A-C. CONTINUITY TEST CIRCUIT—RELAY RACK TYPE G-2108

1. GENERAL:

1.01 This section describes the relay rack type a-c. continuity test circuit per G-2108, which has been designed for use in testing various circuits and apparatus, employed in central offices. The portable type a-c. continuity test set, which operates on similar principles, is described in another section of this division.

1.02 This issue of this section includes a description of the additional testing features which have been added to the G-2108 a-c. continuity test circuit, together with changes in jack designations to conform with the standard a-c. continuity test circuit designations. The jack designations previously used have been changed as follows: CORDS or A to CON, B to LINES, C to REC, D to TOLL and E to TERM. This information should be used for correcting sections in Division 200 which show the former designations for these jacks.

1.03 This test circuit provides a means for detecting circuit or apparatus troubles which may be caused by loose, dirty or high resistance connections or contacts, open circuits, defective wiring or apparatus in line, cord, or trunk circuits by the application of principles peculiar to the electrical unbalance of the circuits caused by these defects. It may also be used to advantage for testing detached pieces of apparatus such as repeating coils, etc.

1.04 The sketches included in this section illustrate the theory upon which the operation of this test circuit is based, together with certain applications to typical circuits and apparatus. Many testing arrangements other than those described herein are possible and it is intended that these sketches shall serve as a general guide to the maintenance man in adapting the circuit for other uses.

1.05 Methods illustrating the application of this test circuit to specific circuits will be found in Division 200.

1.06 It is not intended that the adoption of this test circuit will eliminate the necessity of regular transmission tests, but it is believed that through its everyday use the frequency of the transmission tests may be materially decreased.

2. DESCRIPTION OF TEST CIRCUIT:

2.01 The test circuit is assembled on a special mounting plate 6 inches wide, as shown in Fig. 1, which is arranged for mounting in a standard 19 inch relay rack bay. Wiring for the equipment on the mounting plate terminates on a connecting block on the mounting plate to facilitate installation.

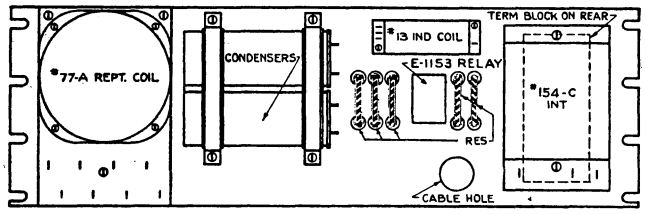

Fig. 1

2.02 Cabling is required between the test circuit connecting block and a terminal strip on the intermediate distributing frame, from which cross connections are made to specially designated test jacks in the switchboard. Battery (24-volt) is obtained from the battery fuse panel and ground is obtained at the relay rack.

2.03 The test jacks at the switchboard are usually in the outgoing trunk multiple strip reserved for Plant Department testing purposes.

2.04 These jacks, which are designated as shown in Fig. 2 are used for the various patching connections as follows:

(a) CON jack is for use in testing circuits having battery on the sleeve conductor such as cord circuits requiring a 34 ohm sleeve ground connection.

(b) LINES jack is for use in testing circuits having ground on the sleeve conductor such as line circuits requiring a battery sleeve connection.

(c) REC jack is for use in connecting the test receiver to the test circuit.

(d) COIN jack is for use in testing the coin features of coin collect and refund cord circuits.

(e) TOLL jack is for use in testing the toll features of universal cord circuits requiring a 500 ohm sleeve ground connection.

(f) TRUNK jack is used for testing the toll features of toll cord circuits requiring a 62 ohm sleeve ground connection.

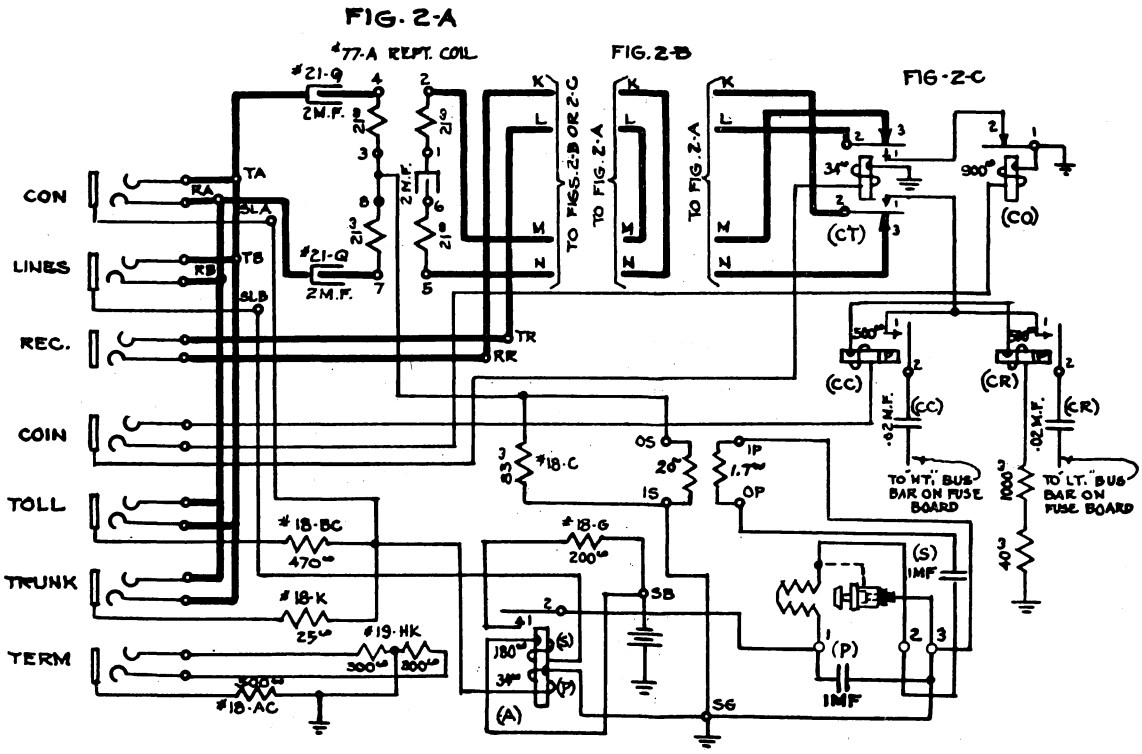

Fig. 2

(g) TERM jack is used for terminating the mate of the cord plugged into the TOLL or TRUNK jacks.

2.05 The a-c. continuity features are in operation only when a plug is inserted in either the CON, LINES, TOLL or TRUNK jack. This causes the control relay to operate, which in turn causes the interrupter to function.

2.06 A No. 525 receiver, equipped with a No. 712 or R2AC cord and either a No. 109 or No. 110 plug, depending upon the type of jacks on which the test circuit terminate, will be required. The patching cords used in performing the various tests are listed in Division 200.

3. OPERATION:

A-C. Continuity Features

3.01 The theory of operation of the a-c. continuity test circuit is somewhat similar to that of a d-c. telegraph simplex circuit, the principal difference being that in the a-c. continuity test circuit alternating current at voice frequency and of minute amount, is employed instead of a comparatively heavy direct current.

3.02 Fig. 3-A shows, by means of arrows, how the current from the interrupter, if the circuit under test is balanced, divides equally at the center point of the repeating coil, one-half of this current flowing through one winding of the repeating coil, one of the condensers, to the tip of the test circuit and through the 100 ohm resistance to ground. The other half of the current flows through the other winding of the repeating coil, the other condenser, the ring of the test circuit and through the other 100 ohm resistance to the same ground.

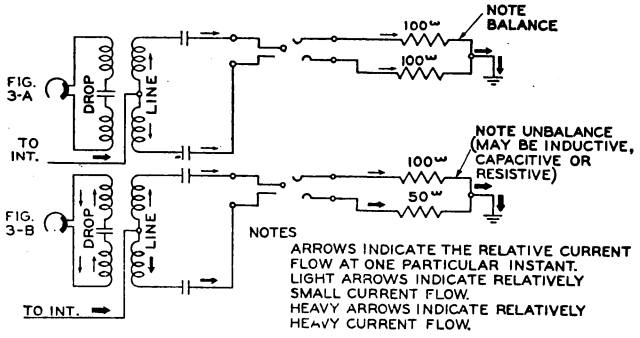

Fig. 3

3.03 As the current at any particular instant is flowing equally, but in opposite directions around the core of the repeating coil, no magnetic flux is set up and consequently no current is induced in the coil which is connected to the test receiver and no tone will be heard.

3.04 Fig. 3-B shows this condition changed so that the ring side of the circuit has one-half the resistance of the tip side.

3.05 Neglecting inductance and capacitance, in order to more clearly illustrate the operation of the a-c. continuity test circuit, it will

be noted that the interrupter current now divides unequally at the center point of the repeating coil, one-third of the total current flowing through one winding of the repeating coil, one of the condensers, the tip of the test circuit and through the 100 ohm resistance to ground. Two-thirds of the current will flow through the other winding of the repeating coil, one of the condensers, the ring of the test circuit and through the 50 ohm resistance to ground.

3.06 The relative current flows are indicated by arrows. The light arrows represent one-third of the total current supplied by the interrupter and the heavy arrows indicate the flow of two-thirds of the interrupter current. It will be noted that, although current is still flowing in opposite directions around the core of the repeating coil, the currents are not equal. Therefore, a flux will be set up in the core of the coil and a current equivalent to approximately one-third of the output of the interrupter will be induced in the windings of the repeating coil, causing a tone to be heard in the test receiver.

3.07 Any change in the values of the interrupter current in the circuit under test, such as a change from 2/3 and 1/3 to 3/4 and 1/4 will effect a corresponding change in the value of current in the drop winding and a corresponding change will be reflected in the volume of tone in the test receiver.

3.08 In practice, few circuits will be encountered which, when connected to the a-c. continuity test circuit, will not have sufficient inherent unbalance to cause a tone in the test receiver. Therefore the use of the a-c. continuity test circuit involves a comparison of tone. After several circuits of a particular type have been tested, the tester will note a tone which is characteristic for that type of circuit. Any variation from the characteristic tone will be readily noted and the cause should be investigated.

3.09 It is desirable of course, that a slight tone be present on circuits which are under test, as it is easier to detect changes in volume of the tone than to detect the difference between no tone and a very slight tone.

3.10 In order to test certain circuits, such as toll or universal cord circuits, it will be necessary to use a balanced path to ground, which is provided in the TERM jack in order to complete the tone circuit. Tests of these circuits without this feature are usually unreliable.

Coin Control Features:

3.11 The coin control features of the test circuit are based upon the operation or non-operation of polarized relays which are connected in the tip of the test circuit when the coin jack is used.

3.12 When the answering cord of a cord circuit arranged for coin service operation is inserted in the COIN jack of the test circuit the CT relay operates and transfers the test receiver from the a-c. continuity portion to the coin test portion of the test circuit.

3.13 The CO relay, which also operates when the plug is inserted in the COIN jack, removes the ground from the test receiver circuit. This relay releases during the coin testing interval as the operation of either the CC or CR key in the cord circuit under test opens the ring of the cord circuit. The release of this relay places ground on one side of the test receiver in order to complete the circuit for either the high or low tone supplied during the operation the CC or CR relay.

3.14 When the coin collect (CC) key associated with the cord circuit is operated, positive coin battery is sent out over the tip of the cord circuit into the test circuit through the CC and CR relays in series to ground. Due to the polarization of the CC and CR relays only the CC relay will operate on the flow of positive current.

3.15 The operation of the CC relay completes a circuit for high tone through the contacts of the CC, CT and CO relays and the test circuit receiver connected to the REC jack.

3.16 When the coin return (CR) key of the cord circuit is operated the test circuit functions as outlined in paragraphs 3.14 and 3.15 except that the CR relay, instead of the CC relay, operates placing low tone on the test receiver.

4. APPLICATION OF TYPICAL CIRCUITS:

4.01 The sketches which are described in the following are intended only to act as a general guide in adapting the a-c. continuity test principle to various circuits. As previously stated, the detailed method of performing tests on specific circuits are covered in Division 200.

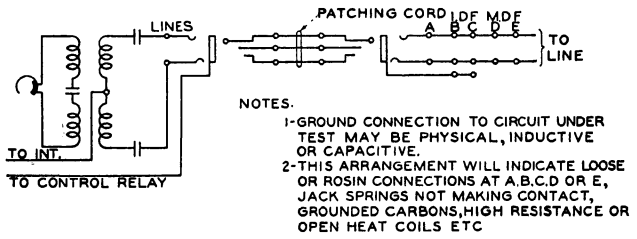

Fig. 4

4.02 Fig. 4 shows the method of patching the test circuit to line circuits, outgoing trunk circuits, and circuits of a similar type.

4.03 In cases of this kind it is seldom necessary to provide a balanced path to ground, as there is usually sufficient capacity to ground from the circuit under test to provide a slight tone in the test receiver.

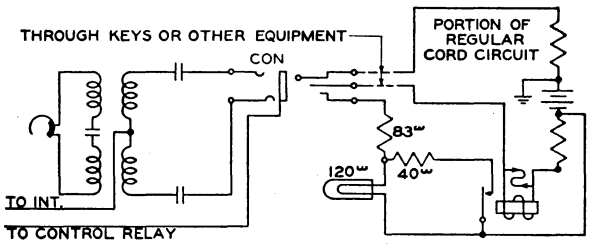

Fig. 5

4.04 Fig. 5 illustrates the application of the a-c. continuity test circuit to a cord circuit. Although the usual type of No. 1 office subscriber cord circuit is shown, the same method may be used in connection with the common battery side of universal cords, as well as other circuits of the same general type.

4.05 Fig. 6 shows the application of the a-c. continuity test circuit to circuits requiring a balanced path to ground, such as toll office cord circuits, magneto office cord circuits, and other circuits of this general character.

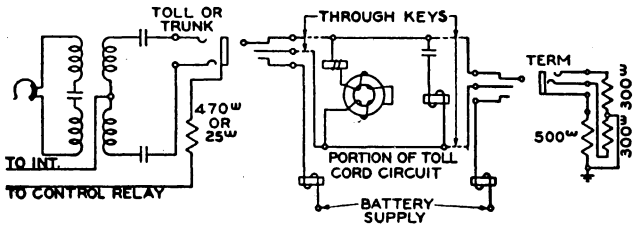

Fig. 6