BIMOTIONAL SWITCHES 2000 TYPE. CHECKING AND INSPECTING BEFORE INSTALLATION

This E.I. details the "Quick Check" method of checking bimotional switches, before installation, which must be introduced immediately.

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SECTION 3. MECHANICALLY OPERATED SPRING ASSEMBLIES, WIPER AND WIPER CORDS.

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SECTION 1. GENERAL.

1.1 Bimotional switches are bought by the Department under contracts which provide for their adjustment by the manufacturer. At the time of installation therefore, switches should not require attention in accordance with E.I. TETEPHONE Exch Auto AD 4221.

The Department's policy is to buy switches which, when placed in switch jacks after unpacking and aligning the wipers to the banks, will provide satisfactory service without readjustment of the mechanism and relays.

To ensure that these requirements are met, the installation staff for the equipment used for the job will be responsible for:-

An examination of each switch for loose screws, rust, wiring etc.

A complete check of 1% of each delivery from the contractors to ensure that the equipment conforms to the required acceptance adjustment.

A "Quick Check" of the remainder of the delivery from the contractor to detect any signs of maladjustment in individual switches.

The application of the procedure as described hereunder when inspecting bi-motional switches before installation.

2. SWITCH ACCEPTANCE PROCEDURE.

2.1 The following procedure must therefore be introduced immediately when inspecting bi-motional switches during an installation.

(i) Firstly fully examine 1% of each contractors type in accordance with conditions detailed in pages 8-39 and para 3.1(ii) on page 4 of this E.I. and record on Installation Fault Recording Dockets the details of any departures from departmental acceptance conditions.

(ii) If departures from specifications are detected, advise the Divisional Engineer and obtain his approval to:-

(a) stop examinations pending further enquiries or examination by contractors representatives; or

(b) to proceed ~with the "Quick Check" as detailed later.

(iii) If the 1% check as set down in (i) shows that the switches being examined meet all specification requirements then proceed with a "Quick Check" of the remainder. Only when evidence of maladjustment is detected during the "Quick Check" should further adjustment checks as detailed in pages 8-39 be made. Take care to keep a full record of any work done as a claim against the manufacturer, may be involved.

(iv) If the switch examined as in (i) and (iii) is satisfactory it must be initialled by the inspecting officer on the under side of the die cast frame and carefully replaced in the carton or fitted into the switch jack, depending on the stage of the installation.

(v) If any switch fails to pass the test inspections as in (i) and (iii) the nature of the unstandard condition must be recorded on a sequentially numbered "Installation Fault Report" (see Fig. 1). The switch must then be replaced in the carton together with the Fault Report and set aside for further attention.

FORM
I.P.I. 1.

Fault No.....

INSTALLATION FAULT RECORDING DOCKET

Type of Equipment
Manufactured by Sched.. Cont

Examined by..... Date.....
Nature of fault.....
.....
.....
.....

Rectified by..... Date.....
Checked by..... Date.....

Time Expended Clearing Fault
Hrs..... Mins.....

FAULT DOCKET.

FIG. 1.

(vi) When the Quick Check inspection referred to in (iii) above has been done, the Engineer responsible for the installation .must again be advised regarding the number of switches requiring attention and the nature of any common unstandard condition.

(vii) The responsible Engineer will determine whether the unstandard conditions resulting from the Quick Check will be rectified immediately or whether arrangements will be made for the Contractor's representative to make an inspection of the equipment before any alterations are made, in case it may be necessary to claim compensation.

(viii) Unstandard adjustments must be rectified only by technicians highly skilled in switch adjustments. The performance of switches in service depends to a very great extent on the condition of their adjustment when installed initially;

(ix) When the faulty switch has been adjusted to comply with the tolerance of this E.I. it must be initialled by the officer completing the work and replaced in the carton or placed in the switch jack according to the circumstances.

(x) The recording procedure detailed in E.I. INTERNAL PLANT INSTALLATION General R 8010 must be followed when completing Installation Fault Reports for unstandard adjustments referred to above.

3. QUICK CHECK.

3.1 General. The "Quick Check" inspection practice which must be introduced with the issue of this E.I. is as follows:-

(i) The "Quick Check" inspection must be made on the remainder of the switches supplied from the one contractor, only after the initial 1% has been completely checked (see para 2.1(i and ii) on page 2) and the general quality of the equipment has been determined as satisfactory. The check should be made with the switches in a suitable Test Stand before they are mounted in the rack. Should any switch fail to pass any of these checks reference to the sections indicated in para 3.3 can be made to determine the exact cause of the fault. It is not necessary to apply part of or the full range of checks referred to in pages 8-39 of this E.I. except where a maladjustment is evident. The checks must be made immediately after the switches have been unpacked and there must be a minimum delay in mounting them on the racks.

(ii) Before doing this check, examine each switch for loose screws, loose or damaged parts or other unstandard conditions. All parts must be examined for quality and consistency of finish. In particular, signs of rust or corrosion must be brought under notice. Examine also the wiring for neatness and each soldered connection for "dry joints" and that soldered tags of relays and other spring-sets clear the franc and each other by at least 1/16".

3.2 Quick Check Inspection. (Reference should be made to para 3.3 for directions regarding various detailed CHECK adjustments should any maladjustment be detected during the Quick Check.)

1. Bearings free. Raise the carriage; rotate and restore it by hand to ensure that the carriage, operating levers, pawls, detents etc. operate freely without bind.

   The shaft must be located without side play in the conical seating, and be firmly clamped by the shaft clamp.

2. Moving off-normal. With the carriage held so that the cam is slightly forced against the comb plate, the selector should step off-normal, when the vertical armature is operated by hand.

   With the play between the latching lug of the rotary detent and the rotary disc taken up, the selector should step off-normal when the vertical armature is operated by hand.

3. Vertical stepping. The carriage should step vertically when the vertical armature is operated electrically, should have no vertical play, and should not drop on one tooth or drop more than 6 mils in any other tooth when the armature restores.

   With the carriage standing on any vertical step it should be held by the vertical detent.

4. Moving into the rotary position. The carriage should move easily into the first rotary position on any level when the rotary armature is operated by hand.

5. Rotary stepping. The carriage should step in the rotary direction when the rotary armature is operated electrically, should have no rotary play, and no backlash on one tooth, and not more than 5 mils on any other tooth when the armature restores.

   With the carriage standing on any rotary step, the short face of the rotary tooth should rest against the rotary detent.

6. Restoring from the 42th rotary position. The carriage should step from the 11th to the 12th rotary position on levels 1, 0, and also on any level on which N.P. cams are fitted, when the rotary armature is operated electrically. With the carriage held on the 12th step by hand, release and re-operate the rotary armature electrically and then allow the carriage to return to normal.

7. Restoring in the normal level. The carriage should restore to normal when released from the 12th position on level 0. The carriage should also restore fully to normal from the 8th rotary position on the normal level.

8. Mechanically operated spring sets. The springs should make good contact, and lift their block springs away from the block in either the normal or operated position, and should operate correctly as intended. Operating surfaces should be clear of the cam except on the positions on which the springs are intended to operate.

9. Interrupters. Vertical interrupters should operate and restore reliably when the vertical armature is operated and restored by hand, with the carriage standing on any rotary step, and when required, should cause the selector to hunt vertically.

   Rotary interrupters should operate reliably when the rotary magnet is energised on any rotary step, and should restore when the rotary armature is returned by hand to its back stop. The selector should restore under action of the interrupter from any rotary step to 'normal without hesitation.

10. Wipers. As detailed in pages 35-38.

3.3 The following table must be used for detailed directions in Checking (NOT ADJUSTING) any suspected maladjustments of switches. Para 2.1 (v and vii) indicates the action to be taken if maladjustment is proven after checking with the detailed directions.

4. PHYSICAL PROPERTIES OF MATERIAL USED IN SWITCHES AND RELAYS.

Divisional Engineers must see E.I. INTERNAL PLANT INSTALLATION General I 0201 and ensure that the conditions in that E.I. have been met. Where an analysis of the physical properties of the materials used in the construction of bimotional switches etc. supplied to a job has not been made action must be taken by the Divisional Engineer in charge of the installation to obtain the required information. The quality of nickel silver, soft magnetic iron, case hardening, plating and insulating materials must be proved.

5. LUBRICATION.

The lubrication of these switches is covered by E.I. INTERNAL PLANT INBTAILATION General A4221.

6. ADJUSTMENTS.

The procedure herein describes a ready means of checking that a switch is in satisfactory adjustment before it is placed into service. Should any readjustment be required the practices as detailed in E. I. TELEPHONE Exch Auto AD 4221 must be followed but the tolerances as given in this E.I. (E 5310) must be used. For relay adjustments see E.I. TELEPHONE Relays AD 1001.

7. INSULATION RESISTANCE.

The insulation resistance between coils and frame and between all parts (except wipers) not intended to be in electrical connection must not be less than 100 megohms at 500 volts D.C. One switch from each case must be tested in this respect, but all other switches from the case should not require the individual cartons to be opened at this stage.

8. ROUTINE TEST.

After the check, each switch must be tested by the appropriate Test Set or Routiner.

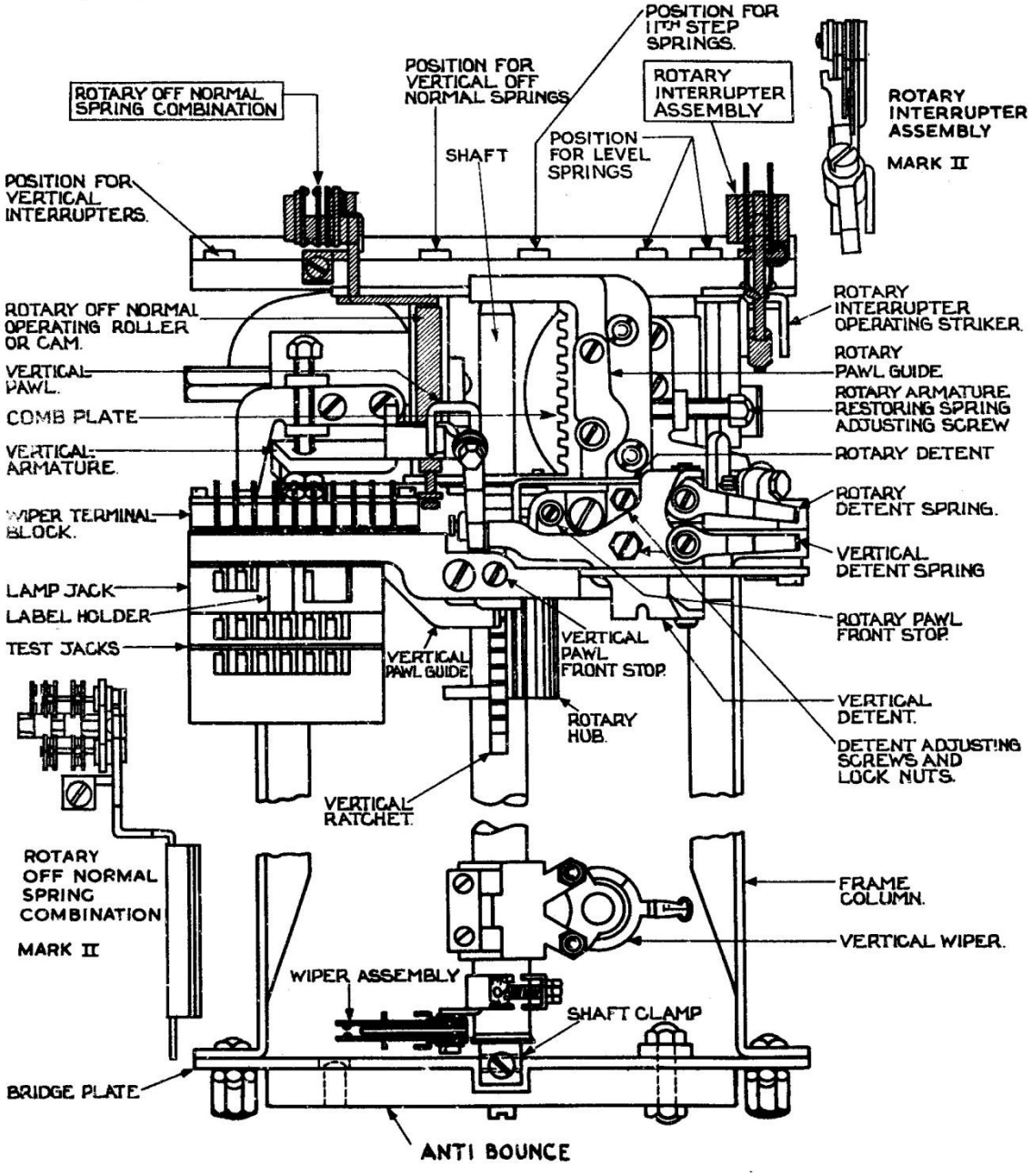
9. ROUTINE TEST.

Records of all adjustments made to new equipment must be recorded on Form I.P.I.1 (see Fig. 1). The fault record docket for any adjustment of a major nature must be marked with a red cross to draw attention to it. The dockets must be numbered sequentially at the beginning of each installation and on completion of the adjustment of equipment, the complete dockets must be sent to the Divisional Engineer.

SECTION 2. MECHANISM ADJUSTMENT CHECKS.

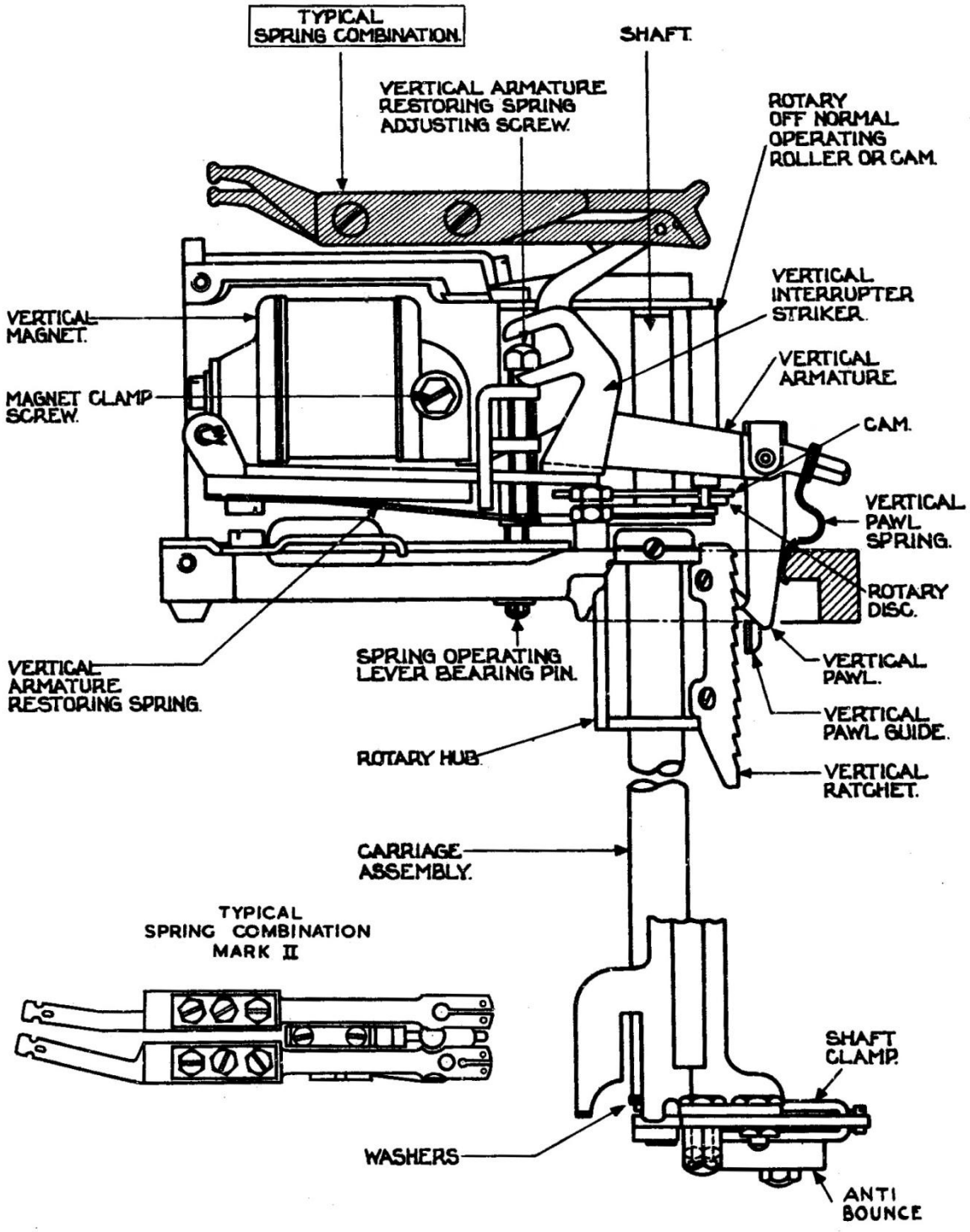
1. NAMES OF THE VARIOUS PARTS.

1.1 The names of the various parts of the Bimotional Switch mechanism are shown on Figs. 1, 2 and 3.



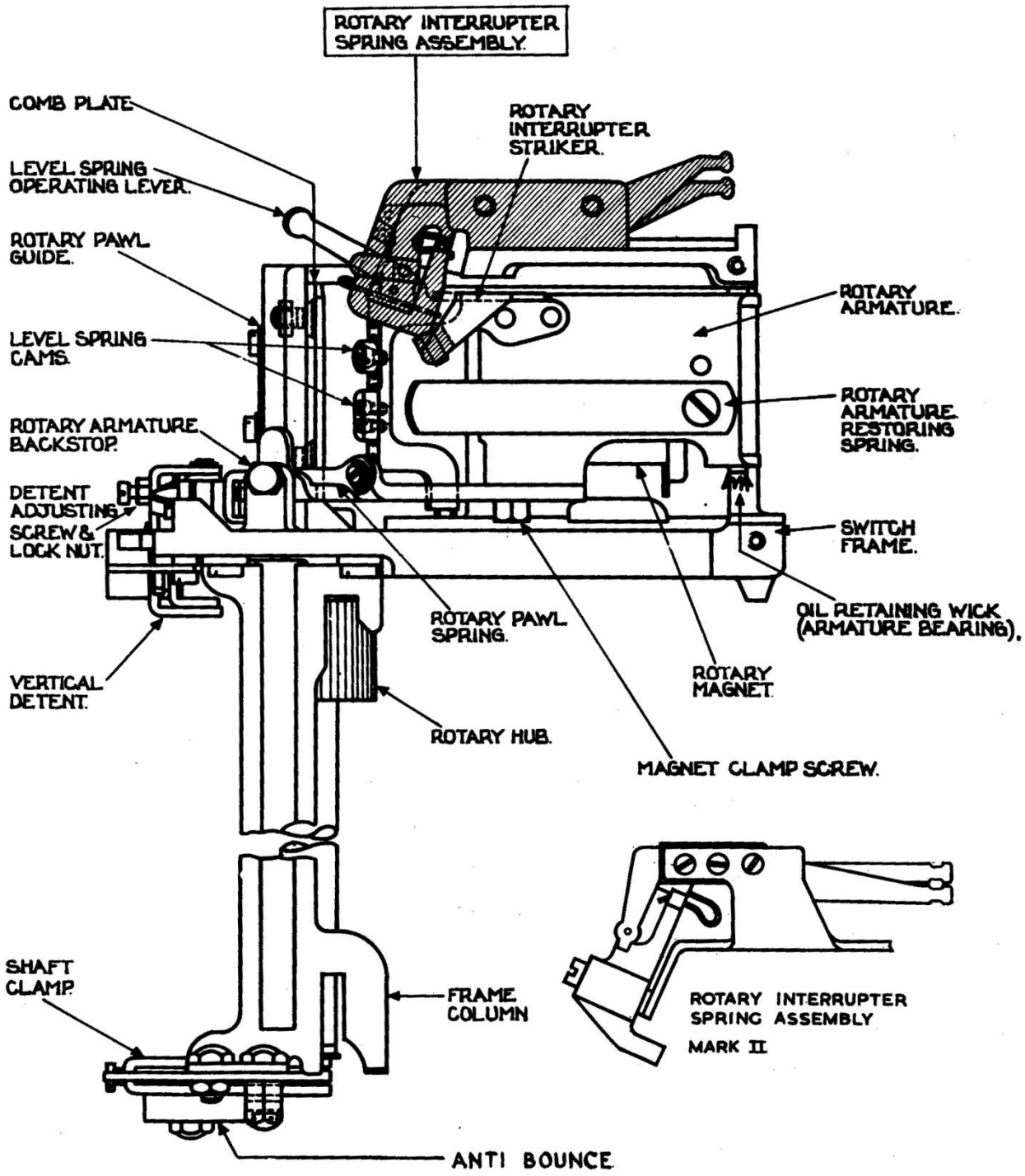
2000 TYPE BIMOTIONAL MECHANISM (FRONT VIEW).

FIG. 1.



2000 TYPE BIMOTIONAL MECHANISM (SIDE VIEW).

FIG. 2.



2000 TYPE BIMOTIONAL MECHANISM (SIDE VIEW).

FIG. 3.

2. REMOVING SWITCHES FROM SHELVES OR TEST STANDS.

2.1 Removal of a Selector from the Shelf. When a selector is to be removed from the shelf, it should first be busied by moving the red test-link from test jacks Nos. 13 and 14, to test jacks Nos. 7 and 8. The green test-link should then be withdrawn from test jacks .Nos. 11 and 12, so as to disconnect the rotary circuit and thus obviate the possibility of wipers rotating during the removal of the selector. If the selector is fitted with' a vertical-marking wiper the vertical-marking bank should next be swung clear of the wiper (see Fig. 5) and locked by the ball engaging the rear Hole in the mounting bracket. The selector should then be gripped firmly alongside the shaft clamp at the bottom of the carriage and by the top cover-guide, and be pushed upwards with a steady pressure until the locating screws in the relay-mounting plate strike the tops of the slots in the shelf cradle (see Fig. 4), the selector should then be lifted forward until it is just clear of the slots, and then upwards until clear of the bank. Care should be taken not to swing the selector too far forward, otherwise damage to the bank-engaging fork at the bottom of the frame columns will result.

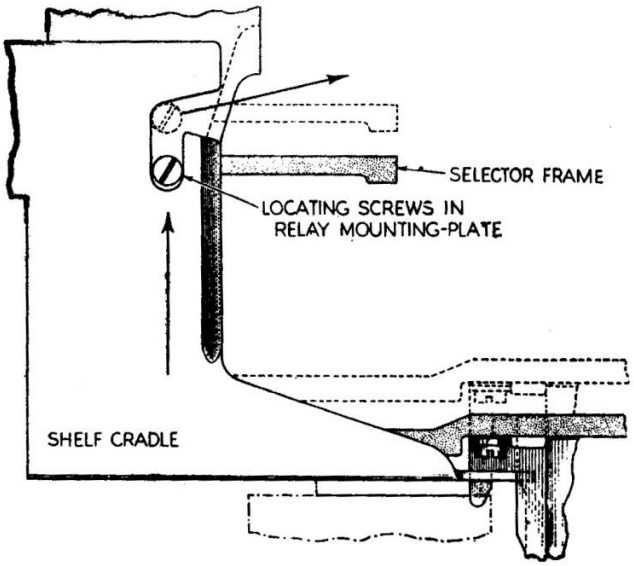


FIG. 4. REMOVAL OF SELECTOR FROM CRADLE.

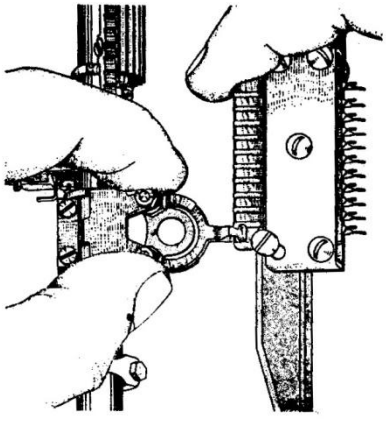


FIG. 5. DISENGAGING VERTICAL-MARKING BANK FROM WIPER.

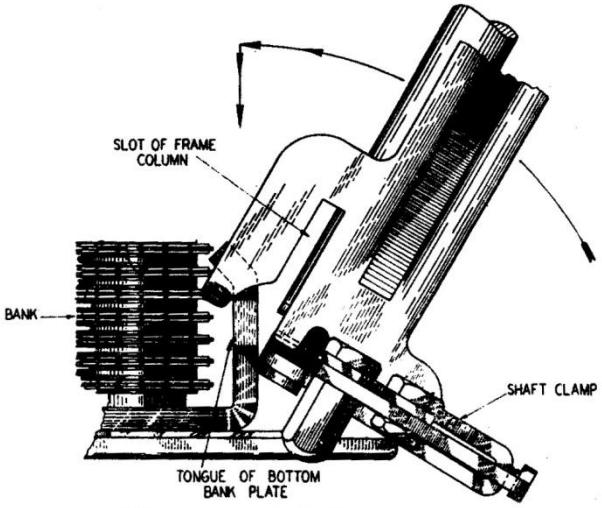


FIG. 6. REPLACEMENT OF SELECTOR.

2.2 Replacement of a Selector on the Shelf. When a selector is to be replaced on the shelf, it should first be checked that-

(i) The red test-link is in test jacks Nos. 7 end 8 and the green test-link has not been replaced Ln test jacks Nos. 11 and 12, and

(ii) The wiper carriage is normal.

Before replacing the selector, the vertical-marking wiper (if one is fitted) should be swung to the front of the carriage so as to avoid the possibility of fouling the line and P-banks.

To replace the selector, the slots in the frame columns should be placed over the tongues on the bottom bank plate, as shown in Fig. 6. The selector should then be hinged towards the shelf, so that the locating screws in the relay-mounting plate engage the slots in the shelf cradle, and then lowered into the shelf jack. The selector should slide down easily into position without straining the frame columns over the bottom bank-plate guides. The position of the selector should be such that it is located by the stop blocks on the underside of the frame resting fully on the cradle (see Pigs. 7 and 8). To restore the selector into service, the test links should be returned to their normal positions.

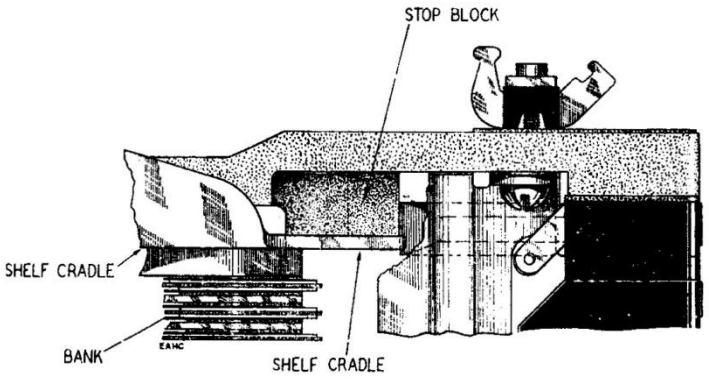


FIG. 7. LOCATION OF SELECTOR ON CRADLE.

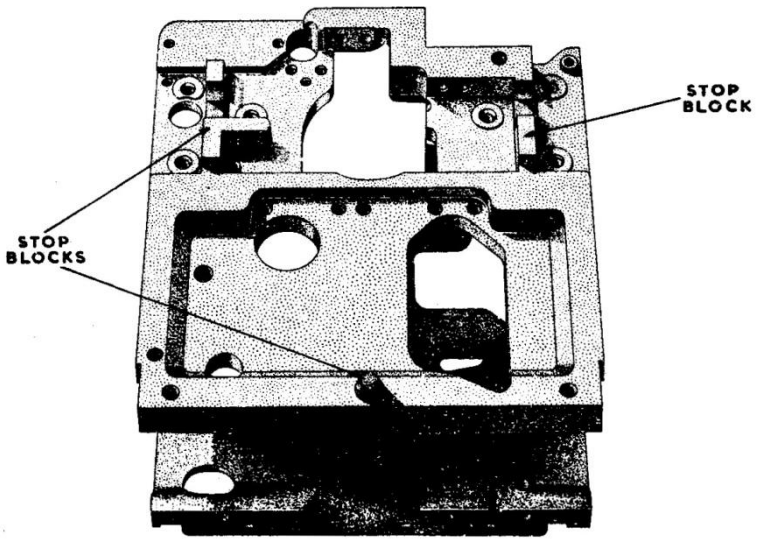


FIG. 8. UNDERSIDE OF FRAME, SHOWING STOP BLOCKS.

2.3, The selectors shall be capable of removal from, and replacement in, the cradle without undue strain.

3. FRICTION LOCKED SCREWS.

3.1 The vertical and rotary pawl front stops shall be held securely by the locking screws. The adjusting screws for the armature restoring springs shall be friction locked and incapable of being turned by hand.

4. ANTI-BOUNCE DEVICE.

4.1 The anti-bounce device should be secured to the bridge plate so that the projecting stud is approximately central in the hole in the plate (see Fig. 9.). The anti-bounce plate should normally lie flat on the bridge plate. Deviations are permissible providing that the anti-bounce plate is in contact with the bridge plate at a point within $\frac{5}{8}$ in. of the shaft axis. Any gap between the anti-bounce plate and the bridge plate at the extreme free end should not exceed 20 mils.

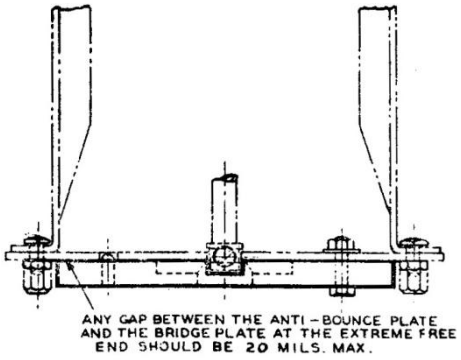


FIG. 9. ANTI-BOUNCE DEVICE.

5. SHAFT AND WIPER CARRIAGE ASSEMBLY.

5.1 Shaft. The shaft shall be located in the conical seating without side-play.

5.2 Carriage Assembly. The assembly shall be free on the shaft when raised or lowered in the twelfth rotary position. Side play, if any, shall be just perceptible. The shaft hub assembly shall return to normal with certainty from the seventh position in the normal level. This is approximately the position at which the left-hand side of the rotary detent is in line with the right-hand side of the gap between the rotary disk and the cam-plate. (See Fig. 10.)

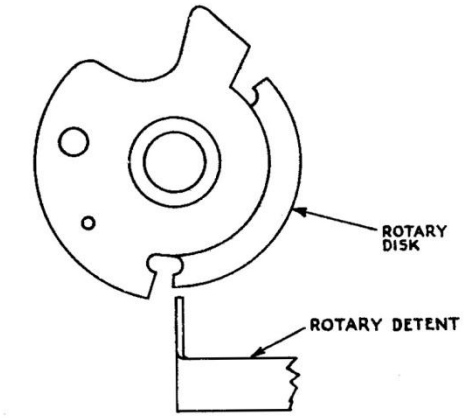
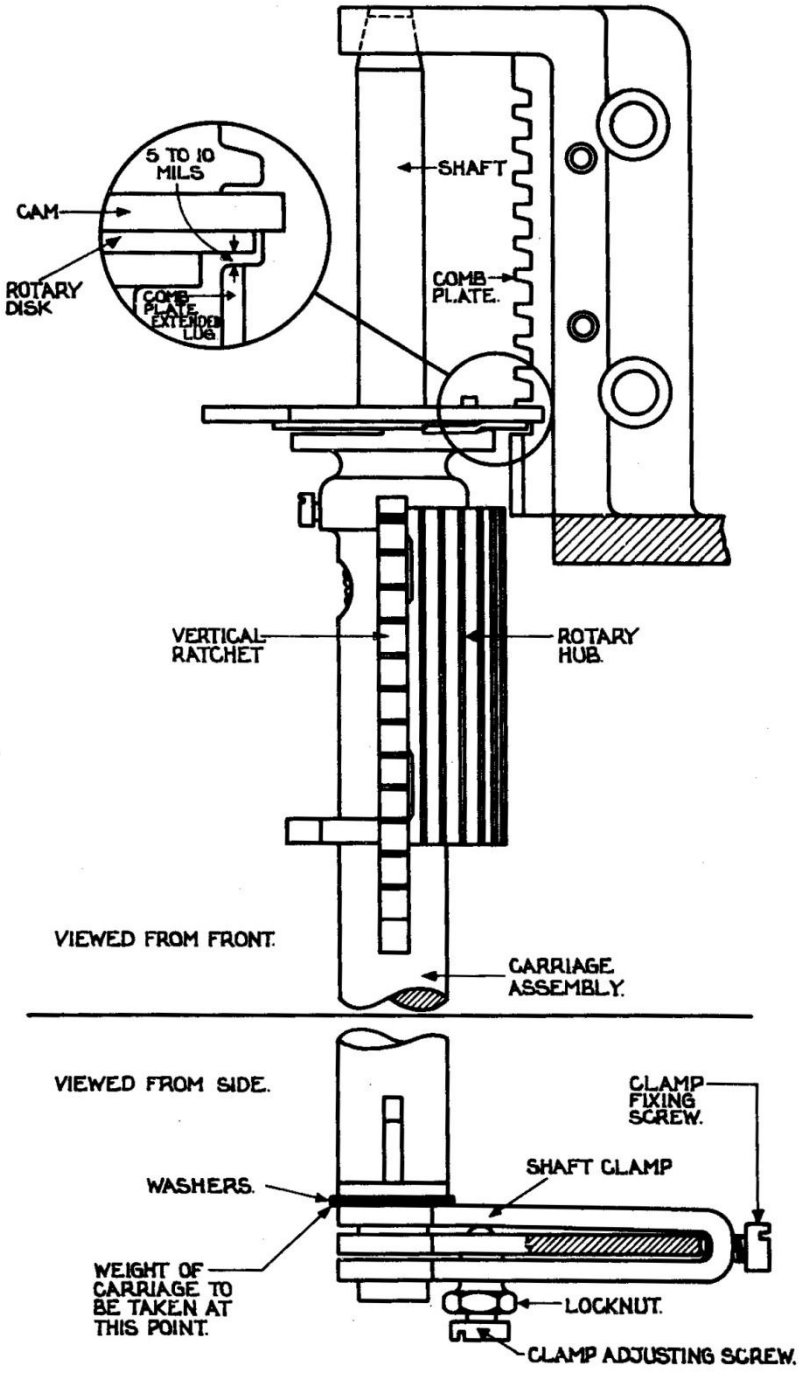


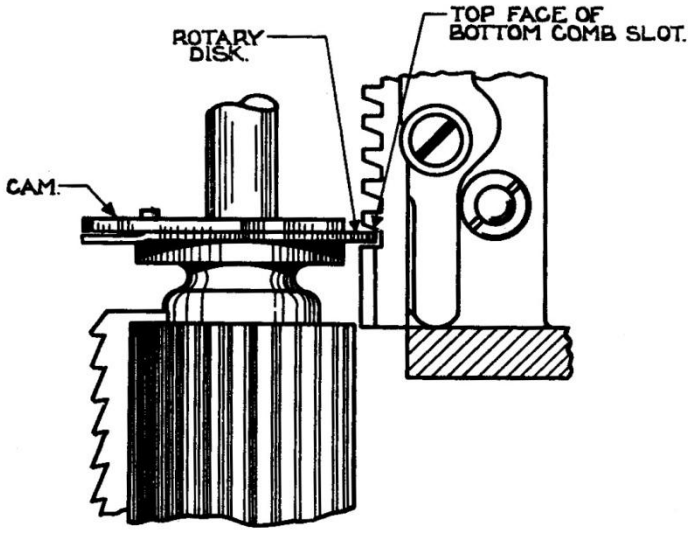
FIG. 10. POSITION FROM WHICH TO RELEASE CARRIAGE TO CHECK LATCHING OF ROTARY DETENT.

5.3 Rotary Disk and Comb Plate Clearances. A clearance of 5. to 10 mils shall exist between the extended lug on the comb plate and the rotary disk with the carriage assembly at normal. The rotary disk shall not foul the upper or inside faces of the comb plate slot on the normal or any other level. See Figs. 11 and 12.



ROTARY DISK AND COMB PLATE CLEARANCES.

FIG. 11.



CHECK FOR CLEARANCE BETWEEN TOP FACE OF ROTARY DISC AND COMB, CARRIAGE RETURNING ON NORMAL LEVEL.

FIG. 12.

6. DETENT ADJUSTMENTS.

6.1 Vertical and Rotary Detent Bearings. The detents shall be free on their bearings without vertical play at the bearings; side play, if any, shall be just perceptible.

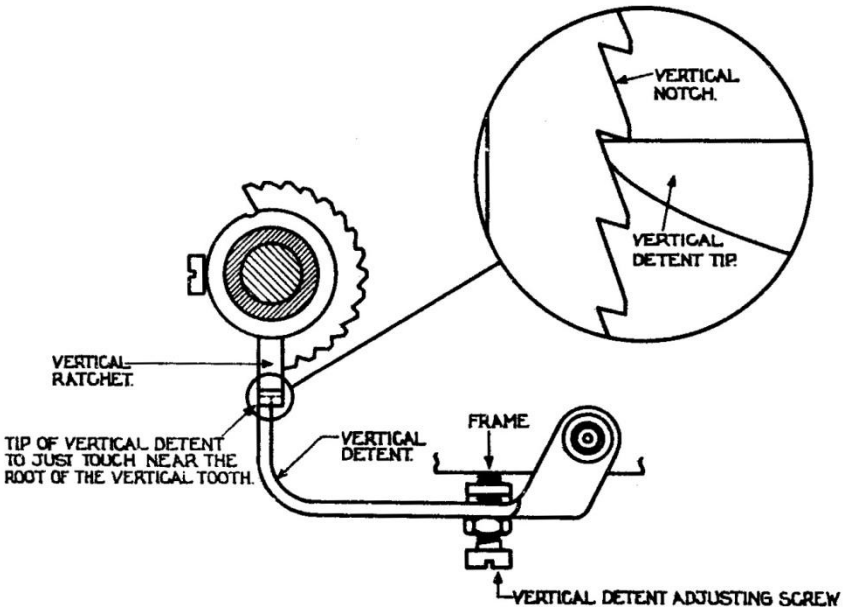
6.2 Vertical Detent. The detent shall be lined up so that it is in full engagement with, and on the left-hand side, of the vertical ratchet. (See Fig. 13.) The tip of the detent shall-

(i) Touch the sloping face of the vertical teeth except the first, and

(ii) Not prev.ent the carriage assembly from finally returning to its normal position.

On selectors where the entering edge of the rotary disk is chamfered, the rotary disk shall enter the slot on the comb without rise or fall as judged visually, when the carriage assembly is rotated on the 5th level by hand operation of the armature.

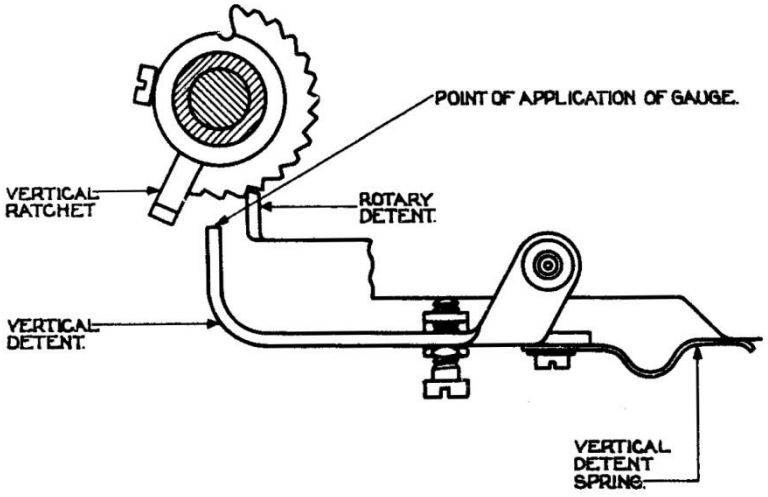
On selectors where the entering edge of the rotary disk is not chamfered, the rotary disk shall enter the slot on the comb on the 5th level with a maximum drop of 6 mils. The carriage assembly must not rise as it cuts in on any level. Also the top surface of the rotary disk shall not foul the comb plate slot on entry.



ADJUSTING DEPTH OF ENGAGEMENT OF VERTICAL DETENT.

FIG. 13.

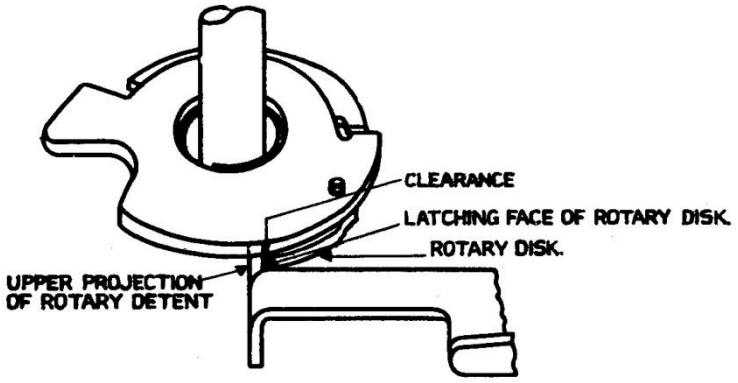
6.3 Vertical Detent Spring. The tension of the spring measured at the tip of the detent with the the carriage assembly rotated in the "0" level, shall be 110 ± 30 grammes. (See Fig. 14.)



CHECKING TENSION OF VERTICAL DETENT SPRING.

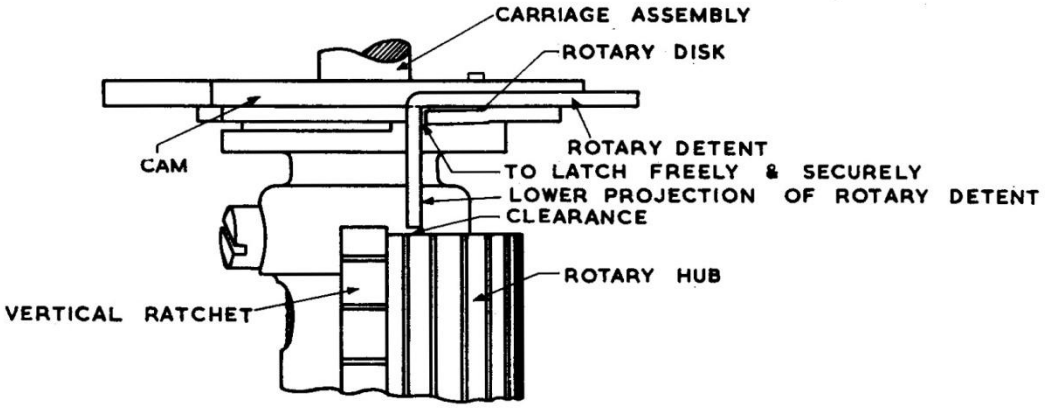
FIG. 14.

6.4 Rotary Detent. The detent projection shall latch freely and securely behind the rotary disk in normal position. The under surface of the detent shall clear the top surface of the rotary hub during the return of the carriage assembly in the normal level. (See Figs. 15 and 16.)



LATCHING OF ROTARY DETENT PROJECTION WTTH ROTARY DISK.

FIG. 15.

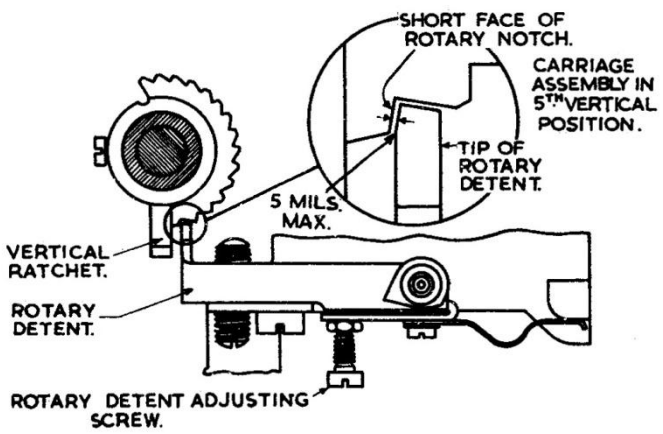


CLEARANCE BETWEEN ROTARY DETENT AND TOP FACE OF ROTARY HUB.

FIG. 16.

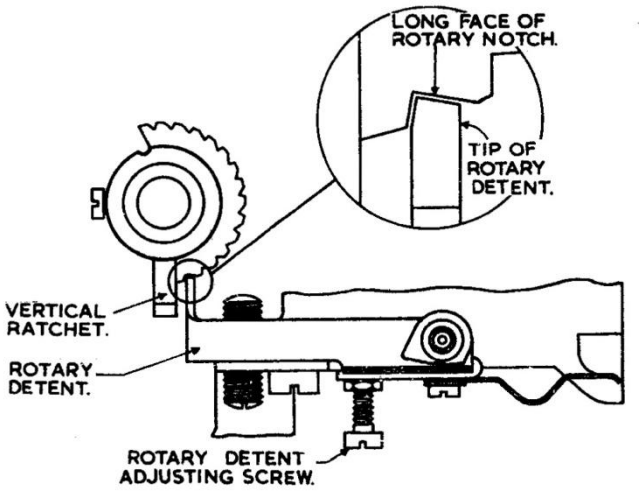
With the shaft hub assembly raised on the 5th level, the detent tip shall lie parallel with, and clear of, the short face of the 1st rotary notch. The maximum clearance between the short face of the rotary notch and the detent shall be 5 mils. (See Fig. 17.)

The position of the detent adjusting screw shall be such that the tip of the detent is clear of the long face of the first rotary notch on the first level. (See Fig. 18.)



LATERAL ADJUSTMENT OF ROTARY DETENT TIP.

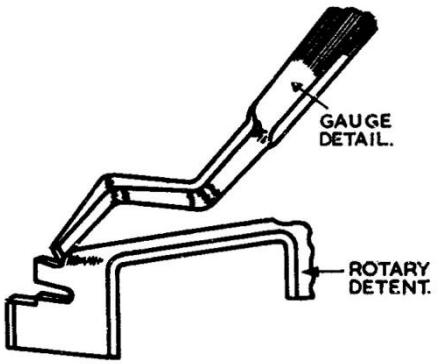
FIG. 17.



DEPTH OF ENGAGEMENT OF ROTARY DETENT.

FIG. 18.

6.5 Rotary Detent Spring. The tension of the detent spring measured at the auxiliary tip of the detent with the carriage assembly raised shall be 130 ± 30 grammes. (see Fig. L9.)



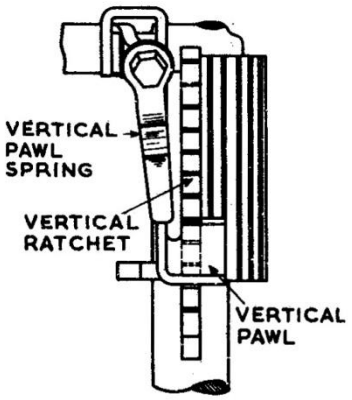
CHECKING TENSION OF ROTARY DETENT SPRING.

FIG. 19.

7. VERTICAL ADJUSTMENTS.

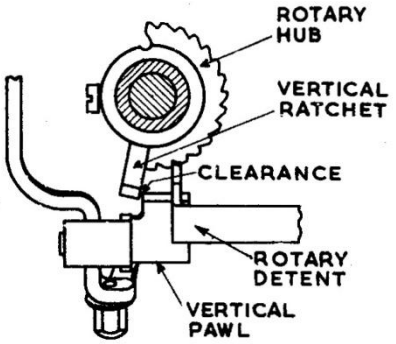
7.1 Vertical and Rotary Magnets, Armatures and Pawl Bearings. The armatures and pawls shall be free on their bearings, and any play shall be just perceptible. The armature shall be square with the magnet poles when operated.

7.2 Vertical Pawl. The ratchet shall be in full engagement on the left-hand side of the pawl when the armature is operated. (See Fig. 20.) The pawl shall clear the ratchet teeth when the carriage assembly is rotated one step electrically. (See Fig. 21.) The carriage shall not attempt to lift vertically when the vertical armature is operated (without lateral movement) by hand. Check on levels 1 and O. The pawl arm shall clear the pawl front stop during operation. (See Fig. 22.)



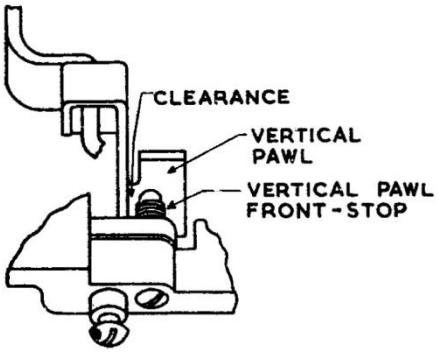
ALIGNMENT OF VERTICAL PAWL WITH VERTICAL RATCHET.

FIG. 20.



CLEARANCE BETWEEN VERTICAL PAWL AND VERTICAL RATCHET TEETH CARRIAGE ROTATED ONE STEP.

FIG. 21.



CLEARANCE BETWEEN SIDE OF VERTICAL PAWL AND PAWL FRONT STOP.

FIG. 22.

7.3 Vertical Pawl Guide. The setting of the vertical pawl guide shall be such that the pawl enters any vertical notch on the ratchet without striking the short face of the notch first. (See Pig. 23.) The vertical pawl shall enter the vertical tooth when the shaft hub assembly returns to normal in the normal level. (The vertical pawl may pivot slightly forward during release.)

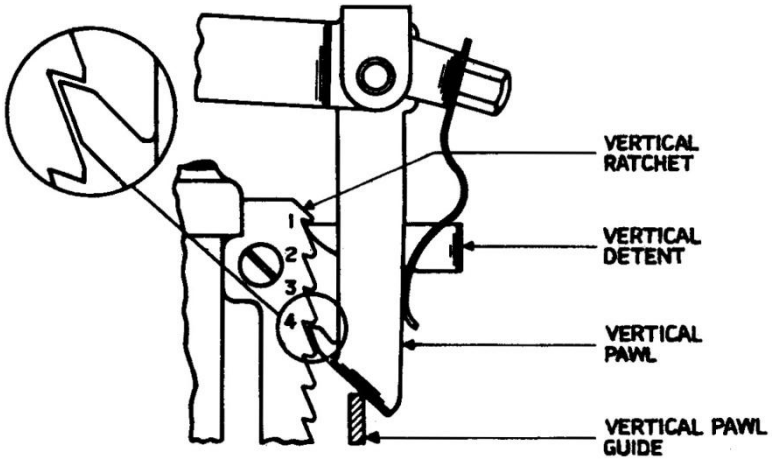


FIG. 23. ADJUSTMENT OF VERTICAL PAWL GUIDE.

7.4 Vertical Armature Backstop. The vertical pawl shall trip over the vertical teeth without causing the shaft hub assembly to rise when the vertical armature restores.

With the vertical detent withdrawn and the carriage assembly held by the vertical pawl on levels 2 and 9 in turn, the rotary disk shall enter the comb slot when the carriage assembly is rotated by operating the rotary armature by hand. On no account must the rotary disk strike the comb plate slot on that portion of the disk above the chamfer. (See Fig. 24.)

On selectors where the entering edge of the rotary disk is not chamfered, the rotary disk shall enter the comb slot without rising when the carriage assembly is rotated with the vertical detent withdrawn.

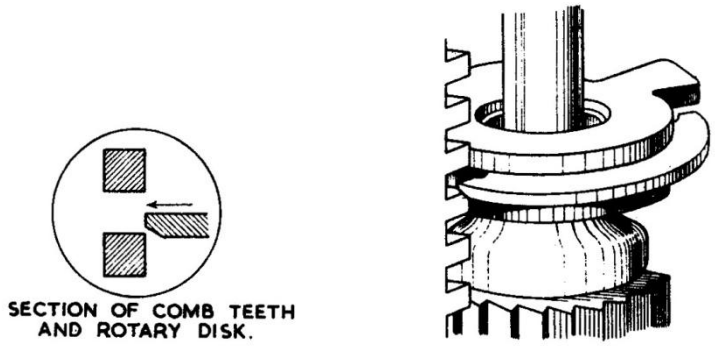
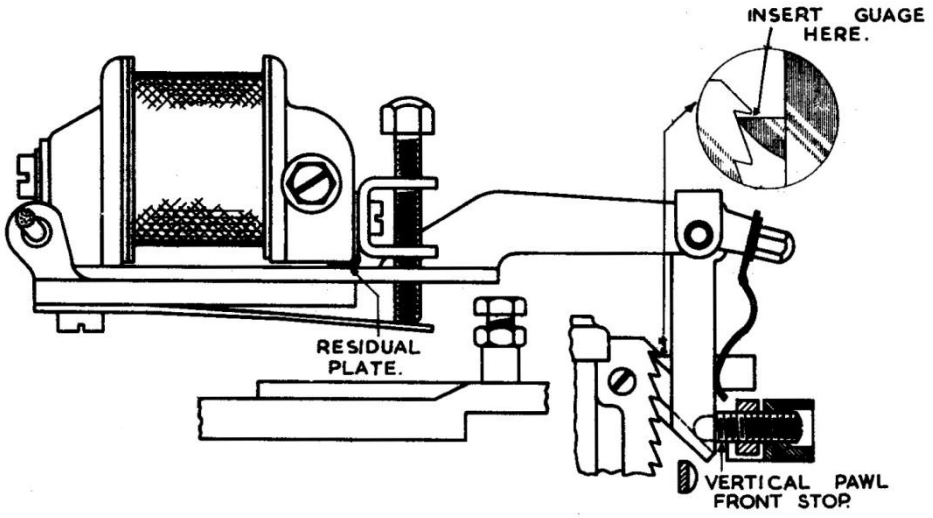


FIG. 24. CHECKING VERTICAL ARMATURE BACKSTOP ADJUSTMENT.

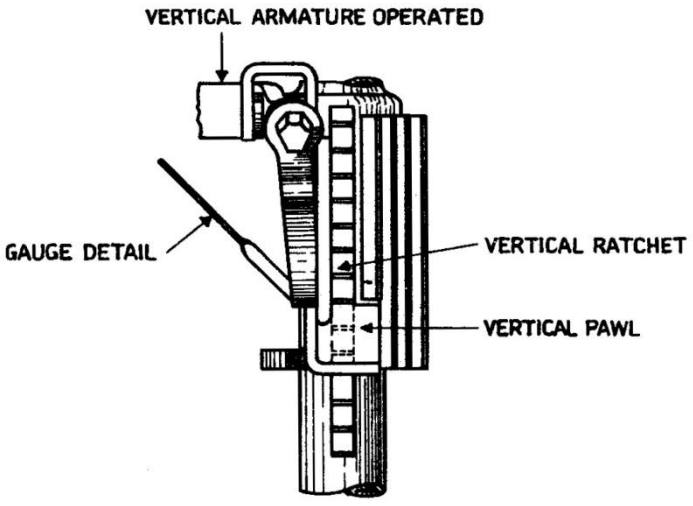
7.5 Vertical Pawl Front Stop. With the vertical armature operated electrically there shall be no vertical play in the carriage assembly. When the armature commences to restore there shall be no drop in the carriage assembly on at least one level and not more than 5 mils on any of the remaining levels. This shall be checked by the insertion of a gauge between the vertical detent and the short face of the vertical teeth when the armature is operated electrically. (See Fig. 25.)



LOCATING VERTICAL ARMATURE IN OPERATING POSITION.

FIG. 25.

7.6 Vertical Pawl Spring. The tension of the spring measured at the spring tip with the armature operated shall be 80 ± 30 grammes. (See Fig. 26.) The spring shall clear the vertical pawl front stop and clamp plate when the armature is normal and when the carriage assembly is in the 10th vertical position.

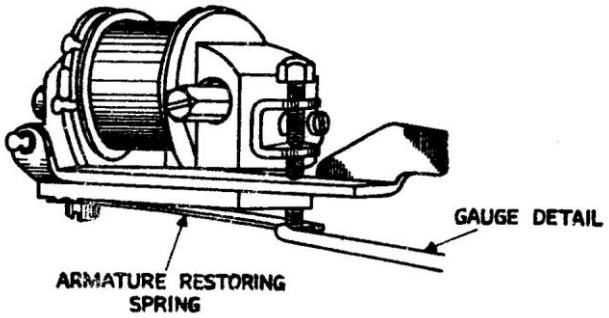


CHECKING THE TENSION OF THE VERTICAL PAWL SPRING.

FIG. 26.

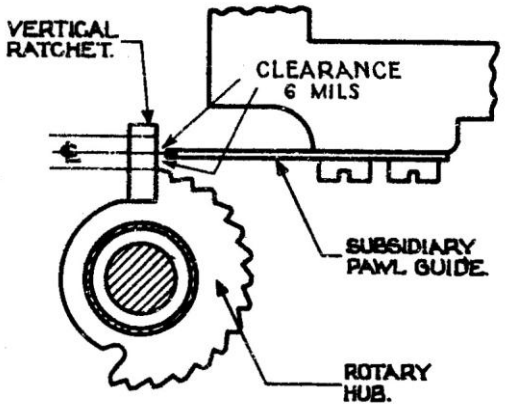
7.7 Vertical Armature Restoring Spring. The tension of the spring measured at the spring tip shall be 350 ± 50 grammes when the armature is normal. The adjusting screw shall have a margin of 'adjustment of at least three threads in each direction. (See Fig. 27.)

7.8 Subsidiary Vertical Pawl Guide. The guide shall clear by at least 6 mils the vertical and rotary ratchet when the carriage assembly is normal. (See Fig. 28.)



CHECKING VERTICAL ARMATURE RESTORING SPRING TENSION

FIG. 27.

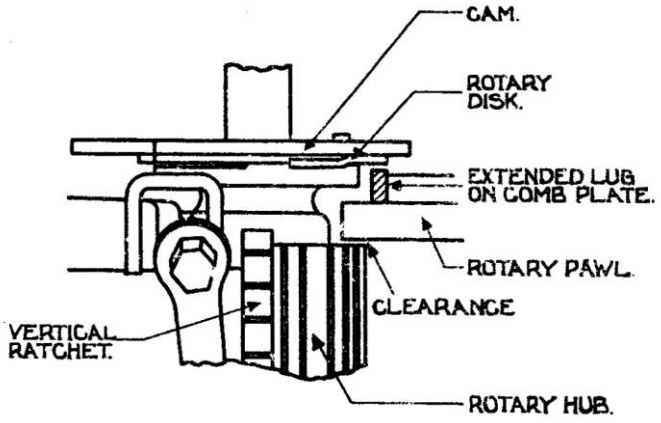


POSITION OF SUBSIDIARY PAWL GUIDE VIEWED FROM UNDERSIDE.

FIG. 28.

8. ROTARY ADJUSTMENTS.

8.1 Rotary Pawl. The tip of the pawl shall strike squarely into the rotary teeth when the rotary armature operates and the pawl locking projection shall not extend above the extended lug on the comb plate. The pawl shall clear the rotary hub when the carriage assembly is returning in the normal level with the rotary armature operated. (See Fig. 29.) The rotary pawl bearing shall, in all circumstances, be clear of the casting.



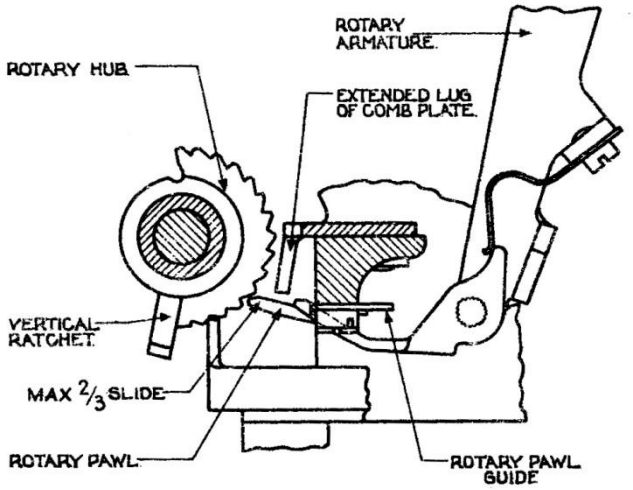
CLEARANCE BETWEEN ROTARY PAWL AND TOP OF ROTARY HUB.

FIG. 29.

8.2 Rotary Pawl Guide. The setting of the rotary pawl guide shall be such that the pawl enters any rotary notch on the hub without striking the short face of the notch first. A maximum slide of two thirds on the long face of the notch is permissible. (See Fig. 30.)

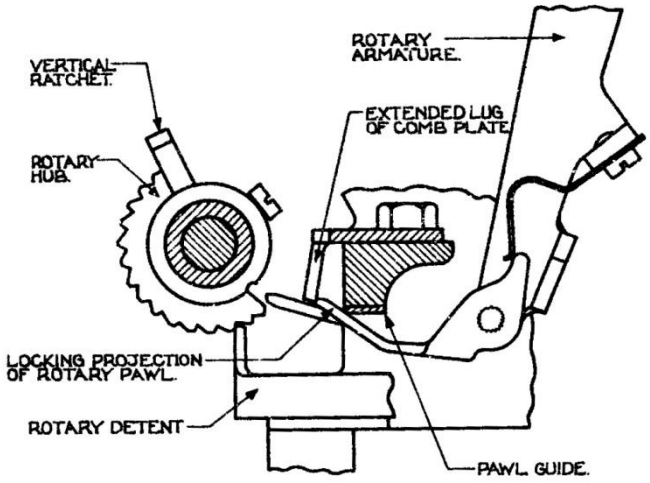
With the rotary armature operated in the twelfth rotary position, the locking projection of the rotary pawl should lock securely behind the extended lug at the bottom of the comb plate. (See Fig. 31.) The pawl shall clear the rotary hub during the restoration from the twelfth rotary position.

The pawl locking projection shall clear the extended lug on the comb plate during the operation of the rotary armature on any step.



ADJUSTMENT OF ROTARY PAWL GUIDE.

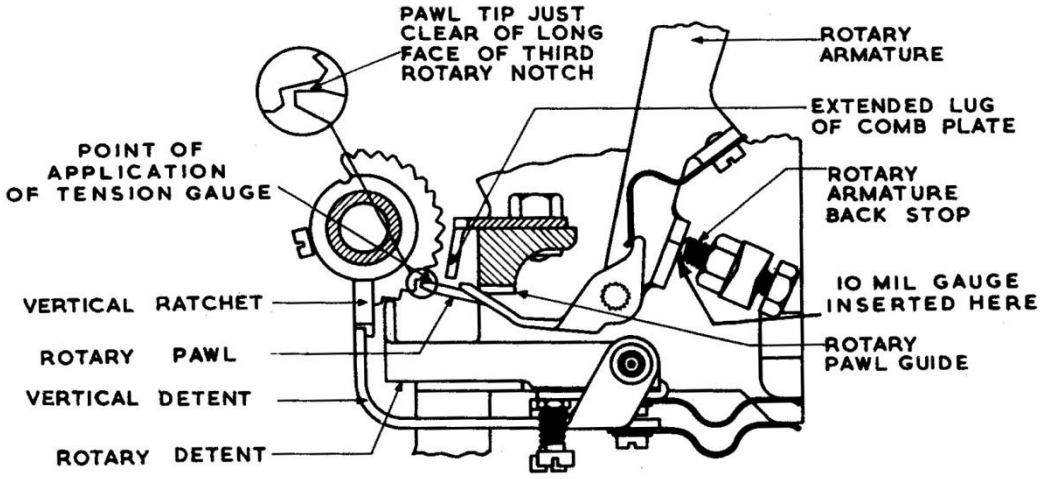
FIG. 30.



LOCKING OF ROTARY PAWL WITH COMB PLATE LUG. (CARRIAGE ON 12TH STEP.)

FIG. 31.

8.3 Rotary Armature Backstop. When the carriage assembly is raised to the first vertical step, the pawl tip shall be clear of the long face of the third rotary notch. (See Fig. 32.) The maximum clearance between the tip of the pawl and the rotary notch shall be such that when a gauge of 10 mils is inserted between the armature and the backstop the tip of the rotary pawl fouls the carriage assembly when it is raised gently from normal to the first level.



SETTING OF ROTARY ARMATURE BACKSTOP AND POINT OF APPLICATION OF GAUGE WHEN MEASURING ROTARY PAWL SPRING TENSION.

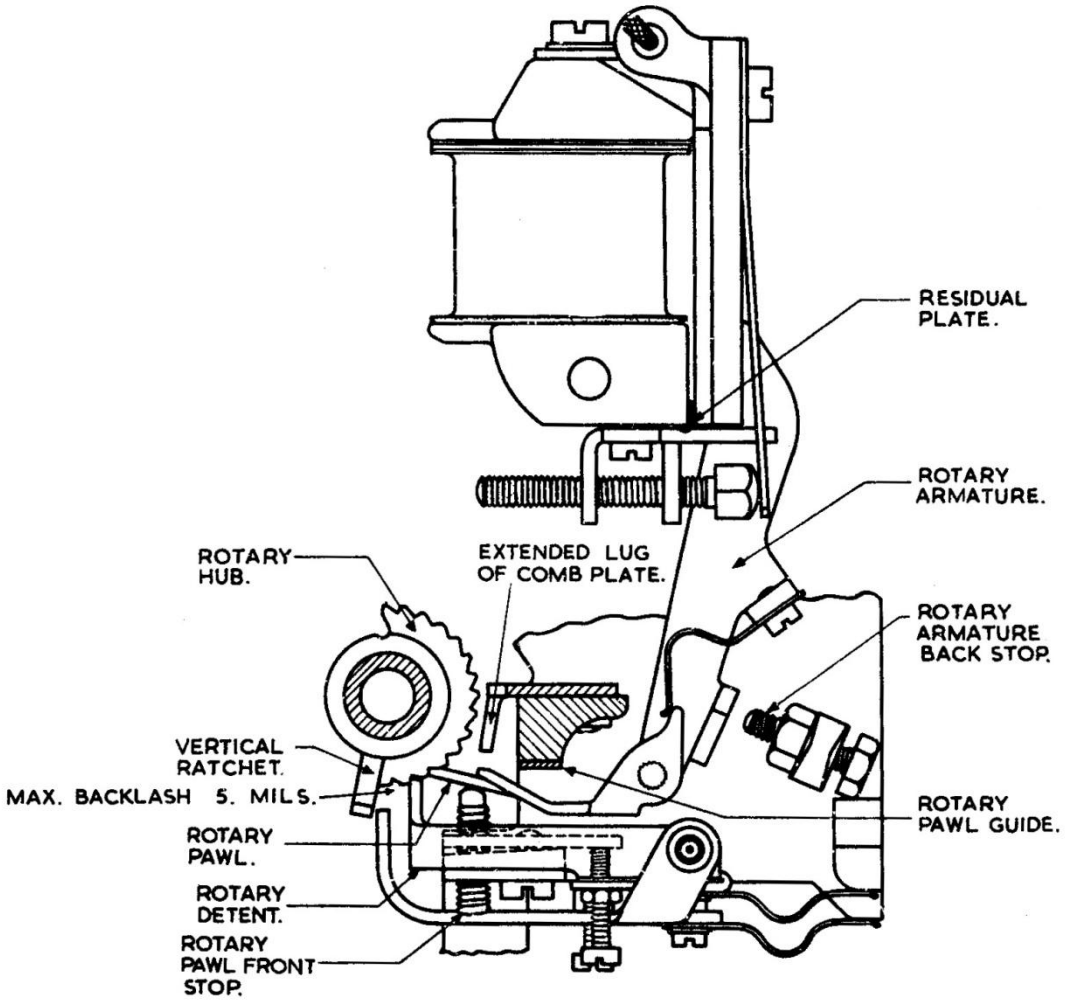
FIG. 32.

8.1 Rotary Pawl Front Stop. With the rotary armature operated electrically, the rotary pawl shall be locked between the front stop and the carriage assembly, that is, there shall be no rotary movement of the hub assembly when an attempt is made to rotate it by hand. When the rotary armature commences to restore after electrical operation there shall be not more than 5 mils backlash on any of the rotary steps. This is allowable on some steps but not all. (See Fig. 33.)

NOTE. The maximum backlash is 5 mils and if it is more than this then the pawl front stop must be readjusted to 5 mils.

8.5 Rotary Pawl Spring. The tension of the pawl spring measured at the tip of the pawl with the armature normal and the shaft carriage assembly raised to the '0' level shall be 150 ± 30 grammes. (See Fig. 32.)

8.6 Rotary Armature Restoring Spring. The tension of the restoring spring measured at the spring tip shall be 350 ± 50 grammes, when the armature is normal. The adjusting screw shall have a margin of adjustment of at least three turns in each direction.



ADJUSTMENT OF ROTARY PAWL FRONT STOP.

FIG. 33.

SECTION 3. MECHANICALLY OPERATED SPRING ASSEMBLIES, WIPER AND WIPER CORDS.

1. MECHANICALLY OPERATED SPRLNG ASSEMBLIES TYPE NO. 1.

1.1 The following examination procedure applies to the early type Mechanically Operated Spring Assemblies shown in Fig. 34.

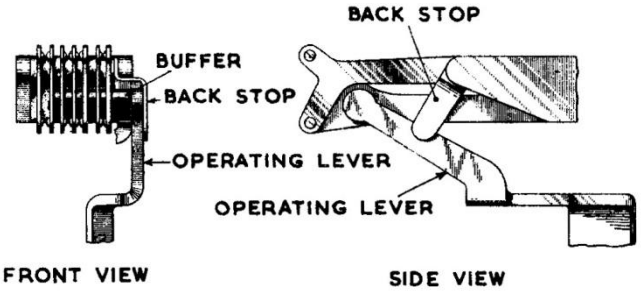


FIG. 34. ALINGMENT OF OPERATING LEVER WITH BUFFER.

1.2 Operating Levers and Rollers. All operating levers shall be free on their bearings. Side play, if any, shall be just perceptible.

All levers shall strike approximately in line with, and flat on, the buffers in the normal position. (See Fig. 34.)

The rollers shall be free to revolve.

1.3 Spring Assemblies (N, NR, S and NP).

(i) All springs shall be reasonably straight between the clamped portion and the buffers, also the springs shall be firmly clamped in their assemblies.

(ii) Twin contacts shall make or break approximately together as judged visually. Contacts shall not overlap each other by more than one-third of the diameter of the contact. (See Fig. 35.)

(iii) The contact pressure of all make or break contacts measured at the V portion of the springs, (see Fig. 36) shall be 30 ± 10 grammes, and shall be such that when operated electrically the selector cuts in cleanly without hesitation and restores reliably from the tenth rotary position of any level. When checking the contact pressure, change-over contacts shall be considered as individual break and make contacts.

(iv) The minimum clearance between springs of adjacent combinations when in the operated or unoperated position shall be 12 mils.

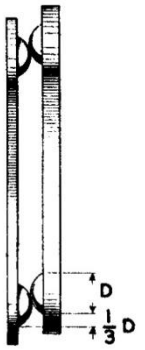


FIG. 35. SHOWING MAXIMUM OVERLAP.

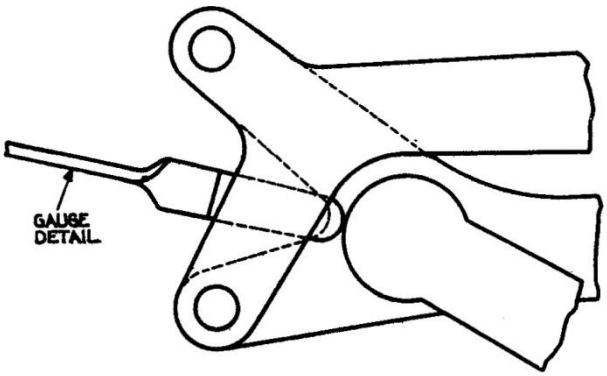


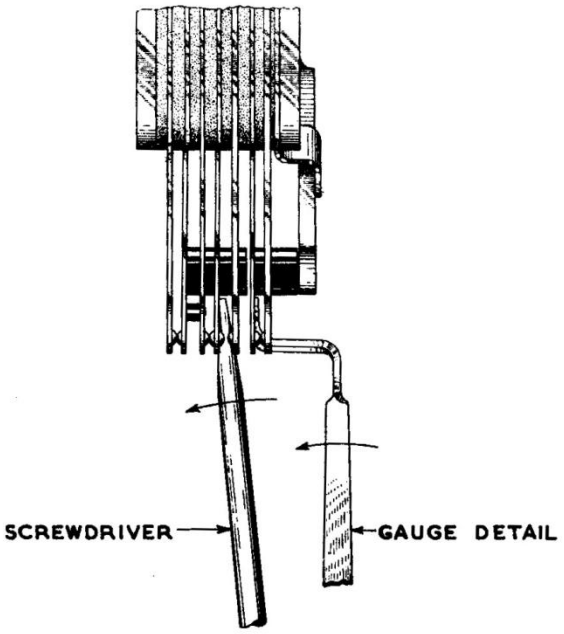
FIG. 36. POINT OF APPLICATION OF TENSION GAUGE.

(v) With a spring-set assembly in its unstrained position, the contact pressure of break contacts shall be measured at the lever spring with the tension of the outer lever springs relieved. (See Fig. 37.) Where a make spring is buffered against the break spring (as in a change-over) the contact pressure shall be measured at the break spring and shall include the tension of the make spring.

(vi) Break contacts shall break together or in sequence commencing from the break nearest the operating lever. The exception is where a make spring is buffered against the break spring (as in a change-over), then this break contact may break before the preceding break contact.

(vii) A buffer clearance is permissible between all lever springs of break contacts, and where this condition exists, Paragraph (vi) need not apply. Any lever spring not having a buffer clearance shall break together or in sequence with its preceding break.

(viii) With a spring-set assembly in its strained position, the contact pressure of make contacts shall be measured at the make spring. When the make spring is buffered against a break spring (as in a change-over) the contact pressure shall include the tension of the break spring.



SHOWING TENSION OF OUTER LEVER SPRING BEING RELIEVED.

FIG.37.

(ix) When a spring-set assembly is in its unstrained position, the buffer of the lever spring of a make contact shall remain in contact with its preceding lever spring.

(x) The contact opening of a single break or single make spring-set assembly shall be 20± 10 mils. The contact opening in all other cases shall be 8 mils minimum.

(xi) Change-over contacts shall have a minimum contact clearance of 5 mils between the break contact before the make contacts close during the change-over.

(xii) When the first set of springs constitutes a break or change-over contact unit, a clearance not exceeding 12 mils shall exist between the operating lever and the buffer of No. 2 spring. (See Fig. 38.)

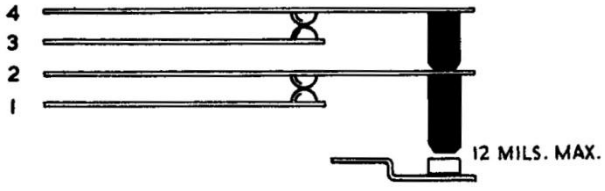


FIG. 38.

1.4 Vertical Off-Normal Springs (N). When the carriage assembly is raised to the first level, the operating arm shall pass freely 'under the cam, with just perceptible clearance. (See Fig. 39.)

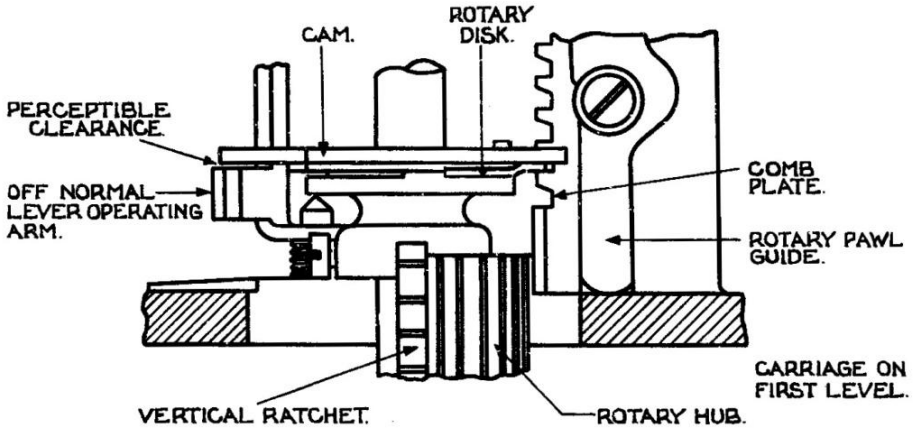


FIG. 39. CLEARANCE BETWEEN TOP SURFACE OF OPERATING ARM AND UNDER SURFACE OF CAM.

With the carriage assembly raised to level 1 and the vertical detent and pawl held out of engagement with the vertical ratchet the rotary disk shall enter the comb slot when the carriage assembly is rotated by Operating the rotary armature by hand. On no account must the rotary disk strike the comb plate on that portion of the disk above the chamfer.

On selectors where the entering edge of the rotary disk is not chamfered, it shall enter the comb slot without rise, when the carriage assembly is rotated by operating the rotary armature by hand with the vertical detent and pawl held out of engagement.

1.5 Rotary Off-Normal Springs (NR). Clearance shall exist between the cam and the operating arm and shall be such that fouling does not occur when the vertical armature is held operated electrically on any vertical step or during release of the carriage assembly. (See Fig. 40.) The springs shall operate correctly on all levels.

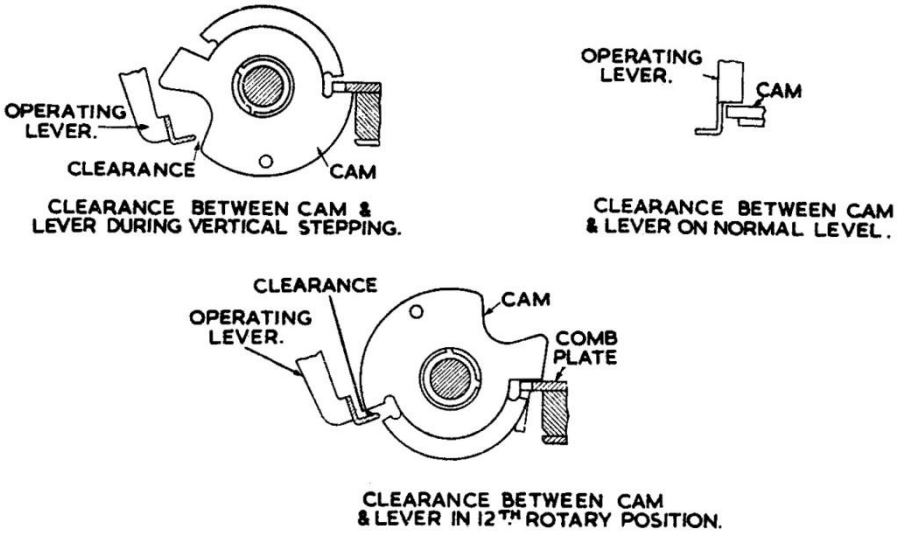
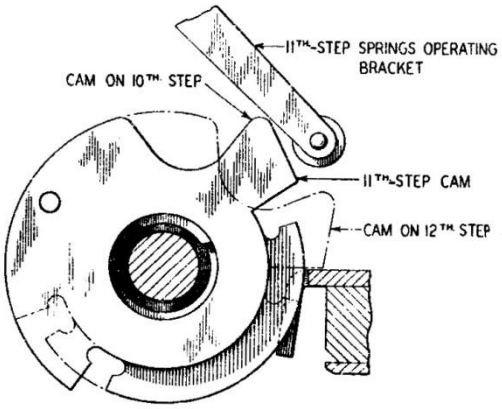


FIG. 40. CHECKING POSITION OF OPERATING BRACKET OF ROTARY OFF-NORMAL SPRINGS.

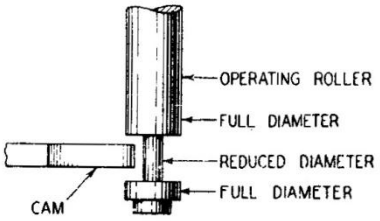
1.6 11th Step Springs (S). The springs shall operate correctly when the carriage assembly is stepped to the 11th step on levels 1 end 0.

The cam shall clear the roller on the step preceding and succeeding the 11th, also during release on the normal level. (See Fig. 41.) The selector shall restore reliably from the 11th rotary position on any level.



View "A"

Clearance between cam and roller on 10th and 12th steps.

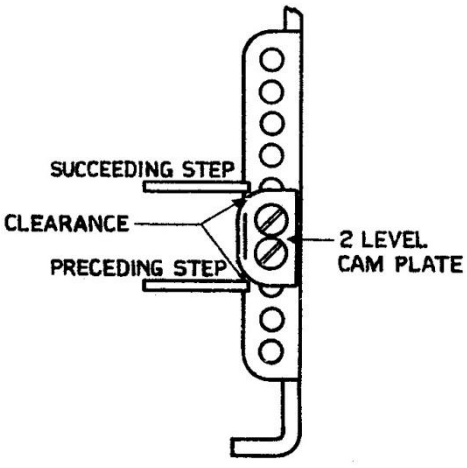


View "B"

Clearance between cam and roller On normal level.

FIG. 41.

1.7 Level Springs (NP). The springs shall operate correctly on the levels concerned. The operating tongue shall clear the cam or cams when the carriage assembly is standing on the vertical step preceding or succeeding those on which the springs are intended to operate and there shall be no movement of the springs when the shaft hub assembly is stepped electrically to the level preceding that on which the springs are intended to operate. (See Fig. 42.)

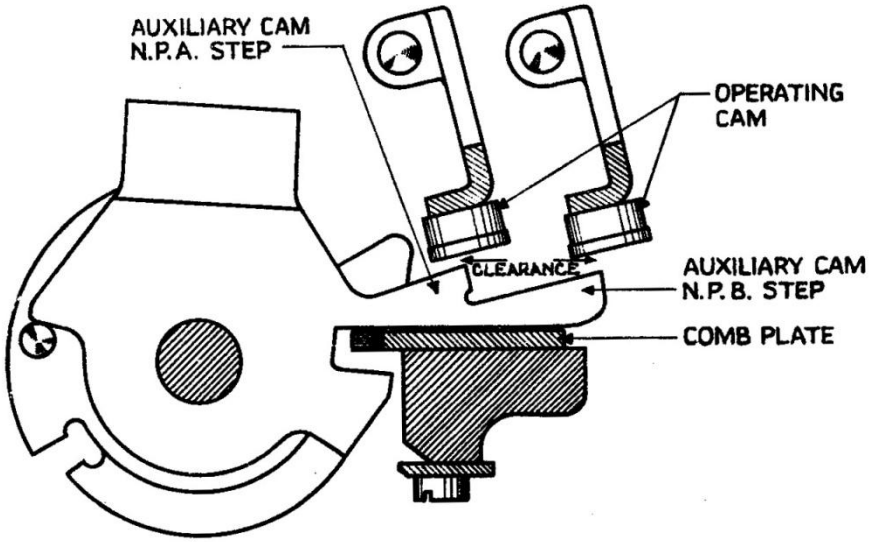


CLEARANCE ON PRECEDING AND SUCCEEDING STEPS.

FIG. 42.

The level spring operating tongue shall hold the springs operated until released by the restoring stud on the cam when the carriage assembly is stepped from the 11th to the 12th rotary position.

A clearance shall exist between the step of the operating tongue and the cam or cams when the carriage assembly is returning to normal from the 12th rotary step on level 0. (See Fig. 45.)



CLEARANCE BETWEEN OPERATING TONGUES AND CAMS DURING RELEASE.

FIG. 43.

2. MECHANICALLY OPERATED SPRING ASSEMBLIES TYPE NO. 2.

2.1 The following examination procedure applies to the Buffer Block Type Mechanically Operated Spring Assemblies shown in Fig. 44.

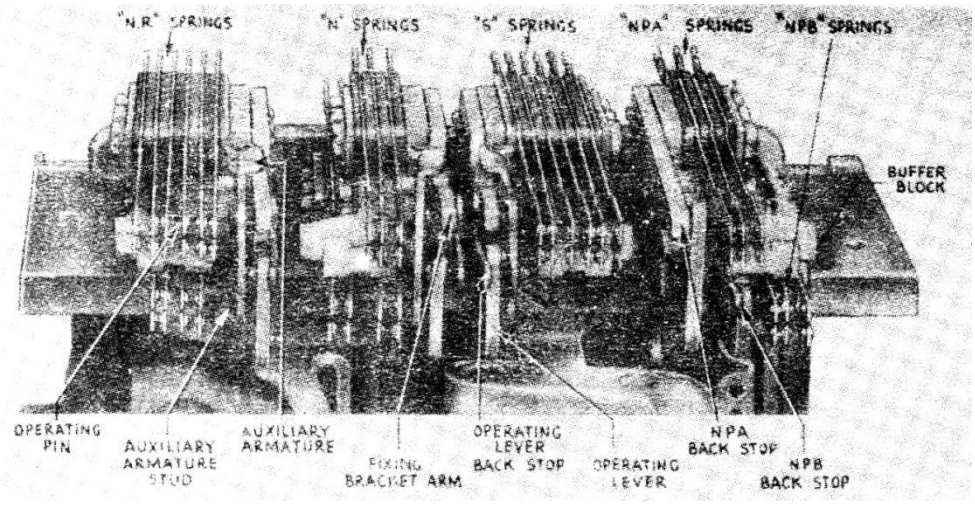


FIG. 44.

2.2 Operating Levers and Rollers. All operating levers shall be free on their bearings. Side play, if any, shall be just perceptible. The dome of the operating levers of N, NR and S assemblies shall engage the auxiliary armature at a point between the spring piles. With the spring-set normal, there shall be a gap of not more than 8 mils between the dome and the armature. (See Fig. 45.) The setting of the operating levers shall be such that sufficient travel is given to the lever springs.

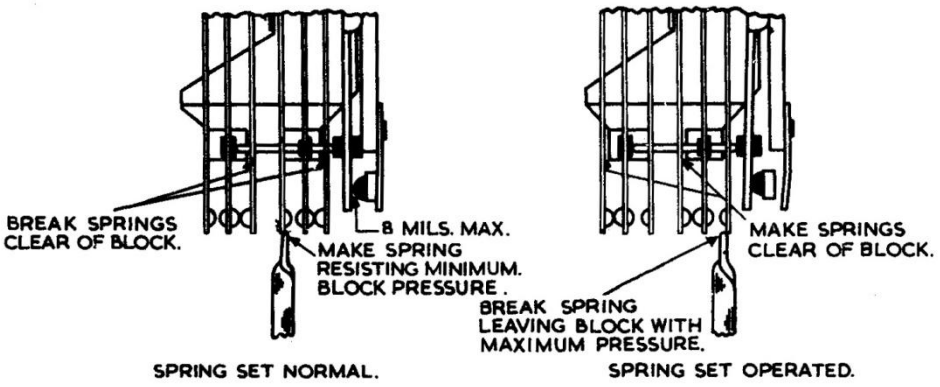


FIG. 45.

2.3 Spring Assemblies (N, NR, S and NP).

(i) All spring-sets shall be capable of operation without binding on or fouling the buffer block. All springs shall be firmly clamped in their assemblies. All make or break springs shall be reasonably straight between the clamped portion and the point which rests on the buffer block. All lever springs shall be reasonably straight throughout their length.

(ii) Twin contacts shall make or break approximately together as judged visually. Contacts shall not overlap each other by more than one-third of the diameter of the contact. (See Fig. 46.)

(iii) Each make or break spring shall be tensioned against the buffer-block with a pressure of 20-35 grammes. Make springs are checked when the spring-set is normal and break springs when the spring-set is operated. (See Fig. 45.)

(iv) All lever springs shall be tensioned towards the armature. On the outer lever springs this tension shall not be less than 5 grammes.

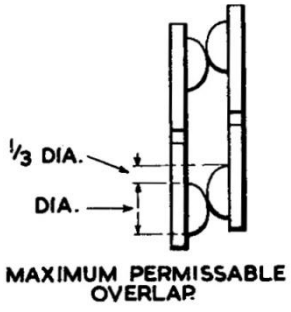


FIG. 46.

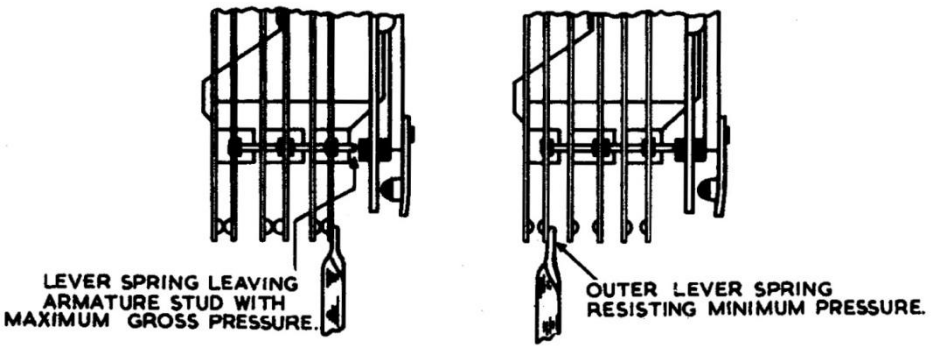


FIG. 47.

The total tension of all lever springs shall not be less than 5 grammes or greater than 30 grammes. The total tension is to be measured by applying the gauge between the twin contacts of the lever spring nearest to the armature. (See Fig. 47.)

(v) The buffer springs of all break contacts shall be clear of the buffer block with the spring-set normal and the buffer springs of all make contacts shall be clear of the buffer block with the spring-set operated. (See Fig.45.)

(VI) When only one single make contact unit is fitted to NP spring-sets, the lever spring should exert a tension of 20-35 grammes on the operating lever. If the unit is fitted with a bias spring, this spring should exert a tension of 20-35 grammes on the buffer block. This tension is to be measured with the spring-set unoperated and the gauge applied adjacent to the lifting stud. (See Pig. 48.)

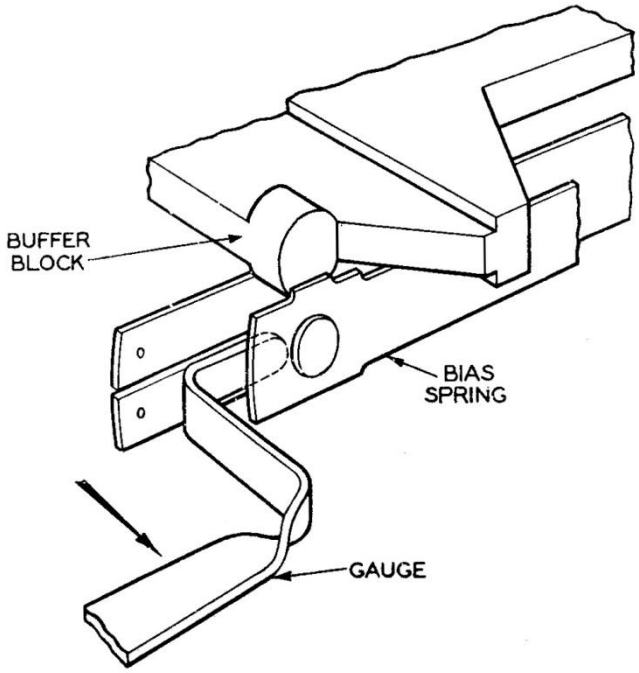


FIG. 42. METHOD OF ADJUSTING SPRING-SETS.

2.4 Vertical Off-Normal Springs [N]. When the carriage assembly is raised to the first level, the operating arm shall pass freely under the cam, with just perceptible clearance. (See Fig. 39.)

With the carriage assembly raised to level 1 and the vertical detent and pawl held out of engagement with the vertical ratchet, the rotary disk shall enter the comb slot when the carriage assembly is rotated by operating the rotary armature by hand. On no account must the rotary disk strike the comb plate on that portion of the disk above the chamfer.

On selectors where the entering edge of the rotary disk is not chamfered, it shall enter the comb slot without rise, when the carriage assembly is rotated by operating the rotary armature by hand with the vertical detent and pawl held out of engagement.

2.5 Rotary Off-Normal Springs (NR). Clearance shall exist between the cam and the operating arm and shall be such that fouling does not occur when the vertical armature is held operated electrically on any vertical step or during release of the carriage assembly. (See Fig. 40.) The springs shall operate correctly on all levels.

2.6 11th Step Springs (S). When the carriage is stepped to the 11th step on levels 1 and 0, the lever shall have sufficient movement to give the required travel to the lever springs. The vertical alignment of the operating bracket shall be such that it does not result in the buffer-spring block clearances being reduced below the specified value on levels 1 and 0. The cam shall clear the roller on the step preceding and succeeding the 11th, also during release on the normal level. (See Fig. 41.) The selector shall restore reliably from the 11th rotary position on any level.

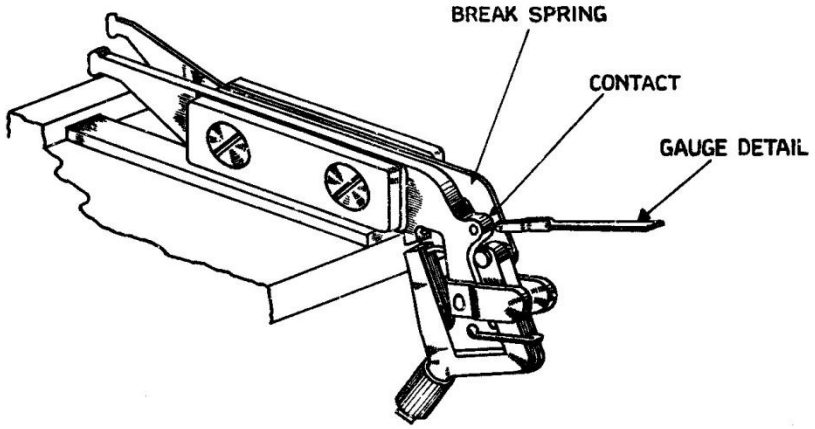
2.7 Level Springs (NP). When the level springs are operated by the carriage standing on the required level, the lever shall have sufficient movement to give the required travel to the lever springs. The operating tongue shall clear the cam or cams when the carriage assembly is standing on the vertical step preceding or succeeding those on which the springs are intended to operate and there shall be no movement of the springs when the shaft hub assembly is stepped electrically to the level preceding that on which the springs are intended to operate. (See Fig. 42.)

The level spring operating tongue shall hold the springs operated until released by the restoring stud on the cam when the carriage assembly is stepped from the 11th to the 12th rotary position.

A clearance shall exist between the step of the operating tongue and the cam or cams when the carriage assembly is returning to normal from the 12th rotary step on level "0". (See Pig. 43.)

3. INTERRUPTER SPRINGS, VERTICAL AND ROTARY, STANDARD TYPE.

3.1 The following examination procedure applies to the type of Interrupter Assembly, shown in Fig. 49, in which the lever stops are mounted on the lever bearing bracket as distinct from the type being supplied by the A.T. and E. Company in which the lever stops are integral with the moulded operating lever.

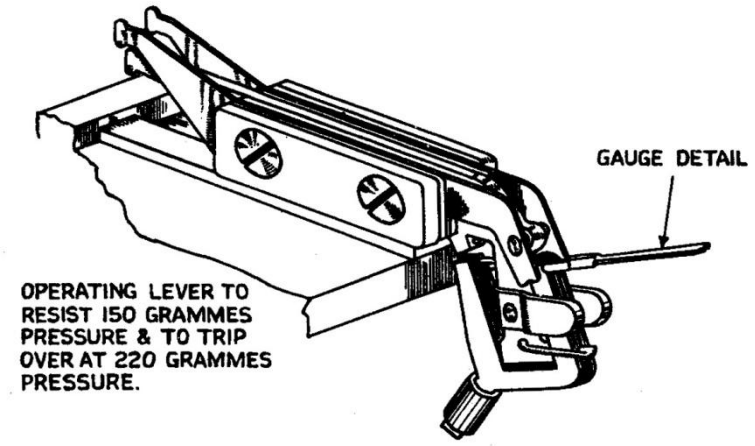


POINT OF APPLICATION OF GAUGE WHEN MEASURING OONTACT PRESSURE.

FIG. 49.

3.2 Vertical and Rotary Interrupter Springs. The rocker arm shall be free on its bearings with a minirmum play. The contact springs shall be approximately straight between the root and the contacts. The contact pressure of both break and make springs measured at the contact shall be 40 ± 10 grammes. (See Fig. 49.) The contact opening of contacts breaking the magnet circuit shall be 15 ± 3 mils.

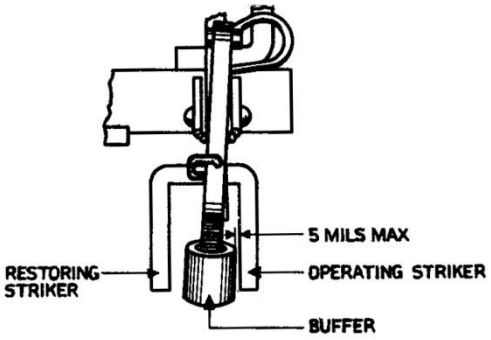
3.3 Rocker Arm Springs. The tension of the rocker arm springs shall be such that the rocker arm will not move from its stop with a pressure of 150 grammes applied immediately in front of the spring operating stud on the rocker arm and that it trips over to the other stop with a pressure of 220 grammes. This check shall be carried out in both directions, and made without relieving the pressure of the contact spring. (See Fig. 50.)



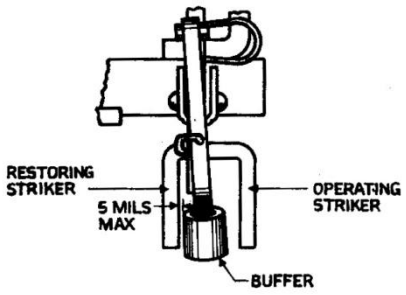
CHECKING TENSION OF LOOP SPRING.

FIG. 50.

3.4 Operating Strikers. A clearance shall exist, but not exceeding 5 mils, between the operating striker and the buffer, with the armature operated electrically and between the restoring striker and the buffer, with the armature fully restored and seated against its backstop. (See Fig. 51.)



(a) SHOWING CLEARANCE BETWEEN OPERATING STRIKER AND BUFFER. ARMATURE OPERATED.



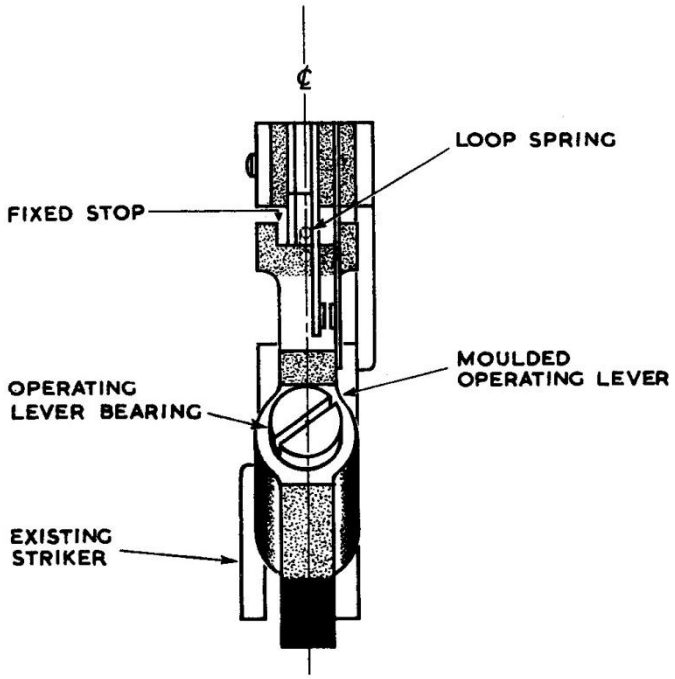
(b) SHOWING CLEARANCE BETWEEN RESTORING STRIKER AND BUFFER. ARMATURE NORMAL.

FIG. 51.

3.5 Rotary Interrupter Springs Only. When the rotary armature is operated electrically in the twelfth position, there shall be a clearance between the operating striker and the rocker arm buffer to ensure that the break contact does not break.

4. VERTICAL AND ROTARY INTERRUPTER SPRINGS, TYPE No. 4.

4.1 The following examination procedure applies to the type of Interrupter Assembly shown in Fig. 52 as being supplied by the A.T. sad E Company and employs a moulded operated lever, the stops for the lever being formed in the tail of the lever.



ROTARY INTERRUPTER IN OPERATED POSITION.

FIG. 52.

4.2 Vertical sad Rotary Interrupter Springs. The operating lever shall be free on its bearing screw without excessive side-play. The bearing face should be lubricated with a smear of grease. The contact springs shall be approximately straight between the root and the contacts. The contact pressure of both break and make spring-sets shall be 30-55 grammes measured at the contacts. When the lever is operated and resting fully against its stop, there shall be a minimum contact clearance of 10 mils. With the operating lever normal, there shall be a minimum clearance of 5 mils between the tip of the break spring and the operating lever.

4-3 Loop Springs. The loop spring shall have sufficient tension to carry and hold the operating lever reliably over to its stop positions on either side against the tension of the contact springs.

The lever shall not move with a pressure of 50 grammes applied to the forked end of the lever. The lever must, however, trip when a pressure of 140 grammes is similarly applied. Both ends of the loop spring shall be lubricated with a smear of grease.

4.4 Operating Strikers. With the armature operated electrically and the lever fully operated, there shall be a clearance of 6-13 mils between the operating striker and the operating lever. With the armature fully restored and resting against its back-stop, there shall be a clearance of 5 mils minimum between the restoring striker end the operating lever.

4.5 Rotary Interrupter Springs Only. With the operating lever normal, the rotary armature operated electrically and the carriage held in the 12th rotary position, there shall be a clearance between the operating lever and the striker so that break contacts do not break.

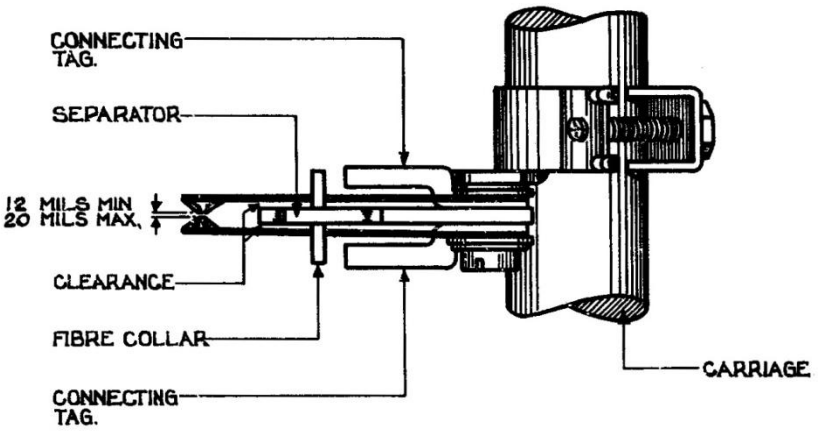
5. WIPERS.

5.1 Check that outward tension exists in each wiper spring by pressing each spring in turn against the separating insulator at a point behind the collar; the other spring should deflect outwards.

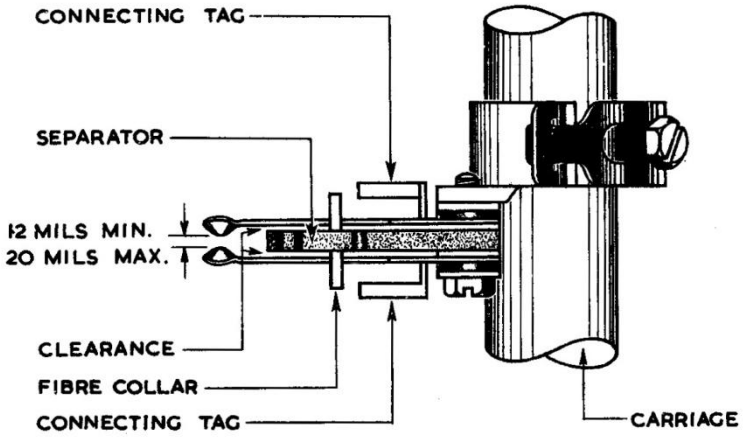
5.2 Check that the collar does not bind on either spring.

5.3 Check that the springs are approximately straight from the spring fixing to the collar and that each spring is clear of the separating insulator. (See Fig. 53.)

5.4 Check that a gap of from 12 to 20 mils exists between the tips of all wipers. (See Fig. 53.)



(a) Earlier B.P.O. Spoon Type Wiper.

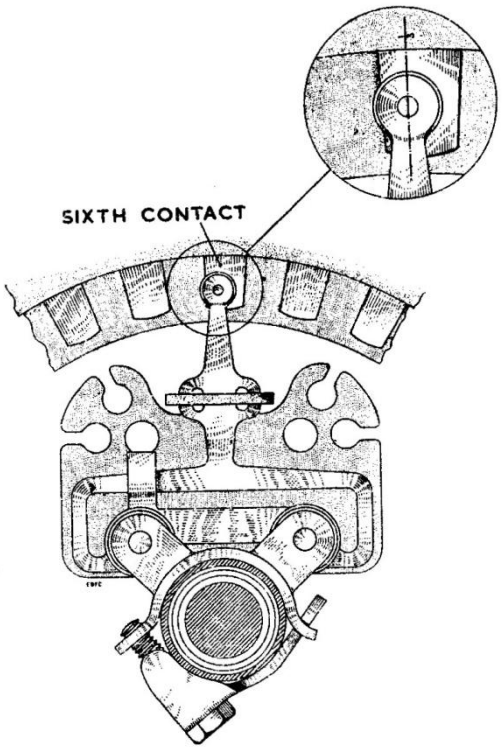


(b) New B.P.O. Type 22 Wiper.

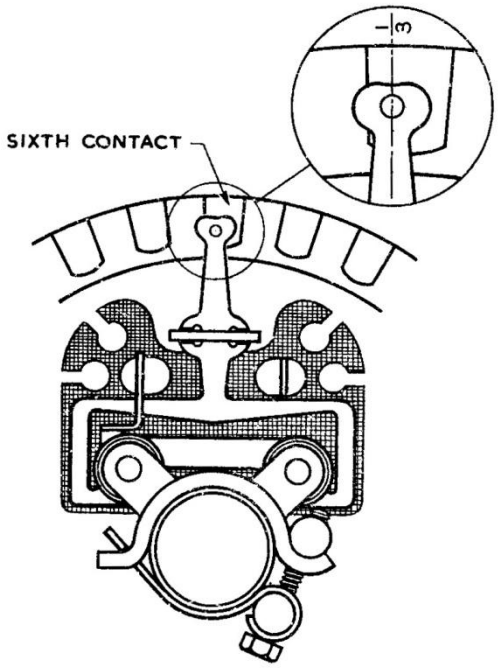
ADJUSTMENT OF WIPERS WHEN OFF THE BANK.

FIG. 53.

5.5 When setting the wipers on the banks they should rest within the limits of 1/3 to ½ way on the contacts. (See Fig. 54.) The wiper springs should be clear of the separating insulator when the wipers are resting on a contact. (See Fig. 55.) The wiper tips should not foul the barge insulation when the carriage assembly is raised from normal to level 0 and lowered from the 12th position.

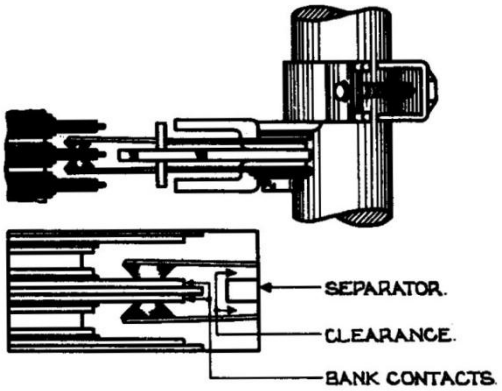


(a) Earlier B.P.O Spoon Type Wiper.

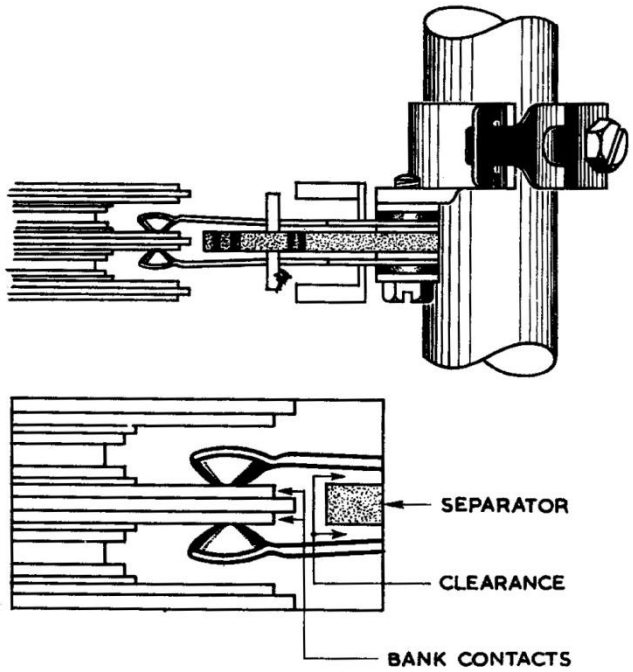


(b) New B.P.O. Type 22 Wiper.

FIG. 54. POSITION OF WIPER ON CONTACT.



(a) Earlier B.P.O. Spoon Type. Wiper.



(b) New B.P.O. Type 22 Wiper.

SHOWING WIPER RESTING ON BANK CONTACTS.

FIG. 55.

6. WIPER CORDS.

6.1 Check that the wiper cords pass through the slots provided in the side of the wiper insulation.

6.2 The cord tag should not foul the wiper spring and the cords should not foul the wiper collar.

SECTION 4. RELAYS.

1. ALL RELAYS.

1.1 All relay spring assemblies shall be free of dust.

1.2 All relay armatures shall be checked for binding excessive play and backstop play where applicable.

1.3 Residual screws shall be checked for tightness.

1.4 Spring-sets shall be visually examined for alignment condition of contacts, spacing of springs and spring 'follow'.

2. RELAYS REQUIRING SPECIAL ATTENTION. IMPULSING AND MARGINAL RELAYS

2.1 Check residual gaps.

2.2 Check the adjustments with gauges.

SECTION 5. TOOLS.

1. TOOLS.

1.1 The following tools are necessary for the examination of bimotional switches.

Tool No.	Description	Use
138	Gauge, Feeler, Set of 8.	Checking clearances, travel, etc., on mechanism.
149	Gauge, Thickness, Bent Blades, 2-46 mils.	Checking relay armature travel and residual gaps.
151	Gauge, Tension, 10-80 grammes.	Checking tensions.
152	Gauge, Tension, 50-250 grammes.	Checking tensions.
153	Gauge, Tension, 100-500 grammes.	Checking tensions.
154	Gauge, Tension, 4-24 grammes.	Checking tensions.
201	Mirror, Magnifying, Dental Type.	General.
257	Screwdriver, Pocket.	Relieving spring tensions while checking adjacent spring tensions.

1.2 If adjustments are found necessary on the switch mechanism, the tools listed in Telephone Engineering Instruction, General TE 3001, Kit No. 13, shall be used.

1.3 If adjustments are found necessary on the relays of the switch, the tools listed in Telephone Engineering Instruction, General TE 3001, Kit No. 11, shall be used.

END.