

A. M. MALMBERG.
 AUTOMATIC TELEPHONE TRUNKING SYSTEM.
 APPLICATION FILED NOV. 8, 1915.

1,289,504.

Patented Dec. 31, 1918.

3 SHEETS—SHEET 1.

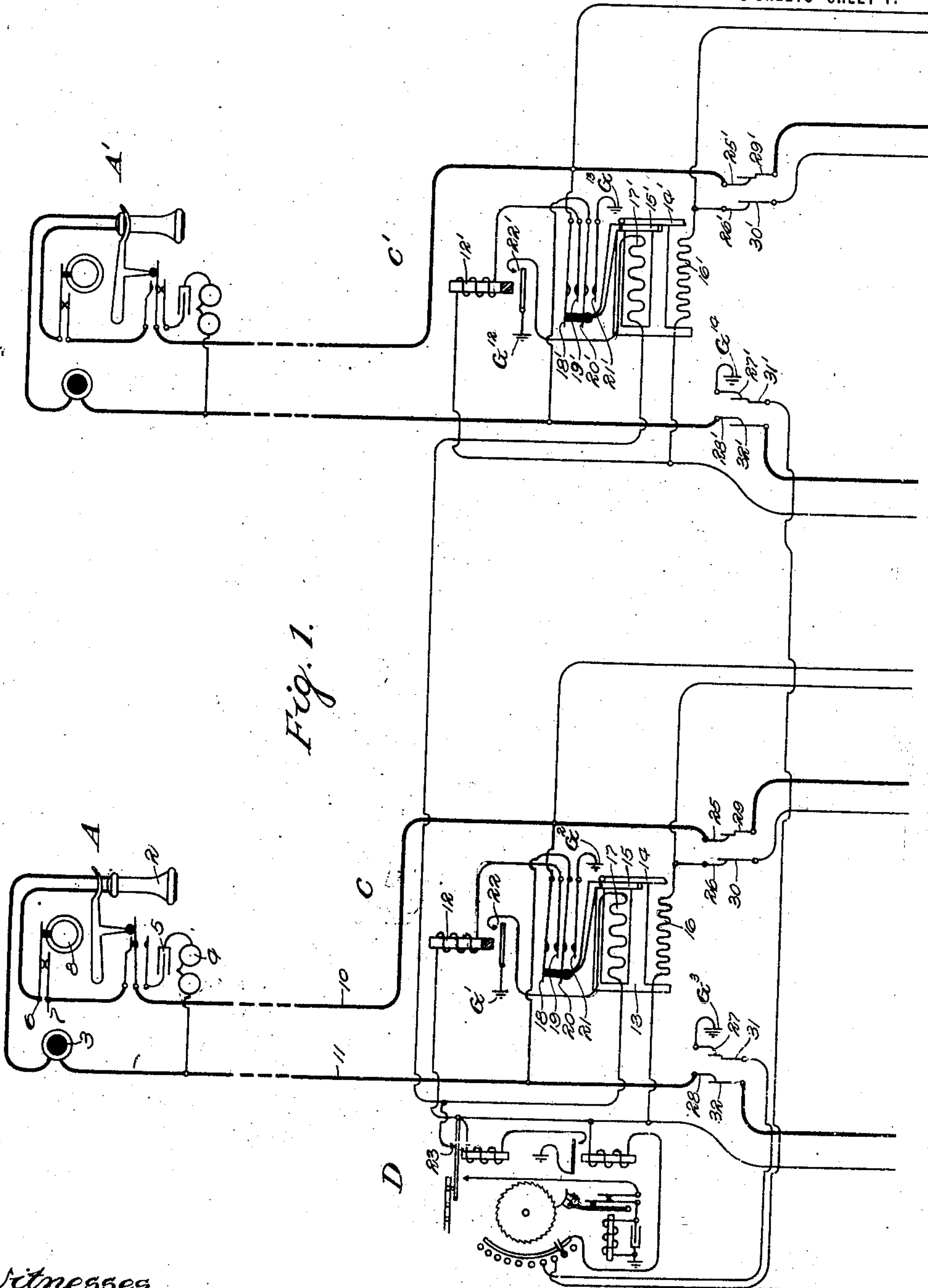


Fig. 1.

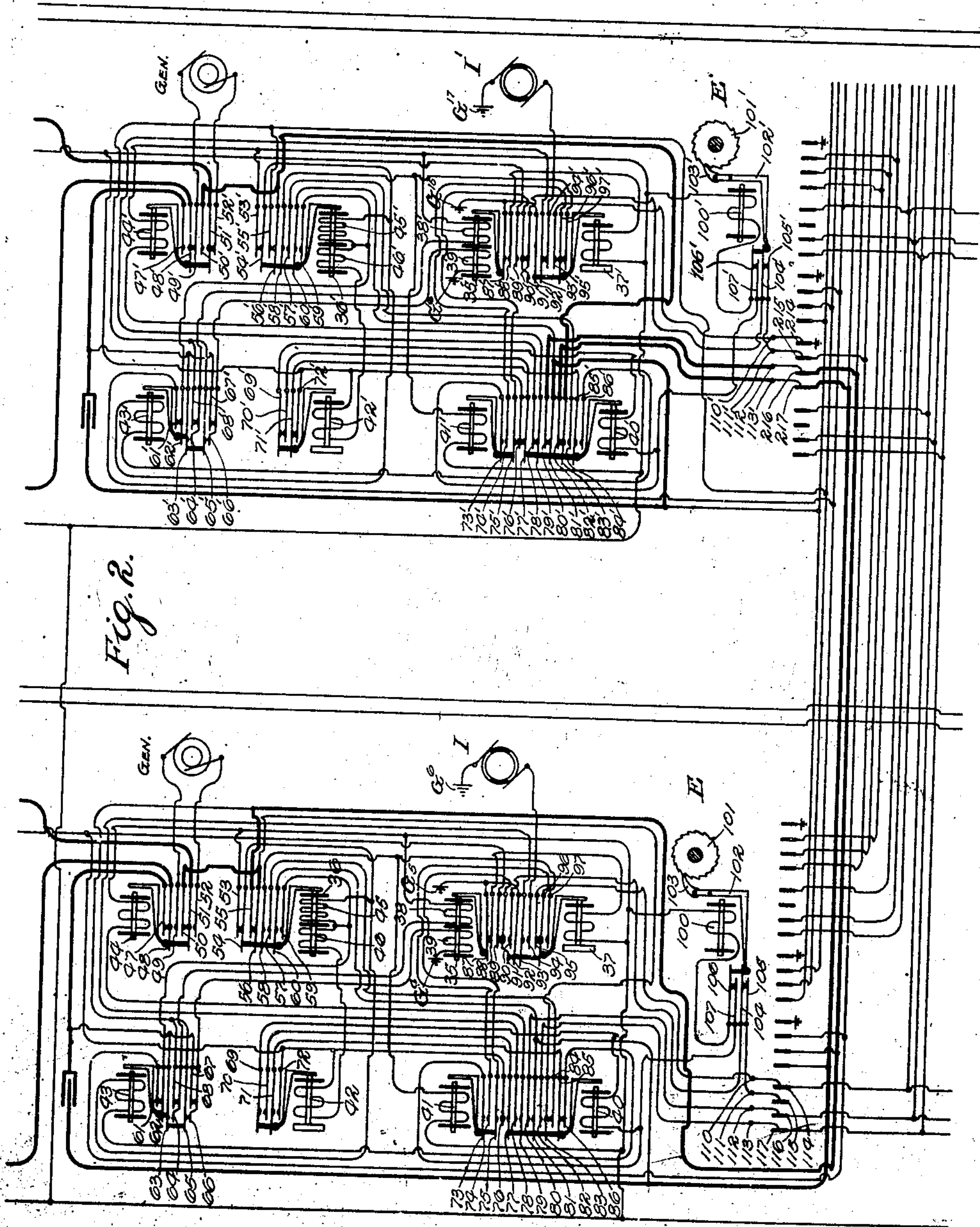
Witnesses
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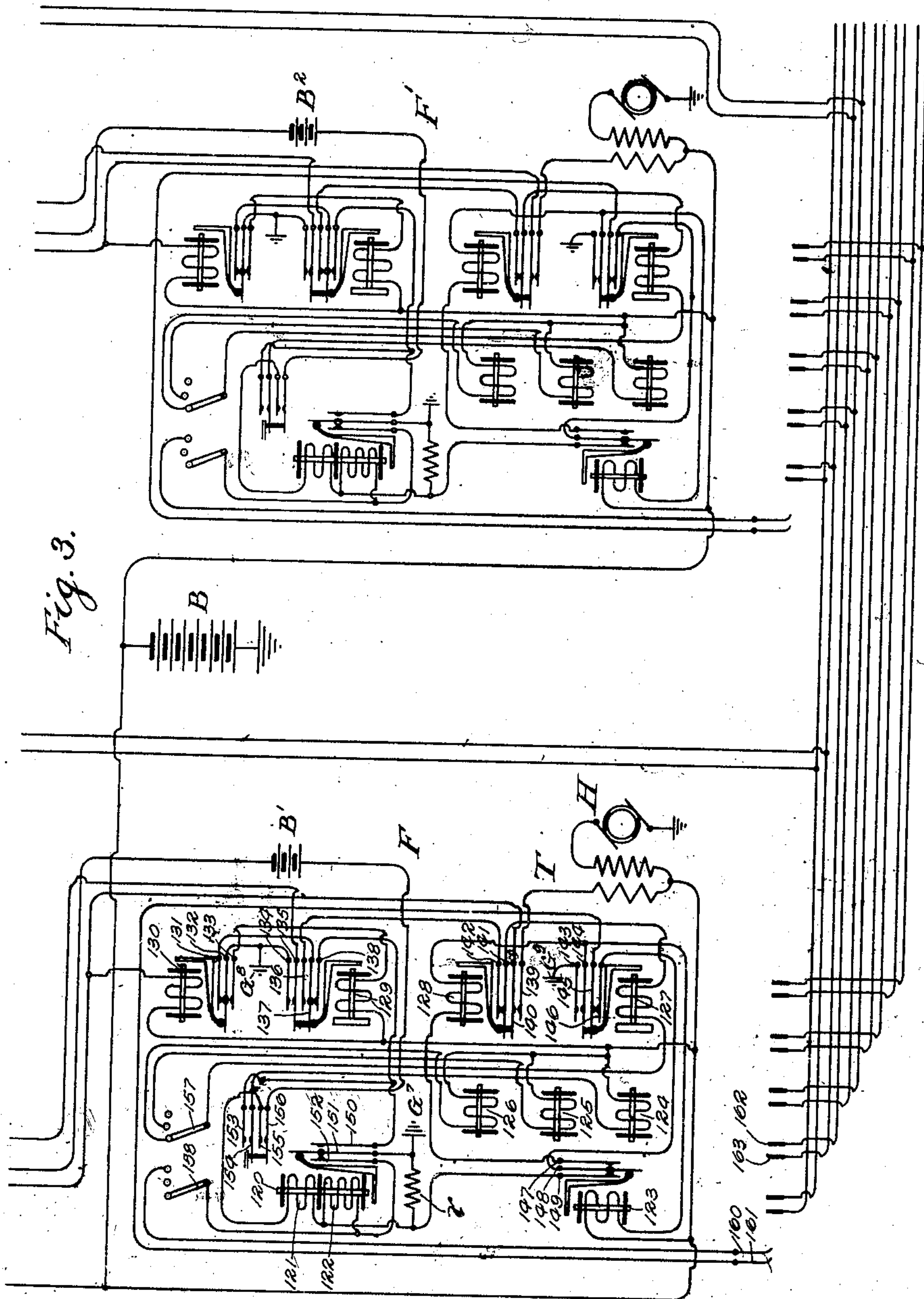
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UNITED STATES PATENT OFFICE.

ANDERS M. MALMBERG, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

AUTOMATIC TELEPHONE TRUNKING SYSTEM.

1,289,504.

Specification of Letters Patent.

Patented Dec. 31, 1918.

Application filed November 8, 1915. Serial No. 60,272.

To all whom it may concern:

Be it known that I, ANDERS M. MALMBERG, a citizen of the United States, and resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Automatic Telephone Trunking Systems, of which the following is a specification.

My invention relates to automatic telephone trunking systems and more particularly to those automatic trunking systems in which numerical and non-numerical switches are employed and in which, for example, a non-numerical switch is used to extend a connection from a subscriber's line to a numerical trunking switch.

Among the objects of my invention are the following: to provide, in a system of the above character, means for extending a connection through the medium of a non-numerical switch to a numerical switch, which latter is then employed in locating the desired line, whereupon another non-numerical switch is brought into use for finding the first non-numerical switch, whereby the connection between the calling and called lines may be established over a more direct path directly from one non-numerical switch to another to the exclusion of the numerical switch; thereby providing a connection from a calling to a called line exclusively through non-numerical switches.

Another object of my invention is to provide means for releasing the numerical switch after it has performed its function in establishing a connection, thereby making it accessible to other calling lines.

Another object of my invention is to provide separate holding circuits for the calling and called non-numerical switches, these holding circuits being under the control of the calling and called subscribers, respectively, thereby permitting either party to a connection to terminate it at will.

Another object of my invention is the provision of means whereby the non-numerical switch of the called line may test for and locate the non-numerical switch of the calling line without interference from other lines which may be calling at the same time, such means consisting of an individual battery for each trunk.

Another object of my invention is to provide certain details of improvement in a system of the above character tending to in-

crease the efficiency and serviceability of an automatic trunking system.

To accomplish the foregoing and other useful ends my invention comprises the means hereinafter set forth and claimed.

In the drawings Figures 1 and 2 show a complete connection between a calling substation A and a called sub-station A' in an automatic system embodying the principles of my invention, and Fig. 3 shows several of the numerical switches or connectors, one of which has been used temporarily to assist in establishing the connection. To fully comprehend the circuits illustrated herein the drawings should be placed side by side in order and with the lines at the sides thereof in alinement.

Referring to Fig. 1, at A and A' there are represented two substations to the line conductors of which there are allotted at the central office individual or line switches C and C'. At D there is shown a master switch for controlling the switches C and C' and similar switches individual to other substations. Referring now to Fig. 2, at E and E' are shown non-numerical rotary switches which are accessible to the line switches C and C'. In connection with each switch E and E' is shown a group of relays whose functions will be described. In Fig. 3, at F and F' are shown connector switches each of which contains terminals of all the lines entering the office. At B is shown a battery the undergrounded pole of which may be traced through all the drawings in order.

The substation shown herein may be of any suitable or approved type and comprises the usual receiver 2, transmitter 3, ringer 4, and condenser 5. Being an automatic substation, it is also provided with an impulse transmitter or calling device which is represented herein by a pair of impulse springs 6 and 7 and an impulse wheel 8, which latter is assumed to be controlled by a finger hole dial (not shown) in such a manner that the impulse springs 6 and 7 may be momentarily separated a number of times corresponding to each digit of the called line.

The line switch C which is associated with the line of substation A is of the general type of line switch shown in British patent to R. W. James, No. 26,301 of 1906; being, however, more nearly of the particular type disclosed in U. S. Letters Patent No. 1078690, granted Jan. 17, 1912, to Frank

Newforth. This line switch comprises among other details a plunger (not shown) attached to the end of a so called plunger arm 14 which is controlled by the magnet 13.

5 The magnet 13 comprises two windings, the pull-in winding 17 and the holding winding 16. The winding 17 operates both the plunger arm 14 and the cut-off armature 15, but the winding 16 is only strong enough to hold
10 the plunger arm and cut-off armature in an operated position after they have been operated by the winding 17.

The circuit of the pull-in winding is controlled by the line relay 12 which is slow acting, *i. e.*, it retains its armature for an instant after the energizing circuit is broken. When the plunger arm 14 is operated the plunger is forced into a bank of springs, forcing the springs 25, 26, 27, 28 into engagement with the contacts 29, 30, 31, 32, respectively. Although only one set of
20 springs and contacts (25 to 32) is shown, it is to be understood that each line switch is provided with a plurality of such sets, each set forming the terminal of a trunk line extending to a rotary switch E. Each trunk line is connected in multiple to the corresponding springs of all the switches controlled by the master switch D.

30 The master switch D is of the same general type as that disclosed in British patent to R. W. James, No. 26,301 of 1906 above referred to; being, however, more nearly of the particular type disclosed in British patent to T. G. Martin, No. 1410 of 1910. The function of the master switch, as is well known, is to maintain the plungers of all the idle line switches in position before an idle trunk line.

40 The rotary switch E may be of any suitable construction in so far as its mechanical details are concerned, it being only required that the wipers 110, 111, 112, 113 and their connections be so constructed as to permit of
45 a forward movement in one direction only. As shown herein diagrammatically, the ratchet wheel 101 is adapted to be actuated by the motor magnet 100 through the medium of its armature 102 and pawl 103. At
50 each energization of the motor magnet 100 it interrupts its own circuit thereby causing a rapid vibration of its armature, which results in the rotation of the ratchet 101 and causes the wipers (110—113) mounted there-
55 on to traverse the contact sets, such as (114—117) in the bank. The bank contact sets, such as (114—117) shown herein as arranged in a straight line for convenience in drawing, are preferably arranged in a complete circle with the wipers (110—113) carried by the ratchet 101 pivotally mounted in the center thereof. The bank contacts of all the rotary switches are in multiple and form terminals of two different kinds of
60 trunks. The contacts (114—117) and simi-

lar sets are multiple terminals of trunk lines leading to connectors F, F', etc., while the contacts (214—217) and similar sets are multiple terminals of trunk lines leading to the rotary switches E, E', etc. At the left
70 of Fig. 2 the first set of multiple contacts (114—117) is shown connected to a trunk leading to a connector F. The next two sets of contacts are similar to contact set (214—217) and are multiple terminals of
75 trunk lines, leading to rotary switches E and E'. The fourth set of contacts is similar to contact set (114—117) and is the multiple terminal of a trunk line leading to a connector F'. While I have shown every
80 third set of contacts as being the multiple terminal of a connector trunk, the rest being multiple terminals of rotary switch trunks, I do not wish to limit myself to any definite proportion between the two kinds of trunks.
85 In actual practice it has been sufficient to make every sixth set of multiple contacts the terminal of a connector trunk.

Since the rotary switch must be capable of testing trunks of either kind at the proper
90 time two test wipers 110 and 111 are provided. When it is required that an idle connector trunk be selected the test wiper 110 is made effective, but while testing for a rotary switch trunk the test wiper 111 is
95 made effective. To enable the wipers to pass all rotary switch trunks when testing for an idle connector trunk, the top contact 214 of all rotary switch trunks is permanently connected to the ground.

100 The connector switch F is of the same general type and construction as that disclosed in U. S. Letters Patent No. 815,176, granted March 13, 1906 to Keith, Erickson and Erickson, the circuits and mechanism
105 however, being modified somewhat to enable it to operate in accordance with my invention. It has the usual magnets for raising and rotating the shaft and for effecting the release of the same. The private magnet
110 123 controls the movement of the side switch wipers 157 and 158 in the well known manner. A busy test relay 128 is provided for connecting one side of the trunk with the induction coil T and busy machine H at
115 the proper time. The battery B' is permanently associated with the connector F and the battery B² is permanently associated with the connector F' in fact every connector such as F or F' has its individual
120 battery such as B' or B². The bank contacts of all the connectors are in multiple and form terminals of normal wires which extend to the incoming negative line and holding winding of the line switches C, C',
125 etc., and it is understood that each incoming line to the exchange is represented by a set of multiple contacts in the connector banks.

Having given a general description of the apparatus I will now describe in detail the
130

operation of my system. It will be shown how the subscriber at A, by taking off his receiver will be automatically connected with an idle rotary switch E which will operate automatically to connect with an idle connector F. It will furthermore be shown how the subscriber at A, by sending two series of impulses to the connector F, can place its wipers upon the normal contacts belonging to the line switch C' associated with the substation A', upon which the line switch C' is operated to make connection with an idle rotary switch E' which rotates automatically until its wipers reach the multiple contacts belonging to the rotary switch E, whereupon its movement is arrested and a connection is completed from substation A to substation A' through line switch C, rotary switch E, rotary switch E' and line switch C'. It will furthermore be shown how, on the completion of this connection, the connector F is released and made accessible to other calling lines. It will furthermore be shown how either party to a connection, such as the subscriber at A or the subscriber at A', can effect the disconnection of his individual line switch and the rotary switch with which it is temporarily connected, independently of the other party.

When the subscriber at A, in making the call, raises the receiver from the hook, a circuit is completed for the line relay 12 of the line switch C, which circuit extends from ground at G², through normally closed contact springs 21 and 20, and over line 11 to substation A, whence it returns over line 10, through normally closed contact springs 18 and 19, and winding of relay 12 to battery B. Upon the energization of the line relay a circuit for the pull-in winding 17 is closed as follows: ground at G', contact 22, pull-in winding 17, contact 23 to battery B. Upon the energization of the pull-in winding the plunger arm 14 and the armature 15 are attracted, the former, by means of its plunger, causing the springs (25—28) to make connection, respectively, with the contacts 29—32; and the latter breaking the connection of the springs 18 and 20 with the springs 19 and 21, respectively.

By the engagement of springs 25 and 28 with contacts 29 and 32, respectively, a circuit is closed for the relay 35 and the line relay 41 of the switch E as follows: ground at G⁴, winding 39 of relay 35, contact springs 66 and 67, contact springs 47 and 48, contact 32, springs 28, previously traced circuit through subscriber's loop, spring 25, contact 29, contact springs 51 and 50, contact springs 83 and 84, contact springs 57 and 58, and winding of relay 41 to battery B.

When relay 35 attracts its armature it closes a circuit for the slow acting relay 37, which circuit extends from ground at G⁵, through contact springs 87 and 88, and

winding of relay 37 to battery B. Upon the energization of relay 37, a holding circuit for the winding 16 of the line switch C is established over the following path: ground at G⁵, contact springs 92, 91 and 89, contact 30, spring 26, and holding winding 16 to battery B. It is understood that the line relay 12 of the line switch C is slow acting in order that the holding circuit just described may be established before it retracts its armature and opens the contact 22. A branch of the holding circuit extends from the junction of the holding winding and spring 26 to the multiple test contact of line switch C in the connector banks where it makes the line busy to incoming calls. As a further result of the energization of relay 37, test wiper 111 is disconnected (contact springs 90 and 91), test wiper 110 is connected up (contact springs 95 and 96), and the contact springs 93 and 94 included in a circuit for the ringing relay, are separated.

When the line relay 41 attracts its armature it completes a circuit for the relay 40 and also completes a circuit to the test wiper 110. The former circuit extends from ground at G⁵, through contact springs 92, 91 and 89, contact springs 76 and 77, contact springs 70 and 69, winding of relay 40, contact springs 107 and 106, and winding of motor magnet 100 to battery B. The latter circuit is as follows: wiper 110, contact springs 95 and 96, and contact springs 74 and 73, to the lower terminal of relay 40, where it joins the previously described circuit of that relay. Now, if the test wiper 110 is resting upon an idle or ungrounded test contact the relay 40 energizes at once from ground at G⁵ and the wipers are not rotated because the winding of the relay 40 is of too high resistance to permit the motor magnet 100 to effectually energize in series with it. If, however, the wiper 110 is resting upon a grounded test contact the relay 40 will be short circuited and the motor magnet 100, having now a direct circuit from ground, will be energized and attracting its armature, will rotate the wipers 110—113 one step. Since the motor magnet interrupts its own circuit at the springs 106 and 107, it continues to rotate the wipers until the wiper 110 reaches an ungrounded test contact, when the rotation necessarily ceases and relay 40 energizes over its previously described circuit. Relay 40, upon attracting its armature, closes a locking circuit for itself at the contact springs 76 and 77 which circuit is the same as the one already completed by the line relay 41. As a further result of the energization of relay 40 the circuit of the line relay 41 is broken at contact springs 83 and 84, and there is substituted for relay 41 the line relay 130 of the connector F, the circuit being as follows: ground at G⁴, winding 39

of relay 35, contact springs 66 and 67, contact springs 47 and 48, contact 32, spring 28, subscriber's loop, spring 25, contact 29, contact springs 51 and 50, contact springs 83 and 82, wiper 113, contact 117, and line relay 130 to battery B. Other circuit changes caused by the energization of relay 40 which are of importance later are the separation of the springs 85 and 86 included in the circuit of relay 43, and the closure of contact springs 80 and 81. The latter springs extend the negative pole of battery B' to the multiple test contacts of rotary switch E in the banks of all the rotary switches, the circuit being as follows: negative pole of battery B', contact 116, wiper 112, contact springs 80 and 81, contact springs 60 and 59, contact springs 62 and 61 to test contact 215 and multiple contacts. The completion of this circuit to the other pole of battery B' will be described later.

Returning now to the line relay 130 of connector F, this relay, upon energizing, completes a circuit for the slow acting relay 129 as follows: ground at G⁸, contact springs 132 and 133, and winding of relay 129 to battery B. Upon energizing, relay 129 closes contact springs 134 and 135 and thereby places ground potential upon the multiple test contacts of connector F, in the rotary switch banks whereby connector F is made busy to other rotary switches, such as E'. Relay 129 also opens its contact springs 137 and 138 which are included in the circuit of the release magnet 124, and closes its contact springs 136 and 137 thus preparing a circuit for the vertical magnet 126.

The foregoing operations have all occurred in response to the removal of the receiver at the substation A. The subscriber at substation A may now operate his dial in accordance with the first digit of the number he wants, thereby breaking the circuit of the line relay 130 a corresponding number of times. At each deenergization of the line relay 130 a current impulse is sent through the vertical magnet 126 thereby raising the wipers 160 and 161 until they stand opposite a row of contacts in which are located the normal contacts of the line switch C' belonging to the substation A'.

The circuit of the vertical magnet 126 is as follows: ground at G⁸, contact springs 132 and 131, contact springs 137 and 136, contact springs 142 and 141, winding of slow acting relay 127, side switch wiper 157 in its first position, winding of vertical magnet 126 to battery B. The relay 127 is energized in series with the vertical magnet but, being slow acting, it retains its armature during a series of impulses. By closing contact springs 143 and 144, relay 127 completes a circuit for the private magnet 123 which circuit is immediately broken at the end of

the series of impulses. The resultant energization and deenergization of the private magnet serves to move the side switch wipers 157 and 158 to their second position in the well known manner.

The subscriber at substation A may now operate his dial in accordance with the last digit of the desired number, resulting, as before, in deenergizations of the line relay 130 which now (side switch wiper 157 being in its second position) sends impulses to the rotary magnet 125. The rotary magnet, by alternately attracting and releasing its armature, rotates the wipers 160 and 161 a number of steps corresponding to the last digit of the number of the desired line until, at the end of the series of impulses, the wipers will be brought to rest upon the normal contacts 162 and 163 of that line. During the rotary impulses the relay 127 keeps the energizing circuit of the private magnet 123 closed as before. At the end of the series of impulses the private magnet deenergizes (assuming the called line to be idle) and allows the side switch wipers to move to their third position.

A number of circuits are now closed over the normal wires extending to line switch C'. The first of these circuits to become operatively effective is a circuit for the line relay 12' of the line switch C'. It may be traced as follows: ground at G⁷, contact springs 151 and 152, side switch wiper 158 in its third position, wiper 160, contact 162, contact springs 18' and 19', winding of line relay 12' to battery B. Line relay 12' attracts its armature and by closing contact 22' completes the circuit of the pull-in winding 17' of the line switch C'. Upon the energization of the pull-in winding 17', the plunger arm 14' and the cut-off armature 15' are attracted, the former, by means of its plunger, causing the springs 25', 26', 27', and 28' to make connection, respectively, with contacts 29', 30', 31', and 32'; and the latter separating the springs 18' and 20', respectively, from the springs 19' and 21'. A holding circuit for the holding winding 16' has already been completed over the other normal wire and may be traced as follows: ground at G⁷, resistance r, contact springs 149 and 148, contact springs 146 and 145, wiper 161, contact 163, and holding winding 16' to battery B.

The engagement of the spring 25' with the contact 29' completes a circuit for the line relay 41' of the rotary switch E', which circuit may be traced as follows: ground at G⁷, contact springs 151 and 152, side switch wiper 158 in its third position, wiper 160, contact 162, spring 25', contact 29', contact springs 51' and 50', contact springs 83' and 84', contact springs 57' and 58', and winding of relay 41' to battery. A branch of the above circuit may be traced from the junction

tion of the contact spring 58' and the winding of the relay 41' by way of contact springs 97' and 96', to contact spring 74'. Upon the energization of the line relay 41 this branch circuit is extended as follows: from contact spring 74' to contact spring 73', thence via contact springs 107' and 106', and winding of motor magnet 100' to battery B.

The line relay 41' also upon energizing, closes a circuit for the relay 40', which may be traced as a branch of the previously described holding circuit of winding 16' of line switch C'. The branch circuit extends from contact spring 26' by way of contact 30', contact springs 76' and 77', contact springs 70' and 69', winding of relay 40', contact springs 107' and 106', and winding of motor magnet 100' to battery B. Relay 40', being short circuited does not energize at this time. Motor magnet 100', however, is energized and since it interrupts its own circuit at contact springs 106' and 107' it starts rotating the wipers (110'—113') in search of the multiple contacts of rotary switch E.

In connection with the rotary switches E and E' it is to be understood that the wipers of these switches have no normal position but rest at all times upon the last trunk used. In the foregoing description it has been assumed that rotation was necessary in order to reach the set of contacts of the desired trunk, but it is evident that at times the wipers will already be resting on an idle connector trunk or the desired rotary switch trunk as the case may be, in which event it will be readily understood that no rotation takes place, the test circuit taking effect immediately.

We will now return to the connector F and trace a circuit from the positive pole of battery B'. We have already traced a circuit from the negative pole of battery B' to the contact 116 of rotary switch E and thence to contact 215 in the bank of rotary switch E'. It is evident then that the positive pole of battery B' must be extended to the test wiper 111' of rotary switch E', this wiper being adapted to engage the multiple test contacts such as contact 215 during its rotation. This extension may be traced as follows: positive pole of battery B', off-normal contacts 156 and 155 (closed at first vertical step of connector F), winding 121 of relay 120, contact springs 149 and 148, contact springs 146 and 145, wiper 161, contact 163, contact spring 26', contact 30', contact springs 76' and 75', contact springs 91' and 90', and contact springs 104' and 105' to test wiper 111'. It follows therefore, that when the wipers of rotary switch E' reach the set of multiple contacts 214—217, and the springs 104' and 105' close upon the return of armature 102', the circuit of battery B' will be completed by the

engagement of the test wiper 111' with the test contact 215. This circuit includes the winding 121 of relay 120 which relay energizes and, upon attracting its armature, causes circuit changes as follows: By separating springs 151 and 152 the circuit of the motor magnet 100' is broken, thereby stopping the rotation and bringing the wipers to rest upon the desired set of contacts. The original energizing circuit of line relay 41' is also broken at contact springs 151 and 152 but the line relay does not deenergize immediately because of a high resistance shunt path around the springs 151 and 152 as follows: ground at G⁷, resistance r , winding 122 of relay 120, side switch wiper 158 in third position, thence over path already traced via wiper 160 and through winding of line relay 41' to battery. The winding 122 of relay 120 is of sufficient resistance to prevent the effective energization of motor magnet 100'. A further result of the separation of the springs 151 and 152 is the removal of the short circuit from relay 40' which thereupon energizes and attracts its armature, causing circuit changes which will be explained hereafter. In addition to separating contact springs 151 and 152 relay 120 closes contact springs 150 and 151 thereby causing the energization of the release magnet 124 over the following circuit: ground at G⁷, contact springs 151 and 150, off normal springs 153 and 154 (closed at first vertical step of connector F) and winding of release magnet 124 to battery B. The energization of the release magnet results in the withdrawal of the holding pawls from the shaft, allowing it to return to normal; and the return to first position of side switch wipers 157 and 158, thereby breaking the circuit of line relay 41' and also the holding circuit of line switch C'. The line relay 41' now retracts its armature but relay 40' and the holding winding 16' of line switch C remain energized over a new holding circuit which may be traced as follows: ground at G⁵ (switch E), contact springs 92, 91 and 89, winding of relay 42, lower winding 46 of relay 36, contact springs 62 and 61, multiple test contact 215, wiper 111', contact springs 105' and 104', contact springs 90' and 91' to contact springs 75', 76', and 77', where the circuit divides, one branch extending by way of contact spring 77', contact springs 70' and 69', winding of relay 40' contact springs 107' and 106', and winding of magnet 100' to battery B; and the other branch extending by way of contact spring 76', contact 30', spring 26', and holding winding 16' to battery B.

Current flowing in the above described holding circuit is sufficient to energize relays 42 and 36 in series, both relays attracting their armatures. Relay 42 opens the circuit of relay 40 which, upon deenergizing, dis-

connects the wipers 112 and 113 and prepares a circuit for relay 43 by closing contact springs 85 and 86. Relay 36 locks itself over a path extending from ground at 5 G^5 through contact springs 92, 91 and 89, winding of relay 42, windings 46 and 45 of relay 36 in series, and contact springs 54 and 53 to battery B. Relay 36 also causes other circuit changes as follows: By opening contact springs 59 and 60, ground through 10 winding of relay 42 and winding 46 of relay 36 is removed from the left hand talking conductor of switch E; by separating contact springs 57 and 58 the original energizing circuit of relay 41 is broken; and finally 15 by closing contact springs 55 and 56 a circuit through the winding 38 of relay 35 is completed as follows: ground at G^4 , winding 39 of relay 35, contact springs 66 and 67, 20 contact springs 47 and 48, contact 32, spring 28, subscriber's loop, spring 25, contact 29, contact springs 51 and 50, contact springs 56 and 55, contact springs 68 and 64, and winding 38 of relay 35 to battery B. 25 The above circuit serves to supply talking battery to substation A and to maintain relay 35 in an energized condition during conversation.

I will now trace an energizing circuit for 30 the relay 36' of switch E' as follows: ground at G^5 contact springs 92, 91 and 89, winding of relay 42, winding 46 of relay 36, contact springs 62 and 61, multiple contact 215, wiper 111', contact springs 105' and 104', 35 contact springs 90' and 91', contact springs 75' and 76', winding of relay 42', winding 46' of relay 36', contact springs 59' and 60', contact springs 81' and 80', wiper 112', contact 216, contact springs 68 and 64, and 40 winding 38 of relay 35 to battery B. Upon energizing, relay 36' locks itself over the following circuit: ground at G^5 , contact springs 92, 91 and 89, winding of relay 42, winding 46 of relay 36, contact springs 62 45 and 61, multiple contact 215, wiper 111', contact springs 105' and 104', contact springs 90' and 91', contact springs 75' and 76', winding of relay 42', windings 46' and 45' of relay 36' in series, and contact springs 54' and 53', to battery B. Immediately 50 after completing the above locking circuit by closing contact springs 53' and 54', relay 36' breaks its original energizing circuit by separating contact springs 59' and 60'. The 55 flow of current in the original energizing circuit is but momentary and relay 42', being a sluggish relay, does not have time to attract its armature before this circuit is broken. Furthermore relay 42' has a marginal adjustment such that it will not attract its armature when in series with winding 45' but will do so when in series with two windings in parallel such as winding 60 of relay 40 and holding winding 16. It 65 is understood that corresponding parts of

switches E and E' are the same. It follows therefore that relay 42' will not be effectively energized at this time.

As a further result of its energization, relay 36' closes contact springs 55' and 56', 70 thereby bridging the double wound relay 35' across the called line extending to substation A'. This circuit is similar to one which has been described in the case of relay 35 and need not be gone over again. 75

Returning now to relay 40', this relay upon energizing, closes contact springs 82' and 83', and 80' and 81', thereby finally completing the connection between the calling and called lines, as will be referred to 80 again hereafter. Also, by closing contact springs 78' and 79' a circuit is completed for the ringing relay 44' which may be traced over the following path: ground at G^{17} , interrupter I', contact springs 94' and 93', contact springs 78' and 79', and winding 85 of ringing relay 44' to battery B. The ringing relay is thereupon energized intermittently and operates to project ringing current from the generator Gen. out over the 90 called line in order to actuate the bell at the substation A'. When the subscriber at substation A', in response to the ringing of his bell, removes his receiver from the hook, the ringing relay being temporarily inactive, the 95 circuit of relay 35' is completed and this relay energizes, feeding talking battery to the substation A' and closing a circuit for the slow acting relay 37' as follows: ground at G^{15} , contact springs 87' and 88', and 100 winding of relay 37' to battery B. Upon energizing, relay 37' opens the circuit of the ringing relay at contacts 93' and 94' and also opens the holding circuit of relay 40' and holding winding 16' by separating con- 105 tact springs 90' and 91'. At the same time a new holding circuit is established as follows: ground at G^{15} , contacts 92', 91' and 89', contact 30', spring 26', holding winding 16' to battery. A branch of this circuit may 110 be traced from contact spring 89' to one terminal of coil 42', where it divides, one branch going through winding of relay 42', windings 46' and 45' in series, and contact springs 54' and 53' to battery, while the 115 other branch may be traced through contact springs 76' and 77', contact springs 70' and 69', and winding of relay 40' contact springs 107' and 106', and winding of magnet 100' to battery B. Referring now to relay 42 in 120 switch E, it is evident that since the holding circuit extending to switch E' has been broken by relay 37' the only current now flowing in relay 42 will be the current supplied to the windings 46 and 45 of relay 36 125 in series. It has been explained in the case of similar relay 42' that this current is insufficient to cause effective energization and relay 42 therefore retracts its armature closing a circuit for relay 43 as follows: ground 130

at G⁵, contact springs 92, 91 and 89, contact springs 72 and 71, contact springs 85 and 86, winding of relay 43, contact springs 54 and 53 to battery B. Upon the energization of relay 43 the contact springs 61 and 62 are separated thereby permanently breaking the connection between the holding circuits of switches E and E'. Also the line extending to substation A is reversed by breaking the connection of springs 64 and 66, with springs 68 and 67, respectively, and by causing springs 63 and 65 to engage springs 64 and 66 respectively.

A complete talking connection has now been established between substation A and substation A'. This circuit is indicated by heavy lines in the drawings and is so apparent that further details will be unnecessary.

It will readily be seen also that since the substations A and A' are furnished with talking battery from the relays 35 and 35' respectively, and moreover, since the holding circuits as described are independent of each other, a subscriber at either substation may now disconnect the switches associated with his line at will. For example, should the subscriber at substation A' hang his receiver up the circuit of relay 35' will be broken and relay 35' will deenergize thereby breaking the circuit of relay 37'. Upon the deenergization of relay 37' ground will be removed from the holding circuit whereupon all relays of rotary switch E will deenergize and also the holding winding 16' of line switch C' will deenergize allowing the plunger to be withdrawn from the bank. The substation A' is now ready to be called again or to originate a call.

I will now describe briefly the case where the called line is busy. Referring to connector F, the test contact such as contact 163, associated with a busy line will have ground potential upon it as has already been mentioned. When, therefore, at the end of the last series of impulses the wiper 161 is brought to rest upon the test contact of a busy line and the relay 127 deenergizes, a circuit is established as follows: ground on test contact, wiper 161, contact springs 145 and 146, contact springs 148 and 147, winding of test relay 128, and winding of private magnet 123 to battery B. As a result of this circuit the private magnet remains energized thereby preventing the side switch wipers from moving to their third position. Also test relay 128 is energized and connects a winding of the induction coil T with one side of the line extending to the substation A. In this way a distinctive tone from the busy machine H is thrown upon the calling line and indicates to the subscriber at substation A that the line called is busy. He will then hang up his receiver breaking the circuit of relays 130 and 35. Upon the

deenergization of relay 130 and consequent deenergization of relay 129 a circuit is closed for the release magnet 124 as follows: ground at G⁸, contact springs 132 and 131, contact springs 137 and 138, off normal springs 153 and 154, and winding of release magnet 124 to battery B. The energization of the release magnet serves to withdraw the retaining pawls from the shaft and allow its return to normal and also restores the side switch levers to their first position. The deenergization of relay 35 and consequent deenergization of relay 37 causes ground to be removed from the holding circuit of relay 40 and holding winding 16 of line switch C. Relay 40 thereupon deenergizes and also holding winding 16 deenergizes and allows the plunger to be withdrawn from the bank. All the apparatus is now in its original condition and ready for use.

It will be seen from the foregoing that I have provided an efficient automatic telephone trunking system in which, after a connection has been built up between a calling and called line through the medium of automatic switches, a talking circuit is established between the said lines over a more direct path, thereby making it possible to release certain apparatus utilized in the original connection and make it accessible for use in other connections.

While I have described in the foregoing a certain specific embodiment of my invention, I do not wish to be held strictly to the form shown herein, for various adaptations will no doubt suggest themselves to persons skilled in the art. I desire, therefore, to include and have protected by Letters Patent all forms and modifications of my invention which may come within the scope of the appended claims.

What I claim as my invention is:

1. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means for operating said third switch to find said second switch, and means for then operating said second switch to find said conductor.

2. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means for operating said third switch to find said second switch, means for then operating said second switch to find said conductor, means for establishing a circuit over said conductor comprising a battery and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

3. In a trunking system, a conductor, a

10. In a trunking system, a plurality of conductors, a switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending it into association with said second switch, a third switch associated with the seized conductor, means for operating said third switch to find said second switch and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means con-

trolled by said magnet for controlling said second switch; means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

11. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches, and means for then operating said second switch to find the seized conductor.

12. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

13. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

14. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of the seized conductor, where-

by a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

15. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, and means for then operating said second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

16. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, and means for then operating said second switch to find the first end of said conductor.

17. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

18. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third

switch to find any one of said second switches, and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

19. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

20. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

21. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a line, a third switch associated with said conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and for further extending said other end thereto, and means for then operating said second switch to find the first end of said conductor.

22. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a line, a third switch associated with said conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and for further extending said other end thereto, means for then operating said second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

23. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a line, a third switch associated with said conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and to extend said other end thereto, means for then operating said second switch to find said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

24. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a line, a third switch associated with said conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and to extend said other end thereto, means for then operating said second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

25. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a line, a third switch associated with said conductor, means for op-

erating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and to extend said other end thereto, means for then operating said second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

26. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with said second switch, a line, a third switch associated with the seized conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and to extend said other end thereto, and means for then operating said second switch to find the first end of the seized conductor.

27. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with said second switch, a line, a third switch associated with the seized conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and to extend the said other end thereto, means for then operating said second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

28. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with said second switch, a line, a third switch associated with the seized conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and

to extend said other end thereto, means for then operating said second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

29. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with said second switch, a line, a third switch associated with the seized conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and to extend said other end thereto, means for then operating said second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

30. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with said second switch, a line, a third switch associated with the seized conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and the second switch and to extend said other end thereto, means for then operating said second switch to find the first end of the seized conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

31. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with one of said second switches, a line, a third switch associated with the seized conductor, means for operating said

third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and any one of said second switches and to extend said other end thereto, and means for then operating the connected second switch to find the first end of the seized conductor.

32. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with one of said second switches, a line, a third switch associated with the seized conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and any one of said second switches and to extend said other end thereto, means for then operating the connected second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

33. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with one of said second switches, a line, a third switch associated with the seized conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and any one of said second switches and to extend said other end thereto, means for then operating the connected second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

34. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with one of said second switches, a line, a third switch associated with the seized conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the

line and any one of said second switches and to extend said other end thereto, means for then operating the connected second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

35. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the seized conductor into association with one of said second switches, a line, a third switch associated with the seized conductor, means for operating said third switch to find said line and to extend the other end of the conductor thereto, a switch for said line and means for then operating said line switch to connect the line and any one of said second switches and to extend said other end thereto, means for then operating the connected second switch to find the first end of the seized conductor, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

36. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and any one of said second switches and to extend said other end thereto, and means for then operating the connected second switch to find the first end of said conductor.

37. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and any

one of said second switches and to extend said other end thereto, means for then operating the connected second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

38. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and any one of said second switches and to extend said other end thereto, means for then operating the connected second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

39. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and any one of said second switches and to extend said other end thereto, means for then operating the connected second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

40. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor, means for operating said third switch to find said line and to extend the other end of said conductor thereto, a switch for said line and means for then operating said line switch to connect the line and any one of said second switches and to extend said

other end thereto, means for then operating the connected second switch to find the first end of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

41. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means for operating said third switch to find said second switch, means for then operating said second switch to find said conductor, and means for controlling said extension whereby when said second switch finds the extension said extension is cut off.

42. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means for operating said third switch to find said second switch and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of said conductor, means for controlling said extension whereby when said second switch finds the extension said extension is cut off, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

43. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means for operating said third switch to find said second switch and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of said conductor, means for controlling said extension whereby when said second switch finds the extension said extension is cut off, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

44. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association

with said second switch, a third switch associated with said conductor, means for operating said third switch to find said second switch and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of said conductor, means for controlling said extension whereby when said second switch finds the extension said extension is cut off, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

45. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means for operating said third switch to find said second switch and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of said conductor, means for controlling said extension whereby when said second switch finds the extension said extension is cut off, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

46. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending it into association with said second switch, a third switch associated with the seized conductor, means for operating said third switch to find said second switch and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of the seized conductor, and means for controlling said extension whereby when said second switch finds the extension, said extension is cut off.

47. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending it into association with said second switch, a third switch associated with the seized conductor, means for operating said third switch to find said second switch and to extend the other end of said conductor thereto, means for then operating said sec-

ond switch to find the first end of the seized conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

48. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending it into association with said second switch, a third switch associated with the seized conductor, means for operating said third switch to find said second switch, and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of the seized conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

49. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending it into association with said second switch, a third switch associated with the seized conductor, means for operating said third switch to find said second switch, and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of the seized conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

50. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending it into association with said second switch, a third switch associated with the seized conductor, means for operating said third switch to find said second switch and to extend the other end of said conductor thereto, means for then operating said second switch to find the first end of the seized conductor, means for controlling said exten-

sion whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

51. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of the seized conductor, and means for controlling said extension whereby when said second switch finds the extension, said extension is cut off.

52. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of the seized conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

53. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of the seized conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized

thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

54. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of the seized conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

55. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending it into association with one of said second switches, a third switch associated with the seized conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of the seized conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over the seized conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

56. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of said conductor, and means for

controlling said extension whereby when said second switch finds the extension, said extension is cut off.

57. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of said conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

58. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of said conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

59. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of said conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

60. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means for operating said third switch to find any one of said second switches and to extend the other end of said conductor thereto, means for then operating the found second switch to find the first end of said conductor, means for controlling said extension whereby when said second switch finds the extension, said extension is cut off, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

61. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with said second switch, and means for then operating said second switch to unite the extended ends of said conductor.

62. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

63. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for con-

trolling said second switch, and means controlled by said magnet for controlling said third switch.

64. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

65. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

66. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with said second switch, a third switch associated with the selected conductor, means including said third switch for extending the other end of said selected conductor into association with said second switch, and means for then operating said second switch to unite the extended ends of said selected conductor.

67. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with said second switch, a third switch associated with the selected conductor, means including said third switch for extending the other end of said selected conductor into association with said second

switch, means for then operating said second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

68. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with said second switch, a third switch associated with the selected conductor, means including said third switch for extending the other end of said selected conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

69. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with said second switch, a third switch associated with the selected conductor, means including said third switch for extending the other end of said selected conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

70. In a trunking system, a plurality of conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with said second switch, a third switch associated with the selected conductor, means including said third switch for extending the other end of said selected conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch,

means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

71. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with one of said second switches, a third switch associated with the selected conductor, means including said third switch for extending the other end of said selected conductor into association with one of said second switches, and means for then operating the selected switch to unite the extended ends of said conductor.

72. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with one of said second switches, a third switch associated with the selected conductor, means including said third switch for extending the other end of said selected conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

73. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with one of said second switches, a third switch associated with the selected conductor, means including said third switch for extending the other end of said selected conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

74. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with one of said second switches, a third switch associated with the selected conductor, means including said third switch

for extending the other end of said selected conductor into association with one of said second switch, and means for then operating the selected second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

75. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with one of said second switches, a third switch associated with the selected conductor, means including said third switch for extending the other end of said selected conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

76. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with one of said second switches, and means for then operating the selected second switch to unite the extended ends of said conductor.

77. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

78. In a trunking system, a conductor, a

first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

79. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

80. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a third switch associated with said conductor, means including said third switch for extending the other end of said conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

81. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and

said line switch for extending the other end of said conductor into association with said second switch, and means for then operating said second switch to unite the extended ends of said conductor.

82. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

83. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

84. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with said second switch, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

85. In a trunking system, a conductor, a first switch and a second switch, said first switch for seizing one end of said conductor and for extending it into association with

said second switch, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and
 5 said line switch for extending the other end of said conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said connector, whereby a circuit is estab-
 10 lished over the said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third
 15 switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

86. In a trunking system, a plurality of
 20 conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into asso-
 25 ciation with said second switch, a line, a third switch associated with the selected conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for
 30 extending the other end of said selected conductor into association with said second switch, and means for then operating said second switch to unite the extended ends of said selected conductor.

87. In a trunking system, a plurality of
 35 conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into asso-
 40 ciation with said second switch, a line, a third switch associated with the selected conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch
 45 for extending the other end of said selected conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said selected conductor, whereby a circuit
 50 is established over the selected conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

88. In a trunking system, a plurality of
 55 conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into asso-
 60 ciation with said second switch, a line, a third switch associated with the selected conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch
 65 for extending the other end of said selected conductor into association with said second

switch, means for then operating said second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet en- 70
 ergized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

89. In a trunking system, a plurality of 75
 conductors, a first switch and a second switch, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into asso-
 80 ciation with said second switch, a line, a third switch associated with the selected conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch
 85 for extending the other end of said selected conductor into association with said second switch, means for then operating said second switch to unite the extended ends of said selected conductor, whereby a cir-
 90 cuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for con-
 95 trolling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

90. In a trunking system, a plurality of
 conductors, a first switch and a second switch, said first switch for seizing one end 100
 of any one of said conductors and for extending the conductor so selected into asso-
 ciation with said second switch, a line, a third switch associated with the selected conductor and having access to said line, a 105
 line switch for said line, means for operating said third switch and said line switch for extending the other end of said selected conductor into association with said second
 switch, means for then operating said second 110
 switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a bat-
 tery in said circuit and a magnet energized 115
 thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inopera-
 120 tive, and release mechanism for said third switch, said mechanism controlled by said magnet.

91. In a trunking system, a plurality of
 conductors, a first switch and a plurality 125
 of second switches, said first switch for seizing one end of any one of said conduc-
 tors and for extending the conductor so selected into association with one of said second switches, a line, a third switch as-
 sociated with the selected conductor and 130

having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said selected conductor into association with one of said second switches, and means for then operating the selected second switch to unite the extended ends of said selected conductor.

92. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with one of said second switches, a line, a third switch associated with the selected conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said selected conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

93. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with one of said second switches, a line, a third switch associated with the selected conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said selected conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

94. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with one of said second switches, a line, a third switch associated with the selected conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said selected conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the

selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

95. In a trunking system, a plurality of conductors, a first switch and a plurality of second switches, said first switch for seizing one end of any one of said conductors and for extending the conductor so selected into association with one of said second switches, a line, a third switch associated with the selected conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said selected conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said selected conductor, whereby a circuit is established over the selected conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

96. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said conductor into association with one of said second switches, and means for then operating the selected second switch to unite the extended ends of said conductor.

97. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for controlling said second switch.

98. In a trunking system, a conductor, a

first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, and means controlled by said magnet for controlling said third switch.

99. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, and means controlled by said magnet for rendering said circuit inoperative.

100. In a trunking system, a conductor, a first switch and a plurality of second switches, said first switch for seizing one end of said conductor and for extending it into association with one of said second switches, a line, a third switch associated with said conductor and having access to said line, a line switch for said line, means for operating said third switch and said line switch for extending the other end of said conductor into association with one of said second switches, means for then operating the selected second switch to unite the extended ends of said conductor, whereby a circuit is established over said conductor, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for controlling said second switch, means controlled by said magnet for controlling said third switch, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

101. In a telephone system, a station, a plurality of switches accessible to said sta-

tion, a line connecting said station and one of said switches, another station, said switches accessible also to said other station, a line connecting said second station and a second one of said switches, said second switch having access to said first line, a plurality of means all having access to all of said switches and each operable for controlling said second switch to connect said second line with said first line, and each one of said means accessible to said first switch whereby the operation of said second switch is placed under the control of said first station through the medium of the selected means.

102. In a telephone system, a station, a plurality of switches accessible to said station, a line connecting said station and one of said switches, another station, said switches accessible also to said other station, a line connecting said second station and a second one of said switches, said second switch having access to said first line, a plurality of means all having access to all of said switches and each operable for controlling said second switch to connect said second line with said first line, each one of said means accessible to said first switch whereby the operation of said second switch is placed under the control of said first station through the medium of the selected means, each of said means including an automatic switch.

103. In a telephone system, a station, a plurality of switches accessible to said station, a line connecting said station and one of said switches, another station, said switches accessible also to said other station, a line connecting said second station and a second one of said switches, said second switch having access to said first line, a plurality of means all having access to all of said switches and each operable for controlling said second switch to connect said second line with said first line, each one of said means accessible to said first switch whereby the operation of said second switch is placed under the control of said first station through the medium of the selected means, and a conductor in association with each of said means and accessible to said first switch for extension into association with said second switch whereby the second switch in its operation may find the said extension and establish a circuit over said extension to stop said second switch on the first line.

104. In a telephone system, a station, a plurality of switches accessible to said station, a line connecting said station and one of said switches, another station, said switches accessible also to said other station, a line connecting said second station and a second one of said switches, said second switch having access to said first line, a plurality of means all having access to all of

said switches and each operable for controlling said second switch to connect said second line with said first line, each one of said means accessible to said first switch whereby the operation of said second switch is placed under the control of said first station through the medium of the selected means, a battery in said circuit and a magnet energized thereby, and means controlled by said magnet for rendering said circuit inoperative.

105. In a telephone system, a station, a plurality of switches accessible to said station, a line connecting said station and one of said switches, another station, said switches accessible also to said other station, a line connecting said second station and a second one of said switches, said second switch having access to said first line, a plurality of means all having access to all of said switches and each operable for controlling said second switch to connect said second line with said first line, each one of said means accessible to said first switch whereby the operation of said second switch is placed under the control of said first station through the medium of the selected means, a conductor in association with each of said means and accessible to said first switch for extension into association with said second switch whereby the second switch in its operation may find the said extension and establish a circuit over said extension to stop said second switch on the first line, a battery in said circuit and a magnet energized thereby, means controlled by said magnet for rendering said circuit inoperative, and release mechanism for said third switch, said mechanism controlled by said magnet.

106. In a telephone system, a station, a plurality of switches accessible to said station, a line connecting said station and one of said switches, another station, said switches accessible also to said other station, a line connecting said second station and a second one of said switches, said second switch having access to said first line, a plurality of means all having access to all of said switches and each operable for controlling said second switch to connect said second line with said first line, each one of said means accessible to said first switch whereby the operation of said second switch is placed under the control of said first station through the medium of the selected means, and a conductor in association with each of said means and accessible to said first switch for extension into association with said second switch whereby the second switch in its operation may find the said extension and establish a circuit over said extension to stop said second switch on the first line, through the medium of a battery and a magnet, each of said conductors having one such battery and one such magnet.

107. In a telephone system, a plurality of stations and lines therefor, individual line switches for said lines, other switches, trunk lines accessible to said line switches and terminating in said other switches, said other switches having access to said trunk lines, means whereby the line switch of a calling line is operated to extend the said line via a selected trunk line to one of said other switches, and means accessible to the selected other switch for locating a called line and for extending said called line through the medium of its individual line switch and another one of said other switches into connection with the calling line.

108. In a telephone system, a plurality of stations and lines therefor, individual line switches for said lines, other switches, trunk lines accessible to said line switches and terminating in said other switches, said other switches having access to said trunk lines, means whereby the line switch of a calling line is operated to extend the said line via a selected trunk line to one of said other switches, and means accessible to the selected other switch for locating a called line and for extending said called line through the medium of its individual line switch and another one of said other switches into connection with the calling line, said last means including an automatic switch.

109. In a telephone system, a plurality of stations and lines therefor, individual line switches for said lines, other switches, trunk lines accessible to said line switches and terminating in said other switches, said other switches having access to said trunk lines, means whereby the line switch of a calling line is operated to extend the said line via a selected trunk line to one of said other switches, and means accessible to the selected other switch for locating a called line and for extending said called line through the medium of its individual line switch and another one of said other switches into connection with the calling line, said last means including an automatic progressively movable switch.

110. In a trunking system, a series of lines, a second series of lines, switching means associated with said lines comprising a pair of movable elements, one of said elements being associated with one of said series and the other of said elements being associated with the other series, means for moving said elements progressively with regards to their respective associated lines, said last means comprising a magnet controllable over either element and its associated lines and means for switching said magnet from the control of one element to the other.

111. In a telephone system, a plurality of lines having access to a plurality of switches, a trunk line including a test conductor for each of said switches and accessible to the

rest of said switches, other switches having access to said first lines, means whereby one of said first switches is operated by a calling line to select one of said other switches and extend its associated test conductor thereto, and means including the selected other switch whereby a called line is located and extended together with said test conductor to an idle one of said first switches.

112. In a telephone system, a plurality of lines having access to a plurality of switches, a trunk line including a test conductor for each of said switches and accessible to the rest of said switches, other switches having access to said first lines, means whereby one of said first switches is operated by a calling line to select one of said other switches and extend its associated test conductor thereto, means including the selected other switch whereby a called line is located and extended together with said test conductor to an idle one of said first switches, and means for operating the last selected first switch to unite the two ends of said test conductor.

113. In a telephone system, a plurality of lines having access to a plurality of switches, a trunk line including a test conductor for each of said switches and accessible to the rest of said switches, other switches having access to said first lines, means whereby one of said first switches is operated by a calling line to select one of said other switches and extend its associated test conductor thereto, means including the selected other switch whereby a called line is located and extended together with said test conductor to an idle one of said first switches, a battery and a magnet in series with said test conductor, and means for operating the last selected first switch to complete a circuit over said test conductor.

114. In a telephone system, a plurality of lines having access to a plurality of switches, a trunk line including a test conductor for each of said switches and accessible to the rest of said switches, other switches having access to said first lines, means whereby one of said first switches is operated by a calling line to select one of said other switches and extend its associated test conductor thereto, means including the selected other switch whereby a called line is located and extended together with said test conductor to an idle one of said first switches, a battery and a magnet in series with said test conductor, and means under the control of said magnet for operating the last selected first switch to complete a circuit over said test conductor and establish a connection over said trunk line between the calling and called lines.

115. In a telephone system, a plurality of lines having access to a plurality of switches, a trunk line including a test conductor for each of said switches and accessible to the

rest of said switches, other switches having access to said first lines, means whereby one of said first switches is operated by a calling line to select one of said other switches and extend its associated test conductor thereto, means including the selected switch whereby a called line is located and extended together with said test conductor to an idle one of said first switches, a battery and a magnet in series with said test conductor, means under the control of said magnet for operating the last selected first switch to complete a circuit over said test conductor and establish a connection over said trunk line between the calling and called lines, and means effective thereupon for restoring the selected other switch to its normal position.

116. In a telephone system, a plurality of lines having access to a plurality of switches, a trunk line including a test conductor for each of said switches and accessible to the rest of said switches, other switches having access to said first lines, means whereby one of said first switches is operated by a calling line to select one of said other switches and extend its associated test conductor thereto, means including the selected other switch whereby a called line is located and extended together with said test conductor to an idle one of said first switches, a battery and a magnet in series with said test conductor, means under the control of said magnet for operating the last selected first switch to complete a circuit over said test conductor and establish a connection over said trunk line between the calling and called lines, and means whereby said connection is placed under the control of the calling line.

117. In a telephone system, a plurality of lines having access to a plurality of switches, a trunk line including a test conductor for each of said switches and accessible to the rest of said switches, other switches having access to said first lines, means whereby one of said first switches is operated by a calling line to select one of said other switches and extend its associated test conductor thereto, means including the selected other switch whereby a called line is located and extended together with said test conductor to an idle one of said first switches, a battery and a magnet in series with said test conductor, means under the control of said magnet for operating the last selected first switch to complete a circuit over said test conductor and establish a connection over said trunk line between the calling and called lines, means whereby said connection is placed under the control of the calling line for breaking the connection, and additional means under the control of the called line for breaking the connection.

118. In a telephone system, subscribers'

lines, a plurality of similar automatic switches common to said lines, a battery supply relay in each switch, means including any two of said switches for establishing a talking connection between two of said lines, and circuit connections whereby the calling subscriber is supplied with talking battery through the said relay in one switch and the called subscriber through the said relay in the other switch.

119. In a telephone system, subscribers' lines, a plurality of automatic switches each provided with a battery supply relay, means for extending both calling and called subscribers' lines to idle ones of said switches during the establishment of connections, and circuit connections whereby each connected line, whether calling or being called is supplied with talking battery through the said relay in the switch to which it was extended.

120. In a telephone system, a subscriber's line, an automatic switch provided with a battery supply relay and adapted for use in connecting said line with another line, means for extending connections to said first line as a called line, and circuit connections whereby the said first line, whether calling or being called, receives its entire supply of talking battery through the said relay in said switch.

121. In a telephone system, a plurality of lines each terminating in an automatic switch, a pair of normal conductors for each line multiplied in the switches associated with the other lines, a condenser in one line conductor of each line, means for operating any one of said switches to connect its associated line with the normal conductors of another line to establish a talking circuit, and a transposition in each pair of normal conductors whereby when a connection is established it will include a condenser in each side of the circuit.

122. In a telephone system, a first line and a second line temporarily connected for conversation, said connection including a pair of movable automatic switch contacts and a pair of fixed contacts engaged thereby, a complete metallic connection via a conductor of said first line to one of said fixed contacts, a condenser connecting the other conductor of said first line to the other of said fixed contacts, and similar metallic and inductive connections from the line conductors of the said second line to said movable contacts, the complete talking connection including only two condensers, one in each side of the circuit.

123. In a telephone system, trunk lines divided into groups, a combined selecting and finder switch having means for selecting idle trunks in one of said groups and means for finding a predetermined trunk line in another group, a pair of test wipers

for the switch one for each group, means controlled over one of said wipers for testing the trunks in only one group when the switch is operated as a selector, and means controlled over the other of said wipers for testing only the trunks in the other group when the switch is operated as a finder.

124. In a telephone system, an automatic switch, a plurality of trunk lines of different character accessible to said switch, the trunks of one character being used to extend connections from said switch and the trunks of the other character being used to extend calls to said switch, means for in one instance operating said switch to select an idle trunk of the first character and means for operating the switch in another instance to find one of the trunks of the other character over which a call has been extended to said switch.

125. In a telephone system, a line, an automatic switch associated with said line, means for operating said switch as a selector to select an idle trunk when a call is extended from said line, means for operating said switch as a finder to complete a connection which has been extended to said line, a relay in said switch, and means for operating said relay when the switch is operated as a finder to apply ringing current to said line for signaling a subscriber thereon.

126. In a telephone system, a calling and a called line, an automatic switch controlled over the calling line to extend a connection in the direction of the called line, a finder switch associated with the called line and operated by the calling subscriber to find said extended connection to complete a connection between said lines, means controlled solely by the calling subscriber for releasing said automatic switch and means controlled solely by the called subscriber for releasing said finder switch.

127. In a telephone trunking system, a plurality of lines, a trunk line, a finder switch for said trunk line having sets of fixed terminals and movable terminals co-operating therewith, means for extending a calling line to a set of said fixed terminals, a conductor terminating at one end in a test terminal of said set, means operable over the said calling line and comprising a series of trunking switches for extending the other end of said conductor into connection with a movable terminal of said finder switch, and means for operating said finder switch to connect the two ends of said conductor.

128. In a telephone trunking system, a plurality of lines, a trunk line, a finder switch for said trunk line having sets of fixed terminals and movable terminals co-operating therewith, means for extending a calling line to a set of said fixed terminals, a conductor terminating at one end in a test

terminal of said set, means operable over the said calling line and comprising a series of trunking switches for extending the other end of said conductor into connection with
5 a movable terminal of said finder switch, means for operating said finder switch to connect the two ends of said conductor, whereby a test circuit for said finder switch

is completed, and a battery in said test circuit.

Signed by me at Chicago, Illinois, this 26 day of October, 1915.

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ANDERS M. MALMBERG.

Witnesses:

CHAS. M. CANDY,
CHRIS MALLERUP.