

CONTACT MAKING AMPERE-HOUR METERS

1. GENERAL

1.01 This section covers KS-5098 and KS-5098-01 contact making ampere-hour meters manufactured by the Sangamo Electric Company.

1.02 It is reissued to include new ordering information for the rheostats used in testing the meters and to bring it up-to-date. Significant changes are marked by arrows.

1.03 Reference shall be made to Section A400.001 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.

1.04 Requirements and associated procedures marked with a number sign (#) need not be checked by the installer unless it is thought that the requirement is not being met or performance indicates that such a check is advisable.

1.05 Requirements and associated procedures marked with an asterisk (*) need not be checked during maintenance unless the apparatus or part is made accessible for other reasons, or performance indicates that such a check is advisable.

1.06 No adjustments shall be made on these meters without authorization from the supervisor.

2. REQUIREMENTS

2.01 General Condition: The case shall be in good mechanical condition and securely fastened to the meter. The glass shall be undamaged and securely fastened. It shall be dust-tight.

2.02 Mounting: The meter shall be securely mounted with its base in a vertical plane with the top edge of the base approximately level. Use level.

*2.03 Direction of Rotation: The meter shall be so connected that the counterweight rotates in a clockwise direction as viewed from above, or from right to left as viewed from the front when discharge current is flowing.

2.04 Accuracy

(a) With its associated shunt connected normally, the speed of the meter on discharge shall be:

Per Cent of Rated Load	Number of Revolutions	Seconds	
		Min.	Max.
100	30	57	63
150	45	57	63
<u>Except the 10 ampere meter</u>			
5	3	-	131
<u>For the 10 ampere meter only</u>			
2.5	2	-	173

(b) With the lowest value of load specified in (a) above, and the meter rotating counterclockwise as viewed from above, it shall rotate slower than when tested with the same load with rotation clockwise. Observe the counterweight, and use the stop watch and test circuit.

2.05 Start, Stop and Alarm Contacts shall be clean and smooth, and shall make reliable contact. Gauge by eye and by the action of associated relays.

2.06 Pointer: The pointer shall be so placed, that when the battery is fully charged, it is in the FULL position.

2.07 Resistor: The resistor shall be so adjusted that the pointer returns to the FULL position when the battery is fully charged.

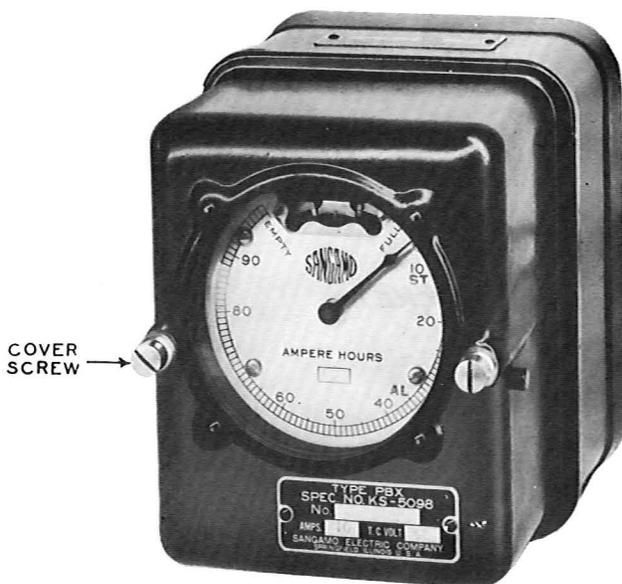
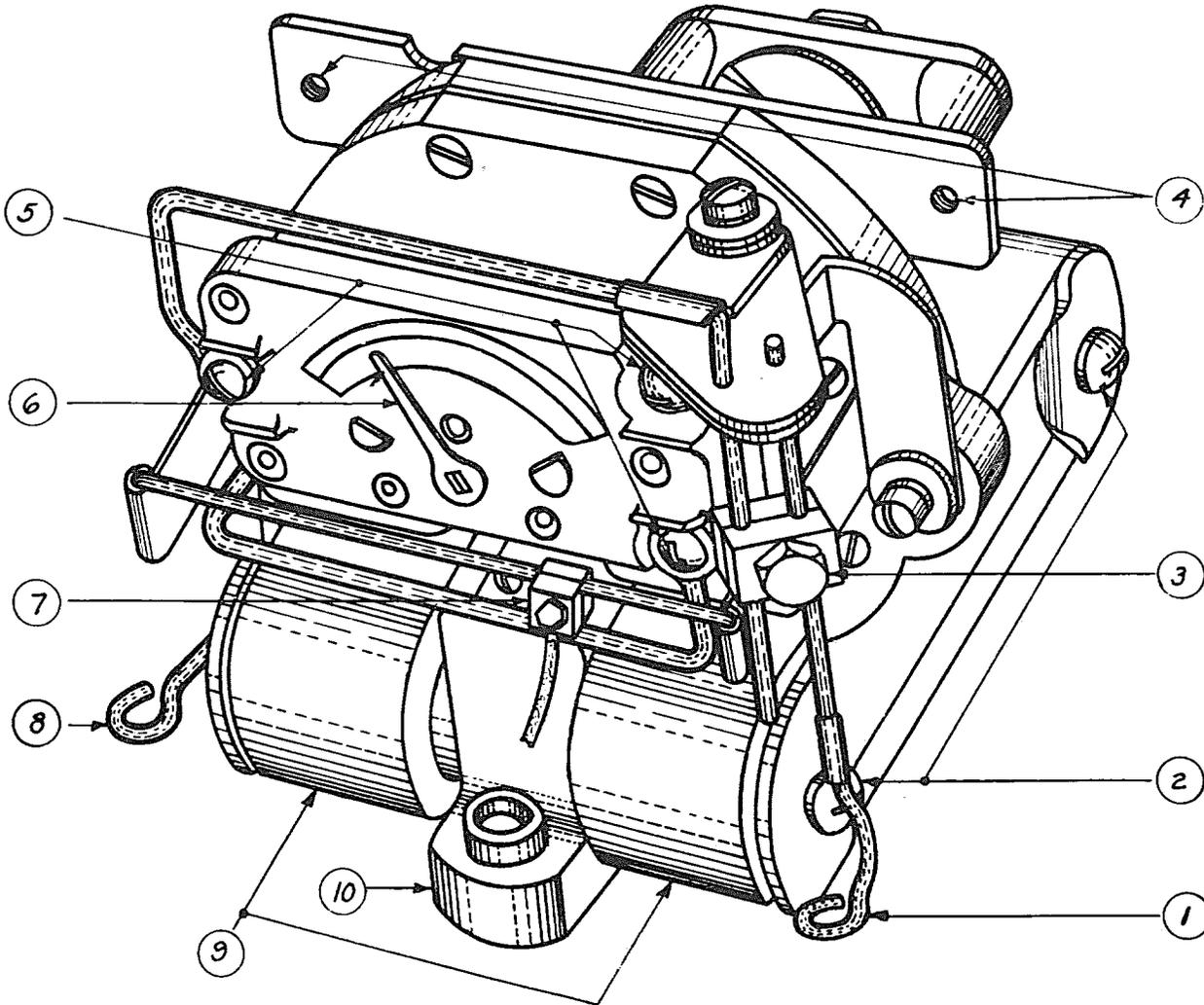
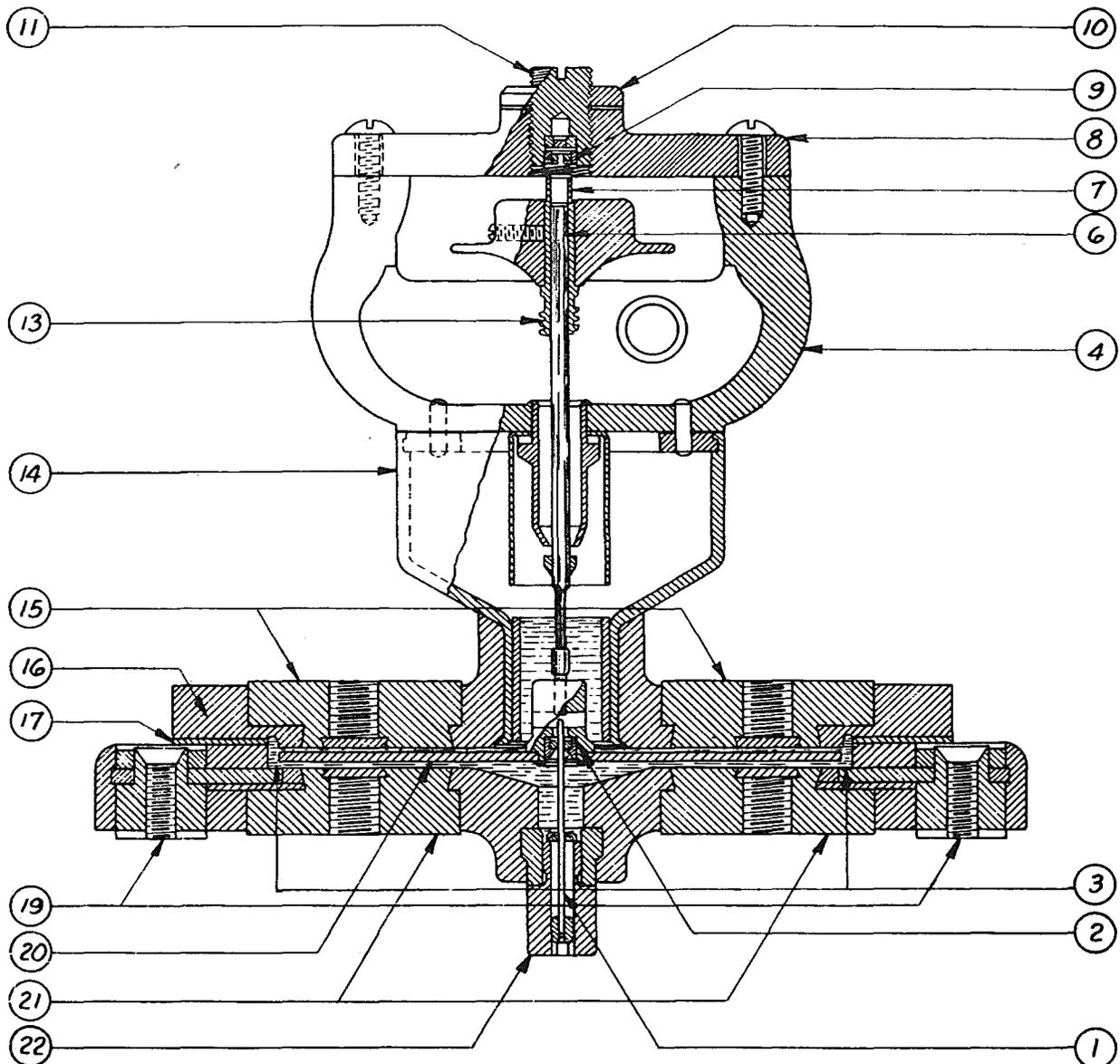


Fig. 1 - Contact Making Ampere-hour Meter



- 1. MAIN NEGATIVE TERMINAL.
- 2. SCREWS HOLDING PERMANENT MAGNETS TO MAIN BRACKET.
- 3. FULL LOAD ADJUSTMENT SLIDER.
- 4. MOUNTING HOLES FOR TRAIN AND DIAL
- 5. CONNECTIONS TO RESISTOR.
- 6. RESISTOR ADJUSTMENT LEVER.
- 7. LIGHT LOAD ADJUSTMENT SLIDER.
- 8. MAIN POSITIVE TERMINAL.
- 9. PERMANENT MAGNETS.
- 10. MAIN BRACKET.

Fig. 2 - Meter Showing Resistor and Adjustment Sliders



1- LOWER PIVOT
 2- LOWER JEWEL GUIDE
 3- CURRENT CONTACT EARS
 4- HOPPER YOKE
 6- STEEL SHAFT
 7- SPINDLE SLEEVE
 8- YOKE BRIDGE
 9- FLAT & RING JEWELS

10- UPPER BEARING SCREW LOCKNUT
 11- UPPER BEARING SCREW
 13- WORM
 14- METAL HOPPER
 15- UPPER MAGNETIC POLE PIECES
 16- UPPER HALF-ARMATURE BOX
 17- PAPER GASKET

19- CURRENT TERMINALS
 20- ROTATING COPPER DISK (ARM
 FLOATING IN MERCURY
 21- LOWER MAGNETIC POLE PIECES
 22- LOWER PIVOT SCREW

Fig. 3 - Motor Unit, Section

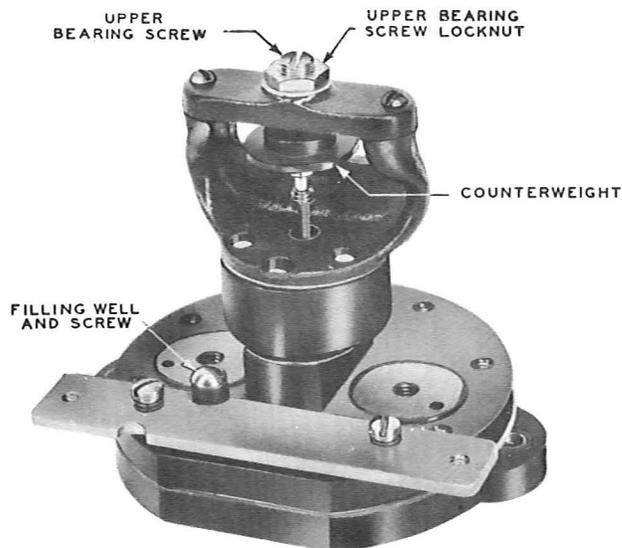


Fig. 4 - Motor Unit, Assembly

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Materials, and Test Apparatus (Equivalents may be substituted)

Tools

Brush, KS-14164
 Burnisher, contact, No. 265C
 Pliers, P-Long nose, 6-1/2"
 Screwdriver, regular, 4"
 Screwdriver, watchmaker's, No. 3
 → Wrench, adjustable, single-end, 6", R-1542

Gauges

Ammeter, d-c, Weston Model 280, ranges 30 amperes or 100 amperes, as required
 Level, metallic, 2-1/2", L.S. Starret Company, No. 135
 Watch, stop, KS-3008

Materials (See Sections A710.011 and A710.012)

Cloth, cleaning, Twill-Jean, D-98063
 Cup, porcelain or glass
 → Keepers, two, soft iron, approximately 1" x 1" x 1/8"
 Mercury, redistilled
 Oil, Nye's watch
 Paper, wrapping

Test Apparatus

Battery, storage, one cell of an ordinary automotive battery, obtained locally
 → Clips, battery, obtained locally as required
 → Rheostat, Allen Bradley, Bul 410, Form WM; No. 438198, size 1/2, 0.25 to 22.5 amperes, or No. 438197, size 5, 1.5 to 75 amperes
 → Wire, as required.

→ 3.002 Test Circuit: Before testing a meter for accuracy, connect a jumper around it to maintain service. Use wire of a size adequate to carry the current. Set up a testing circuit as follows: Disconnect the meter (+) terminal which is normally connected to the load, leaving the (-) terminal connected to the central office battery to provide potential for the thermocouple in the meter. Connect in series, one cell of storage battery, an ammeter of appropriate range, and a suitable rheostat (see 3.003) to the main terminals of the meter. Connect the positive terminal of the test battery to the positive terminal of the meter for rotation in the discharge direction. Use wire of a size adequate to carry the current. Universal test clips, obtained locally, may be used for connection.

3.003 Rheostat: Select in accordance with the current to be used. The Allen-Bradley size 5 is adjustable over a range of 1.5 to 75 amperes and should be used with 30 or 50 ampere meters. The size 1/2 is adjustable over a range of 1/4 to 22.5 amperes and should be used with 10 or 15 ampere meters. In testing a 10-ampere meter at light load it may, in some instances, be necessary to insert additional resistance in the circuit to secure the small current desired. #18 type resistors of 0.5 to 4.0-ohm rating are satisfactory.

3.01 General Condition (Rq. 2.01)

- (1) Replace a damaged case or a broken glass. Retighten cover screws or the screws which hold the glass, as necessary to exclude dust. Adjust or → replace gaskets as necessary.

3.02 Mounting (Rq. 2.02)

- (1) If the top edge of the meter is not level loosen the nuts on the mounting studs and correct. Tighten all nuts firmly after the adjustment has been made.

*3.03 Direction of Rotation (Rq. 2.03)

- (1) If the counterweight rotates in the wrong direction reverse the connections at the main terminals.

3.04 Accuracy (Rq. 2.04)

- (1) Before testing the meter, see that all internal connections, including those at the shunt, are tight. Set up the test circuit as outlined in 3.002 and test at 100%, 150% and light loads in the order named. Light load is 2.5% for 10-ampere meters and 5% for all others.

- (2) Disconnect the light-load adjustment slider and test at light load. If the meter does not run slower than

before, the thermocouple is defective and should be replaced. If no replacement of the thermocouple is indicated, replace the connection without disturbing the adjustment.

(3) Reverse the test leads at the meter in order to reverse the direction of rotation. With the meter rotating in the reverse direction, test at light load. If the speed is the same as for the light load test in the normal direction, clean the armature and the resistor as covered in (7) and (11) and retest, as covered in (12).

Meter Running Slow

(4) Remove the gear train by taking out the screws holding it to the meter. Hold the worm on the spindle sleeve between the thumb and first finger and rotate the armature slowly. Friction will be apparent if the armature is rubbing against the top or bottom of the armature box. If it binds, loosen the locknut and while rotating the armature slowly, turn the upper bearing screw until the armature bottoms lightly in the chamber. Then turn the screw back, one-half to three-quarters of a full turn and tighten the locknut. The armature should now turn freely and it should be possible to force it down about $1/64$ " (visual check) before it strikes the bottom of the chamber.

(5) Test the meter with the gear train off. If it now registers within the requirement, or nearly so, the gear train is at fault. Inspect the gear train for dust and dirt and clean it with the brush. Examine the contacts as covered in paragraph 3.05. Remount the gear train on the meter and retest on light load. If the meter nearly meets the requirement, endeavor to correct, by moving the light load adjustment slider to the right to increase the speed. If it is found impossible to bring up the speed sufficiently by this means replace the gear train with a new one having the same ratio. Reuse the old dial and pointer, if in good condition. After mounting a new gear train adjust the light load speed by means of the light load adjustment.

(6) If the meter runs too slowly when tested on light load with the gear train off, inspect the upper jewels and pivot. This may be done by removing the screws holding the yoke bridge to the yoke and lifting off the bridge together with the upper bearing screw and locknut. If the jewels or pivot are damaged they shall be replaced. Pivots shall be replaced when jewels require replacement and vice versa. Readjust the moving element as outlined in (4) and test the meter on light load. If the meter still

runs slowly or if the jewels and pivot were in good condition, it will be necessary to clean the armature and the chamber in which it operates.

(7) To clean the armature, disconnect the colored leads, remove the screws holding the leads to the main terminals in the base, take out the two large screws holding the main bracket, and remove the meter from its base. Disconnect the leads from the current terminals on the lower side of the armature box and remove the screws holding the resistor in position. Lift the resistor out and remove the large iron screws holding the magnet tips to the pole pieces in the motor unit. Lift out the motor unit and place a keeper across the air gap of each magnet, to be left in place until the unit is again installed. Save the shims found between the lower magnet tips and pole pieces, noting their positions so that they may be replaced as found.

(8) Remove the yoke bridge by taking out the two screws holding it to the yoke. Remove the counterweight by one of the following methods, depending on the design. Loosen the screw in the counterweight or hold the spindle sleeve with pliers and unscrew the counterweight by turning in a counterclockwise direction. Lift the spindle sleeve from the steel shaft. Dismantle the hopper yoke by removing the screws holding it to the top of the metal hopper. Remove the screw in the filling well and pour the mercury into a clean glass or porcelain cup. Then remove the screws holding the halves of the armature box together. Separate the halves of the armature box to obtain access to the armature chamber, taking care not to damage the paper gasket, and remove the armature. Wipe out the chamber and clean the armature with a cleaning cloth, making certain that the contact ears are bright. Clean the flat and ring jewels with the brush. See that no foreign material is left in these bearings or elsewhere in the chamber. Take care not to damage the pivots, the steel shaft or the armature. The lower pivot and pivot screw may be removed for inspection. Replace them as a unit if the pivot is bent or damaged.

(9) If the old mercury is to be reused, clean it by making a cone from clean wrapping paper, having a hole the size of a pin point at the bottom, and pouring the mercury into the cone and catching it in a clean porcelain or glass cup. The mercury will run out in a fine stream from the bottom and the dross will adhere to the sides of the cone. Repeat the operation two or three times, using a new cone each time in order to make certain that the mercury is clean. If, after two or three operations, the

mercury appears greasy or muddy replace it. In some areas it is considered preferable, in all cases, to use new mercury, instead of cleaning and re-using the old. The mercury shall never be placed in any receptacle except porcelain or glass as it may become contaminated.

(10) After all parts have been thoroughly cleaned and any defective parts replaced, screw the lower pivot firmly into the lower half of the armature box. Place the armature in position over the pivot and put on the upper half of the armature box, making sure that the paper gasket is not damaged. Tighten the holding screws, with a lock washer under each, and pour the new or cleaned mercury in through the filling well until it comes to the top of the well. Replace the filling well screw, the hopper yoke, spindle sleeve and counterweight. If the upper bearing screw is still in the yoke bridge, remove it and put the bridge on the yoke. Place a trace of watch oil on the upper pivot for lubrication purposes and put in the upper bearing screw. Adjust the rotating element as outlined in (4).

(11) When it is necessary to clean the armature, clean the resistor also. Remove the bearing screw in the top of the resistor box and pour out the mercury into a clean glass or porcelain cup. Remove the screws holding the halves of the resistor box and lift off the top. Remove the resistor armature and wipe it off with a brush or cleaning cloth. Wipe out the armature chamber and clean the pivot bearing. Clean the mercury as outlined in (9) or obtain new mercury, and reassemble the resistor in the reverse order. See that no foreign matter is left in the resistor and take care that the paper gasket is properly placed and not damaged.

(12) After the meter has been reassembled, make the following tests. Test the meter for 100% load. If it is not within the limits, move the full-load adjustment slider of the meter as necessary. Moving the adjustment slider toward the rear of the meter will increase the speed. Then test with 150% load. If it is not within limits, it will be necessary to readjust the full-load slider until both the 100% and 150% load requirements are met with the same setting of the slider. Then test the meter for the 5% load requirement or, if the meter is a 10-ampere meter, test with a current of 0.25 ampere. The light load adjustment slider may be moved to the right or left to bring the meter within the desired limits at light load. Moving the slider to the right will increase the speed of the meter on light loads. After making the light load adjustment, check the 100% and 150% requirements to see that

their limits are not exceeded as a result of the change in the light load adjustment.

Note: In installations where, for an appreciable part of the time, the office load is small as compared with the rating of the meter, and undercharging of the battery is being experienced as a result, it is recommended that the light load adjustment slider of the meter be moved to the right as far as possible, and left permanently in this position. This will increase the registration slightly, which is particularly desirable at very light loads. In some cases this will cause the meter to creep at no load which is not objectionable in instances where, without the above adjustment, the battery is receiving insufficient charge.

Meter Running Fast

(13) Recheck the connections to the resistor and clean the contact surfaces, if required. If the meter continues to run too fast, correct by moving the full load adjustment slider toward the front of the meter. If this fails, replace the permanent magnets with new ones having the same marked strength as the original.

3.05 Start, Stop, and Alarm Contacts (Rq.2.05)

(1) As required, remove dirt from the contacts with the brush or a cleaning cloth and smooth them with the contact burnisher. If they do not make reliable contact adjust, as covered below.

(2) The movable contact on the type of contact mechanism shown in Fig. 5, and the movable alarm contact on the type shown in Fig. 6 may be adjusted for reliable operation by shaping the contact spring. No other adjustments are feasible and, if difficulties arise replace the entire gear train, including the contact mechanism with one of the type shown in Fig. 6 and having the same gear ratio.

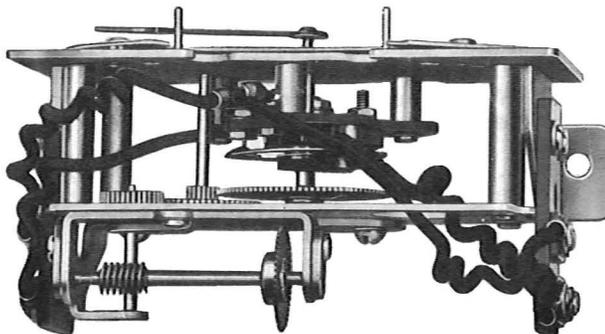


Fig. 5 - Gear Train With One Movable Contact

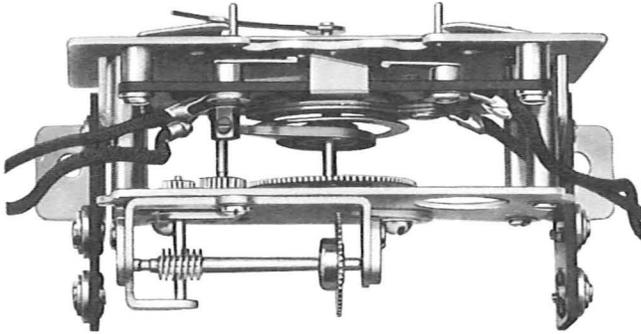


Fig. 6 - Gear Train With Two
Movable Contacts

3.06 Pointer (Rq. 2.06)

(1) To change the position of the pointer, remove the cover from the meter, adjust the pointer, as required, with the fingers and replace the cover.

3.07 Resistor (Rq. 2.07)

(1) If, during maintenance the pointer consistently returns to the full position before the battery is fully charged, move the resistor adjustment to the left when viewed from the bottom of the meter. If the pointer consistently fails to return to the full position when the battery is fully charged, move the resistor adjustment to the right when viewed from the bottom of the meter.

Bell Telephone Laboratories, Inc.