

June 15, 1937.

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2,084,105

TELEPHONE CONTROL SYSTEM

Filed March 11, 1936

3 Sheets-Sheet 1

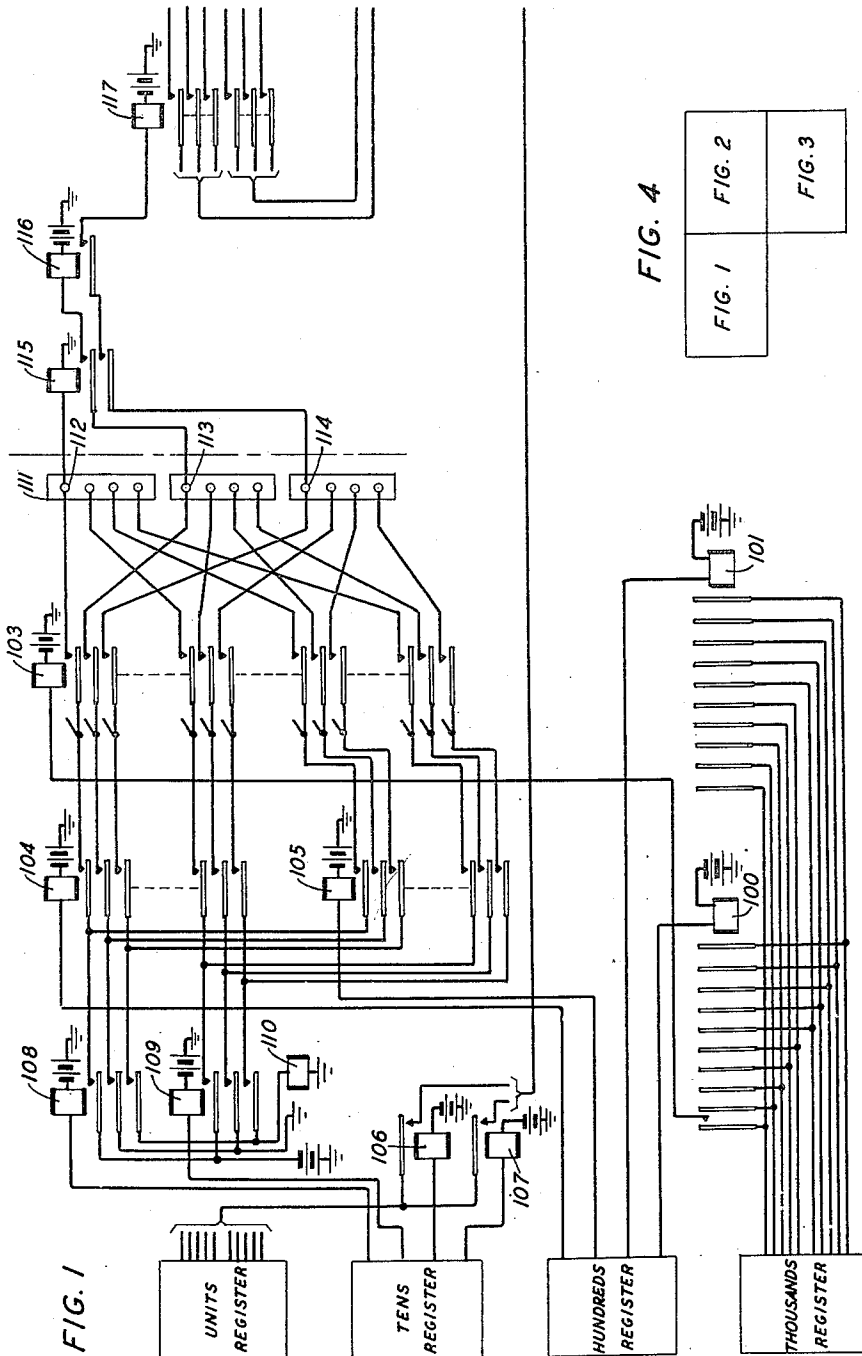


FIG. 4

FIG. 1	FIG. 2	FIG. 3
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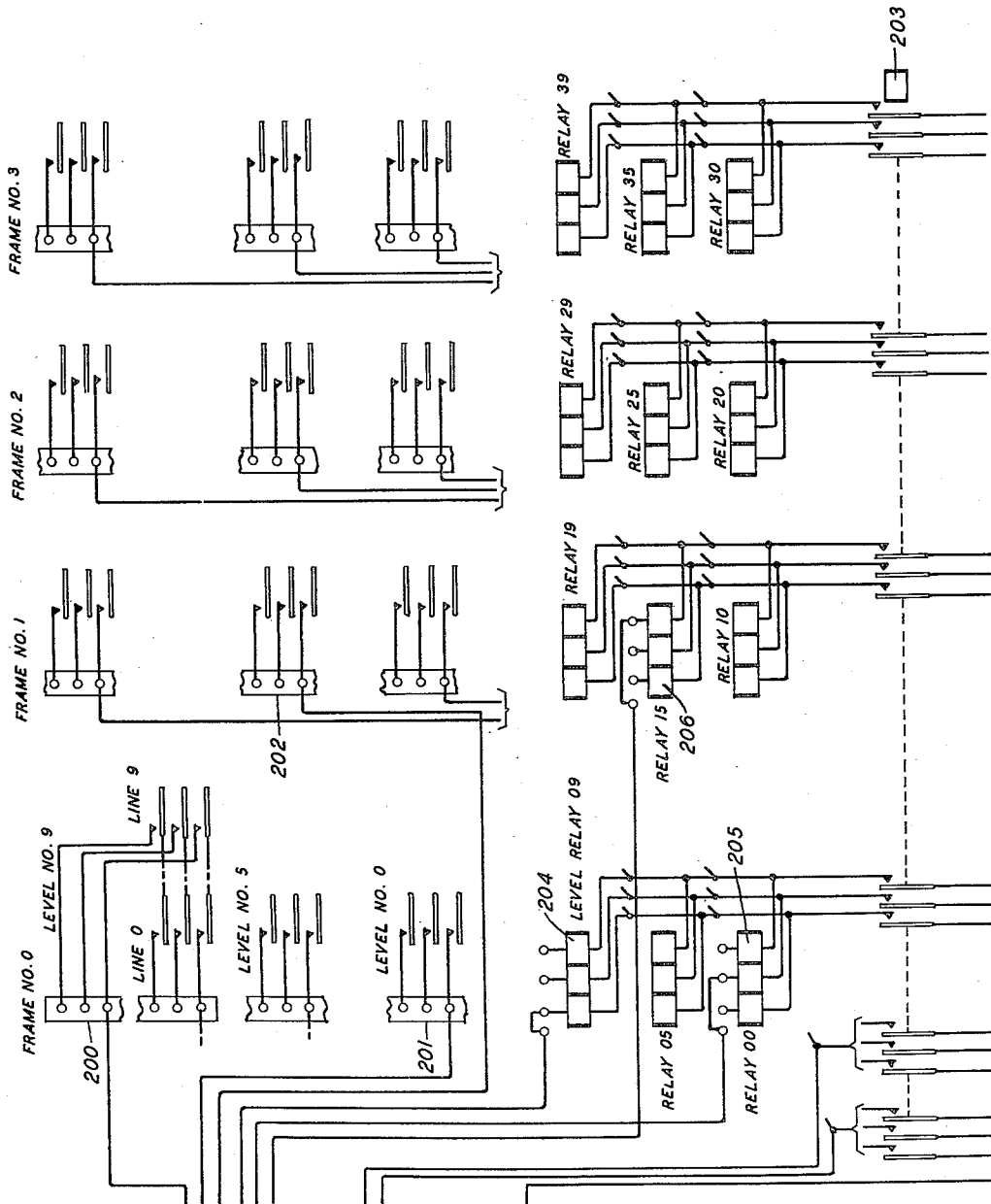


FIG. 2

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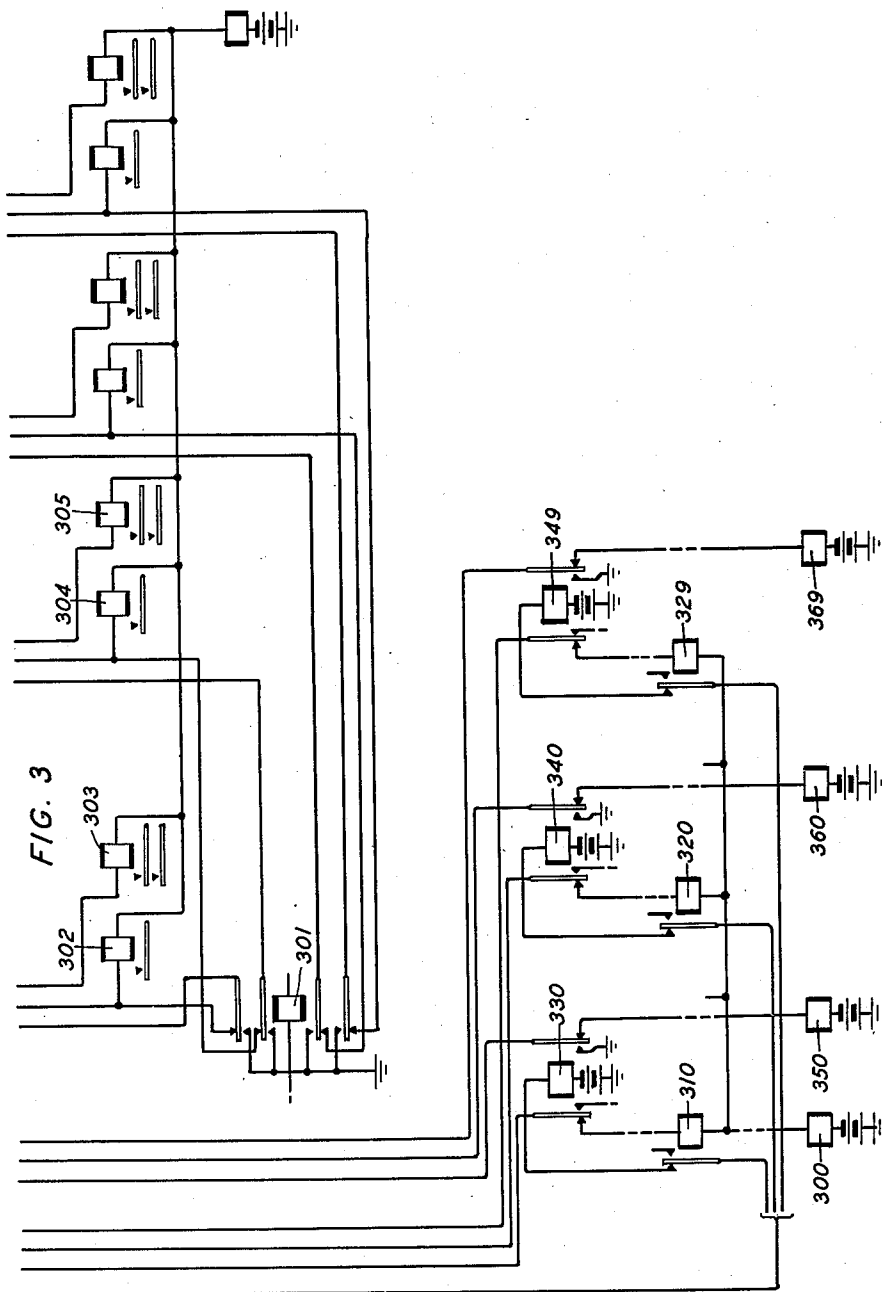
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2,084,105

TELEPHONE CONTROL SYSTEM

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Application March 11, 1936, Serial No. 68,258

7 Claims. (Cl. 179—27)

This invention relates to telephone systems and has for its object to simplify the identification of classes of subscribers' lines.

More specifically, lines may be classed as individual lines, whether serving one or more substations and groups of equivalent lines or trunks serving the same subscriber through the medium of a private branch exchange. In the establishment of connections with a private branch exchange by means of progressive switches, trunk lines other than the last are marked by a resistance which differentiates them from individual lines and which alters the busy condition on the test terminal to cause the switch to advance in search of an idle line. In the case of non-progressive switches, for example, cross-bar switches as shown in the application of W. W. Carpenter, Serial No. 27,305, filed June 19, 1935, the lines and trunks are tested in groups by means of a marker and the switches are operated only if an idle trunk is available. In this application each individual line is provided with a single test lead extending toward the marker, while each trunk of a private branch exchange group with exception of the last is provided with two test leads extending toward the marker. The marker is equipped with two relays for each line of a group to be tested, one of which operates when connected to the test lead of a busy line and both of which operate when connected to the test leads of a busy intermediate private branch exchange trunk. When a line or trunk is found idle, the switching equipment is rendered effective to complete the connection. The location of the called line and therefore the identity of the switching equipment to be used is determined from the line designation.

As a later development of the cross-bar telephone system, the same switches give access to the lines both when originating and receiving calls, the lines being arranged in accordance with their calling rate to give as uniform a load as possible. Therefore, the location of a called line is not fixed and the line testing equipment must tell the marker the location of the line as well as its nature and condition.

In accordance with the present invention, each line has only a single test lead. For each physical group of lines a relay having a plurality of windings is provided, and for each numerical group of lines a multi-contact relay is provided, the contacts of these second relays being cross-connected to the windings of the first group of relays in accordance with the nature of the lines, thereby providing a simultaneous indication of

the type, condition and location of a wanted line. A complete system in which the present invention is employed is disclosed in the application of W. W. Carpenter, Serial No. 68,262, filed March 11, 1936.

The invention will be more clearly understood from a consideration of the accompanying description of the drawings in which:

Figs. 1 and 3 show portions of a terminating marker;

Fig. 2 shows in fragmentary form the distributing frames and line choice connector; and

Fig. 4 shows the manner in which Figs. 1 to 3 should be arranged.

Briefly, the establishment of a connection at a terminating office is as follows: The seizure of junctor incoming to the terminating office is followed by the association therewith of a terminating sender. The completion of the association transmits a signal to the originating sender which thereupon transfers the line designation to the terminating sender. When the designation has been received the terminating sender summons a terminating marker and records the designation therein.

The marker in response to this registration seizes the line choice within which the line lies and tests the line. From the line choice connector it receives an indication of the location and nature of the wanted line, after which it transmits a signal to the incoming junctor of the ringing current to be used, tests for an idle channel interconnecting the incoming junctor and wanted line, operates the proper switch magnets, tests the connection, transfers control to the incoming junctor and releases.

Referring to the drawings, the designation of a wanted line is recorded on the thousands, hundreds, tens and units registers by the sender. The lines are arranged numerically in groups of twenty, determined jointly by the thousands, hundreds and tens registers. To this end the thousands register may ground any one of ten leads corresponding to the ten thousands digits. The hundreds register operates relay 100 for digits from 0 to 4 and relay 101 for digits from 5 to 9. The leads from the thousands register are carried in multiple over the contacts of relays 100 and 101 so that the thousands and hundreds registers jointly control a group of twenty relays which identify numerical groups of five hundred lines, and of which relay 103 is one. As will appear, this relay must control so many contacts that actually a plurality of multiplied relays would be used.

The hundreds register also operates one of five relays, such as relays 104, 105 etc. corresponding to the particular hundred in the five hundred group. For example, relay 104 would be operated whether the recorded digit were 0 or 5.

The tens register also operates one in each of two sets of relays, but it operates relay 106 for even digits and relay 107 for odd digits while it operates one of the five relays 108, 109, etc. to locate the digit in the odd or even group. For example, relay 108 identifies the first digit in either group and therefore is operated for either the digit 0 or the digit 1.

A set of three circuits is controlled by these register operated relays. These three circuits extend in multiple to the five tens relays 108, 109, etc., each of the five multiples of the circuits are again multiplied before the five hundreds relays 104, 105, etc., and each of these twenty-five multiples are in turn multiplied before the twenty relays like relay 103. This results in five hundred sets of three terminals at a distributing rack, such as rack 111. However, with one relay in each group operated, only one set of terminals will be marked as a result of the registration and translation of any number. For example, with relays 108, 104 and 103 operated only the set of three terminals 112, 113, and 114 will be marked.

Physically the lines of an office are arranged in groups of ten which are served by an individual cross-bar switch. The individual switches are arranged in ten levels making up a frame and four frames make up a group called for convenience a choice. According to the amount of traffic, from one to seven switches may be multiplied together in one level so that a frame may serve from one hundred to seven hundred lines and a choice may include four hundred to twenty-eight hundred lines.

Each line choice is connected with each marker by means of a line choice connector and when a set of terminals on rack 111 is marked, battery connected to terminal 112, for example, operates relay 115 which is individual to the marker in the line choice connector serving the line choice which includes the wanted line. A lock-out arrangement, not shown, permits connection of the choice to only one marker at a time and multi-contact relays such as relay 203 make the necessary connections between the marker and connector. With the line choice seized, ground connected to terminal 113 operates hundred-block relay 116 which is individual to a group of one hundred lines, while ground through relay 110 connected to terminal 114 operates twenty-block relay 117 over a contact of relay 116 to pick the group of twenty lines of which the wanted line is one. This group is consecutively numbered but the five twenty-blocks connected to a given hundred-block relay need not be consecutive. There are as many hundred-block and twenty-block relays as are necessary for the number of lines in the choice.

Twenty-block relay 117 controls two sets of twenty armatures, one set cross-connected to the sleeve terminals of the twenty lines and the other set connected to windings of level relays.

In Fig. 2 have been indicated thirteen lines, namely, the first and tenth line (line 0 and line 9) in level No. 9, and one line each in levels No. 5 and No. 0 of frame No. 0 as well as one line each in levels No. 0, No. 5 and No. 9 in frames No. 1, No. 2 and No. 3. Corresponding to these levels there are forty level relays in the line choice con-

necter, one for each of the ten levels of the four frames. Of these, twelve have been shown corresponding to the levels of the lines shown.

Each level relay has three windings and these windings terminate at one side in cross connecting terminals. To these terminals are connected the lower set of armatures of the twenty block relay 117 and similar relays, in accordance with the nature of the line connected to the corresponding armature of the upper set.

The connections for three lines have been shown, namely, line 9 in level No. 9 of frame No. 0, a line in level No. 0 of frame No. 0 and a line in level No. 5 of frame No. 1. For convenience, assume that the first of these lines is an intermediate line in a terminal hunting group, the second the last line of such a group and the third a party line requiring ringing over the tip conductor. Therefore, the corresponding inner armature contacts of relay 117 will be connected to the sleeve terminals of these lines, while the lower armature contacts will be connected respectively to the left, middle and right windings of the corresponding level relays. The opposite side of the windings of the level relays of a frame are multiplied together and connected back to the marker. That is, all of the left windings of the level relays of the No. 0 frame are connected to the outer upper armature of relay 301, the middle windings to relay 302 and the right windings to relay 303. Relays 302 and 303 are connected to the No. 0 frame of a choice, relays 304 and 305 to the No. 1 frame, etc.

When the marker is ready to test the wanted line, relay 301 is operated. The marker connects battery through relay 300, through the windings of twenty test relays 310 to 329, over the left back contacts of relays 330 to 349 respectively, over contacts of relay 203 to the twenty inner armatures of relay 117 and the sleeve terminals of the twenty lines including the wanted line which may be located anywhere within the choice. The test relays corresponding to busy lines operate.

At the same time battery through a set of relays 350 to 369 is connected over the right back contacts of relays 330 to 349 respectively, over the lower set of armatures of relay 117 to the windings of corresponding level relays. The circuit of relay 350 which is connected over the inner armature of the lower set to the left winding of level relay 204 extends to ground over the outer upper front contact of relay 301, and relay 350 operates. Similar circuits are closed for the other relays of the group 350 to 369 which are connected by relay 117 to left windings of level relays. Therefore all relays of group 310 to 329 which are connected to busy lines operate, and all relays of group 350 to 369 which are connected to armatures of relay 117 corresponding to private branch exchange lines are operated irrespective of the individual identity of the wanted line. After an interval, ground is connected through the units register and over the odd or even tens relay to the armature of the test relay corresponding to the wanted line.

For an idle line whether individual or one of a group, the corresponding relay of the group 330 to 349 is operated. For a busy individual line a busy back relay (not shown) is operated. For busy lines of a group, relays 310 to 329 and 350 to 369 cooperate to extend the circuit to the relay of the group 330 to 349 corresponding to the first idle line, or if no line is idle to the busy back relay.

With one of the relays 330 to 349, for example relay 330, operated, relay 301 is released and ground is connected over the right front contact of relay 330, contacts of relays 203 and 117, left winding of relay 204, contact of relay 203, outer upper back contact of relay 301, winding of relay 302 and battery. Relay 302 controls the ringing control relays to signal the junctor to ring over the ring conductor and tells the marker that the wanted line is located on frame No. 0. Relay 204 completes the identification of the level by operating a relay in the line group circuit (not shown).

Line 201 was taken as an example of an individual line or the last line of a terminal hunting group. In this case, with relay 340 normal, the circuit of relay 360 extends over the back contact of relay 340 and contacts of relays 203 and 117 to the middle winding of relay 205, contact of relay 203, directly to the winding of relay 302 and battery. Therefore, neither relay 360 nor relay 302 is operated at this time. Relay 360 normal prevents terminal hunting. When relay 340 substitutes ground for relay 360, relay 302 operates to set ringing and inform the marker that the line is located on frame No. 0.

Line 202 was assumed to be a party line requiring ringing over the tip conductor. When relay 349 operates, assuming the line to be idle, it connects ground over contacts of relays 203 and 117 to the right winding of relay 206 and the winding of relay 305. Relay 305 operates a relay which signals the incoming junctor to apply ringing current to the tip conductor and also informs the marker that the line is located on frame No. 1.

This arrangement also provides a simple means of dealing with unequipped lines. If a line number is unused, the corresponding terminals of the proper twenty-block relay are left disconnected. Therefore, the test relay cannot operate and when the corresponding relay in group 330 to 349 operates, no circuit is closed for a level relay or for a relay such as relay 302, 303, etc. After an interval following the release of relay 301, a circuit is closed over the back contacts of all of the frame indicating relays 302, 303, 304, etc. which causes the transfer of the call to an intercepting operator's position.

The details of several of the above-mentioned functions have not been given since they have been covered in the Carpenter application, Serial No. 68,262.

A study of the drawings and description will show that with this arrangement the lines may be arranged with great flexibility.

The lines bearing a group of twenty consecutive numbers, may be scattered anywhere within a choice, that is anywhere in the ten levels of each of four frames. The entire group may be moved from one choice to another without altering the numbering by changing the cross connection in the upper section of rack III. Alteration of the cross connections in the middle and lower sections may or may not be necessary. If, for traffic reasons, it is desired to change the location of a line within a choice, the number need not be changed, but the sleeve and level leads merely moved in accordance with the new location.

If an entire group of five hundred numbers is not used, the corresponding relay such as relay 103 would be omitted and the lead grounded by the registers connected to a blank number relay. If a group of twenty numbers is omitted, the

terminal in the middle section of rack III is connected to the blank number relay instead of to the line choice connector and the connections to the other sections omitted. As pointed out above, the use of a single number may be discontinued by omitting the connections between the contacts of the twenty-block relay and the line sleeve and the level relay.

What is claimed is:

1. In a telephone system, subscribers' lines of a plurality of types, the numerical and physical groupings of said telephone lines not being the same, numerical group relays having a set of contacts for each line, physical group relays having a winding for each type of line, and means to cross connect the contacts of said numerical group relays and windings of said physical group relays to give a simultaneous indication of the type, and location of a line under test.

2. In a telephone system, subscribers' lines of a plurality of types, the numerical and physical groupings of said telephone lines not being the same, numerical group relays having a set of contacts for each line, physical group relays having a winding for each type of line, and means to cross connect the contacts of said numerical group relays and windings of said physical group relays to give a simultaneous indication of the type, condition and location of a line under test.

3. In a telephone system, party lines requiring special ringing, private branch exchange trunks requiring special testing, said lines being arranged in physical groups independent and differing from their numerical grouping, a relay for each physical group, a relay for each numerical group having a contact for each line in the group control means, and means to cross connect said numerical group relay contact and said physical group relays to indicate to said control means the requirement for special test or for special ringing in accordance with the nature of the line to which said contact is individual.

4. In a telephone system, automatic switches, subscribers' lines having numerical designations, said lines being of a plurality of types and appearing in said switches, the physical grouping of said lines in said switches being independent of said designations, means including a multi-contact relay for selecting a numerical group of lines for test, a relay for each physical group of lines each having a plurality of windings, means for cross connecting contacts of said numerical group relays individual to the lines of the group with one or another winding of said physical group relays in accordance with the type of line, means controlled over said cross connections to indicate the type and location of a line under test, and means under the control of said indicating means to operate said switches to connect with said line.

5. In a telephone system, automatic switches, subscribers' lines having numerical designations, said lines being of a plurality of types and appearing in said switches, the physical grouping of said lines in said switches being independent of said designations, control means including a multi-contact relay for selecting a numerical group of lines for test, a relay for each physical group of lines each having a plurality of windings, means for cross connecting contacts of said numerical group relays individual to the lines of the group with one or another winding of said physical group relays in accordance with the type of line, means controlled over said cross connections to indicate the type and location of

a line under test, means under the control of said indicating means to operate said switches to connect with said line, and means effective if the cross connections of a line are omitted to indicate to said control means that the line number is unused.

6. In a telephone system, automatic switches, subscribers' lines to be treated as individual lines, private branch exchange trunks requiring special testing, and lines requiring special ringing, said lines appearing in said switches in physical groups, a multi-winding relay for each of said physical groups, control means for testing said lines, and controlling said switches, multi-contact relays associable with said control means having a contact for each line in numerical groups differing from said physical groups, means to cross connect said contacts to windings of said physical group relays in accordance with the location and nature of said lines, numerical means for selecting one of said contacts, and means in said control means operated over said contact and cross connection to indicate the location of the corresponding line.

7. In a telephone system, automatic switches, subscribers' lines to be treated as individual lines, private branch exchange trunks requiring special testing, and lines requiring special ringing, said lines appearing in said switches in physical groups, a multi-winding relay for each of said physical groups, control means for testing said line and controlling said switches, multi-contact relays associable with said control means having a contact for each line in numerical groups differing from said physical groups, means to cross connect said contacts to windings of said physical group relays in accordance with the location and nature of said lines, numerical means for selecting one of said contacts, and means in said control means operated over said contact and cross connection to indicate the location of the corresponding line if said line is an individual line, and means in said control means operated over said contact and cross connection if said line is a private branch exchange trunk to render the operation of said indicating means dependent on the first idle trunk.

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