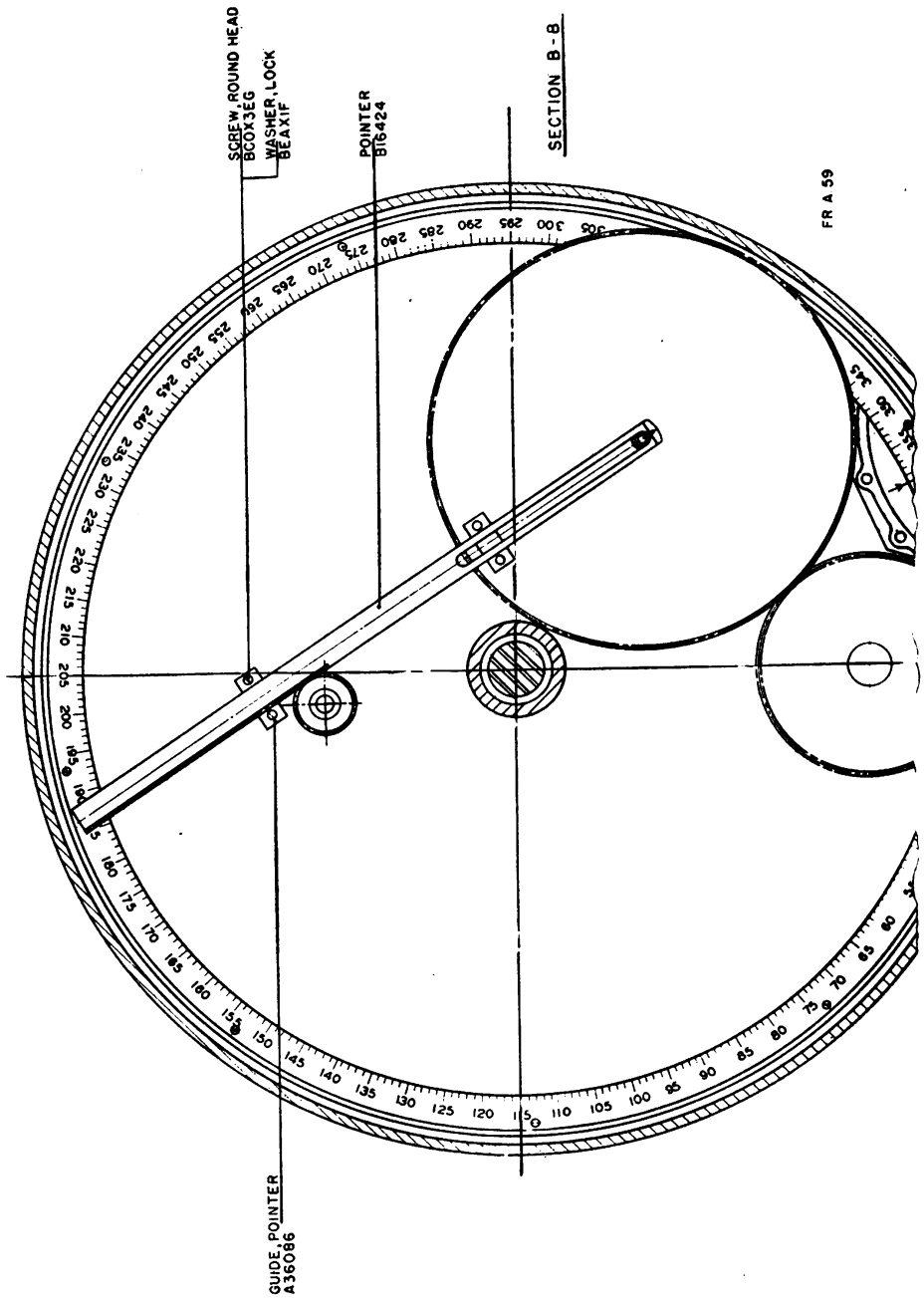


FIGURE 8.—Mount for depression position finder M1—sectioned view.

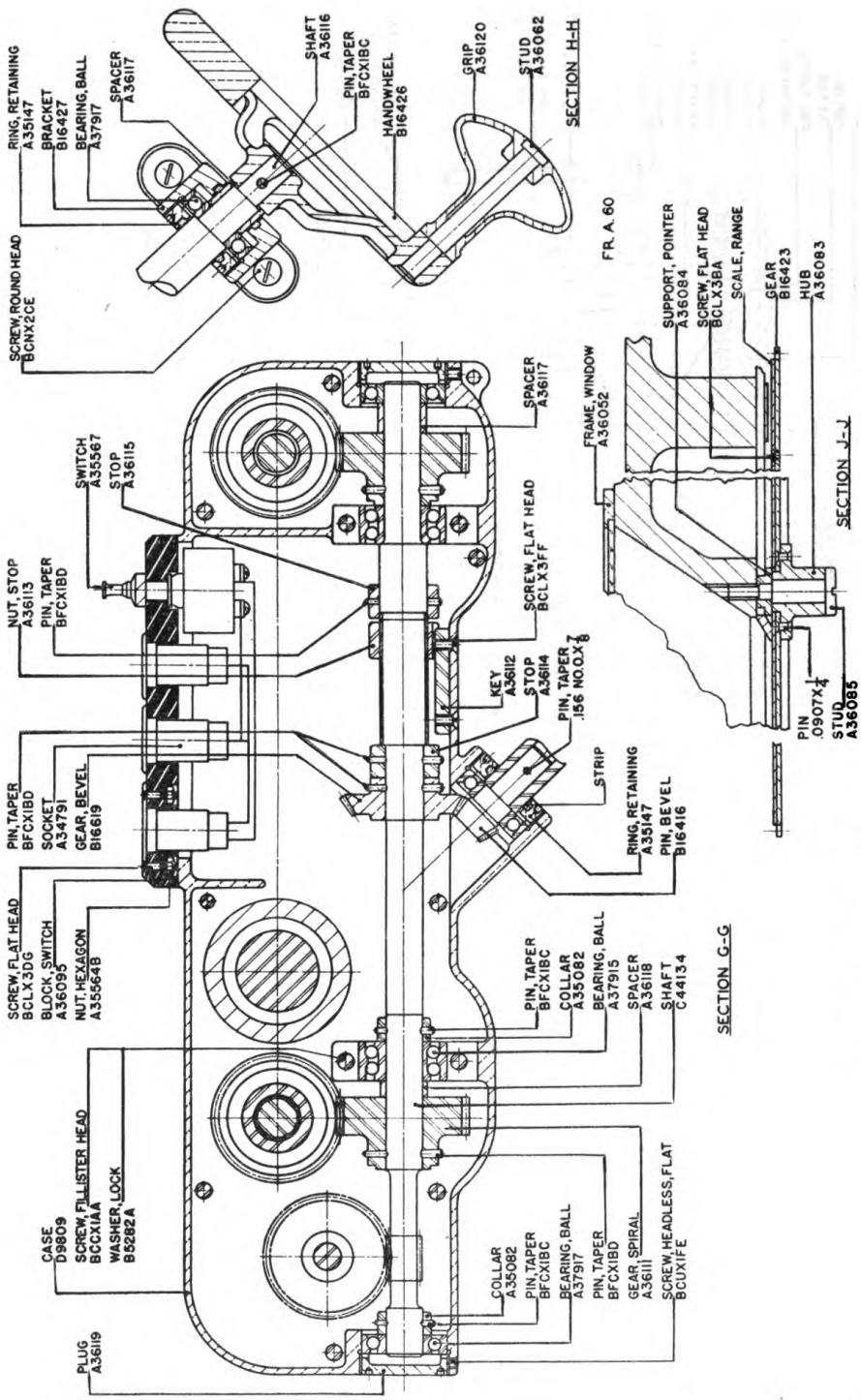


FIGURE 9.—Mount for depression position finder M1—sectioned views.

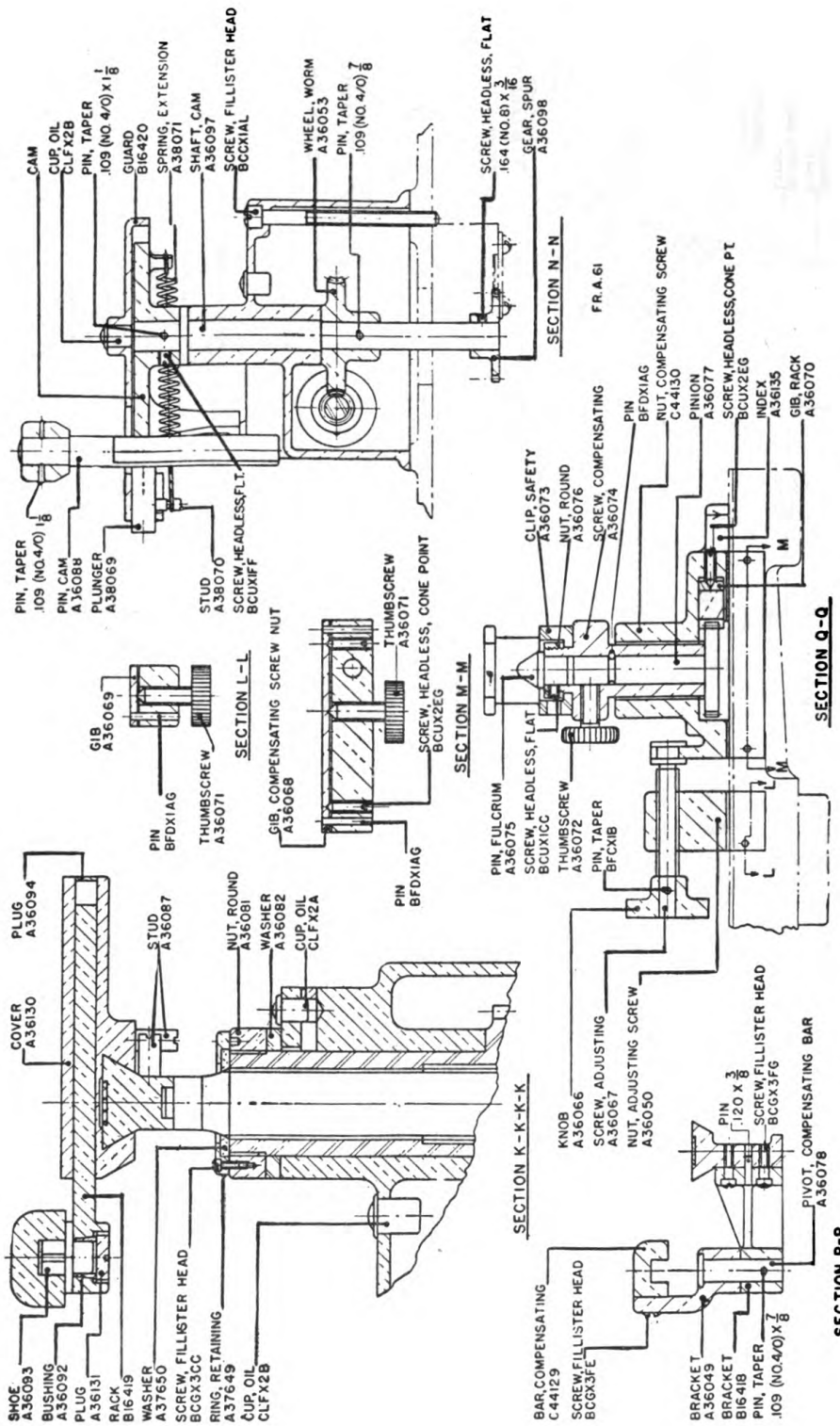


FIGURE 10.—Mount for depression position finder M1—sectioned views.

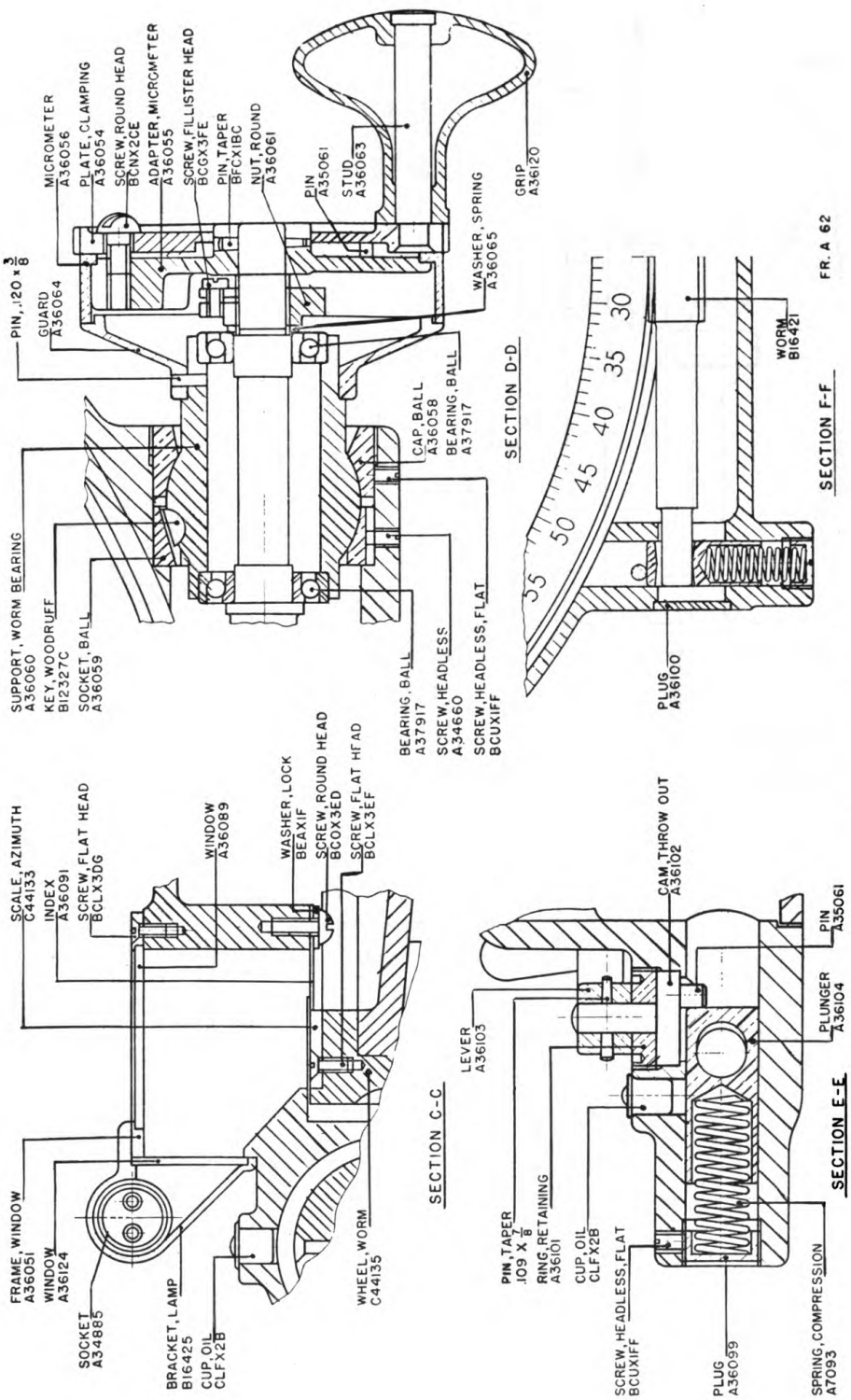


FIGURE 11.—Mount for depression position finder M1—sectioned views.

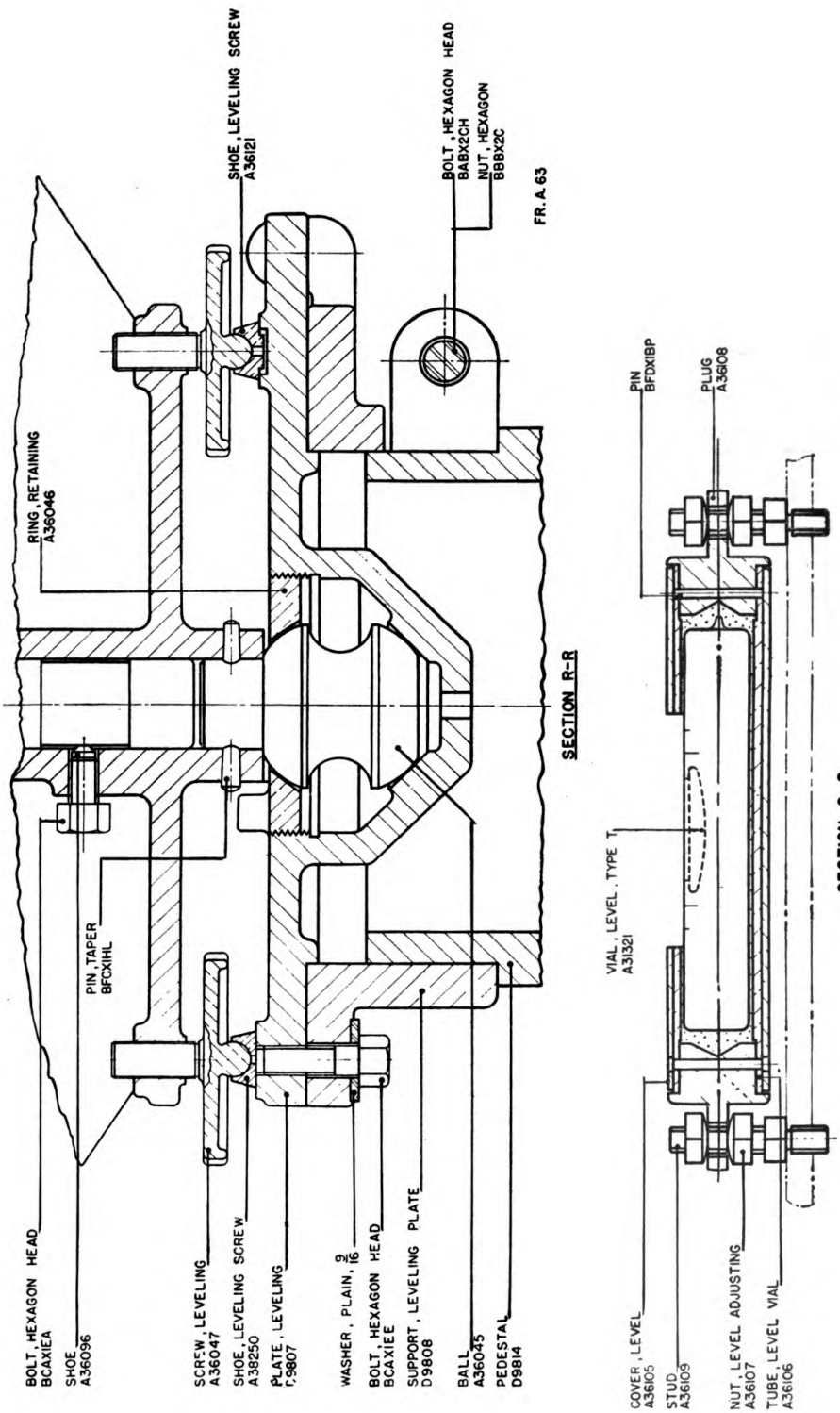


FIGURE 12.—Mount for depression position finder M1—sectioned views.

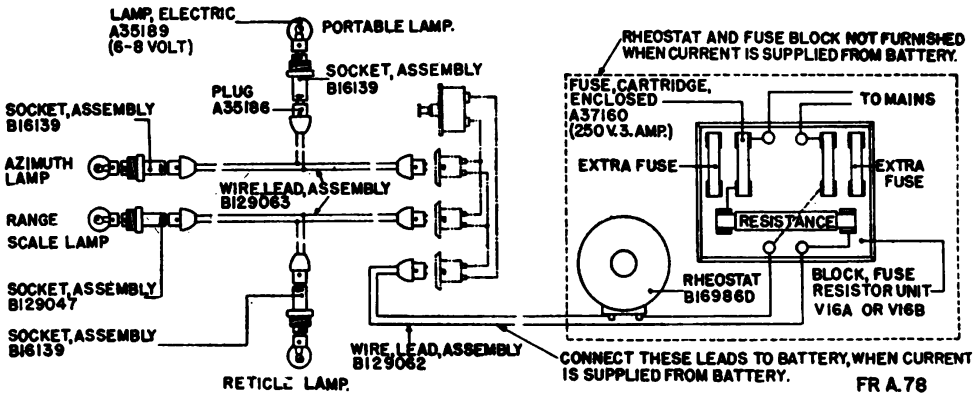


FIGURE 13.—Depression position finder M1 wiring system.

APPENDIX

LIST OF REFERENCES

1. Standard Nomenclature Lists.

Optical repair kit for harbor defense ..... SNL F–93
Finder, depression position, M1 ..... SNL F–111
An up-to-date list of SNL's is maintained as the "Ordnance Publication for Supply Index" ..... (OPSI)

2. Technical Manuals.

Cleaning and preserving materials ..... TM 9–850
Matériel inspection and repair ..... TM 9–1100

3. Field Manuals.

Gunnery, seacoast artillery ..... FM 4–10
Fire control and position finding, seacoast artillery .. FM 4–15

[A. G. 062.11 (8–7–41).]

BY ORDER OF THE SECRETARY OF WAR:

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DISTRIBUTION:
IR and H 4 (3); IBn 9 (2); IC 9 (4).
(For explanation of symbols see FM 21–6.)

U. S. GOVERNMENT PRINTING OFFICE: 1941

For sale by the Superintendent of Documents, Washington, D. C.