

P.O. STANDARD RATCHET RELAY, TYPE I  
Maintenance Adjustment Instruction

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**2. Introduction.** This Instruction describes briefly the P.O. Standard Ratchet Relay, Type 1, and gives the adjustments necessary for its maintenance.

The relay mechanism operates on the reverse drive principle and is available with a ratchet wheel having either 33 or 36 teeth. Except for the ratchet wheel and armature travel, the mechanical details and adjustments of the 33- and 36-tooth relays are identical. To determine easily whether the ratchet wheel of a relay has 33 or 36 teeth, the cam spacer associated with the 36-toothed ratchet wheel is coloured red.

Relay adjustment cards for these relays will not be issued.

Comb-operated spring-sets, 12 mils in thickness, are used in conjunction with a 600-type buffer block. The mechanism may be jacked out to facilitate mechanical adjustment in service, leaving the spring-sets (which are permanently wired) *in situ*.

Figs. 1, 2, 3 and 4 show a typical Type 1 ratchet relay and the names of the principal parts.

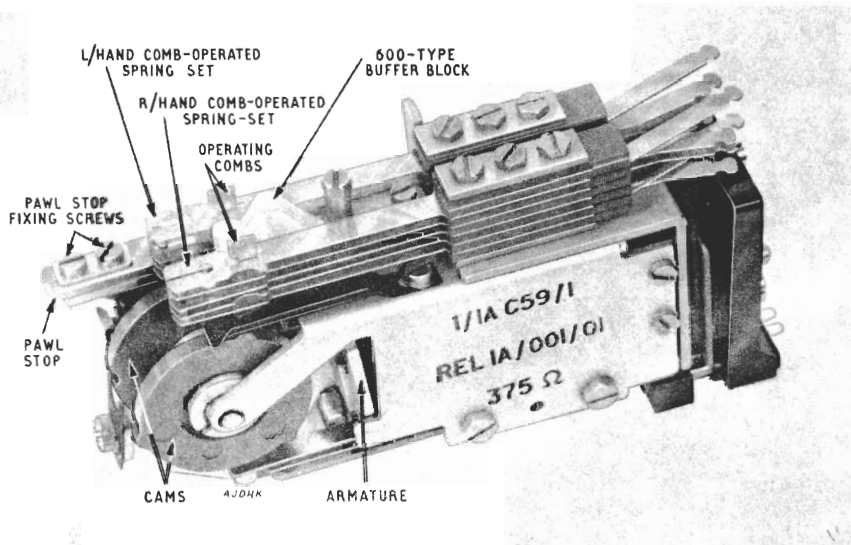


FIG. 1

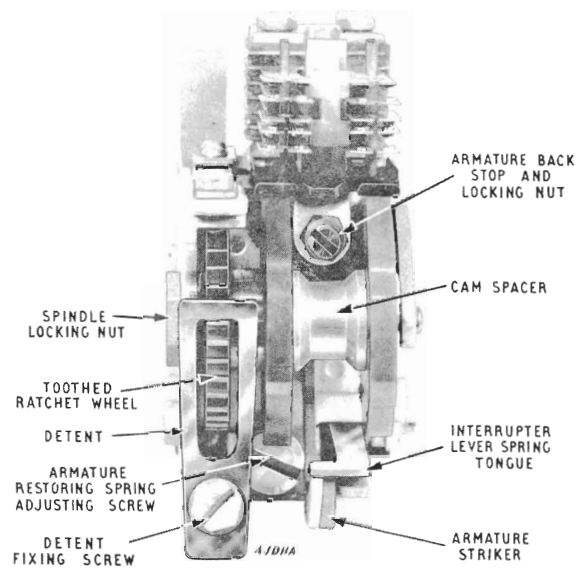


FIG. 2

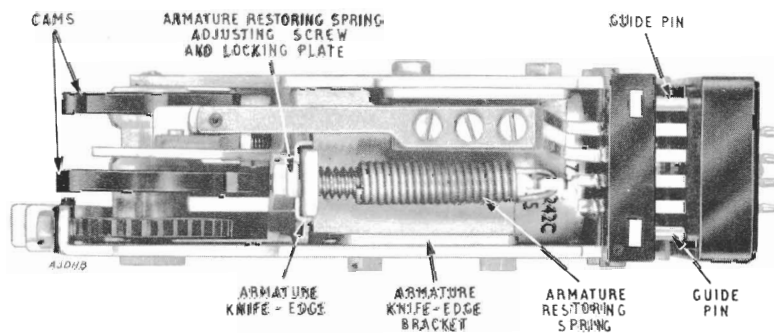


FIG. 3

**3. Mounting.** To reduce the amount of transmitted vibration when stepping, the relay is mounted on rubber. The arrangement is shown in Fig. 5.

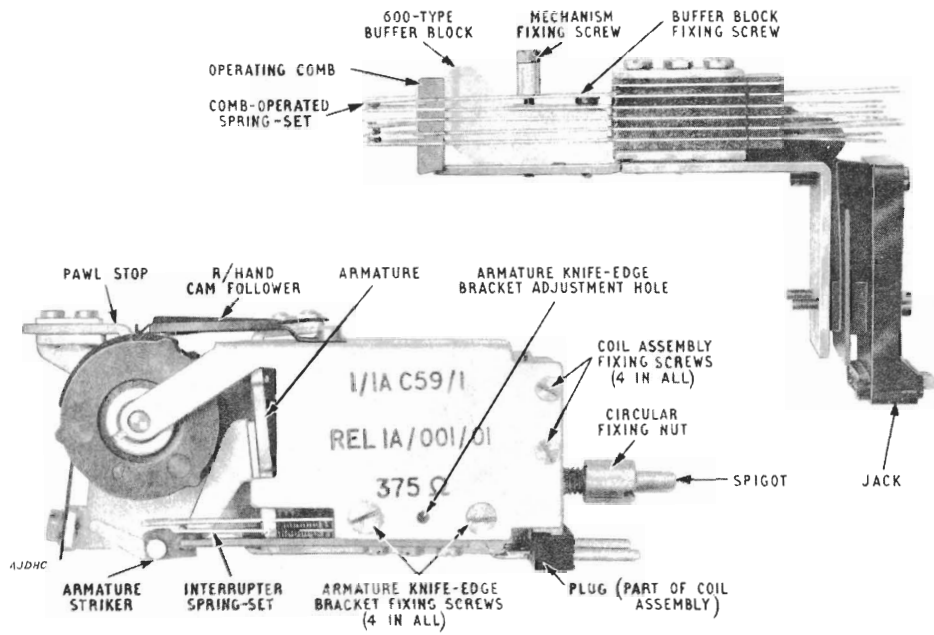


FIG. 4

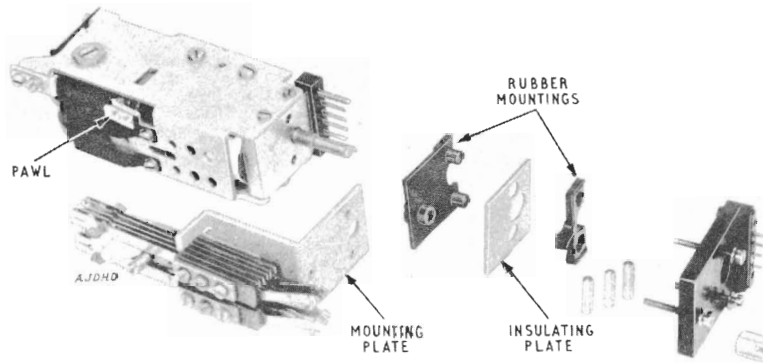


FIG. 5

4. Code markings. Fig. 6 shows the typical markings on the frame of the ratchet relay, used for identification.

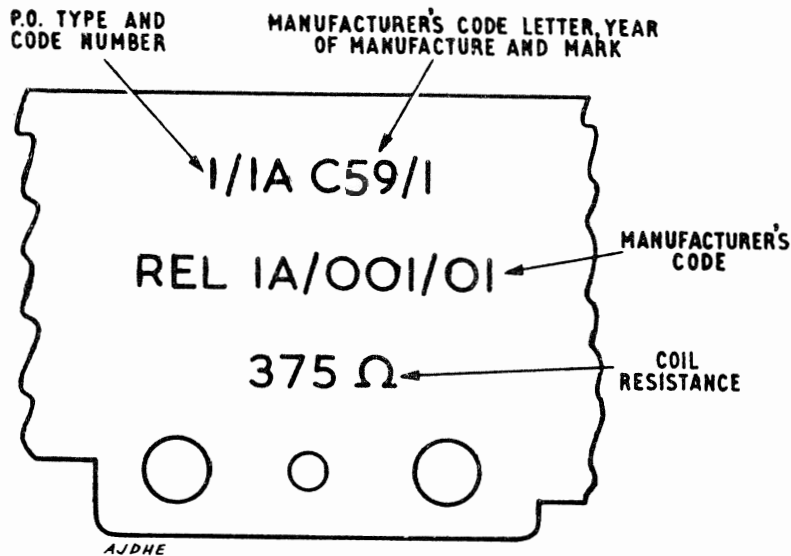


FIG. 6

MECHANISM ADJUSTMENTS

5. Adjustment tolerances. 'Test' and 're-adjust' values are defined in B 5100.

6. Removal of mechanism from rack. After the selector or relay-set is 'busied', the mechanism of the ratchet relay may be withdrawn (see Fig. 4) leaving the spring-sets *in situ*.

Using Spanner, Box, Cranked, No. 6 or Spanner, Flat, No. 13, unscrew the trapped mechanism-fixing screw. Where a circular fixing nut is fitted to the coil spigot, this should be removed, using Ringdriver No. 4, and the mechanism can then be withdrawn.

7. Replacement of mechanism. After replacing the mechanism and tightening the mechanism fixing screw, verify that the spring-set operating combs are located on the cam-follower springs, and the combs correctly located in the spring slots; re-adjust if necessary. Verify that the relay steps and homes correctly.

8. Testing facilities. The jacked-out mechanism may be mounted on a Stand, Testing, No. 8A, fitted with an Adapter No. 23. The adapter is listed in Table 1, together with other parts required to be requisitioned and fitted in order to simulate working conditions.

TABLE 1

Rate Book description	Brief description
Adapter No. 23, for Stand, Testing, No. 8A	-
Part No. 1/DSP/1084	Left-hand spring-set
" " 7/DSP/1230	Right-hand "
" " 1/SBL/21	Buffer block
" " 1/DPL/669	Mounting plate
" " 1/DSC/400	Clamping screw
" " 1/DJA/3	Jack assembly
Screw, No. 8BA x $\frac{15}{32}$ in., Ch. Hd., M.S., Zn.P.	Fixing screw

The parts should be assembled and fitted to the Adapter No. 23, inserting the insulating plate between the jack and the adapter, omitting the flexible mountings and suitably shortening the brass bushes and fixing screws.

To enable self-drive tests to be made, make the following connections to the tags of the jack (Fig. 11):-

- (a) Resistor, Non-linear, No. 2 across tags 'c' and 'd'.
- (b) Suitably fused battery supply to tag 'c'.
- (c) Strap across tags 'b' and 'd'.
- (d) Earth via test resistance (see Table 2) to tag 'a'.

**9. Armature knife-edge bracket.** This should be positioned so that the armature, when fully operated electrically, is parallel as judged visually to the front edge of the frame.

To adjust, slacken the four fixing screws using Spanner, Box, Cranked, No. 8, insert Adjuster, Detent, No. 4 or Spike, Capstan, No. 3B into the holes provided, and lever the bracket into the required position.

The interrupter spring-set tags may have to be unsoldered.

**10. Armature travel.** This should be checked by operating the armature electrically and measuring the gap between the armature and its back stop using Gauges, Feeler, No. 14.

Travel limits:-

Relay with 33-toothed ratchet wheel - 65-70 mils 'test', 66-69 mils 're-adjust'.

Relay with 36-toothed ratchet wheel (cam spacer coloured red) - 58-63 mils 'test', 59-62 mils 're-adjust'.

To alter the armature travel, adjust the back stop, using Spanner, Box, No. 10 and Screwdriver, Instrument, No. 4.

**11. Cam and ratchet wheel assembly.** This should be free on its spindle, with not more than 12 mils end play, which can be checked with a Gauge, Feeler, No. 10.

To adjust, use Spanner, Cranked, No. 12 and Screwdriver, Instrument, No. 2.

**12. Detent.** The detent should engage squarely the ratchet wheel tooth which is immediately above an imaginary horizontal line marking the centre of the cam and ratchet wheel assembly (see Fig. 7).

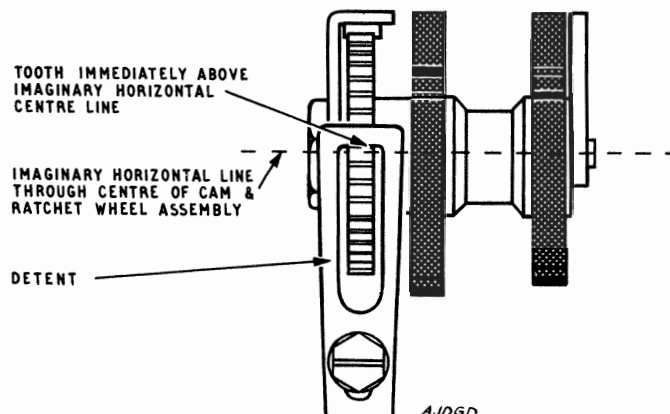


FIG. 7

The detent should engage squarely with each tooth in turn without appreciable back-lash on at least one tooth, and exert a pressure of 20-50 gm 'test', 25-45 gm 're-adjust', measured at the detent tip.

To adjust, use Spanner, Box, Cranked, No. 8 and/or Pliers, Adjusting, No. 1A (duck-bill pliers).

**13. Pawl.** The pawl should exert a pressure of 20-50 gm 'test', 25-45 gm 're-adjust' on the ratchet wheel, measured at the bend near the tip, with the armature operated.

With the armature normal, the pawl should fully engage each ratchet wheel tooth in turn, across the full width of the tooth.

When re-tensioning, slight adjustment can be made to the pawl with the cam and ratchet wheel assembly in place, using duck-bill pliers, otherwise the cam assembly must be removed.

**14. Pawl stop.** Adjust the pawl stop so that the pawl is lightly wedged between the ratchet wheel tooth and the pawl stop. Slight forward lash is permissible on some teeth.

**15. Cam-follower springs.** Each cam-follower spring should remain in contact with the cam periphery on all steps, exerting a pressure of 15 gm maximum on those portions of the cam between cam risers. This pressure is measured at the band adjacent to the 'V' tip, with the comb-operated spring-set tensions relieved [see Figs. 8(a) and (b)].

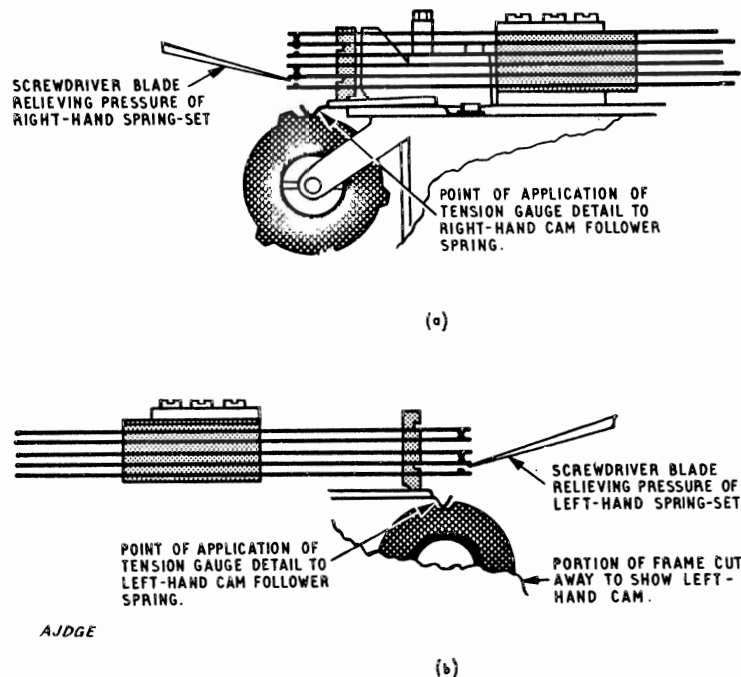


FIG. 8

The springs should not foul the buffer block, and should be securely clamped to the frame, with the 'V' tips lying flat across the full width of the cams.

Each cam follower should be positioned so that the spring-set operating comb is located within its upturned edges.

Each cam-follower spring tip should be clear of the leading edge of each riser on its cam, on the step immediately preceding the riser, with the armature normal [see Fig. 9(a) and (c)]. It should also be clear of the trailing edge of each riser on the step immediately following the riser, when the armature is normal and during its next operation [see Fig. 9(b) and (c)].

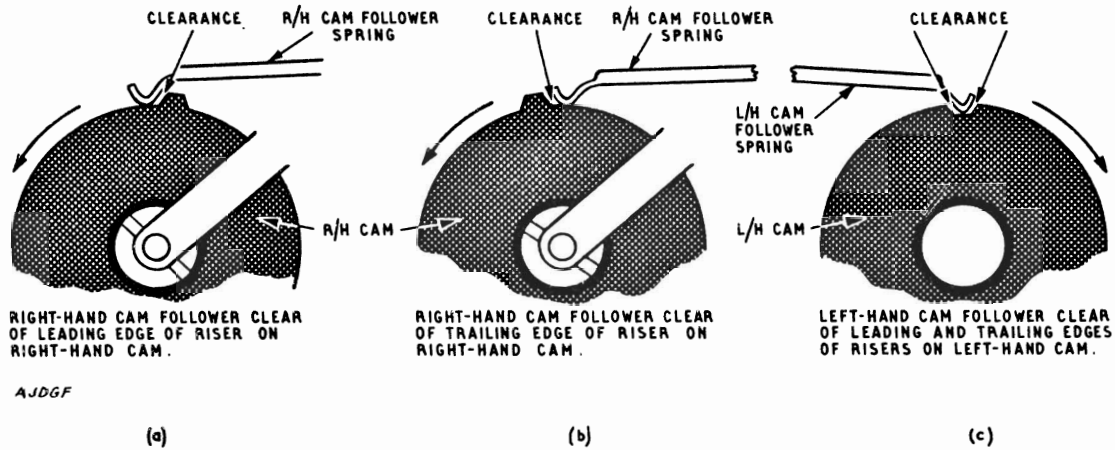


FIG. 9

**16. Interrupter springs.** The spring-set should be screwed securely to the armature knife-edge bracket, with the tags soldered to the appropriate tags of the plug. The interrupter contacts should not overlap by more than  $\frac{1}{3}$ rd of the contact.

The 'break' spring should exert a pressure against the buffer of 5-20 gm 'test', 8-18 gm 're-adjust', which should be checked with the armature operated to relieve the pressure of the lever spring. The lever spring should exert a pressure on the 'break' spring of 40-80 gm 'test', 45-75 gm 're-adjust'. All these spring pressures are measured at the spring tips.

Adjust the gap between the armature striker and the lever spring tongue by bending the buffer plate (see Fig. 10) using Pliers, Adjusting, No. 2, to meet the self-drive conditions detailed in par. 18. After making this adjustment check the spring pressures.

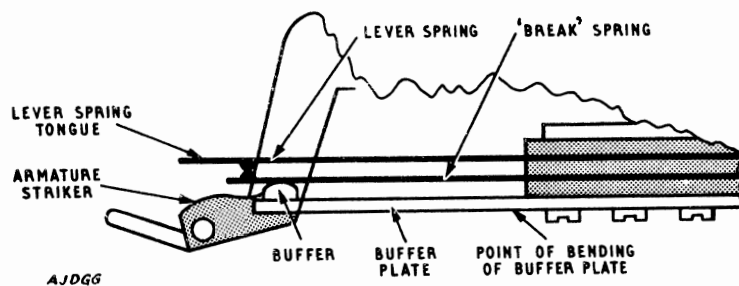


FIG. 10. INTERRUPTER SPRING-SET.

FIG. 10



**17. Armature restoring spring.** By means of the armature restoring spring adjusting screw, tension the armature restoring spring to a point where the armature will just release fully on all steps, with the comb-operated springs fitted. The adjusting screw should then be given one half turn to provide additional restoring-spring tension.

**18. Running tests.** The mechanism should be mounted as described in par. 8, with the cams horizontal.

Table 2 lists the test resistance for each value of ratchet relay coil resistance, and the code of the relative tester which incorporates the test resistance.

TABLE 2

Ratchet relay coil resistance (ohms)	Series running resistance at 50V (ohms)	Tester No.
235	150	80Y
310	100	80X
375	80	80Z

The tensions of the armature restoring spring and the interrupter springs must ensure that the cams will start to rotate reliably when the series resistance is connected to the coil. The instant of interruption of the interrupter springs can be varied to obtain smooth running, by adjusting the gap between the striker and the lever spring.

## MISCELLANEOUS

**19. Dismantling mechanism.**

- (a) Remove cam-follower springs.
- (b) Unsolder and remove interrupter spring-set.
- (c) Remove detent.
- (d) Remove pawl stop.
- (e) Remove cam and ratchet wheel assembly.
- (f) Remove armature back stop.
- (g) Remove armature restoring spring and armature (lift off bottom left-hand corner of armature first).
- (h) Remove armature knife-edge bracket.
- (j) Remove coil assembly from frame.

**20. Assembling mechanism.**

- (a) Replace coil assembly and armature knife-edge bracket in frame; the coil assembly fixing screws must not be tightened until the bracket fixing screws are fitted.
- (b) Replace armature and restoring spring (offer top right-hand corner of armature to pole-face and slide into position).

(c) Replace armature back stop.

Adjust to pars. 9 and 10.

(d) Replace cam and ratchet wheel assembly (lubricate spindle sparingly with Oil, Bearing, No. 16).

Adjust to par. 11.

(e) Fit detent - locate in root of a tooth as a temporary adjustment.

Adjust to pars. 12 and 13.

(f) Replace pawl stop.

Adjust to par. 14.

(g) Replace cam-follower springs (these fixing screws are  $\frac{3}{32}$  in. long).

Adjust to par. 15.

(h) Replace interrupter spring-set - resolder tags.

Adjust to pars. 16 and 17.

## 21. Lubrication. All lubricants should be applied sparingly.

(a) *Graphite, Colloidal in oil* should be applied to the following parts:-

- (i) Teeth of ratchet wheel.
- (ii) Striking face of armature back stop.
- (iii) Armature knife-edge.
- (iv) Pawl and pawl stop, point of contact.

(b) *Oil, Bearing, No. 16* should be applied to the following points:-

- (i) Cam and ratchet wheel assembly bearing.
- (ii) Armature restoring-spring felt insert.

(c) *Grease No. 1* should be used to lubricate the working faces of the cams.

**22. Adjustment of comb-operated springs.** The comb-operated springs, which are 12 mils thick, should be firmly clamped, with perceptible clearance between the lever springs and the buffer block. 'Make' and 'break' springs should rest on their respective buffer block steps. The method of adjustment, straightness of springs, alignment and contact clearance is as detailed in B 5154. Block lift should not be less than 4 mils, and this should be checked on all portions of the cam.

## 23. Spring pressures.

(a) *Block pressure of 'make' and 'break' springs.* 'Make' and 'break' springs should be tensioned against the buffer block to exert a pressure of 12-20 gm 'test', 13-19 gm 're-adjust', measured at the spring tip, 'make' springs normal, 'break' springs operated.

(b) *Lever spring of 'make' contact unit.* The lever spring should be tensioned against the comb step to a pressure of 4-12 gm 'test', 5-11 gm 're-adjust'.

(c) *Lever spring of 'break' contact unit.* The lever spring should be tensioned towards the cam-follower spring so that the 'break' spring is lifted from the block. The lever spring should lift from its comb step when a pressure of 12 gm 'test', 11 gm 're-adjust' is applied to the tip of either the lever or the 'break' spring.

(d) *Change-over contact unit.* The tensions quoted in (a) and (c) apply. There should be a minimum clearance of 5 mils between the 'break' contacts before the 'make' contacts close.

(e) After any spring adjustment, check that the operating combs are free in the spring slots.

**24. Numbering of comb-operated springs.** This follows 600-type relay practice and is detailed in B 5154.

**25. Coil and interrupter spring tag lay-out.** Fig. 11 shows the lettering of the coil and interrupter spring tags.

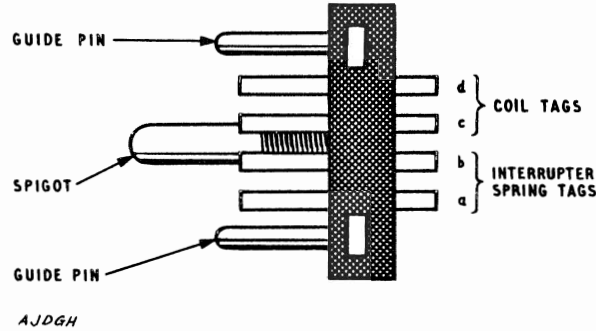


FIG. 11

**26. Piece parts.** Details of piece parts for the ratchet relay are given in B 5541. It should be noted that the cam and ratchet wheel and associated spindle are replaced as one when either item requires to be changed.

**27. Tools.** Tools for adjustment of the comb-operated spring-sets are listed in B 5154. A list of tools suitable for adjustment of the mechanism is given in Table 3. The tools should be used only for the purpose for which they are intended. Any tool which is in such a condition that screws, nuts or springs would be damaged by its use should be changed.

TABLE 3

Rate Book description	Use
Adjuster, Detent, No. 4 or Spike, Capstan, No. 3B	For adjusting armature knife-edge bracket
Gauges, Feeler, No. 10	Strip gauges for general use
" " No. 14	Armature travel
Pliers, Adjusting, No. 1A	For detent adjustment
" " No. 2	For spring adjustment
" " No. 3	" " "
Ringdriver No. 4	For circular fixing nut
Screwdriver, Instrument, No. 2	For general use
" " No. 4	" " "
Spanners, Box, No. 10	For adjusting armature travel (back stop)
" " Cranked, No. 6	For mechanism fixing screw
" " " No. 8	For armature knife-edge bracket and detent fixing screws
" Cranked, No. 12	For cam and ratchet-wheel spindle fixing nut

References:- B 5100, B 5154, B 5541 (TPM2/3)

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