OPERATORS' TELEPHONE CIRCUITS

TELEPHONE SETS

CONTENTS

Fig. 1

1. GENERAL

1.01 This is the third section of a series of practices dealing with operators' transmission. It presents information on the 52- and 53-type head telephone sets which are currently standard for all Bell System operators. The 52-type head telephone set replaces the old chest type transmitter and headband receiver ensemble employing the 396A transmitter unit and the 528 or 716 receiver unit.

1.02 There are four models of the 52-type head telephone set one of which is shown in Fig. 6. The 52A is used by all operators; the 52B by service assistants, assistant chief operators, and chief operators; the 52D by night operators; and the 52C is used in special services. The 52B set has an attachment for a supplementary receiver and employs a cord with a switch for cutting the transmitter "on" or "off." The 52C employs a higher impedance receiver unit than the 52A. The 52D set is similar to the 52A except that a longer cord is provided. The component parts of 52-type telephone sets are shown in Fig. 5.

1.03 Another head telephone set, the 53-type, has the same transmission characteristics as the 52A. However, the 53-type can be used as a hand telephone set as well as a head telephone set. This set is shown in Fig. 7.

1.04 Two versions of the 53-type set are provided. The 53A developed for Bell System use, and the 53BW for use by the Signal Corps. The 53BW differs from the 53A only in mechanical details.

2. TRANSMISSION FEATURES

(A) Transmitters

2.01 The 52- and 53-type sets employ the N1 transmitter unit. Like all carbon transmitters, the resistance of the N1 transmitter varies with age and the current passed through it. An engineering value of 50 ohms is generally used for the dc resistance.

(B) Receivers

2.02 The 52A, B, and D sets, also the 53-type sets, employ the HC3 receiver unit which is smaller, lighter, and more efficient than the HA1 subscriber type receiver. These features were made possible by the development of new alloys having special magnetic properties. The 52C set which is designed for special service uses, is equipped with an HC4 receiver unit. This has a higher impedance than the HC3 receiver as shown by the following table.

TABLE I
IMPEDANCE OF HC-TYPE RECEIVERS

Frequency CPS	HC3	HC4
0	68 + j 0 = 68 / 0	139 + j 0 = 139 / 0
200	80 + j 65 = 103 /39	158 + j 132 = 206 /40
300	89 + j 94 = 129 /47	180 + j 190 = 262 /47
500	117 + j 146 = 187 /51	234 + j 297 = 378 /52
1000	190 + j 196 = 273 /46	395 + j 410 = 569 /46
1500	206 + j 230 = 309 /48	435 + j 492 = 657 /49
2000	184 + j 304 = 355 /59	457 + j 649 = 794 /55
2500	218 + j 403 = 458 /62	588 + j 782 = 978 /53
3000	244 + j 454 = 515 /62	650 + j 882 = 1096 /54
4000	329 + j 582 = 669 /61	858 + j 1020 = 1333 /50

(C) Telephone Sets

2.03 A 52- or 53-type telephone set in the "CD" jacks ("AB" jacks open) of a typical operator's circuit connected to a 900-ohm trunk as shown in Fig. 2, provides an effective transmitting loss of about -5 db and an effective receiving loss of about -10 db, or (T+R)/2 of -7.5 db. In this circuit approximately 100 ma direct current flows through the transmitter. Further details on the transmission losses of these telephone sets may be found in Section AB22.171.1.

2.04 With respect to the superseded operators' telephone set (396-528) instruments, the 52A provides an effective transmission gain of about 5 db (T+R)/2.

(D) Transformers (Induction Coils)

2.05 The 181B and C induction coils have been designed for use with the 52- and 53-type head telephone sets. For existing installations there are operators' circuits employing other type induction coils that are providing satisfactory transmission. However, for a number of induction coils employing a 1 uf capacitor in the transmitter circuit, there is a transmission impairment of 4 to 5.5 db. For further discussion and details, refer to Section AB22.171.2.

3. BATTERY SUPPLY ARRANGEMENTS WITH 52- AND 53-TYPE SETS

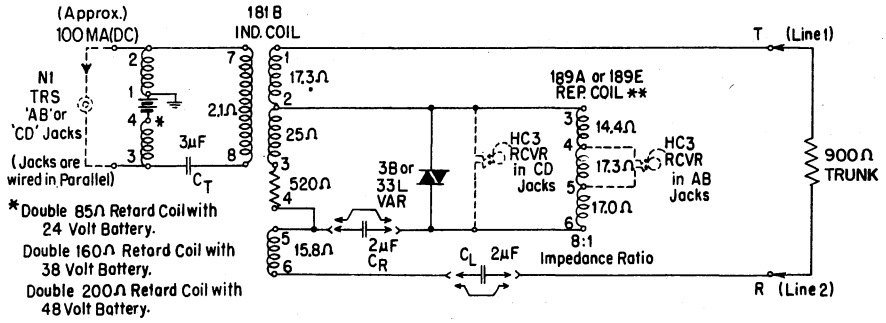
3.01 The 52- and 53-type sets contain an N1 transmitter unit which is designed for maximum efficiency with a direct current of about 100 ma. Currents greatly in excess of this value will result in excessive heating of the unit, while lower values will result in sizable transmitting volume impairments. For example, a current of 50 ma will result in an impairment of about 4 db compared to the 100 ma condition.

3.02 In common battery central offices, the transmitter battery is supplied in series with retardation coils of appropriate resistance so as to provide a current of about 100 ma as shown in Fig. 2.

3.03 In magneto central offices and in special local battery applications the battery, which may range from about 3 volts to 12 volts, is fed in series with the transmitter, induction coil, and an auxiliary resistor R as shown in Fig. 3. The purpose of this auxiliary resistor is to minimize the tendency of the transmitter to "breathe," that is, to vary cyclically in resistance. Also, the auxiliary resistor prevents excessive current which might result in "packing" of the transmitter carbon. In common battery applications mentioned in Paragraph 3.02 the necessary resistance is provided by the retardation coils. The following table gives values of the auxiliary resistor R for various voltages in magneto and special service applications.

TABLE II

Battery Voltage	Value of Resistor R
3.0	8 ohms
4.5	13 "
6.0	30 "
7.5	45 "
9.0	60 "
10.5	75 "
12.0	85 "

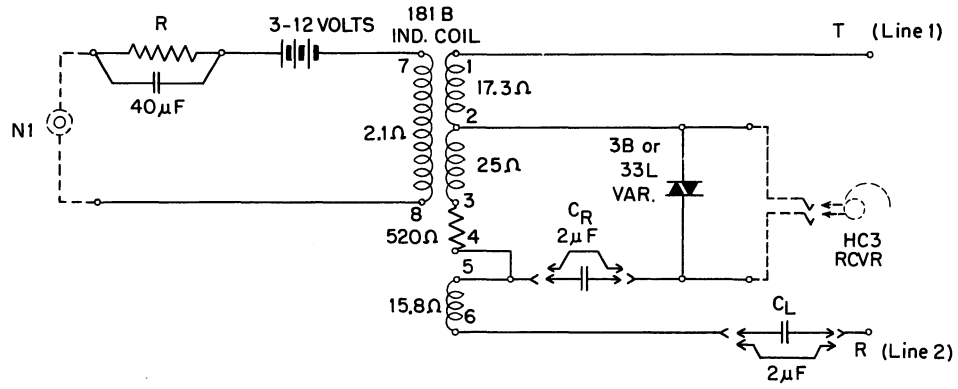


** Busy Test Windings of 189A or 189E Coil are not shown as they are not part of the normal Transmission Path.

The N1 Transmitter and HC3 Receiver are shown dotted as they are a part of the Operator's Telephone Set and are plugged into the Operator's Telephone Circuit at the CD or AB Jacks.

OPERATOR'S TELEPHONE CIRCUIT IN COMMON BATTERY TYPE CENTRAL OFFICES

Fig. 2



N1 TRANSMITTER ARRANGEMENT IN MAGNETO TYPE CENTRAL OFFICES OR SPECIAL LOCAL BATTERY USE

Fig. 3

Higher values of resistance than those shown in Table 2 are not recommended because they would introduce excessive transmitting impairments.

3.04 The external resistances shown in the table in Paragraph 3.03 provide a range of currents from about 50 ma at 3 volts to 90 ma at 12 volts. The higher voltage arrangements therefore are preferable from the standpoint of transmitting efficiency.

3.05 The resistor R required to bring the circuit resistance into agreement with Table 2 should be bypassed with a capacitor having at least 40 uf as shown in Fig. 3 in order to prevent excessive transmission loss. In this arrangement the phase angle of the resultant impedance of the parallel resistance and capacitance should approach 90 degrees in order to minimize the transmission loss. For example, at 300 cycles the impairment of a 10-ohm resistor with a 3 uf capacitor is one db greater than with a 40 uf capacitor. With a resistance of 85 ohms, the impairment with a 3 uf capacitor is 8 db greater than with a 40 uf capacitor. If an electrolytic type of bypass capacitor is used, it will be necessary to match its polarity with that of the battery.

4. USAGE OF 52- AND 53-TYPE SETS

4.01 The design of the 52- and 53-type sets insures that the distance between the mouth and the transmitter is not changed when the operator moves her head. This gives greater freedom of movement and eliminates the transmitting volume losses which occur with a chest type transmitter when the operator moves her head away from the mouthpiece when consulting records. The set properly worn does not obstruct the vision.

4.02 For supervisory use, the transmitter of the 52-type set may be moved aside when not needed.

4.03 The 52-type operators' head telephone set is designed to provide optimum transmission efficiency when the transmitter is used as shown in Fig. 4. The impairment in transmitting efficiency increases rapidly for distances greater than 0.5 inch. For example, a 2-inch separation from the lips causes a reduction of 11 db in efficiency. Transmitting impairment is especially aggravated when the transmitter is worn under the chin. It is therefore particularly important that the headset be worn correctly.

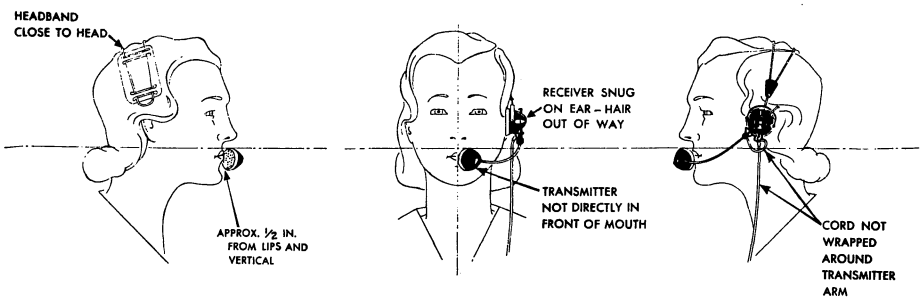
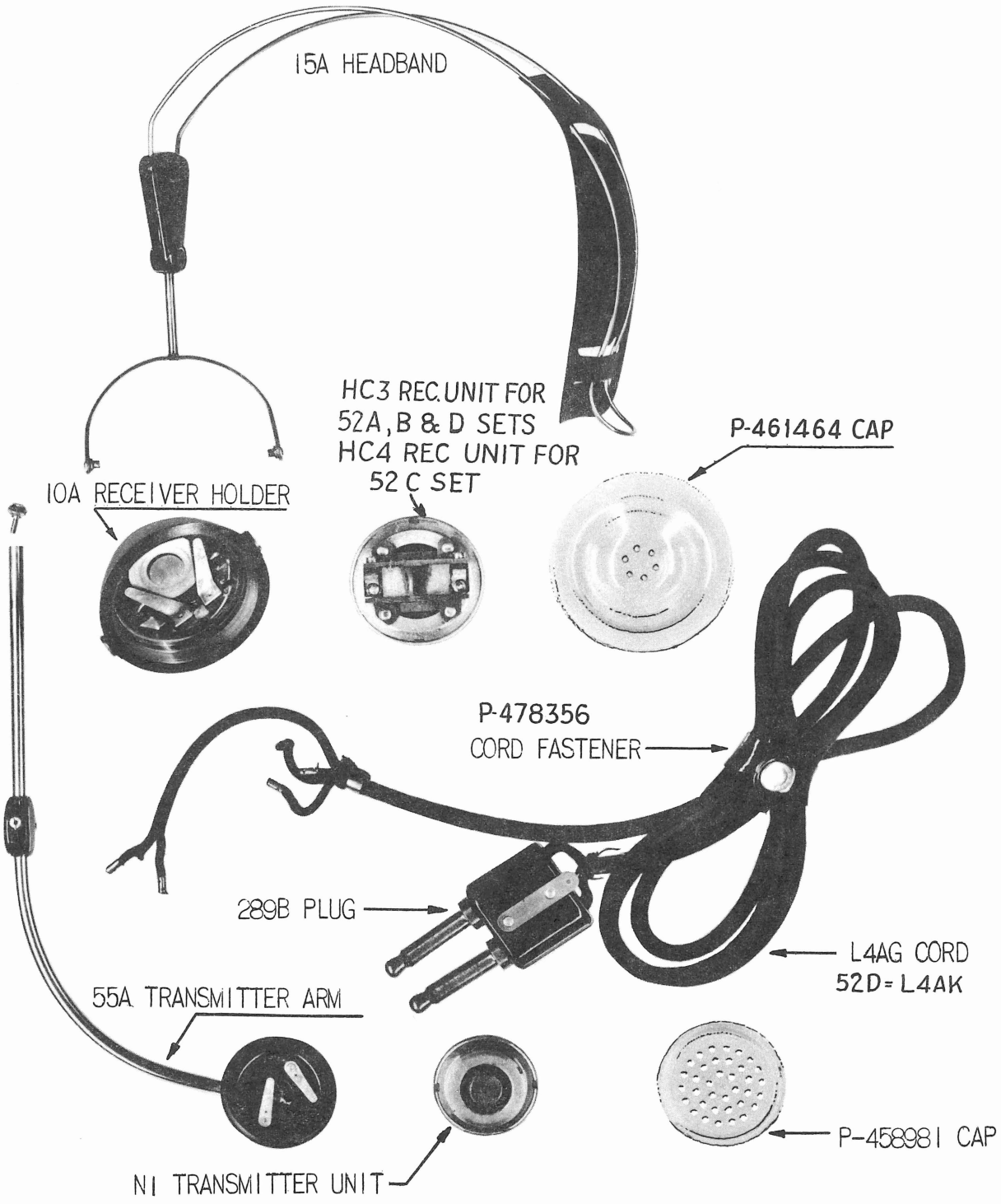


Fig. 4 - 52-Type Head Telephone Set



COMPONENT PARTS OF THE 52-TYPE HEAD TELEPHONE SET

Fig. 5

Fig. 6 - 52-Type Head Telephone Set

Fig. 7 - 53-Type Head Telephone Set