LOCALIZATION OF CONTACT NOISE

STEP-BY-STEP OFFICES

CONTENTS

1. GENERAL

This section provides methods of measuring contact noise in step-by-step dial offices for the purpose of isolating the major noise sources when the overall intraoffice or other types of measurements indicate the noise to be excessively high.

The procedures now standard for cleaning step-by-step multiple bank and wiper contacting surfaces which are covered in various "A" sections of the Bell System Practices are usually effective in reducing contact noise. However, there may be specific instances where a relatively large proportion of noise remains after cleaning and in these cases the procedures outlined in this section of practices should be helpful in locating the contributing sources which may result from any one of the items listed below. In certain cases the methods prescribed in this section of practices may also be used for determining outstanding sources of contact noise before any remedial measures are attempted.

a. Unsatisfactory or incomplete cleaning.

b. Worn wipers

c. Bridging wipers

d. Dirty shelf jacks

e. Dirty relay contacts

f. Excessive vibration

After a step-by-step office is cleaned from a contact noise standpoint and a satisfactory reduction is not obtained, it is more desirable to attempt to locate the source of noise by types of switch rather than reclean the whole office. If the noise is found in a particular type of switch, additional cleaning should be applied to the contacts of the switches and retests made. If the results are still not satisfactory some of the other items as outlined above should be looked for as the contributing sources.

Worn wipers sometimes are noise contributors but more often, especially with the older type multiple bank, the bridging of bank terminals is possible. This results in a click in the receiver of the noise measuring set and an instantaneous deflection on the meter. Where a number of these clicks or instantaneous readings are observed during measurements, it is an indication of bridging wipers which while not a part of the contact noise problem, might influence the readings. Any test data resulting from bridging wipers should

preferably not be included as a part of the noise test but indicated on a separate record form and referred to the proper group for consideration.

Shelf jacks have been found to be an important source of contact noise in several cases and can only be found after the contact noise from the wiper and bank terminals has been eliminated.

Relay contacts are not usually involved in the noise problem but have been reported in a few instances.

When switches are operated, a certain amount of vibration is set up which usually has a direct adverse effect upon any contact noise which may be present as the result of contacting surfaces which are not absolutely clean. The switches on the same shelves as those being observed upon from a contact noise standpoint are the more important in this respect. The adjacent switches have more influence than the other switches, the effect being somewhat in proportion to the location of the switch with respect to the one in which the contact noise exists. Switches located on one shelf have very little, if any, influence upon switches located on another shelf.

The testing methods for contact noise consist in general of measuring from the test jack of one switch to the test jack of another and wherever "quiet" battery supply is furnished by the transmission circuit of the particular switch involved, this should be used to furnish current to the contacts under test. Where switches do not furnish their own battery supply and transmission circuit, this should be furnished through auxiliary apparatus as covered under "Noise Measuring Apparatus and Test Arrangements."

Since the scheme of picking up the contacts for measurement, is to operate a switch from its test jack a certain number of relay contacts are necessarily included in the test circuit. These contacts together with the contacts of shelf jacks and plugs should not be overlooked as noise sources in drawing conclusions as to the effectiveness of any cleaning work or the condition that might be responsible for the excessive noise.

There are three general methods of procedure for determining the noise producing contacts. These are as follows:

(a) By making overall channel measurements and cleaning the bank and the wiper contacts of one type of switch at a time and then retesting the overall channel. This method is not particularly satisfactory since if noise is encountered from uncleaned switches there will always be some doubt as to the effectiveness of the cleaning work until all of the switches have been cleaned.

(b) By making part channel measurements which are a modification of the procedure discussed under (c) below. This procedure has the advantage that clues may be obtained as to the location of the major noise sources with a relatively small amount of testing.

The procedure in this type of test is influenced somewhat by the relative importance of the various switches from a contact noise standpoint. Studies to date indicate that line finders and connectors are of first importance while in some specific cases line switches have been found to be outstanding contributors. The various types of selectors have been found to contribute least to the overall contact noise. If, however, information is available that would indicate a change in the order of the test procedure in a specific case this is, of course, permissible.

(c) By following the procedure outlined in this section of practices which provides for sampling tests of tip and ring contacts of the various switches included in the overall dial trains. In this case no further cleaning work need be performed until the outstanding noise producing contacts have been located and the method of eliminating the noise has been decided upon.

It is not necessary to use the same switches which were included in the overall measurements except in cases where a particular small section of the office is being studied.

A comparison of the results of tests of the contacts of individual switches as outlined in this section of practices with the results of measurements on the overall channels should give an indication as to the particular switches which are outstanding noise contributors. Comparison of the results of tests of one type of switch with other types may also be indicative as to the noise source.

Where the average noise is relatively low (where the average effect on transmission of the overall noise is in the order of 0.1 to 0.2 db as computed from the NTI values given in other information) it may not be practicable to isolate the particular switches responsible for this small amount of noise as it may be found that it is an accumulation of a number of small noises which by themselves are not readily detectable. Where the average noise is relatively high (probably of the order of 0.5 db or more, computed as above) it is usually a relatively simple matter to isolate the offending types of contacts. In noisy dial trains including line switches, it is suggested that

tests to determine the noise contribution of line switches be made first as these have been found to be outstanding noise sources in some cases. This also applies to interoffice trunk circuits where the plunger type line switch is employed as an out trunk switch. The line finder and connector switches are next in importance as they may be found to be more likely noise sources than the various types of selectors.

2. TEST SAMPLE

The test sample for each type or group of switch, for example, line finder, first, second, third selectors, etc., should include two or three different contacts from as many switches as possible in order to make up at least 200 one-minute measurements. The switches should be chosen from the lower and upper shelves in addition to some located on the middle shelves. If the noise on one type of switch clearly predominates over that from other types, 200 such measurements on each type would in general indicate the noisy type of switch. If there is not a clear predominance, 200 measurements will probably not be enough to distinguish the actual differences between different types of switches on account of random variations in the noise and the small number of contacts involved in a measurement.

The testing work should be performed at times when the traffic is relatively heavy since traffic in step-by-step offices has quite an important bearing upon the contact noise.

3. NOISE MEASURING APPARATUS AND TEST ARRANGEMENTS

The noise measuring apparatus used in the general contact noise survey which is covered in other sections of the practices will be required in this testing work. In addition, certain auxiliary apparatus arrangements including specially wired cords and plugs will also be necessary.

It is particularly important in making connections between test plugs and the test jacks of switches that these be clean and free from noise, otherwise, the results will not be comparable with the measurements made on the overall channels from the call-through test set. If it is suspected that noise is likely to result from the plug and jack contacts, the 419A tool should be used in place of the 240 type plugs and when it is connected to the jack springs of the various switches, it should be tightly clamped and possibly moved several times on the spring in order to ensure a clean contacting surface.

The auxiliary arrangements which may be made up locally are shown schematically on Figs. 1 and 2 and provide means of establishing the various circuits in the talking condition and then holding and terminating them during the test period. In addition, provision is made for talking circuits which can be employed by the testers so that they may keep in touch with each other during the testing work.

The apparatus arrangement of Fig. 1 is always used at the originating end of the circuit and by means of it the noise measuring set may be connected to the circuit under test. The arrangement of Fig. 2 is employed at the called end of the circuit, and its main function is to provide a 200-ohm termination in addition to sleeve conditions when these are necessary.

These arrangements provide for two test connections which may be employed exclusively for test purposes and will, when so used, help expedite the work since a second connection can be established over TEST LINE-2, for example, just prior to the completion of measurements on TEST LINE-1. Where both test lines of the arrangements of Figs. 1 and 2 are employed for test purposes, two sets of the various cords and plugs referred to in these sketches will be necessary.

Sometimes it may not be convenient for the testers to use the office talking circuits to keep in touch with each other during the testing work, and in these cases one of the test lines may be used as a talking connection by completing a call over one of the circuits in the group under test. Since this may be the usual case, the detailed procedures covered in this section have been written on the basis of using only TEST LINE-1 for test purposes, as this will simplify the written material.

The various cords and plugs which will be required in this testing work are indicated on Figs. 1 and 2. The majority of these cords will normally be found in step-by-step offices, but some will need to be modified to provide the required circuit arrangements. Where cords and plugs have been modified they should be set aside for the exclusive use of the noise testers as they will not be suitable for use by the regular central office forces in their tests of the office circuits.

In testing certain parts of the step-by-step dial train, it will be necessary to provide quiet battery supply and the proper transmission circuit. For example, in testing line finders and the local selectors the equivalent of the connector circuit with its battery supply will be required while if toll connectors are being tested, the battery supply and transmission circuit of the toll transmission selector should be furnished, etc.

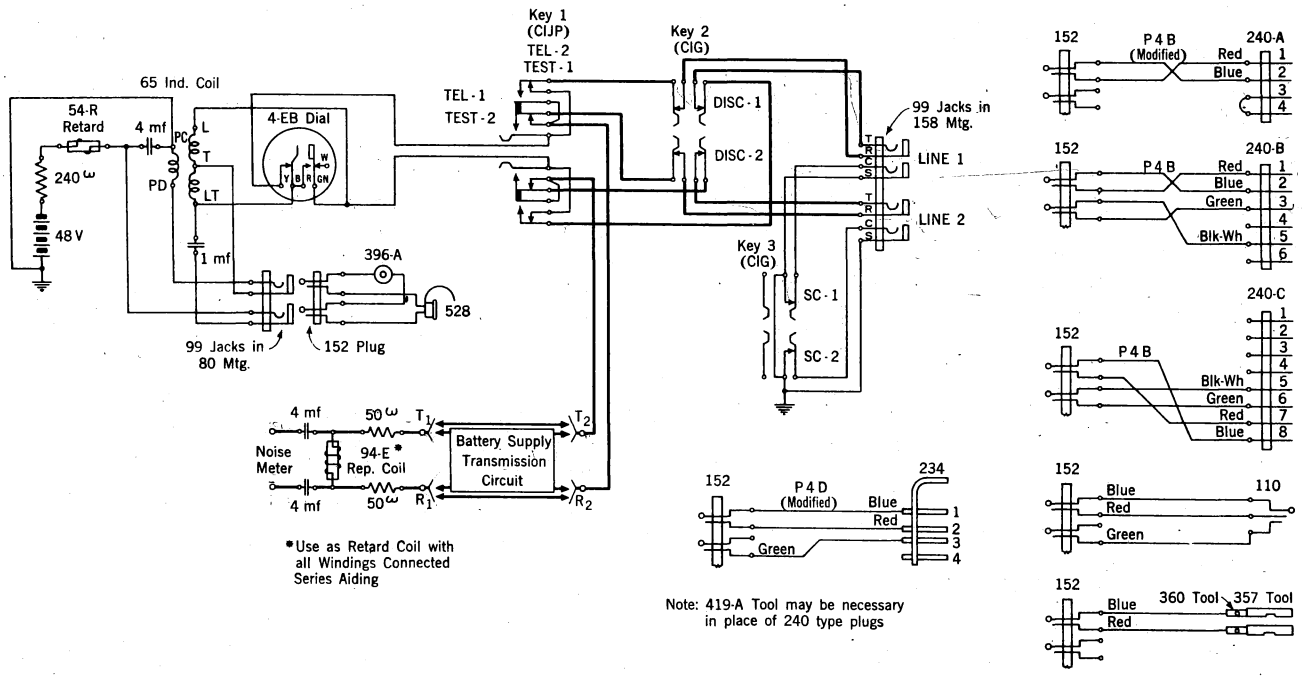

Fig. 1.

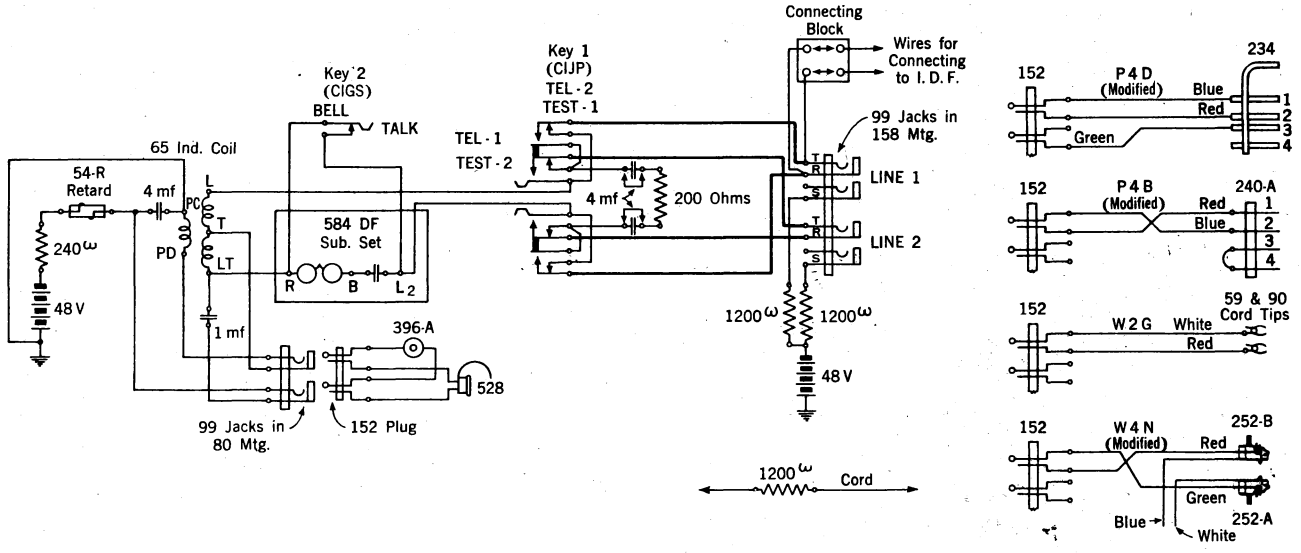

Fig. 2.

Where test connections include their own battery supply and transmission apparatus, such as local connectors and toll transmission selectors, the equivalent circuits will not be needed and Terminals T1 and T2 and Terminals R1 and R2 to which they would normally be connected should be strapped together as indicated on Fig. 1.

Fig. 3 shows the transmission circuit of the connector, and when assembling the apparatus, complete "A" and "D" relays should be used and not simply the coils alone. It is not necessary to use the spring pile-ups, but it is important that the coils be equipped with the heel piece and armature, since these affect the electrical characteristics of the coils.

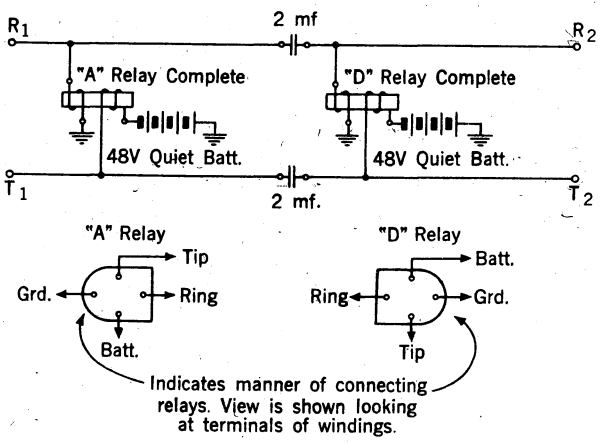

Fig. 3.

Schematics of the toll circuits are shown later in these practices under the test procedure where they are first required. The assembled circuits should be exactly like the circuits in service when these latter are in the talking condition. Proper polarity of the battery connections is important in order that the battery noise will be comparable with that observed in the overall channel measurements.

4. PART CHANNEL MEASUREMENTS

The test procedure is arranged on the basis that line finders, line switches, and connectors are more important contact noise sources than the various types of selectors.

On this basis, tests should first be made from the various first selectors to connector terminals. The connector terminals or called lines used in the overall channel test may also be employed in these tests. A comparison of the results of these measurements with the result of the overall channel tests will give an indication as to whether this part of the channel or the line finders or line switches as the case may be, are the major contributors of contact noise.

If the indications point to the combination of selectors and connectors the next test should be that of the connectors alone. A comparison of these two sets of measurements should indicate whether the selectors or the connectors are the major noise contributor. In the event that the selectors are the major noise source, the next step would be to test either the various individual types of selectors as covered in detail in this section of practices or make part channel measurements from the various succeeding selectors calling the same connector terminals as used in the previous measurements. The former procedure is probably the more preferable, since it will ultimately be necessary to test the noisy type of switch by itself before the application of remedial measures. Where remedial measures are applied, noise tests should follow in order to determine the effectiveness of the measures.

If line switches or line finders are suspected as being the major noise contributors, these should be tested alone following the detailed procedures outlined in this section.

4.1 Preparation

The apparatus arrangement of Fig.1 will be required for establishing the test connections and providing the proper termination. In addition, the call through test set with the usual auxiliary equipment to be used with the noise measuring set will be required.

Fig. 1 - No transmission circuit will be required to be connected to the arrangement of Fig. 1 since this will be furnished from the connectors included in the tests. If the resistance and repeating coil making up the termination and holding bridge of Fig. 1 is not required at the call through test set for use with the noise meter, Terminals T1 and T2 of Fig. 1 should be strapped together and Terminals R1 and R2. If the resistance and the repeating coil is required at the call through test set, a 200-ohm resistance should be connected across Terminals T2 and R2 of this apparatus arrangement.

Cord with 152 and 240 Type Plugs - The type of 240 plug will depend upon the type of selector from which the test calls are to be established. For example, local selectors will require the 240A plug while toll intermediate selectors will require the 240B plug.

4.2 Contacts Involved

The contacts involved in these channels will depend upon the type of selectors included in the test circuit and can be determined from the information provided in the tests outlined for the individual switches.

4.3 Test Procedure

(1) At the call through test set see that the TR keys are in the normal or non-operated position and that any keys of the auxiliary test arrangements used with the call through test set and noise measuring set are operated in the proper position. The details for this

equipment are covered in a section of Bell System Practices entitled "Methods of Making Contact Noise Measurements in Local Dial Offices."

(2) The keys of the apparatus arrangement of Fig. 1 should be operated as follows:

Key 1 - Normal
Key 2 - DISC-1
Key 3 - Normal

(3) Insert the 240-type plug of the apparatus arrangement of Fig. 1 in the test jack of a selector from which the calls are to be established.

(4) Restore Key 2 of Fig. 1 to normal and dial the necessary number of digits that will direct the call to the call through test set.

(5) When the signal is received at the call through test set, operate the necessary keys to connect the noise measuring set to the circuit.

(6) At the apparatus arrangement of Fig. 1, operate Key 1.

(7) Measure the noise.

(8) Release the circuit by removing the 240-type plug from the test jack of the selector and at the call through test set remove the noise measuring set from the circuit. Repeat the above testing procedure from other selectors calling either the same connector terminal or a different connector terminal as the case may be.

5. PRIMARY LINE SWITCHES

In view of the circuit arrangement of primary line switches, there is no convenient straightforward method of picking up switches for test. Also, since a calling line is associated with only one primary line switch and has access only to this particular switch, the primary line switches which were used in the overall intraoffice channels will not provide a sufficiently large equipment sample. A test sample should include not less than twenty line switches so that it will be necessary to supplement the ten switches used in the overall intraoffice channel tests with an additional ten switches.

These tests are made from the "BCO" relay at the primary line switches to the test jacks of the associated secondary line switches.

5.1 Preparation

Establish a talking connection between the testers at the primary and secondary line boards.

About twenty primary line switches should be removed from working lines for the purpose of the test and the lines involved should be transferred to spare switches for this period. Upon completion of the tests, the switches which had been removed from service should be restored to their respective lines as this procedure will make it unnecessary to change any office records.

In selecting primary line switches for test it will be necessary to study the trunking arrangements between the primary and secondary switches in order to select secondaries that are reasonably near each other as this will help expedite the testing work. A convenient choice of primaries would be switches which are associated with secondaries within a single line board and which appear only on one side of the board.

In order that the measurements may be confined only to the primary switch contacts and not include the contacts of the secondary switch, it will be necessary to release the plunger of the secondary switch seized by the primary line switch when the call is established.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - Use Transmission Circuit of Connector with Quiet Battery as shown on Fig. 3. This should be connected to Fig. 1 as indicated.

- Cord with 152 plug on one end and 360 and 357 tools on the other end.

Fig. 2 - Cord with 152 and 240A plugs.

Fig. 4 shows the circuit arrangement for the test and a schematic of the transmission circuit.

5.2 Contacts Involved

The following contacts are involved in this circuit.

(1) Primary line switch bank and wiper.

5.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1	Fig. 2
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) At the primary line switch manually operate the "E" relay of the master switch to pick up any idle plungers on the master switch guide rod.

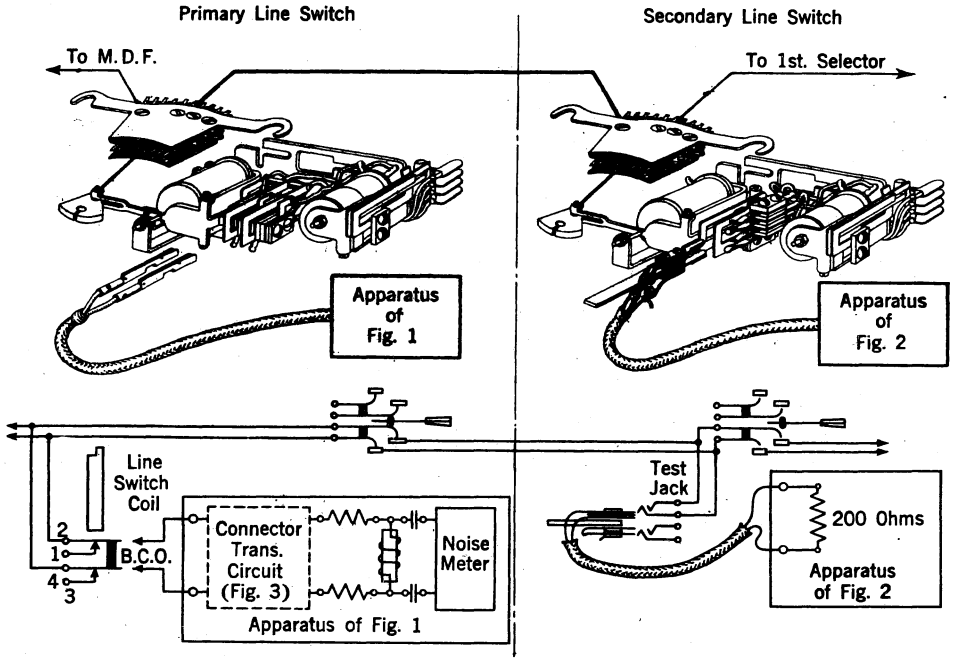

Fig. 4.

(3) Choose a primary line switch from which a particular set of contacts are to be tested.

(4) If the plunger of the line switch to be included in the test is not opposite the particular contacts to be tested, momentarily operate the "B" relay of the master switch or momentarily short-circuit springs Nos. 2 and 4 of the "BCO" relays associated with non-working primary line switches until the plunger of the switch to be included in the test is in the required position. If the trunk to the secondary switch is busy the master switch will not stop opposite this trunk.

(5) Connect the 357 type tools associated with the cord of Fig. 1 to springs Nos. 2 and 4 of the "BCO" relay associated with the primary line switch to be tested.

(6) Momentarily restore Key 2 of Fig. 1 to normal in order to plunge the switch under test and to step the master switch ahead to the next trunk. Determine from the trunk multiple card the secondary line switch selected.

(7) At the associated secondary line switch seized, short-circuit springs Nos. 1 and 2 of the "A" relay (or block the "A" relay operated). This straps together the "Hold" and "Release" trunks between the primary and secondary line switches and prevents the primary line switch from chattering.

(8) Release the plunger of the secondary line switch seized by inserting an insulating tool between contact springs Nos. 2 and 3 of the "B" relay.

(9) At the secondary line switch test jack insert the 240A plug of the apparatus arrangement of Fig. 2.

(10) A check as to whether the tester at the secondary line board has picked the proper switch may be obtained by the testers talking over the circuit from their respective telephone sets.

(11) Operate Key 1 of Figs. 1 and 2 and measure the noise.

(12) Release the circuit by removing the 357 type tools from the "BCO" springs of the primary line switch. At the secondary line switch remove the 240A plug from the test jack, the blocking tool or short-circuit from the springs of the "A" relay and the insulating tool from the springs of the "B" relay.

(13) Repeat the above procedure for tests of other terminals in the same line switch or of terminals in a different primary line switch.

6. SECONDARY LINE SWITCHES

These tests are made between the test jacks of the secondary line switches and the test jacks of the associated first selectors.

6.1 Preparation

Establish a talking connection between the testers at the secondary line board and the first selectors.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - Use Transmission Circuit of Connector with Quiet Battery as shown on Fig. 3. This should be connected to Fig. 1 as indicated.

- Cord with 152 and 240A plugs.

Fig. 2 - Cord with 152 and 240A plugs.

Fig. 5 shows the circuit arrangement for the test and a schematic of the transmission circuit.

6.2 Contacts Involved

(1) Secondary line switch bank and wiper.

6.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) Momentarily short-circuit springs Nos. 1 and 2 of the secondary master switch test jack. This causes the primary master switches to pick up all plungers standing opposite the trunks to the secondary line switches.

(3) At the secondary line switches manually operate the "B" and then the "A" relay of the master switch to pick up any idle plungers on the master switch guide rod.

(4) Choose a secondary line switch from which a particular set of contacts are to be tested.

(5) If the plunger of the switch to be included in the test is not opposite the particular contacts required, momentarily short-circuit test jack springs 3 and 4 of a number of idle line switches until the plunger of the switch involved is in the required position.

(6) At the secondary line switch insert the 240A plug of the apparatus arrangement of Fig. 1 in the test jack of the line switch to be tested.

(7) Restore Key 2 of Fig. 1 to normal and determine from the trunk multiple card the first selector seized by the secondary line switch.

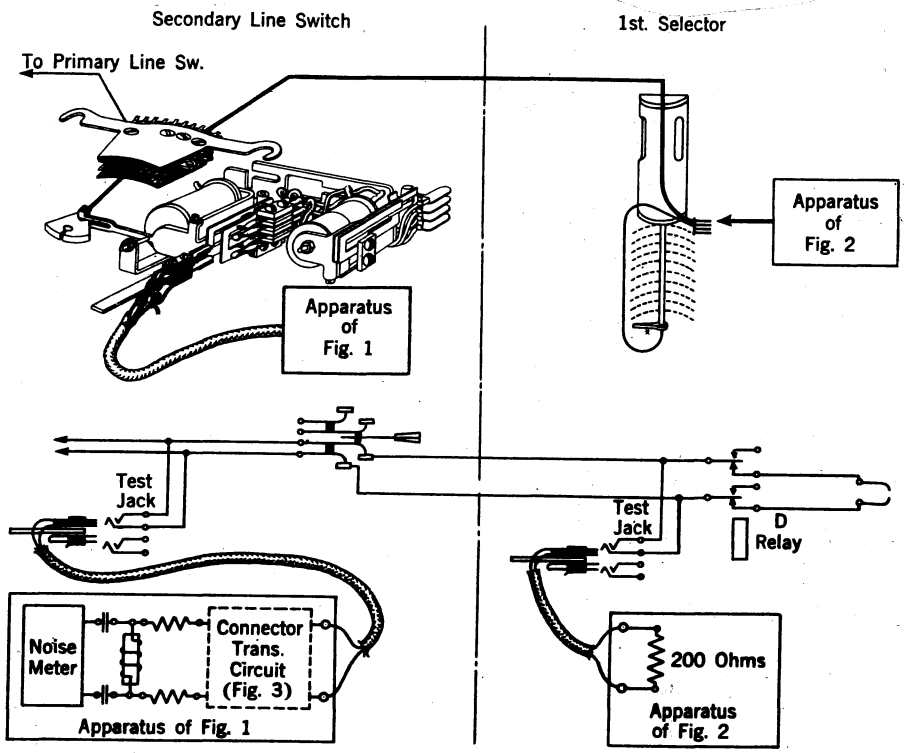

Fig. 5.

(8) At the first selector test jack insert the 240A plug of the apparatus arrangement of Fig. 2 and raise the shaft off normal. The first selector shaft should be held in this position for the duration of the test. This may be done either manually or by supporting the shaft on an orange wood stick placed across the projections of the lower bank plates.

(9) A check as to whether the tester at the first selector has picked the proper switch may be obtained by the testers talking over the circuit from their respective telephone sets.

(10) Operate Key 1 of Figs. 1 and 2 and measure the noise.

(11) Release the circuit by removing the 240A plugs from the test jacks of the secondary line switch and first selector. Also restore the first selector shaft to normal.

(12) Repeat the above procedure for tests of other terminals in the same line switch or of terminals in a different secondary line switch.

7. LINE FINDERS

The calling lines (line group and relay numbers) which were used in the overall intraoffice channel contact noise measurements may also be used in these tests. If necessary additional lines from the same groups may also be used. These lines should be selected from both upper and lower line banks. Since the 234 plug is used in picking up the calling lines for test at the multiple bank terminal strip it will be more convenient if even numbered lines are used, since these are on the outside of the terminal strip and can readily be connected to by means of the 234 plug. The procedure which is given for testing line finders will be based upon the use of the even numbered lines.

Tests are made from the line finder multiple bank terminal strip to the test jack of a first selector.

In connection with this testing work, it is necessary to determine the particular line finder seized by the calling line. Since the tester is usually located in front of the group of line finders under test he can watch for the finder that seizes his line and thus save himself the time required to trace the call.

In cases where it is necessary to trace the calls through the line finders the following should be helpful to the testers.

7.1 Tracing Calls to the Line Finder

When a call is initiated an idle line finder is started to hunt for the calling line to find the particular line terminals. When the line is found, it is extended through the bank wipers to a first selector and is cleared of all attachments and dial tone is returned to the originating line from the first selector.

The line finder is designed to handle a group of 200 subscribers lines and is arranged with three banks, two in which the tip and ring terminals appear and the third or top bank in which the sleeve terminals appear. The lower bank accommodates the tip and ring terminals of 100 lines and the middle bank the tip and ring terminals of the other 100 lines. Within each line finder group, lines 00 to 99 appear in the lower banks and lines 100 to 199 in the middle banks. If the calling line is in the middle bank the "B" relay of the line finder will be operated, and if the line is in the lower bank, this relay will remain unoperated.

Each calling line has access to any one of a number of different line finders in a group and the bank multiple is so arranged as to permit each line to have an equal chance of being seized on the lowest level of a line finder bank when a call is initiated. This is accomplished by a slip in the multiple of one level between adjacent finders so that lines which appear on the first level of a line finder appear on the second level of the next line finder, etc. Usually there are two line finders on which a calling line or a line group and relay appear on the first level and are referred to as the "home" or "first choice" finders and, if idle, will be the first finders to select the calling line. If these line finders are busy the rotation of line finder choice will be to the left except for switch No. 1 where the next choice will be switch No. 10 and thereafter the choice will be to the left. Terminals of any particular line always appear in the same position within a level.

There is a definite relation between the line or relay numbers and the various line finders. The first choice or "home" line finders can be readily identified by the uniform relation between the line (relay number) and the line finder numbers as follows:

Line Numbers	Line Finder Numbers
10 to 19 and 110 to 119	1, 11 and 21
20 to 29 and 120 to 129	2, 12 and 22
30 to 39 and 130 to 139	3, 13 and 23
-	-
-	-
-	-
00 to 09 and 100 to 109	10, 20 and 30

Note: In specific cases some lines may have one less "home" finder than other lines.

Suppose, for example, a call is originated from a line associated with line group 134, relay 84. The tester would look for the "first choice" or "home" finders in

line group 134 which, in this case, would be switch No. 8 or switch No. 18. If either of these switches has seized the calling line, the wiper will be resting on a terminal "up 1 and in 4" (level 1 and terminal 4). If neither of these switches is found to be in this position, the tester would then check the wiper position of switches 7 and 17 for being up 2 and in 4 and then switches 6 and 16 for being up 3 and in 4, etc. When a line finder is found in one of these positions, a check should be made with a test receiver for the presence of ground on both sleeve wipers. If ground is found on the lower sleeve wiper and no ground on the upper sleeve wiper, it indicates that the line finder is cut through to Line 84. If ground is found on both sleeve wipers, it will be necessary to remove the switch cover and note the condition of the "B" relay. If the "B" relay is not operated, the line finder will be cut through on Line 84. If it is operated, the line finder will then be cut through on Line 184 and it will be necessary to locate another line finder in the position corresponding to Line 84.

7.2 Preparation

Establish a talking connection between the testers at the line finders and first selectors.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - Use Transmission Circuit of Connector with Quiet Battery as shown on Fig. 3. This should be connected to Fig. 1 as indicated.

- Cord with 152 and 234 plugs.

Fig. 2 - Cord with 152 and 240A plugs.

Fig. 6 shows the circuit arrangement for the test and a schematic of the transmission circuit.

7.3 Contacts Involved

The following contacts are involved in this circuit:

(1) Line finder bank and wiper.

(2) Line finder "B" and "F" relays.

7.4 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

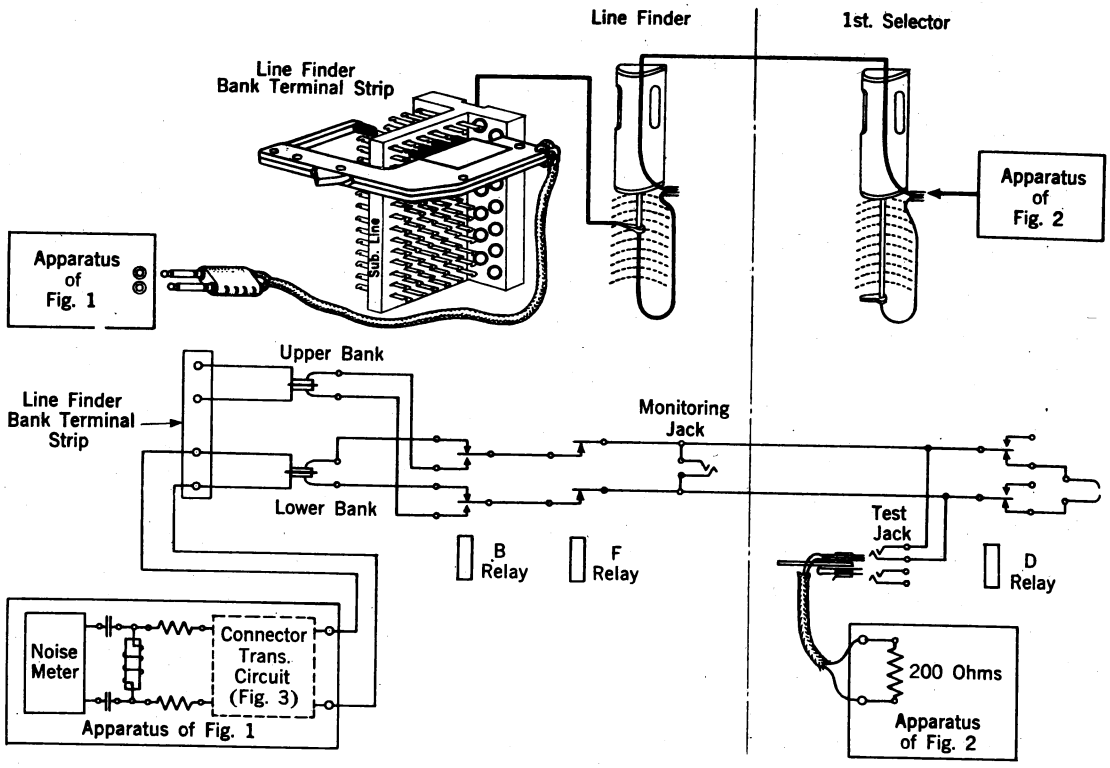

Fig. 6.

(2) At the line finder multiple bank terminal strip connect the 234 plug of the apparatus arrangement of Fig. 1 to the tip and ring terminals of a calling line.

(3) Restore Key 2 of Fig. 1 to normal and determine the particular line finder switch which has seized the calling line.

(4) Note the forward tracing on the line finder switch number card to determine the first selector seized by the line finder.

(5) At the first selector test jack insert the 240A plug of the apparatus arrangement of Fig. 2 and raise the shaft off normal. The first selector shaft should be held in this position for the duration of the test. This may be done either manually or by supporting the shaft on an orange wood stick placed across the projections of the lower bank plates.

(6) A check as to whether the tester at the first selector has picked the proper switch may be obtained by the testers talking over the circuit from their respective telephone sets.

(7) Operate Key 1 of Figs. 1 and 2 and measure the noise.

(8) Release the circuit by removing the 234 plug from the line finder bank terminal strip, the 240A plug from the test jack of the first selector and by restoring the shaft of the first selector to normal.

(9) If it is required to test the corresponding bank terminals on other levels of different line finders in the same group, (that is, the terminals that have access to the same calling number) the 234 plug of Fig. 1 should not be removed from the terminal strip but Key 2 of Fig. 1 should be operated to release the line finder switch and first selector. Make busy the preceding choice line finders by inserting make busy plugs in the associated test jacks at the line finder test panel and proceed as outlined above using the same calling line. Otherwise, repeat the above procedure using a different calling line.

8. LOCAL SELECTORS PRECEDING OTHER LOCAL SELECTORS

The following covers tests of local selectors where these precede other local selectors.

The tests are made between the test jack of the selector to be tested and the test jack of the succeeding local selector.

8.1 Preparation

Establish a talking connection between the testers at the local selectors as above.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - Use Transmission Circuit of Connector with Quiet Battery as shown on Fig. 3. This should be connected to Fig. 1 as indicated.

- Cord with 152 and 240A plugs.

Fig. 2 - Cord with 152 and 240A plugs.

Fig. 7 shows the circuit arrangement for the test and a schematic of the transmission circuit.

8.2 Contacts Involved

The following contacts are involved in this circuit.

(1) Selector bank and wiper.

(2) Selector "D" relay.

8.3 Test Procedure

(1) The keys of the apparatus arrangements of Fig. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) Insert the 240A plug of the apparatus arrangement of Fig. 1 in the test jack of a local selector to be tested.

(3) Restore Key 2 of Fig. 1 to normal and dial a digit that will direct the call to the succeeding local selector.

(4) Note the position of the wiper in the selector multiple bank and determine from the shelf multiple trunk card the particular succeeding selector involved in the test.

(5) At the test jack of the succeeding selector insert the 240A plug of the apparatus arrangement of Fig. 2 and raise the shaft off normal. The selector shaft should be held in this position for the duration of the test. This may be done either manually or by supporting the shaft on an orange wood stick placed across the projections of the lower bank plates.

(6) A check as to whether the tester at the succeeding selector has picked the proper switch may be obtained by

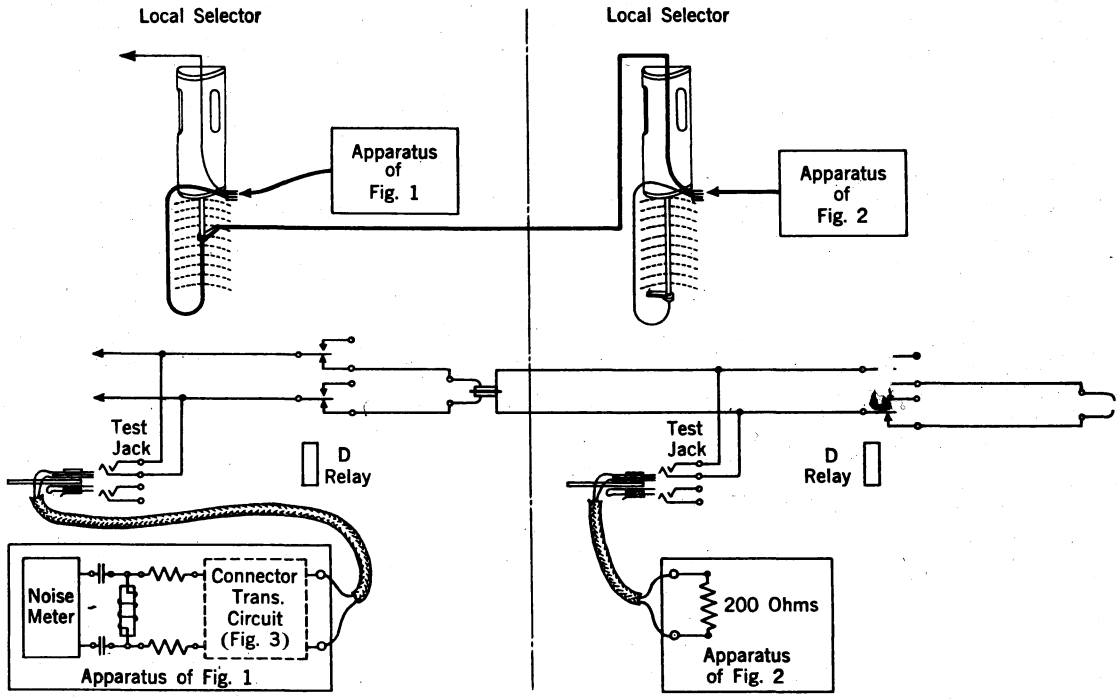

Fig. 7.

the testers talking over the circuit from their respective telephone sets.

(7) Operate Key 1 of Figs. 1 and 2 and measure the noise.

(8) Release the circuit by removing the 240A plugs from the test jacks of the local selectors and by restoring the shaft of the succeeding selector to normal.

(9) If it is required to test other terminals in the same local selector, make busy the succeeding selector included in the above tests by inserting a make-busy tool between test jack springs 3 and 4 and proceed as outlined above, using the same selector just tested. Otherwise, repeat the above procedure from a different selector.

9. LOCAL SELECTORS PRECEDING CONNECTORS

The following covers tests of local selectors where these precede connectors.

These tests are made from the test jacks of local selectors to the tip and ring wiper terminals of local non-hunting connectors, the local side of combination connectors or local rotary connectors.

9.1 Preparation

Establish a talking connection between the testers at the local selectors and local connectors.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - No transmission circuit will be required to be connected to the arrangement of Fig. 1 since this will be furnished from the connectors included in the tests. The terminals where the transmission apparatus would normally be connected should be strapped together. (Tip-Tip and Ring-Ring.)

- Cord with 152 and 240A plugs.

Fig. 2 - Cord with 152 plug on one end and appropriate clips on tip and ring conductors at other end.

- 1200 ohms in series with single conductor cord.

Fig. 8 shows the circuit arrangement for the test and a schematic of the transmission circuit.

9.2 Contacts Involved

The following contacts are involved in this circuit.

(1) Local selector bank and wiper.

(2) Local selector "D" relay and connector "D", "F" and "K" relays. Also "J" relay in cases of combination connectors.

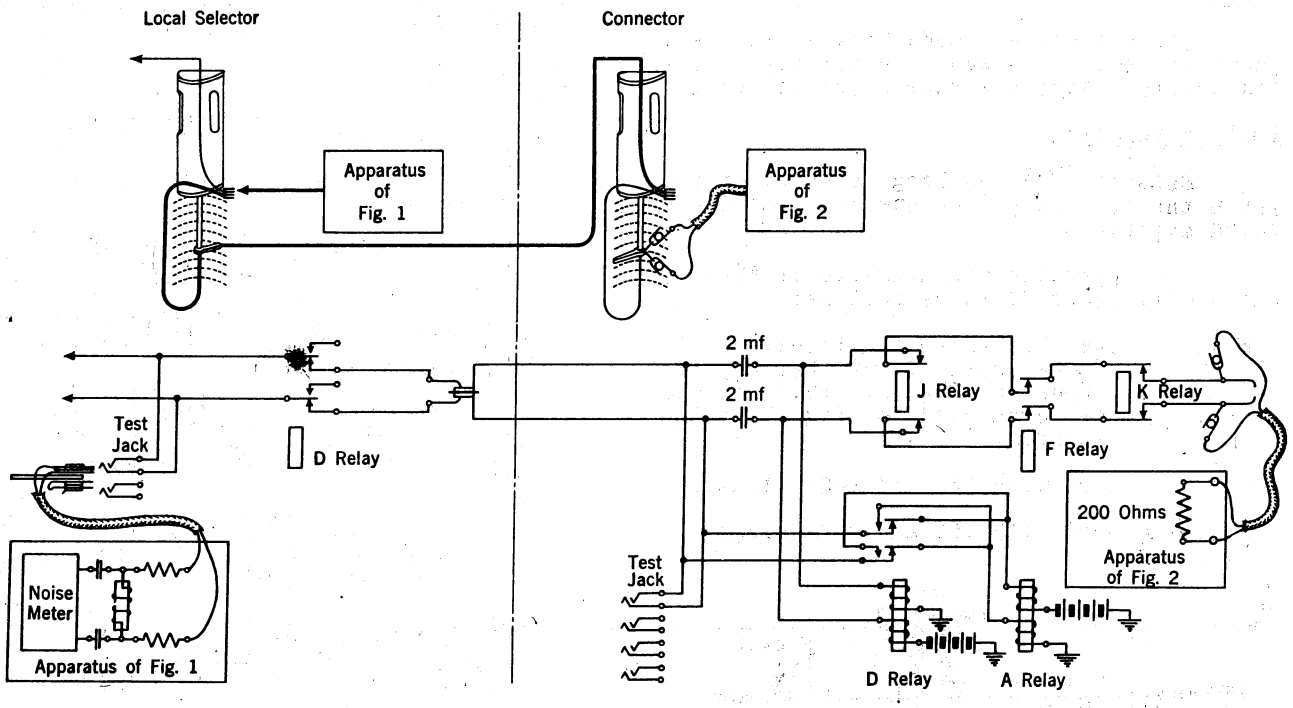

Fig. 8.

9.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) Insert the 240A plug of the apparatus arrangement of Fig. 1 in the test jack of a local selector to be tested.

(3) Restore Key 2 of Fig. 1 to normal and dial a digit that will direct the call to a connector hundreds group in which one of the called lines used in the overall intraoffice channel tests is located and then dial another digit to raise the shaft of the connector to any level.

(4) Note the position of the wiper in the selector multiple bank and determine from the shelf multiple trunk card the particular connector involved in the test.

(5) At the connector momentarily bridge the sleeve wiper (lower wiper of top bank) to a fused 48-volt battery on an adjacent connector shelf through the 1200-ohm cord. This will operate the cut-through relay of the connector.

(6) Connect the clips of the cord of the apparatus arrangement of Fig. 2 to the soldering lugs of the tip and ring wipers of the connector.

(7) A check as to whether the tester at the connector has picked the proper switch may be obtained by noting that the connector shaft is raised so that the wiper is opposite a bank level but not cut into the level. A further check may be obtained by the testers talking over the circuit from their respective telephone sets.

(8) Operate Key 1 of Figs. 1 and 2 and measure the noise.

(9) Release the circuit by removing the 240A plug from the test jack of the local selector and the clips from the soldering lugs of the connector wiper.

(10) If it is required to test other terminals in the same local selector, make busy the connector just tested by inserting a make-busy tool between Test Jack Springs 3 and 4 and proceed as outlined above, using the same selector. Otherwise repeat the above procedure from a different selector.

10. SPECIAL SECOND (AUXILIARY FIRST) SELECTORS

These tests are made between the test jacks of special second (auxiliary first) and special third (service code) selectors.

10.1 Preparation

Establish a talking connection between the testers at the special second and third selectors.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - Use Transmission Circuit of CLR Trunk with Quiet Battery as shown on Fig. 9. This should be connected to Fig. 1 as indicated.

- Cord with 152 and 240A plugs.

Fig. 2 - Cord with 152 and 240A plugs.

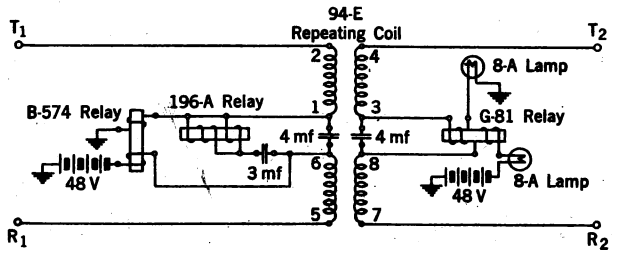

Fig. 9.

Fig. 10 shows the circuit arrangement for the test and a schematic of the transmission circuit.

10.2 Contacts Involved

The following contacts are involved in this circuit.

(1) Special second selector bank and wiper.

(2) Special second selector "D" relay.

10.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) Insert the 240A plug of the apparatus arrangement of Fig. 1 in the test jack of a special second selector to be tested.

(3) Restore Key 2 of Fig. 1 to normal and dial "1" (one) in order to direct the call to a special third selector.

(4) Note the position of the wiper in the special second selector multiple bank and determine from the shelf multiple trunk card the particular special third selector involved in the test.

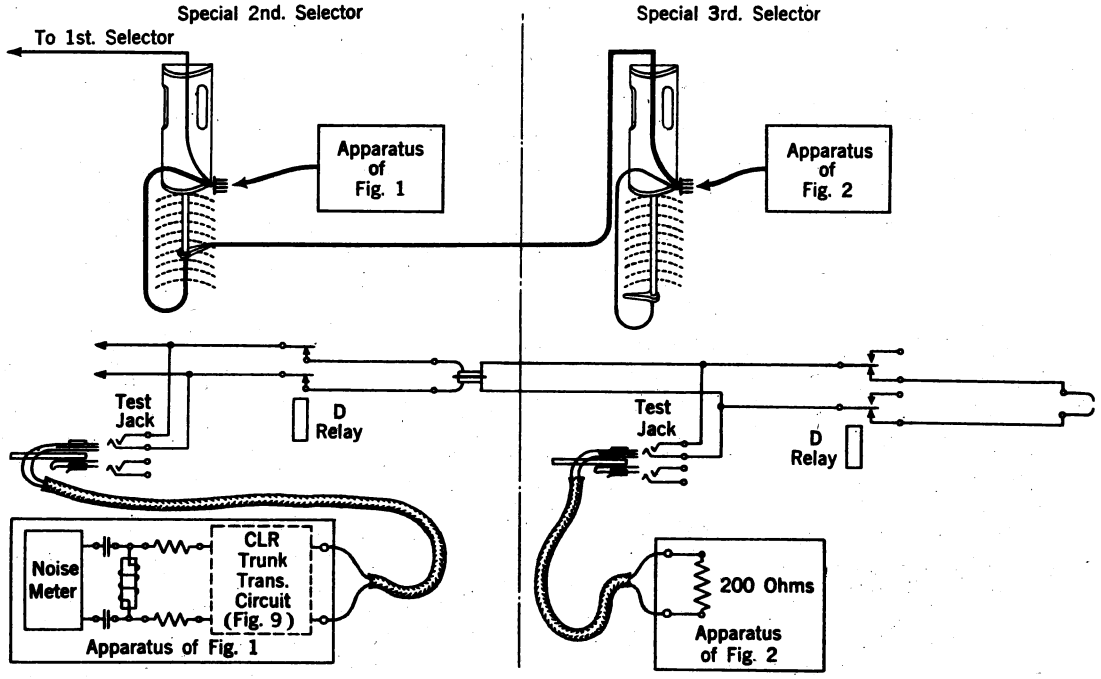

Fig. 10.

(5) At the special third selector test jack insert the 240A plug of the apparatus arrangement of Fig. 2 and raise the shaft off normal. The third selector shaft should be held in this position for the duration of the test. This may be done either manually or by supporting the shaft on an orange wood stick placed across the projections of the lower bank plates.

(6) A check as to whether the tester at the third selector has picked the proper switch may be obtained by the testers talking over the circuit from their respective telephone sets.

(7) Operate Key 1 of Figs. 1 and 2 and measure the noise.

(8) Release the circuit by removing the 240A plugs from the test jacks of the special second and third selectors and by restoring the shaft of the third selector to normal.

(9) If it is required to test other terminals in the same special second selector, make busy the third selector just tested by inserting a make-busy tool between test jack springs 3 and 4 and proceed as outlined above, using the same special second selector. Otherwise, repeat the above procedure from a different special second selector.

11. SPECIAL THIRD (SERVICE CODE) SELECTORS TO 3-WIRE CLR TRUNKS

These tests are made from the test jacks of special third or service code selectors to a spare multiple jack in the toll switchboard.

11.1 Preparation

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - No transmission circuit will be required to be connected to the arrangement of Fig. 1 since this will be furnished from the CLR trunks included in the tests. The terminals where the transmission apparatus would normally be connected should be strapped together (Tip-Tip and Ring-Ring).

- Cord with 152 and 240A plugs.

Fig. 2 - Twisted pair wire to connect this apparatus arrangement at the I.D.F. to a spare multiple jack in the toll switchboard.

- 4 mf. condensers in each side of test line where No. 1 Toll Switchboard is involved.

The 4 mf. condensers are required at No. 1 Toll Switchboards in order that the operator may obtain proper cord circuit supervision. These condensers will not be required where No. 3 Toll Switchboards are involved.

The multiple jacks in the toll switchboard should be designated in a manner different from other jacks in order to prevent operators from assuming that they are available for regular service and attempt to use them.

When the arrangement of Fig. 2 is connected to the toll switchboard jack at the I.D.F., Key 1 of this arrangement should be operated to provide the 200-ohm termination since it will not be necessary for a tester to be located at this point.

Fig. 11 shows the circuit arrangement for the test and a schematic of the transmission circuit.

11.2 Contacts Involved

The following contacts are involved in this circuit.

(1) Special third selector bank and wiper.

(2) "D" relay of special third selector.

(3) Switchboard jacks and plugs.

11.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Operated
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) Insert the 240A plug of the apparatus arrangement of Fig. 1 in the test jack of a special third selector to be tested.

(3) Restore Key 2 of Fig. 1 to normal and dial "0" (zero) in order to direct the call to the toll switchboard.

(4) When the operator answers advise her that you are testing and ask her to connect the trunk to the specially wired jack without ringing on the circuit. The work with the operator can be facilitated by referring to the designation assigned to the jack.

(5) Operate Key 1 of Fig. 1 and measure the noise.

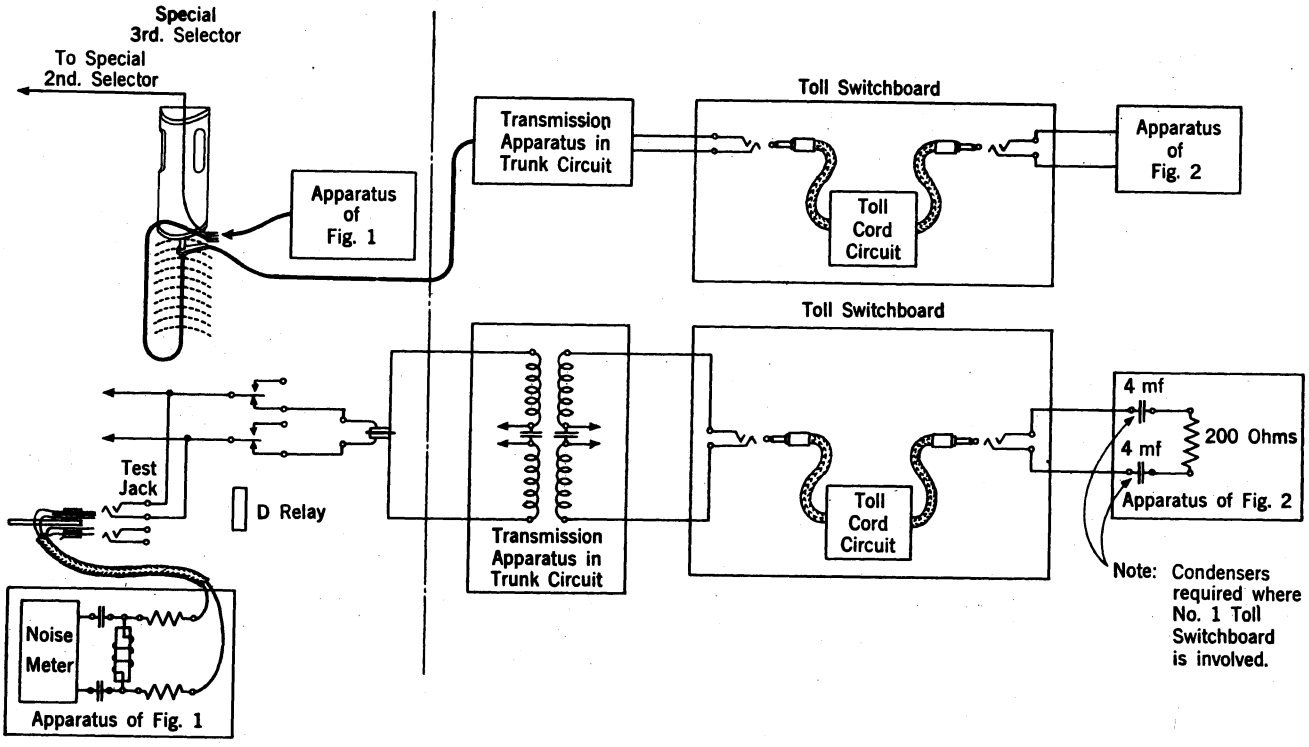

Fig. 11.

(6) Release the circuit by removing the 240A plug from the test jack of the special third selector. The operator will automatically pull down the connection at the toll switchboard upon receipt of cord circuit supervision.

(7) If it is required to test other terminals in the same special third selector, make busy the trunks associated with the terminals preceding the one to be tested by grounding the trunk sleeve at the terminal assembly.

12. SPECIAL THIRD (SERVICE CODE) SELECTORS TO 2-WIRE CLR TRUNKS

These tests are made from the test jacks of special third or service code selectors to the vertical side of the M.D.F. in the dial office in order that the cable pair may be disconnected from the test circuit during measurement.

12.1 Preparation

Establish a talking connection between the testers at the special third selectors and M.D.F. of dial office.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - No transmission circuit will be required to be connected to the arrangement of Fig. 1 since this will be furnished from the CLR trunks included in the tests. The terminals where the transmission apparatus would normally be connected should be strapped together (Tip-Tip and Ring-Ring).

- Cord with 152 and 240A plugs.

Fig. 2 - Cord with 152 and 252 type plugs.

Fig. 12 shows the circuit arrangement for the test and a schematic of the transmission circuit.

12.2 Contacts Involved

The following contacts are involved in this circuit:

(1) Special third selector bank and wiper.

(2) "D" relay of special third selector.

12.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

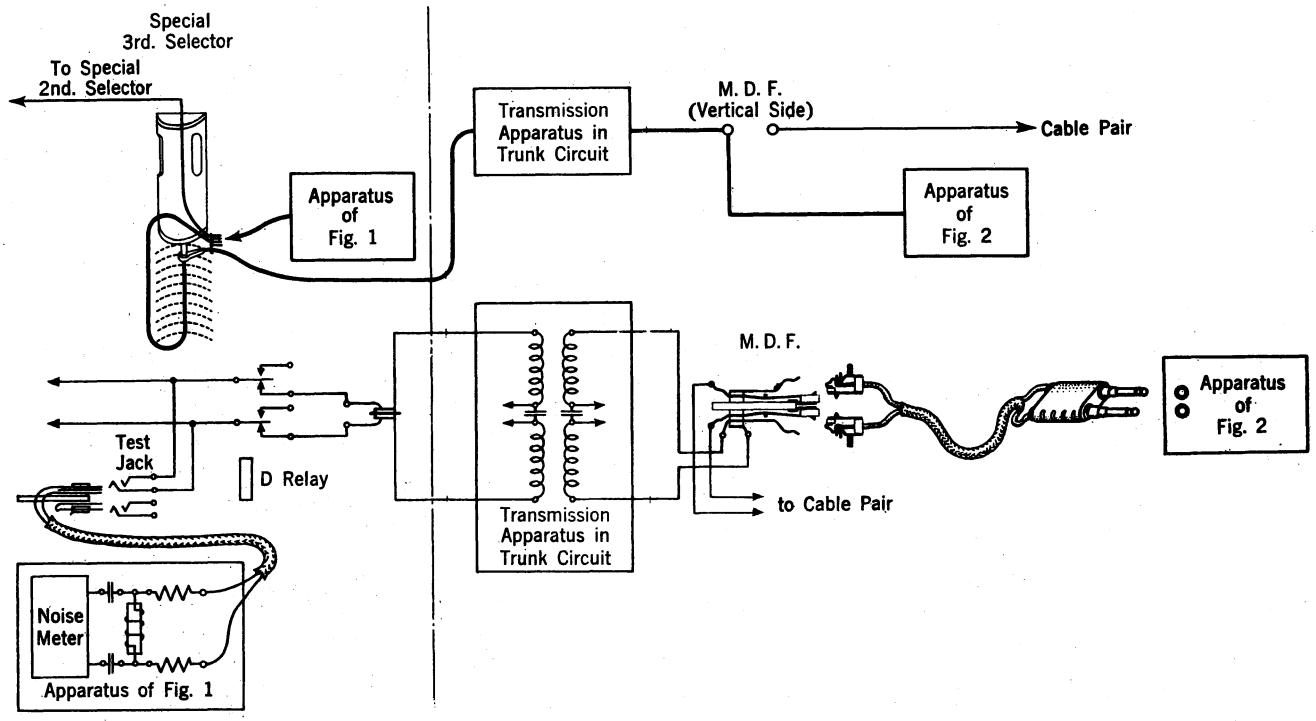

Fig. 12.

(2) Insert the 240A plug of the apparatus arrangement of Fig. 1 in the test jack of a special third selector to be tested.

(3) Restore Key 2 of Fig. 1 to normal and dial "0" (zero) in order to direct the call to the toll switchboard.

(4) When the operator answers advise her that you are testing and ask her for the number of the trunk to which she is connected. Also advise the operator to leave the plug of the cord circuit in the trunk jack until receipt of disconnect supervision.

(5) Advise the tester at the M.D.F. of the trunk number who can by referring to the cable record, determine the cable pair involved.

(6) At the M.D.F. remove the heat coils of the cable pair involved. When the cable pair is opened the operator will obtain a disconnect signal and will remove the plug of the cord circuit from the trunk jack.

(7) At the M.D.F. insert the 252 type plugs of the apparatus arrangement of Fig. 2 in the protector springs of the cable pair involved in the test.

(8) A check as to whether the tester at the M.D.F. has picked the correct cable pair may be obtained by the testers talking over the circuit from their respective telephone sets.

(9) Operate Key 1 of Figs. 1 and 2 and measure the noise.

(10) At the special third selector, restore Key 1 of Fig. 1 to normal.

(11) At the M.D.F. remove the 252 type plugs and replace the heat coils.

(12) When the operator answers advise her from the special third selector that you are testing the circuit. This will be an indication that the circuit has been restored for normal traffic use.

(13) If it is required to test other terminals in the same special third selector, make busy the trunks associated with the terminals preceding the one to be tested by grounding the trunk sleeve at the terminal assembly.

13. TOLL PRECEDING SELECTORS - LOOP DIALING

There are usually only a limited number of toll preceding selectors in an office and these can be cleaned in about the same time required to make the necessary contact noise measurements. In view of this no detailed test procedures are given for this type of switch. However, if a rough check as to the contact noise condi-

tion of these switches is required, it can be obtained by reviewing the overall toll switching channel measurements with the results obtained on the various individual switches in the toll dial train, such as the toll transmission selectors, toll intermediate selectors and toll connectors.

14. TOLL PRECEDING SELECTORS REPEATED DIALING

These selectors usually have no d-c. flowing through the tip and ring wiper and multiple bank contacts and, therefore, can not be tested with a noise meter. Since the effect on transmission of such contacts that develop contact resistance is to cause fading or opens, it is suggested that cleaning measures be applied at more frequent intervals than those suggested for contacts in which d-c. does flow during the talking condition.

15. A-B TOLL PRECEDING SELECTORS - LOOP DIALING

No detailed testing method is given for this type of selector in view of the limited number of installations now in service. When it is required to test these switches, methods similar to those outlined for local selectors using the appropriate transmission and battery supply circuit can be employed. The tester should confer with the local central office maintenance forces as to the relay contacts which need to be isolated in order to open any transmission apparatus of the succeeding selector or trunk circuit which may be bridged across the circuit in the test condition.

16. TOLL TRANSMISSION SELECTORS - LOOP DIALING

These tests are made between the test jacks of toll transmission and toll intermediate selectors.

16.1 Preparation

Establish a talking connection between the testers at the toll transmission and toll intermediate selectors.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - No transmission circuit will be required to be connected to the arrangement of Fig. 1 since this will be furnished by the toll transmission selector under test. The terminals of Fig. 1 where the transmission apparatus would normally be connected to this arrangement should be strapped together. (Tip-Tip and Ring-Ring.)

- Cord with 152 and 240A plugs.

Fig. 2 - Cord with 152 and 240A plugs.

Fig. 13 shows the circuit arrangement for the test and a schematic of the transmission circuit.

16.2 Contacts Involved

The following contacts are involved in this circuit.

(1) Toll Transmission Selector bank and wiper.

(2) Toll Transmission Selector A, H and R relays.

16.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1	Fig. 2
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) Insert the 240A plug of the apparatus arrangement of Fig. 1 in the test jack (springs 1, 2, 3, 4) of a toll transmission selector to be tested.

(3) Restore Key 2 of Fig. 1 to normal and dial any digit that will direct the call to a toll intermediate selector.

(4) Note the position of the wiper in the toll transmission selector multiple bank and determine from the shelf multiple trunk card the particular toll intermediate selector involved in the test.

(5) At the toll intermediate selector test jack (springs 1, 2, 3, 4) insert the 240A plug of the apparatus arrangement of Fig. 2 and raise the shaft off normal. The toll intermediate selector shaft should be held in this position for the duration of the test. This may be done either manually or by supporting the shaft on an orange wood stick placed across the projections of the lower bank plates.

(6) A check as to whether the tester at the toll intermediate selector has picked the proper switch may be obtained by the testers talking over the circuit from their respective telephone sets.

(7) Operate Key 1 of Figs. 1 and 2 and measure the noise.

(8) Release the circuit by removing the 240A plugs from the test jacks of the toll transmission and toll intermediate selectors and by restoring the shaft of the toll intermediate selector to normal.

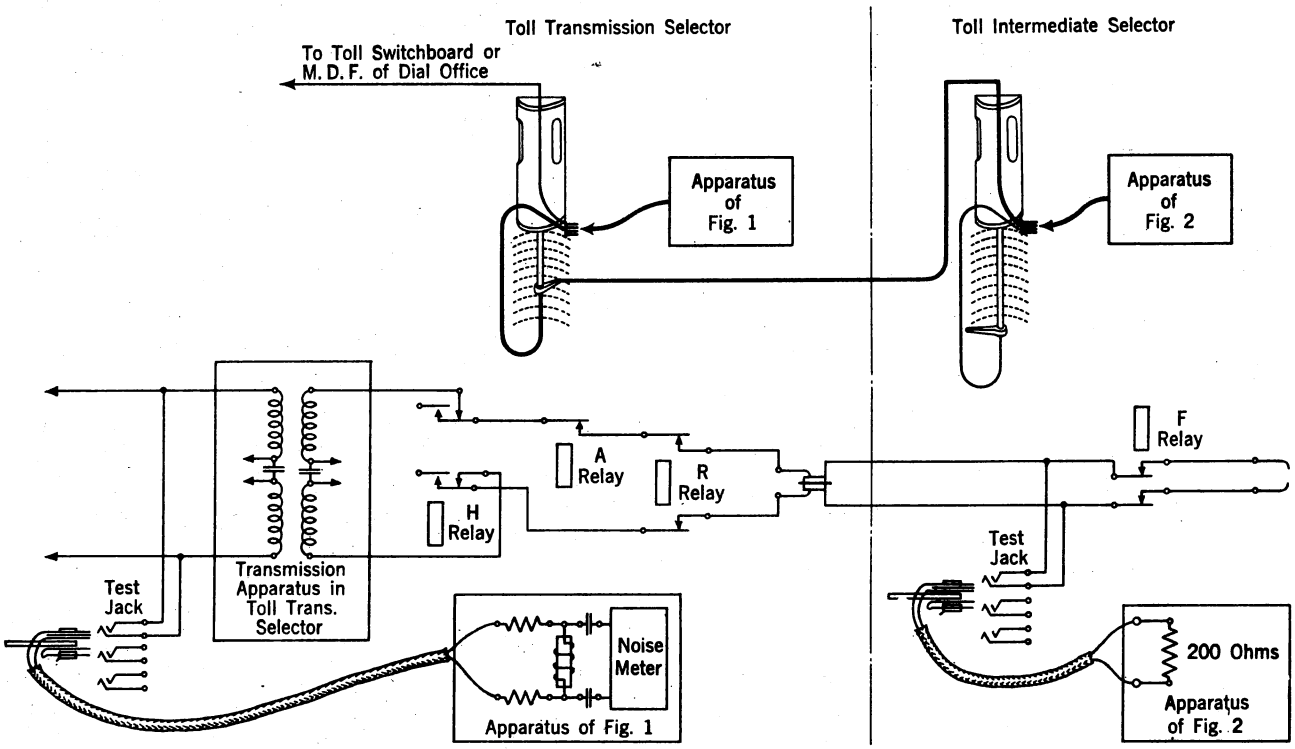

Fig. 13.

(9) If it is required to test other terminals in the same toll transmission selector, make busy the toll intermediate selector just tested by inserting a make-busy tool between test jack springs 3 and 4 and proceed as outlined above, using the same toll transmission selector, otherwise repeat the above procedure from a different toll transmission selector.

17. TOLL TRANSMISSION SELECTORS - REPEATED DIALING

The method of testing this type of selector is the same as outlined for Toll Intermediate Selectors with the exception that no transmission or battery supply circuit need be provided since this is furnished by the relay equipment circuit associated with the selector.

18. A-B TOLL TRANSMISSION SELECTORS - LOOP DIALING

The method of testing this type of selector is the same as outlined for Toll Transmission Selectors - Loop Dialing.

19. TOLL INTERMEDIATE SELECTORS - LOOP DIALING

These tests are made between the test jacks of toll intermediate selectors and toll combination or rotary hunting and non-hunting connectors.

19.1 Preparation

Establish a talking connection between the testers at the toll intermediate selectors and toll connectors.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - Use Transmission Circuit of Toll Transmission Selector with Quiet Battery as shown on Fig. 14. This should be connected to Fig. 1 as indicated.

- Cord with 152 and 240B plugs.

Fig. 2 - Cord with 152 and 240A plugs.

- 1200 ohms in series with single conductor cord.

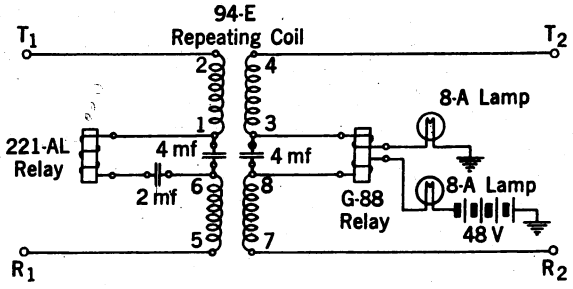

Fig. 14.

Fig. 15 shows the circuit arrangement for the test and a schematic of the transmission circuit.

19.2 Contacts Involved

The following contacts are involved in this circuit:

(1) Toll intermediate selector bank and wiper.

(2) Toll intermediate selector F relay.

19.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) Insert the 240B plug of the apparatus arrangement of Fig. 1 in the test jack of a toll intermediate selector to be tested.

(3) Restore Key 2 of Fig. 1 to normal and dial a digit that will direct the call to a connector hundreds group in which one of the called lines used in the overall intraoffice channel tests is located, and then dial another digit to raise the shaft of the connector to any level.

(4) Note the position of the wiper in the toll intermediate selector multiple bank, and determine from the shelf multiple trunk card the particular connector involved in the test.

(5) At the toll connector test jack insert the 240A plug of the apparatus arrangement of Fig. 2. In the case of toll rotary hunting and non-hunting connectors, the 240A plug should be inserted in test jack springs 1, 2, 3, 4, while in the case of combination connectors, the 240A plug should be inserted upside down in test jack springs 8, 7, 6, 5, since in this case springs 8, 7, and 6 are, respectively, the tip, ring, and sleeve of the circuit.

(6) At the connector momentarily bridge the sleeve wiper (lower wiper of top bank) to a fused 48-volt battery on an adjacent connector shelf through the 1200-ohm cord. This will operate the cut through relay of the connector.

(7) A check as to whether the tester at the connector has picked the proper switch may be obtained by noting that the connector shaft is raised so that the wiper is opposite a bank level but not cut into the level. A further check may be obtained by the testers talking over the circuit from their respective telephone sets.

(8) Operate Key 1 of Figs. 1 and 2 and measure the noise.

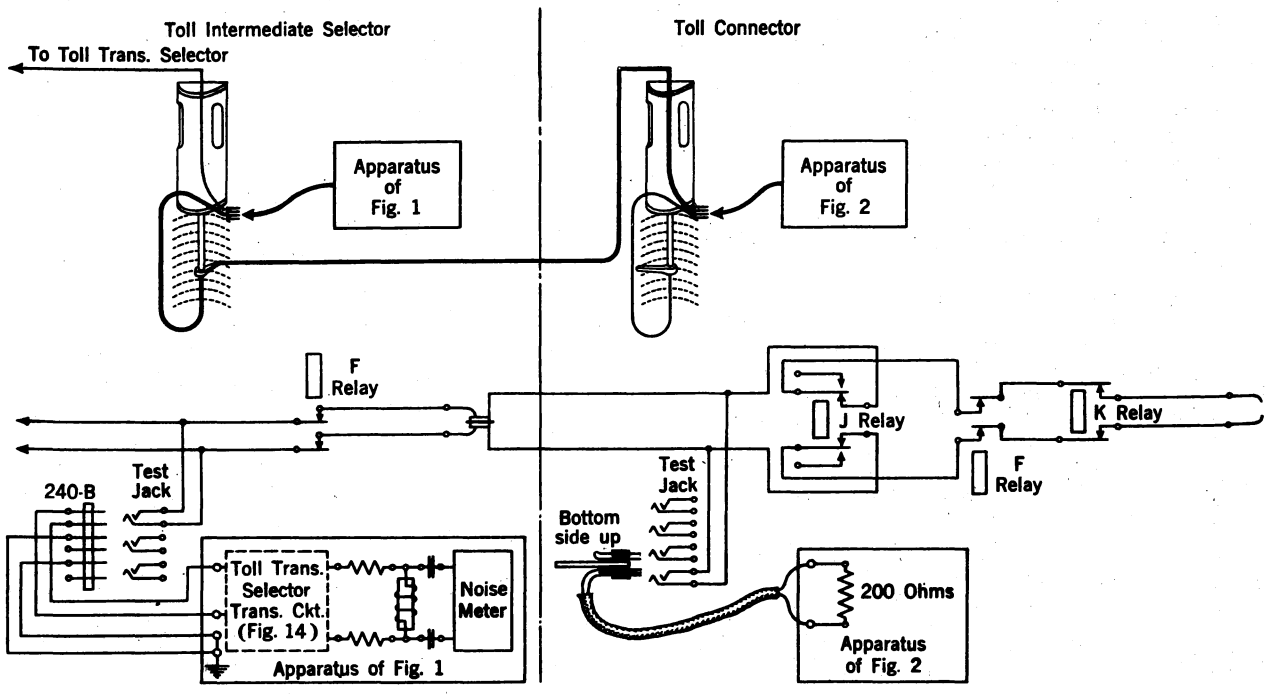

Fig. 15.

(9) Release the circuit by removing the 240-type plugs from the test jacks of the toll intermediate selector and toll connector.

(10) If it is required to test other terminals in the same toll intermediate selector, make busy the connectors previously tested by inserting a make-busy tool between test jack springs 3 and 4 and proceed as outlined above, using the same toll intermediate selector, Otherwise repeat the above procedure from a different toll intermediate selector.

20. LOCAL CONNECTORS

This test procedure is applicable to local non-hunting connectors, the local side of combination connectors and local rotary hunting connectors.

The tests are made between the test jacks of the local connectors as referred to above and the terminal strip to which the lines of the multiple banks are connected.

The called lines which were used in the overall intraoffice contact noise measurements may also be used for these tests. If, however, additional called lines are required, they should be removed from intercepting trunks and then restored to these trunks as soon as the measurements are completed. Since the 234 plug is used to pick up the called lines at the multiple bank terminal strip, it will be more convenient to choose even-numbered lines since these are more accessible by means of the 234 plug than the odd-numbered lines.

20.1 Preparation

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - No transmission circuit will be required to be connected to the arrangement of Fig. 1 since this will be furnished by the connector included in the tests. The terminals of Fig. 1 where the transmission apparatus would normally be connected should be strapped together. (Tip-Tip and Ring-Ring.)

- Cord with 152 and 240A plugs.

Fig. 2 - Cord with 152 and 234 plugs.

- 1200 ohms to 48-volt battery connected to sleeve of test jacks.

Fig. 16 shows the circuit arrangement for the test and a schematic of the transmission circuit.

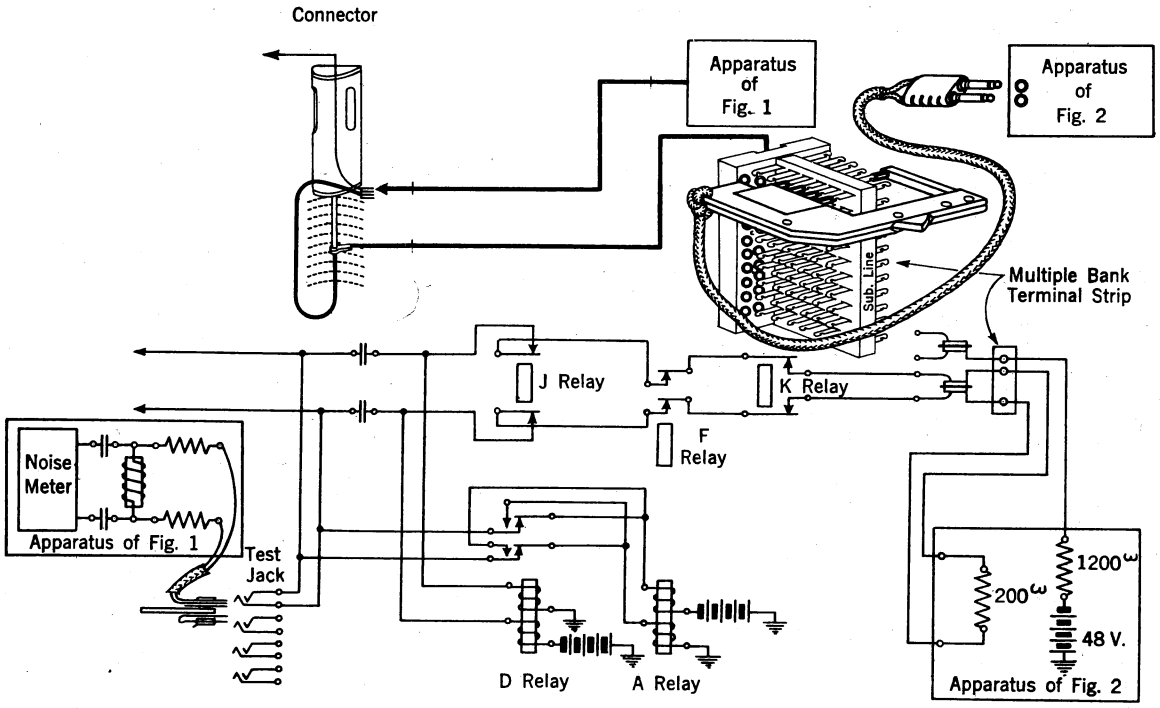

Fig. 16.

20.2 Contacts Involved

The following contacts are involved in this circuit.

(1) Connector bank and wiper.

(2) Connector D, F, and K relays, also J relay in combination connectors.

20.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Operated
Key 3 - Normal	

(2) At the connector multiple bank terminal strip connect the 234 plug of the apparatus arrangement of Fig. 2 to the tip, ring and sleeve terminals of a line to which the calls may be directed.

(3) Insert the 240A plug of the apparatus arrangement of Fig. 1 in the test jack (springs 1, 2, 3, 4) of a local connector to be tested.

(4) Restore Key 2 of Fig. 1 to normal and dial the last two digits of the called line under test.

(5) When the signal is received at the apparatus arrangement of Fig. 2 operate Key 1 of Fig. 2. This will trip the ringing.

(6) Operate Key 1 of Fig. 1 and measure the noise.

(7) Release the circuit by removing the 240A plug from the connector test jack and the 234 plug from the multiple bank terminal strip.

(8) If it is required to test from a different connector to the same number as used above, the 234 plug of Fig. 2 should not be removed from the terminal strip but Key 1 of Fig. 2 should be restored to Normal with Key 2 remaining operated to BELL. The 240A plug of Fig.1 should be inserted in the test jack of another connector in the same connector group and the procedure as outlined above should be followed. Otherwise, repeat the above procedure using a different called number.

21. TOLL CONNECTORS

This test procedure is applicable to toll non-hunting connectors, the toll side of combination connectors and toll rotary hunting connectors.

The tests are made between the test jacks of the toll connectors as referred to above and the terminal strip to which the lines of the multiple banks are connected.

The called lines which were used in the overall intraoffice contact noise measurements may also be used for these tests. If, however, additional called lines are required, they should be removed from intercepting trunks and then restored to these trunks as soon as the measurements are completed. Since the 234 plug is used to pick up the called lines at the multiple bank terminal strip, it will be more convenient to choose even-numbered lines since these are more accessible by means of the 234 plug than the odd-numbered lines.

21.1 Preparation

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - Use Transmission Circuit of Toll Transmission Selector with Quiet Battery as shown on Fig. 14. This should be connected to Fig. 1 as indicated.

- Ground should be associated with Key 3.

- Cord with 152 and 240B plugs for toll rotary hunting or non-hunting connectors.

- Cord with 152 and 240C plugs for combination connectors.

Fig. 2 - Cord with 152 and 234 plugs.

- 1200 ohms to 48-volt battery connected to sleeve of test jacks.

Fig. 17 shows the circuit arrangement for the test and a schematic of the transmission circuit.

21.2 Contacts Involved

The following contacts are involved in this circuit.

(1) Connector bank and wiper.

(2) Connector F and K relays, also J relay in combination connectors.

21.3 Test Procedure

(1) The keys of the apparatus arrangements of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Operated
Key 3 - Normal	

(2) At the connector multiple bank terminal strip connect the 234 plug of the apparatus arrangement of Fig. 2 to the tip, ring, and sleeve terminals of a line to which the calls may be directed.

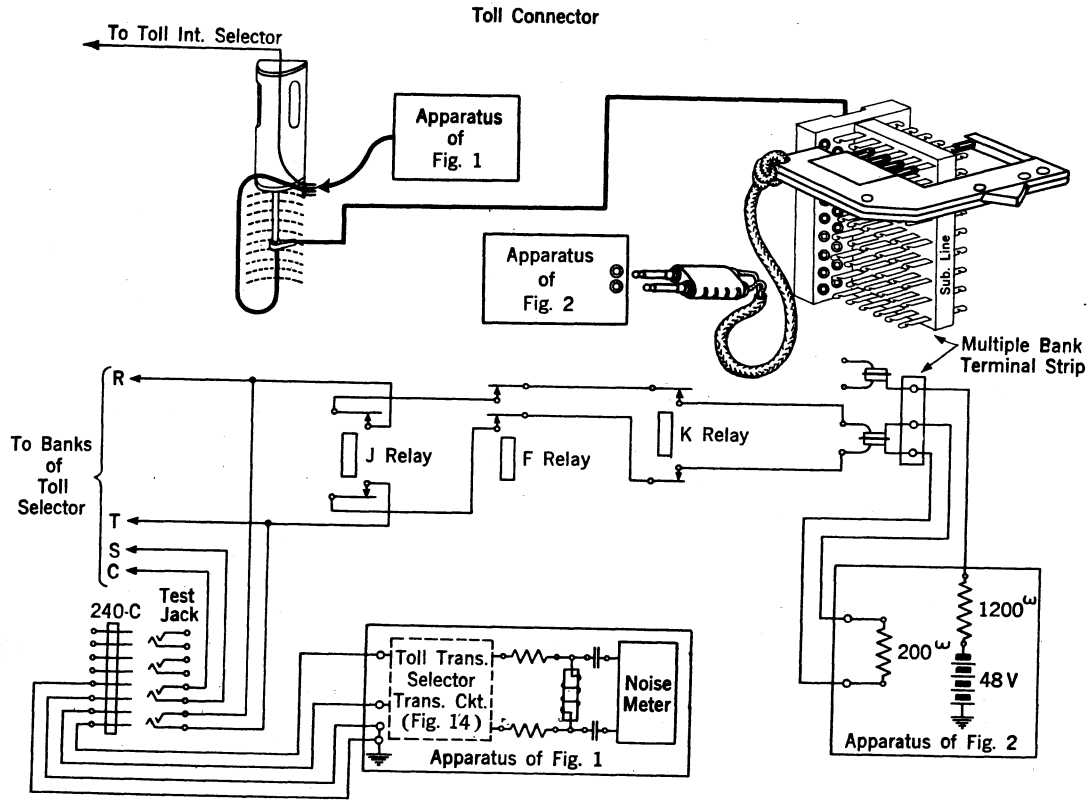

Fig. 17.

(3) Insert the 240C plug of the apparatus arrangement of Fig. 1 in the toll test jack (springs 1 to 8) of a combination connector to be tested or a 240B plug in the test jack (springs 1 to 6) of other toll connectors.

(4) Restore Key 2 of Fig. 1 to normal and dial the last two digits of the called line under test.

(5) Momentarily operate Key 3 of Fig. 1 which is associated with the sleeve and control circuits of the toll connector under test.

(6) When the signal is received at the apparatus arrangement of Fig. 2 operate Key 1 of Fig. 2. This will trip the ringing.

(7) Operate Key 1 of Fig. 1 and measure the noise.

(8) Release the circuit by removing the 240 type plug from the connector test jack and 234 plug from the multiple bank terminal strip.

(9) If it is required to test from a different connector to the same number as used above, the 234 plug of Fig. 2 should not be removed from the terminal strip but Key 1 of Fig. 2 should be restored to Normal with Key 2 remaining operated to BELL. The 240 type plug of Fig. 1 should be inserted in the test jack of another connector in the same connector group and the procedure as outlined above should be followed. Otherwise, repeat the above procedure using a different called number.

22. LEVEL HUNTING CONNECTORS

It is not practicable to make contact noise measurements on the wiper and multiple bank terminals of level hunting connectors which are in service and in view of the relatively small number of these switches in a dial office, the testing time involved in a detailed investigation would be somewhat comparable with the time required to thoroughly clean the switches. No testing methods are therefore given in this section of practices for the level hunting type connectors but it is recommended that the cleaning procedures be followed.

23. PLUNGER TYPE OUT-TRUNK SWITCHES

These tests are made between the test jack of the line switches at the out-trunk board and the test jack of the repeaters associated with the various trunks.

23.1 Preparation

Establish a talking connection between the testers at the out-trunk board and the repeaters.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - No transmission circuit will be required to be connected to the arrangement of Fig. 1 since this will be furnished by the repeater associated with the out-trunk switch under test. The terminals of Fig. 1 where the transmission apparatus would normally be connected to this arrangement should be strapped together. (Tip-Tip and Ring-Ring.)

- Cord with 152 and 240A plugs.

Fig. 2 - Cord with 152 and 240A plugs.

- 4 mf. condensers should be connected in the tip and ring circuit to prevent d-c. of the repeater "A" relay from flowing through the 200 ohms termination.

Fig. 18 shows the circuit arrangement for the test and a schematic of the transmission circuit.

23.2 Contacts Involved

(1) Out-trunk switch bank and wiper.

(2) D relay of repeater.

23.3 Test Procedure

(1) The keys of the apparatus arrangement of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) At the out-trunk board manually operate the "B" and then the "A" relay of the master switch to pick up any idle plungers on the master switch guide rod.

(3) Choose an out-trunk switch from which a particular set of contacts (or trunk) is to be tested.

(4) If the plunger of the switch to be included in the test is not opposite the particular contacts (or trunk) to be tested, momentarily short-circuit test jack springs 3 and 4 of a number of idle out-trunk switches (not including the one which is to be tested) until the plunger of the switch involved is in the required position.

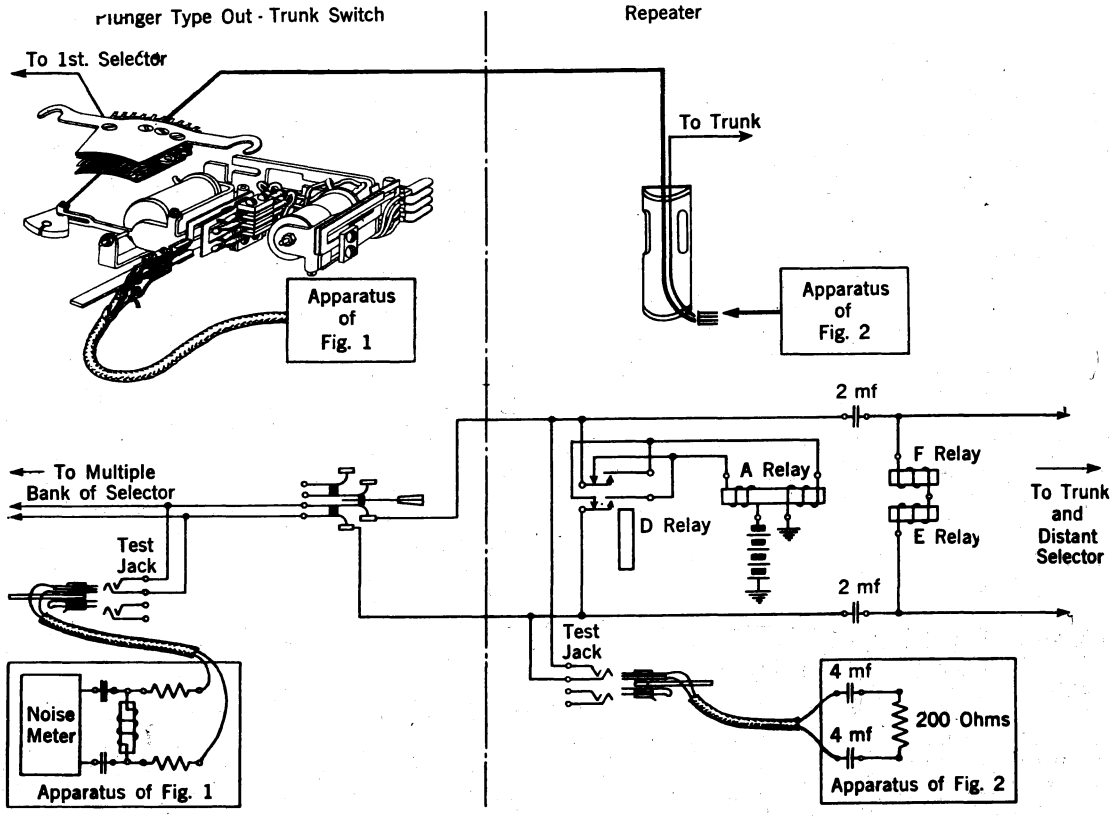

Fig. 18.

(5) Insert the 240A plug of the apparatus arrangement of Fig. 1 in the test jack of a switch to be tested.

(6) Determine from the trunk multiple card the repeater selected.

(7) In the test jack of the repeater insert the 240A plug of the apparatus arrangement of Fig. 2.

(8) A check as to whether the tester at the repeater has picked the proper switch may be obtained by the testers talking over the circuit from their respective telephone sets. Key 2 of Fig. 1 should be restored to normal if this check is to be made.

(9) Block the "A" relay of the repeater in the non-operated position to open the circuit to the cable pair. Key 2 of Fig. 1 should be operated in order to facilitate the blocking of the relay. In some cases where this may not open the circuit to the cable pair the heat coils should be removed at the M.D.F. Where this latter is resorted to it will not be necessary to block the "A" relay in the non-operated position.

(10) Restore Key 2 of Fig. 1 to normal and operate Key 1 of Figs. 1 and 2 and measure the noise.

(11) Release the circuit by removing the 240A plug from the repeater and the blocking tool from the "A" relay. At the out-trunk switch remove the 240A plug from the test jack. Where the cable pair was removed by opening the circuit at the M.D.F. the circuit should now be closed at the M.D.F.

(12) If it is required to test other contacts (or trunks) from the same out-trunk switch this can be done by proceeding from item (4) above, otherwise repeat the above using a different out-trunk switch.

24. ROTARY OUT-TRUNK SWITCHES

These tests are made between the test jacks of rotary out-trunk switches and the test jacks of the repeaters associated with the various trunks.

24.1 Preparation

Establish a talking connection between the testers at the rotary out-trunk switches and the repeaters.

The apparatus arrangements of Figs. 1 and 2 will be required as follows:

Fig. 1 - No transmission circuit will be required to be connected to the arrangement of Fig. 1 since this will be furnished by the repeater associated with the out-trunk switch under test. The terminals of Fig. 1 where the transmission apparatus would normally be connected to this arrangement should be strapped together. (Tip-Tip and Ring-Ring.)

- Cord with 152 and 110 plugs.

- Ground should be associated with Key 3 of Fig. 1.

Fig. 2 - Cord with 152 and 240A plugs.

- 4 mf. condensers should be connected in the tip and ring circuit to prevent d-c. of the repeater "A" relay from flowing through the 200 ohms termination.

Fig. 19 shows the circuit arrangement for the test and a schematic of the transmission circuit.

24.2 Contacts Involved

(1) Out-trunk switch bank and wiper.

(2) D relay of repeater.

24.3 Test Procedure

(1) The keys of the apparatus arrangement of Figs. 1 and 2 should be operated as follows:

Fig. 1.	Fig. 2.
Key 1 - Normal	Key 1 - Normal
Key 2 - DISC-1	Key 2 - Normal
Key 3 - Normal	

(2) At the out-trunk switch unit choose an idle switch to be tested.

Note: If an out-trunk switch is busy the associated "SL" relay will be operated. If the switch wiper is not opposite the particular terminal to be tested the wiper may be advanced by operating the associated "ST" relay.

(3) Insert the 110 plug of the apparatus arrangement of Fig. 1 in the TST jack of a switch to be tested.

(4) Note the position of the indicator on the out-trunk switch and determine from the forward tracing card on the out-trunk switch frame the repeater selected.

(5) In the test jack of the repeater insert the 240A plug of the apparatus arrangement of Fig. 2.

(6) A check as to whether the tester at the repeater has picked the proper switch may be obtained by the testers

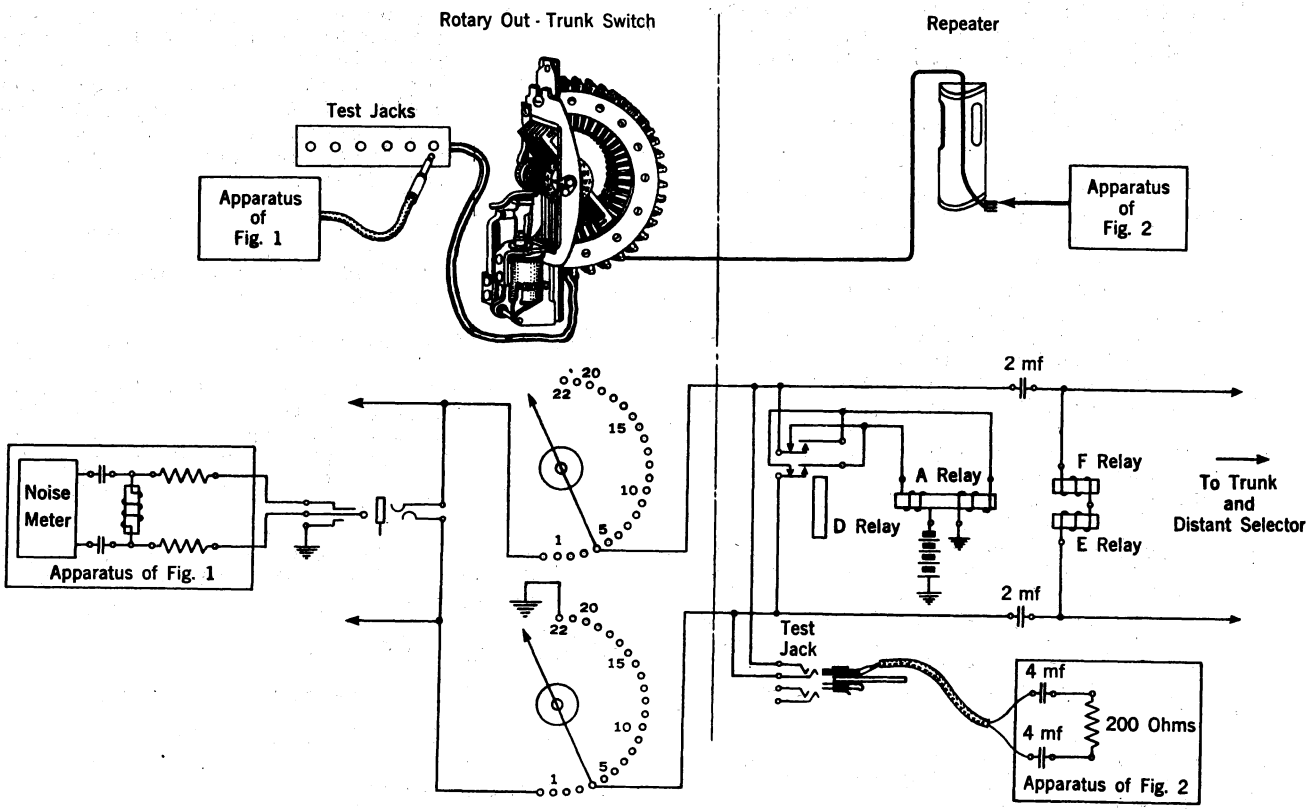

Fig. 19.

talking over the circuit from their respective telephone sets. Key 2 of Fig. 1 should be restored to normal if this check is to be made.

(7) Block the "A" relay of the repeater in the non-operated position to open the circuit to the cable pair. Key 2 of Fig. 1 should be operated in order to facilitate the blocking of the relay. In some cases where this may not open the circuit to the cable pair the heat coils should be removed at the M.D.F. Where this latter is resorted to it will not be necessary to block the "A" relay in the non-operated position.

(8) Restore Key 2 of Fig. 1 to normal and operate Key 1 of Figs. 1 and 2 and measure the noise.

(9) Release the circuit by removing the 240A plug from the repeater and the blocking tool from the "A" relay. At the out-trunk rotary switch remove the 110 plug from the test jack. Where the cable pair was removed by opening the circuit at the M.D.F. the circuit should now be closed at the M.D.F.

(10) If it is required to test other contacts (or trunks) from the same rotary out-trunk switch, remove the 110 plug from the test jack at the rotary out-trunk switch and manually operate the "ST" relay associated with the switch to direct the wiper to another idle contact (or trunk), and repeat the above procedure from Item 2. Otherwise, repeat all of the items using a different out-trunk switch.