REGENERATOR No. 1
Maintenance Adjustment Instruction

1. Introduction.—This Instruction details the maintenance adjustment of the Regenerator No. 1. General views of the regenerator showing the names of the principal parts are given in Figs. 1, 2, 3 and 4.

2. Contents.

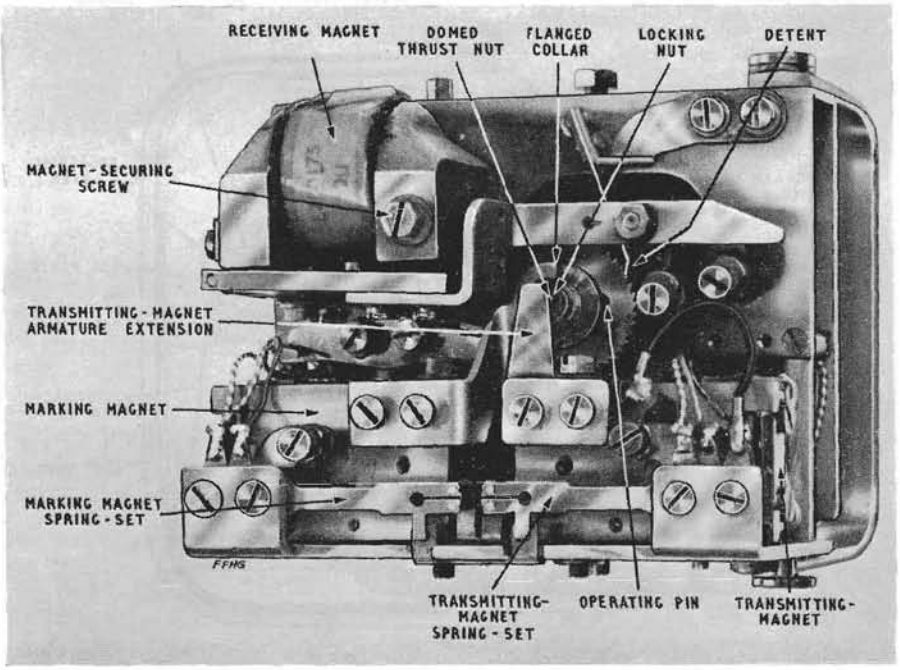
3. General.

★(*a*) *Care necessary when handling regenerators.*—When it is necessary to make major adjustments or replacements, the regenerator should be removed from its mounting and fitted in the outrigger. The mechanism should be handled carefully, to avoid damage to the springs etc. *To avoid bending the code pins, the 'M' magnet must always be held operated before operating the 'R' magnet.* A handle which folds back against the mechanism is provided to facilitate removal and replacement.

(*b*) *Removal of a regenerator from its mounting.*—When a regenerator is to be removed from its mounting it should first be verified that the circuit is free. The circuit should then be busied.

To remove the mechanism, the clamping bolt must be loosened. If there is difficulty in removing the mechanism, due to stiffness of the plug and jack, gently ease the mechanism upward and downward; *sideways movement must be avoided*, as it is liable to distort the plug pins and jack springs.

(*c*) *Replacement of a regenerator into its mounting.*—When replacing a regenerator, first confirm that the mechanism has properly restored to normal, i.e. there should be no digits stored.



★FIG. 1

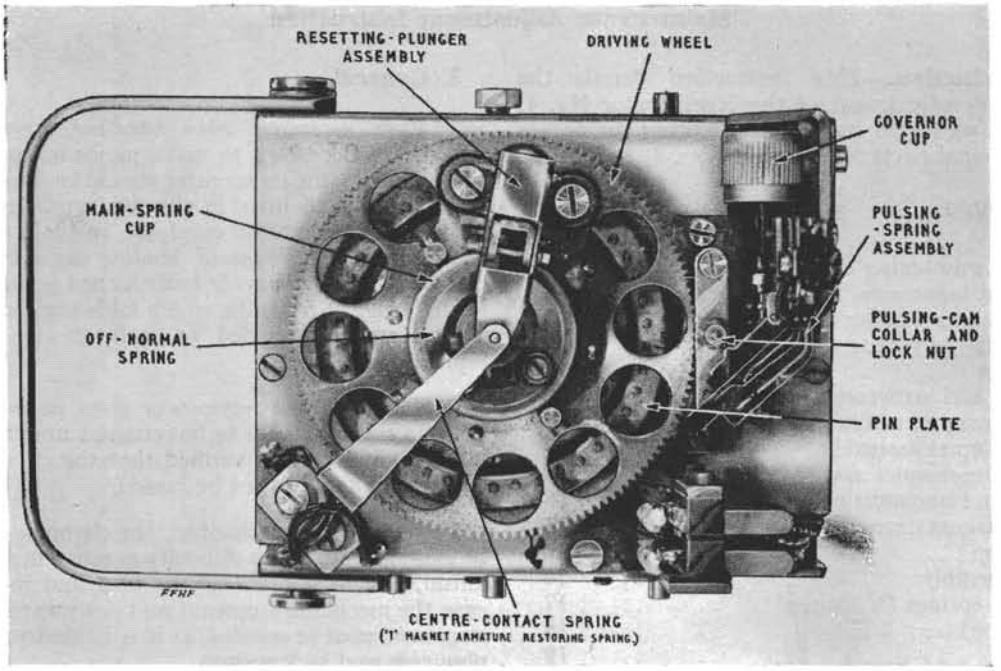
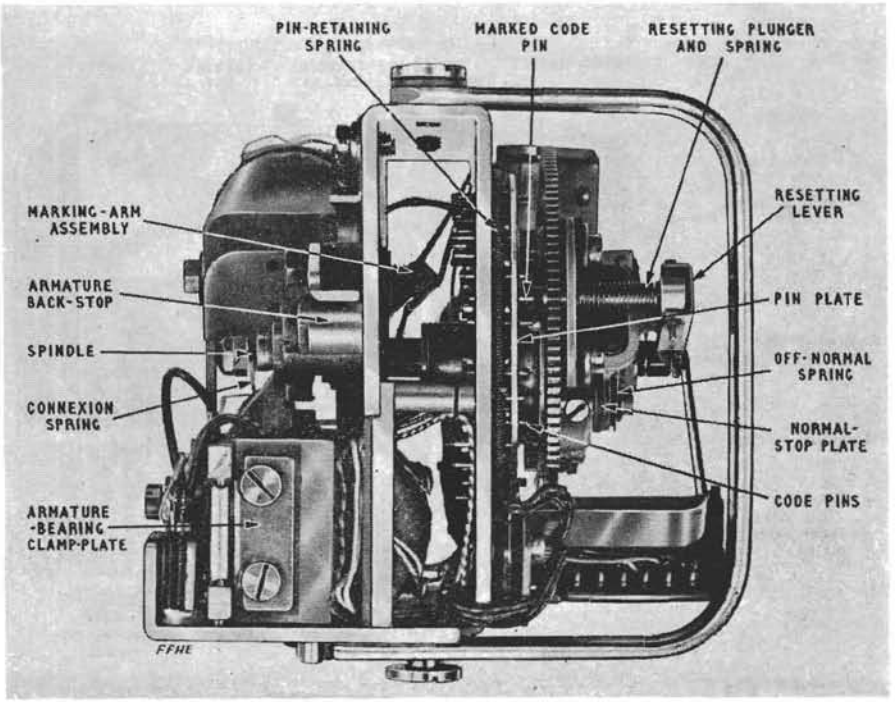

RESETTING-PLUNGER ASSEMBLY
DRIVING WHEEL
GOVERNOR CUP
MAIN-SPRING CUP
PULSING-SPRING ASSEMBLY
OFF-NORMAL SPRING
PULSING-CAM COLLAR AND LOCK NUT
PIN PLATE
CENTRE-CONTACT SPRING
('I' MAGNET ARMATURE RESTORING SPRING.)
FFHE

FIG. 2


PIN-RETAINING SPRING
MARKED CODE PIN
RESETTING PLUNGER AND SPRING
MARKING-ARM ASSEMBLY
RESETTING LEVER
ARMATURE BACK-STOP
PIN PLATE
SPINDLE
OFF-NORMAL SPRING
CONNEXION SPRING
NORMAL-STOP PLATE
CODE PINS
ARMATURE-BEARING CLAMP-PLATE
FFHE

★FIG. 3

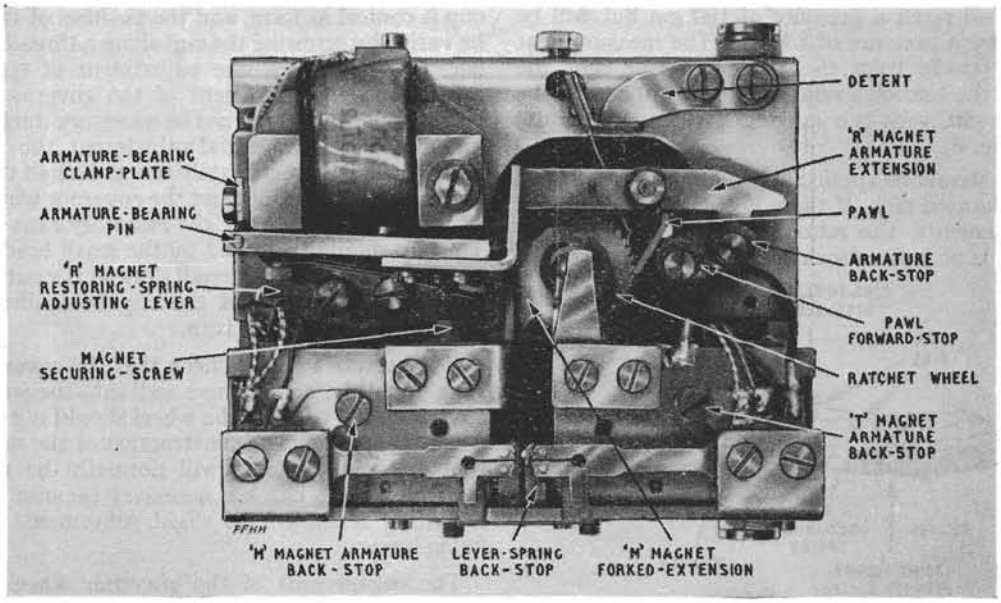


FIG. 4

Engage the guide screws and clamping bolt with the mounting slots, so that the mechanism is guided into its correct position. If there is difficulty in replacement due to the stiffness of the plug and jack, restore the handle to its normal position and apply pressure direct to the frame and handle. Tighten the clamping bolt.

(*d*) *Fixing screws, nuts, residual plates and wiring.*—

(i) All fixing screws and nuts should be tight.

(ii) The residual plates should be flat on the magnet armatures.

(iii) All wiring should be clear of moving parts.

All parts, including nuts and screws, which are worn or damaged should be changed.

4. Jack point numbering.—The numbering of jack points are shown in Fig. 5.

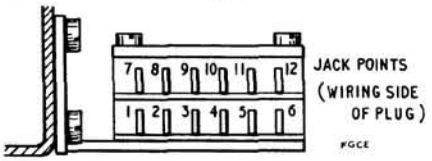


FIG. 5

5. Adjustment tolerances.—The terms 'test' and 'readjust' values used in this Instruction are defined in B 5100.

6. Code pins and retaining spring.—

(*a*) *Code pins* should be examined for bending in the pin plate and any that are worn or bent should be replaced. If removal of the code pins, rollers, and retaining spring has been necessary, the procedure recommended for assembly is as follows:—

(i) Place the frame in the normal position and carefully replace the pins.

(ii) Slip an elastic band around the pins to hold them in position, then place the rollers one at a time under the elastic band between alternate pairs of pins.

(iii) When all the rollers are in position, slip the retaining spring carefully into place and remove the elastic band. This operation will be assisted if the pins are positioned flush with the pin plate. Restore the pins to the normal position before proceeding.

As a maintenance aid when replacing code pins, a Telephonist's Pencil, Type SP 337b (gravity feed) may be used to hold the code pins when positioning them in the pin plate. The code pin will be securely gripped if it is inserted approximately $\frac{1}{8}$ in. into the pencil chuck.

(*b*) *Retaining spring.*—A spring with strained turns should be changed. Check that turns in the retaining spring are evenly spaced throughout its length. The joint in the spring should be positioned midway between two adjacent rollers.

The tension of the spring should be such that any code pin will resist a pressure of 100 gm but will be displaced by a pressure of 250 gm. The measurement should be made from the pin plate side and the pointer of the tension gauge should be applied to the end of the pin, with the gauge at right-angles to the pin (see Fig. 6).

The test should be applied at random to a number of widely-separated pins. If there is difficulty in meeting the requirements, the retaining spring or code pin, whichever is at fault, should be changed.

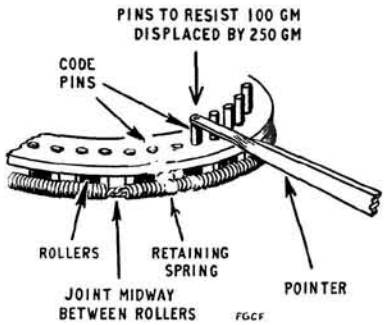


FIG. 6

7. Governor and governor wheel.—

(*a*) *Governor.—*

(i) *Precaution.*—If, for any reason, it is necessary to disengage the governor or governor wheel, the transmitting magnet should not be operated nor should the main driving wheel be rotated anti-clockwise and then released, because sudden impact between the plunger and the pins is liable to damage the pins.

(ii) *Governor cup.*—To avoid difficulties due to oil within the governor cup, the governor spindle is fitted with a cupped washer (between the governor wings and the worm gear) to prevent oil from entering the cup, and the governor bearing (within the cup) is drilled in a copper-graphite plug, inserted in the brass mounting; the use of copper-graphite avoids the need for lubricating the bearing within the cup. The inner surface of this type of governor cup is chromium-plated to improve the smoothness of rotation.

The chromium-plated governor cups fitted on regenerators should be inspected carefully for wear of the plating on the inside of the cup. Any cups in which the brass is showing through the plating should be changed.

(iii) *Governor spindle and wings.*—The governor spindle should be free on its bearings and without excessive end play. The end play should not exceed 10 mils, as near as can be judged by eye; end play can be varied by adjustment of the governor-bearing screw. If excessive lateral play is found the bearing should be changed. The governor wings should be positioned so that the tips of the weights are equidistant from the spindle.

(iv) *Adjustments.*—The inside face of the governor cup is conical in form, and the position of the cup can be varied by screwing the cup along a threaded mounting; this permits a fine adjustment of speed to be readily made. Adjustment of the governor wings is permissible, but should not be necessary during normal maintenance. As an initial adjustment, the cup should be positioned approximately one and a half turns along its threaded mounting, and the governor wings adjusted, if necessary, so that the assembly runs smoothly. The cup should be locked by the small bracket which engages one of the four small slots on the outside of the cup, the adjustment of the cup being limited to a minimum of a quarter turn.

(*b*) *Governor wheel.*—Check that the governor wheel runs smoothly, and engages well into the worm of the governor; the teeth of the wheel should not touch the governor spindle. The construction of the unit is such that the requirements will normally be met automatically, but a check is necessary because the bridge mounting is subject to slight movement about the fixing screws.

The engagement of the governor wheel with the main driving wheel should be such that the assembly runs smoothly. The depth of engagement can be varied by moving the governor-assembly bracket about its fixing screws and its position must be such that there is just perceptible backlash in the wheel, when checked in four positions equally-spaced around the main driving wheel. The governor wheel should not engage too deeply otherwise vibration will occur.

8. Main spring.—The tension of the main spring should be checked with

(*a*) a single pulse stored

(*b*) the driving wheel horizontal, and

(*c*) the load of the pulse spring removed from the cam.

The pointer of the Gauge, Tension, No. 3 should be applied in a clockwise direction to any convenient tooth on the driving wheel (see Fig. 7). With the gauge applied in this manner the main driving wheel

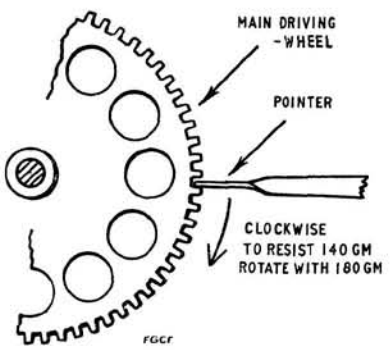


FIG. 7

should resist 140 gm, but rotate with 180 gm applied. It is not intended, however, that the governor should be driven backwards, the movement of the main driving wheel need only take up play in the gear and worm.

The tension of the main spring can be adjusted by rotating the cup in steps of a quarter turn minimum; to increase the tension rotate the cup clockwise and to decrease the tension rotate the cup anti-clockwise.

9. Armatures and armature bearings.—The armatures should be free on their bearings, without excessive lateral play. The armature-bearing clamp-plate should be positioned so that, when the magnet is energized, the armature strikes squarely and simultaneously on both magnet poles. To meet this condition, slacken the armature-bearing-pin clamp screws and the magnet-securing screws; operate the armature electrically, position the bearing pin in its locating hole, and retighten the magnet-securing screw and the armature-pin clamp screws. *It is important that the armature adjustment is correctly made before proceeding with other associated adjustments.* If the armature strikes the rear magnet pole before striking the front magnet pole, there will be difficulty in meeting some of the adjustments and tolerances which follow.

10. Receiving-magnet assembly.—

NOTE:—Operating armature by hand. If it is desired to operate the receiving magnet armature by hand, the marking-magnet armature must first be operated to ensure that the marking arm is free of the code pins.

(*a*) *Armature.*—The armature should be aligned to the magnet pole-pieces as described in par. 9.

(*b*) *Pawl.*—The pawl should be free on its bearings without excessive side play. The position of the pawl relative to the ratchet wheel must be such that the pawl engages the full width of the ratchet teeth. Its tip must also engage the teeth squarely (see Fig. 8).

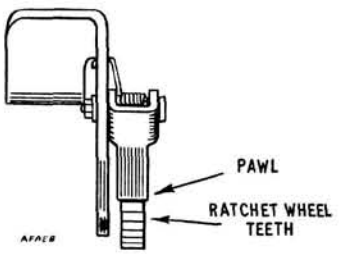


FIG. 8

This can be checked by observing the tip of the pawl as it passes over tips of the ratchet teeth. Adjustment is obtained by bending the armature, as shown in Fig. 9.

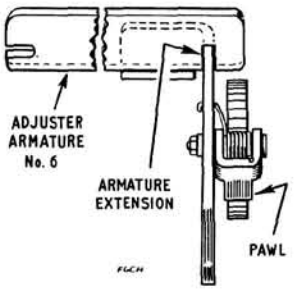


FIG. 9

(*c*) *Armature back stop.*—The armature back stop, which is eccentric, must be positioned such that when the armature is normal the marking arm engages approximately centrally with any marked code pin (see Fig. 10). This should be checked at several positions around the code-pin plate.

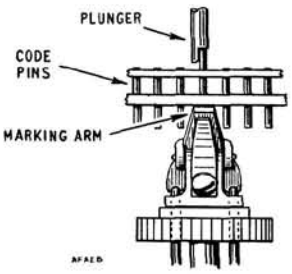


FIG. 10

Adjustment is obtained by loosening the back-stop fixing screw and rotating the stop until the correct position is obtained. The fixing screw should then be securely tightened. Adjustment will be facilitated if the back-stop is moved to its extreme uppermost position, the armature is operated and released, and the stop then slowly rotated in a clockwise direction until the desired position is obtained. The final position will then be such that the impact of the armature tends to tighten the fixing screw.

(*d*) *Pawl forward stop.*—The position of the pawl forward stop, which is eccentric, must be such that the pawl is lightly wedged between the ratchet wheel and the stop when the armature is normal. When the armature is normal, the armature-restoring force should be taken by the armature back stop. Slight forward play of the ratchet wheel is permissible but play, if any, should be such that the clearance between the pawl and the forward stop, measured in several positions equidistant around the ratchet wheel, does not exceed 2 mils (see Fig. 11).

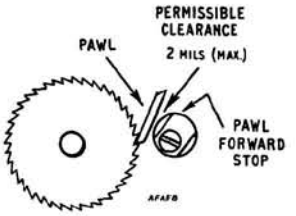


FIG. 11

Check that there is no clearance between the armature extension and the back stop on any steps due to the pawl being too tightly wedged between the forward stop and ratchet wheel.

The final position of the stop will be such that the impact of the pawl tends to tighten the fixing screws (see Fig. 12).

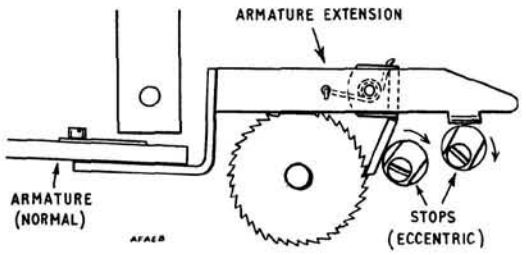


FIG. 12

★(*e*) *Detents*—

(i) *Straight detent.* Fig. 13 (*a*).—The spring of the detent should be straight. The full width of the detent spring should engage squarely with the short face of the ratchet teeth. The latter adjustment may be checked by observing the alignment of the side of the ratchet wheel and the edge of the detent spring.

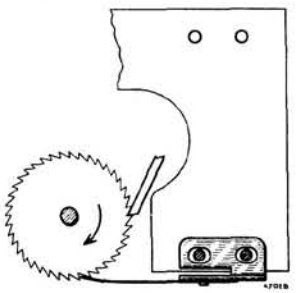


FIG. 13 (*a*)

The detent should be adjusted by positioning it on its elongated fixing holes, so that, when the armature is operated and released by hand, it drops into each tooth of the ratchet wheel when the armature extension returns to its back stop, but does not drop in when a 6-mil gauge (test), 4-mil gauge (readjust), is inserted between the armature extension and the back stop. The tension of the detent spring should be adjusted, by bending the free end of the bracket to which the spring is riveted, so that a pressure of 100 gm maximum (test), 30 $\pm$ 20 gm (readjust), is exerted on the ratchet tooth; the tension should be measured as near to the tip of the spring as possible, and checked at four points equidistant round the periphery of the ratchet.

When measuring the tension exerted by the detent on the ratchet wheel, ensure that the tip of the detent spring does not bind on the short face of the ratchet teeth.

(ii) *Bracket-type detent.* Fig. 13 (*b*).—The detent should be positioned about its fixing holes so that there are two complete teeth between the tip of the spring and the pawl of the receiving-magnet armature when the pawl is in its normal position. The detent should also be positioned so that the tip of the spring covers the full width of the ratchet teeth and when the armature is operated and released by hand, it drops into each tooth on the ratchet wheel when the armature extension returns to the back stop, but does not drop in when a 6-mil gauge (test), 4-mil gauge (readjust), is inserted between the armature extension and the back stop.

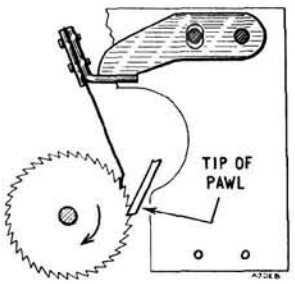


FIG. 13 (*b*)

The tension of the detent should be adjusted by bending at the base of the spring so that a pressure of 35 $\pm$ 25 gm (test), 35 $\pm$ 20 gm (readjust), is exerted on the ratchet tooth. The tension should be measured as near to the tip of the spring as possible and checked at four points equidistant round the periphery of the ratchet wheel.

When measuring the tension exerted by the detent on the ratchet wheel, ensure that the tip of the detent spring does not bind on the short face of the ratchet teeth.

(*f*) *Magnet.*—The travel of the receiving-magnet armature is adjusted by slightly loosening the magnet-securing screw, and pivoting the magnet about its bearing pin; take care that the end of the bearing pin remains engaged in the bearing hole in the frame. The position of the magnet should be such that, with the armature operated electrically, the pawl will step over each ratchet tooth with a 2-mil gauge inserted between the armature residual plate and the magnet pole-

piece (see Fig. 14), but with an 8-mil gauge (test), 6-mil gauge (readjust) inserted, the pawl should not step over the ratchet teeth. The adjustment should be checked on four teeth equidistant round the periphery of the ratchet.

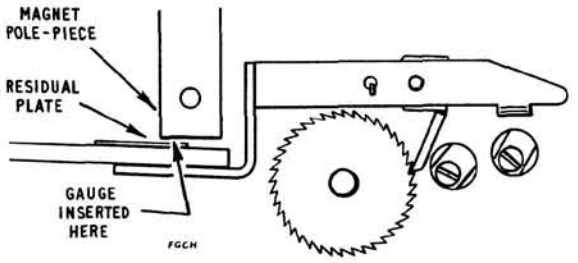


FIG. 14

(*g*) *The armature-restoring spring tension* is adjusted by swinging the adjusting lever about the screw in the circular hole and clamping it in position by means of the screw in the slotted hole (see Fig. 15). Both fixing screws should then be securely tightened.

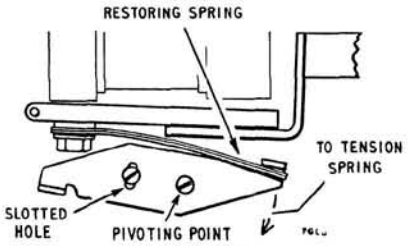


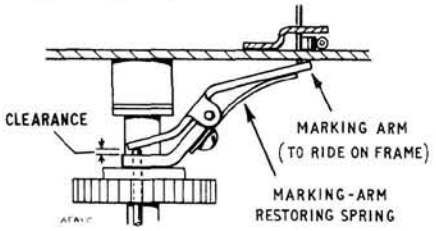
FIG. 15

The restoring spring should be tensioned so that the marking arm will step unaided from the 40th to the 41st position. This should be tested manually by releasing the marking magnet after the 40th step, operating the receiving magnet for the 41st step, and then operating the marking magnet. The receiving armature should fully restore to complete the 41st step. This should be checked on at least four positions, equally-spaced round the ratchet wheel. As a check that the detent engages the teeth of the ratchet wheel correctly and that 41 complete steps can be taken, operate the marking armature and slowly step the receive armature by hand and observe the engagement of the detent during each step. The detent must drop fully into the ratchet tooth at the end of the 41st step. If this is prevented by the normal stop striking the rear of the stud, the striker assembly should be positioned outwards as far as possible in a radial direction. This will reduce the amount of engagement between the normal stop and the stud on the striker assembly.

(*h*) *Current tests.*—The magnet should operate fully from normal when 680 mA is applied to the coil without prior saturation. A single rheostat may be damaged if used alone in the circuit set-up to obtain the required 'operate' current. Therefore, to obtain the operate current, connect two rheostats in parallel, with a milliammeter and a battery supply in series with the coil and, as quickly as possible, adjust the rheostats so that approximately-equal resistance is in circuit in each rheostat and the required current value is obtained.

11. Marking-magnet assembly.—

(*a*) *Magnet.*—With the marking-magnet armature normal, the tip of the marking arm should rest against the frame (see Fig. 16). See also par. 9. The magnet



★FIG. 16

position is adjusted by slightly loosening the magnet-securing screw, and pivoting the magnet about the bearing pin; care should be taken to ensure that the end of the bearing pin does not become disengaged from the locating hole in the frame. The marking magnet should be set so that, when the armature is fully operated, the forked end of the marking arm remains clear of the flange on the main shaft, and its tip clears the code pins by 10 mils minimum (test), 12-20 mils (readjust), when they are pushed home flush with the face of the pin plate (see Fig. 17). This adjustment can be effected conveniently by using the armature back stop as follows:—

Slacken the magnet-fixing screw, operate the armature electrically and advance the armature back stop until the required marking-arm to code-pin clearance is obtained, tighten the magnet-fixing screw and withdraw the armature back stop to the normal position. If the back-stop screw is used for this purpose it may be necessary to remove the back-stop lock-nut. However, if desired, an Adjuster, Armature, No. 7 may be used for this purpose.

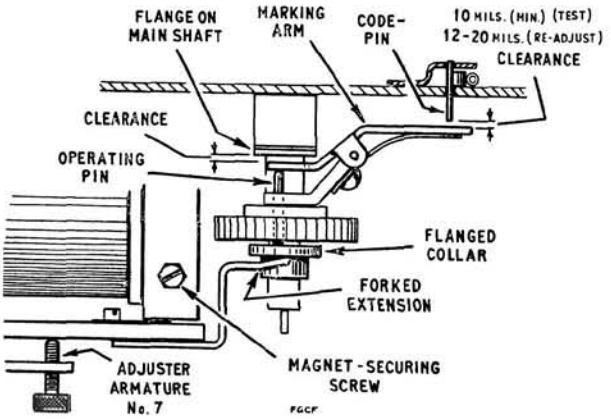


FIG. 17

(*b*) *Armature.*—The forked extension of the marking armature must not foul the hub of the flanged collar whether the armature is in the normal or in the operated position (see Fig. 18).

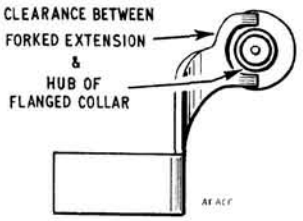
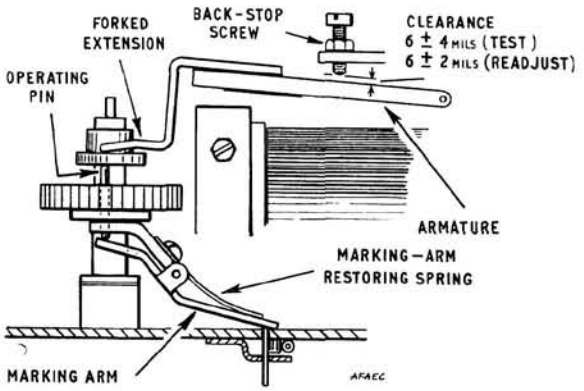


FIG. 18

With the tip of the marking arm resting against the frame, adjust the marking-magnet armature back stop so that there is a clearance of 6 ± 4 mils (test), 6 ± 2 mils (readjust), between the back stop and the armature (see Fig. 19). This adjustment should be done with the armature uppermost so that its weight maintains the armature forked extension, flanged collar, operating pins and marking arm in contact with each other (see Fig. 19).



★FIG. 19

12. Transmitting-magnet assembly.—

(*a*) *Armature.*—The transmitting-magnet armature should be adjusted as described in par. 9.

(*b*) *Connexion spring.*—The connexion spring should be tensioned against the inner locking nut so as to exert a pressure of 50 gm minimum. This should be measured at one of the top corners of the spring.

(*c*) *Magnet.*—The position of the transmitting magnet is adjusted by slightly loosening the magnet-securing screw and pivoting the magnet about the bearing pin; take care that the end of the bearing pin does not become disengaged from the locating hole in the frame. The magnet should be adjusted so that, when the armature is operated electrically, there is a clearance of 15 mils maximum (test), 10 mils maximum (readjust), between the end of the plunger and the pin plate. This should be checked at several positions on the pin plate (see Fig. 20).

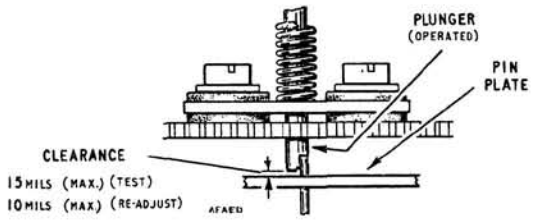


FIG. 20

Fine adjustments may be obtained by changing the position of the spindle, locking nut and domed thrust nut. The check should not be made when the marking arm and plunger coincide on a pin of the regenerator.

(*d*) *Armature back stop.*—The transmitting-armature back-stop should be adjusted so that, when the armature is normal, and without any digits stored, there is a clearance of 10 mils minimum (test), 12 mils minimum (readjust), between the end of the code pin and the bottom of the operating step in the plunger (see Fig. 21). This adjustment should be checked when the plunger is engaging the side of a code pin which has been marked electrically. If difficulty is experienced in obtaining this clearance by positioning the armature back stop it is permissible to bend the tip of the resetting lever. If the lever is bent it will be necessary to recheck the adjustment shown in (*c*) and, if necessary, to reposition the magnet.

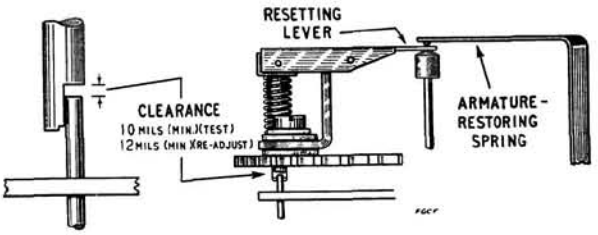


FIG. 21

(*e*) *Armature-restoring spring.*—The tension of the transmitting-armature-restoring spring should be such that it exerts a pressure of 150 ± 25 gm on the resetting lever. The horizontal portion of the spring should be at right-angles to the regenerator frame, and the contact should engage the plunger arm about the centre of the spindle-insulating stud. If it is desired to increase the tension of the spring, it should be loosened from the frame and the portion of the spring parallel with the frame should be given a set inwards at the bend in the spring; to relieve the tension of the spring, the portion of the spring parallel with the frame should be set gently outwards at the bend.

13. Marking- and transmitting-magnet spring-sets.—

(*a*) *Alignment of the springs and contacts* and the methods of tensioning the springs are similar to those for the 3000-type relay described in B 5144.

(*b*) *Adjustment of the buffers* can be effected by loosening the two buffer-assembly fixing screws and sliding the screws along the elongated holes in the frame until the desired position is reached. A slight side movement can also be obtained on the buffer assembly, to cater for differences in the normal positions of the transmitting- and marking-magnet armatures. If the specified buffer clearance cannot be obtained by the above methods, the spring lugs may be given a slight set.

(*c*) *Adjustment of the position of the lever-spring back-stops* is obtained in a similar manner to that for the buffers but, when making the adjustment, take care not to disturb the position of the buffers. Final adjustment may be made by slightly altering the set in the back stop associated with each lever spring.

(*d*) *Lever-spring tension* is obtained with the armature fully operated. The lever spring should be adjusted to rest on the lever-spring back stop with a pressure of 4–15 gm (test), 10 ± 3 gm (readjust), measured at the tip of the spring.

(*e*) *Buffer pressure.—*

(i) *With the armature fully operated*, adjust the make spring so that it rests against the buffer with a pressure of 20 ± 5 gm (test), 20 ± 3 gm (readjust), measured at the tip of the spring.

(ii) *With the armature normal*, adjust the position of the make-spring buffer so that there is a buffer clearance of 10 ± 5 mils (test), 10 ± 3 mils (readjust). If the position of the buffer is adjusted, the tension of the make spring should be checked and corrected, if necessary.

NOTE:—The normal position of the transmitting-magnet armature is when it is resting against its back stop and the normal position of the marking-magnet armature is when it is in the position described in par. 11 (*b*).

(iii) With the armature fully operated, the lever-spring back stop should be adjusted so that there is a contact clearance of 10 mils minimum. If the back stop is readjusted, the tension of the lever spring should be checked and corrected, if necessary.

14. Marking-magnet current tests.—Without prior saturation, the magnet should operate fully when a current of 250 mA is applied to the coil, but when 100 mA is applied, the tip of the marking arm should not lift from the frame. If the assembly does not pass this test, it may be possible to reposition the magnet, but the clearances specified in par. 11 must be maintained. Failing this, the marking-arm restoring spring must be changed.

★15. Normal stop.—Adjust the normal stop as follows:—

With the regenerator in the normal position, i.e. without any digits stored, loosen the two grub-screws securing the normal stop to the shaft, hold the normal stop lightly inwards (against the shoulder on the main shaft) and rotate it clockwise until its tip touches the striker bracket. Tighten the normal-stop grub-screws.

NOTE:—The position of the normal stop may alter slightly as the grub-screws are tightened due to the presence of slight indentation on the shaft. This can be rectified by slackening the two screws holding the striker bracket and adjusting its position so that it is in engagement with the normal stop. Tighten the two fixing screws. The normal position should be such that the main driving wheel is arrested by the normal stop simultaneously with the plunger engaging the side of the code pin [see Fig. 22(A)].

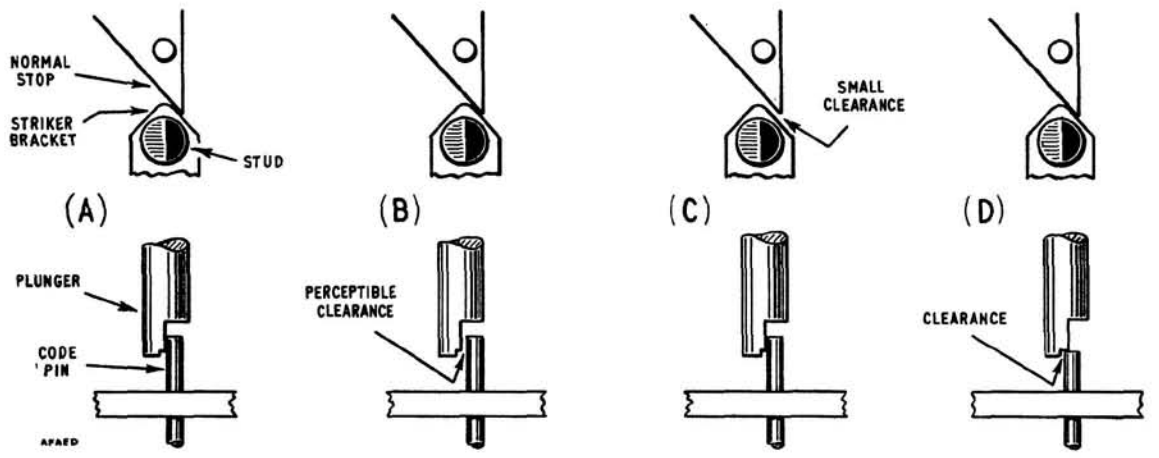


FIG. 22

To allow for slight variations in adjustment and for variations in the spacing of the code pins around the pin plate the main driving wheel may be stopped in some normal positions by the resetting plunger against a code pin with a small clearance between the striker bracket and normal stop [see Fig. 22 (C)]. It is not permissible for the driving wheel to be stopped in the normal position by the normal stop with a clearance between the resetting plunger and code pin [see Fig. 22(B)].

To ensure that the variations are not excessive in either direction, however, the following conditions should be applied:—

When stopped in the normal position by the resetting plunger against a code pin [see Fig. 22(C)] operate the marking- and transmitting-magnet armatures by hand and slowly release the transmitting-magnet armature. Note any forward movement of the plunger tip. Then release the marking-magnet armature and note the restoration of the code pin. If there has been no forward movement of the plunger tip, the code pin will re-enter the deep recess in the plunger [see Fig. 22(C)]. If there has been forward movement of the plunger tip, the code pin may not re-enter the deep recess in the plunger but the forward movement must not be sufficient to prevent the code pin from entering the shallow recess at the tip of the plunger [see Fig. 22(D)]. If the code pin has entered the shallow recess operate and release the marking and receive magnets manually in sequence, to store one digit. The forward movement, if any, of the driving wheel must not cause pulsing springs 1 and 2 to break, check in each position around the pin plate.

After the normal stop adjustment has been completed recheck that the regenerator can store 41 complete pulses [see par. 10(*g*)].

After the pulse springs have been replaced it will be necessary to recheck these conditions [see par. 16 (*d*)].

16. Pulsing assembly.—

(*a*) *Pulsing lever.*—The pulsing lever must be free on its bearing. The pulsing assembly must be positioned about its fixing holes in the governor bracket so that the pulsing lever engages the pulsing cam squarely and lines up with the inner face of the cam (see Fig. 23).

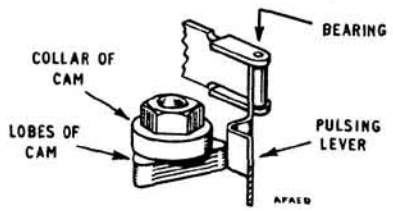


FIG. 23

(*b*) *Pulsing cam.*—The pulsing cam should be positioned so that, when the mechanism is normal, the set of the pulsing lever rests on the peak of one of the three lobes of the cam. This can be effected by repositioning the engagement of the governor gear with the main driving wheel; a fine adjustment can be obtained by moving the governor assembly about the play in the fixing holes. Check the depth of engagement of the governor gear with the main driving wheel before re-fixing the assembly.

As a check of the position of the cam, store 41 separate pulses so that all pins are marked. When transmitting the pulses, observe that the pulsing cam comes to rest correctly in relation to the pulsing lever at the conclusion of each pulse; also check that each pin has been restored to normal.

If, during overhaul, it is found necessary to disturb the position of the pulsing cam on the governor-wheel spindle, or when fitting a new cam, adjust the cam by loosening its fixing nut and rotating the cam until the desired position is obtained. To avoid damaging the mechanism while making this adjustment, the main driving wheel should be rotated and held, by hand, away from the stop while loosening or tightening the nut.

(*c*) *Pulsing springs.*—For the purpose of the following adjustment the springs are numbered 1–4 outwards, commencing with the spring adjacent to the pulsing lever.

(i) *Spring No. 1.*—When the lever is resting on the pulse collar, midway between the lobes on the cam, spring No. 1 should be tensioned to exert a pressure of 10 ± 5 gm against the buffer of the pulse lever. The tension should be measured at the tip of the spring, with spring No. 4 lifted clear (see Fig. 24).

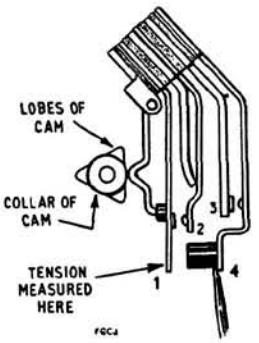


FIG. 24

On auto. telex circuits the clearance between springs Nos. 1 and 2 under the above conditions should be 15 ± 3 mils.

(ii) *Spring No. 2.*—When the pulse lever is resting on a crest of the pulse cam, spring No. 2 should be tensioned so that it exerts a pressure of between 20 and 35 gm (test), 25 ± 5 gm (readjust), against spring No. 1, measured at the point indicated in Fig. 25.

On auto. telex circuits required to give a nominal 60% break period the clearance between the buffer spring and spring No. 2 when the mechanism is held by a marked pin should be 8 ± 2 mils.

(iii) *The buffer spring* should be adjusted so that there is a clearance of 5 ± 1 mils between the tip of the buffer spring and spring No. 2 when the mechanism is held by a marked pin (see Fig. 25). The clearance may be varied in order to obtain the required pulse ratio (see par. 19).

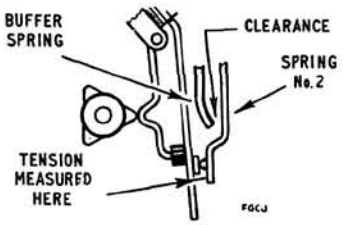


FIG. 25

(iv) *Spring No. 4* should be so tensioned that it exerts a pressure of 20 ± 5 gm on spring No. 3 when the pulse lever is resting on the collar midway between the lobes of the cam. The pressure should be measured immediately in front of the contact (see Fig. 26), with the gauge held at right angles to the spring-set.

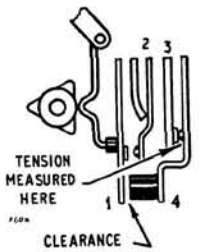


FIG. 26

(v) *Spring No. 3* should be so positioned that when springs Nos. 1 and 2 are fully open, i.e. the pulse lever is resting on the collar midway between the lobes of the cam, there is a clearance between spring No. 1 and the buffer of spring No. 4 (see Fig. 26). As a preliminary adjustment, this clearance should be not more than 4 mils. The tension of spring No. 4 should be checked after this adjustment.

★(*d*) *Overall check.*—A check of the combined adjustment of the normal stop, detent, pulsing springs and cam should be made at this stage. The position of the pulsing lever on the cam must be such that springs Nos. 1 and 2 do not break and springs Nos. 3 and 4 do not make under the following conditions:—

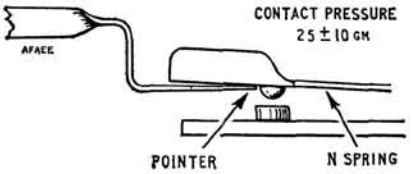
(i) If there is a movement, in the reverse direction, of the main driving wheel when, with the marking magnet operated, the receive magnet is operated with no pulses stored. This check should be made in that position on the ratchet wheel where the most backlash exists.

(ii) When, with one pulse stored, the driving wheel is stopped by a code pin engaged in the shallow recess of the resetting plunger

★17. Off-normal springs (N springs)

On existing regenerators the lever spring of the N spring-set forms an integral part of the spindle assembly. In future replacement piece parts and new regenerators will be supplied with the lever spring and spindle as separate items.

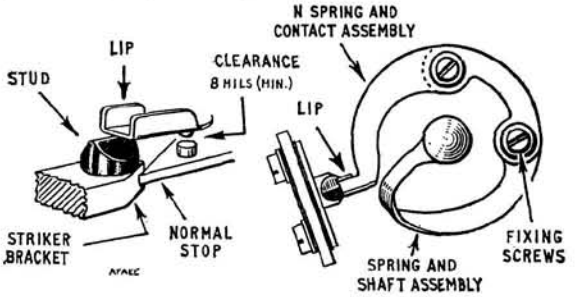
(*a*) *Contact pressure.*—The contact pressure of the N springs when the main driving wheel is rotated away from the normal stop should be 25 ± 10 gm. The tension should be measured at a point immediately in front of the contact (see Fig. 27). The tension should be adjusted by stroking the free end of the spring with adjusting pliers.



★FIG. 27

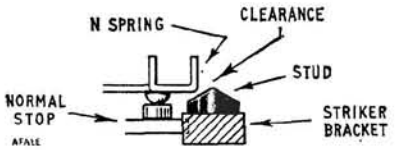
(*b*) *Contact position and opening.*—The contact clearance when the regenerator is normal should be 8 mils minimum. The contacts should not break until pulsing spring No. 1 commences to move for the final closure at the end of the last pulse train.

With the regenerator normal the N spring should be positioned by moving the spring about its fixing holes so that the stud on the striker bracket is just over the lip of the spring (see Fig. 28). The stud should be clear



★FIG. 28

of the spring when the driving wheel is rotated one revolution so that the normal stop is against the other side of the striker bracket (see Fig. 29).



★FIG. 29

The positioning of the spring should be checked with the regenerator normal at four positions equally-spaced around the pin plate.

After adjustment, alignment of the N contacts should be such that they do not overlap each other more than $\frac{1}{3}$ diameter of the contact on the N spring (see Fig. 30). Slight adjustment of contact opening can be made by resetting the tip of the spring. If difficulty is obtained in reducing the contact opening without distorting the spring tip, the normal stop can be repositioned along the shaft, or the striker stud about its fixing holes, taking care in either case not to disturb the normal position of the main driving wheel. The conditions specified in par. 15 should be checked if any repositioning is made.

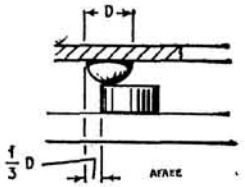


FIG. 30

18. Pulsing speed.—The speed is adjusted by rotating the governor cup (which has previously been positioned on its threaded mounting to allow for adjustment in either direction) in steps of a quarter turn. When locking the cup in position with the aid of the locking piece provided, ensure that the locking piece is in the proper slot and not pressing against the outside of the cup. The locking piece should not press against the bottom of the slot.

The governor should be so adjusted that a speed of 9–11 p.p.s. (test), 9·5–10·5 p.p.s (readjust), is obtained. This should be checked as described in TESTS & INSPECTIONS, Routine, R 5512.

★19. Pulse ratio.—The pulse ratios detailed below should be checked as described in TESTS & INSPECTIONS, Routine, R 5512.

(*a*) *Springs 1 and 2*

(i) The break period must be between 63 and 70% of the pulse period.

(ii) On certain auto. telex circuits the break period must be between 61·5 and 58·5% of the pulse period [see par. 16, (*c*) (ii)].

(*b*) *Springs 3 and 4*

The break period must be between 40 and 60% of the pulse period.

The pulse ratio of springs Nos. 1 and 2 should be checked after the adjustment for speed has been completed. If, after adjustment of the pulsing assembly, it is found that the break ratio is not within the limits quoted, the buffer spring should be adjusted to give correct break ratio. An increase in the clearance between the tip of the buffer spring and spring No. 2 will shorten the break period; a decrease in the clearance will lengthen the break period. The pulse ratio of springs Nos. 3 and 4 can be varied by repositioning spring No. 3 but its position must be such that there is a clearance between spring No. 1 and the buffer of spring No. 4.

20. Dismantling.—The procedure for dismantling described below has been arranged so as to obviate disconnexion of soldered connexions. When disconnecting the wiring from the screw terminals on the pulsing springs, it may be found desirable to mark each wire to facilitate re-connexions.

(*a*) Remove the transmitting-magnet-restoring spring (centre contact spring), taking note of the position of insulation pieces and contact plates. Tie the plates back to the wiring to support them and facilitate assembly.

(*b*) Remove the resetting lever and plunger assembly, by withdrawing the two bracket-fixing screws and holding the main driving wheel until the two fixing screws and the resetting plunger have been removed, then allow the driving wheel to rotate until the main spring is unwound. To avoid damage to the main spring during subsequent operations, the driving wheel must not be rotated anti-clockwise.

(*c*) Remove the pulsing-spring assembly.

(*d*) Remove the governor and governor-gear assembly, by withdrawing the three screws securing it to the frame; this assembly can then be dismantled. Normally, it should not be necessary to remove the pulsing cam and collar from the governor-wheel spindle.

(*e*) Loosen the two grub-screws which secure the normal-stop plate to the main shaft.

★(*f*) Loosen the locking nuts on the spindle and, holding the normal-stop plate, remove the two nuts and gently lift out the spindle and N spring-set complete. During this operation take care not to damage the N spring. The N spring-set may be dismantled into its component parts if required.

(*g*) Slacken the screws which secure the main-spring cup and gently remove the cup containing the spring. *Care should be exercised.* If the spring cannot be readily detached from its centre fixing, a small screwdriver may be inserted through the hole in the spring cup and be used to detach the spring from its centre fixing.

(*h*) Using a Screwdriver, Combination, No. 2, remove the main-spring retaining screw, which also secures the brass collar to the main shaft.

(*j*) Remove the brass collar.

(*k*) Remove the transmitting-magnet-armature back stop and locking nut.

(*l*) Remove the transmitting-magnet-armature extension and connexion-spring assembly, complete, from the transmitting-magnet armature. Do not attempt to separate the assembly.

(*m*) Remove the marking-magnet forked extension.

(*n*) Remove the flanged collar which rides on the main shaft, and the two operating pins.

(*o*) Remove the marking-magnet-armature back stop and locking nut.

(*p*) Remove the transmitting- and marking-magnet armatures. The residual plates on the magnet armatures need not be removed.

(*q*) Release the tension in the receiving-magnet-restoring spring, by slackening the screws holding the adjusting lever.

(*r*) Remove the receiving-magnet-armature back stop and pawl stop.

(*s*) Remove the receiving-magnet armature and pawl-assembly, complete.

(*t*) Remove the detent.

(*u*) To facilitate replacement of the ratchet and marking arm on the shaft in their original positions, mark the outer flank of the ratchet immediately above the marking arm.

(*v*) Remove the transmitting-magnet fixing screws and securing nut. With the transmitting magnet moved to one side, rotate the ratchet wheel and marking arm until the main shaft can be withdrawn.

(*w*) Remove the main-shaft assembly, comprising the ratchet wheel, the marking arm, together with the shaft and its washer.

(*x*) Remove the ratchet wheel together with the marking-arm assembly from the shaft, by withdrawing the four countersunk fixing screws.

(*y*) Loosely replace the transmitting-magnet fixing screw and securing nut.

(*z*) Remove the main driving wheel and main bearing, by removing the fixing screws on the inside of the frame.

(*aa*) Dissociate the main bearing and ball-race from the wheel, by removing the four fixing screws on the main driving wheel.

(*ab*) Loosen the marking-magnet and receiving-magnet fixing screws and set the magnets well back.

(*ac*) For the purposes of normal readjustment, it should not be necessary to remove the magnets, code pins, rollers and their retaining spring. If, however, during overhaul or for other reasons, it is necessary to remove the code pins and rollers, measures should be taken which will facilitate replacement of the pins in their original positions. The pins should be removed before the retaining spring. The pin plate must not be removed from the regenerator frame.

★21. Assembling.—Before assembly, clean all parts of the mechanism and remove any existing lubricant by washing the affected parts with clean white spirit, wiping dry afterwards. Renovate contacts in accordance with H 5006 and examine all code pins (see par. 6).

The following list details the order in which the parts of the mechanism should be assembled. During assembly, lubricate the mechanism in accordance with B 5137.

(*a*) Replace the code pins, rollers and retaining spring.

(*b*) Secure the ball-race and main bearing to the driving wheel and verify that the ball-race runs freely then replace the assembly, by securing the main bearing to the frame; it should be positioned so that the main bearing oil-hole is uppermost and towards the front of the mechanism (i.e. accessible from under the handle).

(*c*) Replace the ratchet on the main shaft; check that the plunger holes in the ratchet line up with those in the flange. Replace the two short fixing screws in the tapped holes; these two screws should pass through the screw holes in the ratchet most distant from the mark made on the ratchet [see par. 20 (*u*)] during dismantling.

(*d*) Check that the laminated marking-arm spring is in alignment with the marking arm.

Replace the marking-arm assembly on the main shaft, using the two long screws.

(*e*) Remove the transmitting-magnet fixing screw and securing nut. Holding the magnet on one side, carefully replace the mainshaft assembly, and check that the washer which rides on the main shaft, between the flange and the main bearing, is in place.

(*f*) Secure the main-shaft assembly in position by fitting the brass collar and main-spring retaining screw. Two fixing holes are provided in the collar. Select the hole which permits very slight end play to be felt in the main shaft.

(*g*) Replace the transmitting-magnet fixing screws and securing nut. Before proceeding further, check that the tip of the marking arm is resting against the frame.

(*h*) Replace the marking-magnet armature and back stop with its locking nut. Adjust the armature as indicated in par. 9.

(*j*) Replace the two operating pins in the ratchet wheel and check that they ride freely in the holes through the assembly. This may be done by depressing each pin, in turn, with the shaft held vertically. The opposite pin should fall freely.

(*k*) Replace the flanged collar on to the shaft.

(*l*) Replace the forked extension on to the marking armature. Adjust its position by moving it about its two fixing screws so that the tips of the fork engage the flange approximately centrally. The fork must not foul the boss on the collar throughout the movement of the armature.

(*m*) Replace the receiving-magnet armature and pawl assembly, complete, taking care to engage the armature-restoring spring with the adjusting lever.

(*n*) Replace the receiving-magnet-armature, back stop and pawl stop. Adjust the armature as indicated in par. 9.

(*o*) Replace the detent. Roughly adjust the receiving assembly so that its resting position is such that the ratchet can be stepped one step at a time, and that the tip of the marking arm rests approximately centrally on a code pin.

(*p*) Replace the transmitting-magnet armature and the back stop with its locking nut. Adjust the armature as indicated in par. 9.

(*q*) Replace the transmitting-magnet-armature extension and connexion spring. See that the hole in the connexion spring lines up with the hole in the end of the main shaft.

(*r*) Replace the main spring in the cup, taking care that the outer end of the spring is securely engaged. If any distortion of the fixing points of the spring is observed, the spring should be changed.

(*s*) Replace the cup with its main spring on the shaft. Carefully turn the cup clockwise to engage the inner end of the spring with the spring-retaining screw in the shaft. If necessary, insert a small screwdriver through the hole in the spring cup to assist in engaging the spring on its centre fixing.

(*NOTE*:—Until the main spring is tensioned, the spring cup must not be rotated anti-clockwise, as this may result in damage to the spring.)

★(*t*) Reassemble the N spring-set on to the normal-stop plate with the spring and contact assembly outermost. Replace the spindle with the N spring assembly to the main shaft. Do not tighten the grub-screws in the normal stop.

Replace the spindle locking nut and the domed thrust nut.

The domed nut should be fully engaged on the spindle thread but the threaded portion must not project through the dome.

Lock the nuts together, using two Spanners, Flat, No. 2, taking care not to damage the N spring assembly or the spindle thread.

(*u*) Replace the resetting lever and plunger assembly, fitting the stepped fibre washers with the steps engaging the holes in the bracket. Any play in the fixing holes and bushes should be taken up by positioning the striker assembly outwards as far as possible in a radial direction [see par. 10(*g*)].

(*v*) Replace the transmitting-magnet-armature restoring spring (centre contact spring), fitting the stepped insulators with the steps engaging the holes in the centre contact spring and tag: check that it has sufficient tension to restore the spindle fully.

(*w*) Before the main spring tension can be conveniently applied, step the ratchet wheel, by operating the receiving-magnet armature, until the marking arm can be seen easily; then, viewing the driving wheel side, rotate the driving wheel in a clockwise direction until the plunger arm is in a position 90° anti-clockwise from the marking arm.

(If the marked code pin prevents the rotation of the driving wheel, operate the marking magnet and restore the marked pin, by hand, to its normal position.)

Hold the driving wheel in this position and rotate the spring cup clockwise until the fixing holes line up with their four fixing screws. Secure the cup by evenly tightening the screws.

(*x*) Replace the governor assembly. The governor gear should so engage the main driving wheel that the assembly runs smoothly; the driving wheel should not be engaged too deeply, otherwise vibration will occur. Adjustment can be obtained by moving the governor-assembly bracket about the fixing screws.

(*y*) Tension the main spring as follows:—

Viewing the driving wheel side, operate the marking magnet and restore the marked pin by hand to its normal position; rotate the main driving wheel clockwise so that the plunger rotates twice past the marking arm, release the marking-magnet armature and allow the main driving wheel to return slowly so that the plunger engages with the marked pin. Before proceeding temporarily position the normal stop as indicated in the first part of par. 15.

(*z*) Replace the pulsing-spring assembly, which should be positioned so that the pulsing lever engages the full width of the lobes of the pulsing cam and the collar. The pulsing lever should be free on its bearing, and rest squarely against the pulsing cam.

Adjust the complete assembly in accordance with pars. 6–19.

22. Piece parts.—Details of the piece parts are given in B 5620.

23. Tools.—The tools required for maintenance, overhaul and adjustment of the regenerator are given in Table 1. Tools should be used only for the purpose for which they are intended. Any tool that is in such a condition that screws or nuts would be damaged by its use should be changed.

24. Lubrication.—Details of the lubrication of the mechanism are indicated in B 5137.

[*Table 1 follows*]

★TABLE 1

Description	Qty.	Use
Adjuster, Armature, No. 6	1	Setting receiving-magnet armature extension
,, ,, No. 7	1	Setting marking-magnet position
,, Detent, No. 3	1	Tensioning the detent
,, Spring, No. 1	1	General spring adjustments
,, Spring, No. 2	1	
Burnisher, Contact, No. 2	1	Burnishing large contacts and contact surfaces
Cleaner, Contact, No. 1	1	Cleaning contacts
★Gauges, Feeler, No. 1 (including Parts 2B, 6B & 10B)	1	General
Gauges, Feeler, No. 10	1	
,, Tension, No. 1	1	
,, ,, No. 2	1	
,, ,, No. 3	1	
Outrigger No. 3	1	Mounting the mechanism horizontally on bench
Pliers, Adjusting, No. 1	1	General spring adjustments
,, ,, No. 3	1	
,, ,, No. 5	1	Setting the governor wings
Screwdriver, Instrument, No. 1	1	General
,, ,, No. 2	1	
,, ,, No. 3	1	
,, Combination, No. 2	1	Main-spring retaining screw
Spanner, Box, No. 8	1	Pulsing-cam locking nut
,, Flat, No. 2	2	General
★ ,, ,, BA 0–2	1	
,, ,, BA 4–6	2	
† Pencil, Type SP 337b (gravity feed)	1	Replacing code pins

† This is a stationery item obtainable from the Supplies Dept., Mount Pleasant, London, E.C.1.

References:—B 5100, B 5137, B 5144, B 5620, H 5006
(TPM2/3) TESTS & INSPECTIONS, Routine, R 5512

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