

## 100A TELETYPEWRITER TEST DISTRIBUTOR

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### 1. GENERAL

1.01 This section describes and gives operating information for the 100A teletypewriter test distributor, a motor-driven portable device designed to provide a local source of 5-unit (7.42 elements with the start and stop) open and close recurring test signals for testing teletypewriter circuits and checking the efficiency of start-stop selectors in teletypewriter apparatus. Undistorted teletypewriter characters and telegraph reversals are provided, and in addition the teletypewriter characters may be arranged to have bias or end-distortion of 20 per cent, either marking or spacing. In this section the term **reversals** means alternate open and close signals (marks and spaces) of equal length.

1.02 This section has been reissued primarily to suggest the use of the 164C1 telegraph transmission measuring set in connection with the 100A teletypewriter test distributor. Other details are changed to bring the information up to date, as for example, mentioning use at speed of 100 words per minute. Most of the section is rewritten to eliminate repetition and to present the information on the use of the control switches more clearly. In view of the extent of the changes, the use of marginal arrows is not feasible.

1.03 The 100A teletypewriter test distributor may be used at outlying stations in connection with transmission testing between the station and the central office or assigned test center. It will also be found of use at a test center not having a permanently installed source of teletypewriter test signals. This set will also be required when orientation tests are to be made locally at a station disconnected from the loop. The signals produced by the 100A set are those required by the 161A telegraph station test set (Blank, T, O, M, V, LTRS), so that the 100A equipment will be particularly useful in connection with that set. The 100A set may also be useful with the 164C1 telegraph transmission measuring set and the 118-type telegraph transmission measuring set. The open and close signals supplied by this set should not be used directly in line and loop circuits which normally employ polar or effective polar transmission. In most cases the signals from this distributor will be used in local circuits of repeaters where the open and close signals are satisfactory.

## 2. DESCRIPTION

2.01 **General:** This set is contained in a 5- by 7- by 8-3/4-inch wrinkle-finished metal carrying case which has a leather handle, rubber feet, and a removable lid. The complete set weighs about 12 pounds and is therefore easily carried. It is equipped with control switches for setting up signal or unit combinations or undistorted telegraph reversals, and for introducing fixed amounts of distortion to be transmitted. An output jack is located to the right of the switches to accommodate a patch cord. A power cord with a switch for starting and stopping the motor is supplied with the set. The commutator face and brush arm are protected by a hinged cover having a transparent nonbreakable top. To the left of the hinged cover is a compartment in which the power cord and plug adapters for connection to the usual types of power outlets may be packed. **Fig. 1**



**Fig. 1—100A Teletypewriter Test Distributor (Front View)**

**2.02 Accuracy of Signals:** When the 100A teletypewriter test distributor is in proper adjustment, the undistorted signals produced by it have no more than about 1 per cent distortion. The bias and end-distortion are within the range of 19 to 21 per cent (the specified value is 20 per cent).

### Transmission

2.03 **Distributor:** The distributor completes the electrical connections between the control switches and the signal line in the correct sequence and at the required speed. This is accomplished by three brushes which are mounted on a brush arm attached to the distributor shaft. The brushes rotate over three concentric segmented rings of a commutator face. The outer ring and the middle ring each have seven segments which are strapped together for the transmission of the test characters. The segments of these two rings are offset 20 per cent of a unit element with respect to each other in order to transmit 20 per cent bias or end-distortion. The inner ring has eight segments of equal length for the transmission of undistorted telegraph reversals.

(a) **Operating Speed:** Test signals and reversals may be obtained at the speed given below with the gears indicated.

| WPM | Speed of<br>Teletypewriter<br>Test Signals | Speed of<br>Reversals | Gears |
|-----|--------------------------------------------|-----------------------|-------|
|     | Dots Per Second                            | Dots Per Second       |       |
| 60  | 22.8                                       | 24.5                  | 100A  |
| 75  | 28.4                                       | 30.6                  | 100B  |
| 100 | 37.1                                       | 40.0                  | 100C  |

**Note:** The reversals from the 100A set will be found generally satisfactory for use in measuring bias. They should not, however, be used in calibrating bias-producing circuits such as in the 119-type sets unless correction is made for the speed difference.

2.04 **Control Switches:** With the switch panel facing the operator, the first three switches from left to right will be referred to as A, B, and C; and the remainder as 1, 2, 3, 4, 5, and STOP as inscribed on the panel. The position of the switch handles, forward or rearward, will be referred to as **Front, Rear, and Center**. The functions of the switches in the positions indicated are as follows: **Fig. 1**

#### Switch

|   |        |   |                                                                                                                                                  |
|---|--------|---|--------------------------------------------------------------------------------------------------------------------------------------------------|
| A | Front  | — | (RS) Telegraph reversals                                                                                                                         |
|   | Rear   | — | (TTY SIGS) Teletypewriter signals                                                                                                                |
| B | Front  | — | Signals with 20 per cent end-distortion                                                                                                          |
|   | Center | — | In this position a closed-loop condition is produced regardless of the other keys, so that no signals are transmitted from the test distributor. |
|   | Rear   | — | Signals with 20 per cent bias                                                                                                                    |

|      |        |   |                                   |
|------|--------|---|-----------------------------------|
| C    | Front  | — | Spacing signal distortion         |
|      | Center | — | Zero signal distortion            |
|      | Rear   | — | Marking signal distortion         |
| 1    | Front  | — | Spacing for first signal element  |
|      | Rear   | — | Marking for first signal element  |
| 2    | Front  | — | Spacing for second signal element |
|      | Rear   | — | Marking for second signal element |
| 3    | Front  | — | Spacing for third signal element  |
|      | Rear   | — | Marking for third signal element  |
| 4    | Front  | — | Spacing for fourth signal element |
|      | Rear   | — | Marking for fourth signal element |
| 5    | Front  | — | Spacing for fifth signal element  |
|      | Rear   | — | Marking for fifth signal element  |
| STOP | Front  | — | Disconnects stop element          |
|      | Rear   | — | Connects stop element             |

2.05 Using the same designations as above, the following types of signals may be obtained by positioning the switches as indicated.

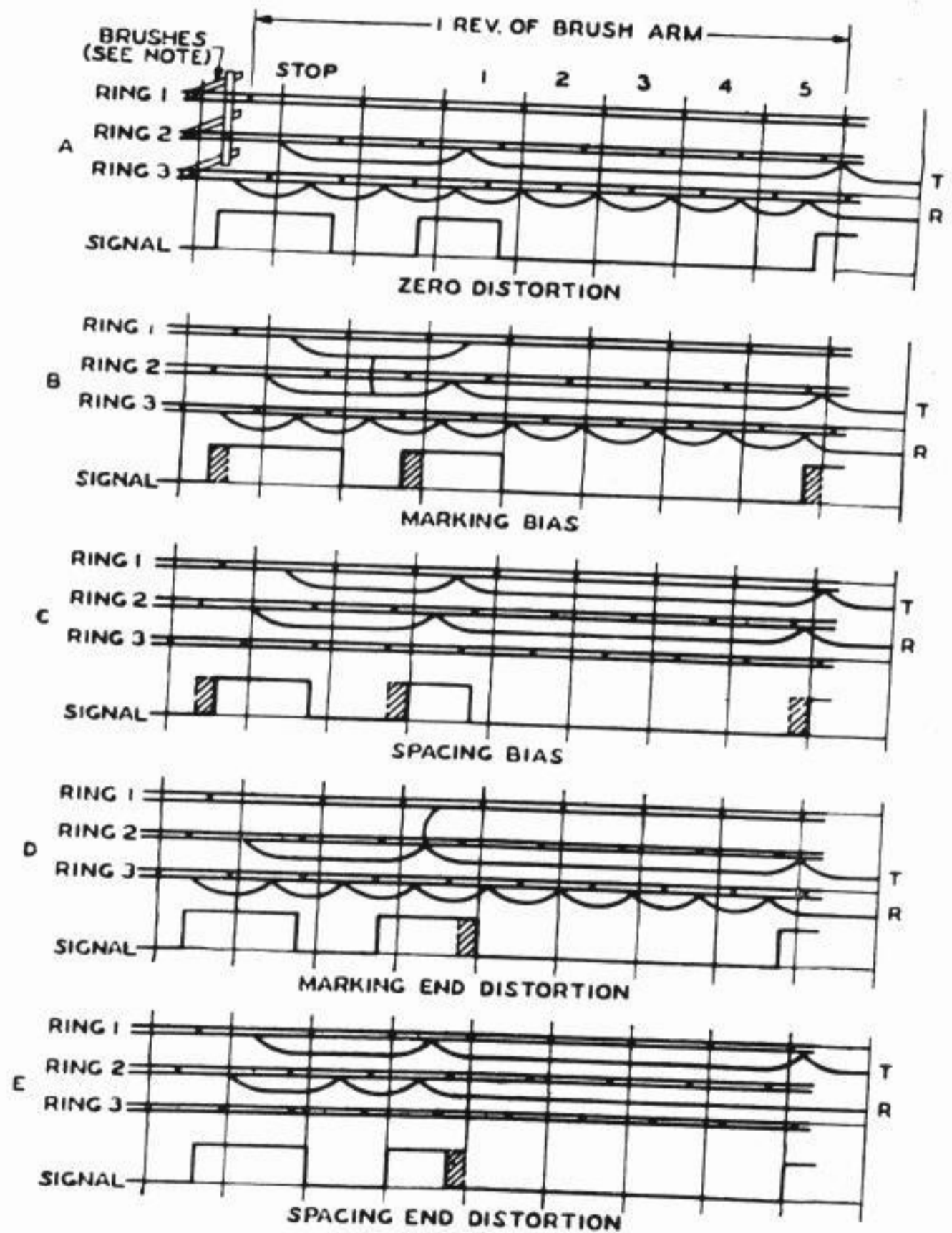
| <u>Signals</u>         | <u>Switches</u> |          |          |                 |             |
|------------------------|-----------------|----------|----------|-----------------|-------------|
|                        | <u>A</u>        | <u>B</u> | <u>C</u> | <u>1 thru 5</u> | <u>STOP</u> |
| Reversals              | Front           | Front*   | Center   | Rear            | Rear        |
| Undistorted            | Rear            | Rear*    | Center   | Any**           | Rear        |
| Marking Bias           | Rear            | Rear     | Rear     | Any**           | Rear        |
| Spacing Bias           | Rear            | Rear     | Front    | Any**           | Rear        |
| Marking End-distortion | Rear            | Front    | Rear     | Any**           | Rear        |
| Spacing End-distortion | Rear            | Front    | Front    | Any**           | Rear        |
| Repeated Blanks        | Rear            | Rear*    | Center   | Front           | Rear        |
| †Unit Signal Element   | Rear            | Rear*    | Center   | ***             | Front       |

\*Any position except center. See 2.04, Switch B

\*\*Any position to form the desired 7.42-unit teletypewriter test character.

\*\*\*One of the control switches 1 through 5 to **Rear** (marking) and the STOP switch to **Front** (spacing).

†This permits transmission of a single marking signal element of unit length, as required for certain tests of equalization.



NOTE: THE THREE BRUSHES ARE STRAPPED TOGETHER AND TRAVERSE RINGS 1, 2 AND 3 SIMULTANEOUSLY, FORMING OPEN AND CLOSE SIGNALS.

Fig. 2—Method of Distorting Teletypewriter Characters

2.06 **Method of Distorting Teletypewriter Characters:** Fig. 2 shows the connections to the segments of the concentric rings and the resulting teletypewriter signal for zero distortion, 20 per cent marking and spacing bias, and 20 per cent marking and spacing end-distortion, respectively. For these examples it is assumed that switches A, B, and C are operated as indicated in 2.05 for the particular type of distortion to be produced, that the toggle switches controlling the STOP element and the No. 1 control switch are operated to ON so that these are marking elements, and control switches 2, 3, 4, and 5 are operated to OFF and are spacing as in the code for the character E. The T and R connections at the right of the figures are the tip and ring, respectively, of the output jack. Since the 100A sends only open and close signals, current flows in the output circuit only while the commutator brushes close the circuit between T and R. The three brushes are strapped together electrically by the mounting arrangement of the brush arm, and move together from left to right in the figures. It is assumed that the brushes of rings 1 and 2 cross the vertical lines of the figures simultaneously, as this must be the case in order to produce the desired distortion. **Fig. 2**

(a) Fig. 2A shows how undistorted signals are produced using rings 2 and 3. Current flows in the T and R circuit only during the time the brush of ring 2 is passing over the STOP segment and the No. 1 selecting segment. **Fig. 2A**

(b) Fig. 2B shows how marking bias is produced using all three rings. Current flows in the T and R circuit during the time the brushes of rings 1 and 2 are passing over the STOP and No. 1 selecting segments of these rings. Due to the 20 per cent displacement between rings 1 and 2, 20 per cent of a unit element is added to the beginning of each marking element as indicated by the shaded portions of the signal.

(c) As shown by Fig. 2C, spacing bias is produced by using rings 1 and 2 only. Current flows in the T and R circuit only during the time the brushes of rings 1 and 2 effectively strap together the corresponding marking segments of the two rings, in this case the STOP and No. 1 selecting segments of these rings. This results in 20 per cent of the unit element being subtracted at the beginning of each marking element as indicated by the shaded portions of the signal.

(d) In Fig. 2D all three rings are used for marking end-distortion. Current flows in the T and R circuit during the time the brush is passing over the stop segment of ring 2 and during the time the brushes of rings 1 and 2 are passing over the No. 1 segment of these rings. This results

in an undistorted stop element and adds 20 per cent of a unit element to the end of the No. 1 selecting element as indicated by the shaded portion of the signal.

(e) In Fig. 2E, spacing end-distortion, only rings 1 and 2 are used. Current flows in the T and R circuit during the time the brushes of rings 1 and 2 are both on the STOP segments of these rings and during the time the start segment of ring 2 overlaps the STOP segment of ring 1, thus forming an undistorted stop element. Current also flows during the time the brushes of rings 1 and 2 are both on the No. 1 selecting segment of these rings. This results in subtracting 20 per cent of a unit element at the end of the No. 1 selecting segment as indicated by the shaded portion of the signal.

**2.07 Method of Producing Reversals:** With the control switches operated as in line one of the table in 2.05, alternate segments of the inner concentric ring are strapped together and a common ring is formed by strapping together all the segments of the middle and outer rings. Operation of the set under this arrangement will produce a repetition of undistorted open and close signals. No provision is made for distorted reversals.

### 3. USE

#### **Power Supply and Line Connections**

3.01 Commercial 115- to 120-volt 60-cycle power is required if the 100A set is equipped with a synchronous motor. If the set is equipped with a governed motor, the power supply may be 60-cycle ac or dc at 115 to 120 volts.

3.02 A 1/10-ampere, 250-volt fusetron is mounted inside the case to protect the motor. If the power is known to be connected and the motor will not operate, the fusetron in the set should be examined.

3.03 Connection to the local power supply is made with the power cord supplied as part of the set, while connection to the circuit under test is made by means of a patch cord.

3.04 Signals may be applied to the circuit under test using electrical connections as follows:

(a) **Subscriber Station:** At subscriber stations the same electrical connections should be used as are normally employed for the station keyboard.

(b) **Central Offices:** At central offices the same electrical connections should be used as are normally employed for multiple senders and 14 tape-type transmitter-distributors. Bell System Practice sections covering the 161A1



telegraph station test set and the 164C1 telegraph transmission measuring set are of interest in this connection (see 6.01).

3.05 Since the amount of distortion in the signals depends upon the adjustment of the brushes, it is well to measure the signals locally before using the set. This may be done with a 161A1 set, a 164C1 set, a 118-type set, or other suitable measuring device. The signal distortion thus determined should be taken into account when measurements are made.

3.06 Care should be taken that the circuits are tested in such a way that the signals will not be distorted before they are transmitted to the line. To avoid this, it is best to remove the loops from the telegraph line terminal circuit. When testing toward a line from the loop side of a repeater and a telegraph line terminal circuit containing a fairly long loop which cannot be removed, the 100A set should be connected between the loop and the repeater which is sending to the line under test in order to avoid excessive bias. Even with this connection, an amount of marking bias sufficient to be objectionable may be introduced by the loop when measuring small values of distortion as is necessary in equalization testing.

#### 4. MAINTENANCE

##### Motor

4.01 **Motor Fan:** The motor fan should be positioned laterally on the motor shaft so that it will turn freely when the motor is running.

(a) To adjust, reposition by means of the fan setscrew.

4.02 **Motor Position:** When the position of the motor is properly adjusted, the motor shaft should be parallel to the base plate, and the center line of the pinion should be level with the center of the main-shaft gear. With this adjustment there should be barely perceptible backlash between the motor pinion and the main-shaft gear throughout a complete revolution of the main shaft, and there should be no excessive gear noise. Armature-shaft end play should not be confused with backlash.

(a) To adjust, position the motor by means of its mounting screws.

##### Commutator Brushes

**Caution:** The brushes will be damaged if the brush arm is rotated in a counterclockwise direction while the brushes are resting on the face of the commutator.

4.03 The brushes should be trimmed off squarely so that the entire width will rest on the commutator rings.

4.04 **Alignment:** With a screwdriver inserted in the hole provided in the commutator disc, raise the brushes from the face of the commutator and rotate the brush arm counterclockwise until the trailing edge of the brush counterbalance arm is against the screwdriver. In this position the brush holder should be parallel to the inscribed white line on the commutator disc, and the ends of the brushes should line up with this inscribed line.

- (a) To adjust, lower the brushes and position the brushes and brush holder by means of their clamping screws.

#### 4.05 **Pressure**

**Note:** Excessive pressure will wear both the brushes and the commutator segments and make frequent adjustment necessary.

With the brush-holder arm rotated so that the brushes just make good contact with their respective commutator rings, turn the eccentric stop so there is a clearance of Min 0.025 inch, Max 0.030 inch between the brush-holder stop post and the eccentric stop. Secure the eccentric stop in this position by means of its screw. Then rotate the brush-holder arm so that the brush-holder stop post rests against the eccentric stop. Tighten the brush-holder arm clamping screw.

4.06 As the brushes wear the signals become slightly biased. To insure accuracy within about 1 per cent, it is desirable to change the brushes after about 24 hours of operating time.

4.07 To guard against operating failures, it is important that the commutator brushes, commutator segments, and slots between the segments be cleaned frequently. For general cleaning requirements see BSP Section P30.010.

4.08 In addition to the general lubricating requirements to be found in BSP Section P30.011, the parts listed below should be lubricated as follows:

Lower brush-arm shaft bearing—Oil once every 3 months or after about 400 operating hours when used in intermittent service

Motor shaft gear—grease

Motor pinion—grease

**Note:** The upper bearing of the brush-arm shaft is a sealed ball bearing which is packed with grease and should not be lubricated.

## 5. WIRING DIAGRAM

5.01 Fig. 3 shows the wiring diagram for the 100A teletypewriter test distributor.

Fig. 3—100A Teletypewriter Test Distributor—  
Wiring Diagram

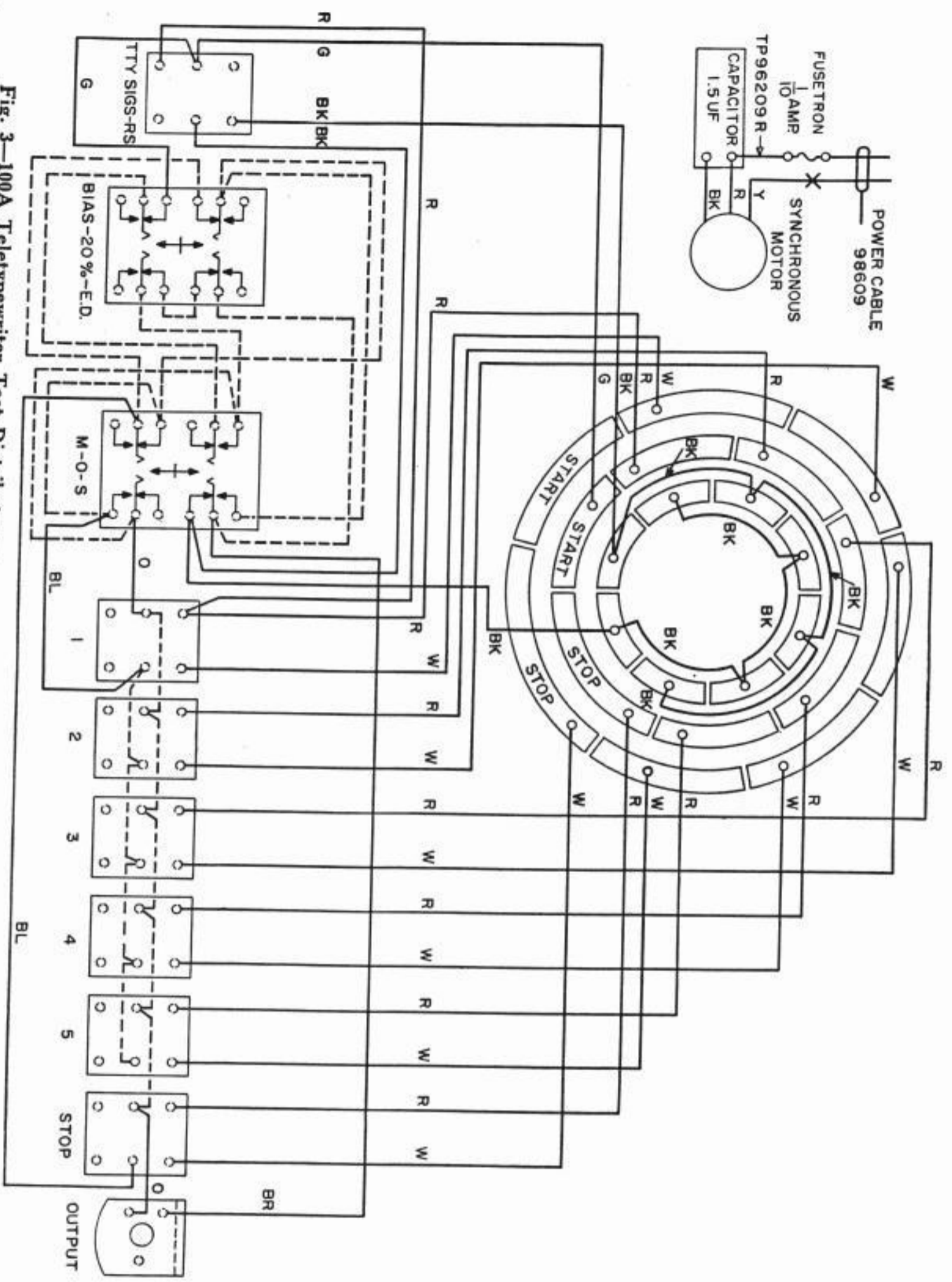


Fig. 3—100A Teletypewriter Test Distributor—  
Wiring Diagram

## 6. REFERENCE TO BELL SYSTEM PRACTICES

6.01 The following BSPs contain information used with P31.402.

| <u>Title</u>                                               | <u>Section No.</u>        |
|------------------------------------------------------------|---------------------------|
| Teletypewriter Stations — Orientation and Distortion Tests | P30.002                   |
| 118A1 and 118B1 Telegraph Transmission Measuring Sets      | E45.423, P70.707          |
| 118C3 Telegraph Transmission Measuring Set                 | E35.428, E45.428          |
| 119A2 Telegraph Signal Biasing Set                         | E35.416, E45.416          |
| 119B Telegraph Signal Biasing Set                          | E35.417, E45.417          |
| 119C1 Telegraph Signal Distorting Set                      | E45.419                   |
| 161A1 Telegraph Station Test Set                           | P31.401, E35.422, E45.422 |
| 164C1 Telegraph Transmission Measuring Set                 | P31.405, E45.438          |
| Cleaning—General Requirements                              | P30.010                   |
| Lubrication—General Requirements                           | P30.011                   |