

MAINTENANCE OF AUTOMATIC ELECTRIC CO. DIALS AT SUBSTATIONS

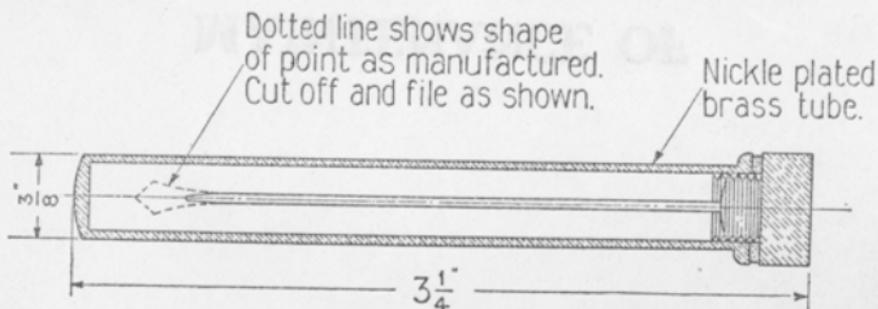
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TOOLS AND REPAIR PARTS

1. The tools and repair parts required by these specifications, for use at substations, are given below in alphabetical order.

- Brush:** **THREE-EIGHTH INCH FLAT, BRISTLE, BANNER BRUSH.** Used for cleaning worm and pinion gear.
- Backing:** **CARDBOARD BACKING.** Placed under instruction card of dial with new type ratchet.
- Carrying Case:** **#4-A DIAL CARRYING CASE.** Used for carrying dials to and from substations.
- Dial:** Standard A.E. Co. dial used.
- Escutcheon:** Used for holding instruction card and card cover to front of dial.
- Finger Stop:** **STANDARD FINGER STOP,** for A.E. Co. dial.
- Instruction Card:** **CIRCULAR CARD WITH HOLE IN CENTER.** Used with A.E. Co. dials.
- Instruction Card Cover:** **CIRCULAR CELLULOID COVER.** Used to protect instruction cards from soiling.
- Nut:** **NUT FOR SCREW HOLDING ADAPTER TO STAND OR SET.** 4-36, hexagonal, nickel plated.
- Oil Can:** **ONE DROP OIL CAN,** modified as below:



- Oil:** **WATCH OIL:** Used for oiling governor worm.

- Ratchet Block:** Used with new type ratchet.
- Ratchet Spring:** Bronze. Used with new type ratchet.
- Screws:** **ESCUTCHEON SCREW:** ~~5-32~~ round head, nickel plated brass, 1/8 inch long, used for holding escutcheon to front of dial.
- SCREW HOLDING ADAPTER TO STAND OR SET.** 4-36, round head, nickel plated brass, 5/16 inch long.
- SCREW HOLDING DIAL TO ADAPTER OR A.E. CO. DESK STAND.** ~~5-32~~ round head, nickel plated brass, 3/16 inch long.
- FINGER STOP SCREW.** ~~5-32~~, round head, nickel plated brass, 1/8 inch long. Used for holding finger stop to dial.
- Screw Driver:** **STARRETT #552.** Used with screw holding dial to adapter on W.E. Co. wall sets.
- Tool:** **#270 DIAL ADJUSTING TOOL.** Used for adjusting governor wings and contact springs.
- Washer:** **SPRING WASHER.** 7/32 inch—1/8 inch—.033 inch. Used under nut holding adapter to stand or set.

CORRECTIONS:

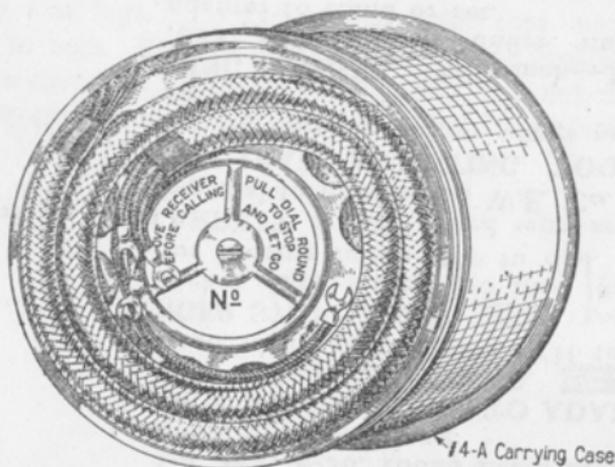
The #272 dial adjusting tool should be used in place of the #270 tool specified on this and other pages. Starrett #552 screw driver should be #552-A.

GENERAL

2. Whenever a machine switching substation is visited for any reason, inspect and repair external parts of dial according to these specifications. To make certain that dial is operating satisfactorily, always test dial (See Section 18) with test desk whether or not any repair or adjustment is required. If test shows dial speed not between 8 and 11 pulses per second or dial not operating satisfactorily, inspect and adjust internal parts of dial according to Section 9 to 18 and replace dial if necessary. When changing dials do not leave spring assembly of old dial in place but change the whole dial. Do not replace any internal parts of dials with parts of other dials.

Work only in good light. Do not use pliers in place of screw driver or other tools. When tightening small screws, take care to see that threads are not stripped by forcing screw.

Carry dial in #4-A Carrying Case. See that cord is coiled up on the face of dial; not at back of dial.



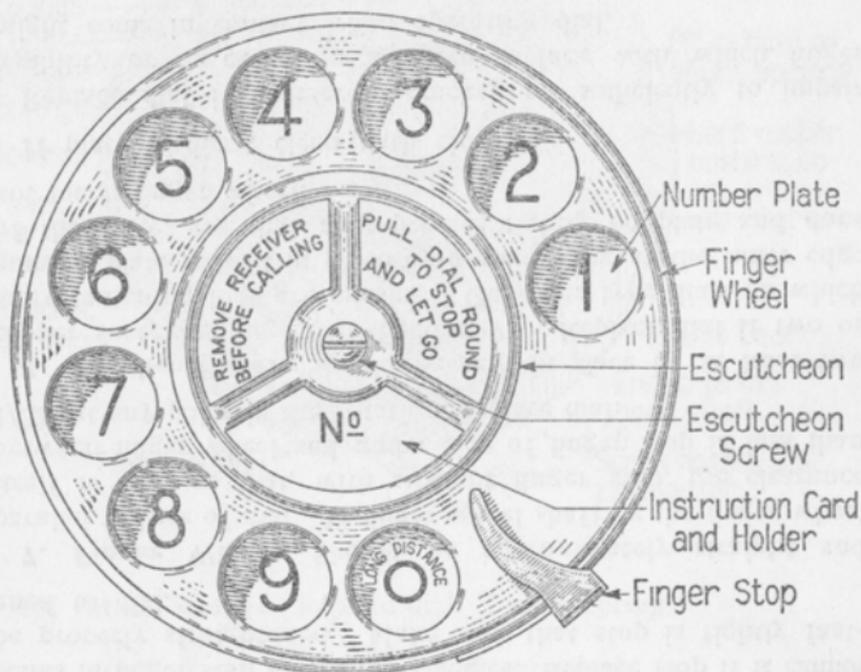
When cord is coiled up as above, it serves to protect dial from injury. When dial is used with an A.E. Co. desk stand, short wires are used in place of cord. In this case, a disc of felt or double-faced corrugated cardboard should be placed upon dial to serve as a pad.

INSPECTION OF EXTERNAL PARTS

3. Loose Dial. If a dial is loose in adapter or A.E. Co's. desk stand, tighten screw which holds it to adapter or stand. Do not use screw longer than $3/16''$ as it will strike teeth of pinion gear. For dials on wall sets, Starrett No. 552 screw driver may be used for this screw. With Western Electric wall sets, screw will be made more accessible by removing transmitter.

If adapter is loose, tighten screws which hold it in place. If any screws are missing, replace with proper screws.

4. External Parts:



5. Instruction Card and Escutcheon: See that escutcheon and instruction card are placed as shown in Section 4 and that card is protected by celluloid cover. Be sure that station number on card is correct. Replace card if damaged or dirty. Replace celluloid if so badly scratched that instruction card is not legible. Straighten escutcheon if necessary or replace with new one. See that escutcheon screw is tight.

INSPECTION OF EXTERNAL PARTS.

6. Finger Stop: A bent finger stop touching the finger wheel will cause a slow dial. See that there is at least $1/32''$ clearance between the stop and the finger wheel.

If the finger stop is bent remove and shape with pliers, using smooth jaw pliers to avoid damaging surface. See that both bends in finger stop are at right angles. Replace stop if it cannot be properly straightened. Make sure that stop is tightly fastened to dial.

7. Finger Wheel: Should be approximately straight and parallel to base of dial. If finger wheel shaft or the finger wheel itself is bent so that, with straight finger stop, the clearance between finger wheel and under side of finger stop is less than $1/32''$ at any point in the rotation, replace dial.

8. Number Plate: Should be held in place by at least two copper fastening lugs (see Section 9). Replace dial if two or more fastening lugs are missing. On older type dials on which number plate is held in place by a metal ring at the inner edge of the plate, see that ring presses tightly on plate and does not touch finger wheel.

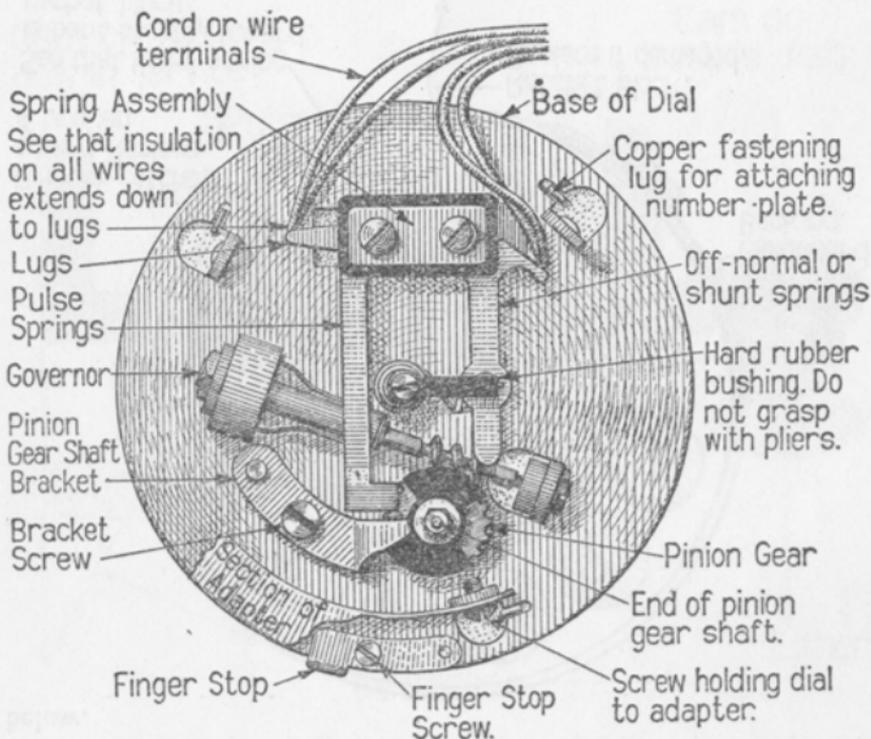
If plate is dirty, clean with cloth.

Replace dial if enamel is cracked off sufficiently to impair legibility or to cause an abrasive surface with which finger might come in contact when operating dial.

NOTE: New dials in the future may have screws for holding number plate. In this case any missing screws should be replaced.

INSPECTION AND ADJUSTMENT OF INTERNAL PARTS

9. Internal Parts: (102-A dial shown).



10. Main Spring: Replace dial, if main spring:

- (a) Is broken.
- (b) Fixed end of spring is unhooked.
- (c) Spring is weak causing slow dial. (see Section 18.)

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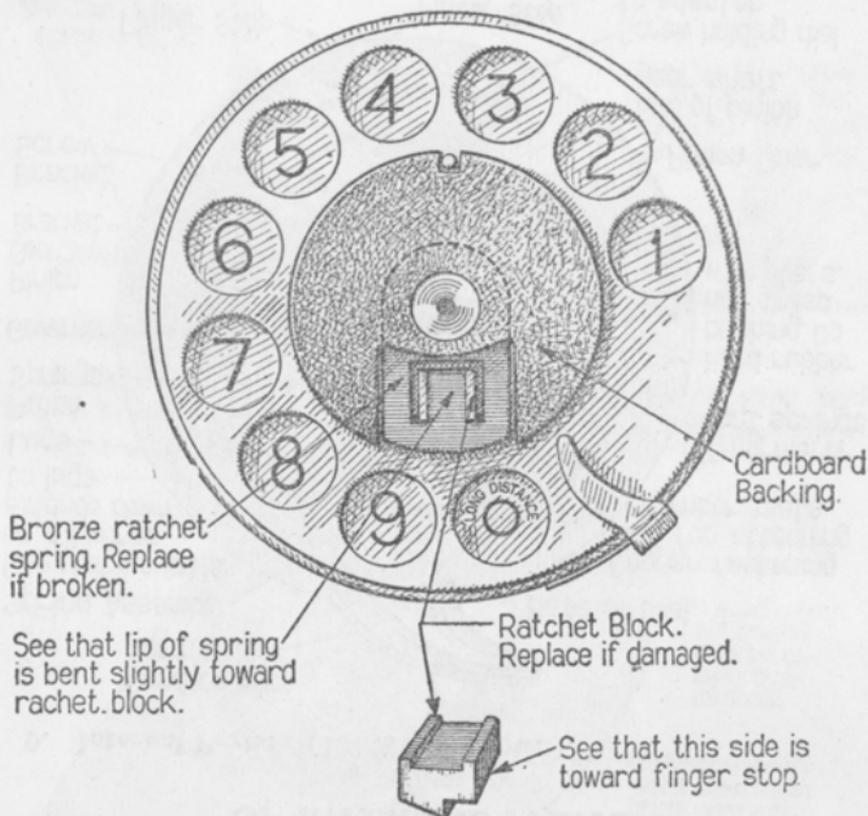
INSPECTION AND ADJUSTMENT OF INTERNAL PARTS.

11. Ratchet and Ratchet Spring: Dials have either new or old type ratchet. In the new type a flat bronze spring and a ratchet block are visible when the instruction card is removed, while the old type has no bronze spring nor block.

New Type: Inspect ratchet if:

- (a) Finger wheel sticks.
- (b) Flies quickly back to normal.
- (c) Works stiffly.
- (d) Clicking of ratchet does not sound normal when dial is operated.

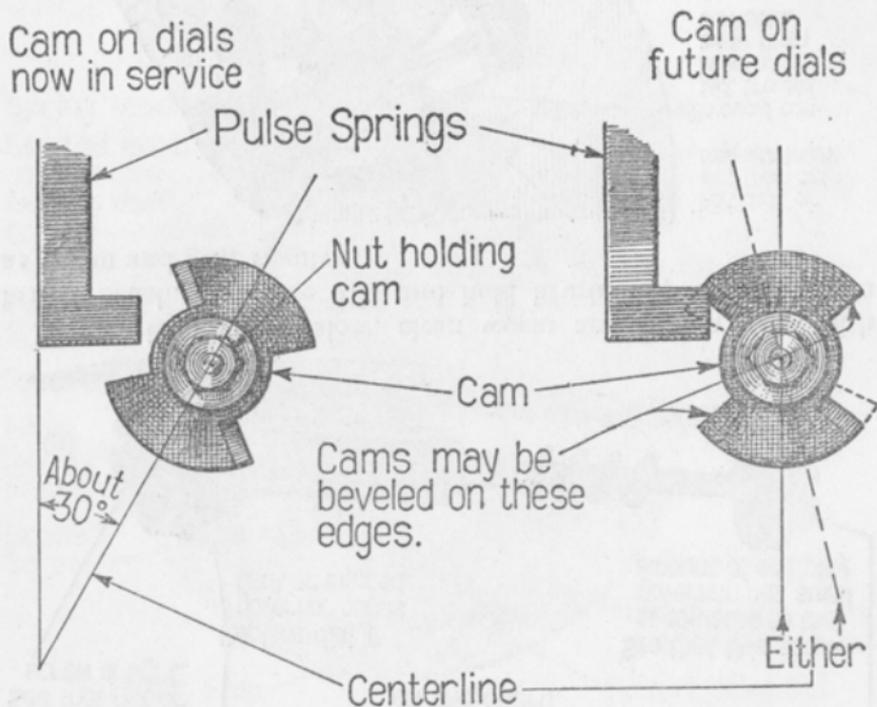
After removing escutcheon and instruction card, see that ratchet block, spring and cardboard backing is assembled as below.



Old Type: Replace dial if ratchet spring is badly worn or if any laminations of spring are broken as indicated by sound of ratchet when dial is operated.

12. Cam: See that nut holding cam on shaft is tight. If nut is loose and cam may be rotated completely around on its shaft (due to hole in cam being worn), replace dial.

Replace dial if normal position of cam is not as shown:



13. Pinion Gear Shaft: See that pinion gear shaft (see Section 9) has perceptible side and end play. If bearing holes are so badly worn that side play is excessive, replace dial.

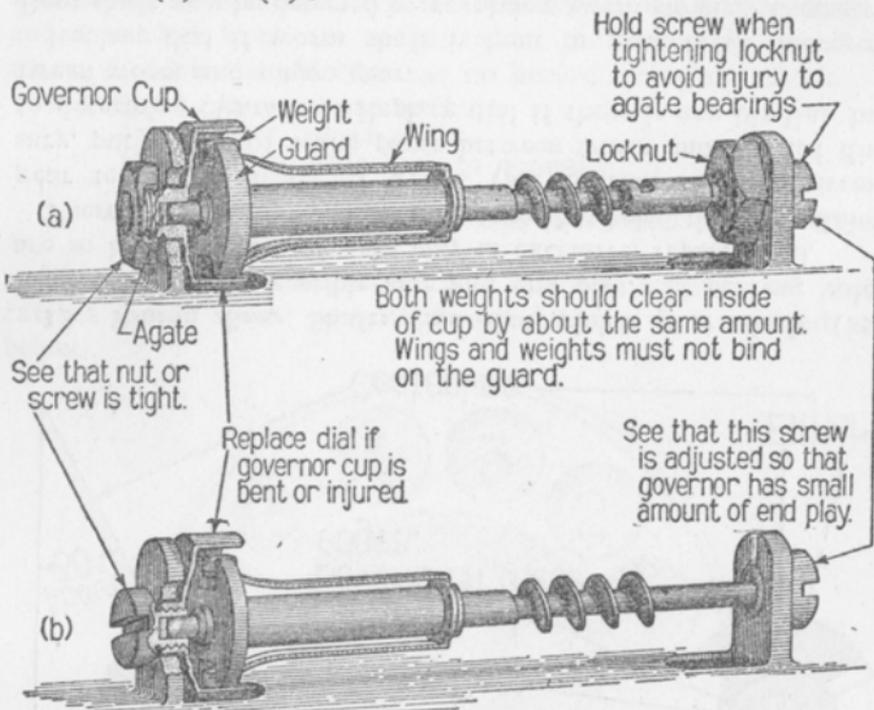
There should be visible clearance between tips of pinion gear teeth and inside of worm, (see Section 18). If necessary, put a strip of white paper between worm and base of dial to determine clearance. Replace dial if there is any binding between worm and pinion gear.

Replace dial if worm shaft is bent or gear teeth damaged. Bent shaft may be detected by revolving worm slowly. Damaged gear teeth may be felt by holding the finger lightly against gear as it revolves.

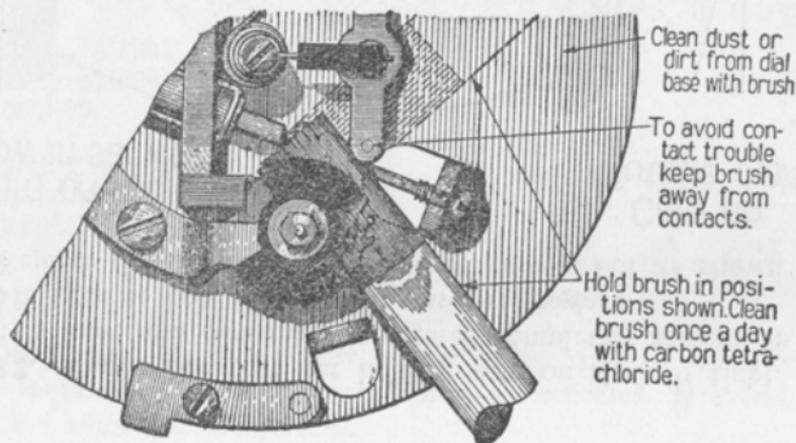
See that pinion bracket screw is tight.

INSPECTION AND ADJUSTMENT OF INTERNAL PARTS.

14. Governor: The governor cup and bearings may be as shown at (a) or (b):

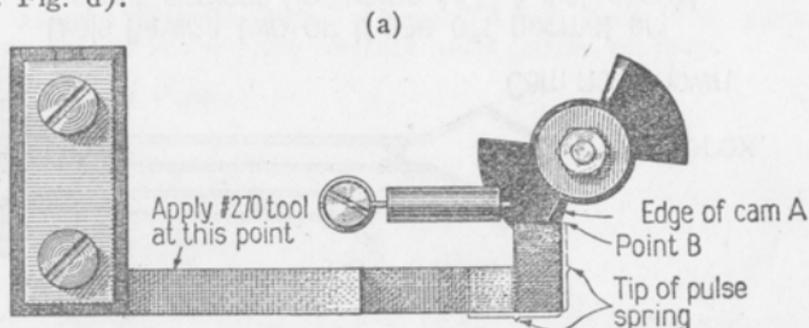


If dial is dirty or slow, clean worm and pinion gear with bristle brush. Operate dial and hold brush in positions shown as worm and gear revolve:

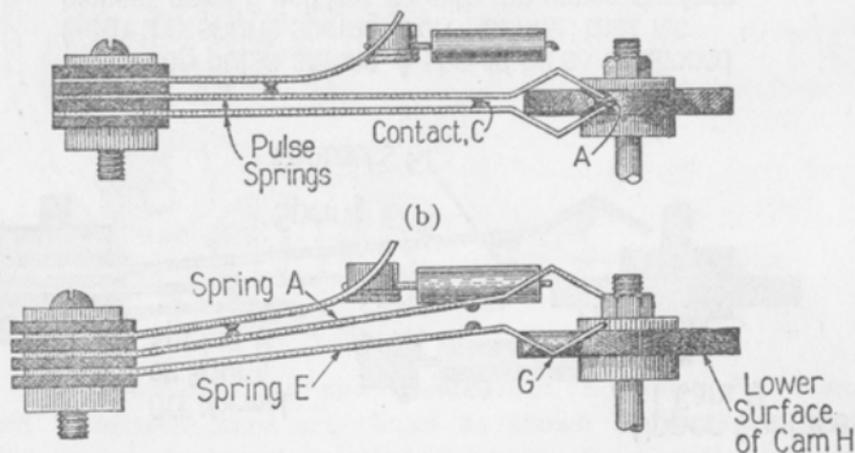


15. Pulse Springs: See that bracket supporting spring assembly is parallel to base of dial. If necessary, bend to correct position. Bracket may be bent upward by using screw driver as a lever or downward by pressing with fingers.

See that springs are free from bends (other than those shown) and adjusted according to figures a, b, c and d. Change dial if tips of spring are out of shape. When contacts are closed, tips of pulse springs should be about $1/32''$ apart, (see Fig. d).



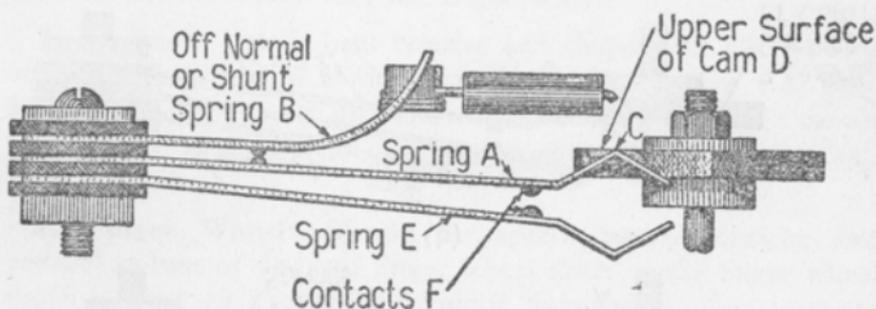
Cause cam to pass slowly between springs to see if cam strikes both springs at the same time. Adjust spring with #270 tool if necessary. Contact C should begin to break as the edge A of the cam comes through flush with the tips of the pulse springs at point B.



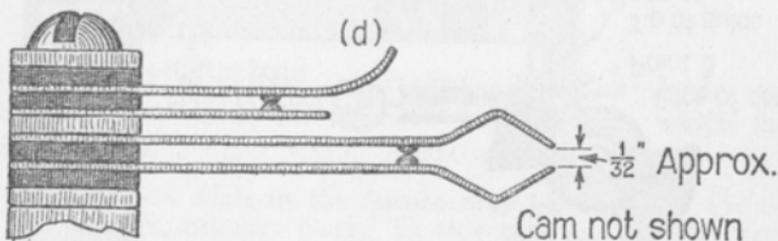
The lower pulse spring E should be so tensioned that the lowest point G will line up with the lower surface H when the upper pulse spring A is forced upward far enough to break the contact.

INSPECTION AND ADJUSTMENT OF INTERNAL PARTS.

(c)



The top pulse spring A should be so tensioned (with the shunt spring B off normal) that its highest point C will line up with the upper surface D of the cam when the lower pulse spring E is forced downward far enough to break the contact F

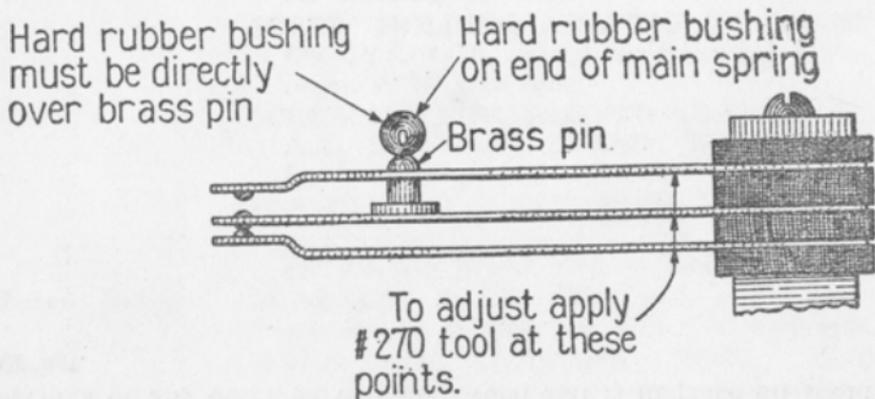


Dials having two or three off normal or shunt springs (including #102-A dial) should have pulse springs adjusted as above except that dials need not be moved off normal.

NOTE: The above figures show the off-normal or shunt springs as they appear in two arrangements of the dial. Another arrangement has three (3) springs directly over the pulse springs. The #102-A dial has three springs located as shown in Section 9.

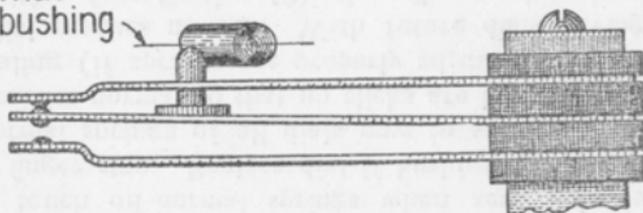
16. Off Normal or Shunt Springs.

In the case of the #102-A dial see that normal position of shunt springs and bushing on end of main spring is as shown:



The tension of the off-normal springs of the #102-A dial should be such that center spring will cause either top or bottom spring to travel $1/32''$ after making contact with it and have an approximate follow of $1/32''$ before breaking contact with either. Center spring should not have more tension than would cause it to raise brass pin past the center line of main spring bushing as shown. Adjust, if necessary.

Top of brass pin must be even with center line of bushing



INSPECTION AND ADJUSTMENT OF INTERNAL PARTS.

If normal and off-normal positions are not in accordance with the above, bend end of main spring with fingers (do not use pliers) until proper position is obtained. See that end of main spring does not touch off-normal springs when zero hole is pulled around to finger stop. Replace dial if bushing is broken.

See that off-normal springs of all dials now in service operate just as dial reaches normal so that no clicks are heard in the receiver when dialing (if springs are properly adjusted) except a click just as dial reaches normal. With future dials having the new cam position (see Section 12), the off-normal springs should operate after the last pulse transmitted by pulse springs and no clicks should be heard in receiver.

The foregoing adjustments in regard to the amount of follow up and the time of operation of the off-normal springs also apply to all dials having the off-normal springs (see Section 15) located directly over the pulse springs.

17. Dial Cord: See that cord terminals are securely soldered to proper dial lugs. To avoid crosses see that insulation extends up to lugs. Replace dial if any lugs are broken.

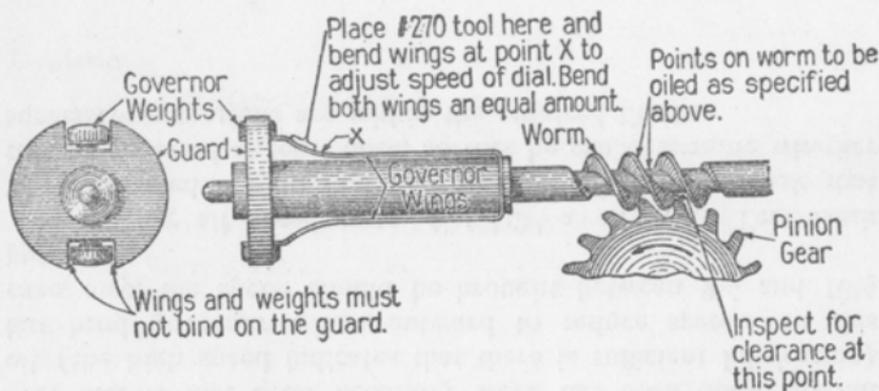
Arrange cord and terminals so that they will not rest against springs or any other part of dial when dial is in place on stand or set.

DIAL SPEED

18. Test speed of dial whenever station is visited for any reason; also, after any necessary work on dial has been completed. Speed should be between 8 and 11 pulses per second and should be tested with dial tester (speed indicator at test desk.) Approximate speed may be determined by noting whether the zero hole travels from finger stop to normal in about one second or by comparing with a correct dial.

If approximate test or test with test desk shows that dial is slow, oil worm.

In oiling, withdraw needle from one drop oil can and wipe off excess oil on mouth of can so that only a film of oil (not enough to form a perceptible drop at the needle point) adheres to the needle. Then touch **side of needle** to worm at points shown and operate dial to distribute oil.



Do not oil any bearings and if oil accidentally gets into governor cup or on any contacts, replace dial.

If dial is still slow after oiling, as shown either by approximate test or test with test desk, bend both governor wings in toward shaft to increase speed. The governor wings should be of the general shape shown. If wings are badly out of shape, do not attempt to adjust but change dial.

DIAL SPEED.

Whenever it is necessary to adjust governor wings, the speed should be brought between $9\frac{1}{2}$ and $10\frac{1}{2}$ pulses per second. This provides a greater margin of safety against the dial getting outside of the limits of 8 and 11 pulses and is advisable when it is necessary to adjust governor wings.

In case speed remains slow, after all adjustments have been made, change dial.

If dial is fast after necessary work has been done, do not oil (the high speed indicates that there is sufficient lubrication) but bend governor wings outward to reduce speed. In this case, also, the speed should be brought between $9\frac{1}{2}$ and $10\frac{1}{2}$ pulses.

In making all speed tests, dial "O" as soon as Test Desk has connected line to dial tester. Test Desk should ask that this be repeated at least once, so that he can determine whether successive operations are within the required limits.