

ROYAL CANADIAN AIR FORCE



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REPAIR & OVERHAUL
INSTRUCTIONS

STANDBY COMPASS,
TYPE AN5766-T3

ISSUED ON AUTHORITY OF THE CHIEF OF THE AIR STAFF

LIST OF RCAF REVISIONS

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Figure 1-1. Standby Compass AN5766-T3

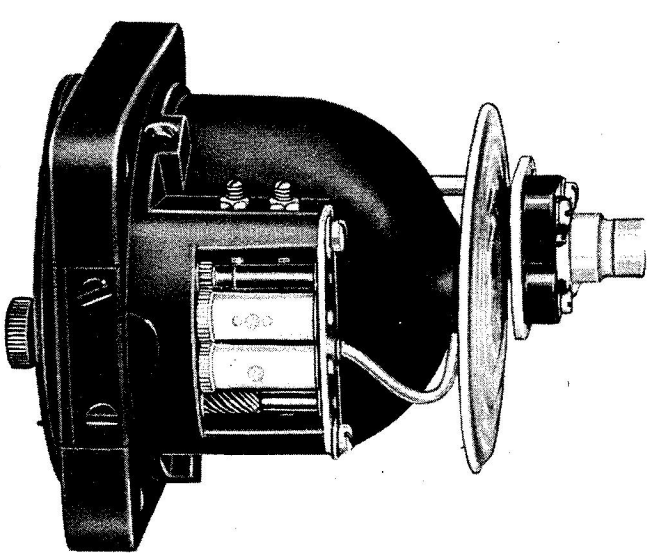


Figure 1-2. Top View - Standby Compass

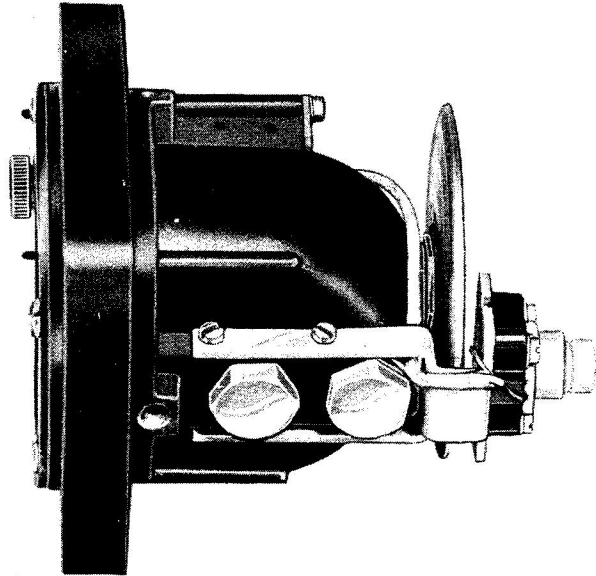


Figure 1-3. Bottom View - Standby Compass

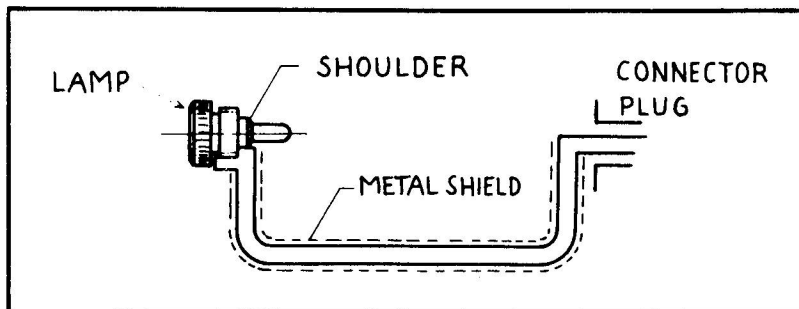


Figure 1-4. Wiring Diagram - Standby Compass

SECTION I INTRODUCTION

1-1. Sections I, II, and III of this handbook contain overhaul and test instructions for equipment manufactured by White-Rodgers Electric Company, St. Louis, Mo. as follows:

Part No.	Stock No.
Standby Compass 6970-1	AN5766-T3

1-2. The standby compass is designed for emergency use in the event that the remote indicating compass becomes inoperative. It is a "fast period" type magnetic compass relying on the magnetic influence of the earth for its operation. Properly installed and adjusted

to compensate for deviations caused by local effects of the airplane and its equipment, the compass is intended to indicate continuously the heading of the aircraft in relation to the earth's magnetic field.

1-3. Overhaul and test instructions for additional models will be provided in Section IV by use of Difference Data Sheets. The additional models included in Section IV will be listed in Section IV.

1-4. Overhaul and test procedures for models included in Section IV are the same as the procedures given in Sections II and III except for the specific differences noted by the applicable Difference Data Sheets.

SECTION II OVERHAUL INSTRUCTIONS

2-1. SPECIAL TOOLS.

2-2. The following is a list of special tools and test equipment required for performing work described in this handbook.

Part No.	Nomenclature	Procuring Service Stock Number
G-4895	Gage	
G-4896	Card Leveling Plate	
G-4897	Guide Reamer	
G-4898	Spring Gage	
G-4899	Punch	
G-4900	Anvil	
G-4901	Punch	
G-4902	Socket Wrench	
G-4903	Card Balancing Stand	
G-4904	Wrench	
G-4918	Magnetizer	
G-4919	Compass Turntable	

2-3. REASONS FOR DISASSEMBLY.

2-4. Malfunctioning of the compass may generally be traced to discolored liquid, air in the case, friction or damaged parts. Discolored liquid makes it difficult to read the compass. Air inside the case, as evidenced by a bubble, generally indicates a leak which will make the compass inoperative. Friction is usually caused by damaged or worn parts, such as the pivot or jewel. Friction, in the guide assembly destroys the shock absorbing qualities of that assembly and increases the possibility of damage to the jewel and pivot.

2-5. DISASSEMBLY.

2-6. Disassembly is in the same order as the key index numbers assigned to the exploded view illustration, figure 2-1.

2-7. REMOVAL OF DIAPHRAGM.

2-8. When removing the diaphragm assembly (3), place the compass face down. Use the special thin wrench (G-4904) to avoid damaging the diaphragm or the gasket (4).

CAUTION

Draining and refilling of the compass is done through the diaphragm insert hole and not through removal of the filling plug (45). The filling plug should be removed only when it is necessary to replace the gasket (46) in order to seal a leak at that point.

2-9. If the liquid is not discolored, drain it into a clean container for reuse in reassembly.

2-10. REMOVAL OF ELECTRICAL CONNECTIONS.

2-11. It is usually not necessary to remove the wiring or electrical parts during overhaul. If removal is found necessary, unsolder the wires from the connector plug (6) before removing the plug and bracket (8).

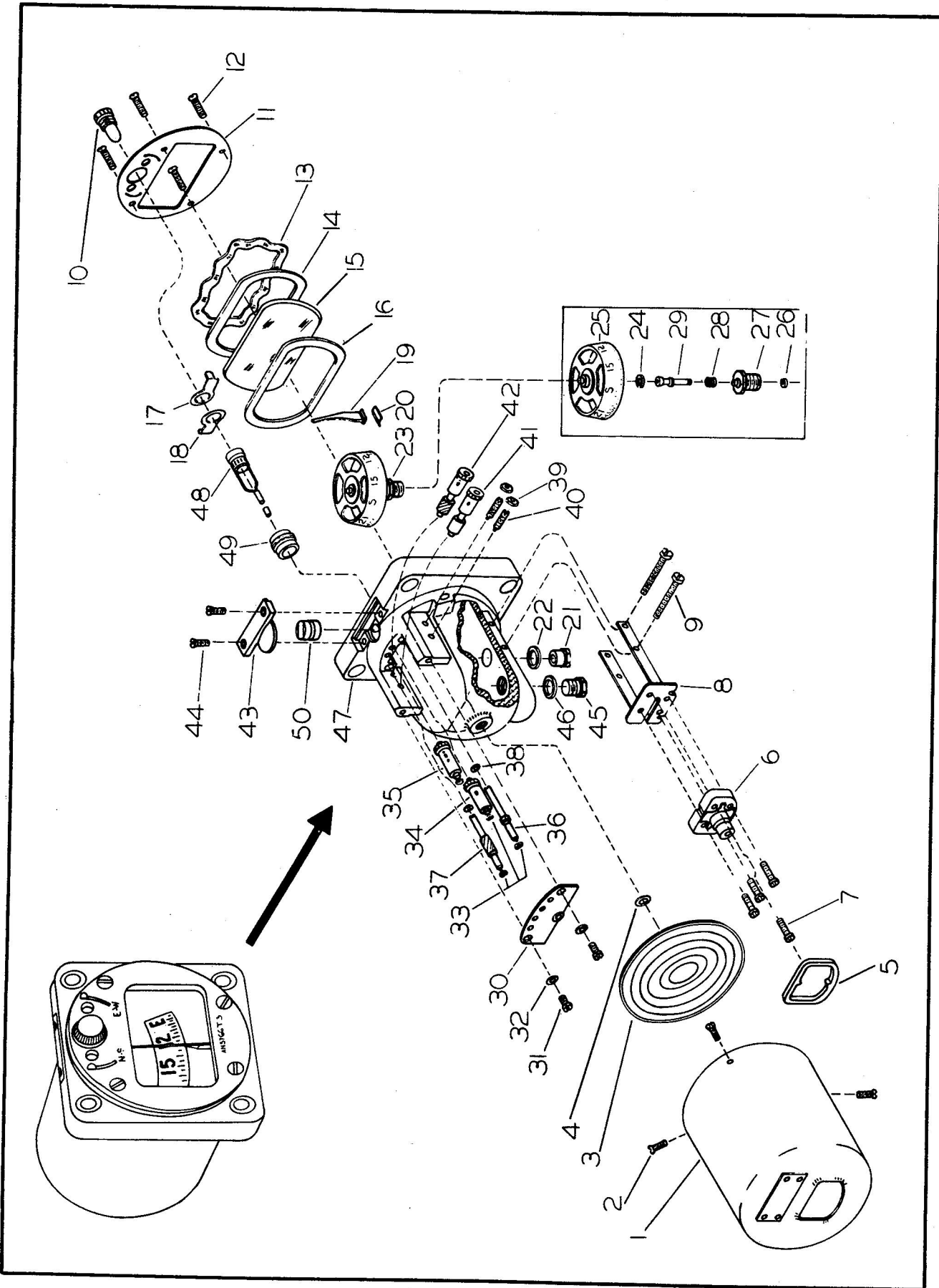


Figure 2-1. Exploded View - Standby Compass AN5766-T3

References for Figure 2-1

- | | | |
|------------------------------|--------------------------------|------------------------------|
| 1. Standby compass assembly | 18. Shutter spring | 34. N-S magnet gear assembly |
| 2. Shell screw | 19. Lubber line | 35. N-S magnet gear assembly |
| 3. Diaphragm assembly | 20. Lubber line spring | 36. N-S drive gear |
| 4. Diaphragm gasket assembly | 21. Guide nut | 37. E-W drive gear |
| 5. Connector gasket | 22. Nut guide gasket | 38. Drive gear washer |
| 6. Connector plug | 23. Card and mounting assembly | 39. Lock nut |
| 7. Connector screw | 24. Retaining ring | 40. Bearing screw |
| 8. Connector bracket | 25. Card assembly | 41. E-W magnet gear assembly |
| 9. Connector bracket screw | 26. Snap ring | 42. E-W magnet gear assembly |
| 10. Light bulb | 27. Guide | 43. Lens hole cover |
| 11. Front cover | 28. Jewel stud spring | 44. Screw |
| 12. Cover mounting screw | 29. Jewel stud assembly | 45. Filling plug |
| 13. Spring ring | 30. Compensator plate | 46. Filling plug gasket |
| 14. Sealing gasket | 31. Compensator plate screw | 47. Case |
| 15. Glass | 32. Compensator plate washer | 48. Socket assembly |
| 16. Sealing gasket | 33. Spring washer | 49. Socket sleeve |
| 17. Shutter spring | | 50. Light lens |

NOTE

Pay particular attention to the positioning of the shielded connection wires which run from the connector plug (6) through the eyelet of the compensator plate (30) and under the E-W magnet gear assemblies (41 and 42) to the light socket (48).

2-12. REMOVAL OF CARD AND MOUNTING ASSEMBLY.

- a. Should the glass (15) adhere to the case, apply a small amount of benzine between the case gasket (16) and the glass and allow it to soak until the glass is free.
- b. In removing the glass, use care not to damage the sealing gasket (16) as it is not necessary to remove it during the overhauling procedure unless the gasket becomes damaged, in which event it must be replaced.
- c. In prying out the lubber line (19) use care not to bend, damage the paint, or lose the spring (20).
- d. In removing the guide nut (21) to release the card and mounting assembly (23) it may be necessary to hold the guide (27) inside the case with a 3/8-inch open-end wrench.
- e. Tilt the card and mounting assembly slightly when removing it, using care not to damage the assembly in any way.

2-13. REMOVAL OF GUIDE FROM CARD ASSEMBLY. Rest the card and mounting assembly (23) in an inverted position on a solid, flat surface. Use tweezers to remove the retaining ring (24) but avoid exerting any pressure on the guide jewel (29) as it may jam on the pivot and become damaged.

2-14. REMOVAL OF PIVOT. The pivot may be removed for repair as follows:

- a. Use special punch (G-4899) and anvil (G-4900).
- b. Place the centerpiece of card assembly (25) on the anvil with the magnets down and, using the punch, gently tap the pivot from the card into the opening of the anvil.

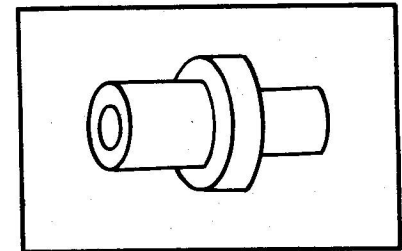


Figure 2-2. Anvil (G-4900) for Servicing Card Assembly

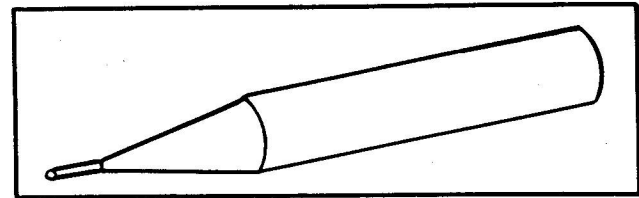


Figure 2-3. Punch (G-4899) for Removing Pivot

2-15. REMOVAL OF COMPENSATOR UNIT. It is necessary to use the special socket wrench (G-4902) to release the lock nuts (39) from the bearing screws (40) in order that these screws can be backed out to release the two E-W magnet gear assemblies (41 and 42).

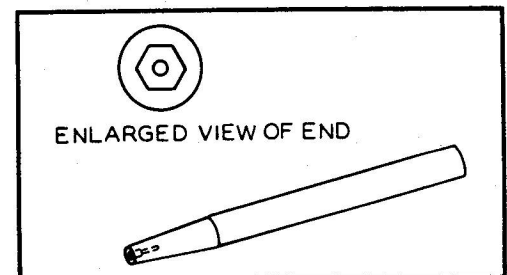


Figure 2-4. Socket Wrench (G-4902)

CAUTION

When removing any of the parts of the compensator unit, use care not to damage the gear teeth.

2-16. CLEANING.

2-17. GUIDE AND JEWEL STUD. Wash the guide (27) and jewel stud (29) in benzine and dry with a light blast of air from a hose. Polish the surface of the jewel with dry pithwood.

2-18. CARD. Clean the card (25) by washing in benzine and drying off with a light blast of air from a hose.

2-19. PIVOT. The pivot may be cleaned without removal from the card. Drill a small hole in the end of a pegwood stick and dip it into a paste made of Levigated Alumina and water. Press the pivot lightly into the hole of the stick and twist the stick back and forth several times. After this process, wash the pivot in benzine and polish it with dry pithwood.

2-20. CASE. Wipe the case (47) clean inside and out with a cloth dipped in benzine, and then blow dry with a light blast of air from a hose.

2-21. GLASS. The glass (15) must be absolutely clean. First, wash it with soap and hot water; dry with lintless cloth. Then, immerse in alcohol to remove any oil film and dry again with lintless cloth. Finally, blow off with air from a hose. Handle glass by edges at all times, to prevent finger marks.

2-22. INSPECTION.

2-23. GUIDE AND JEWEL STUD. Test the action of the jewel stud (29) by pressing it in and out of the guide (27). The parts should move smoothly without any binding or stickiness. Examine the jewel with a magnifying glass. If the jewel is chipped or cracked, a new jewel stud (29) must be used.

2-24. CARD. Check to see that paint on the card graduations is in perfect condition.

2-25. PIVOT. Use a magnifier to inspect the pivot which is attached to the centerpiece of the card (25). The pivot contour should be as shown in figure 2-6 and the surface should be smooth and free from scratches.

2-26. CASE. Inspect the case (47) for cracks or other indications of damage that might result in leaks.

2-27. GLASS. Inspect the glass (15) for finger prints, oil film, and smudges. It must be absolutely clean for reassembly. If chipped, cracked, or scratched, replace with a new glass.

2-28. PAINT. The luminescent paint on the card (25) should be checked using ultra-violet light. This test should be made in a darkroom.

2-29. MAGNETS. Examine the magnet gear assemblies (34, 35, 41, and 42) and the drive gears (36 and 37) of the compensator unit to see that the gear teeth are undamaged.

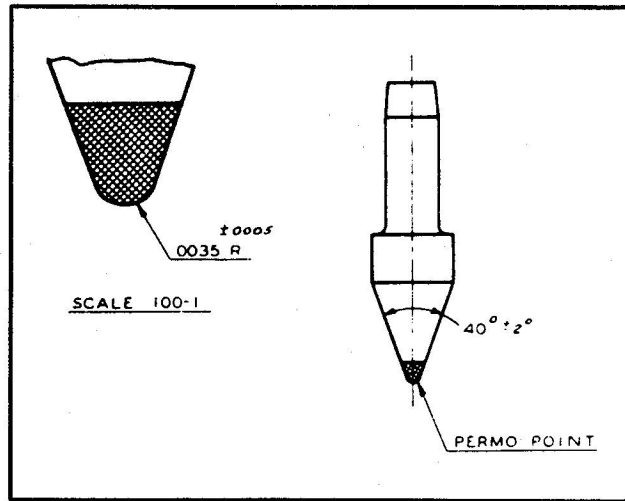


Figure 2-5. Details of Pivot

2-30. TESTING.

2-31. DIRECTIONAL MAGNETS.

a. Test the strength of the directional magnets by placing the card assembly (25) on the jewel stud in the balancing stand (G-4903). Fill the stand with enough compass liquid to completely immerse the assembly.

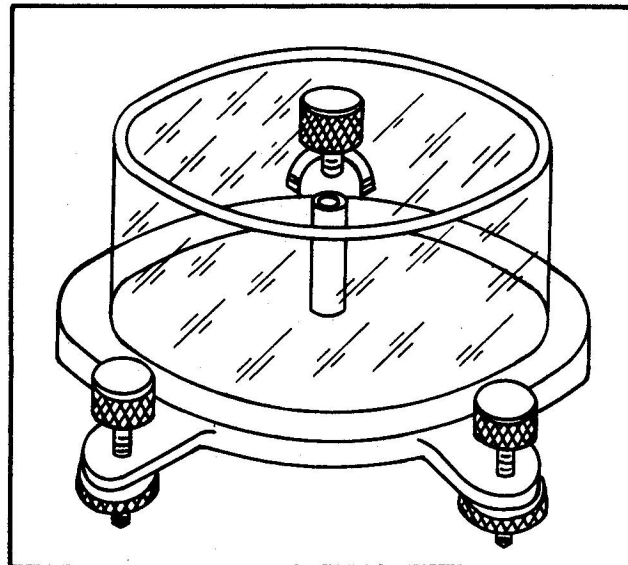


Figure 2-6. Compass Balancing Stand (G-4903)

b. Use a narrow bar magnet and deflect the card 30 degrees. When the card comes to a stop, quickly remove the bar magnet and, using a stop watch, check the length of time it takes the card to return 25 degrees (from the 30-degree to the five-degree mark).

c. Repeat step "a," deflecting the card in the opposite direction.

d. If the average of the two lengths of time required exceeds 1.8 seconds, it is an indication of weak directional magnets.

2-32. COMPENSATOR MAGNETS.

a. To test the strength of the compensator magnets, apply the maximum compensation on the north and east headings separately and note the deflection of the card.

b. If the maximum deflection is less than 30 degrees, the magnets need remagnetizing and the compensator unit must be disassembled.

2-33. REPAIR AND REPLACEMENT.

2-34. CARD AND MOUNTING ASSEMBLY. If a new jewel stud (29) is required or if the jewel stud is not working smoothly in the guide, the card and mounting assembly (23) must be disassembled.

a. The action of the new jewel stud in the guide (27) should be free from stickiness or binding. If not, ream the guide with the reamer (G-4897).

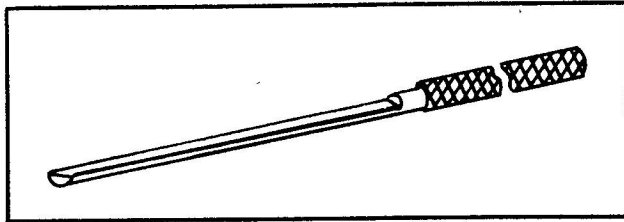


Figure 2-7. Reamer (G-4897)

b. Using gage (G-4898) check the length of the spring (28) which must be of correct length to assure proper shock absorbing action.

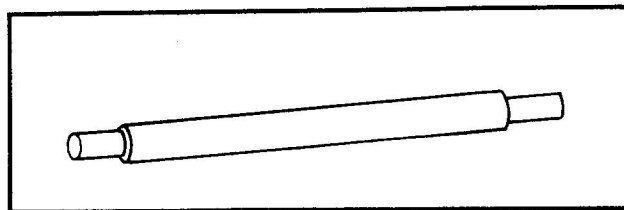


Figure 2-8. Spring Gage (G-4898)

2-35. PIVOT. If the pivot is damaged beyond repair, replace card (25) containing new pivot.

a. If the pivot can be made usable by stoning, it should be polished with a flat, white, Arkansas stone while the pivot is turning in a lathe, but care must be used to maintain the same pivot contour as shown in figure 2-5.

NOTE

After repair, the length of the pivot from the point to the shoulder should not be less than 0.075 inch.

b. To replace the pivot, invert the card (25) on the anvil (G-4900), and use the special punch (G-4901). Use a small amount of tallow to hold the pointed end of the pivot in the punch and carefully tap the pivot into the centerpiece of the card.

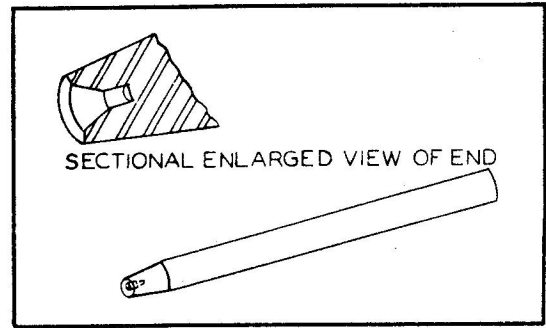


Figure 2-9. Punch (G-4901) for Replacing Pivot

2-36. DIRECTIONAL MAGNETS.

2-37. Through use of the magnetizer (G-4918), the directional magnets may be remagnetized without being removed from the card.

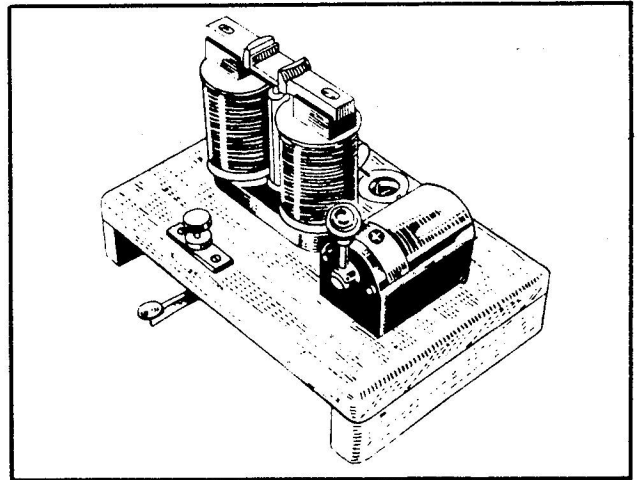


Figure 2-10. Magnetizer (G-4918)

a. Connect the proper current to the magnetizer and turn on the switch.

b. Hold a free swinging magnet above the pole pieces to determine the N and S poles of the magnetizer.

c. Place the card assembly so that the north poles of the directional magnets are against the south pole of the magnetizer and clamp the magnets between the pole pieces of the magnetizer.

d. Close and open the switch five or six times. The last time the switch is opened, open it slowly. This will remagnetize the magnets sufficiently.

2-38. COMPENSATOR MAGNETS.

2-39. Replace any units having damaged gear teeth.

2-40. If test proves it necessary to remagnetize the magnets, clamp the magnet gear assemblies (34, 35, 41, and 42), one at a time, between the poles of the magnetizer (G-4918) so that the dot or dots stamped next to the end of each magnet (dots indicate north pole) are next to the south pole of the magnetizer. Open and close

the switch of the magnetizer four or five times but, upon breaking the circuit the last time, open the switch slowly.

2-41. LUBRICATION. No lubrication is required.

2-42. REASSEMBLY.

2-43. Reassembly is in the reverse order of disassembly.

2-44. REASSEMBLY OF THE CARD ASSEMBLY.

2-45. Check the alignment of the directional magnets with respect to the north-south axis of the card (25) before proceeding with reassembly.

a. Use the card balancing stand (G-4903). Place a permanent bar magnet of very narrow design at one side, but directly in line with the lubber lines indicated on the bowl. (If two magnets are used, the card will not tip.) This will provide an artificial magnetic field concentrated near the lubber line to attract the card magnets.

b. Place the card on the jewel post in the bowl and fill the bowl with compass liquid.

c. Use a nonmagnetic straight edge and place it across the top of the bowl in line with the lubber lines indicated on the bowl. Sight down the straight edge onto the card from directly above. The north-south graduations of the card should be directly in line with the straight edge. If necessary, adjust the alignment by moving the magnets slightly, but always maintain the proper distance between them as measured by gage (G-4895).

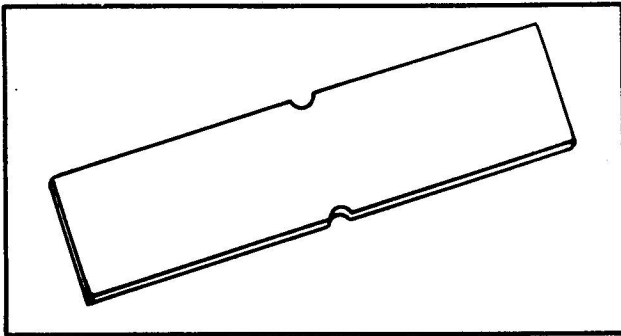


Figure 2-11. Gage (G-4895)

2-46. After checking alignment, check the card (25) to see that it is level.

a. Place the card assembly upright on the card leveling plate (G-4896) with the magnets in the center cut-out.

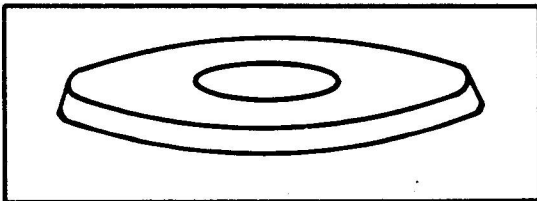


Figure 2-12. Card Leveling Plate (G-4896)

b. Hold the unit up to the light on a level with the eye. Any high spots will be found by light between the card and the plate.

c. Carefully press down on the upper edge of the card, at those points where high spots are apparent, until the card is level with the plate.

2-47. The card assembly should be checked also for proper balance.

a. Use the card balancing stand (G-4903) and locate it away from any disturbing magnetic influences.

b. Fill the bowl with compass liquid until there is sufficient liquid to cover the card when placed on the jewel post.

c. Use the three thumb screws to adjust the card balancing stand until the liquid in the bowl indicates that the bowl is level.

d. Place the card assembly on the jewel post in the container making certain the assembly is completely immersed.

e. A nonmetallic plate with parallel edges makes a satisfactory sight with which to check the level of the card. Use the level of the liquid as an additional check.

f. If the card assembly is unbalanced north or south, add or remove a small amount of solder from the rounded end of the magnets.

g. If the card assembly is unbalanced east or west, change the center of gravity of the card by bending the magnet hook in such a manner as to shift the weight of the magnets to east or west as required. However, the distance between the magnets as measured by the gage (G-4895) must be maintained.

CAUTION

In shifting the magnets, care must be used not to break the solder seal which secures the magnet hook to the card.

h. Repeat the above procedures as necessary to bring the card to a balanced condition.

2-48. REASSEMBLY OF THE GUIDE ASSEMBLY TO THE CARD ASSEMBLY.

a. Place the card (25) in an inverted position on a flat surface.

b. Carefully hold the jewel stud (29) in the recess of the card centerpiece and gently press the retaining ring (24) into place.

CAUTION

Avoid jamming the jewel onto the pivot

2-49. REPLACEMENT OF THE CARD AND GUIDE ASSEMBLY.

a. Use a new nut guide gasket (22).

b. Tilt the card and mounting assembly (23) to prevent damaging the card when inserting it into the case (47).

c. Holding the guide (27) with the fingers to prevent its turning, screw the guide nut (21) onto the guide until it is "hand-tight." The guide should be positioned so that the slot is toward the rear of the compass.

d. Hold the guide with a 3/8-inch open-end wrench to prevent its turning, and tighten the guide nut securely, using a 7/16-inch box or socket wrench.

CAUTION

Extreme care must be used when tightening the guide nut (21) in order to avoid damaging the card and mounting assembly (23).

e. Using a pegwood stick, press the lubber line (19) into the groove in the case (47) provided for it and secure with spring (20).

f. Use a straight edge to check the lubber line for straightness.

g. Be sure the glass (15) is clean.

CAUTION

When screwing on front cover (11), start with one screw and tighten it a portion of a turn; then proceed to the screw directly opposite it and tighten it a portion of a turn until all screws are tight. This process evenly distributes the pressure, minimizing the chance of cracking the glass.

2-50. FILLING THE COMPASS.

2-51. Fill the compass at a temperature of approximately 20°C (68°F) with compass liquid in accordance with Specification MIL-C-5020. Filling is done through the diaphragm insert hole (paragraph 2-8).

a. Fill and drain the compass several times until the liquid is absolutely clean. This rinsing process washes out any dirt particles which might have lodged inside the case during overhaul. Close the diaphragm insert hole and swirl the liquid. Any foreign matter remaining in the liquid will be apparent through the glass.

b. The liquid for final filling must be clean and free from contamination. If necessary, filter the liquid to satisfy this condition.

c. Place the compass and diaphragm assemblies in a container of clean compass liquid so that the open diaphragm insert holes in the case and the opening of the diaphragm are up and the units are completely immersed. Then place the container in a vacuum chamber. Evacuate the chamber to the extent of available suction (at least 3.136 inches of mercury absolute or 50,000 feet of altitude). Allow the compass to remain in this condition for at least one hour.

d. After the one hour period, open the chamber until the pressure equals that of the atmosphere. Being careful to keep the compass immersed, tilt the compass so that it is in a vertical position with the glass up, and see if a bubble appears. If so, lower the compass to its original position and allow the bubble to escape through the diaphragm insert hole. Repeat this procedure until no bubbles appear.

e. While the compass and diaphragm are still immersed in the liquid, use a new gasket (4) and screw the diaphragm (3) into the case. Tighten it with special open-end wrench (G-4904) exercising care not to damage the diaphragm.

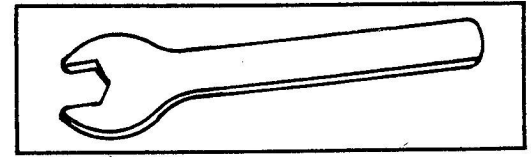


Figure 2-13. Wrench (G-4904)

f. After removing the compass from the container, immerse the entire compass in carbon tetrachloride to remove the oil film. Dry it with air from a hose, being careful not to blow too strong a blast of air on the diaphragm, as this may damage the compass.

2-52. REASSEMBLY OF COMPENSATOR UNIT.

2-53. Reassemble in reverse order of disassembly but, as positioning of parts is critical to the operation of the compass, the following instructions must be closely followed.

a. When reassembling the two E-W magnet gear assemblies (41 and 42) into place with bearing screws (40), mesh gears so that the magnets are parallel and the dot on gear (42) is up and the dot on gear (41) is down. The dots are stamped on the assemblies next to the north pole of each magnet. (See figure 2-14.)

CAUTION

During reassembly of compensator unit, avoid injuring the gears.

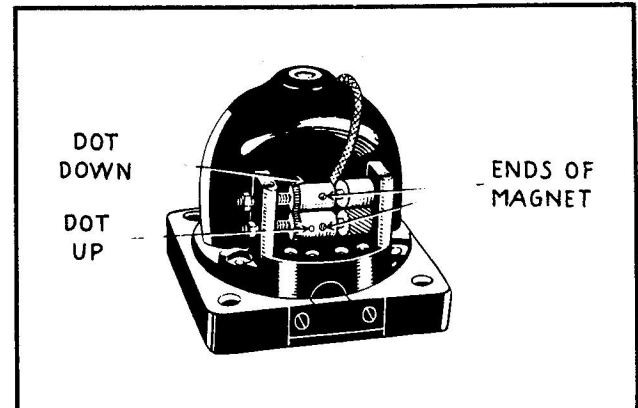


Figure 2-14. Positions of E-W Magnet Gear Assemblies

b. Turn in bearing screws (40) until an end play of approximately 0.005 inch is obtained.

c. Use socket wrench (G-4902) to tighten the lock nuts (39).

d. Check to see that the magnets turn freely but not loosely, ending the check with the magnets in the position described in step "a."

e. When reinstalling the E-W drive gear (37), insert the slotted end through the hole in the case so that the spiral gear meshes with that of the E-W magnet gear assembly (42) and the dot on the slotted end is adjacent to the dot on the front of the case. (See figure 2-14.)

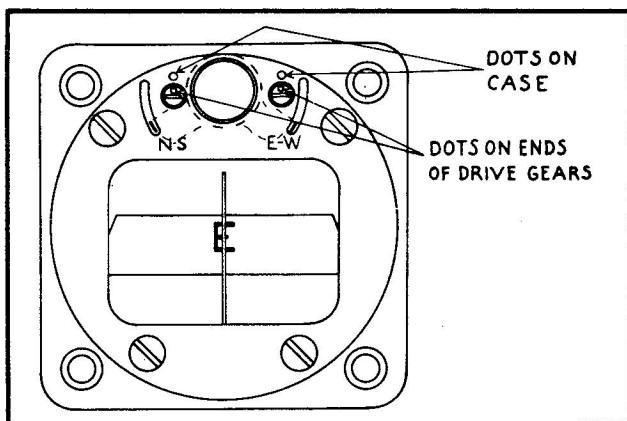


Figure 2-15. Front of Compass

f. Reinstall the N-S drive gear (36) making certain that the dot on the slotted end is adjacent to the dot on the front of the case. (See figure 2-15.)

g. Reinstall the N-S gear assemblies (34 and 35) using care in meshing gears so that the magnets are parallel and the dots on gear (35) are up and the dot on gear (34) is down. (See figure 2-16.)

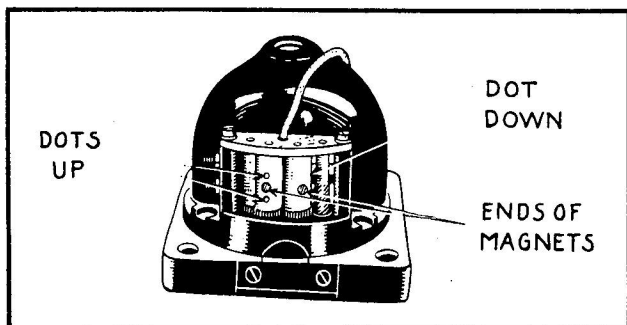


Figure 2-16. Positions of N-S Magnet Gear Assemblies

h. The spring washers (33) should be used with their convex sides toward the gears.

i. After compensator plate (30) has been replaced, check the action of the movable parts by using a non-magnetic screwdriver through the holes in the front of the case. The parts should not turn too freely but yet should not bind. Friction may be increased or decreased by bending or flattening spring washers (33).

j. Recheck the positions of the dots on the ends of the drive gears when the magnets of each pair are parallel. The dots should be adjacent to the dots on the front of the case. If they are not, the mesh between the magnet gears or between the drive gear and the driven magnet gear should be changed.

2-54. Check the deflection of the card when the maximum amount of compensation is applied by the compensator for the N-S and E-W headings, and also check the neutral position of the compensator magnets.

a. The compass should be mounted on the compass turntable (G-4919) in a horizontal position and in the earth's magnetic field, undisturbed by other magnetic influences.

b. Using a nonmagnetic screwdriver, set the compensator magnets in the neutral position. (The dots on

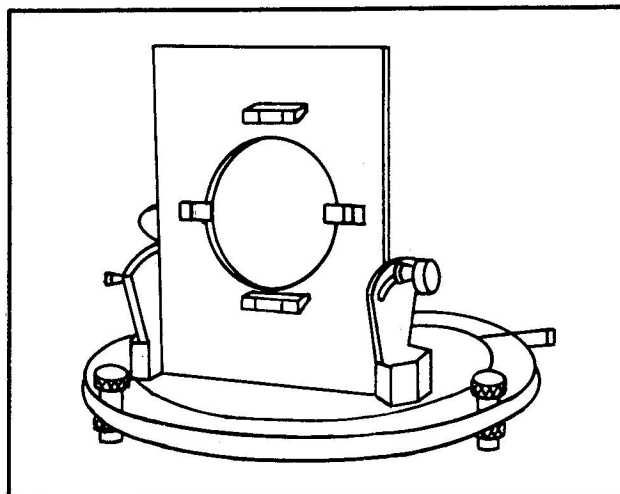


Figure 2-17. Compass Turntable (G-4919)

the ends of the drive gears should be adjacent to the dots on the front of the case.) With the magnets in this position, the compass card should align itself with the earth's north and south magnetic meridian within two degrees. If the variance is greater than two degrees, the compensator magnets probably are not in the proper relationship to the dots. Change the relationship of the magnet gears to correct this condition.

c. With the compensator magnets set at neutral and, with the compass heading directly north, check the amount of deflection when the maximum compensation is applied with the N-S compensator in first one direction and then the other. Tap the base of the compass stand and allow the compass liquid to come to rest before taking each reading. The amount of deflection in each direction should not be less than 30 degrees. A smaller amount of deflection in each direction should not be less than 30 degrees. A smaller amount indicates that the compensator magnets are weak and should be remagnetized.

d. Reset all compensator magnets to neutral position and check the amount of deflection caused on the E-W heading using the same procedure as described in the above paragraph, but applying the maximum amount of compensation with the E-W compensator.

e. After the check, the compensator should be set to neutral.

NOTE

As the purpose of compensation is to overcome the possible deviation caused by local magnetic effects of the airplane and its equipment, the final compensation setting should only be made after the compass is installed in the aircraft.

2-55. Check the card error as follows: with a plane through the lubber line and the center of the pivot post parallel to the magnetic meridian, the compass should indicate north (zero degrees) and/or south (180 degrees) within two degrees. Turn the compass about its vertical axis from the above described position by reference to the circular scale of the turntable to each 30-degree heading. The error at any point should not exceed one degree. This test should be made with the compensator magnets in the neutral position.

SECTION III TEST PROCEDURE

3-1. GENERAL.

3-2. Except when otherwise specified, the compass should be tested in a normal operating position and should be lightly tapped or vibrated when test readings are made. Mount the compass on a suitable turntable away from magnetic influence for these tests.

3-3. The instrument should be tested at atmospheric pressure (approximately 29.92 inches of mercury) and at room temperature of approximately 25°C (77°F).

3-4. **INDIVIDUAL TESTS.** After overhaul, each compass should be subjected to the following tests in the order given below.

3-5. CARD ERROR.

a. A plane through the lubber line and the center of the pivot should be parallel to the magnetic meridian. With the compensator set at zero and the compass mounted on a common bracket with a master compass, the compass under test should indicate north and/or south within two degrees. Any variation is known as "alignment error." Turn the compass about its vertical axis from the above described position by reference to an accurate circular scale to each 30-degree heading. The error at any point, after allowing for alignment error, should not exceed one degree.

b. If errors are present during this test, the surroundings should be investigated for magnetic influences on the compass. If no external influences are present, it may be assumed that the directive magnets are not properly aligned with the north-south axis of the card.

3-6. FRICTION ERROR.

a. After the card has been deflected from the position of equilibrium either way, by five degrees, it should return to within one degree of its original position without vibration.

b. Friction errors are due to a dirty or cracked jewel or a corroded, worn, or damaged pivot.

3-7. BALANCE.

a. The card should balance on its pivot so that the plane of the card is within one degree of the horizontal.

b. The balancing of the card is described in paragraph 2-47.

3-8. CARD TEST.

a. This test should be made in a uniform magnetic field (such as that of the earth) having a horizontal component of approximately 0.18 oersted. Magnetically deflect the card 30 degrees from its equilibrium position and hold at this position long enough for the liquid to come to rest. Then release and observe the time required for the card to pass through 25 degrees toward

the equilibrium position. Repeat the test, deflecting the card 30 degrees in the opposite direction. Do not change the position of the compass between observations, as the deflection in both directions is to average out any error due to incorrect setting of the lubber line with reference to the equilibrium position of the card. The average time of the two lengths of time required should not exceed 1.8 seconds nor be less than 1.4 seconds.

b. A longer time of swing indicates weak directional magnets.

3-9. OVERSWING.

a. Magnetically deflect the card 30 degrees from its equilibrium position. Hold at this position long enough for the liquid to come to rest, then release and note the amount of overswing past the equilibrium noted. Repeat the test, deflecting the card in the opposite direction. The average of the two amounts of overswing should not exceed 15 degrees.

b. Excessive overswing indicates weak directional magnets.

3-10. DAMPING TEST.

a. With the liquid at room temperature (approximately 25°C (77°F)) and the compass in its normal upright position, start on any heading and turn the compass through 360 degrees in one minute of time. The maximum deflection of the card from the original heading should not exceed two degrees.

b. A deflection greater than two degrees indicates friction or weak directional magnets.

3-11. HEELING.

a. With the compensator set at zero, the compass should be observed and readings taken at each 30-degree heading. The compass should then be tilted 10 degrees about a horizontal axis in pitch. The change in reading at each 30-degree heading should not exceed two degrees. When tilted 18 degrees about a horizontal axis in bank, the reading of each 30-degree heading should not differ more than five degrees from the reading obtained from the compass in the normal position.

b. Failure to meet this test may be due to the magnets being too close together, the pivot being too short, or the guide spring being too short.

3-12. **COMPENSATION.** The compass should be in a normal upright position in a uniform magnetic field of approximately 0.18 oersted horizontal component. The compass should be positioned to indicate first north (zero degrees) and then east (90 degrees). When the minimum increment of compensating magnetism is properly introduced for either heading (crosswise for north and parallel for east), a deviation of not more than two degrees should result. Maximum compensa-

tion applied unnaturally (parallel for north and cross-wise for east) on either heading shall not affect the indication on the other heading more than two degrees. The compensating system should be so arranged that when the compensator is set at zero, no deviation of the card will result when the compass is set on any heading.

3-13. APPEARANCE.

a. Observe the compass under daylight conditions. The damping liquid should be colorless and the paint on the card should be in good condition. When the liquid in the bowl is stirred, no foreign particles should be apparent. When the compass is turned face up, no air bubble should appear. There should be no bright metal spots, either inside or outside.

b. Discolored or dirty liquid requires that the com-

pass be drained and refilled. Deteriorated paint requires that a new card be used. Air in the compass indicates a leak or improper filling; a condition which must be corrected. Bright spots on the exterior surfaces (with the exception of the connector plug) should be touched up with a dull black lacquer.

3-14. LUMINESCENT PAINT.

a. The luminescent paint on the card should glow when subjected to ultra-violet light and all cardinal headings, numerals, and 10-degree graduations should be clearly visible. This test should be made under conditions of complete darkness equivalent to that of a photo darkroom.

b. Test visibility using correct voltage (three volts) applied to light installed in compass.