

PILOT WIRE MASTER FLAT GAIN CONTROLLER

KS-7664

REPLACEMENT PARTS AND PROCEDURES

1. GENERAL

1.01 This section covers the information necessary for ordering parts to be used in the maintenance of Pilot Wire Master Flat Gain Controllers KS-7664 for flat gain regulation of type K1 carrier telephone systems. It also covers approved procedures for replacing these parts.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 Part 2 of this section covers the various parts which may be replaced in the field in the maintenance of this equipment. No at-

tempt should be made to replace parts not designated. Part 2 also contains explanatory figures showing the different parts. This information is called "Replacement Parts".

1.04 Part 3 of this section covers the approved procedures for the replacement of the parts covered in Part 2. This information is called "Replacement Procedures"

2. REPLACEMENT PARTS

2.01 The figures (1 to 10 inclusive) in this part of the section show the various replacement parts in their proper relation to the other parts and also their corresponding names.

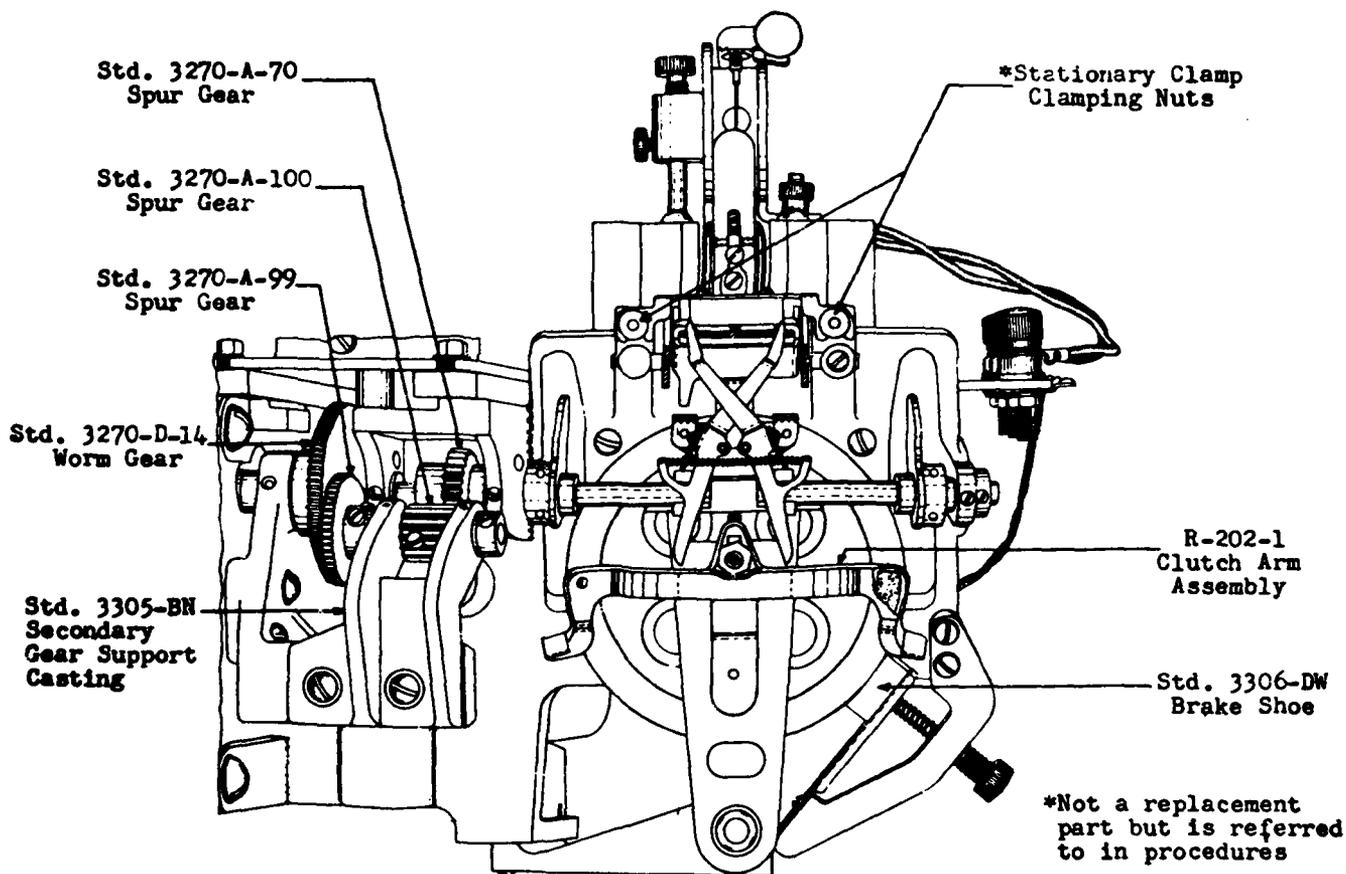


Fig. 1 - Control Mechanism

2.02 When ordering replacement parts give both the number and name for the part and also mention that the part is for the KS-7664 Pilot Wire Master Flat Gain Controller. The designations and numbers in this section are

those assigned by the manufacturer the Leeds and Northrup Company. Do not refer to BSP numbers. Western Electric piece part numbers for relays used with this controller are contained in the BSP's for those relays.

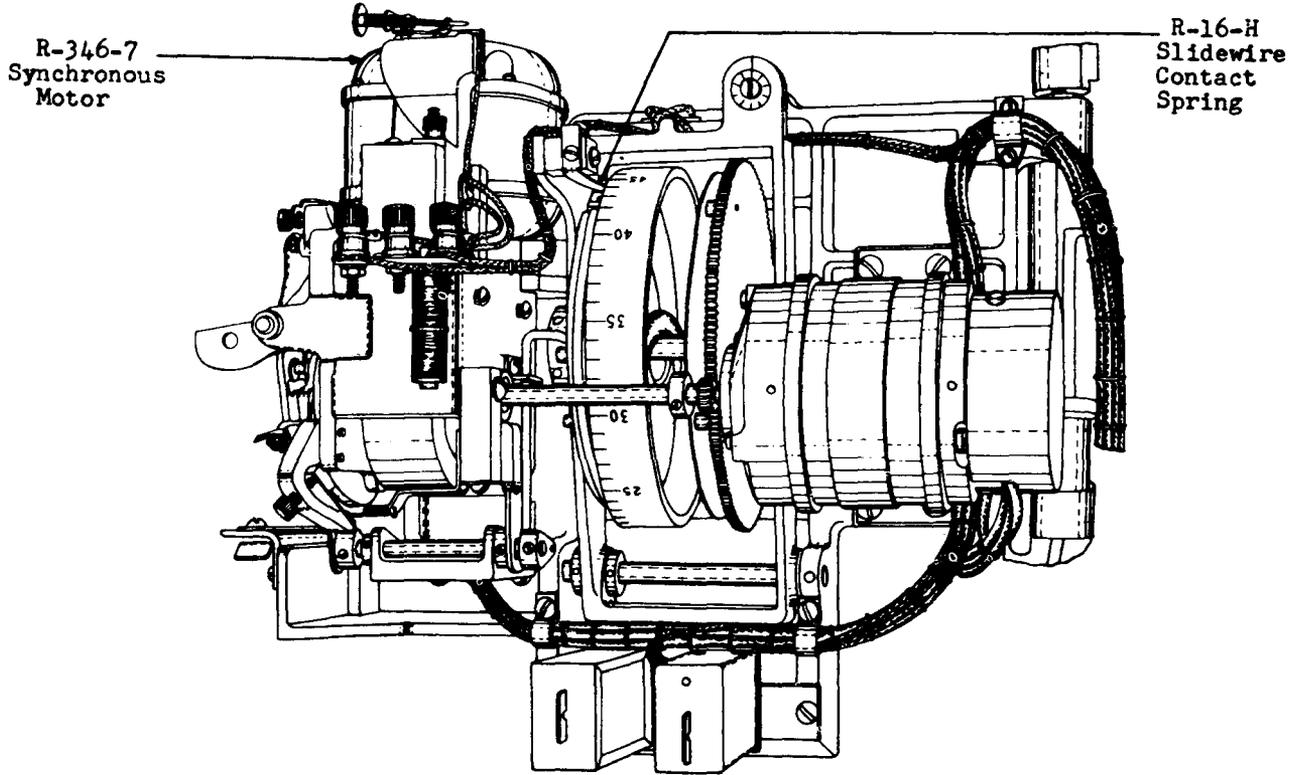


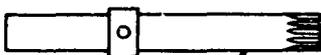
Fig. 2 - Control Mechanism - Side View



Fig. 3 - R-10224-UU Phosphor Bronze Bearing for 1/4" Shaft



Fig. 5 - R-346-V-4 Ball Bearing for Synchronous Motor



Std. 13270-A-97 Pinion Gear Shaft with Tell Tale

Fig. 4



Std. 3305-CG Bushing

R-203-AE Balancing Mechanism Adjusting Screw



R-3-C Fibre Contact Button

Fig. 6

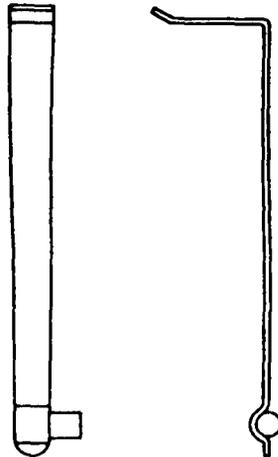


Fig. 7 - R-16-H Slidewire Contact Spring

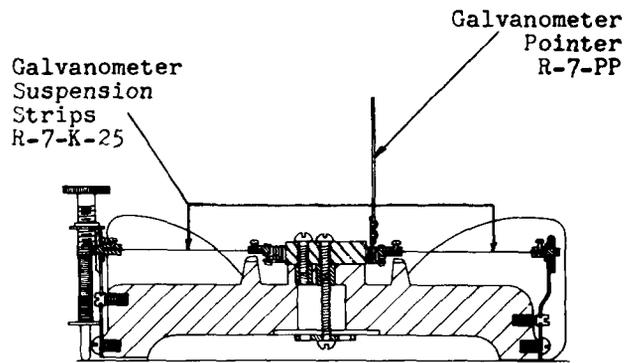


Fig. 8A - Galvanometer Pointer and Galvanometer Suspension Strips

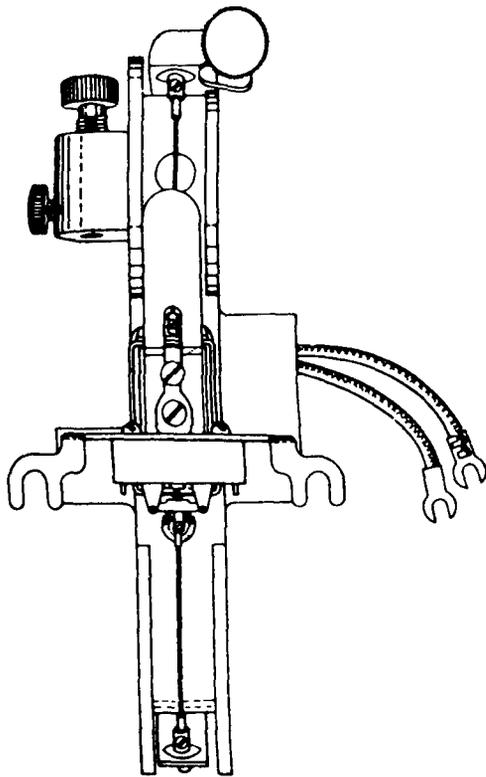


Fig. 8 - R-10208-1200-25 Galvanometer Complete

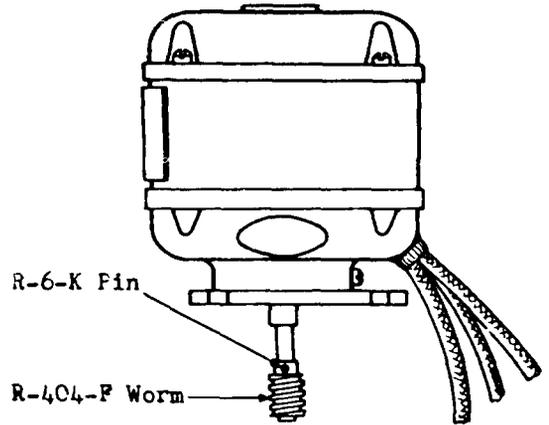


Fig. 9 - R-346-7 Synchronous Motor 55 Volts 60 Cycles (worm is included with motor)

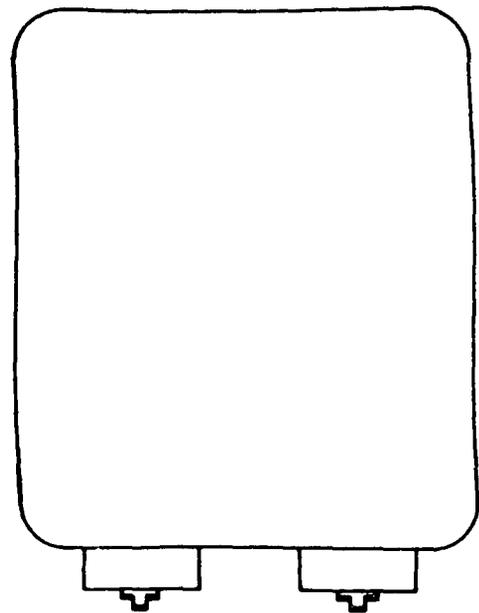


Fig. 10 - R-346-B-25 Capacitor for Synchronous Motor

3. REPLACEMENT PROCEDURES**3.01 List of Tools and Gauges**

| CODE NO. | DESCRIPTION |
|--------------|--|
| TOOLS | |
| 129B | 1/4-Inch Hex. Open Double End Offset Wrench |
| 207 | Offset Screwdriver |
| 418A | 5/16-Inch and 7/32-Inch Hex. Open Double End Flat Wrench |
| — | KS-6854 3-1/2-Inch Screwdriver |
| — | D-160806 Bearing Puller |
| — | 3-1/2-Inch Cabinet Screwdriver |
| — | 4-Inch Regular Screwdriver |
| — | Tweezers 4-1/4-Inch No. 15 Hammacher-Schlemmer Co., New York |
| — | Watchmakers Screwdriver Size 5 William Dixon Inc., Newark, N.J. |
| — | Watchmakers Screwdriver Size 3 William Dixon, Inc., Newark, N.J. |
| — | KS-5747 Tool Kit (consists of one or more of the following Leeds and Northrup Co. tools) |
| A-1 | Draw Nut |
| A-2 | Bearing Back Up Washer |
| A-3 | Bearing Assembly Washer |
| A-4 | Bearing Assembly Bushing |
| A-5 | Bearing Alignment Shaft |
| A-6 | Draw Nut |
| A-7 | Bearing Back Up Washer |
| A-8 | Bearing Assembly Washer |
| A-9 | Bearing Alignment Shaft |
| A-10 | Bearing Assembly Bushing |
| A-11 | Clamping Stud |
| A-12 | Assembly Block |
| A-13 | Recess Saucer Washer |
| A-14 | Back Up Saucer Washer |
| A-15 | Bearing Assembly Bolt |
| A-16 | Stop Button |
| A-17 | Bearing Assembly Nut |
| R-1-A | Push Out Nut |
| R-1-B | Bearing Recess Washer |
| R-1-C | Draw Screw |

| CODE NO. | DESCRIPTION |
|--------------|-------------|
| TOOLS | |

| | |
|-------|------------------------|
| R-2-A | Push Out Nut |
| R-2-B | Bearing Recess Washer |
| R-2-C | Draw Bolt |
| AR-1 | Center Shaft |
| AR-2 | Pressure Nut |
| AR-3 | Support Collar |
| AR-4 | Thrust Nut |
| AR-6 | 5/16-Inch Mach. Reamer |
| AR-7 | Wrench Single End |
| AR-8 | Wrench Double End |
| AR-9 | 1/4-Inch Line Reamer |
| — | Tap Wrench |

Note: Spare 1/4-inch and 5/16-inch bronze bearings, and bearing holding screws are included in the KS-5747 Tool Kit.

GAUGES

| | |
|-----|--|
| 75D | .005-Inch Thickness Gauge |
| — | Leeds and Northrup Co. GX-334 Gauge (included in KS-5747 tool kit) |
| — | Leeds and Northrup Co. AR-5 Gauge Block (included in KS-5747 tool kit) |

3.02 No replacement procedures are specified for parts where the replacement consists of a simple operation.

3.03 After making any replacements the controller shall meet the requirements involved as specified in Section 024-330-701. Parts whose adjustments may have been disturbed by the replacing operations shall be checked and an over-all operation check made of the controller before restoring it to service.

3.04 Stopping Controller

Stop the controller by blocking relay BF in its nonoperated position and insulate the arm contacts on it. Stop the controller in such a position that the straight edges of the sweep cams extend vertically upward.

3.05 Removing Balancing Mechanism

Removal of the balancing mechanism is necessary to accomplish some of the replacements covered in this section. To remove the balancing mechanism loosen the stationary

clamp clamping nuts (Fig. 1) until the stationary clamp is free, then unhook the spiral spring from the bottom of the clutch operating lever and loosen the balancing mechanism mounting screw, using the 3-1/2-inch cabinet screwdriver. Move the balancing mechanism to the right, thus pushing the right-hand mounting pin out far enough to permit the clutch arm operating lever to clear the left-hand mounting pin, and lift the mechanism clear of the frame.

3.06 Remounting Balancing Mechanism

To remount the balancing mechanism slide it into position so that the bearing in the left side of the clutch operating lever fits on the left-hand mounting pin. Then, holding the balancing mechanism so that the bearing in the right-hand side of the clutch operating lever is in line with the mounting pin, push the mounting pin into its bearing. Do not push too hard on the pin after it is fully in its bearing as this may cause the pin to exert sufficient pressure against the bracket in which the rocker arm is mounted to prevent the rocker arm from moving freely and may even cause it to stick. The pin should be moved in far enough so that there will be no lost motion to the left or right between the bearings and the mounting pin. Tighten the balancing mechanism mounting screw. Hook the spiral spring into place again. Push the stationary clamp down as far as it will go and tighten the stationary clamp clamping nuts.

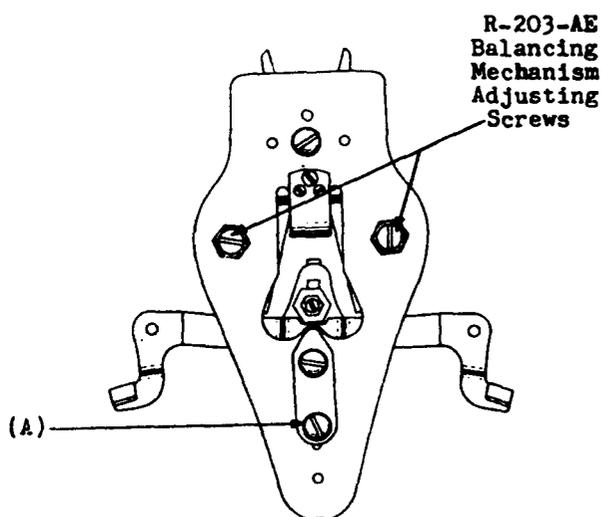


Fig. 11

3.07 Replacement of Clutch Arm

Remove balancing mechanism as described in paragraph 3.05. Remove screw (A) (Fig. 11) using the 3-1/2-inch cabinet screwdriver and remove detail (A) (Fig. 12). Remove the clutch arm. Remount the new clutch arm. Remount detail (A) and tighten screw (A). Remount the balancing mechanism as described in paragraph 3.06.

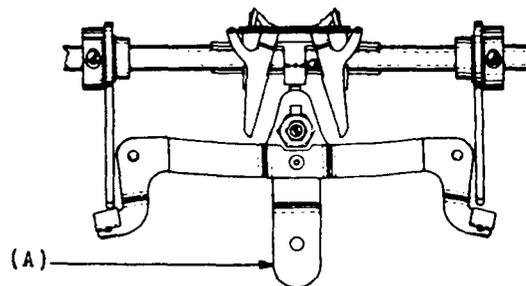


Fig. 12

3.08 Replacement of Fibre Contact Button

Remove the balancing mechanism as described in paragraph 3.05. Remove the locknut from the R203-AE balancing mechanism adjusting screw with the 418A wrench. With the 3-1/2-inch cabinet screwdriver turn the screw in a clockwise direction until it is removed. Insert a screw with a new R-3-C fibre contact button and turn until the head of the screw extends out beyond the front of the plate approximately the same distance as the original screw. Remount the locknut on the screw but do not tighten the locknut. Remount the balancing mechanism as described in paragraph 3.06. Turn each of the screws clockwise until the fibre contact buttons just touch the operating cams and then continue to turn each screw 2 turns in a clockwise direction. Tighten the locknut on the screws.

3.09 Replacement of Motor Bearings

- (1) To replace the motor bearings proceed as follows: Remove the motor leads from the terminal block. Remove the four motor mounting screws using either the 4-inch regular screwdriver or the 129B wrench and lift the motor clear of the controller.

(2) Remove the four through bolts which hold the end covers, using the 4-inch regular screwdriver. Tap the top cover to loosen it and then remove it (being careful not to lose the thrust plate and washers from this cover). Lift the rotor out of the motor frame (being careful not to lose any of the washers from this end of the motor). Remove the bearings by means of the D-160806 bearing puller applied as shown in Fig. (13).

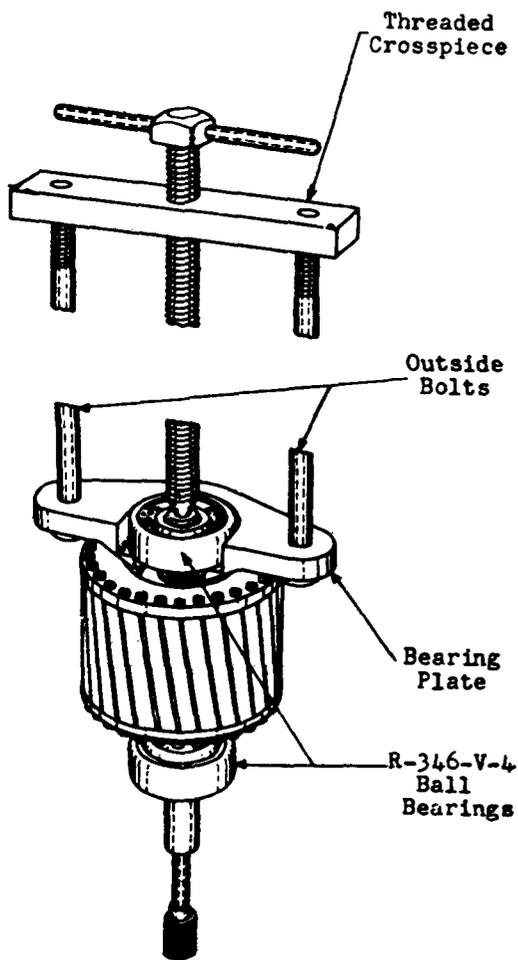


Fig. 13

(3) Using the D-160806 bearing puller applied as shown in Fig. (14), mount the new bearings on the shaft. To make the D-160806 bearing puller applicable for forcing the new bearings into position on the shaft it will be necessary to make a slight change in this tool as follows: Unscrew the two outside bolts from

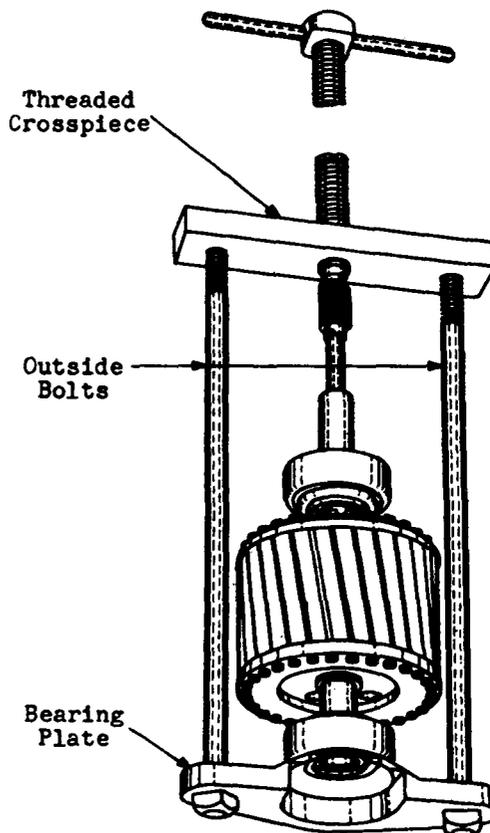


Fig. 14

the threaded cross piece and slip the bearing plate off these bolts. Reverse the bearing plate so that the cupped portion of it is reversed with respect to the position it had for bearing removal, and then reassemble the tool with the bearing plate in this reversed position as shown in Fig. (14). Force the new bearings into position against the shoulders on the shaft with the open end of the bearing facing toward the end of the shaft. In forcing on the bearings be sure that the pressure is applied only on the inner ball race of the bearing (this race is lower than the outer race). Place the flat metal washer in the bottom of the end cover attached to the stator, then the cork washer, and then the collared metal washer (fit the collar of this washer to the cork washer). Replace the rotor in the stator. Place the flat metal washer (or washers) on the upper end of the shaft. Then place the collared metal washer on with the collar facing up. Fit the cork washer around the collar of the metal washer and place the perforated thrust plate

on top of the cork washer. Remount the top end cover and the four through bolts. The cover should be placed so that the large headed screw (at the side of the center plug) is on the same side of the stator as the nameplate. Be sure to draw the cover tight.

(4) Remount the motor on the controller, being careful that the correct location of the worm with respect to the worm gear is obtained, and tighten the four mounting screws to hold the motor in place. Connect the motor leads to the terminal block.

(5) Adjust for possible end play of the motor shaft as follows: If the motor appears to be too noisy, loosen the small set screw at the large plug screw in the upper end cover, using the 3-1/2-inch cabinet screwdriver. Then with the motor running, very gently adjust the large plug screw, using the 207 tool, until the noise decreases a reasonable amount or until the plug just binds against the thrust plate in the cover. Under the latter condition continue to turn in a clockwise direction for approximately 1/8 of a turn. Tighten the set screw to hold the plug screw in place.

3.10 Replacement of Motor Worm

(1) To replace the worm on the motor shaft disconnect the motor leads and take out the screws holding the motor to the mounting using the 4-inch regular screwdriver or the 129B tool and lift the motor clear of the controller.

(2) Force out the small pin which holds the worm to the shaft and remove the worm. Place the new worm on the shaft and force the pin into position. Then remount the motor on the controller being careful that the correct location of the worm with respect to the fibre gear is obtained, and tighten the four mounting screws to hold the motor in place. Connect the motor leads to the terminal block.

3.11 Replacement of Worm Gear Std 3270-D-14

To replace this worm gear proceed as follows: Remove the three screws from the window frame on the front of the door, using the KS-6854 screwdriver. Remove the window frame and the glass. Loosen the set screws in the hub of the worm gear. Push the shaft through the window until the worm gear is free. Replace

with a new worm gear and slide the shaft back in place until the collar pinned on the shaft is snug against the left end of the shaft bearing. Tighten the set screws in the hub of the worm gear so that the gear is snug against the right end of the shaft bearing. Remount the glass and window frame.

3.12 Replacement of Bronze Bearings

(1) Remove balancing mechanism as described in 3.05. Remove the three screws from the window frame on the front of the door, using the KS-6854 screwdriver. Remove the window frame and the glass. Loosen the set screws holding worm gear Std. 3270-D-14 on the tell tale shaft. Remove the tell tale shaft through the window. Remove the three mounting screws which hold the tell tale casting to the main casting and remove the two small castings together as a unit. Do not separate the secondary gear support casting (Std. 3305-BN) from the tell tale casting.

Note: On early model of controller (having no tell tale casting because tell tale shaft bearing is in main frame) the secondary gear support casting should be taken off by removing its mounting screws. If any shims are under this casting they should be saved for reuse when remounting the casting.

(2) **Cam Shaft Bearings:** Loosen the set screws of both sweep cams (see note), the operating cam and the spur gear (Std. 3270-A-70). Remove the cam shaft by sliding it out to the right. The spur gear, the left hand sweep cam, the operating cam and the right hand sweep cam will drop off as the shaft is moved out to the right. (Observing the position of these cams with respect to each other will be of help when reassembling them on the shaft later on). Remove the bearing holding screws. Remove the bearings by means of the bearing removal tool shown in Fig. 15.

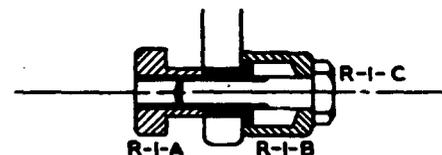


Fig. 15

The three parts of this tool are marked R-1-A, R-1-B and R-1-C. Assemble them in the bearing as shown so that when nut R-1-A is tightened the bearing will be pushed into the recess of R-1-B.

Note: The blade of the KS-6854 screwdriver is too wide for the sweep cam set screws. Modify this screwdriver locally by grinding until the end of the blade is 7/64-inch wide tapering off gradually to the original width of the blade.

(3) To insert new cam shaft bearings use the tool shown in Figs. 16, 17 and 18. Part A-11 is inserted into part A-3 and tightened so that its point goes into the conical spot in A-5. Install the left-hand bearing first, using

the tool assembly shown in Fig. 16. Make certain that the oil hole and the set screw hole in the bearing are lined up for their corresponding holes in the casting so that when the bearing is finally in place the holes in the bearing will coincide with those in the casting. Draw the new bearing into place by tightening nut A-1. In the same manner install the middle bearing as shown in Fig. 17 using the tool assembled as shown in the figure. Install the right hand bearing using the tool assembled as shown in Fig. 18. Insert the bearing holding screws. By means of the line reamer AR-9, line ream the new bearings to insure a running fit for cam shaft. Make sure that all metal particles from the reaming are cleaned out and that none have lodged in the oil holes.

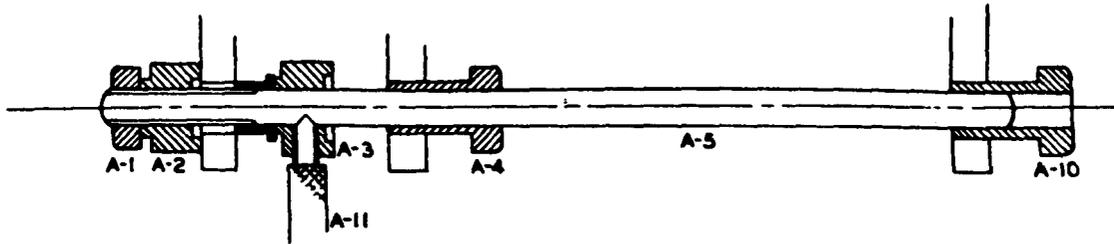


Fig. 16

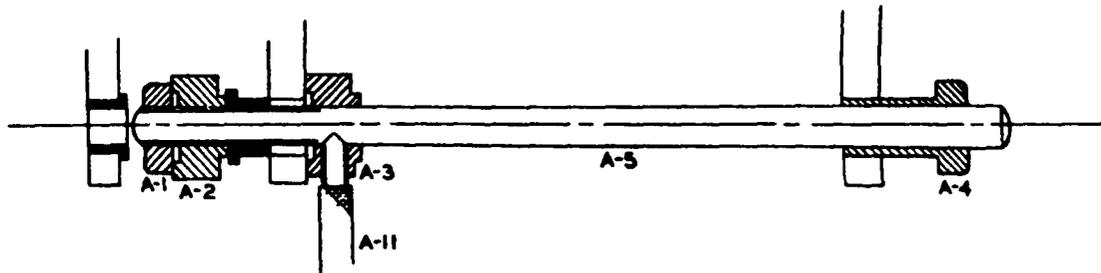


Fig. 17

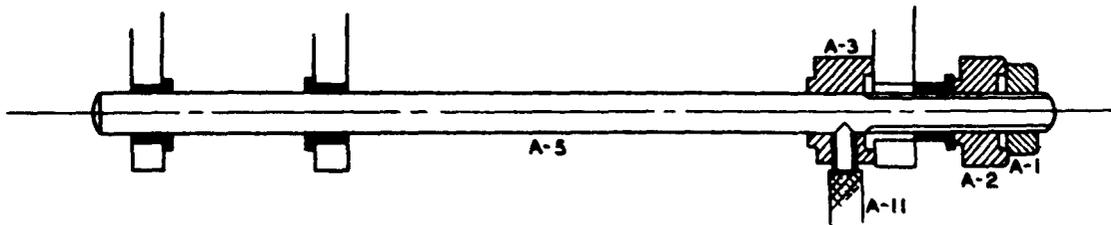


Fig. 18

(4) Bearings in Secondary Gear Support Casting:

Loosen the set screws of gear (Std. 3270-A-100) and gear (Std. 3270-A-99). Slide the shaft out to the right. Remove the bearing holding screws (located underneath the bearing). Remove the bearings by means of the bearing removal tool shown in Fig. 15. The three parts of this tool are marked R-1-A, R-1-B and R-1-C. Assemble them in the bearing as shown so that when nut R-1-A is tightened the bearing will be pushed into the recess of R-1-B.

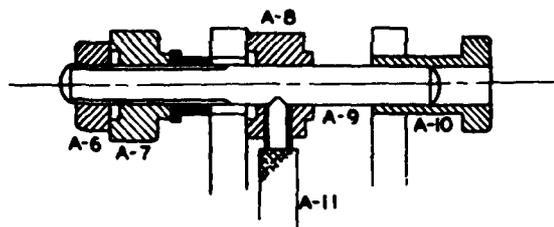


Fig. 19

(5) To insert new bearings use the tool assembly shown in Fig. 19. Part A-11 is inserted into part A-8 and tightened so that its point goes into the conical spot in A-9. Make certain that the oil hole and the set screw hole in the bearing are lined up for their corresponding holes in the casting so that when the bearing is finally in place the holes in the bearing will coincide with those in the casting. Force the new bearing into place by tightening nut A-6. Insert the bearing holding screws.

(6) Insert the shaft in the new bearings and see if the shaft turns easily. If it binds then the bearings should be line reamed using the AR-9 reamer. It will be necessary to loosen the two screws which hold the two castings together and to move the castings far enough apart so that the reamer is not blocked by the tell tale casting. Take care not to lose any shims that may be between the two castings. After reaming make certain that all metal particles are cleaned out and that none have lodged in the oil holes. Final tightening of the two screws holding the castings together should be left till later, paragraph (12).

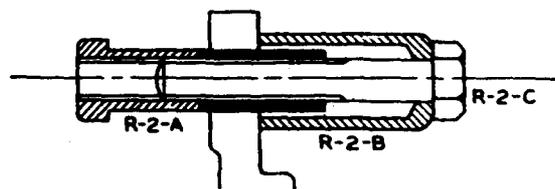


Fig. 20

(7) **Tell Tale Shaft Bearing:** Remove the tell tale shaft bearing by means of the bearing removal tool shown in Fig. 20. The three parts of this tool are marked R-2-A, R-2-B and R-2-C. Assemble them in the bearing as shown so that when nut R-2-A is tightened the bearing will be pushed into the recess of R-2-B.

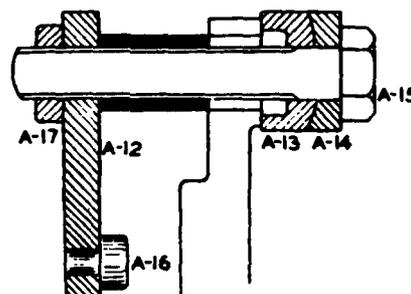


Fig. 21

(8) To insert a new tell tale shaft bearing use the tool assembly as shown in Fig. 21. The parts to this tool assembly are marked A-12 to A-17 inclusive. Make certain that the oil hole in the bearing is lined up for the corresponding oil hole in the casting so that when the bearing is finally in place the hole in the bearing will coincide with the hole in the casting. Force the new bearing into place by tightening the A-17 nut until the .005" gauge (75D) is a slide fit between the A-16 button and the casting.

(9) Insert the tell tale shaft in the new bearing and see if it turns easily. If it binds the bearing should be reamed using the AR-6 reamer. Care should be exercised when reaming this bearing that the reamer is held straight and in line with the center line of the bearing. If the reaming is out of line it will

cause the tell tale shaft to be out of line and the gears on it will not mesh properly with the other gears. After reaming make certain that all metal particles are cleaned out and that none have lodged in the oil hole.

(10) **Aligning Tell Tale Shaft and Secondary Gear Shaft:** Insert the secondary gear shaft in its bearings holding the Std. 3270-A-100 gear in position so the shaft slides through it. Mount the Std. 3270-A-99 gear in position on the shaft. Tighten the set screws of both gears. Check that the shaft turns freely and without excessive end play. If it doesn't turn freely it may be that the hub of the Std. 3270-A-99 gear is rubbing against the edge of the bearing, or the collar at the right end or the shaft may be rubbing against the bearing at that end. Shift the position of the gear or the collar slightly to overcome this.

(11) Insert the tell tale shaft in its bearing, mount the Std. 3270-D-14 gear on it and tighten the set screw of the gear. Check that the shaft turns freely. If it doesn't turn freely it may be that the hub of the gear is up against the edge of the bearing too tightly. Shift the position of the gear on the shaft slightly to overcome this.

(12) Any shims that fell out from between the tell tale casting and the secondary gear support casting in (6) should be reinserted now. Tighten up slowly on the two screws holding these two castings together, and while doing this shift the position of the secondary gear support casting as necessary to obtain proper meshing of the tell tale pinion gear with the Std. 3270-A-99 gear. When the two castings are securely fastened together the gears should turn smoothly without binding. If there is any bind loosen slightly the two casting holding screws and shift the position of the secondary gear support casting a small amount as necessary to overcome the bind and then tighten the screws securely. It may be necessary to add a thin shim between the two castings.

(13) The Std. 3270-D-14 gear and the tell tale shaft must be removed from the tell tale casting before the casting can be mounted on the controller, but do not mount it at this time as the cam shaft has to go in place first.

(14) **Tell Tale Shaft Bearing for Early Model of Controller where Bearing is in Main Frame Casting:** To remove a tell tale shaft bearing from the main frame casting use the bearing removal tool shown in Fig. 22. The three parts of this tool assembly are marked AR-1, AR-2 and AR-4. Assemble them in the bearing as shown so that when AR-2 is tightened the bearing will be drawn into the recess of AR-2.

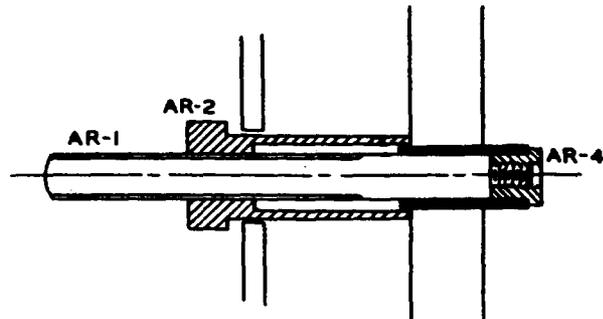


Fig. 22

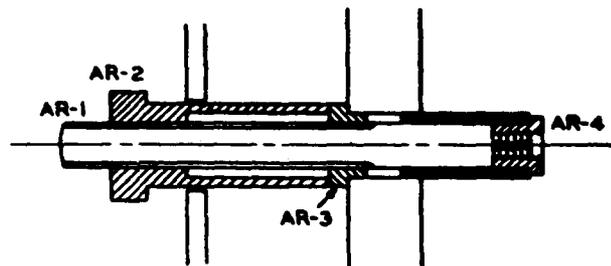


Fig. 23

(15) To insert a new tell tale shaft bearing in the main frame casting use the tool assembly shown in Fig. 23. The parts to this tool assembly are marked AR-1, AR-2, AR-3 and AR-4. Make certain that the oil hole in the bearing is lined up for the corresponding oil hole in the casting so that when the bearing is finally in place the hole in the bearing will coincide with the hole in the casting. Start the new bearing into place by tightening the AR-2 nut. Remove the AR-3 collar after the bearing has been started. Then with the AR-3 collar removed, force the bearing into place by tightening the AR-2 nut. Use the AR-5 gauge block to obtain the 3/4-inch spacing in Fig. 24.

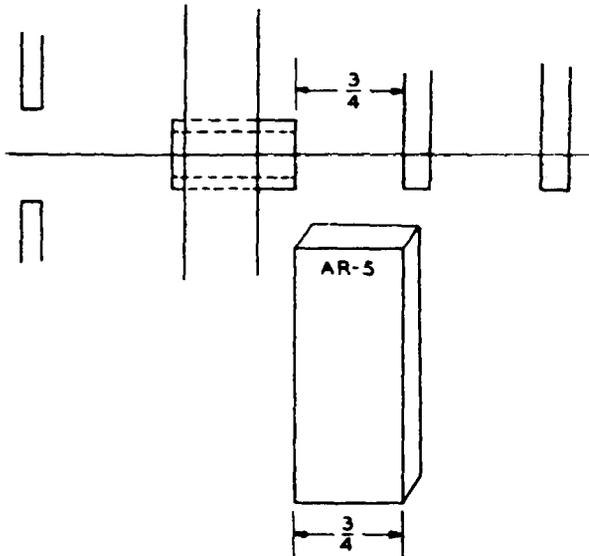


Fig. 24

(16) Insert the tell tale shaft in the new bearing and see if it turns easily. If it binds the bearing should be reamed using the AR-6 reamer. Care should be exercised when reaming this bearing that the reamer is held straight and in line with the center line of the bearing. If the reaming is out of line it will cause the tell tale shaft to be out of line and the gears on it will not mesh properly with the other gears. After reaming make certain that all metal particles are cleaned out and that none have lodged in the oil hole. The secondary gear support casting should not be mounted in position at this time as the cam shaft has to go in place first.

(17) **Reassembly:** Insert the cam shaft in its bearings sliding it in from the right. After the end of the shaft has been passed through the right-hand bearing, slide onto it the right-hand sweep cam, then the operating cam and then the left-hand sweep cam. After the shaft has been passed through the middle bearing slide onto it the spur gear Std. 3270-A-70. Fasten the operating cam in position on the cam shaft by means of its holding screw. Fasten both sweep cams on the shaft by means of their set screws and adjust position of them as covered in Section 024-330-701. Tighten the set screw for the Std. 3270-A-70 spur gear.

(18) The tell tale casting and the secondary gear support casting were aligned and fastened together previously and should now be remounted in position as a unit. Remount the tell tale casting in position by means of its three mounting screws but leave the final tightening up of these screws till later. Insert the tell tale shaft through the circular window and into its bearing. Hold the worm gear Std. 3270-D-14 so that it slides onto the shaft as the shaft is pushed on through into position. Make certain that the pinion gear end of the shaft meshes properly with the Std. 3270-A-99 spur gear. Also make certain that the worm gear Std. 3270-D-14 meshes properly with the worm on the motor shaft. Tighten the three mounting screws of the tell tale casting. Remount the small circular glass window and frame on front of door. Remount balancing mechanism as described in 3.06.

(19) **For the early model of controller** (having no tell tale casting because tell tale shaft bearing is in main frame) the secondary gear support casting should now be remounted in position. Leave the final tightening up of the mounting screws till later. Insert the tell tale shaft through the circular window and into its bearing. Hold the worm gear Std. 3270-D-14 so that it slides onto the shaft as the shaft is pushed on through into position. Make certain that the pinion gear end of the shaft meshes properly with the Std. 3270-A-99 spur gear. Also make certain that the worm gear Std. 3270-D-14 meshes properly with the worm on the motor shaft. Tighten the mounting screws of the secondary gear support casting. Remount the small circular glass window and frame on front of door. Remount balancing mechanism as described in 3.06.

3.13 Replacement of Galvanometer Suspension Strips

- (1) **Care should be taken in working with the galvanometer to insure that the small parts are not strained and that everything is kept clean.**
- (2) Stop the controller as described in paragraph 3.04.
- (3) Remove the galvanometer as follows: Disconnect the galvanometer leads at their screw terminals. Remove the galvanometer

clamping nut (Fig. 25). Loosen the galvanometer clamp screw and loosen the stationary clamp clamping nuts. Slowly lift out the galvanometer by the lug on the left-hand side.

(4) Loosen the stationary clamp mounting screw using the 3-1/2-inch screwdriver, and remove the stationary clamp from the galvanometer.

(5) To replace a broken suspension strip proceed as follows: Hold the suspension binding post with the pair of tweezers and using the size 5 watchmakers screwdriver, loosen the small suspension binding screws (A) (A') or (F) (F'), (Fig. 26) and remove the broken parts. At the base of each of the flat springs (B) and (G) which serve to support and put tension on the galvanometer system, is located a screw (C) or (H) for adjusting the tension. Using the size 3 watchmakers screwdriver, turn the screw (C) or (H) on

the spring associated with the suspension strip to be installed, in the direction which would normally reduce the tension and insert the new suspension strip. Be sure that the soldered joints are on top and that the suspension strip is not twisted. Tighten the suspension binding post screws and adjust the suspension tension as follows:

(6) The tension in the galvanometer suspension should be such that there is no appreciable sag in it, when the galvanometer is laid in a horizontal position. The tension is increased by turning the tension screws (C) and (H) in a counterclockwise direction, using the size 3 watchmakers screwdriver, and is decreased by turning the screws in a clockwise direction. A very fine adjustment is required as one-eighth of a turn causes a large change in tension when the suspension is nearly taut. Care should be taken that the tension

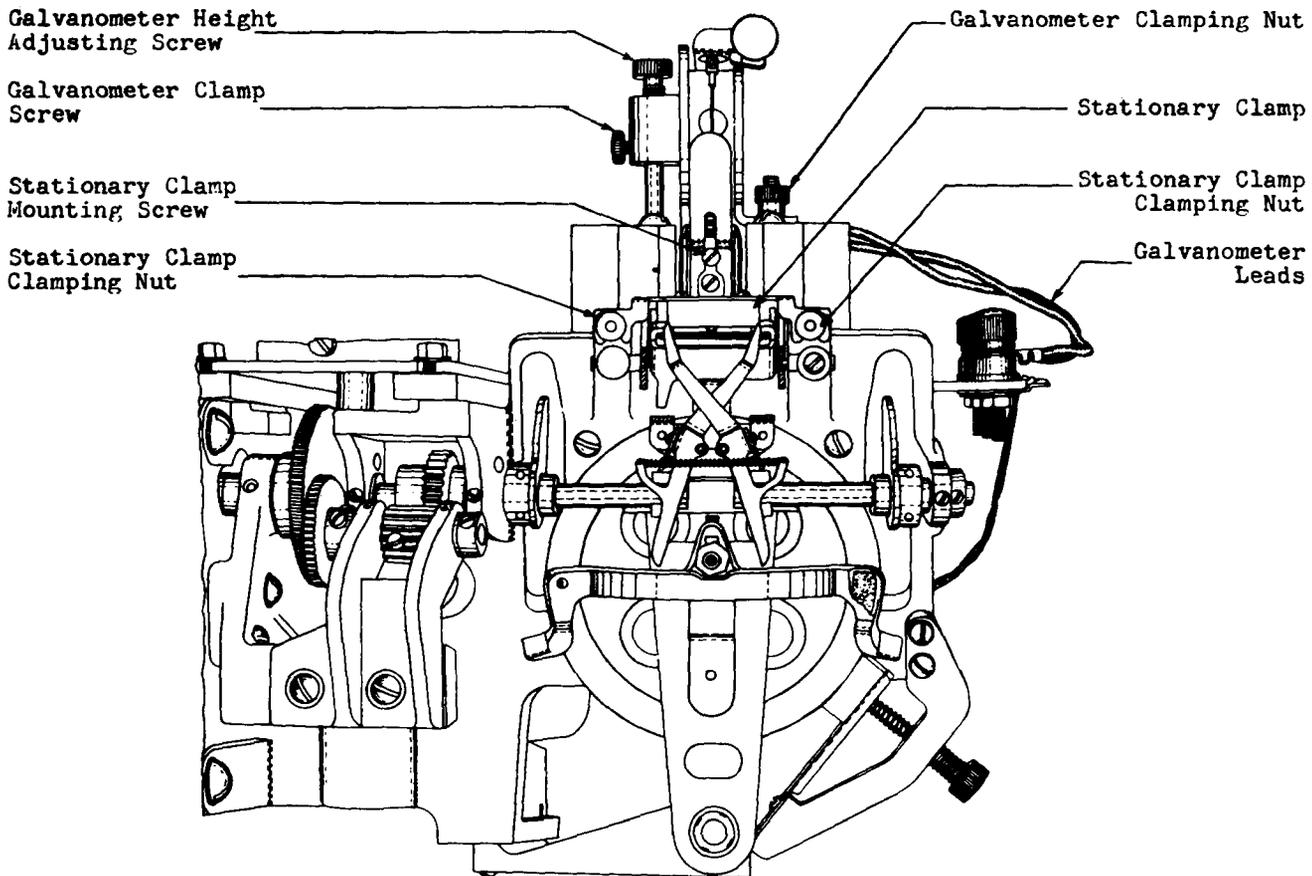


Fig. 25 - Controller Mechanism

put on the system is not too great as this will break the suspension strip. If the suspension tension is not correct the pointer may vibrate excessively when the galvanometer system is in place in the controller. Usually the remedy for this is to increase the tension slightly.

(7) Before remounting the galvanometer the stationary clamp should be remounted. Place the support for the clamp on the galvanometer core and tighten the stationary clamp mounting screw so that the edges of the support clamped under the screw are parallel to the edges of the galvanometer moulding.

(8) To remount the galvanometer proceed as follows: Be sure that the straight edges of the sweep cams extend vertically upward so that they will be out of the way while the galvanometer is being remounted. Turn the galvanometer height adjusting screw (Fig. 25) in as far as it will go. Slide the galvanometer down along its guide rods. Unscrew the galvanometer height adjusting screw until the galvanometer pointer just clears the rocker arm clamping wires for a full deflection in either direction. Push the stationary clamp down as far as it will go and secure it in this position by tightening the stationary clamp clamping nuts. Raise or lower the galvanometer system by means of the galvanometer height adjusting screw until the pointer is centered between the stationary clamp and the clamping wires. Tighten the galvanometer

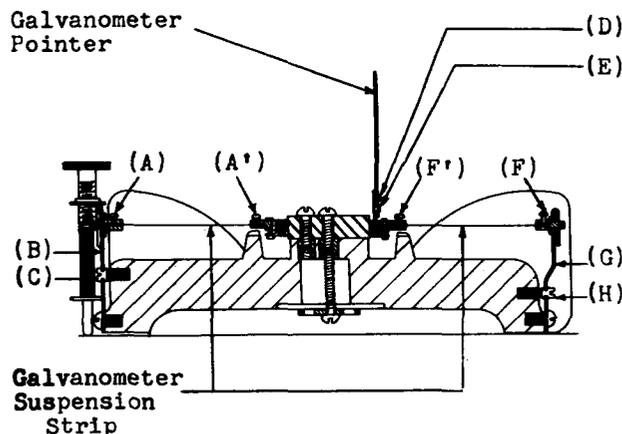


Fig. 26

clamp screw and remount the galvanometer clamping nut turning it down until it just touches the lug. Care shall be taken that this nut is not tightened against the lug as this will throw the galvanometer system out of alignment. Connect the galvanometer leads to their proper terminals. If the leads are reversed the controller will work away from balance instead of toward it.

3.14 Replacement of Galvanometer Pointer

- (1) Care should be taken in working with the galvanometer to insure that the small parts are not strained and that everything is kept clean.
- (2) Stop the controller as described in paragraph 3.04.
- (3) Remove the galvanometer as follows: Disconnect the galvanometer leads at their screw terminals. Remove the galvanometer clamping nut (Fig. 25). Loosen the galvanometer clamp screw and loosen the stationary clamp clamping nuts. Slowly lift out the galvanometer by the lug on the left-hand side.
- (4) Loosen the stationary clamp mounting screw using the 3-1/2-inch screwdriver, and remove the stationary clamp from the galvanometer.
- (5) To replace the galvanometer pointer proceed as follows: Release the tension on the suspension by turning in screw (H) (Fig. 26), using the size 3 watchmakers screwdriver. Hold the galvanometer with the flat back of the moulding against the palm of one hand. Extend the thumb and fingers around the moulding and hold the coil. Carefully loosen screw (E) and remove screw (D), using the size 5 watchmakers screwdriver. Remove the pointer by sliding it away from the coil. Mount the new pointer by sliding the slot in the end of the pointer under the loosened screw (E). Remount screw (D) and tighten both screws only sufficiently to lightly clamp the pointer. Adjust the pointer so that it is at right angles to the plane of the coil and tighten both screws. Adjust the suspension tension as described in paragraph 3.13 (6). Remount the galvanometer as described in 3.13 (7) and (8).