TM 9-1660

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

SOUND LOCATOR M2

WAR DEPARTMENT,
WASHINGTON, October 9, 1940.

TM 9–1660, Ordnance Maintenance, Sound Locator M2, is published for the information and guidance of maintenance personnel. This manual was prepared by the Sperry Gyroscope Company, Incorporated, for the use of the War Department.

Instructions contained in this manual are to be followed to the same extent as instructions in any other Technical Manual.

[A. G. 062.11 (10–9–40).]

BY ORDER OF THE SECRETARY OF WAR:

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Chief of Staff.

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The Adjutant General.

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(For explanation of symbols, see F M 21–6.)

FOREWORD

1. TM 9–1660 contains information for guiding qualified maintenance personnel in locating and correcting such trouble as may be encountered with the sound locator M2. Maintenance personnel, whether of the using arm or of the Ordnance Department, may be qualified for this work either through the successful accomplishment of a recognized course of instruction in sound locator maintenance, or through adequate experience in the type of operation to be undertaken. A recognized course of instruction is defined as one having the approval of the Chiefs of Ordnance and Coast Artillery for qualification in sound locator repair. Determination of adequate experience will be made in each case by the responsible ordnance officer. The responsible ordnance officer will take necessary action for maintenance requiring facilities beyond those available locally.

2. The material herein is divided into the following parts:

Section I—Introduction.
Section II—Maintenance and inspection.
Section III—Disassembly and reassembly.
Section IV—Trouble shooting.

3. Successful servicing of the sound locator requires patience and attention to detail as well as an understanding of the interrelations of the component parts and adjustments, so it is essential that service men acquaint themselves with the purpose, functions, and limitations of each of the sound locator mechanisms. It is recommended that TM 9–360, 3″ AA gun matériel, which includes description, operation, disassembling for transportation, check tests, and care and preservation, TM 9–2660, and sections II and III of this manual be carefully studied before referring to section IV, trouble shooting. In this way service personnel will become familiar with the entire instrument and will be in a position to inspect and apply the correct service procedure to any particular part to be repaired. TM 9–2660, Instruction Guide, Sound Locator M2, explains the principles of operation of the sound locator and gives a detailed description of its parts. It contains the material previously given in part I of the sound locator handbook.

4. Adjustment and repair of the sound locator mechanism, especially those of the corrector and pantograph drives, will not be attempted by the using arms, except by personnel who have been qualified for this work as set forth herein.

CONTENTS

LIST OF ILLUSTRATIONS

Sound locator M2.

Section I

INTRODUCTION

1. Field servicing will include replacement of motor brushes, periodic checking and cleaning of electrical contacts, special lubrication service, and other maintenance, inspection, replacement, and adjustment operations. It is recommended that periodic checks (at periods determined by service conditions) be made to insure that the sound locator is in satisfactory working condition. Each instrument is thoroughly checked for proper adjustment prior to leaving the factory and no readjusting should be done except as outlined in this manual and/or at the discretion of the officer in charge of maintenance. A check of the accuracy of data transmission is made by means of a searchlight or a test station which corresponds to a searchlight data receiving system. The procedure for making this check is outlined in section II of this manual.

2. Spare parts and tools, sufficient for normal field servicing operations, are contained in the wrapper and spare parts box inside of the stowage box. In any operation involving the removal of cover plates, special precautions should be observed to prevent dust, dirt or other foreign matter from entering the mechanism.

3. Disassembly and reassembly instructions are included for reference, in event of damage to the sound locator necessitating replacement or repair of damaged parts. To facilitate repairs, spare parts are stored in Ordnance supply depots and some complete assemblies can be supplied upon requisition. For identification of parts reference should be made to the manufacturer's parts list.

Section II

MAINTENANCE AND INSPECTION

1. In addition to the routine maintenance instructions outlined in TM 9–2660, Instruction Guide, Sound Locator M2, the sound locator should be subjected to periodic inspection and maintenance check, dependent on service conditions. This procedure should also be applied after disassembly and reassembly operations. All mechanisms, adjustments, and settings should be carefully checked and all parts should be inspected for lubrication, fit, and placement.

2. It is recommended that the cleaning of lubricated parts be done with solvent, dry cleaning*. Parts so cleaned should then be thoroughly dried and relubricated. Instrument oil may be used for ball and sleeve bearings. Andok "C" grease** is recommended for lubrication of the pantograph drive chains. After lubrication of a ball bearing, a coat of the above grease should be applied to the outside to afford additional protection by acting as a semiseal. Instructions for operation at extreme temperatures are in appendix B.

I. MAIN CASE ASSEMBLY

3. Remove front and rear cover plates 15 and 38, respectively, figure 1.

4. Inspect all gears, ball bearings, and shaft bearings for lubrication or wear. Check all taper pins, keys, and set screws for placement and tight fit.

5. Check drive chains 19 and 20, figure 2, for proper lubrication and direction of travel. These chains, if correctly installed, should operate the upper sprockets 126 and 124, figure 8, in such a manner that the sprockets will turn counterclockwise when viewed from the elevation rack side of the main case, for decreasing azimuth or elevation.

6. Check condition of slip rings 61, figure 1. Clean with carbon tetrachloride, making certain that surfaces are completely clean and dry before applying any electrical power. Check resistors for continuity and resistance by means of volt-ohmmeter supplied with this equipment. See wiring diagram on inside of cover plate 15, figure 2.

II. CORRECTOR DRIVE ASSEMBLY

7. Remove corrector drive cover plate 16, figure 2, and inspect rack and drive shaft bearings, as well as pinion and drive gears for lubrication or wear.

8. Check corrector drive mechanism to see that there is no lost motion or binding. Should excessive lost motion be evidenced, the corrector drive mechanism should be thoroughly checked for loose, sheared, or missing taper pins or setscrews, particularly between the azimuth and elevation transmitter drives 41 and 42, respectively, figure 3, and the respective transmitters. Lost motion may also result from loose

*Any standard Stoddard solvent may be used. In emergency, a good grade of gasoline may be used but is not recommended. *In no case should a solvent having rusting properties be used.*

**Andok "C" is the trade name for a grease manufactured by the Standard Oil Company of New Jersey. If not available a good grade of petrolatum (vaseline) may be used.

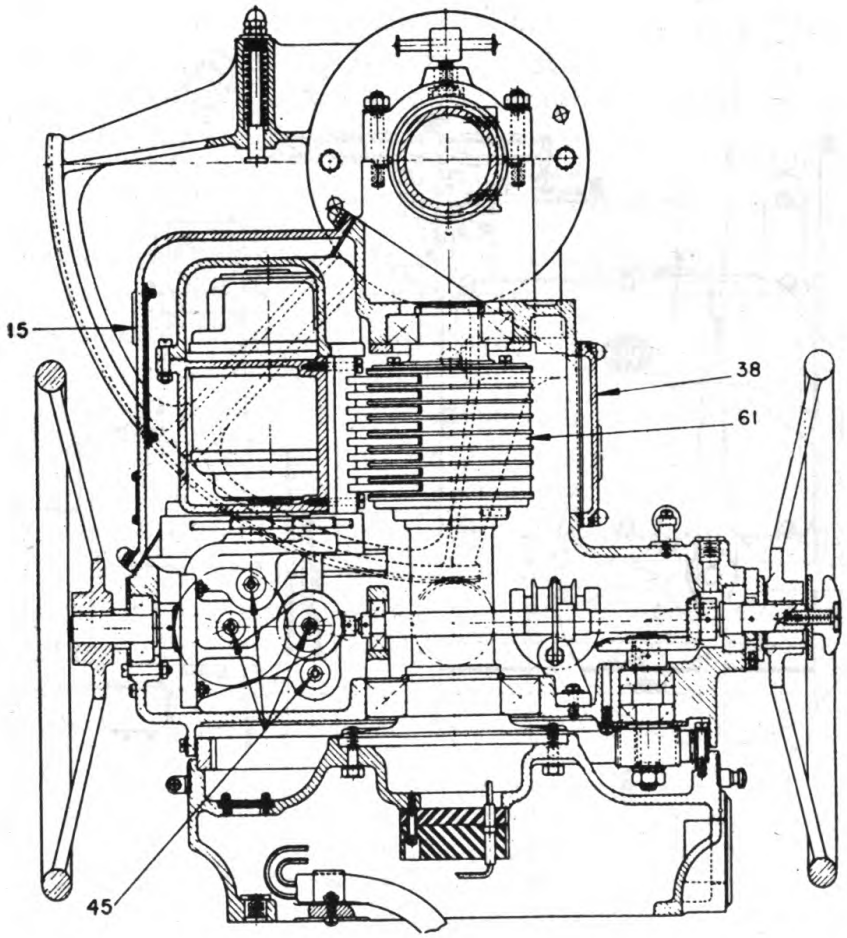

FIGURE 1.

MAIN CASE ASSEMBLY

(Right side—sectional)

15. Cover plate—front.
38. Cover plate—rear.
45. Extension shaft couplings.
61. Slip rings.

463650°—42——2

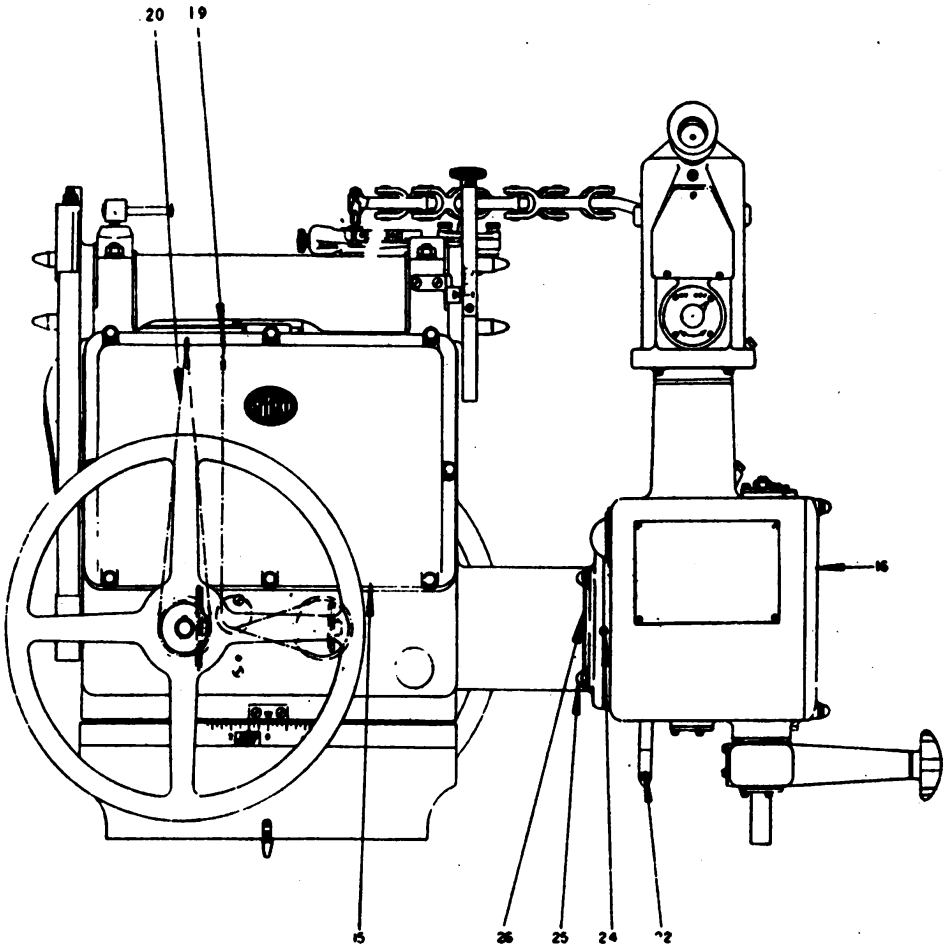

FIGURE 2.

CORRECTOR ASSEMBLY

(Front view)

15. Main case cover plate (front).
16. Corrector drive cover plate.
19. Course analyzer azimuth drive chain.
20. Course analyzer elevation drive chain.
22. Crank handle stop stud.
24. Setscrews.
25. Mounting nuts.
26. Safety wire.

couplings on the extension shafts between the drive mechanisms and elevation and azimuth control handwheels.

9. Inspect gears and bearings in the open sight assembly for lubrication or wear. The sight mirror should also be checked for mounting rigidity and cleanliness of surface. ***Caution:*** Do not attempt to lift open sight assembly off corrector drive case unless complete readjustment of corrector drive assembly is contemplated.

10. Check sight mirror and corrector handle and knob adjustment as outlined in subsection VI, Operation Tests.

11. Reference should be made to paragraph 2, page 2, for cleaning and lubrication information.

III. PANTOGRAPH DRIVE ASSEMBLY

12. Check pantograph structure for distortion by measuring the distance between pantograph pointer and the center of the sight mirror for all positions of elevation. This distance should be 7.5 inches with no speed or parallax correction set in. This dimension is given as a guide. If the results of check problem tests are satisfactory, slight inaccuracy in this dimension may be disregarded.

13. Inspect all gears, bearings, sprockets, rollers, and drive chains for lubrication or wear. Reference should be made to paragraph 2, page 2, for cleaning and lubrication information.

14. Inspect resolving ball 131, figure 9, and its supporting bowl for dirt or gummy lubricant. Clean and relubricate with light machine oil as indicated in paragraph 2, page 2.

15. Check mechanism for loose, sheared, or missing taper pins and set screws.

NOTE: It is recommended that light instrument oil be used for lubrication of resolving ball and associated rollers and supporting bearing bowl in very cold climates. Medium lubricating oil may be used in very warm climates.

IV. DATA TRANSMITTER ASSEMBLY*

16. Inspect repeater brushes and clean or replace as required.

17. Check brush and spring assembly to make certain tension is sufficient to maintain constant contact on slip rings. Brushes should be inspected for cleanliness and wear. If new brushes are necessary, change as required.

18. Inspect all terminal blocks and terminals for dirty or corroded contacts. Clean all terminals and blocks, making certain that no oil or grease is left on block.

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*This assembly includes units which are standard self-synchronous repeaters used as *transmitters*. They will be referred to in this text as repeaters.

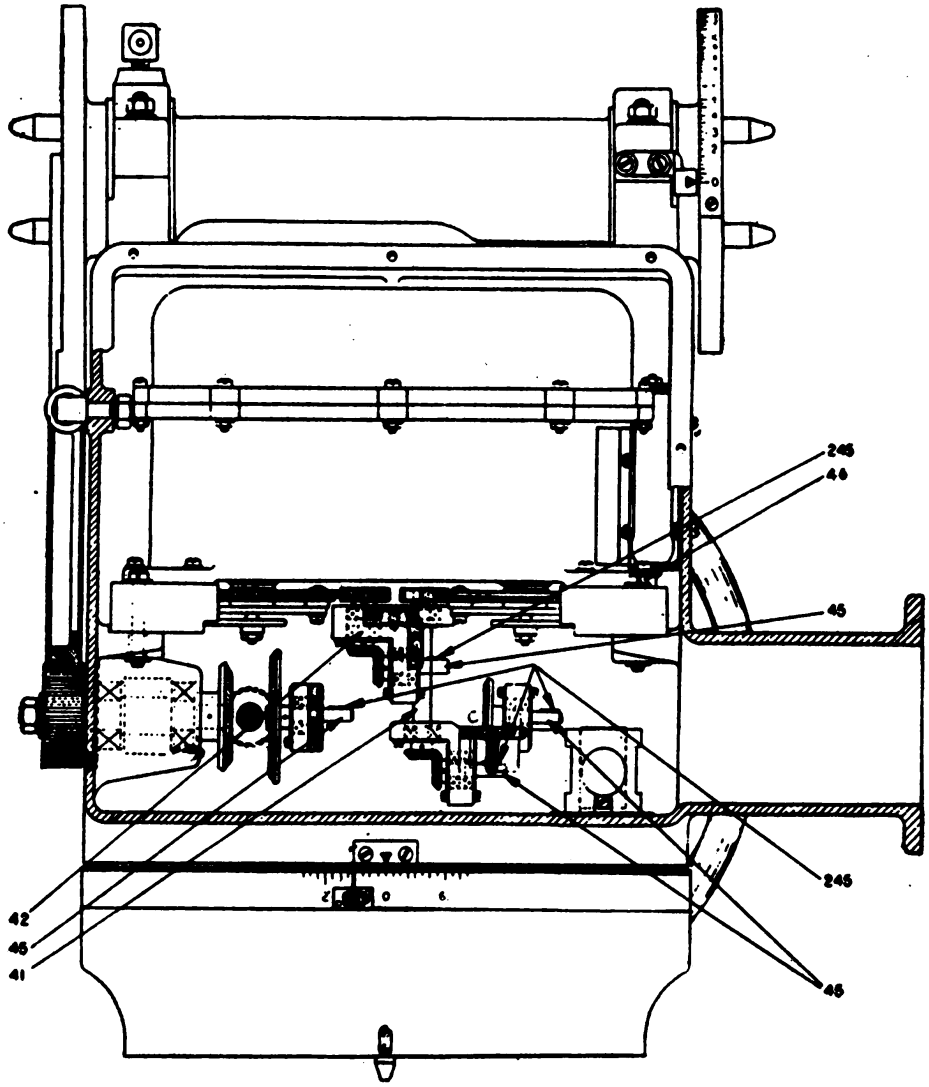

FIGURE 3.

MAIN CASE ASSEMBLY

(Front—sectional)

41. Azimuth transmitter drive.
42. Elevation transmitter drive.
45. Extension shaft couplings.
46. Data transmitter mounting screw.
245. Keys.

19. Using a continuity meter or ohmmeter, check continuity of repeater windings to determine the presence of grounds or short circuits. Ohmmeter tests should show the following resistances:

Between terminals	*Approximate resistance in ohms*
1–2	24
2–3	24
3–1	24
4–5	16

20. Check the control cable between each of the 10 conductors and the main case for grounded circuits, and from end to end of each conductor for continuity.

NOTE.—Using an ohmmeter, a reading of infinity will indicate absence of grounds and a low reading will indicate a closed circuit. If available, a 500-volt, d-c megger may be used to measure the insulation resistance between each point of the 10-conductor cable and the main case. The minimum acceptable value is 2 megohms.

V. ACOUSTICAL ASSEMBLIES

21. Cover plates 215 and 227, figures 10 and 11, respectively, should be removed, and the elbow fittings inspected for proper fit and condition. If required, the soundproofing material should be replaced.

22. All horns should be inspected, inside and out, for fracture or improper assembly.

23. Inspect all external flexible tubing for deterioration, fracture, or stoppage due to presence of foreign material or water in tubes. This latter inspection should be made by listening to some prearranged sound source.

24. When acoustical assemblies are disassembled for any purpose such as repair, the opportunity should be taken to inspect and clean all parts.

VI. OPERATION TESTS

A. Clamp locks

25. ***Caution:*** Do not force handwheels. Tighten elevation clamp lock and attempt to turn elevation handwheel, to determine amount of friction. This friction lock and the azimuth friction lock were designed, not to "lock" the controls, but to make accidental movement unlikely.

26. Tighten azimuth clamp lock and attempt to turn azimuth handwheel to determine amount of friction.

B. Course indicator

27. Tighten elevation lock and loosen azimuth lock.

28. Train sound locator clockwise to increase azimuth. The course indicator should align itself parallel to the elevation axis within ±2° and point to the right*.

29. Train sound locator counterclockwise to decrease azimuth. The course indicator should align itself parallel to the elevation axis ±2° and point to the left*.

30. Tighten azimuth lock and loosen elevation lock.

31. Increase elevation. The course indicator should align itself perpendicular to the elevation axis and point toward the elevation operator.

32. Decrease elevation. The course indicator should align itself perpendicular to the elevation axis and point away from the elevation operator.

C. Parallax pointer

33. Tighten elevation lock and loosen azimuth lock.

34. Note the direction of the parallax pointer. It should remain pointing in the same direction, relative to some external object, regardless of azimuth movements of the sound locator.

*D. Test problems***

35. Connect the sound locator to a test station consisting of, or equivalent to, a searchlight data receiving system. Rotate the sound locator to increasing azimuth and/or elevation. Rotation of the test station by the same amount should maintain the zero reader indicator at center.

36. Check the accuracy of the data transmission system by moving the sound locator in suitable steps and then moving the test station to center the zero reader indicator. Comparison of the dial readings of the sound locator and the test station, in azimuth and elevation, will indicate the accuracy of the data transmission.

37. Lock the sound locator at zero azimuth and zero elevation. Set the parallax and speed settings to zero. Center the pantograph pointer on the cross lines of the sight mirror by means of the corrector handle and knob. Then set the test station to zero without

*The left and right directions of the course indicator are to be taken as viewed from the elevation side of the sound locator.

**Additional problems are in the rear of TM 9–2660, Instruction Guide, Sound Locator M2.

disturbing the sound locator. Set the speed setting to 400 miles per hour on the course indicator and point it to the right as viewed from the elevation side, and parallel with the elevation axis of the sound locator. Set the test station to 500 mils and move the corrector handle clockwise until the zero reader indicator is centered. The pantograph pointer should appear centered in the cross lines of the mirror to within ½ the diameter of the pointer.

38. Reverse the course indicator, that is, point it to the left and parallel with the elevation axis of the sound locator. Set the test station to 5900 mils and move the corrector handle counterclockwise until the zero reader indicator is centered. The pantograph pointer should appear centered on the cross lines of the mirror within ½ the diameter of the pointer.

39. Loosen the elevation lock, elevate to 1600 mils elevation and lock again. With 400 miles per hour speed setting point the course indicator perpendicular to the elevation axis toward the elevation side of the sound locator. Set the test station to 2100 mils elevation and move the corrector handle to increasing elevation until the zero reader indicator at the test station is centered. The pantograph pointer should appear centered on the cross lines of the mirror to within ½ the diameter of the pointer.

40. Reverse the course indicator, that is, point it away from the elevation side of the sound locator. Set the test station to 1100 mils and move the corrector handle to decreasing elevation until the zero reader indicator at the test station is centered. The pantograph pointer should appear centered on the cross lines of the mirror to within ½ the diameter of the pointer.

41. Lock the sound locator at zero azimuth, elevation, and parallax. Set the air speed at zero. Center the pantograph pointer on the cross lines of the sight mirror and set the test station to zero. Set the parallax scale to 10, declutch the parallax pointer and set it parallel with the elevation axis of the sound locator and pointing to the right. Set the test station to 6275 mils and move the corrector handle counterclockwise until the zero reader indicator at the test station is centered. The pantograph pointer should appear centered on the cross lines of the mirror to within ½ the diameter of the pointer.

VII. SPARE PARTS AND TOOLS

42. In addition to the accessories and protective coverings supplied with each sound locator (See TM 9–2660), the following spare parts and tools are also supplied:

Sperry part number	*F. A. drawing number*	*No. required*	*Description*
158800		1	Wrench, double end (¼″ x 5/16″)
158801		1	Wrench, double end (⅜″ x 7/16″)
156695		1	Wrench, double end (½″ x 9/16″)
165520		1	Wrench, end (adjustable)
154739	A177656	1	Wrench, jack
165521		1	Hammer
35591		1	Pliers, side cutting
35592		1	Screw driver (4½ inch)
4680		1	Screw driver (1¼ inch)
165509		1	Can, oil
165519	A177753	1	Wrapper
153499		1	Lamp, portable trouble
153826	A177602	1	Ball, resolving
153842	A277616	2	Roller, resolving ball friction
154108	A177648	1	Roller, resolving ball caster
155352		130	Ball, resolving ball bearing
163738		4	Brush ass'y., selsyn
121437	A177461	4	Brush ass'y., slip ring
156180		1	Kit, tube clamp
153736		1	Pressure roller
153834	A177608	1	Spring, pressure roller
167102	A177767	1	Mirror, corrector
136366	A39125	2	Shield, rubber eye
149218	A177471	1	Pointer, pantograph
800488	B138252	4	Tubes, helmet } One item only furnished
801415		4	Tubes, helmet } as ordered
173647		1	Contents, list of spare parts box
*164765		1	Volt-ohmmeter, 0–150 volts a-c (accessory)
†141444		1	Pantograph pointer lamp

*Furnished only with sound locators with serial numbers below 376.
†Not furnished with sound locators with serial numbers below 376.

Section III

DISASSEMBLY AND REASSEMBLY FOR SERVICING, REPLACEMENT AND ADJUSTMENT OF PARTS

1. Disassembly required for repair or replacement of parts should be undertaken only by maintenance personnel qualified as described in the foreword. The instructions in this section, if followed, will

simplify such disassembly. Only the more intricate mechanisms are covered in detail, since reference to the illustrations or to the manufacturer's parts list will give sufficient information to allow servicing of the simpler assemblies and subassemblies. TM 9–2660, section III, describes assemblies mentioned herein. During servicing operations it is recommended that service personnel DO NOT DISASSEMBLE the instrument any further than necessary to complete the required work.

2. During repairs, adjustments, or servicing of any kind involving the removal of cover plates, care should be taken to prevent dirt or foreign matter from entering the mechanisms. Parts removed from the sound locator during disassembly should be placed in a location that will protect them from possible damage or dirt. An identifying tag, bearing the name of the part or subassembly and its location in the instrument, should be attached to each part.

3. As a first step in any extensive disassembly of the sound locator for repairs or servicing, the single and double horn arm assemblies and the pantograph should be removed to prevent possible damage to these units. The pantograph should be placed in its stowage box.

4. In servicing the sound locator it is recommended that the main case assembly be left on the column. This tends to simplify overhaul and testing of the instrument, since the essential elevation and azimuth mechanisms are readily available for testing the other major assemblies.

Caution: Do not attempt to operate the sound locator in the field until the inspection and check problems outlined in section I of this book have been completed. During servicing, repairs, or parts replacement, care should be taken to prevent damage to gears or shafts within the mechanisms as a result of improperly applied force, dropping of tools on the mechanisms or other causes. When removing or replacing gears, do not exert off-center pressure on the gear. When removing or replacing taper pins make certain that the shaft, or part, is securely supported from the side opposite that to which force is applied.

5. The corrector assembly consists of four parts: (1) the main case assembly, (2) the corrector drive assembly, (3) the pantograph drive assembly, and (4) the data transmitter assembly. These, with the acoustical assemblies and the platform assembly and column, are covered in this section.

I. MAIN CASE ASSEMBLY

6. The main case assembly consists of two parts: (1) the stationary assembly (base), and (2) the revolving assembly (housing). The

latter is composed of the elevation and azimuth handwheels with associated gear trains, elevation rack, pinion, elevation scale, data transmitters and spring brush assembly, spirit level, push button cut-out switch, and potentiometer resistors.

7. No detailed disassembly instructions are required for the main case.

II. CORRECTOR DRIVE ASSEMBLY

8. The following procedure is recommended for disassembly and reassembly of the corrector drive assembly, both from corrector assembly and as a unit.

Disassembly.

a. Remove the data transmitter assembly from the main case, as follows:

(1) Disconnect the wires on terminal block 160, figure 4.*

(2) Remove safety wire and mounting screws 46, figure 3.

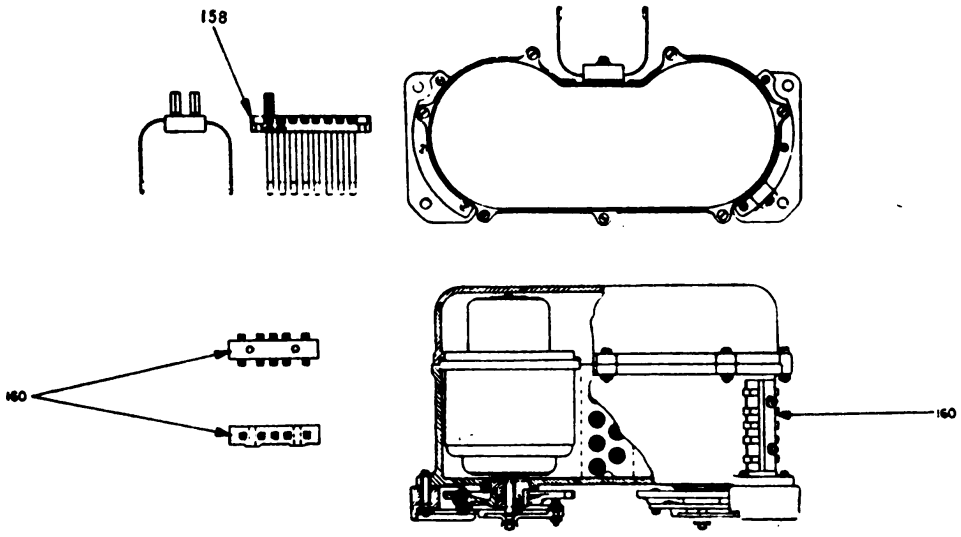

FIGURE 4.

DATA TRANSMITTER ASSEMBLY

158. Brush and spring assembly.
160. Terminal block.

(3) Bring assembly forward until gears on under side are free. Taking care not to distort the brush springs in the rear 158, figure 4, lift assembly up toward elevation handwheel until unit is clear of main case housing. Set transmitter assembly down in an inverted position to avoid damage to couplings or gears.

*Three-terminal block used in sound locators below serial number 376.

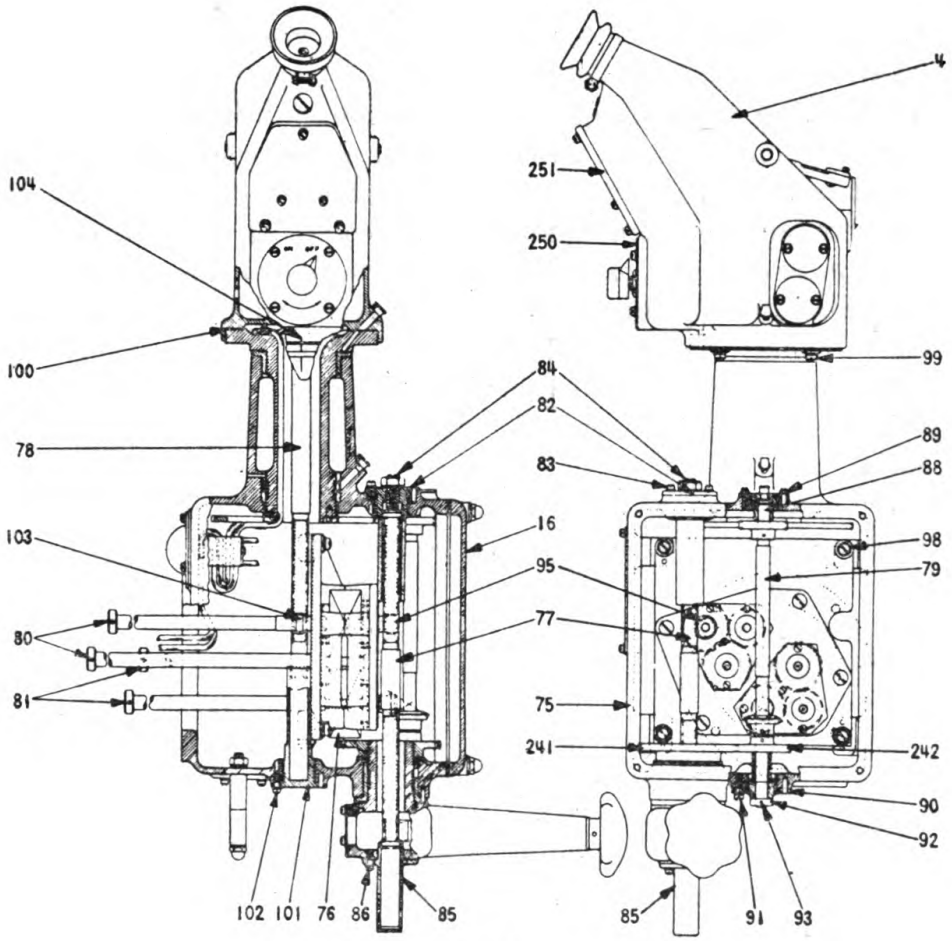

FIGURE 5.

CORRECTOR DRIVE ASSEMBLY

4. Open sight assembly.
16. Cover plate.
75. Corrector drive housing.
76. Corrector drive differential.
77. Outer rack.
78. Inner rack.
79. Drive shaft.
80. Elevation drive extension shafts.
81. Azimuth drive extension shafts.
82. Upper bearing—outer rack.
83. Upper bearing mounting screws.
84. Stop screw.
85. Lower bearing—outer rack.
86. Lower bearing mounting screws.
88. Upper bearing—drive shaft.
89. Upper bearing mounting screws.
90. Lower bearing—drive shaft.
91. Lower bearing mounting screws.
92. Collar.
93. Taper pin.
95. Rack pinion gear.
98. Differential assembly mounting screws.
99. Open sight assembly mounting screws.
100. Open sight bearing surface.
101. Lower bearing—inner rack.
102. Lower bearing mounting screws.
103. Inner rack pinion gear.
104. Guide marks.
241. Gear.
242. Gear.
250. Rheostat assembly.
251. Cover of lamp housing.

b. Remove corrector drive assembly as follows:

(1) Loosen set screws at end of extension shafts 80 and 81, figure 5.

(2) Remove setscrews 24, figure 2.

(3) Remove safety wire 26, and holding corrector drive housing in position, remove nuts 25.

(4) Holding assembly in normal position, pull it straight out from main case, being careful not to damage or distort the extension shafts.

c. Referring to figure 5, remove cover plate 16.

d. Drive out taper pin 93 and remove collar 92.

e. Remove screws 91, and allow bearing 90 to drop free. Care should be exercised during this operation to prevent damage to gears and pinions when driving shaft 79 drops out of position.

f. Remove screws 89 and bearing 88.

g. Move drive shaft toward bottom of case, tilt away from differential, and lift out.

h. Remove screws 83 and bearing 82.

i. Remove screws 86 and bearing 85.

j. Tilt outer rack 77 away from pinion gear 95, and lift rack out of housing.

k. Remove screws 98 and pull differential assembly 76 straight out from housing.

l. Remove rheostat assembly 250 from open sight assembly 4. Remove cover 251 and lamp. Disconnect one wire from lamp and one wire from rheostat to enable open sight assembly to be removed.

m. Remove screws 99 and lift open sight assembly 4 out of corrector drive housing. Care should be exercised during this operation to prevent damage to inner rack 78, which forms a part of the open sight assembly.

n. Remove screws 102 and bearing 101.

9. No detailed instructions are necessary for disassembly of the open sight assembly.

Reassembly.

10. The following procedure is recommended for reassembly of the corrector drive assembly as a unit. This is the most critical of all operations and the following instructions should be closely adhered to for satisfactory and accurate operation of the unit. Prior to reassembly the sound locator must be leveled, and the mirror must be blocked in its 15° below horizontal position and held thus during reassembly.

11. If the open sight assembly has been disassembled it should be reassembled as follows:

a. Referring to figure 6, and to the actual mechanisms, reassemble the unit in such a manner that when the scribe marks on the mirror gear sector 114 and the idler gear 113 are in line as observed through aperture 246, the mirror is at a position 15° below horizontal. This may also be accomplished with level-protractor or gunner's quadrant, or by use of pointer provided* on the open sight bracket. This pointer indicates accurately the 15° position of the mirror by coincidence between the pointer and the finished top surface of the mirror mounting bracket.

b. Assemble inner rack 78 and idler pinion 112 into open sight in such a manner that, with previous setting maintained, the length of

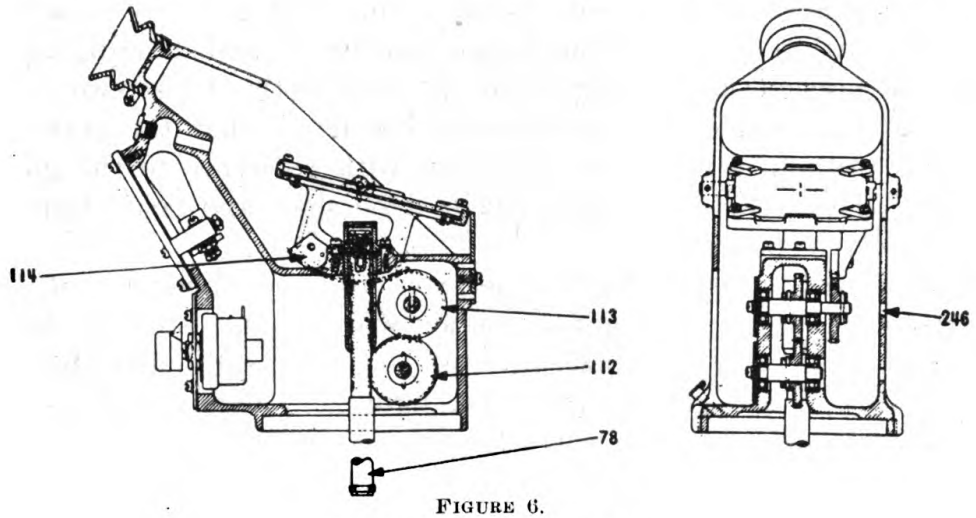

FIGURE 6.

OPEN SIGHT ASSEMBLY

78. Inner rack.
112. Idler pinion.
113. Idler gear.
114. Mirror gear sector.
246. Observation hole for scribe lines.

the inner rack as measured from the under bearing surface of the open sight assembly 100, figure 5, to the extreme lower end of the inner rack, is $9\frac{7}{32}''$.

12. Mount open sight assembly on corrector drive housing. Securely fasten open sight assembly to corrector drive case by means of screws, 99.

Caution: Care must be taken that dimensions and settings outlined in paragraph 11 are rigidly maintained during this operation.

13. Replace and reconnect rheostat assembly, lamp, and cover.

14. Set sound locator at zero elevation, speed, and parallax.

15. Mount corrector drive differential 76 in housing 75, and mesh inner rack 78 with pinion gear 103. Replace and fasten bearing 101.

*Not provided on sound locators with serial numbers below 376.

Mount housing on main case. This operation is the reverse of the disassembly operation outlined in paragraph 8*b*. Fasten extension shafts of differential assemblies to shaft couplings 45, figures 1 and 3, making certain that all shafts are properly keyed (245, fig. 3) and connected.

16. Referring to figure 5, turn the open sight assembly in azimuth until the guide marks 104 are aligned. Do not disturb this setting until azimuth synchronization has been completed. Position corrector handle and knob so that it projects at right angles (90°) to the azimuth heading of the corrector drive housing.

a. Replace drive shaft 79 and bearings 88 and 90.

b. Mark a guide line across point of mesh of the two gears 241 and 242 with a pencil. Then loosen bearing 90 and, holding drive shaft to prevent its turning, lower it until teeth of the two large gears are unmeshed. Move corrector handle so that the gear 241 turns 3 teeth in a clockwise direction, with reference to the guide marks. Then remesh with gear 242 on drive shaft and fasten bearing 90 securely in position.

c. This offset procedure compensates for the thickness of the corrector handle at the point of contact with the stop stud 22, figure 2, resulting in equal displacement of the open sight assembly on either side of the guide marks 104, figure 5. This completes the azimuth adjustment of the corrector drive assembly.

17. Maintaining all settings and dimensions indicated in paragraph 11, and retaining zero elevation, speed, and parallax settings, replace outer rack 77 and bearings 82 and 85, being careful not to disturb pinion gear 95 when meshing rack with gear.

18. Center pantograph pointer on cross lines of mirror; this will result in mirror being positioned 15° below horizontal. If not certain of pantograph accuracy, leave mirror blocked in position. Remove stop screw 84, and measure distance from *top surface of bearing* 82 to upper end of outer rack. This distance must be adjusted to 1½″. To accomplish this remove the upper bearing 82, unmesh rack from pinion gear, and raise or lower rack until this dimension is established. Then remesh rack and pinion gear, replace and fasten bearing, and replace stop screw.

Caution: Do not run stop screw down, but leave greater part of it out of bearing.

19. Replace data transmitter assembly, reversing the disassembly operations described in paragraph 8*a*.

20. Unblock mirror, elevate sound locator to 1600 mils, and lock in position. Run outer rack all the way down, by means of the cor-

rector handle knob, until it comes to a stop against the lower bearing 85. Using a scribe, mark the rack at a point level with the upper surface of gear 241. Run outer rack up, by means of knob, until the distance of travel as measured between the scribe mark and the upper surface of gear 241 is 2.110″. The stop screw 84 should now be turned down until it butts against the upper end of the outer rack. Tighten locknut on screw.

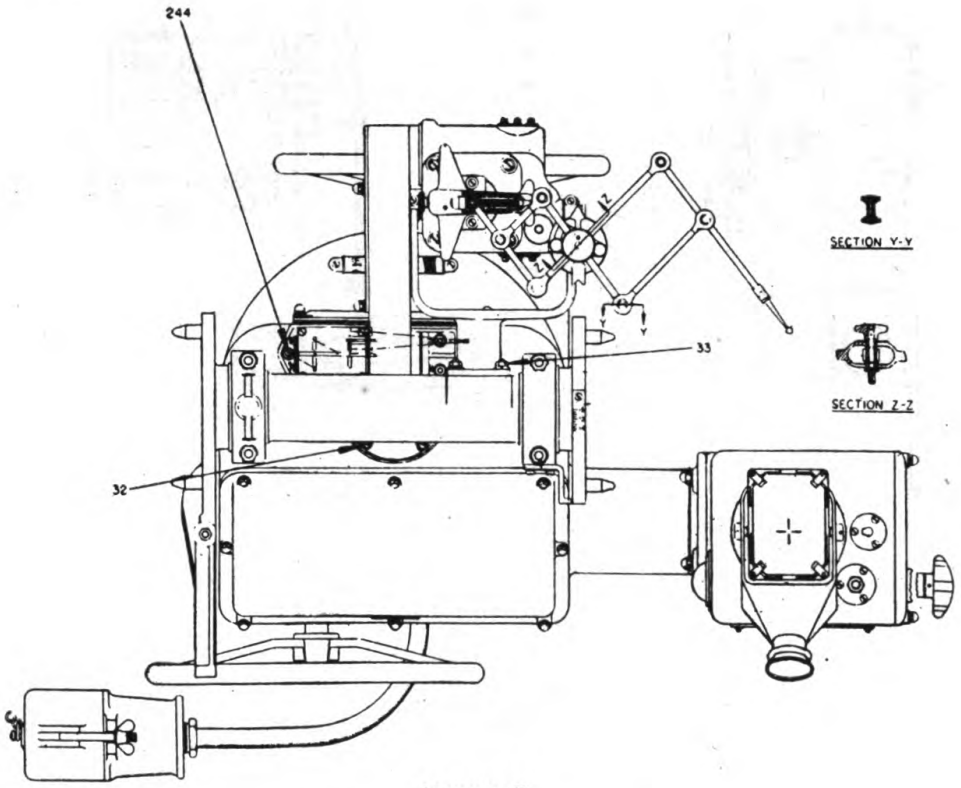

FIGURE 7.

CORRECTOR ASSEMBLY

(Top view)

32. Parallel link mounting screws.
33. Drive case fork mounting nuts.
244. Nut.

21. Unlock sound locator and decrease elevation to zero. It should now be possible to center pantograph pointer on cross lines of sight mirror at any elevation setting, without binding, and to have such centering maintained during subsequent operations of the sound locator.

22. Replace cover plate 16. The corrector drive is now adjusted in azimuth and elevation with respect to the sight mirror and pantograph, and the unit is ready for operation.

III. PANTOGRAPH DRIVE ASSEMBLY

23. The following procedure is recommended for disassembly and reassembly of the pantograph drive assembly, both from the corrector assembly and as a unit.

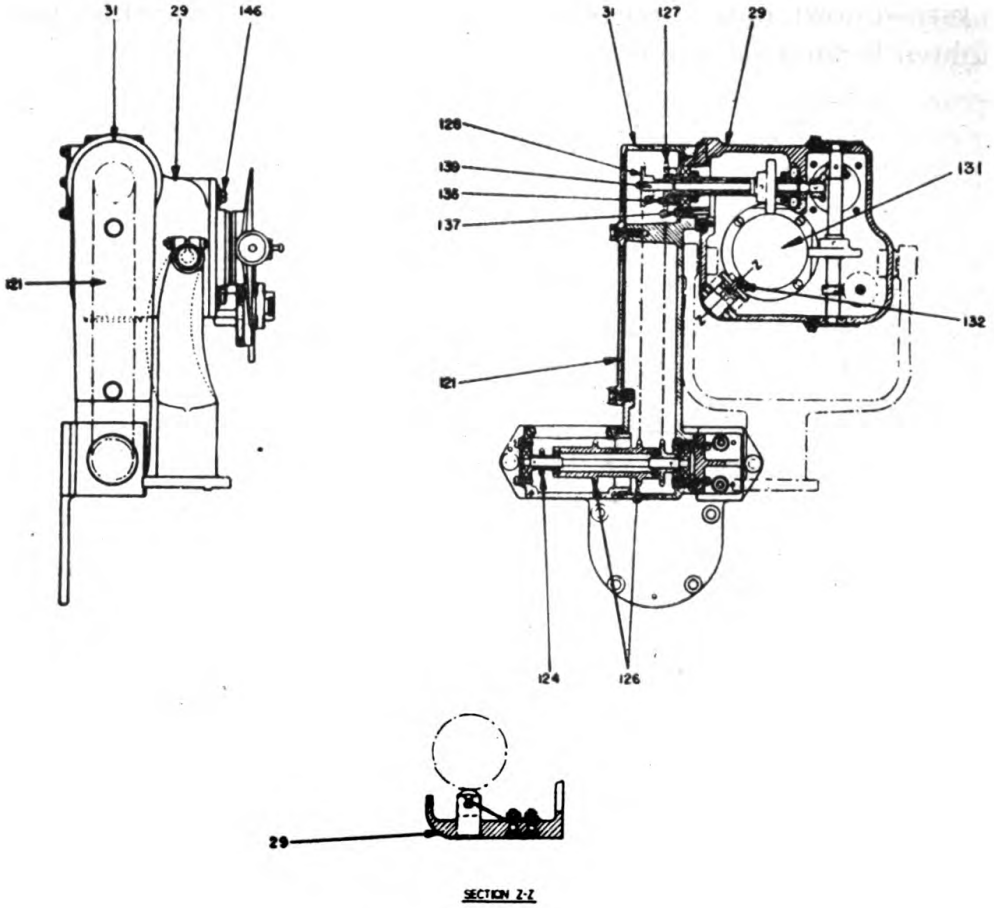

FIGURE 8.

PANTOGRAPH DRIVE ASSEMBLY

29. Drive case.
31. Parallel link.
121. Cover plate—parallel link.
124. Intermediate elevation sprocket.
126. Azimuth sprocket.
127. Elevation drive sprocket.
128. Azimuth drive sprocket.
131. Resolving ball.
132. Pressure roller assembly.
136. Sprocket mounting screws.
137. Parallel link mounting screws.
139. Taper pin.
146. Mounting screws.

Disassembly.

a. Remove pantograph drive assembly as follows:

(1) Remove pantograph drive chains 19 and 20, figure 2, by opening a link of each chain. Care should be taken to prevent undue distortion of the links, in order that they may be available for reassembly operations.

(2) Referring to figure 7, remove four screws 32, and two nuts 244.

(3) Holding the assembly in position, remove nuts 33 and lift assembly away from main case. Care should be taken to prevent the assembly from dropping against the main case during this operation.

b. Referring to figure 8, remove screws 146 and *very slowly* lift the course indicator assembly off drive case 29. The resolving ball may now be lifted out.

Caution: Use care not to deform any parts while removing the course indicator assembly. It must be removed slowly to prevent the spring-backed pressure roller 132 from projecting the resolving ball from the case and scattering the many small ball bearings 151, figure 9, on which it revolves.

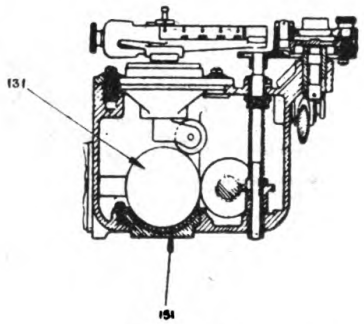

FIGURE 9.

PANTOGRAPH DRIVE CASE

131. Resolving ball.
151. Ball bearing.

c. To remove parallel link and drive chain housing assembly, the following procedure should be observed. Referring to figure 8:

(1) Remove the cover plate 121.

(2) Remove taper pin 139 from azimuth drive sprocket 128 and remove sprocket. If in so doing it is found necessary first to remove the chain, it may be done by opening a link.

(3) Remove three screws 136 from elevation drive sprocket 127 and remove sprocket.

(4) Remove four parallel link mounting screws 137 and remove the collar held by them.

(5) Pull parallel link 31 away from drive case 29.

d. Drive chains which have been removed (by opening a link) should be placed in an envelope and tied to the assembly.

24. No detailed instructions are necessary for further disassembly.

Disassembly.

25. Reassembly procedure of the pantograph drive assembly is the reverse of the disassembly operations. Care must be taken in reas-

sembling the course indicator to the speed corrector assembly that the caster roller comes under the tail of the model airplane, and not under the nose.

IV. DATA TRANSMITTER ASSEMBLY

26. No detailed disassembly and reassembly instructions are required for the data transmitter assembly.

V. ACOUSTICAL ASSEMBLIES

27. In disassembling the acoustical assemblies, care should be taken during operations involving removal of sound conducting

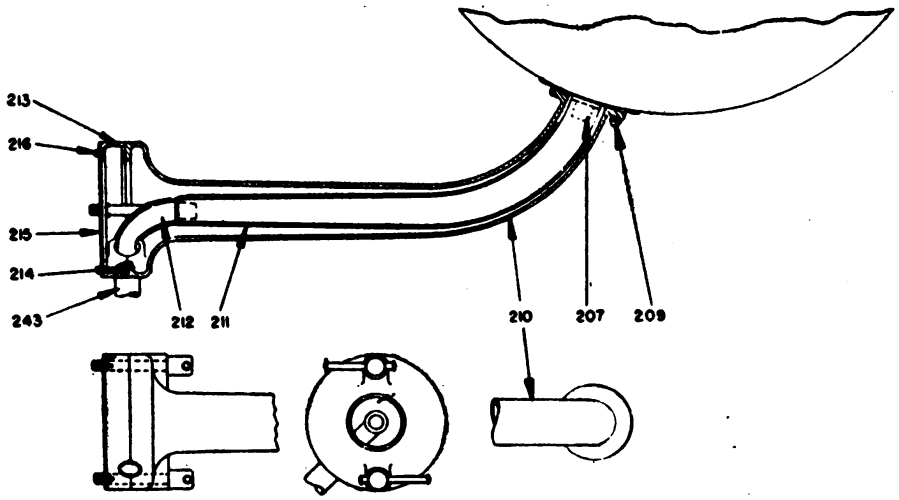

FIGURE 10.

SINGLE HORN ARM ASSEMBLY

207. Elbow fitting.
209. Mounting screws.
210. Horn arm.
211. Rubber tubing.
212. Elbow fitting.
213. Hinge clamp.
214. Clamp stud nuts.
215. Cover.
216. Cover screws.
243. Rubber tubing.

tubing from the horn arms, since this tubing after a prolonged period has a tendency to adhere to the hinge clamp section of the horn arm. The recommended procedure for complete disassembly is as follows:

Disassembly.

28. To disassemble the single horn arm, and referring to figure 10:

a. Remove screws 216 and cover 215.

b. Remove nuts from clamp studs 214 and remove hinge clamp 213.

c. Remove tube 243 from elbow fitting 212.

d. Remove screws 209 and, pushing tube 211 and elbow fitting 212 toward horn, pull horn arm 210 away from horn, until arm has been backed off far enough to allow access to elbow fitting 207, and clamp band at end of horn throat.

e. Remove tubing from elbow fitting 207 and pull tubing out of horn arm.

29. To disassemble the double horn arm, and referring to figure 11:

a. Remove screws 228 and cover 227.

b. Remove nuts from clamp studs 224 and 226, and remove hinge clamp 223.

c. Remove two tubes 243 from "Y" fitting 221.

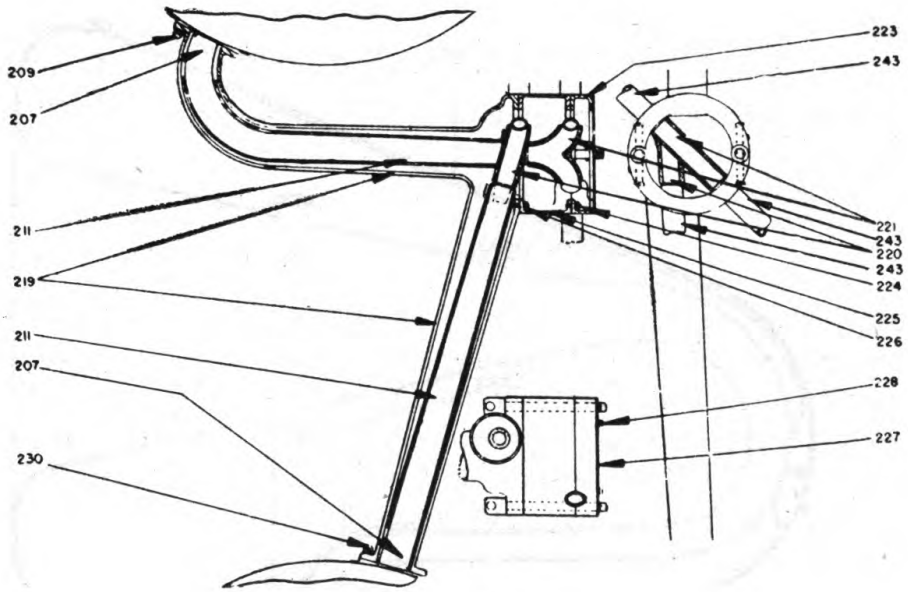

FIGURE 11.

DOUBLE HORN ARM ASSEMBLY

207. Elbow fitting.	221. "Y" fitting.	227. Cover.
209. Mounting screws.	223. Hinge clamp.	228. Cover screws.
211. Rubber tubing.	224. Clamp studs.	230. Mounting screws.
219. Horn arm.	225. Spacer clamp.	243. Rubber tubing.
220. Elbow fitting.	226. Clamp studs.	

d. Push "Y" fitting 221 inside.

e. Remove spacer clamp 225.

f. Remove one tube 243 from elbow fitting 220.

g. Remove screws 209, and pushing tube 211 toward horn, pull horn arm 219 away from horn until arm has been backed off far enough to allow access to elbow fitting 207 at end of horn throat.

h. Remove tubing from elbow fitting 207 and pull tubing out of horn arm.

i. Remove screws 230 and repeat operation *g*.

30. If disassembly of horn assembly, figure 12, is required, remove screws 248 and casing 197.

Reassembly.

31. The reassembly operations for the acoustical assemblies are just the reverse of the disassembly operations, with the following exception. The tube clamp bands, when once removed, are NOT to be used again. New clamp bands should be installed at each reassembly period. In replacing bands, it is recommended that the band be run through the ring, wrapped around the tube a second time, again run

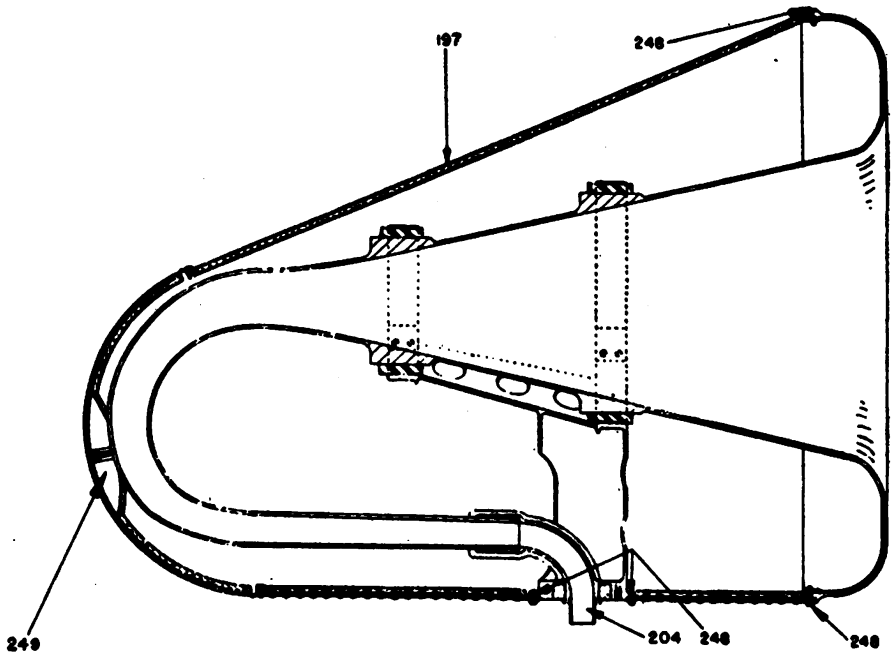

FIGURE 12.

HORN ASSEMBLY

197. Casing (aluminum)
204. Elbow fitting.
248. Screws.
249. Position of counterweight when used.

through the clamp ring and then tightened. This method of assembly allows greater clamp action without the possibility of fracturing the tubing.

NOTE.—In replacing bands on tubing at end of horn throat, follow the above procedure but, after rolling the end of the band to tighten it, bend the roll and the clip back, and cut off the roll in back of clip. Then straighten the end and lay it flat, so that it will not interfere with horn arm. Helmet tubes of synthetic rubber are for use at tropical stations; tubes of rubber are for use in cold and temperate climates because the synthetic rubber loses an appreciable amount of its flexibility at low temperatures (below +20° F.). The rubber tubing is distinguished by one white dot molded approximately 1½ inches from the helmet end. The synthetic tubes are unmarked.

32. Care should be taken to prevent any undue strain being placed on the elbow fitting 204, figure 12, at the end of the horn throat. Dur-

ing reassembling operations, inspection should be made prior to final assembly of horns and horn arms, to make certain that all elbow fittings, tubing, etc. are securely and completely covered with specified soundproofing material. When replacing a horn assembly, figure 12, a lead counterweight is required in each of the two upper horns but none is required in the lower horn. When a horn is reassembled it is recommended that casing points be coated with an acetate base cement or with shellac before replacing screws 248.

VI. PLATFORM ASSEMBLY AND COLUMN

33. No detailed instructions are required for servicing these units.

SECTION IV

TROUBLE SHOOTING

1. The sound locator M2 determines and transmits to the searchlight the necessary data to control the searchlight beam with respect to a moving target. It is essential, therefore, that the persons designated to service the sound locator familiarize themselves with the purposes and functions of the various mechanisms as outlined in TM 9–2660, Instruction Guide, Sound Locator M2. This information is of the utmost importance when a trouble develops, especially when there is little time to locate and remedy that trouble.

2. The troubles which may be encountered in the sound locator can be divided into two general classifications: First, troubles occurring in an instrument that has been properly adjusted and in which there has been no change in component parts. These may be failures due to accident, or to dirt or other foreign matter in the mechanisms, or to general wear by extensive use in the field; second, troubles experienced when adjusting a sound locator after assembly, or when one or more component parts have been repaired or replaced.

3. It is impossible to foretell all troubles which may result from improper servicing or unusual field service conditions, but the following possible troubles have been listed to afford the service personnel an opportunity to make an intelligent analysis.

I. MAIN CASE ASSEMBLY

The main case, containing the positive drives of the elevation and azimuth mechanisms, should not prove a source of trouble. It is recommended that all bearings, keys and taper pins be checked for replacement and tight fit, and all moving parts for cleanliness and proper lubrication.

II. CORRECTOR DRIVE ASSEMBLY

Symptom 1—Sight mirror not in adjustment with pantograph pointer

Probable cause	*Remedy*
a. Loose couplings on extension drive shafts.	Check all couplings and keys and tighten set screws.
b. Gear pins sheared from shafts.	Check pins and replace as required.
c. Inner and outer racks not in adjustment with mirror.	Readjust in accordance with paragraphs 10 to 21, inclusive, section III.

III. PANTOGRAPH DRIVE ASSEMBLY

Symptom 1—Intermittent operation of pantograph

Probable cause	*Remedy*
a. Gummy lubricant on resolving ball.	Remove resolving ball in accordance with paragraph 23*b*, page 19, and clean, relubricate, or replace as required.
b. Marred or burred surfaces on resolving ball, drive rollers, or resolving ball supporting bowl.	Remove resolving ball as indicated in Remedy *a*, and smooth or replace.
c. Insufficient tension on pressure roller bearings.	Remove resolving ball and pressure roller and increase tension of the spring or replace it.
d. Loose or binding coupling joints on pantograph structure.	Replace pantograph by loosening stud and lifting structure off drive case.
e. Gear pins sheared from shafts.	Check pins and replace as required.

Caution: When removing resolving ball, care should be taken to prevent ball from jumping out of position as a result of spring tension of pressure roller. This will result in projection of roller into the small bearings in the resolving ball supporting bowl.

IV. DATA TRANSMITTER ASSEMBLY

Symptom 1.—Transmitters fail to operate or have loud hum

Probable cause	*Remedy*
a. No voltage at terminals.	Check continuity of power cables and plugs. Check terminal block wiring in accordance with figure 14.

Probable cause	*Remedy*
b. Brushes not making contact or set on wrong slip ring.	Check brush and spring assembly and slip ring contact arrangement. If required, replace brush and spring assembly by first removing data transmitter assembly in accordance with paragraph 8*a*, page 12.
c. Terminal block wiring incorrect.	Check with wiring diagram, figure 14.
d. Open circuit in transmitter winding.	Repair or replace, as required. Remove data transmitter assembly in accordance with paragraph 8*a*, page 12.
e. Open circuit in control cable.	Check continuity of cable and plugs and repair or replace.
f. Short circuit in control cables.	Check insulation between conductors of cable and repair or replace.

Symptom 2.—Transmitters furnish erroneous data

Probable cause.	*Remedy*
a. Reversed secondary connections.	Check with wiring diagram, figure 14, and correct as required.
b. Incorrect field connections.	Same as *a*.
c. Dirt or foreign matter on spring brushes or slip rings.	Clean with carbon tetrachloride and dry thoroughly or replace brushes.
d. Poor tension on spring brushes.	Increase tension or replace brush assembly.
e. Loose couplings on extension drive shafts from corrector drive mechanisms.	Inspect all couplings and tighten setscrews.
f. Gear pins sheared from shafts.	Check pins and replace as required.
g. Spring brush contact not lined up with slip rings.	Check brush and slip ring alignment.

NOTE.—Periodically, as determined by service conditions, it is recommended that the continuity of all motor windings and electrical circuits be tested for open or short circuits to preclude any possibility of failure under actual service conditions.

V. ACOUSTICAL ASSEMBLIES

Symptom 1.—Excessive noise

Probable cause	*Remedy*
a. Fracture of external rubber tubing or fittings.	Check condition and repair or replace as required.
b. Fractured horn.	Repair or replace with new horn.
	NOTE.—Small fractures or holes in horn may be repaired by filling with putty or plastic wood. Refer to paragraphs 27, 28, 29 and 30, pages 20 and 21.

Symptom 2.—No sound heard

Probable cause	*Remedy*
a. Water in horns and/or rubber tubing.	Drain horns and tubing and blow dry with air.
b. Dirt or foreign mater in rubber tubing or fittings.	Blow clear with compressed air.
c. Collapsed fittings or tubing.	Inspect and repair or replace as required. Refer to paragraphs 27, 28, 29 and 30, pages 20 and 21.

APPENDIX A

REFERENCES

1. Standard nomenclature lists:

Until SNL F–176, Sound Locator M2, becomes available, the Manufacturer's Parts List will be used.

An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index"---------- (OPSI)

2. Technical manuals:

3-inch AA gun matériel----------	TM 9–360
Cleaning and preserving materials----------	TM 9–850
Instruction guide, sound locator M2----------	TM 9–2660

Appendix B

OPERATION AT EXTREME TEMPERATURES

1. The sound locator is lubricated at the factory with the light grease recommended in section II, and satisfactory operation is obtained for a temperature range between +10° F. and +120° F. If the sound locator is to be operated at a temperature between +10° F.

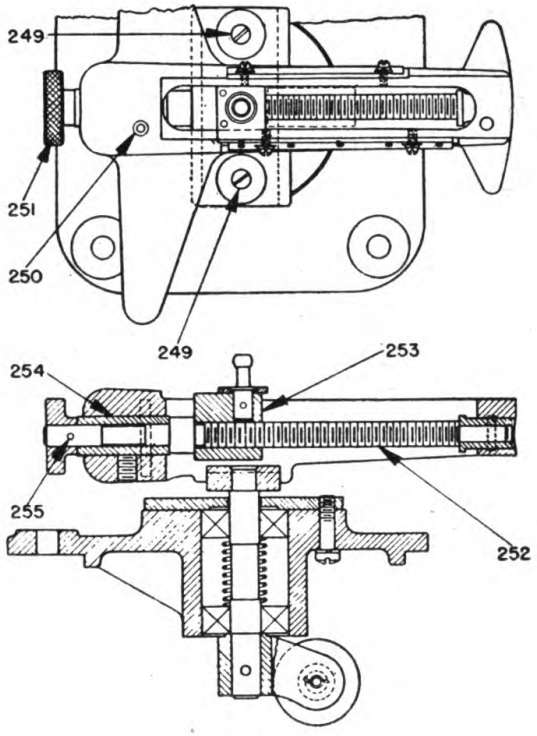

Figure 13.

SPEED CORRECTOR ASSEMBLY

249. Machine screw.
250. Pin.
251. Knob.
252. Screw.
253. Nut.
254. Bushing.
255. Pin.

and −10° F., difficulty may be experienced, which should be corrected as follows:

a. If elevation handwheel turns with difficulty, wash grease from elevation rack bearing and relubricate with light oil.

b. If course indicator movement is sluggish or if the correct course is not indicated, wash grease from speed corrector mounting plate ball bearings and relubricate with light oil.

c. If target speed setting screw turns with difficulty, proceed as follows. With the pantograph off, remove the course indicator (miniature airplane) from the speed corrector assembly, figure 13, by removing two screws 249. Drive out pin 250 by tapping the end

which is not marked "O." Pull knob 251 forward, drawing screw 252, nut 253 and bushing 254 with it until the bushing clears the casting. If necessary, screw nut 253 toward the tail of the airplane, but not far enough to separate it from the screw. Drive out pin 255,

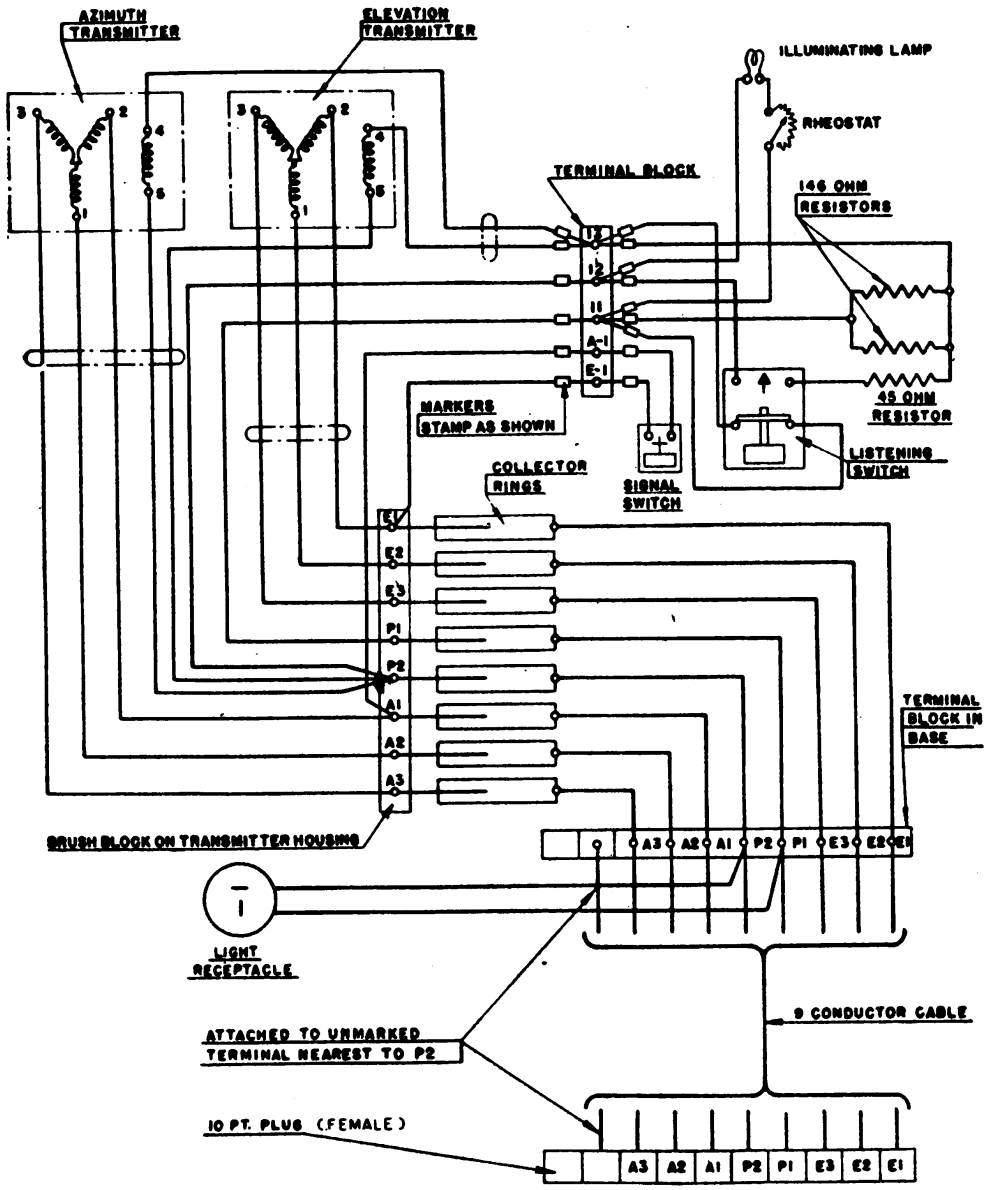

FIGURE 14.

SCHEMATIC WIRING DIAGRAM

(Sperry drawing No. 800524–B)

remove knob 251 and bushing 254. Wash both bearings clean and relubricate with light oil. Reassemble the course indicator.

d. If corrector knob turns with difficulty, wash grease from hand knob shaft bearings and relubricate with light oil.

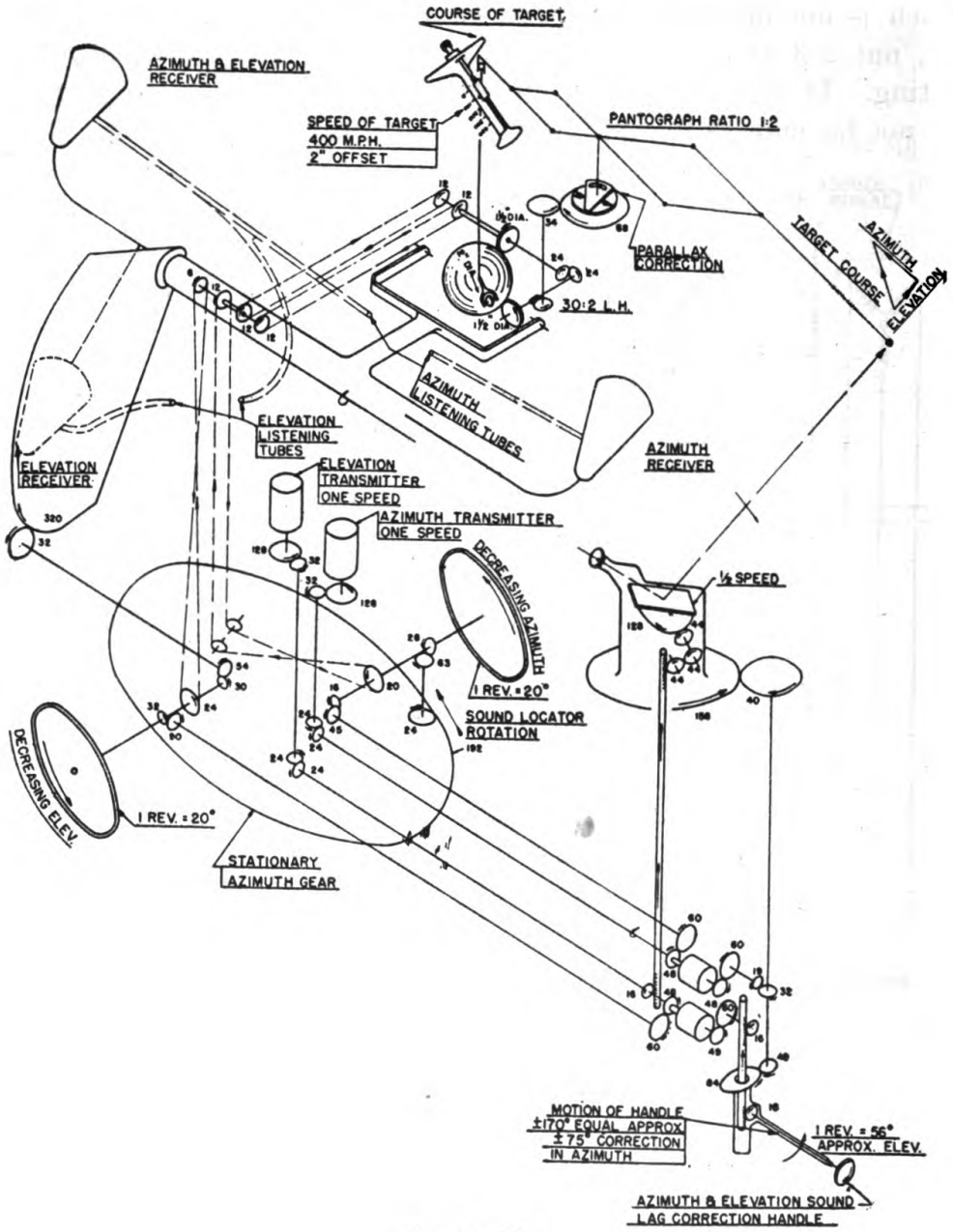

FIGURE 15.

SCHEMATIC GEARING DIAGRAM

(Sperry drawing No. 644030–A)

2. For extended operation under extreme cold-temperature conditions it may be advisable to relubricate with light oil all ball and sleeve bearings except the two center post ball bearings, which normally will not require relubrication.

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