

50 TYPE DIAL TESTERS REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

- 1.01 This section covers 50 type dial testers.
- 1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.
- 1.03 Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.
- 1.04 Part 1, "General" and Part 2, "Requirements" form part of the Western Electric Co. Inc. Installation Department handbook.
- 1.05 Operated position of the stop and stepping magnets is that position to which the armature advances when the specified current is applied to the magnet and the armature moves so that at least one of the non-freezing discs is touching the magnet core.
- 1.06 Non-operated or normal position of the stop and stepping magnets is that position which the armature assumes when it is resting against the armature back stop screw with the armature air-gap within the specified limits.
- 1.07 Operated position of reset lever is that position in which the lever is in its extreme left-hand position.
- 1.08 Normal position of reset lever is that position in which the lever is in its extreme right-hand position.
- 1.09 One Drop of Oil for the purpose of this section is the amount of oil obtained from a piece of No. 22 bare tinned copper wire, after it has been dipped in oil to a depth of 1/2" and quickly removed.
- 1.10 After setting the disc at the starting point, the reset lever should always be returned to the normal (extreme right-hand) position, before the dial is operated, to prevent interference with the motion of the disc.
- 1.11 The instrument is designed to test the speed of dials only when the digit 0 is dialed. If any other digit is dialed, the stop magnet is not released and the disc will continue to oscillate after the dial has come to rest.
- 1.12 Care should be taken to prevent jarring the instrument while testing the speed of a dial since the accuracy of the result will be affected.
- 1.13 Be sure always to allow sufficient time (usually about one second) after setting the disc at its start position to allow it to come to rest

2. REQUIREMENTS

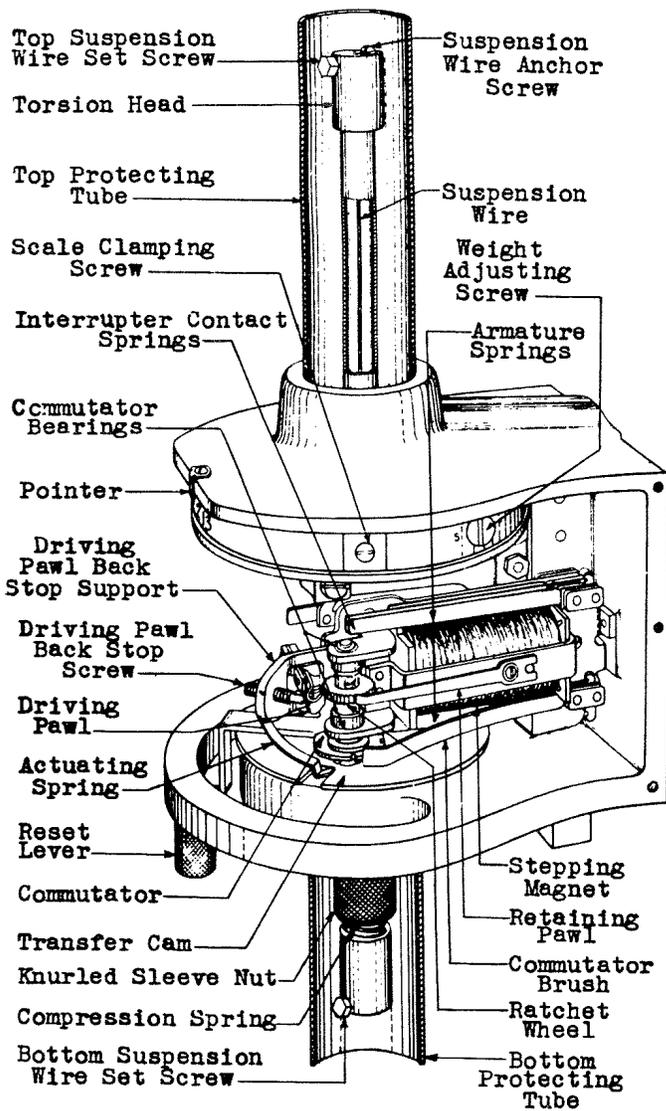


Fig. 1

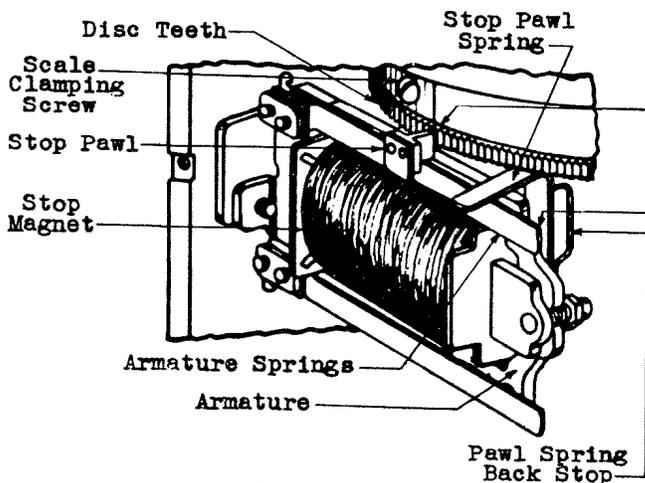


Fig. 2

2.01 Cleaning The ratchet wheel commutator, disc teeth, commutator bearings, and transfer cam shall be cleaned only by approved methods, and the interrupter contacts shall be cleaned when necessary in accordance with the section covering cleaning procedures for relay contacts and parts.

2.02 Lubrication

(a) Commutator Shaft Bearings The upper and lower bearings of the commutator shaft shall be adequately lubricated with KS-6232 Oil. When lubrication is necessary, one drop of oil shall be applied to each bearing.

(b) Ratchet Wheel Teeth The surfaces of the ratchet wheel teeth shall be adequately lubricated with KS-2248 oil dag mixture. When lubrication is necessary two drops of oil dag mixture shall be applied to the surfaces of the teeth. This lubricant shall be applied while slowly operating and releasing the stepping magnet armature.

(c) After turn-over it is recommended that the above mentioned parts of the dial tester be lubricated at intervals of six months. This interval may be extended if periodic inspections have indicated that local conditions are such as to insure that requirements (a) and (b) will be met during the extended interval.

2.03 Record of Lubrication During the period of installation, a record shall be kept, by date, of the lubrication of the dial tester and this record shall be turned over to the Telephone Company with the equipment. If no lubrication has been done, the record shall so state.

2.04 Clearance Between Stop Pawl and Disc Teeth With the stop magnet operated, there shall be a clearance between the stop pawl and the disc teeth at any point on the periphery of the disc of:

Test - Min. .005", Max. .017"
 Readjust - Min. .010", Max. .017"

The .018" blade of the No. 74-D gauge shall not enter. Use the .005" and .010" blades of the No. 74-D gauge to check the minimum limits.

2.05 Stop Magnet Armature Spring Pressure With the armature in its operated position, the pressure of each stop magnet armature spring measured at the end of the spring shall be:

Test - Min. 25 grams, Max. 35 grams
 Readjust - Min. 27 grams, Max. 33 grams

Use the No. 70-D gauge.

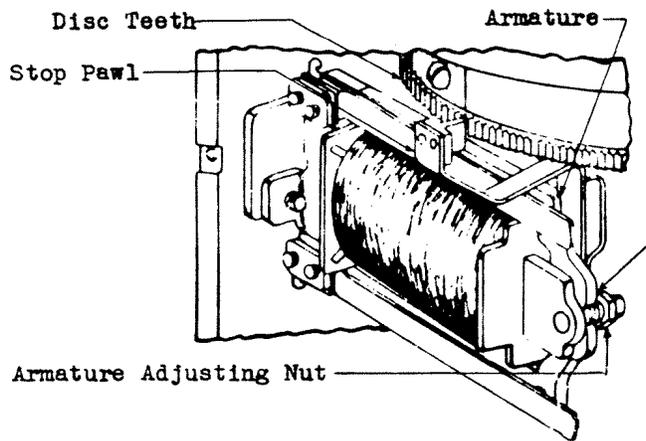


Fig. 3

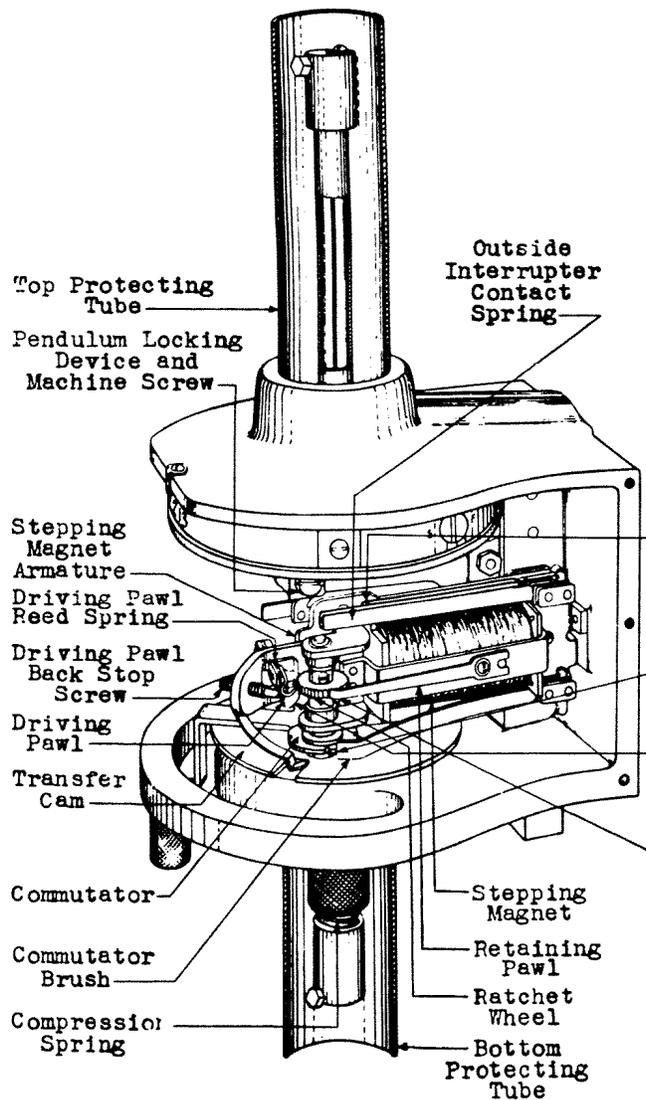


Fig. 4

2.06 Stop Magnet Armature Location The armature shall just touch the armature adjusting nut when the stop pawl bottoms in the teeth on the rim of the disc, gauged when the disc is in the start position and also when the disc is hanging freely in its rest position. Gauge by eye.

2.07 Commutator Brush Pressure The pressure of the commutator brush measured at the end of the brush shall be:
 Test - Min. 25 grams, Max. 35 grams
 Readjust - Min. 27 grams, Max. 33 grams
 Use the No. 70-D gauge.

2.08 Commutator Brush Location When the commutator brush is resting on an insulated slot of the commutator it shall be as near as practicable equidistant from the edges of the slot of the commutator. Gauge by eye.

2.09 Interrupter Spring Pressure The pressure of the outside interrupter contact spring against the inside spring, measured at the end of the spring with the stepping magnet operated shall be:
 Test - Min. 23 grams, Max. 33 grams
 Readjust - Min. 25 grams, Max. 31 grams
 Use the No. 70-D gauge.

2.10 Interrupter Spring Contact Separation With the stepping magnet operated, the air-gap between the open contact of the interrupter contact springs shall be approximately ($\pm .005$) .020". Gauge by eye.

2.11 Interrupter Spring Contact Follow When the armature is restored to its normal position, the contact follow shall be perceptible (approximately .005"). Gauge by eye.

2.12 Stepping Magnet Armature Spring Pressure With the armature in its operated position, the pressure of each armature spring against the armature, measured at the end of the spring shall be:
 Test - Min. 65 grams, Max. 85 grams
 Readjust - Min. 70 grams, Max. 80 grams
 Use the No. 79-C gauge.

2.13 Driving Pawl Pressure The pressure of the driving pawl measured at the hook shall be:
 Test - Min. 20 grams, Max. 40 grams
 Readjust - Min. 25 grams, Max. 35 grams
 Use the No. 70-D gram gauge.

2.14 Retaining Pawl Pressure The pressure of the retaining pawl, measured at the bend in the spring with the spring resting on the crown of any ratchet wheel tooth, shall be:
 Test - Min. 20 grams, Max. 30 grams
 Readjust - Min. 22 grams, Max. 28 grams
 Use the No. 70-D gram gauge.

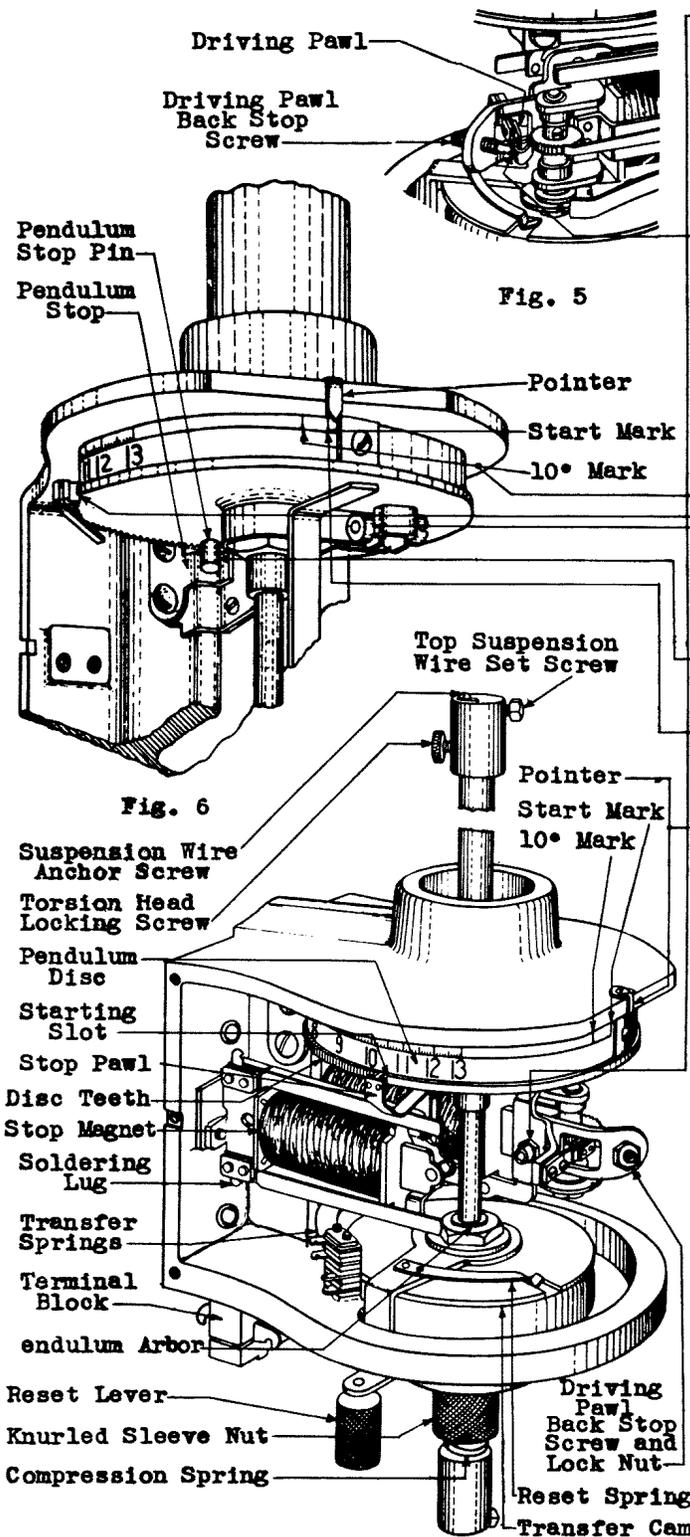


Fig. 7

- 2.15 Stepping Magnet Armature Air-Gap With the armature in its operated position, the armature air-gap, measured between the back of the armature and the armature adjusting nut shall be:
 Test - Min. .040", Max. .050"
 Readjust - Min. .044", Max. .047"
 Use the No. 78 thickness gauge.
- 2.16 Driving Pawl Location The driving pawl shall just touch its back stop on its back stroke. Gauge by eye.
- 2.17 Oscillation Check for Alignment When the disc is allowed to swing from its start position the decrease in amplitude of the disc at the end of the first twenty swings shall be less than 10°. Gauge by eye.
- 2.18 Start Position of Disc
 - (a) With the reset arm moved to the extreme left-hand position and then returned to normal the stop pawl shall fall in the starting slot and rest against the first tooth in the rim of the disc.
 - (b) The clearance between the pendulum stop pin and its stop shall not exceed 1/64".
 - (c) The start mark on the scale shall be directly beneath the pointer. Gauge by eye.
- 2.19 Rest Position of Disc When the disc is allowed to oscillate freely it shall come to rest with the figure 10 directly beneath the pointer. Gauge by eye.
- 2.20 Oscillation Test for Speed
 - (a) When the disc is allowed to swing from its starting point, fifty complete swings shall occur in at least 89 seconds, but not more than 91 seconds.
 - (b) The suspension wire shall always be kept taut. Gauge by eye.
- 2.21 Stepping Magnet Operation The stepping magnet shall release in a local circuit at a speed which will rotate the commutator not less than ten complete revolutions in 16 seconds. Gauge by eye.
- 2.22 Transfer Spring Contact Separation The air-gap between the open contacts of the springs shall be approximately ($\pm .005"$) .020". Gauge by eye.
- 2.23 Transfer Spring Contact Follow The transfer springs shall have a follow of approximately ($\pm .010"$) 1/32". Gauge by eye.
- 2.24 Pendulum Locking Device Position The locking device shall not touch the pendulum when it is swinging. Gauge by eye.

3. ADJUSTING PROCEDURESTOOLS

<u>Code No.</u>	<u>Description</u>	<u>Code No.</u>	<u>Description</u>
35	Screw-driver 3-1/2"	KS-6232	Oil
43	Wrench 3/16" and 1/4"	KS-8372	Trichloroethylene
or	Hex. Open - Double-end Flat	-	Piece of No. 22 Bare Tinned Copper Wire
388-A	Wrench 3/16" and 1/4" Hex. Open - Double-end Offset	3.001	Before making any of the tests given below, set the dial tester for operation by moving the reset lever to the extreme left-hand position and then returning it to normal.
179	Spring Adjuster	3.002	<u>Connections for Test</u> In a number of instances through this part it is necessary to connect the dial tester to a dial in order to check various requirements. For this purpose use the dial of the local test desk on which the dial tester is located and make the following set-ups respectively for panel type and step-by-step equipment.
209	Wrench 5/16" Hex. Open-end Offset		<u>Panel Type Equipment</u> Insert an operator's telephone set into the operator's jack, select an idle talking line from the final multiple and operate the associated key to the talking (halfway down) position, thereby lighting the busy lamp associated with that key and connecting this final multiple line with the dial on the desk. After receiving dial tone in the operator's telephone set, dial the local test desk code (usually "511") and wait for flashing of red and white lights on one of the incoming test trunks. Insert the secondary cord into the jack associated with the flashing red and white lights and operate the "DT" key. This extinguishes the white light and the red light becomes steady. The dial on the test desk is now connected through to the dial tester and ready for test.
245	Wrench 3/8" and 7/16" Hex. Open - Double-end Flat		
259	Spring Adjuster		
265-B (or the replaced 265)	Contact Burnisher		
277	Wrench 1/4" Hex. Open-end Offset		
303	Spring Adjuster		
327	Adjuster		
349	Wrench 3/16" and 7/32" Hex. Closed - Double-end Offset 3/16" Flat Open-end Wrench		
-	Bell System P-Long Nose Pliers - 6-1/2" per A.T. & T.Co. Drawing 46-X-56		
<u>GAUGES</u>			
70-D (or the replaced 70)	50-0-50 Gram Gauge		<u>Step-by-Step Equipment</u> Insert an operator's telephone set into the operator's jack, select an idle talking line from the connector multiple and operate the associated key to the talking (halfway down) position, thereby lighting the busy lamp associated with that key and connecting this connector multiple line with the dial on the desk. After receiving dial tone in the operator's telephone set, dial the local test desk code (usually "117") and wait for flashing of red light on one of the incoming test trunks. Insert the secondary cord into the jack associated with the flashing red light and operate the "DT" key. This extinguishes the red
74-D (or the replaced 74-C)	Assembly of No. 75 Type Thickness Gauges		
78	.044" and .047" Double-end Thickness Gauge		
79-C	0-200 Gram Push-Pull Tension Gauge		
<u>MATERIALS</u>			
KS-2248	Oil Dag Mixture		

light. The dial on the test desk is now connected through to the dial tester and ready for test.

3.01 CLEANING (Rq.2.01)

M-1 Ratchet Wheel Teeth, Commutator, Disc Teeth, Commutator Bearings and Transfer Cam If upon inspection there is found to be an accumulation of gummy oil or foreign matter on the ratchet wheel teeth, commutator, disc teeth, commutator bearings and transfer cam, trichloroethylene may be used very sparingly to soften this matter so that it may be removed. Only trichloroethylene shall be used. All wearing parts of the dial tester such as the ratchet wheel, armature bearings, and disc teeth must be allowed to dry and then be relubricated, if they are cleaned with trichloroethylene.

M-2 Interrupter Contacts Clean the interrupter contacts in accordance with the section covering cleaning procedures for relay contacts and parts.

3.02 LUBRICATION (Rq.2.02)

M-1 Commutator Bearings Apply one drop of KS-6232 Oil on both the upper and lower bearings of the commutator shaft.

M-2 Ratchet Wheel Teeth Apply two drops of oil dag mixture per KS-2248 to the surfaces of the ratchet wheel teeth while slowly operating and releasing the stepping magnet armature.

3.03 RECORD OF LUBRICATION (Rq.2.03) (No Procedure)

3.04 CLEARANCE BETWEEN THE STOP PAWL AND THE DISC TEETH (Rq.2.04)

M-1 To adjust for clearance between the stop pawl and the disc teeth attempt to insert the .010" blade or the .018" blade of the No. 74-D gauge between the stop pawl and the disc teeth.

M-2 Apply the No. 303 spring adjuster close to the base of the stop pawl spring and adjust the spring as required so that the minimum gauge enters the gap and the maximum gauge does not enter the gap or if it does, fits snugly in the gap.

3.05 STOP MAGNET ARMATURE SPRING PRESSURE (Rq.2.05)

M-1 To check the stop magnet armature spring pressure, operate the stop magnet armature and apply a No. 70-D gauge to the end of each of the springs.

M-2 To adjust the stop magnet armature spring pressure apply the No. 179 spring adjuster near the bases of the springs and tension the springs as required.

3.06 STOP MAGNET ARMATURE AIR-GAP (Rq.2.06)

M-1 To check the stop magnet armature air-gap note whether or not, with the armature unoperated (pawl engaging the teeth), a slight movement of the armature toward its core will cause the disc to follow in the same direction. If the pawl bottoms in the teeth, this movement can be detected. In order that slight rotation of the disc which may result from this movement of the pawl will not be confused with displacement of the disc in line with the pawl, the latter movement should be observed at the tube enclosing the suspension wire where it enters the arbor of the dial tester. If this movement is more than .002" or .003" the armature air-gap should be reduced.

M-2 To adjust the armature location apply the No. 349 wrench to the armature back stop nut and by turning the nut to the left (counter-clockwise) or to the right (clockwise) adjust the gap until the pawl just bottoms in the disc teeth checked as described in M-1.

3.07 COMMUTATOR BRUSH PRESSURE (Rq.2.07)

M-1 To adjust the pressure of the commutator brush, apply the No. 179 spring adjuster near the base of the brush and obtain the required pressure by adjusting the brush to the right (clockwise) or to the left (counter-clockwise) as required.

3.08 COMMUTATOR BRUSH LOCATION (Rq.2.08)

M-1 To check for the proper commutator brush location, step the commutator to the point where the commutator brush occupies an insulated slot of the commutator and note that the brush is then approximately equidistant from the edges of the slot of the commutator.

3.08 (Continued)

M-2 To adjust the location of the commutator brush apply the No. 303 spring adjuster near the contact end of the brush and adjust the brush as required.

- 3.09 INTERRUPTER SPRING PRESSURE (Rq.2.09)
 3.10 INTERRUPTER SPRING CONTACT SEPARATION (Rq.2.10)
 3.11 INTERRUPTER SPRING CONTACT FOLLOW (Rq.2.11)

M-1 To adjust for spring pressure, contact separation and contact follow, apply the No. 179 spring adjuster near the base of the interrupter springs and adjust them as required. If it is difficult to meet the requirement for follow by readjustment of the springs in this manner, it will be satisfactory to bend the tang a slight amount. Use P-long nose pliers to bend the tang.

3.12 STEPPING MAGNET ARMATURE SPRING PRESSURE (Rq.2.12)

M-1 To adjust the pressure of the stepping magnet armature springs, apply the No. 179 spring adjuster close to the base of the springs and tension them as required.

3.13 DRIVING PAWL PRESSURE (Rq.2.13)

M-1 To check the driving pawl pressure, rotate the disc and observe that the pawl engages satisfactorily against the root of any ratchet wheel tooth.

M-2 To adjust the driving pawl pressure, remove the armature back-stop nut with the No. 277 wrench and loosen the driving pawl back-stop screw and nut with a No. 35 screw-driver and a No. 209 wrench sufficiently to allow the driving pawl to clear the ratchet wheel when the armature is moved away from the core. Hold the armature so that the pawl clears the ratchet wheel, apply the No. 259 spring adjuster to the reed of the driving pawl in the manner shown in Fig. 8 and carefully adjust the pawl as required.

M-3 After making this adjustment replace the armature back-stop nut and adjust the position of the driving pawl back-stop screw as required.

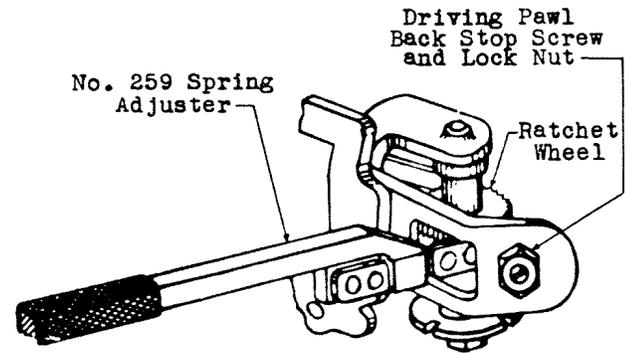


Fig. 8 - Method of Adjusting Driving Pawl Pressure

3.14 RETAINING PAWL PRESSURE (Rq.2.14)

M-1 To adjust the retaining pawl pressure, apply the No. 179 spring adjuster near the base of the spring and adjust it as required.

3.15 STEPPING MAGNET ARMATURE AIR-GAP (Rq.2.15)

M-1 To check the armature air-gap of the stepping magnet, operate the armature and apply the No. 78 gauge between the back of the armature and the armature adjusting nut. The .044" end of the gauge should not bind and the .047" end of the gauge should fit snugly.

M-2 To adjust the armature air-gap of the stepping magnet, apply the No. 277 wrench to the armature adjusting nut and turn the nut to the left (counter-clockwise) or right (clockwise) as required.

3.16 DRIVING PAWL LOCATION (Rq.2.16)

M-1 To check the location of the driving pawl, observe that it just touches its back-stop on its back stroke when the stepping magnet is operated electrically.

M-2 To adjust the location of the driving pawl loosen the driving pawl back-stop lock nut with the No. 209 wrench and turn the screw in or out as required with the No. 35 screw-driver.

3.17 OSCILLATION CHECK FOR ALIGNMENT (Rq.2.17)

M-1 To check the alignment of a dial tester, move the disc to its start position by means of the reset lever and return the lever to its normal position.

M-2 Make the connections for test which are outlined under procedure 3.04.

M-3 Dial the digit 1 or release the "DT" key. This causes the stepping magnet to make one step, which brings the commutator brush (normally resting on an insulated segment of the commutator) in contact with a metallic segment of the commutator, thereby operating the stop magnet which releases the disc of the dial tester and allows the disc to oscillate.

M-4 While the disc is oscillating, count its swings (a complete swing being a motion from one extreme position of the disc to the opposite extreme position). If, after 20 swings, the decrease in amplitude exceeds 10° as indicated on the scale, it is an indication that the dial tester is not properly aligned.

M-5 In making the above tests sufficient time (usually about one second) should be allowed between the setting of the disc and its release to permit it to come to rest.

M-6 If the dial tester is not properly aligned, observe the lower part of the pendulum arbor where it swings in the hole in the lower part of the dial tester. When the dial tester is level the arbor will be approximately centered in the hole.

M-7 If it is observed to touch at the front or back of the hole it will be necessary to loosen the bolts by means of which the dial tester is mounted on the test board with a No. 245 wrench and place small fibre shims behind the top or bottom of the dial tester as necessary.

M-8 Should it be observed to touch at the right or left of the hole, loosen the mounting bolts with the No. 245 wrench and shift the dial tester slightly to level it.

M-9 After leveling the dial tester, repeat the tests for alignment.

3.18 START POSITION OF DISC (Rq.2.18)

M-1 If readjustment for the start position of the disc is necessary, adjust the pendulum stop with a No. 327 Adjuster in the manner shown in Fig. 9.

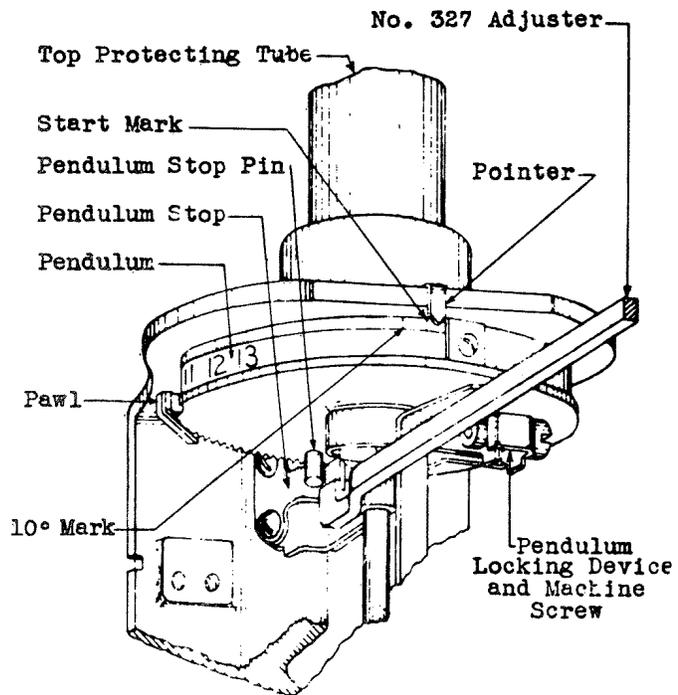


Fig. 9 - Method of Adjusting Start Position of Disc

M-2 If the start mark on the scale is not directly beneath the pointer, loosen the scale clamping screws at both ends of the scale with a No. 35 screw-driver and slide the scale to the left or to the right until the start mark on the scale is directly beneath the pointer. Retighten the scale clamping screws after the desired adjustment has been obtained.

3.19 REST POSITION OF DISC (Rq.2.19)

M-1 To observe the disc in its rest position, move the disc to its start position by means of the reset lever and return the lever to its normal position.

M-2 Make the connections for test which are outlined under paragraph 3.002.

3.19 (Continued)

M-3 Dial the digit 1 or release the "DT" key. This causes the stepping magnet to make one step, which brings the commutator brush (normally resting on an insulated segment of the commutator) in contact with a metallic segment of the commutator, thereby operating the stop magnet which releases the disc of the dial tester and allows the disc to oscillate. Allow the disc to oscillate freely until it comes to rest. It is permissible to dampen the swing of the disc to allow it to come to rest quickly.

M-4 Observe that the disc stops with the figure 10 exactly beneath the pointer.

M-5 If it is necessary to make a correction for this requirement, remove the top protecting tube, release the knurled torsion head locking screw in the torsion head and turn the torsion head in the proper direction to line up the figure 10 on the scale with the pointer.

M-6 After making these corrections, tighten the locking screw and replace the top protecting tube.

3.20 OSCILLATION TEST FOR SPEED (Rq.2.20)

M-1 Move the reset arm to its extreme left-hand position and then return it to normal.

M-2 Make the connections for test which are outlined under procedure 3.04.

M-3 Dial the digit 1 or release the "DT" key. This causes the stepping magnet to make one step, which brings the commutator brush (normally resting on an insulated segment of the commutator) in contact with a metallic segment of the commutator, thereby operating the stop magnet which releases the disc of the dial tester and allows the disc to oscillate.

M-4 Allow the disc to swing from its starting point and note the time required for 50 complete swings. The 50 completed swings should occur in at least 89 seconds but not more than 91 seconds.

M-5 To tighten the suspension wire, remove the top and the bottom protecting tubes and turn the knurled sleeve nut, which is attached to the

lower head screw, down until the clearance between adjacent turns of the compression spring is approximately 1/64" or an amount which is sufficient to prevent adjacent turns from touching.

M-6 Care should be exercised in turning the knurled sleeve nut since if it is turned to a point where there is no clearance between the adjacent turns of the compression spring, the suspension wire may be broken.

M-7 In case the suspension wire cannot be tightened sufficiently to obtain the proper torsion under the above conditions, turn the knurled sleeve nut up as far as possible and then, with the No. 43 or 388-A wrench loosen the suspension wire bottom set-screw sufficiently to allow the wire to be pulled through the hole in the bottom anchor screw. Take up the slack in the suspension wire, tighten the locking nut and turn the knurled sleeve nut down as described under paragraph M-5 above. Then replace the protecting tubes.

M-8 To make the pendulum fast or slow, turn the adjusting screw in a clockwise direction to increase the speed and in a counter-clockwise direction to decrease the speed. It is very improbable that such adjustment will be needed. Therefore this adjusting screw should be moved only after a check of all of the parts has failed to remedy the trouble.

3.21 STEPPING MAGNET OPERATION

M-1 To check the release of the stepping magnet, short-circuit the two lower transfer springs and move the reset lever slightly from its normal position. The stepping magnet should then operate and release at a speed which will rotate the commutator at the specified speed.

M-2 Before adjusting for this requirement observe whether or not the stepping magnet meets all of the other requirements specified for it. If the stepping magnet meets all the other requirements but fails to operate at the desired speed, it may be necessary to change the tension of the interrupter springs or armature springs.

M-3 Care should be taken when reducing spring pressures to

weaken the springs which have the strongest pressure and not to weaken any spring below its required pressure.

3.22 TRANSFER SPRING CONTACT SEPARATION
3.23 TRANSFER SPRING CONTACT FOLLOW

M-1 To check that the transfer springs have the proper contact separation and follow place the reset lever in its normal position and first observe that the reset spring is in its lowest position in a notch of the cam. Check for the proper contact separation.

M-2 Move the reset lever from the normal position and check the follow of the back contact springs.

M-3 After moving the reset lever from the normal position, move it to the operated position and, as the reset spring returns to its position in a notch of the cam check the follow of the front contact springs.

M-4 To adjust for contact separation and follow apply the No. 259 spring adjuster to the upper and the lower sets of springs and adjust them as required.

M-5 In making any of the above adjustments, care should be taken to avoid making sharp bends or kinks in springs.

3.24 PENDULUM LOCKING DEVICE POSITION

M-1 When it is necessary to ship or move a dial tester from one position to another the pendulum locking device should be tightened by turning the pendulum locking screw in (clockwise) with a No. 35 screw-driver. The device clamps the pendulum in a rigid position thereby preventing swinging of the pendulum and breaking the suspension wire.

M-2 After the dial tester is mounted on the test desk, the pendulum should be released by loosening the pendulum locking screw. This should be done by turning the locking screw out (counter-clockwise) with the screw-driver.

M-2 In loosening the locking screw, care should be taken to see that the screw is turned out far enough so that the locking device does not touch the pendulum when it is swinging.