

American Telephone and Telegraph Company

BELL SYSTEM PRACTICES  
Teletypewriter Stations  
Installation and  
Maintenance

SECTION P65.905  
Issue A, 8-31-53  
Long Lines Department  
Dist. Class. 600AC

AUTOMATIC DIALER

TELERAPID TR-350

1. GENERAL

1.01 This section gives general information pertaining to the TR-350 Telerapid automatic dialing unit such as description and use, installation, maintenance, connections and coding.

1.02 The TR-350 dialer may be used in place of the D-97807 dial (covered in Section C34.111) and 5LA dial employed in 64C-type selector circuits. This section will describe the latter use.

2. DESCRIPTION AND USE

2.01 The TR-350 dialer shown in Figure 1 is a device designed to mechanically dial any one of 50 predetermined selector codes each consisting of five digits. The bracket shown will raise the one end about two inches to permit the numbers on the directory cards to be viewed more readily.

2.02 Each of the two directory cards under the plastic windows has 25 spaces for inscribing names or numbers of the stations which may be dialed by the device. The directory card on the left is numbered from 1 to 25 inclusive and the card on the right is numbered from 26 to 50 inclusive. Furthermore, the spaces for listing the names on one card are staggered with respect to those on the other card so that the indicator as it is moved a step at a time alternately points to names on the two cards. The names and numbers may be arranged and placed on the cards in any way the customer desires but care should be exercised so that the selector discs are arranged on the main shaft in corresponding positions.

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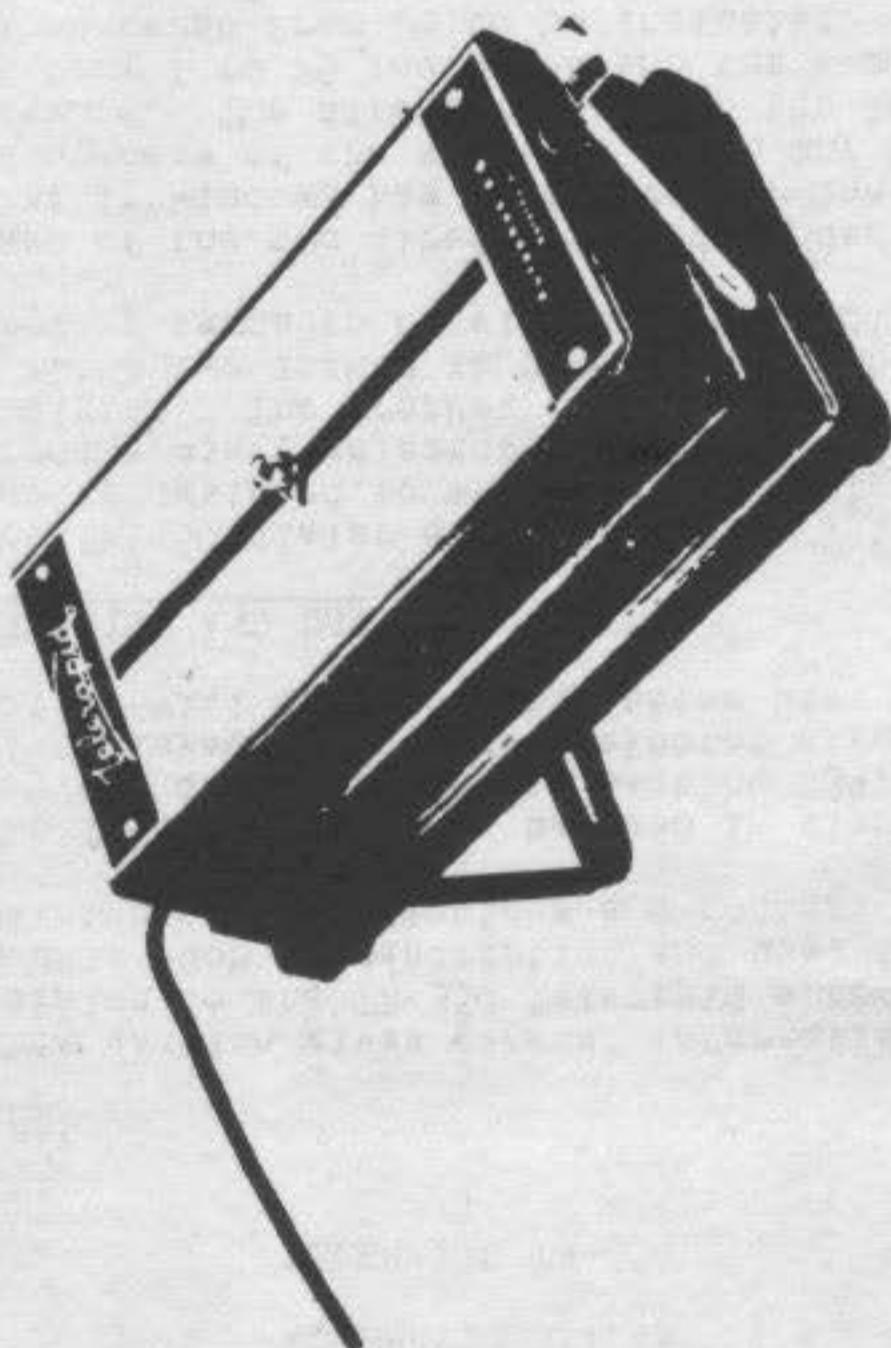


Figure 1

2.03 Because the line circuit is wired through the dialer, the contacts in the socket through which the unit is connected to the 64C1 calling circuit are arranged so that they automatically close when the socket is removed from the dialer for any reason. This facilitates the removal of the dialer for servicing, for the replacement of discs or for possible use at more than one sending position if such other positions are equipped with the special cord.

2.04 The station to be called or the function to be performed is selected by sliding the selector knob until the desired station or number appears directly opposite the pointer of the selector. Having set the pointer to the desired position, the "dial key" is depressed and the lever on the front of the dialer is operated by depressing it downward as far as it will go and then releasing it. The dialer will then pulse the digits associated with the station to be connected. When the lever has stopped rotating (counter-clockwise until the handle portion is about in line with the top of the dialer housing), the "dial key" can be released.

Caution - If the "dial key" is released before the dialer completes its cycle some of the pulses will be lost and it will be necessary to repeat the operation.

Also

Do not attempt to move the indicator during the dialing cycle.

### 3. INSTALLATION

- 3.01 The TR-350 dialer, will be supplied with a connecting cord and plug and 50 uncut discs.
- 3.02 Before installing the TR-350 dialer it will be necessary to cut the desired number of discs with their proper codes.

3.03 The discs to be cut must be removed from the dialer. This is done as follows:

(a) Remove the base plate of the dialer by releasing the spring latch in the front portion of the under side of the base. This will expose the disc pile-up

(b) .The discs each have two holes, and are removed from the main shaft by inserting the TR-352 tool, shaped somewhat like the letter A, between the discs until the up-turned ends of the two fingers engage the openings in the disc to be removed. A slight upward pull will dislodge the disc from the shaft. (If this tool is not available, the disc can be removed by carefully using "duck-bill" or "long-nose" pliers.)

3.04 Each disc has 102 teeth with each tooth representing a pulse. Each code will contain five digits with the first and last digits being the numeral one. It is desired that ten teeth shall be removed between the first and second, and between the fourth and fifth digits, and five teeth removed from between the other adjacent digits; also all teeth following the last digit shall be removed. For example, the steps for Code 16591 will be as follows:

- Tooth 1 - Standing for (1) one pulse
- Teeth 2 to 11 inclusive - removed (interval with no pulses)
- Teeth 12 to 17 inclusive - standing for (6) six pulses
- Teeth 18 to 22 inclusive - removed (interval with no pulses)
- Teeth 23 to 27 inclusive - standing for (5) five pulses
- Teeth 28 to 32 inclusive - removed (interval with no pulses)
- Teeth 33 to 41 inclusive - standing for (9) nine pulses

Teeth 42 to 51 inclusive - removed (interval  
with no pulses)  
Tooth 52 - standing for (1) one pulse  
Teeth 53 to 102 inclusive - removed (interval  
with no pulses)

3.05 A TR-351 disc cutting tool is required to remove the teeth. This is done as follows:

- (a) Slide the disc with the side holding the retaining spring facing up on the stud nearest the handle of the cutting tool in such a way that the slot in the disc is toward the plunger. Shown in Figure 2.
- (b) To begin cutting the disc, rotate it clockwise so that tooth No. 1 clears the plunger. Care should be taken that the stop pin is not damaged.
- (c) Operate the handle, this will completely cut off teeth Nos. 2, 3 and 4 and part of tooth No. 5, thus setting up the first digit.
- (d) Rotate the disc again to the right and operate the handle until teeth Nos. 2 to 10, inclusive are cut off completely and a small portion of tooth No. 11.
- (e) Remove the disc and cut out the remaining portion of tooth No. 11 with a pair of diagonal cutting pliers.
- (f) Rotate the disc again to the right until the number corresponding to the second digit is exposed to the right, 6 in this example.
- (g) Operate the handle, this will cut off teeth Nos. 18, 19 and 20 and a small portion of tooth No. 21, thus setting up the second digit.
- (h) Rotate the disc again to the right until teeth Nos. 18 to 21, inclusive are cut off completely and a small portion of tooth No. 22.

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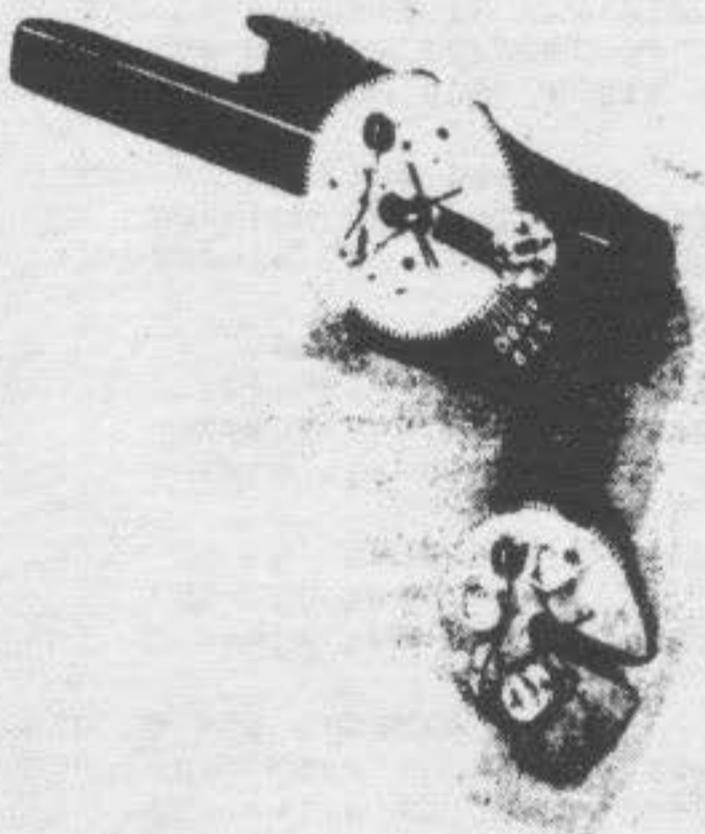


Figure 2



- (i) Remove the disc and cut out the remaining portion of tooth No. 11 with diagonal cutting pliers.
- (j) Repeat steps (d) and (e) for the third, fourth and fifth digits, cutting off with diagonal pliers and 32nd and 51st tooth.
- (k) Cut out all the following teeth, i.e., 52nd to the 102nd.
- (l) Dress off the high points left after removing teeth with the cutter by taking small bites or "nibbling" with the cutter between the groups of standing teeth.
- (m) With a fine file slightly round off or bevel the leading corner of each single tooth and of the first tooth in each group. This operation will permit the rider of the dialer to slide more readily over the teeth.

Note: Due to the high cost of the TR-351 disc cutting tool, it may be found desirable to have the discs for all stations in a particular area prepared at a central location such as a Western Electric Company branch house. In this event it will be desirable that the procedure described above be specified because, if the discs are cut as described in other sources of instructions on the use of the TR-351 tool, there will be a partial tooth in each group of teeth which is apt to become bent resulting in a possible false operation.

3.06 Regardless of the number of discs which are cut for dialing for the TR-350 dialer, 50 discs must always be in place on the shaft in order to keep each disc in its normal operating position. The discs require no adjustment other than to be sure they are not bent or otherwise damaged and that they are installed in the proper spaces. Ordinarily the discs, while on the shaft can be identified with the

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number on the directory card by virtue of the fact the pointer inside the dialer housing points to the disc corresponding to the number indicated by the pointer on the selector knob.

3.07 If for any reason more than one disc is removed from the shaft, the discs can be identified by counting the teeth in each digit.

3.08 When replacing discs it will be found that there is considerable resistance before they are completely seated. This resistance is due in part to friction and in part to the detenting action of the retaining spring. In view of this care must be exercised against bending or otherwise distorting the discs during replacement. It is suggested that they be pushed into place by finger pressure applied on the periphery, pressing only until it becomes uncomfortable and that the process be completed by applying pressure on the middle spacer cup by means of a screw driver having a blade thin enough to pass between adjacent discs.

3.09 To remove or replace the directory cards, remove the lower name plate and the selector knob with its pointer, loosen the two screws holding the upper name plate in place. The plastic windows and directory cards can then be readily removed.

3.10 After the required number of discs have been cut and replaced as outlined above, replace the base and be sure the spring catch is securely latched.

3.11 The TR-350 dialer is connected to the 64C1 pulse dividing circuit through the three conductor cord described in Paragraph 3.01. Make connections as shown in Figure 3 of Bell System Practices P90.980, i.e., the yellow and the white wires will be equivalent to the wires on the Y and B terminals of the 5LA dial which are designated D and C. The blue wire will not be used and should be

turned back and taped at the pulse dividing circuit. These connections are shown also in Figure 3.

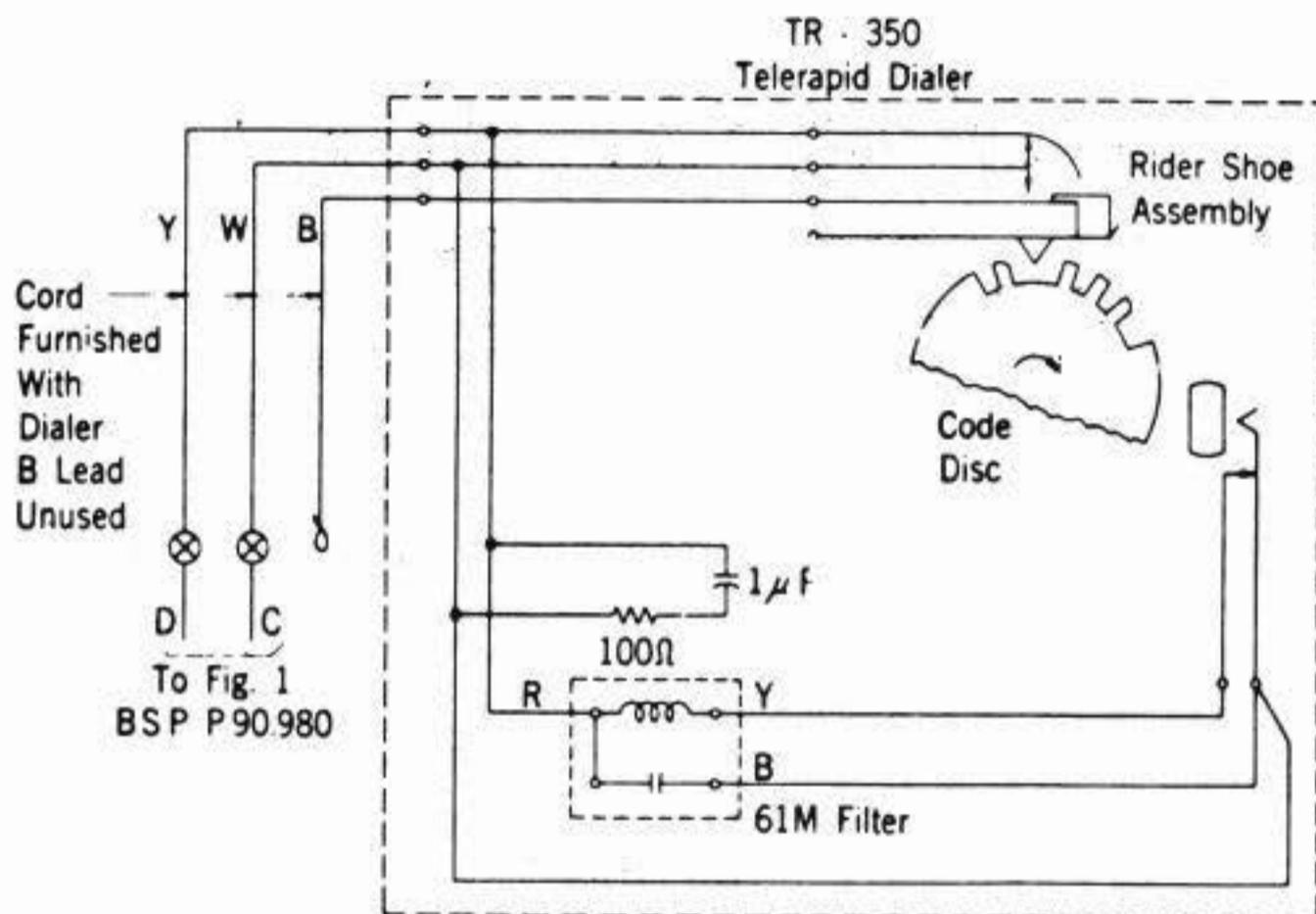


FIG. 3  
Replaces Fig. 3 of  
BSP P90.980

3.12 If radio suppression should be required provide a 61M filter assembly and clip it on to the left tie rod and wire it into the circuit as shown in Figure 4. Keep leads as short as practicable.

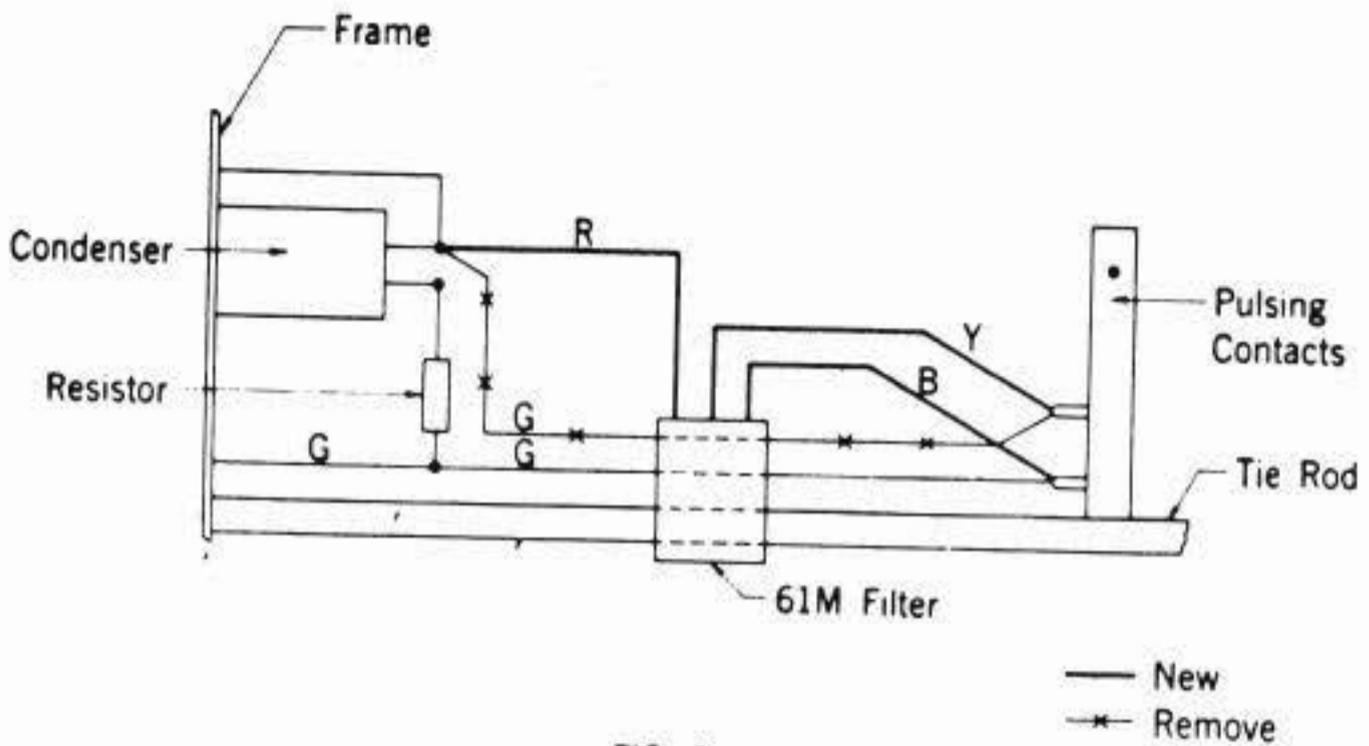


FIG. 4  
Addition of  
61M Filter

#### 4. MAINTENANCE

##### A. PRELIMINARY

##### Removal of Case

4.01 To obtain access to the dialing mechanism for any purpose other than to change discs, it will be necessary to remove the entire housing. This is done as follows in the sequence listed.

- (a) Remove the base plate of the dialer by releasing the spring latch in the front portion of the under side of the base.

- (b) Remove the dialing lever by removing the screw which secures it to its shaft.
- (c) Remove the index knob and pointer.
- (d) Remove the upper and lower name plates, each held in place by two screws.
- (e) Remove the four chassis screws, one in each corner.
- (f) Lift the rear of the case and move forward to clear the wind-up shaft.

#### Preparation of Disc Stack

4.02 Arrange the disc stack so that there is a coded disc in Position 1, 38 and 50 (back center and front with lever toward the operator). If necessary to shift discs, follow the procedure covered in Paragraph 3.04 (b). Make sure that all positions are filled.

### B. TEST AND ADJUSTMENTS

#### Rider Shoe Assembly

4.03 There shall be some clearance between the curved tip of spring No. 1 and the insulator on spring No. 4, (Clearance B in Figure 5A.) Adjust by bending the spring at its tip or along the blade, as found necessary.

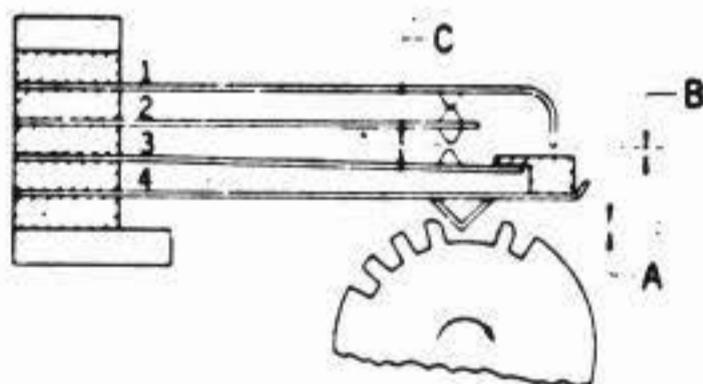


FIG. 5A  
Rider Shoe Assembly  
Unoperated

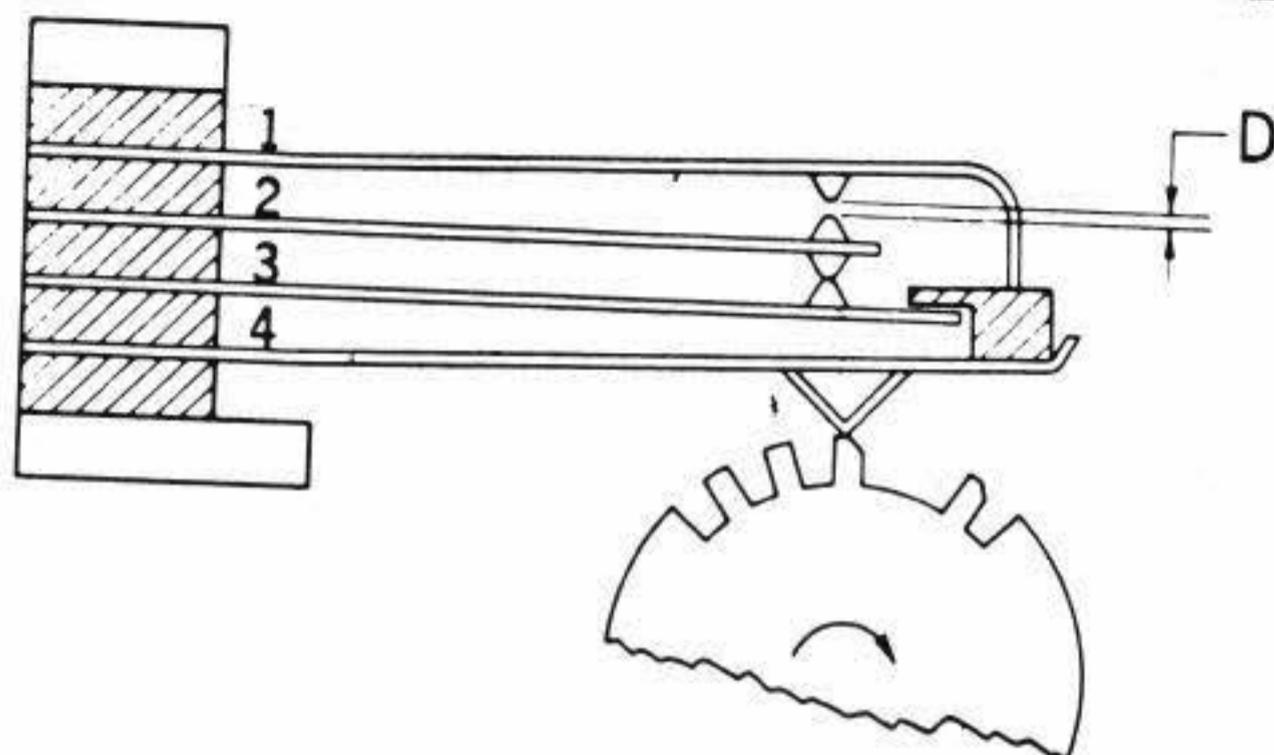


FIG. 5B  
Rider Shoe Assembly  
Operated

4.04 There shall be a movement of minimum .032", maximum .042" of the rider shoe from its non-operate position (over a location where there are no teeth), to its operate position (on top of a tooth), at index Positions 1, 38 and 50.

(a) To check, face the rear of the unit, grasp the disc stack and turn it slowly a sufficient distance to move the rider shoe from the unoperate to the operate position, i.e., from its low position to the top of a tooth. Figures 5A and 5B.

(b) The sum of Gap B, Figure 5A and Gap D, Figure 5B will be the extent of travel of the rider shoe.

(c) Adjust by bending spring No. 4 using a 363 spring adjusting tool; also bend spring No. 1, if necessary, to provide some clearance between it and the insulator on spring No. 4, Figure 5A.

4.05 With the contact shoe in the non-operate position and spring No. 3 horizontal and just touching the under side of the projection of the insulator on spring No. 4, there shall be a gap of minimum .010", maximum .015" between the contacts on springs Nos. 2 and 3.

(a) Adjust by bending spring No. 2.

4.06 With the rider shoe on top of a tooth there shall be a gap of minimum .015", maximum .025" between the contacts on springs Nos. 1 and 2.

(b) Adjust by bending spring No. 1.

4.07 Turn the disc stack so that the rider shoe is in an adjacent low spot and check that there is some clearance between the end of spring No. 1 and the insulator on spring No. 4.

4.08 Check adjustments 4.05 and 4.06 at four points about 90° apart on discs in index positions 1, 38 and 50.

4.09 If all the above requirements are not met, refine adjustments 4.05 and 4.06.

4.10 The tensions of the springs of the rider shoe assembly are so small that it is impracticable to measure them. If the springs are straight and generally parallel to each other, the spring tensions should be satisfactory.

#### Pulsing Contact Assembly

4.11 With the dialer in the unoperated condition and the pulsing contact springs approximately parallel to each other and to the flat surface on the pulsing cam, and with a clearance of about 1/16"

between the long spring and the cam surface, as gauged by eye, it shall require a minimum of 10 grams to separate the contacts when the gauge is applied at the bend of the spring.

(a) Adjust by bending the long contact spring.

4.12 Rotate the disc stack until the pulsing cam is horizontal. In this condition, the contact gap shall be minimum .012", maximum .016" when measured at each of the top points of the cam. (180° apart)

(a) Adjust by bending the short spring.

(b) Recheck 4.11.

4.13 The adjustments of the pulsing contact assembly can be checked and refined by connecting the contacts into a .060 ampere circuit. When the dialer is operated, the meter should read .030 ampere.

#### Slide Bar Springs

4.14 The contact measure of each of the three slide bar springs shall be not less than 50 grams when measured at the point of contact.

(a) Adjust by bending the spring.

#### Synchronization

4.15 In the unoperated condition, the line circuit is carried through contacts on springs Nos. 1 and 2, Figure 5, which are shunted by the pulsing contacts. During operation of the dial, contacts on springs Nos. 1 and 2 are open when the rider shoe is on a tooth at which time the line circuit is through the pulsing contacts only. The pulses are sent out by the opening and closing of these contacts through the operation of the pulsing cam.

4.16 To insure synchronization of the rider and pulsing contacts, the rider shoe shall be centered on top of a disc tooth and the pulsing contact cam shall be centered with the actuating spring of the pulsing contact.

(a) To adjust with the rider shoe assembly near the middle of the disc stack, loosen the front and rear mounting screws of the rider shoe assembly bracket until they are friction tight, turn the disc stack manually until the long axis of the pulsing cam is vertical, then by means of the eccentric on the bracket (middle screw), shift the rider shoe assembly until the shoe is in the valley between two adjacent teeth and touching the edges of both teeth. Tighten the two mounting screws and recheck Paragraph 4.15.

#### Miscellaneous.

4.17 The disc stack and the pulsing cam shaft are both locked in the unoperate position by the same Y shaped latch; one arm drops into a notch on the disc stack shaft assembly and the other hooks over a detent screw on the cam shaft. When the operating lever is depressed, this latch is moved out of engagement with the two shafts allowing them to rotate. A light leaf spring presses the latch against the disc stack shaft and when the notch in the shaft and the detenting portion of the latch are in alignment, the latch will move into the notch thereby locking the dialer. Failure of the dialer to stop after completing its cycle can usually be attributed to weakening of the leaf spring tension. This can be corrected by slightly flattening the loop in the spring.

4.18 On the inside end of the operating lever shaft will be found a collar with a filister-headed screw. This collar turns when the operating lever is depressed and the screw will cam against the locking latch discussed in Paragraph 4.15 forcing it out of engagement with the notch in the disc stack. When the dialer is in the unoperate condition, this screw will project downward and slightly to the left as viewed from the front of the dialer. This can be checked best by turning the dialer upside down with the operating lever away from the observer. The operating lever in its unoperated position will project to the right about  $45^{\circ}$  above the horizontal; it should be depressed to horizontal or a little below and released to start a dialing cycle.

Note: If the locking latch should fail to engage at the completion of a cycle, the code will be repeated and the operating lever will turn further to the left. In this case, check the operation of the locking latch and then turn the operating lever to its normal unoperated position.

### Speed

- 4.19 The dial speed may be checked by sending dial signals to the receiving unit of a teletypewriter through the pulse divider. Also, a quick check can be made to determine if the dial speed may be the cause of pulsing errors by timing the operation. Since the pulsing cam will make 54 revolutions and send out 102 pulses for one complete cycle of the dialer (six pulses are not sent due to a necessary gap in the code disc) the speed can be assumed to be within tolerable limits if an operating cycle is completed between 9-1/2 and 11 seconds.
- 4.20 The dial and teletypewriter will ordinarily be located on the same premises. However, it is expected that fairly accurate results would be obtained if it were desired to send dial signals over a loop or outlying point leg from a customer's office, through the pulse divider for checking at a central office. A teletypewriter of either 60 or 75 speed may be employed. If the teletypewriter is equipped with a governed motor, make sure that the motor speed is correct before proceeding with the test.
- 4.21 The dial speed is changed by raising or lowering the governor ball assembly which is secured to its shaft by two diametrically opposite screws; raising the assembly will increase the speed, lowering it, will decrease the speed. If the speed limits cannot be met initially by raising or lowering the governor ball assembly, bend the spring support springs on each of the weights and then raise or lower the assembly as required. When at rest the two weights should be approximately equidistant from the shaft. The two support springs are most easily adjusted with the governor ball assembly in its highest position.

Note: Be sure that the screws securing the governor ball assembly to its shaft are tight before allowing the governor to rotate to insure against loss of the screws.

Dial Speed Tests using 60 or 75 Speed Teletypewriter Equipment

4.22

(a) Arrange the teletypewriter to respond to dial signals through the pulse divider. In most installations this may be done by separating the Jones socket and plug used to carry the (V) and (W) leads from the (K) dial key to the teletypewriter base. If temporary wiring changes are necessary do not make them while any of the leads to the key are energized, and check connections before potentials are applied. Restore to normal upon completion of tests.

(b) Groups of five pulses are desired for testing purposes and, since the pulse divider slows down the signal speed to one half the speed of the generated signal groups of ten teeth will be required on the test disc. Therefore, prepare a test code disc to have groups of ten teeth with spaces of five teeth, that is, retain the first ten teeth remove the next five, retain the next ten, remove the next five, etc. This will provide seven groups of ten teeth each and six gaps of five teeth each. Since there are 102 teeth on the disc, the last group to be removed will be the last two teeth on the disc.

(c) Install this test disc at any convenient location in the disc stack and move the dial selector knob to select this disc.

(d) Note optimum setting of the range finder.

4.23 With the orientation arm set at specific points, certain characters will be printed on the teletypewriter from which an indication of the dialer speed can be determined. These signals will

be transmitted by depressing the dial key (K) and then depressing and releasing the dialer operating lever. The teletypewriter will receive signals in spurts of five but a continuous line of characters will be printed. It will be found desirable to step the tape or paper after each spurt in order to segregate these groups for examination as outlined in the next paragraph.

4.24 Set the range finder as indicated in the following table and operate the dialer several times. Observe the characters printed by the teletypewriter and proceed as indicated.

#### 60 Speed Teletypewriter

<u>Step</u>	<u>Range Scale Setting</u>	<u>Character Printed</u>	<u>Dial Speed</u>	<u>Remarks</u>
1(a)	10 Points. <u>Below</u> Optimum	Five "T"	-	Follow Step 2 (a)
1(b)	10 Points <u>Below</u> Optimum	Five "T" & "Blank" or Five "Blank"	Slow	adjust speed until Step 1 (a) is met
1(c)	10 Points <u>Below</u> Optimum	Five "O" or Five "M" or Five "T" & "O" or Five "O" & "M"	Fast	Adjust speed until Step 1(a) is met
2(a)	20 Points <u>Above</u> Optimum	Five "O"	OK	Set Range Scale at Optimum
2(b)	20 Points <u>Above</u> Optimum	Five "T" or Five "T" & "O"	Slow	Adjust Speed until Step 2(c) is met
2(c)	20 Points <u>Above</u> Optimum	Five "O"	Appar- ently OK	Follow Step 2(d)

<u>Step</u>	<u>Range Scale Setting</u>	<u>Character Printed</u>	<u>Dial Speed</u>	<u>Remarks</u>
2(d)	10 Points <u>Below Optimum</u>	Five "T"	OK	Set Range Scale at Optimum

75 Speed Teletypewriter

<u>Step</u>	<u>Range Scale Setting</u>	<u>Character Printed</u>	<u>Dial Speed</u>	<u>Remarks</u>
1(a)	Optimum	Five "Blank"	-	Follow Step 2(a)
1(b)	Optimum	Five "T" or Five "O" or Five "M" or Five "Blank" & "T" or Five "T" & "O" or Five "O" & "M"	Fast	Adjust Speed until Step 1(a) is met
1(c)	Optimum	Letters	Slow	Adjust Speed until Step 1(a) is met
2(a)	35 Points <u>Above Optimum</u>	Five "T"	OK	Set Range Scale to Optimum
2(b)	35 Points <u>Above Optimum</u>	Five "Blank" or Five "Blank" & "T"	Slow	Adjust Speed until Step 2(c) is met
2(c)	35 Points <u>Above Optimum</u>	Five "T"	Ap- par- ently OK	Follow Step 2(d)

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<u>Step</u>	<u>Range Scale Setting</u>	<u>Character Printed</u>	<u>Dial Speed</u>	<u>Remarks</u>
2(d)	Optimum	Five "Blank"	OK	Leave Range Scale at Optimum Setting

4.25 If any troubles are experienced with the TR-350 dialer not discussed in the foregoing or whose clearance is not obvious, arrangement shall be made to return the unit to the Western Electric Company. If this is done be sure to retain the code discs and directory cards for the new dialer.

## 5. CLEANING

5.01 Contacts shall be cleaned, when necessary, in accordance with the section covering cleaning of relay contacts and parts.

## 6. LUBRICATION

6.01 It is not expected the dialer will require any lubrication during its operating life, however, if in the opinion of the maintenance man the unit requires lubrication it shall be returned to the Western Electric Company.

Note: Under no circumstances apply any lubricant in the governor cup nor on the governor balls.

## 7. REASSEMBLY

7.01 When maintenance work is completed on the dialer, reassemble it in the reverse procedure outlined in Paragraph 4.01 except that before adding the base plate, check that the code discs are in their proper positions.

7.02 Insert the plug of the three-conductor cord into the connector on the dialer.

## 8. TOOLS AND MATERIAL

8.01 The following special tools and tools not normally carried in the maintenance man's tool kit will facilitate the installation and maintenance of the TR-350 dialer.

TR-351 disc cutting tool (see Note after Paragraph 3.05 (m))  
TR-352 disc removing tool (see Paragraph 3.03 (b))  
363 spring adjusting tool

8.02 Extra code discs may be obtained by specifying TR-353 discs and extra cord and plug assemblies may be obtained by specifying "(quantity) cord equipped with plug for Telerapid TR-350 Dialer".

## 9. REFERENCE

9.01 Figure 1 is reproduced from photograph No. 179404. Figure 2 is reproduced from photograph No. 188652. Figures 3, 4 and 5 are reproduced from a Long Lines drawing identified as "Figures for Bell System Practices P65.905.