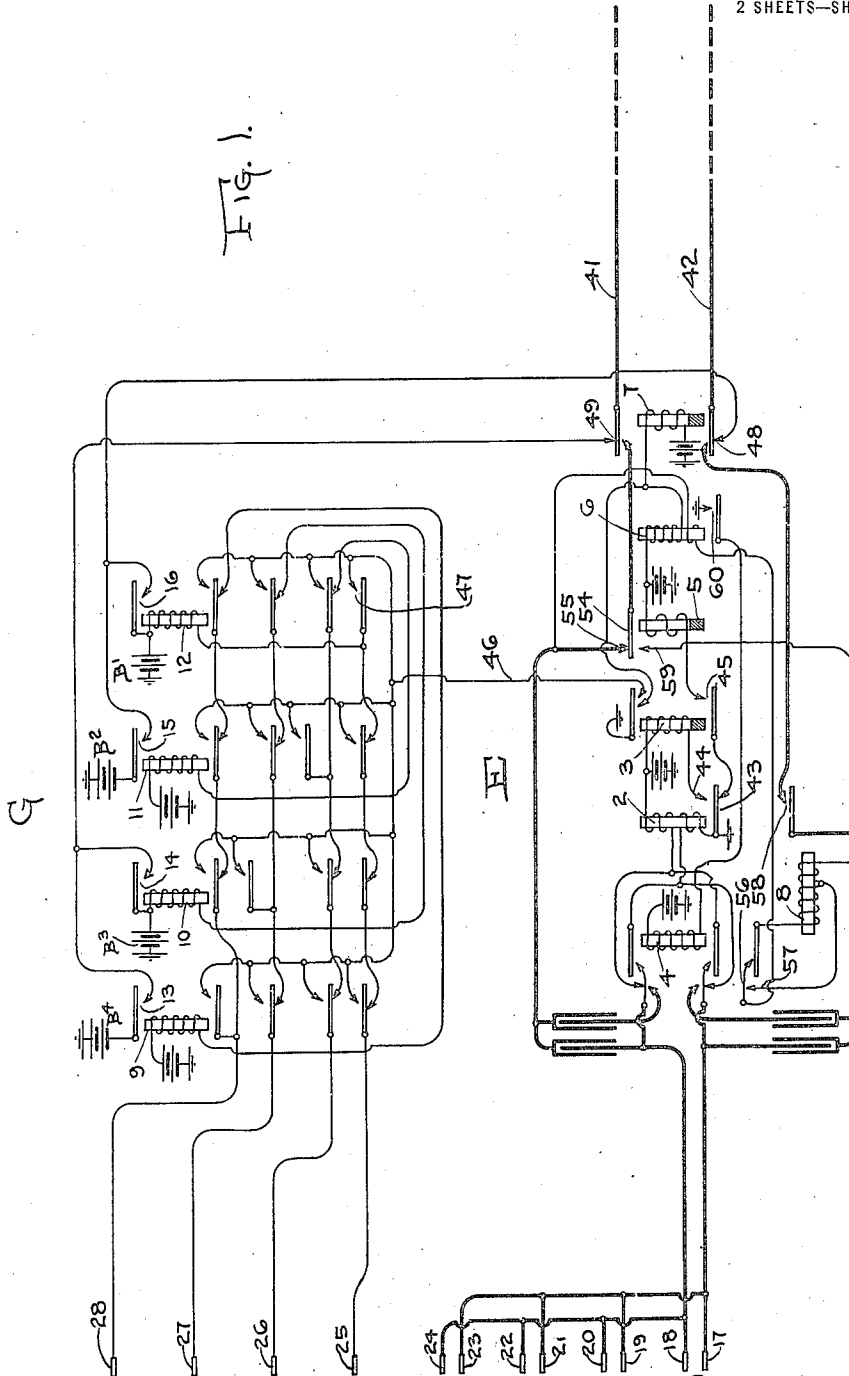


T. G. MARTIN.
AUTOMATIC TELEPHONE SYSTEM.
APPLICATION FILED FEB. 4, 1918.

1,435,249.

Patented Nov. 14, 1922.

2 SHEETS—SHEET 1.



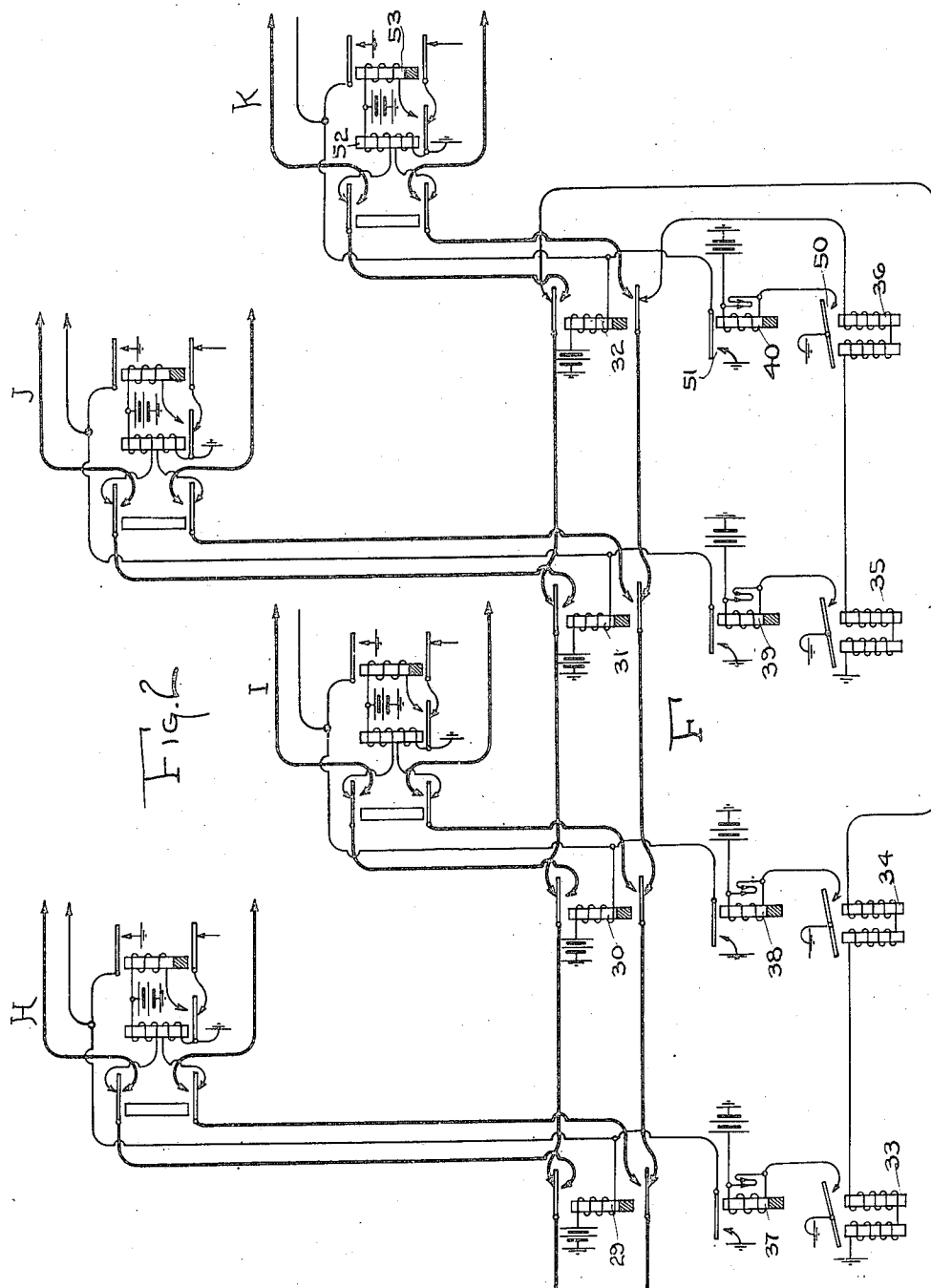
Inventor
Talbot G. Martin
By E. D. Fales.
Attorney

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UNITED STATES PATENT OFFICE.

TALBOT G. MARTIN, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC TELEPHONE SYSTEM.

Application filed February 4, 1918. Serial No. 215,235.

To all whom it may concern:

Be it known that I, TALBOT G. MARTIN, a citizen of the United States of America, and a resident of Chicago, Cook County, and State of Illinois, have invented certain new and useful Improvements in Automatic Telephone Systems, of which the following is a specification.

My invention relates in general to apparatus and circuits for use in automatic telephone systems and more specifically to an improved method of extending connections from one exchange to another.

Among the objects of my invention are to decrease the number of trunks necessary for the establishment of connections between two exchanges; to make it possible to obtain access to a plurality of lines in different groups in one exchange, or to a plurality of groups of different character over a single trunk line between exchanges.

Heretofore in calling in from a small branch exchange to a larger exchange it has been necessary to provide a plurality of groups of trunk lines between the exchanges, one group of trunks for each group of lines in the main exchange. Also if it was desired to give the branch exchange subscribers access to an operator for trouble or long distance, another group of trunks was required. This causes a large number of trunks to be required for each purpose even though the traffic was very low. In my improved system I have made it possible to use a single group of trunks for all such purposes and to make this single group of trunks accessible from a number of levels of the selectors in the branch exchange that number corresponding to the number of groups to which it is desired to have access, for instance when one of this group of trunks is seized from one level of the selector, mechanism is provided at the main exchange to switch the trunk automatically to one group, or to one operator as desired whereas when the same trunk is seized from another level, other mechanism is operated to cause the said trunk line to be switched over to another group or operator and so on. Therefore the traffic may be handled much more efficiently by a small number of trunks, the same trunks being used for calling into various groups or levels and for calling information, toll or trouble. Further objects and features of my invention will be pointed out hereinafter

with reference to the accompanying drawings.

In the drawings I have illustrated that portion of a telephone system which is used to call from one exchange to another namely a repeater in one exchange (Fig. 1) in which terminates an outgoing trunk line to a second exchange (Fig. 2) where the said trunk line terminates in a combination of relays. It will be understood that the repeater E (Fig. 1) is one of a number of similar repeaters which are accessible to the usual Strowger type of selector switches only the bank contacts of which are shown. Also it will be understood that the relay set shown in (Fig. 2) may be readily changed to switch the incoming trunk line to any desired mechanism such as an operator's position. I have shown each relay as switching the connection to a selector of the Strowger type for the sake of simplicity and have shown only the line and release relays, respectively, of said selectors, it being understood that a line switch or a connector or another selector of any well known type may be substituted for that shown without in any way departing from the spirit of my invention.

Referring to Fig. 1, the repeater E, is of a well known type of repeater, which is controlled by impulses over two sides of the line circuit in series and which operates to repeat said impulses over two sides of the trunk line to a distant exchange, this repeater comprises, among other details, a line or repeating relay 2, a release relay 3, a reversing relay 4, a pair of back bridge relays 6 and 8, and a pair of auxiliary slow relays 5 and 7. The trunk line leading to the repeater E, as well as the private conductors associated therewith, is multiplied into various levels of the selector switches of the branch exchange, one level for each class or group of lines in the main exchange to which access is desired. Each private conductor associated with this repeater E has a relay individual thereto which controls the set of relays F (Fig. 2) in a particular manner to switch the trunk line 41 and 42 over to a certain group of lines in the main exchange. These relays associated with the private conductors are shown in Figure 1 above the repeater E in a group G.

Associated with the trunk line 41 and 42 in the main exchange (Fig. 2) is a group of relays F which are controlled by impulses

of different character from the various relays G (Fig. 1) to switch the trunk line 41 and 42 over to one of a number of selectors II, I, J or K as desired, or to an operator or any other circuit which may be substituted for the said selectors. It may be here noted that the relays 33 and 34 are connected to the conductor 41 through the back contacts of the relays 29, 30, etc., and that the relays 35 and 36 are connected to the conductor 42 through similar back contacts. The relays 33 and 34 are polarized relays, the relay 33 responding only to current from a battery whose negative terminal is grounded and relay 34 responding only to current from a battery whose positive terminal is grounded. Also the relays 35 and 36 are polarized in the same manner, relay 35 responding to current from positive battery and relay 36 responding to current from negative battery.

I will now describe in detail the details and method of operation when a subscriber in the branch exchange seizes the repeater E through the first level (for instance) and thereby establishes a connection with the selector K (Fig. 2). Where connection is extended to repeater E by a selector, which may be of any approved type preferably of Strowger 2 wire type, the first operation of said selector after having tested the contacts 17, 18 and 25 and found them idle is to throw a ground out on its private wiper and thence over the contact 25, through the back contacts of relays 9, 10 and 11 and through relay 12 to battery B'. Also when the selector cuts the calling line through to repeater E a circuit is closed for the line or repeating relay 2 of the repeater E over the two sides of the calling line in series. The relay 2 upon energizing, closes a circuit from ground through springs 43 and 44 and relay 3 to battery. Relay 3 upon energizing, prepares a circuit for the relay 5 at springs 45, supplies ground to the lead 46, and also closes a circuit for the upper winding of relay 6 and relay 7 in parallel. Relay 7 energizes over this circuit but relay 6 does not energize it being adjusted so as not to energize except with both of its windings energized by current in the same direction. Before the relay 7 has had time to energize, however, the relay 12 has operated its armatures due to current flowing in the above traced circuit, and closed a locking circuit for itself through the springs 47 to the lead 46 and also closed a circuit from battery B', the positive pole of which is grounded, through the springs 16, springs 48, conductor 42, back contacts of relays 29, 30, 31 and 32, and through the relays 36 and 35 to ground. As hereinbefore pointed out only the relay 36 of these last named relays is adjusted to operate its armature when current from negative battery passes there-

through, the relay 36 will therefore operate to close a circuit for the relay 40 from ground through the springs 50. Relay 40 will thereupon energize to close a circuit for relay 32 from ground through springs 51. Shortly after the relay 12 closed the above circuit for the relay 36 (Fig. 2) the relay 7 energized and opened the said circuit at the springs 48, so that the relay 36 receives only a momentary impulse of current from negative battery B', while the relay 12 locked in energized position over a circuit which receives ground from the upper springs of relay 3. Relay 12 while in energized position also extends the ground from the springs of relay 3 through its front contacts to all the private contacts 25, 26, 27 and 28 in the various levels, thereby rendering the repeater E busy to all calls.

Returning to the operation of relay 36 it will be seen that although the relay 36 was energized for only a brief interval the relay 32 is energized for a much longer interval due to the slow action of the relays 40 and 32 and in its energized position operates to disconnect the trunk line conductors 41 and 42 from the relays 33 to 36 inclusive and connects said trunk conductors instead to a trunk line leading to the selector switch K. In the meantime the relay 7 has energized so that as soon as relay 32 operates a circuit is completed from battery through the upper winding of relay 52, upper front contact of relay 32, upper back contacts of relays 31, 30 and 29, conductor 41, upper front contact of relay 7, springs 54 and 55, lower winding of relay 6, springs 56 and 57, right hand winding of coil 8, springs 58, lower front contacts of relay 7, conductor 42, lower back contacts of relays 29, 30 and 31, lower front contact of relay 32, and through the lower winding of line relay 52 to ground. The line relay 52 energizes over this circuit to close a circuit for the well known release relay 53 which in turn energizes to prepare a circuit for the operating magnets of the switch K (not shown) and also to supply a holding ground to the relay 32. The relay 6 (Fig. 1) does not energize over the above circuit as the current flowing in its lower winding over this circuit opposes that flowing in its upper winding. It will be seen that the trunk line 41 and 42 is now ready for the usual impulses and is entirely disconnected from the relay sets G and F. Also it will be seen that the repeater E and therefore the trunk line 41 and 42 is busy to all calls from the branch exchange in the various levels of the selector private banks in which its private trunk is multiplied.

As soon as the selector K has been selected, the calling subscriber will operate his calling device to thereby open and close the circuit of the line relay 2 of repeater E a num-

ber of times corresponding to one of the digits of the called number. The line relay 2 in response to these impulses attracts and retracts its armature a corresponding number of times. The slow relays 3, 5 and 7 maintain their armature attracted during this operation, the slow relay 5 operating to disconnect the winding of coils 6 and 8 from the outgoing circuit and closes an impulsing circuit for the line relay 52 of selector K extending through the upper front contacts of the relay 7, springs 54 and 59, springs 58, and lower front contacts of the relay 7. Each time the line relay 2 deenergizes the circuit of the relay 52 is opened and this relay operates in a manner well known to this type of selector switch to control the usual vertical, rotary and private magnets to extend the connection beyond said selector. After the connection is extended beyond such selector the usual switching relay of this selector is operated to disconnect the relays 52 and 53, and to extend the holding circuit of the slow relay 32 to the next succeeding switch.

As soon as the impulses for all the digits have been repeated by the repeater E, the line relay of said repeater comes to rest in its energized position, allowing the slow relay 5 to deenergize and restore the windings of coils 6 and 8 in series with the trunk line and therefore in series with a line relay of the last of the switches which was used in establishing the connection in a well known manner. The called subscriber is now automatically signalled and upon lifting his receiver operates the connector switch in the usual manner to reverse the connections of the line relay of said connector with regard to the extended talking circuit to thereby reverse the direction of the current flow in the lower winding of the back bridge relay 6 of repeater E.

The two windings of said relay 6 being now energized in the same direction, said relay will energize to close a circuit at the springs 60 for the reversing relay 4. Relay 4 upon energizing, operates to reverse the connections of the line relay 2 to reverse the direction of the current flow in the calling line or operator's cord circuit as the case may be for any purpose and also operates to include the left hand high resistance winding of coil 8 in series with the right hand winding thereof and with the winding of coil 6 in the holding circuit or back bridge which reduces the current flow in the trunk line 41 and 42 without causing any other change to occur.

The release of the extended connection is accomplished in the usual manner by the restoration of the receiver of the calling subscriber. This causes the line relay 2 to deenergize. The relay 2 upon deenergizing, allows relays 3 and 7 to deenergize. Relay 3

upon deenergizing, removes the ground from the release trunk to cause the relay 12 to be deenergized which in turn removes the ground from all the private contacts 25, 26 etc. The relay 7, upon deenergizing, opens the back bridge of the repeater E and thereby opens the holding circuit of the connector to which the connection has been extended, the connectors and selectors thereupon release in the usual manner and therefore remove the ground from the holding circuit of the relay 32 (Fig. 2) which in turn deenergizes and restores the relays 33 to 36, inclusive, to connection with the trunk conductors 41 and 42.

It will therefore be seen that I have provided a very simple and efficient method of operation which enables one trunk line, or a group of such trunk lines to be used for calling into a plurality of groups or to a plurality of different classes of lines.

It will be understood that when the repeater E is seized from the second level for instance the relay 11 will be operated by ground over the private conductor 26 and will then operate to deliver a momentary impulse of current from the positive pole of battery B² over the conductor 42 to operate the relay 35 (Fig. 2) in which case the said trunk line will be extended to the selector J by means of the relay 31. Also when connection is made with the third level of said selector banks, the relay 10 will operate to send a momentary impulse from negative pole of battery B³ over the conductor 41 to operate the relay 34, and when relay 9 is operated it will in turn operate the relay 33.

As before stated this trunk line may at one point for instance in place of selector H be given access to an operator, while at another point frequency selectors, or any other class of service may be obtained without in any way departing from the spirit of my invention.

Having described my invention and the method of operation thereof I will point out in the appended claims what I consider to be new and desire to have protected by Letters Patent.

What I claim as my invention is:

1. In a telephone system, a trunk line, other trunk lines individual to said first trunk line but normally disconnected therefrom, a plurality of relays associated with said first mentioned trunk line, each of said relays responsive to an impulse of current of a different character to connect said first trunk line with a different one of the last mentioned trunk lines and to render said other relays inoperative, and an automatic progressively movable switch for seizing said first trunk line, for electing which one of said relays shall be operated, and for operating the elected relay.

2. In a telephone system, a trunk line comprising a pair of conductors, a plurality of relays connected in series with each conductor of said trunk line, other trunk lines associated with said first trunk line, said relays each responsive to an impulse of a particular character to connect said first trunk line with a particular one of said other trunk lines.
3. In a telephone system, a trunk line comprising a pair of conductors, other trunk lines associated with said first trunk line, a pair of relays connected in series with each conductor of said trunk line, one of the relays on each conductor responsive to impulses of one character only and another relay on each conductor responsive only to impulses of another character and means for operating each of said relays to connect said first trunk line with a different one of said other trunk lines.
4. In a telephone system, a trunk line, a repeater on one end of said trunk line, a plurality of relays at the other end of said trunk line, means for connecting with said repeater over a plurality of different paths, and means for operating any one of said relays responsive to the establishment of said connection, the relay operated depending upon which of said paths is used.
5. In a telephone system, a trunk line, a repeater associated with one end of said trunk line, a plurality of other trunk lines normally disconnected from said first trunk line, a plurality of relays associated with the other end of said trunk line, each adapted to connect said first trunk line with a different one of said other trunk lines, means for extending a connection to said repeater over a plurality of different paths, and means independent of subscriber control for operating any one of said relays when connection is extended to said repeater, the relay operated depending upon the path used.
6. In a telephone system, a trunk line, a repeater at one end and a set of relays at the other end thereof, a selector switch for seizing said repeater, the talking conductors and the test conductor of said repeater multipled into a plurality of levels in said selector, a relay for each multiple of said test conductor, means for energizing the associated relay when said selector switch tests one of said private multiples, a plurality of trunk lines adapted to be connected with said first trunk line by said set of relays, and means whereby when any one of said relays associated with a test conductor is energized, a certain one of the relays of said set is operated to in turn connect said trunk line to a certain one of said other trunk lines.
7. In a telephone system, a trunk line other trunk lines normally disconnected therefrom, a repeater, said repeater having means for connecting different characters of battery to any conductor of said trunk line to operate another means for connecting said trunk line to any one of said other trunk lines and for thereafter repeating impulses to said other trunk line.
8. In a telephone system, a trunk line, other trunk lines normally disconnected therefrom, a relay individual to each of said other trunk lines controlled over said first trunk line, a progressively movable switch for seizing said first trunk line and combined means for extending battery thereover for operating the relay individual to the desired trunk.
9. In a telephone system, a trunk line, other trunk lines normally disconnected therefrom, a relay individual to each of said other trunk lines controlled over said first trunk line, a progressively movable switch for seizing said first trunk line and combined means for connecting batteries of different polarities to operate the desired one of said relays.
10. In a telephone system, a trunk line, a plurality of branches associated with one end of said trunk line, a plurality of corresponding branches associated with the other end of said trunk line, two talking conductors and a test conductor for each of said last mentioned branches, an automatic switch for seizing any one of said last mentioned branches, and means controlled over the test conductor of the seized branch for connecting the corresponding branch at the opposite end of said trunk line with said trunk line.
11. In a telephone system, a trunk line, a plurality of branches associated with one end of said trunk line each terminating in an automatic switch, a plurality of corresponding branches associated with the other end of said trunk line, two talking conductors and a test conductor for each of said last mentioned branches, another automatic switch adapted to seize any one of said last mentioned branches, and means controlled over the test conductor of the seized branch for preparing the switch associated with the corresponding branch at the other end of said trunk line for operation.
12. In a telephone system, a trunk line having a plurality of incoming branches at the originating end thereof, a corresponding plurality of outgoing branches at the distant end of said trunk line, said last branches being individual to said trunk line but normally disconnected therefrom, an automatic switch operable to extend a connection to said trunk line via any desired one of said incoming branches, a repeater included in said trunk line for establishing a holding circuit for said switch, and relay mechanism at the distant end of said trunk line controlled thereover responsive to the establish-

ment of said connection for connecting up the outgoing branch corresponding to the incoming branch in use.

13. In a telephone system, a trunk line 5 having a plurality of incoming branches at the originating end thereof, a corresponding plurality of outgoing branches at the distant end of said trunk line, said last branches being individual to said trunk line but normally disconnected therefrom, an automatic 10 switch operable to extend a connection to said trunk line via any desired one of said incoming branches, a repeater included in said trunk line for establishing a holding 15 circuit for said switch, relay mechanism at the distant end of said trunk line for connecting up the outgoing branch corresponding to the incoming branch in use, and relay mechanism associated with said repeater for 20 controlling said distant relay mechanism by establishing characteristic circuits over said trunk line.

14. In a telephone system, a trunk line having a plurality of incoming branches at

the originating end thereof, a corresponding 25 plurality of outgoing branches at the distant end of said trunk line, automatic switching mechanism for connecting with said trunk line via any desired one of said incoming 30 branches, a device for momentarily establishing a characteristic circuit over the trunk line when the incoming branch is connected with, a plurality of connecting relays at the distant end of said trunk line, one of said 35 relays being responsive to the establishment of said characteristic circuit for connecting the outgoing branch corresponding to the incoming branch in use, relay means controlled over the connected outgoing branch for completing a holding circuit for the energized 40 connecting relay, and means including a slow acting relay for maintaining said connecting relay energized during the interval between the opening of said characteristic circuit and the closing of said holding circuit. 45

Signed by me at Chicago, Cook County, State of Illinois.

TALBOT G. MARTIN.