

POST OFFICE STANDARD DIALS

[Maintenance Adjustment Instruction (M.A.I.) No.26]

1. Introduction. This Instruction relates to the dismantling, assembly, adjustment and lubrication of P.O. standard dials. The two dials, viz:- "Dial, Automatic, No.10", and "Dial, Automatic, No.11", are identical except that the No.11 type has an auxiliary impulse-control cam and spring-set. Views of a "Dial, Automatic, No.10", showing the names of the parts are given in Figs. 1, 2 and 3, and a rear view of a "Dial, Automatic, No.11" is given in Fig.27. The necessary adjustments are described in this Instruction as follows:-

(a) General adjustments for both types of dial in paras. 2 to 14, and 20 to 29.

(b) Additional adjustments for the No.11-type dial in paras.15 to 19. For a full description of the mechanical features and operation of the standard dial, reference should be made to B 1001. The maintenance procedure is detailed in B 5002. When a dial is dismantled, the parts should be thoroughly cleaned (see para.20) and inspected for wear. If any parts, especially the steel bearing in the governor-pivot bearing or cup, are found to be worn or rusty, they should be changed.

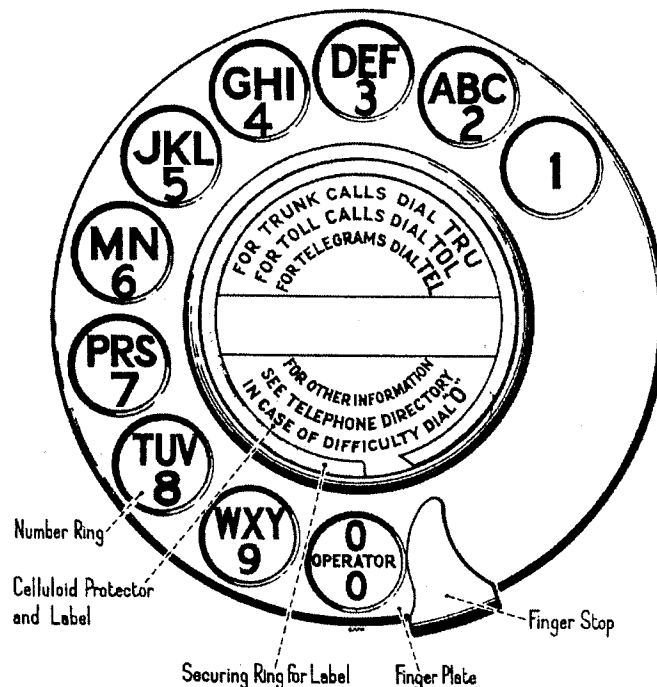


FIG.1. FRONT VIEW OF TYPICAL DIAL

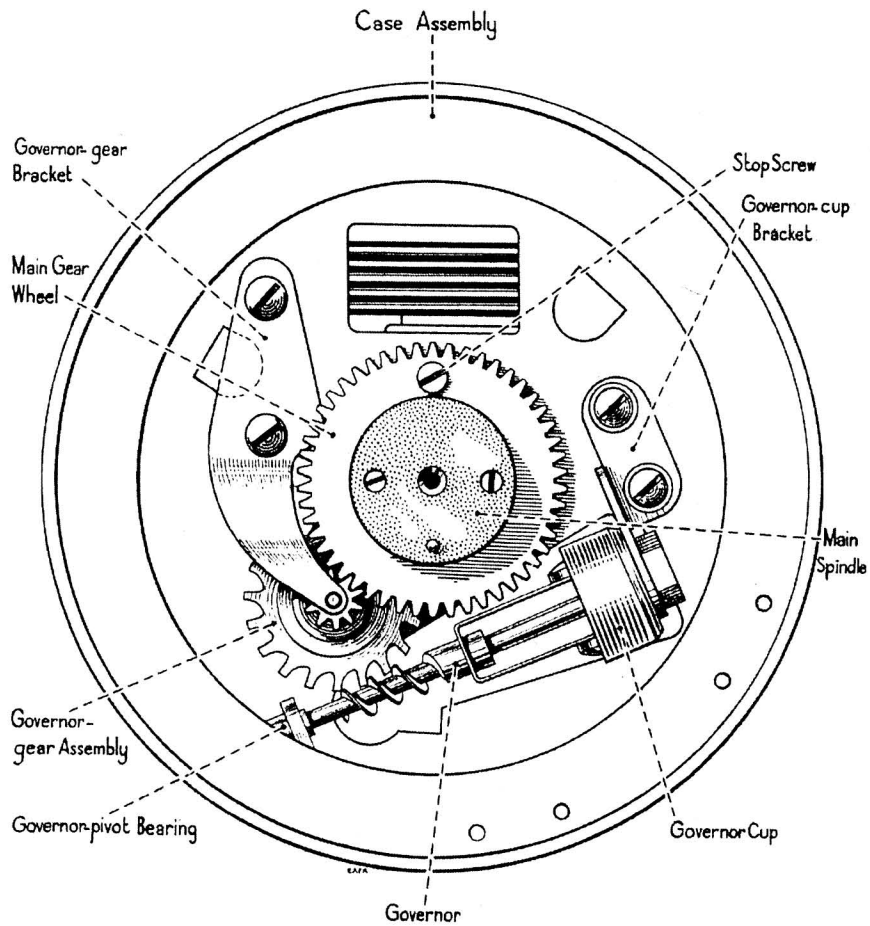


FIG. 2. FRONT VIEW WITH FINGER PLATE REMOVED

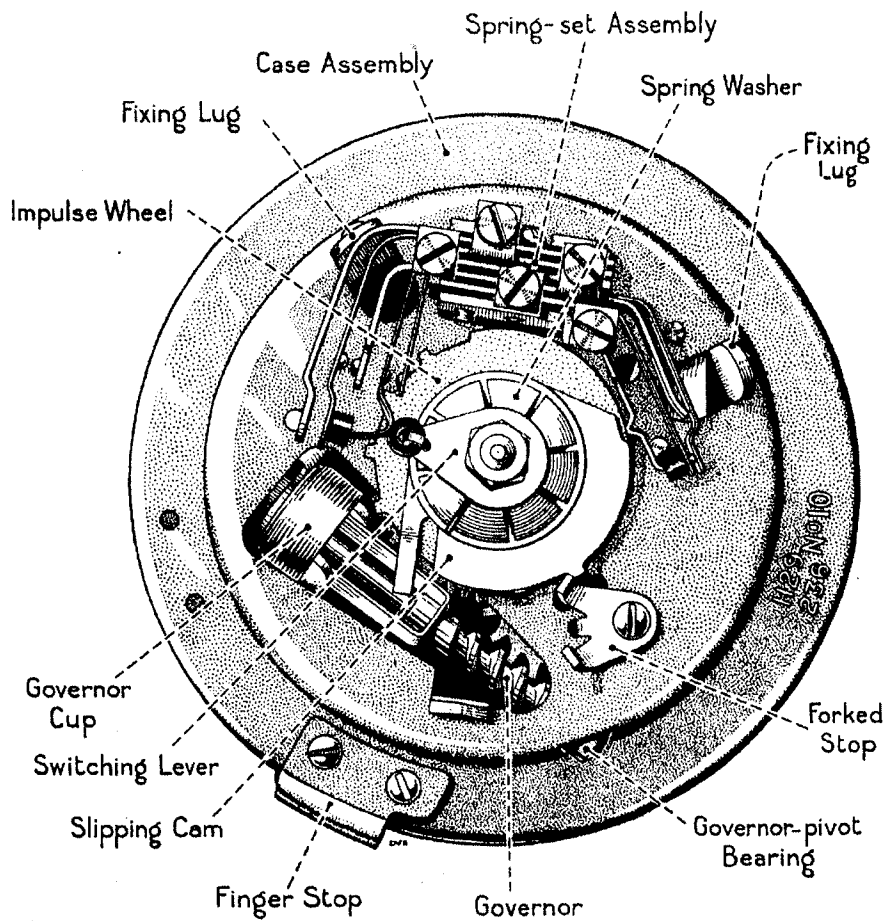


FIG. 3. REAR VIEW OF TYPICAL DIAL

### GENERAL ADJUSTMENTS

2. Governor. The governor wings should be free from kinks or bows and, as an initial adjustment, they should be set slightly inwards by means of "Pliers, Adjusting, No.5". The governor-cup fixing holes are elongated, to enable the cup to be positioned to give the best running position for the governor, i.e. the cup should be square with the governor when observed from the angles shown in Figs.4 and 5. The governor should run smoothly in both directions. It should be free, with a maximum end-play of 13 mils as near as can be judged by feel. The governor may be tested to prove that it is running satisfactorily in both directions, by running a small screwdriver along the governor worm as shown in Fig.6. The governor should be adjusted to run smoothly *before* any further assembling or adjustments are carried out.

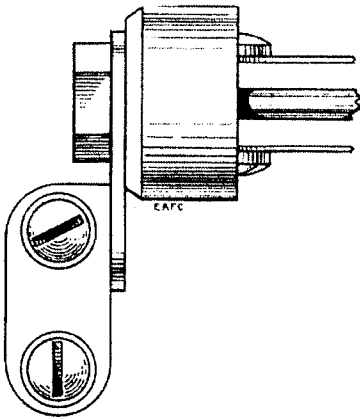


FIG. 4. GOVERNOR CUP AND BRACKET (FRONT VIEW)

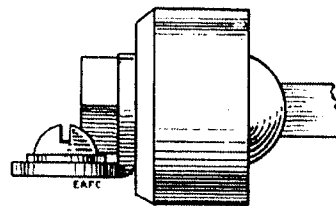


FIG. 5. SIDE VIEW

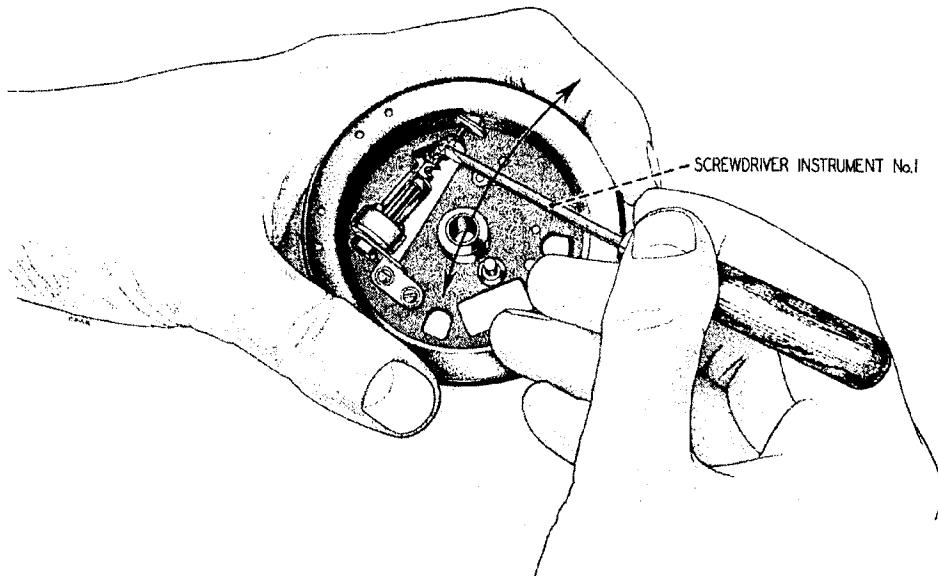


FIG. 6. TESTING THE GOVERNOR FOR SMOOTH RUNNING

3. Governor gear. It should be checked that the governor gear engages the governor worm correctly. A good method to test the running of the governor gear and governor is to replace the main gear-wheel assembly temporarily, and revolve the finger plate a few times; if the governor gear engages the governor worm too deeply the governor will not run smoothly; if the governor gear engages the main gear-wheel too deeply, vibration will occur. The governor gear should be set as shown in Fig.7. In the event of the governor or governor gear becoming damaged, the complete governor assembly or governor-gear assembly, as the case may be, should be renewed. The dial should then be reassembled and adjusted.

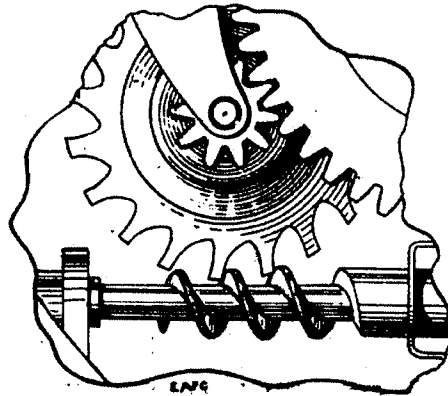


FIG.7. SETTING OF THE GOVERNOR GEAR

4. Method of fitting and adjusting the main spring. When fitting a main spring, it should be wound in the spring box starting from the outer edge, the arrow on the inside of the spring box indicating the direction of winding. To apply the correct tension to the main spring after the dial has been assembled, the finger plate should be rotated in a clockwise direction until the spring is felt to tighten; the finger plate should then be allowed to return through one complete revolution, and the stop screw then screwed down. The dial should then return (through not less than one-half of a complete revolution) to its normal position.

5. Slipping cam. The spring washer should apply sufficient tension to the slipping cam, so that:-

(a) The cam will not slip with a pressure of 60 gm. applied tangentiall at the point shown in Fig.8; if it does, it should be changed, the faulty washer being discarded. Attempts should *not* be made to increase the tension of a faulty washer.

(b) The cam will slip with a pressure of 90 gm.; if it does not, the tension may be reduced as follows:- Fully wind-up the dial, gently raise one edge of the slipping cam, and allow the dial to return to normal (see Fig.9). If the tension is still too great, the operation should be repeated. Care should be taken to ensure that the edge of the cam is only slightly raised; if the edge of the cam is raised too much the tension of the washer may be reduced below the minimum specified value. Rotate the dial and check that the rib of the nickel-silver washer remains in engagement with a slot of the spring washer.

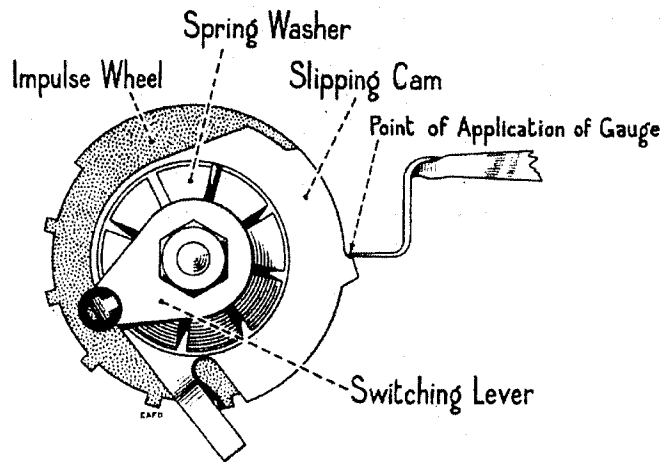


FIG. 6. TESTING THE SLIPPING CAM

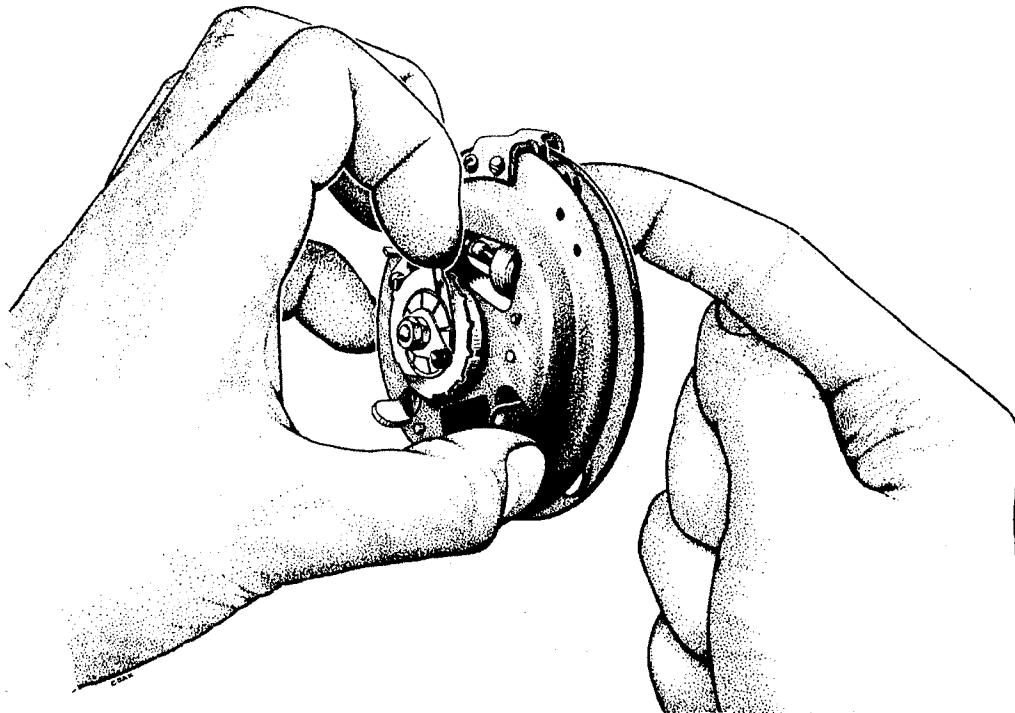


FIG. 9. REDUCING THE TENSION OF THE SPRING WASHER

6. Movement of slipping cam. There should not be a sudden increase in radius from the neutral portion of the impulse wheel to the edge of the slipping cam. This may be checked, *after the spring-set has been fitted*, by slowly moving the cam forward by hand and noting that the movement is smooth and that a bump is not evident as the edge of the cam meets the V-shaped portion of the impulse lever (see Fig.17).

7. The switching lever should be adjusted so that, when normal, it rests at the top of the set in the first lever-spring (see Fig.10).

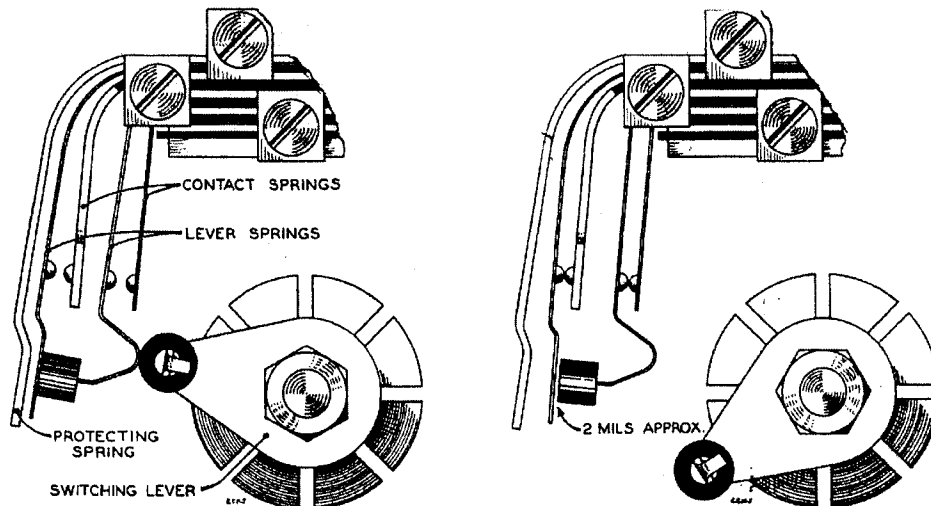


FIG. 10. ADJUSTMENT OF SWITCHING LEVER  
(normal position)

FIG. 11. ADJUSTMENT OF SWITCHING SPRINGS

8. Switching springs. The minimum contact separation should be 10 mils. Springs 1 and 2 should be adjusted to break first, to ensure that clicks are not received in the subscriber's receiver when the dial is pulled off-normal. For this adjustment to be effective, there must be a space of approximately 2 mils between the buffer of the first lever-spring and the face of the second lever-spring, when the dial is off-normal (see Fig.11). The two lever-springs should be tensioned to give a distinct follow to the two contact-springs. Spring No.5 is a protective spring only, and should be adjusted to lie parallel to spring No.4 when the dial is normal.

9. Impulse springs. When tensioning the impulse springs, the dial should be in an off-normal position, with the impulse lever resting in the impulsing recess of the slipping cam.

(a) *The impulse lever* should be free on its bearing and should rest squarely on the impulse wheel. The angle of the set in the impulse lever should not be altered, as any such alteration would affect the ratio of the impulses. If the lever is faulty it should be changed; attempts should not be made to adjust it.

(b) The inner impulse-spring should be straight, and should be tensioned at the base so that it will resist a leverage of 5 gm. (see Fig.12) and lift from the buffer of the impulse lever with a leverage of 15 gm. (see Fig.13), applied at the tip of the spring with the impulse lever resting in the impulse recess of the slipping cam.

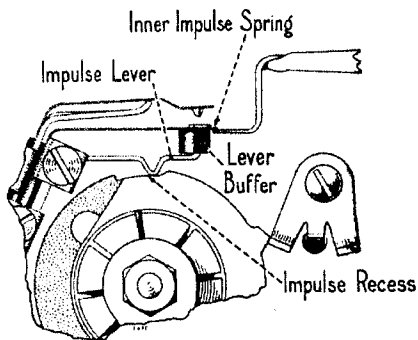


FIG. 12. CHECKING TENSION OF INNER IMPULSE SPRING (TENSION GAUGE SET AT 5 GM.)

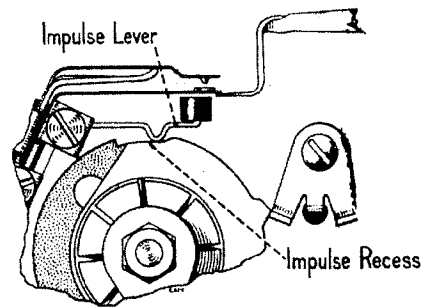


FIG. 13. CHECKING TENSION OF INNER IMPULSE SPRING (TENSION GAUGE SET AT 15 GM.)

(c) The outer impulse-spring should be tensioned so that it will resist a leverage of 20 gm., and lift from the inner impulse-contact with a leverage of 35 gm., applied at the tip of the spring with the dial at normal (see Figs.14 and 15).

Care should be taken to make the adjustments of the impulse springs accurately, as these adjustments, combined with the angle of the set in the impulse lever and the width of the impulse-wheel teeth, determine the impulse break-to-make ratio.

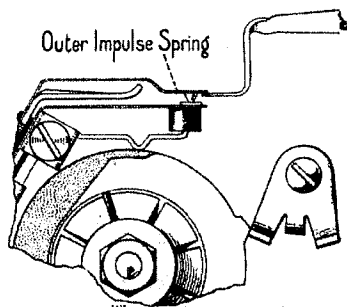


FIG. 14. CHECKING TENSION OF OUTER IMPULSE SPRING (TENSION GAUGE SET AT 20 GM.)

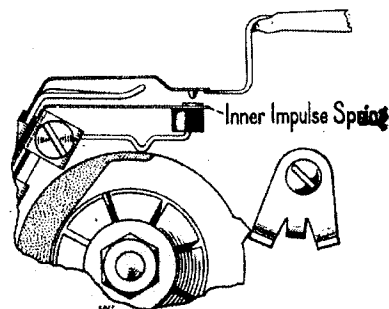


FIG. 15. CHECKING TENSION OF OUTER IMPULSE SPRING (TENSION GAUGE SET AT 35 GM.)



10. The buffer spring should be adjusted by bending with "Pliers, Adjusting, No. 1", so that there is a space of 6 mils  $\pm$  1 mil between the tip of the buffer spring and the outer impulse-spring with the dial at normal (see Fig. 16). The tension of the outer impulse-spring should be checked at this stage.

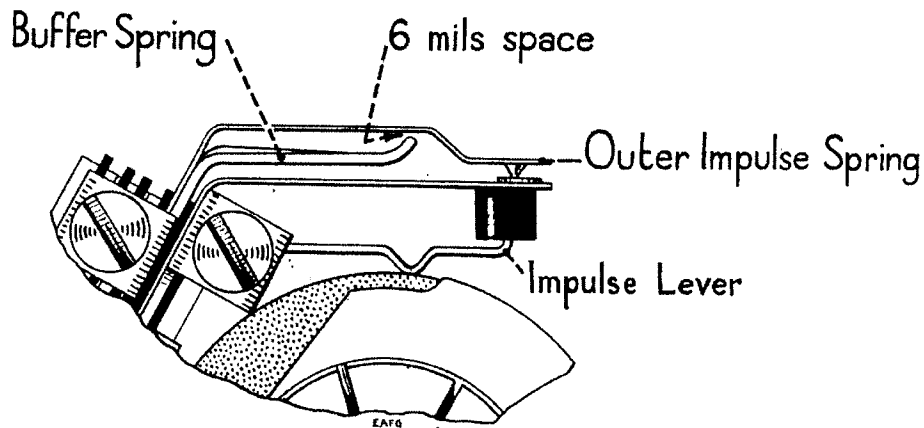


FIG. 16. ADJUSTMENT OF BUFFER SPRING (SHOWING 6-MIL CLEARANCE BETWEEN THE BUFFER AND THE OUTER IMPULSE SPRING)

11. Contact openings. The opening of the impulse contacts should not be less than 14 mils when the impulse lever is resting in the impulse recess of the slipping cam. The impulse lever is shown resting correctly in the impulse recess of the slipping cam in Fig. 17. Figs. 18 and 19 show incorrect positions of the impulse lever. The correct position can be obtained by bending the forked stop.

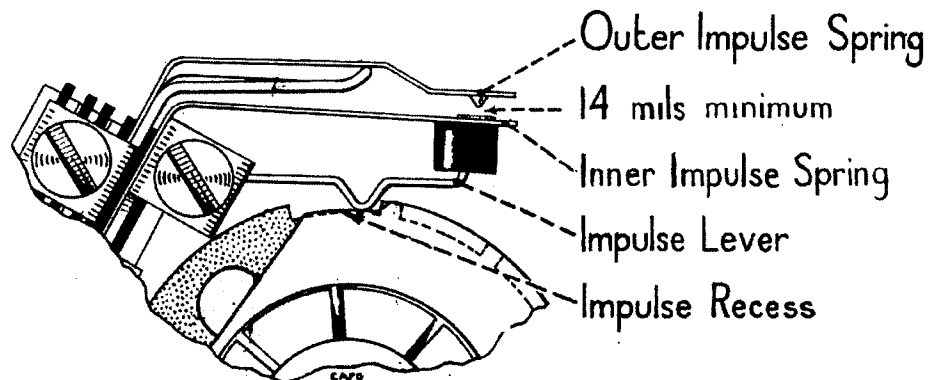


FIG. 17. ADJUSTMENT OF IMPULSE SPRINGS (IMPULSE LEVER IN CORRECT POSITION)

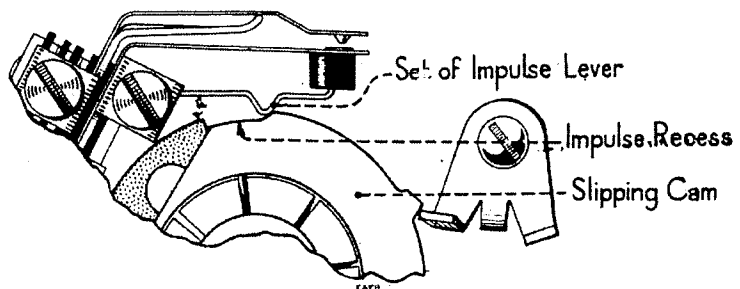


FIG.18. INCORRECT POSITION OF IMPULSE LEVER

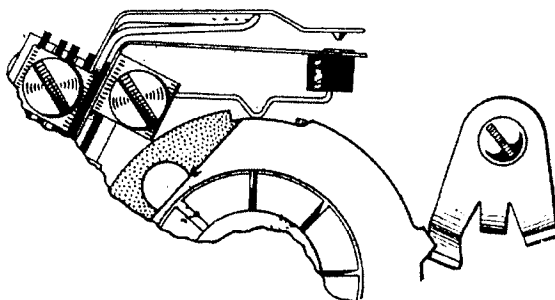


FIG.19. INCORRECT POSITION OF IMPULSE LEVER

12. To ensure that the first opening of the contacts on any digit is not shortened, the corner of the impulse tooth should be just visible in the impulse recess of the slipping cam (see Fig.20) when the hole of any digit in the finger plate is pulled round to the finger stop. If the corner of the tooth is not visible, the projecting tongue of the slipping cam should be bent inwards; if too much of the tooth is showing, the projecting tongue should be bent outwards. When making this adjustment, the tongue should be gripped firmly, using "Pliers, wiring, No.2" as shown in Fig.21.

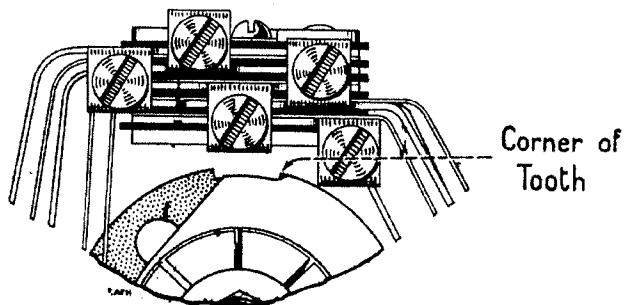


FIG.20. CHECK OF ADJUSTMENT OF SLIPPING CAM

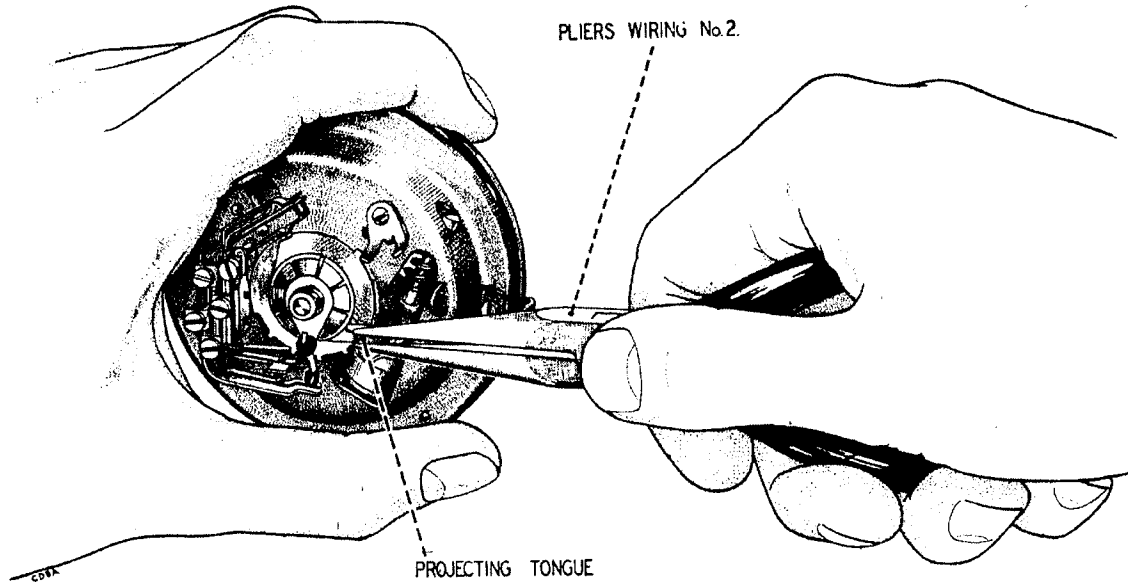


FIG. 21. METHOD OF ADJUSTING THE  
'SLIPPING CAM

13. Dial speed. The speed of the dial can be varied by adjusting the wings of the governor. The wings should be bent from the root only, by means of "Pliers, Adjusting, No.5" (see Fig.22). To increase the speed of the dial, the wings should

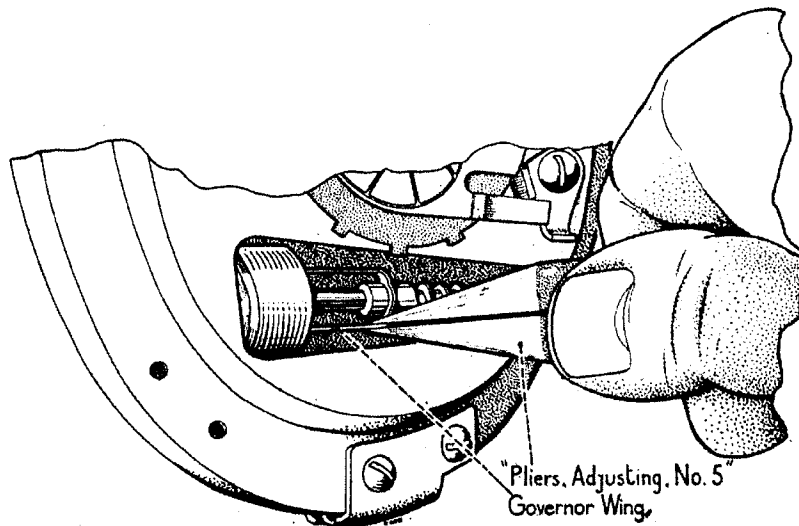


FIG. 22. ADJUSTING GOVERNOR TO ALTER DIAL SPEED

be bent inwards. To decrease the speed of the dial, the wings should be bent outwards. The governor wings and weights are so proportioned that the speed of the dial will be approximately 10 i.p.s. when the wings are set parallel to each other and the governor spindle.

14. Relative position of parts. The position of the impulsing contacts, slipping cam and switching lever are described in (a) to (c).

(a) When the dial is normal, the relative positions should be as shown in Fig. 23.

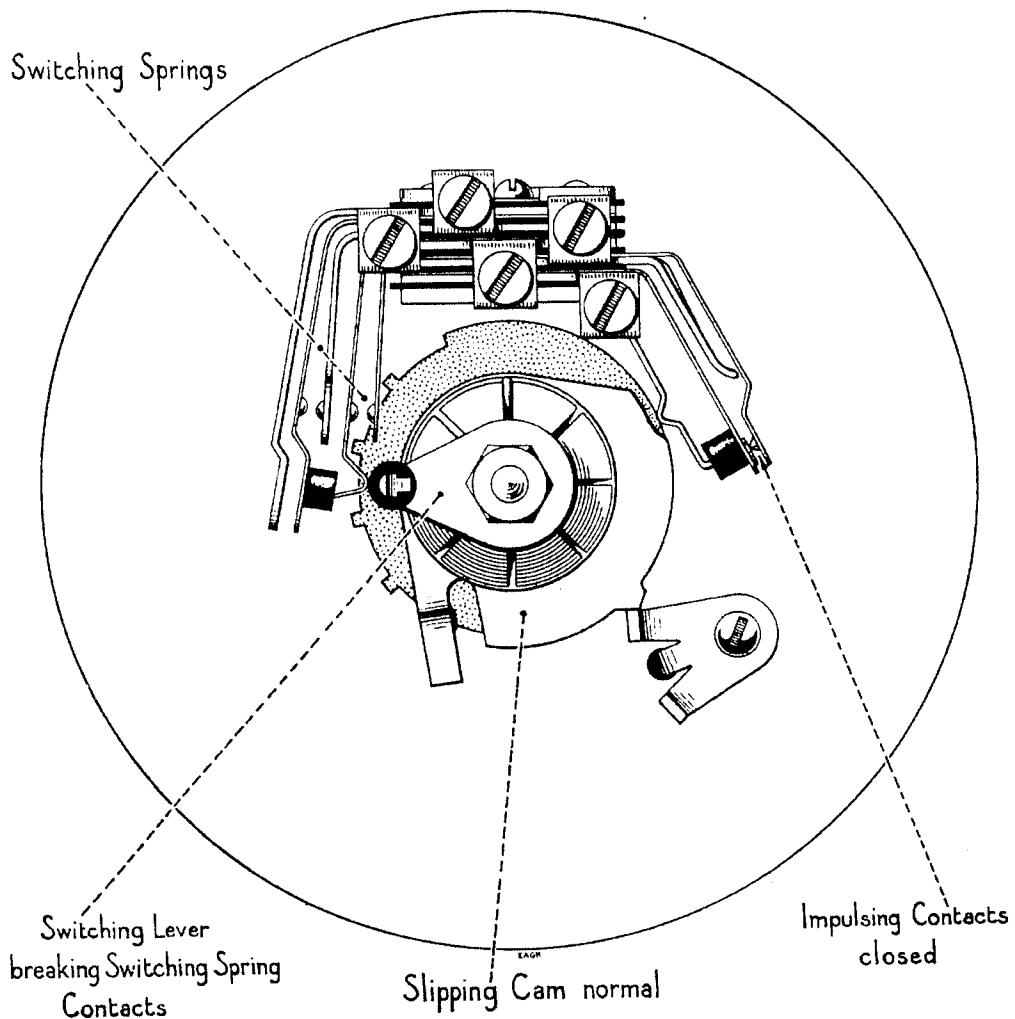


FIG. 23. NORMAL POSITION OF IMPULSE CONTACTS, SLIPPING CAM AND SWITCHING LEVER

(b) When the dial is prepared for sending one impulse, the positions should be as shown in Fig.24. Note that the corner of one tooth of the impulse wheel is just showing in the impulse recess of the slipping cam, and also that the impulsing-spring contacts and the switching-spring contacts are closed.

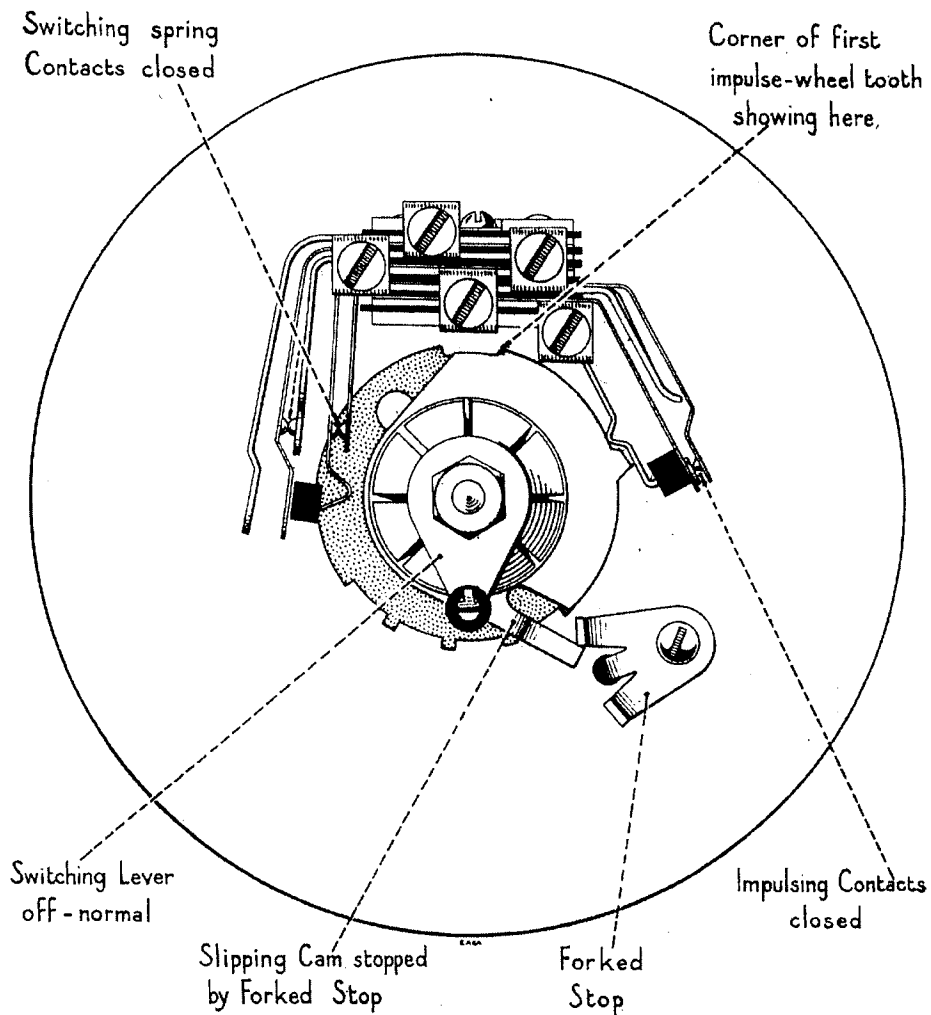


FIG.24. POSITION OF IMPULSE CONTACTS, SLIPPING CAM, AND SWITCHING LEVER (ONE IMPULSE PREPARED)

(c) When the dial is sending one impulse, the positions should be as shown in Fig. 25. Note that the impulse lever is resting in the impulse recess of the slipping cam and that the impulsing contacts are open. The switching-spring contacts should be opened by the switching lever after the impulsing contacts have closed on the return of the dial to normal.

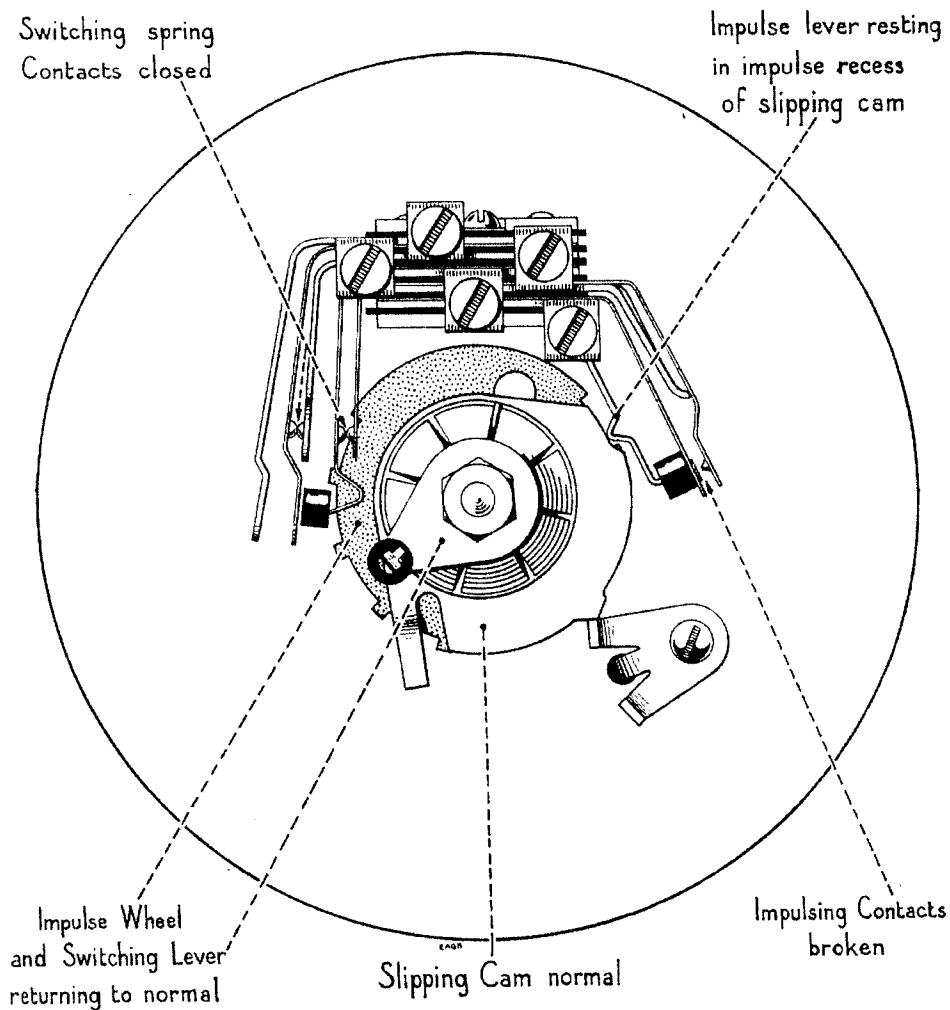


FIG. 25. POSITION OF IMPULSE CONTACTS, SLIPPING CAM, AND SWITCHING LEVER (ONE IMPULSE SENDING)

ADJUSTMENTS OF AUXILIARY CONTROL CAM AND SPRING-SET ASSEMBLY OF  
"DIAL, AUTO., NO.11"

15. A rear view of a "Dial, Automatic, No.11" showing the names of the auxiliary parts is given in Fig.26. With the switching lever in correct adjustment (see Fig.10) the adjustments contained in paras.17 to 20 can be obtained.

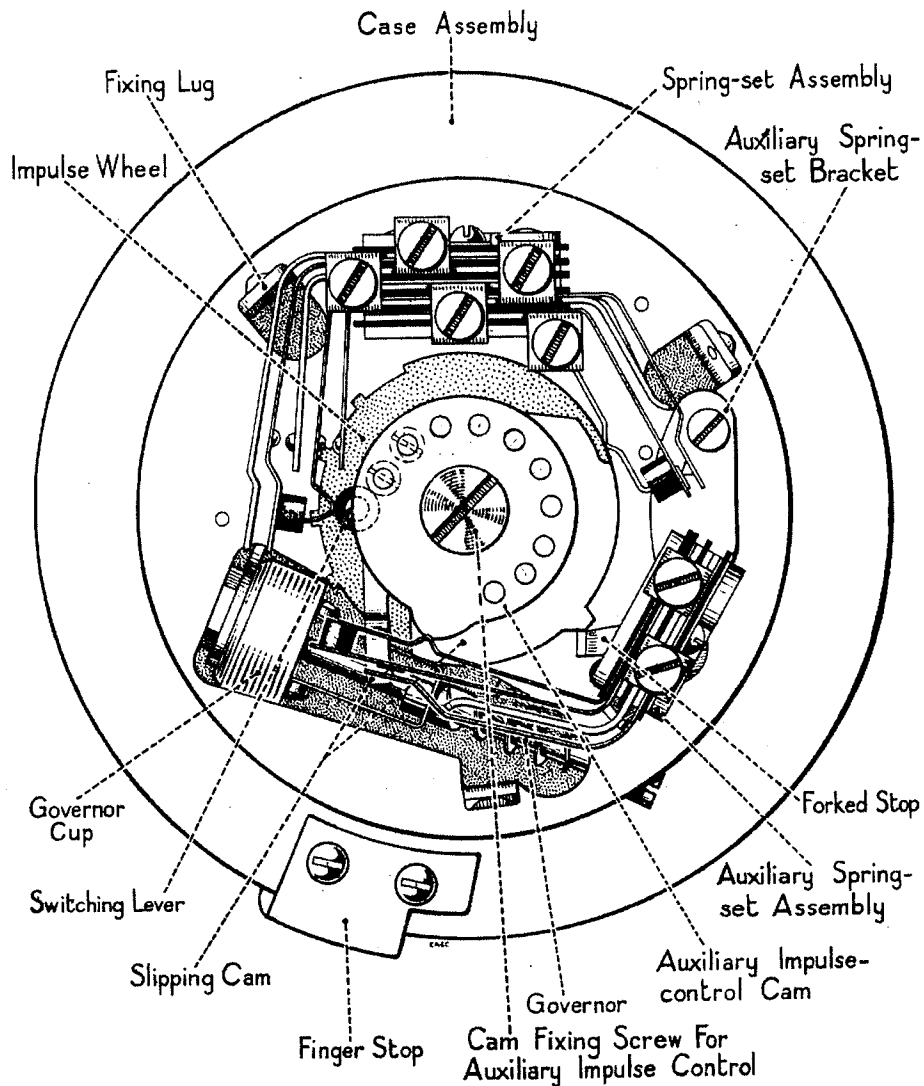


FIG.26. REAR VIEW OF "DIAL, AUTOMATIC, NO.11"

16. The auxiliary impulse-control cam should swing freely on its bearing, with a minimum amount of side-play. When the finger plate of the dial is moved steadily round from the "0" position (or from any other pre-determined position provided for by the insertion of an additional screw in the appropriate hole in the control cam) to the finger stop, the switching lever should, by contact with the control screw, trip the control cam off-normal immediately before the finger plate is stopped by the finger striking the finger stop. Also, the switching lever should, by contact with the control screw, just trip the control cam back to its normal position as the finger plate stops on the return of the dial to normal, i.e. the right-angle bend of the lever spring should engage in the notch at the top of the 'lift' of the control cam (see Fig.27). The control cam should not allow the auxiliary-spring contacts to close until after the impulsing contacts have finally closed.

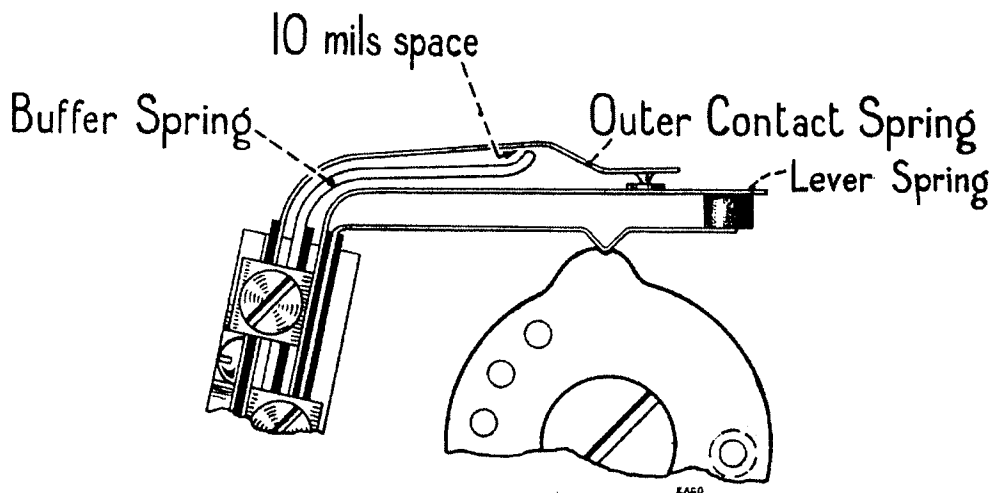


FIG. 27. ADJUSTMENT OF AUXILIARY IMPULSE-CONTROL CAM

17. Auxiliary springs. When the control cam is normal, there should be a gap of approximately 10 mils between the tip of the buffer spring and the outer contact-spring (see Fig.27).

18. The total pressure exerted by the two inner springs on the auxiliary impulse-control cam, when the latter is off-normal, should be 5 gm. minimum to 10 gm. maximum. The point of application of the gauge is shown in Fig.28.

19. When the control cam is in the normal position, the contact pressure of the auxiliary springs should be 12 gm. minimum to 15 gm. maximum. The point of application of the gauge is shown in Fig.29.



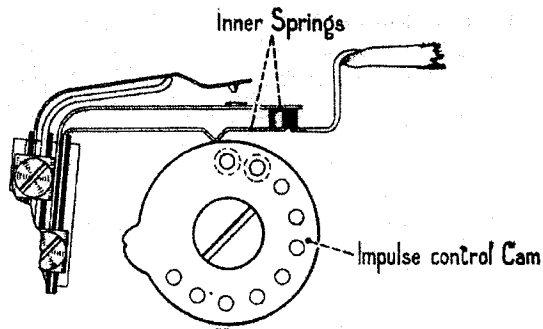


FIG. 28. CHECKING CONTACT PRESSURE  
OF AUXILIARY SPRINGS

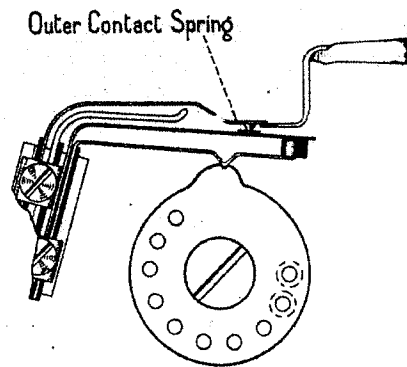


FIG. 29. CHECKING CONTACT  
PRESSURE OF AUXILIARY SPRINGS

### LUBRICATION

20. Before making any adjustments to a dial, it should be examined to see that it is clean, as a dirty dial is sluggish in action although the main spring may be at full tension.

21. A dirty dial should be dismantled and the following parts washed in clean white spirit:-

- (a) Governor
- (b) Governor-pivot bearing
- (c) Governor cup and bracket
- (d) Governor-gear assembly
- (e) Main spindle
- (f) Slipping cam
- (g) Washers (if fit for re-use)
- (h) Main spring (if fit for re-use)

22. The remaining parts should be cleaned with a soft cloth. After the mechanism has been cleaned, the parts which have been washed in white spirit should be wiped dry and the following parts lubricated with "Oil, Bearing, No. 16" in the manner indicated:-

- |                                 |  |
|---------------------------------|--|
| (a) Governor bearings           | Apply one drop of oil to each end of the governor spindle          |
| (b) Governor-gear spring clutch | Apply one drop of oil  |
| (c) Governor-gear bearing       | Apply one drop of oil to each bearing                              |
| (d) Governor worm               | Apply one drop of oil  |
| (e) Main spindle                | Apply one drop of oil to the bearing portion                       |
| (f) Steel washers               | Apply one drop of oil between each friction surface before fitting |

23. Care should be taken not to use the oil in excess, especially on the governor assembly. Each drop of oil specified should be that pendant on the end of a piece of No.23 S.W.G. (9-lb.) bare copper wire after it has been dipped into a reservoir of oil, the level of which is maintained at a depth of 5/8th of an inch.

24. A main spring which is fit for re-use, should, after being washed in white spirit, be replaced in the spring box. After replacement, the spring should be lubricated by the application of three drops of oil, distributing them over the spring.

25. Spare coiled main-springs should be stored in a bath of "Oil, Bearing, No.16". The springs should be drained before assembly, and further lubricant should not be applied.

26. Spare steel washers should be stored in a bath of "Oil, Bearing, No.16", and, when required for use, removed with a pair of tweezers. The oil should then be removed and the washers lubricated as specified.

#### DISMANTLING AND ASSEMBLING

27. Dismantling. The following list details the order in which the parts should be dismantled.

- (a) Remove the spring-set assembly
- (b) Remove the securing screw of the auxiliary impulse control cam
- (c) Remove the auxiliary impulse-control cam
- (d) Remove the spindle for the auxiliary impulse-control cam
- (e) Remove the securing ring and the celluloid protector for the label
- (f) Remove the label
- (g) Withdraw the stop screw and allow the dial to revolve until the main spring is unwound
- (h) Remove the finger stop and the forked stop
- (j) Remove the hexagon lock-nut and clamping nut (*Dial No.10 only*)
- (k) Remove the switching lever. Remove the spring washer, the nickel-silver washer, and the two steel washers
- (l) Remove the slipping cam
- (m) Remove the two steel washers
- (n) Remove the bush
- (o) Remove the impulse wheel
- (p) Remove the finger-plate and the main spindle complete
- (q) Remove the spring box, with the main spring, from the dial frame
- (r) Remove the securing ring for the number ring
- (s) Remove the number ring
- (t) Remove the governor-gear bracket and the governor-gear assembly
- (u) Remove the governor cup and the bracket
- (v) Remove the governor
- (w) Remove the governor-pivot bearing
- (x) Remove the finger plate from the main spindle
- (y) Remove the label holder from the finger plate
- (z) Remove the main gear-wheel from the main spindle.

28. Assembly. The following list details the order in which the parts should be assembled.

(a) Replace the main gear-wheel on the main spindle. The threaded hole for the stop screw should be diametrically opposite the finger-plate locating pin on the main spindle, otherwise the stop screw will be obscured by the finger plate.

(b) Replace the governor-pivot bearing

(c) Replace the governor with the governor cup and bracket

(d) Replace the governor-gear assembly and the bracket

(e) Replace the finger plate and label holder to the main spindle

(f) Replace the number ring and its securing ring. See that the holes in the number ring are opposite the finger-stop fixing holes; if this is not done, damage may be caused to the number ring when the finger-stop fixing screws are replaced.

(g) Replace the spring box and mainspring

(h) Replace the main-spindle assembly

(i) Replace the impulse wheel (with the face stamped "A", "S", or "W" uppermost)

(j) Replace the bush

(k) Replace the lower two steel washers

(l) Replace the slipping cam

(m) Replace the upper two steel washers

(n) Replace the nickel-silver washer (with the rib uppermost)

(o) Replace the spring washer. The rib on the nickel-silver washer should rest between adjacent leaves of the phosphor-bronze spring washer

(p) Replace the switching lever

(q) Replace the spindle for the auxiliary impulse-control cam (*Dial No.11 only*)

(r) Replace the auxiliary impulse-control cam (*Dial No.11 only*)

(s) Replace the clamping nut, so that the switching lever is securely fixed (*Dial No.10 only*)

(t) Replace the finger stop

(u) Replace the forked stop

(v) Replace the spring-set assembly. If any portion of a spring-set is damaged, the complete spring-set should be replaced in preference to changing individual parts

(w) Replace the securing screw of the auxiliary impulse-control cam (*Dial No.11 only*)

(x) Replace the lock-nut (*Dial No.10 only*)

(y) Replace the label (with the lettering horizontal when the dial is in its normal position)

(z) Replace the celluloid protector and the securing ring.

**NOTE:-** All screws and nuts should be tight. They should not be damaged or mutilated in any manner.

MISCELLANEOUS

29. Tools and their uses.

<i>Rate Book description</i>	<i>General description and use</i>
Pliers, Wiring, No.2	Taper-nosed pliers, for adjusting slipping-cam tongue
Screwdriver, Instrument, No.1	Screwdriver for general use
" " " 2	" " " "
Pliers, Adjusting, No.1	Bent duckbill pliers for general adjustments of springs
" " " 5	Taper-nosed pliers for general adjustment of springs and governor wings
Spanner, Flat, No.2	Spanner, for miscellaneous nuts
Gauges, Feeler, No.1	Feeler gauges, for general use
" , Tension, No.1	Pressure gauges, for measuring spring pressures
" , " No.2	Pressure gauges, for measuring slipping-cam pressure

The tools should only be used for the purpose for which they are intended. A tool which is in such a condition that screws, nuts, or springs would be damaged by its use should not be used. The tool, if damaged or faulty, should be changed.

References:- B 1001, B 5002  
(Tp2)

*Instructions cancelled:-* This Instruction, together with B 1001 (when available) and B 5002 cancels T.I, XXV, Part 24A  
Circular Telephones 512, M/L Oct./30

E N D