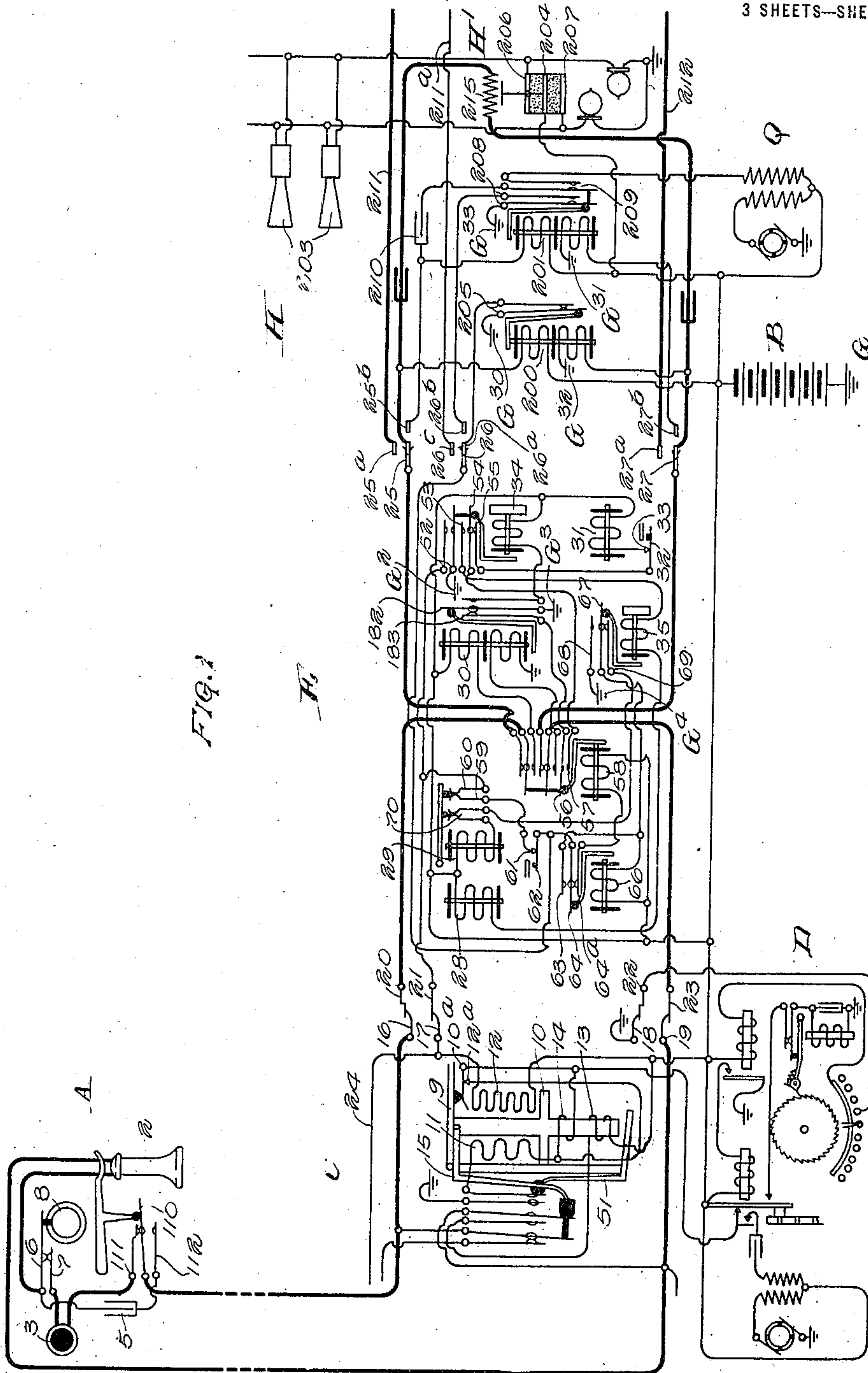


A. ANDERSEN.
TELEPHONE SYSTEM.
APPLICATION FILED OCT. 24, 1913.

1,295,096.

Patented Feb. 25, 1919.

3 SHEETS—SHEET 1.



WITNESSES

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INVENTOR:
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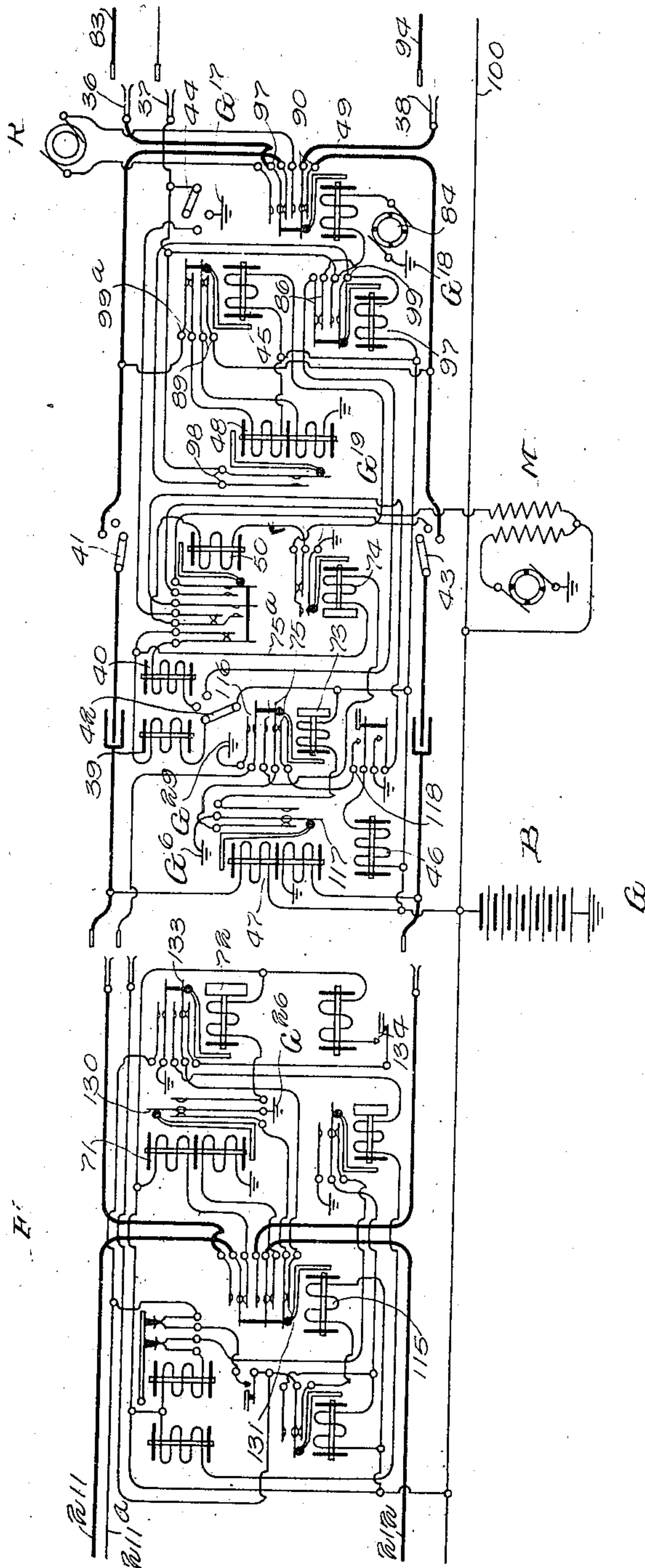
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3 SHEETS—SHEET 2.

Fig. 2.



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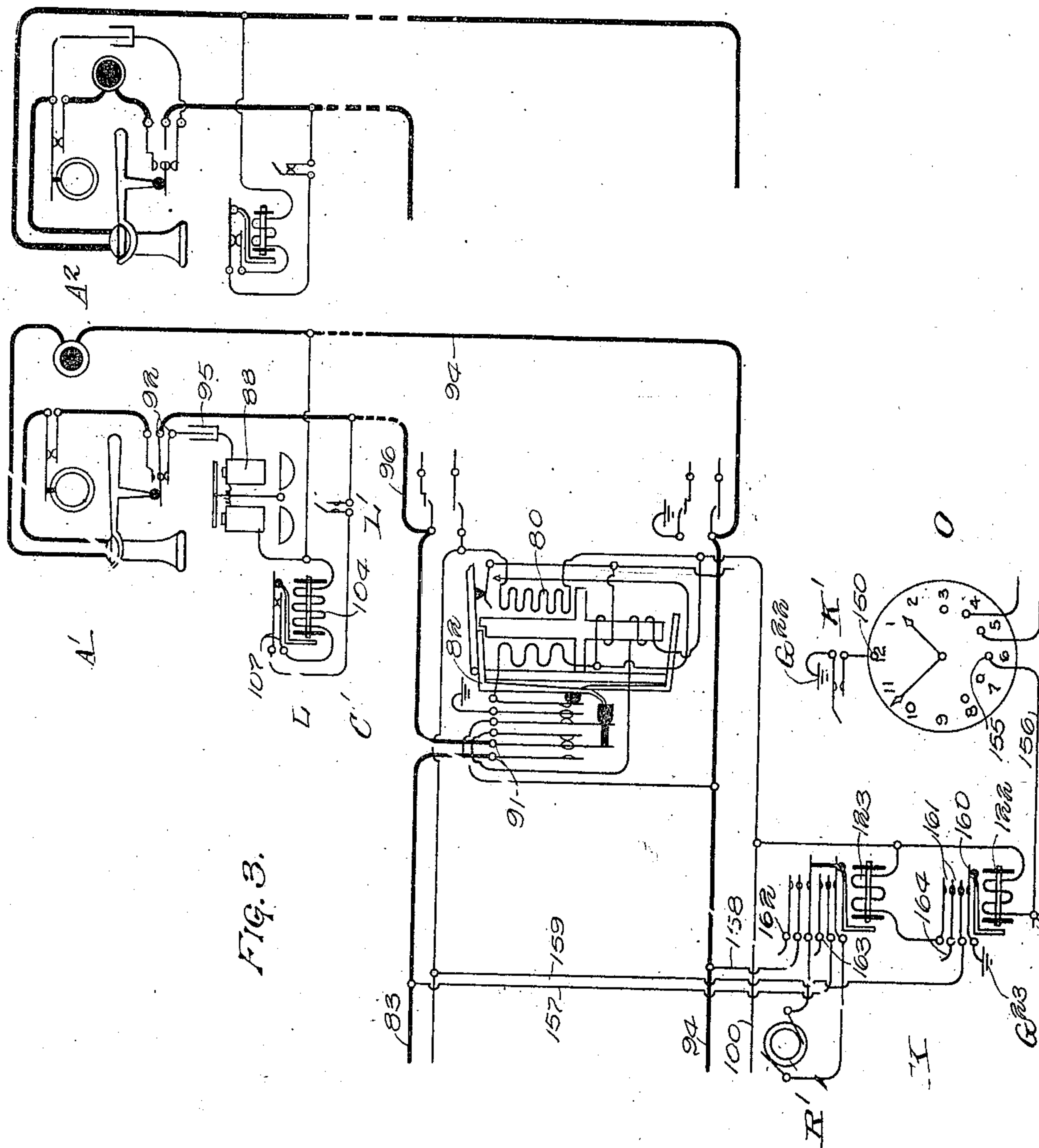


FIG. 3.

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TELEPHONE SYSTEM.

1,295,096.

Specification of Letters Patent.

Patented Feb. 25, 1919.

Application filed October 24, 1913. Serial No. 797,103.

To all whom it may concern:

Be it known that I, ALBERT ANDERSEN, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to improvements in telephone systems, and has for its object certain improvements in the construction and operation of the substation and central office apparatus employed in such systems.

Among the objects of my invention is the provision of a substation circuit in which the usual call signal or bell is omitted, the subscriber being signaled through the receiver, which is normally bridged across the line through a condenser.

A second feature of my invention is the provision of an enunciator system by which any subscriber can automatically establish connection with a series of enunciators or announcers.

A further feature of my invention is the provision of a special busy signal which is controlled by the subscriber, so that if the subscriber is going out, or for any other reason can not answer the telephone, he can connect this special signal to the line, so that if his line is called the calling subscriber will know immediately that the desired subscriber can not answer the telephone and will accordingly immediately hang up his receiver and prevent the trunk lines being tied up for an unnecessary period of time.

A further feature of my invention is the provision of means whereby a subscriber can be automatically called from the central office at any predetermined time.

These and other objects of my invention will be more clearly understood by reference to the accompanying drawings, in which I have illustrated the same in connection with an automatic system of a well-known type.

Figures 1, 2 and 3 taken together represent diagrammatically a connection between a calling and a called subscriber's line. This connection is established in the well-known manner by means of the individual line switch C, the first selector E, the second se-

lector F and the connector J. At H I have indicated an enunciator apparatus with which the first selector E is adapted to establish connection when moved to a certain level.

The substation A comprises the usual receiver 2 and transmitter 3 adapted to be connected in series across the line when the switch hook is in raised position. When the receiver is upon the hook, however, instead of having the usual bell bridged across the line, the receiver 2 is bridged across the line through the springs 112 and 110 and the condenser 5, whereby when the subscriber is called the ringing current passes through the receiver and thus this receiver acts as the calling signal. The impulse-transmitting device for controlling the automatic switches is represented diagrammatically by a pair of impulse springs 6 and 7 controlled by an impulse wheel 8, which latter may be controlled in the well-known manner through the medium of a dial provided with finger holds in such a way that the impulse springs will be momentarily separated a number of times corresponding to the respective digits of the number of the called subscriber.

The subscriber's individual switch C is of the general type of subscriber's switch shown in British patent to R. W. James No. 26,301 of 1906, being, however, of the particular type disclosed in British patent to T. G. Martin No. 1419 of 1910.

The master switch D is of the same general type as that disclosed in British patent No. 26,301 of 1906, referred to above, being, however, of the particular type disclosed in said British patent No. 1419 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 to engage the terminals of an idle trunk line.

The first selector switch E is of the general type of selector switch disclosed in United States Letters Patent No. 815,321, granted March 13, 1906, to Keith, Erickson and Erickson, except that the so-called side switch is omitted and the circuits are modified so as to permit the switch to be operated in a two-wire system, in the manner

shown in British Patent No. 10,376 of 1912, granted to T. G. Martin.

The second selector F is essentially the same as the selector E.

5 The connector switch J (Fig. 2) is of the same general type of connector switch as disclosed in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson, the circuits, however, being modified to adapt the switch
10 to operate in a system in which the central office apparatus is controlled by impulses delivered over the two sides of the line in series, in the manner shown in British Patent No. 10,376 of 1912, above referred to.

15 The substation A' is the usual form of automatic substation including the bell 88, which is normally bridged across the line through the condenser 95. This substation is likewise provided with a relay 104 connected in a normally open bridge across the line controlled by the key L'. This relay 104 is provided with a pair of interrupter springs 107, whereby it operates as a buzzer
20 for the purpose of giving this special busy signal in a manner to be hereinafter described.

The substation A² is the same type as substation A except in addition it has an interrupter relay connected in a normally open bridge across the line controlled by a key similar to that of substation A'. The called subscriber's line may be provided with a substation like A' or a substation like A².

30 The enunciator apparatus H comprises the double-wound relay 200 for placing a guarding potential on the private bank contact 26^a, which prevents more than one party from using the same enunciator at the same time. There is also shown an amplifier or microphone repeater H' comprising the coil 215 and microphone controlled thereby, which microphone repeater is well known in the art. The impulses or sound waves transmitted over one circuit are received by a magnet 215 which operates the differential microphone. The impulses are thus repeated by the microphone in the circuit which contains the loud speaking receivers
40 or reproducers. These reproducers and amplifiers can be of any desired type and may be similar to those shown in French Patent No. 450,768 and British patents to W. H. Derriman Nos. 21,812 and 21,814 of 1911.

55 For the purpose of supplying battery current for operating the apparatus in the exchange and for talking purposes there is shown a plurality of batteries B having one terminal grounded at G. Only one battery, however, is necessary in practice.

60 In order that my invention may be more clearly understood I will now explain how a party at the substation A may establish connection with the enunciator apparatus, or with a subscriber at the substation A'. Since

the automatic switching apparatus disclosed in this application is in general well known in the art, and is fully described in the publications hereinabove referred to, it is not thought necessary to describe in detail the manner in which these switches operate to establish the connections.

When a subscriber, desiring to establish connection with an enunciator apparatus, removes his receiver from the switch-hook at the substation A preparatory to making a call, an energizing circuit is closed through the line winding 13 of the individual switch C and this switch is tripped in the well-known manner to connect with the trunk extending to the selector E, which we will assume is idle at this time. The line relay 30 of the selector switch E is thereupon energized, closing the circuit through the relay 34. The relay 34, upon energizing, closes a holding circuit through the cut-off winding 12 of the line switch C. The usual guarding ground potential is also supplied to the connector private bank contacts of the calling line as soon as the relay 34 is energized. The enunciator apparatus H being connected to the contacts of the first level of the selector, the calling subscriber now operates his calling device for the digit 1, whereby the substation impulse springs 6 and 7 are separated once momentarily, breaking the circuit of the selector line relay 30. This single impulse operates in the well-known manner to step the switch wipers up to the first level and then rotate the same onto the first contact in that level to which the enunciator apparatus H is connected. If the enunciator is not already in use, the circuit of the switching relay 58 is closed in the well-known manner, and this relay 58, upon energizing, disconnects the line relay 30 from the line and extends the line connection to the apparatus H through the wipers 25, 26 and 27. The double-wound relay 200 thereupon becomes energized to send back a holding ground to take the place of the usual ground G², since the relay 34 is deenergized when the line relay 30 is disconnected from the line. The new holding circuit is traced from ground G³⁰ through the springs 205, contact 26^a, wiper 26, contact springs 64 and 64^a and the relay 58 to battery B. The holding circuit for the winding 12 is also traced from ground G³⁰ through the springs 205, contact 26^a, wiper 26, springs 62 and 61, 60 and 59, bank springs 21 and 17 and through said winding to battery B. The calling party now talks into the transmitter and the waves are transmitted through the receiver portion 215 of the amplifier (which may be placed around in any desired locations) to the transmitter portion 204 and are finally delivered by the enunciators 203 and there repeated.

Assuming now that the apparatus H was

already in use, the wiper 26 would find the contacts 26^a which it engages provided with a guarding potential, which would be transmitted through the relay 66 and the springs 63 and 64, thereby preventing it from de-energizing. The rotary magnet, however, deenergizes when the springs 70 disengage, regardless of whether the relay 66 remains energized or not. If the relay 66 remains energized, the circuit of the rotary magnet will be again closed as soon as the armature drops back far enough to close the springs 59 and 60. Thus the wipers are moved onto the next contacts, *i. e.*, contacts 25^b, 26^b and 27^b, and owing to the fact that there is no guarding potential on the private contact 26^b, relay 66 deenergizes, thereby permanently breaking the circuit of the rotary magnet 29. However, as soon as the wipers come to rest after being rotated off the engaged contact, the circuit of the double-wound relay 201 (which is similar to the relay 200) is closed from ground G³¹ through the lower winding of said relay, contact 27^b, over the heavy conductors, through the telephone, back through the contact 25^b and the top winding of the relay 201 to battery B. Upon the relay 201 becoming energized, a holding circuit is provided from ground G³³ through the springs 208, contact 26^b and through the relay 58 and the winding 12 in multiple to battery B. This circuit is closed before the slow acting relay 34 has time to deenergize to break the circuit of the switching relay 58. A busy circuit is also closed from the busy machine Q through the springs 209, condenser 210, contact 25^b, through the calling subscriber's telephone, back through the contact 27^b and through the lower half of the relay 201 to ground. Upon the busy signal being heard at the substation A, the receiver is returned to the switch-hook and the connection released.

Assuming now that a subscriber at substation A, instead of wishing to connect with the enunciator, wishes to make connection with another subscriber's line at substation A', whose number is 2220. The operations for the first digit are precisely the same as described for the digit 1 when connecting with the enunciator. By calling the digit 2, the wipers are raised two steps to a position opposite the second row or level of bank contacts in which are the terminals of trunk lines leading to a group of the above-mentioned second selectors F. They then are rotated onto the first contacts in a manner already described and the rotary magnet 29 of the first selector E acts as a buzzer, rotating the wipers until an idle trunk is found, at which time the connection is extended over the conductors 211 and 212 to the line relay 71 of the selector F (Fig. 2).

When the substation calling device is operated for the second digit 2, the selector F

operates in the same manner as explained for the selector E to extend the line connection to the connector J (Fig. 2).

When the calling device is operated for the third digit 2, the circuit of the line relay 47 is momentarily broken twice to raise the wipers of the connector to the second level, and then when the calling subscriber operates his calling device for the last digit 0, the connector line relay 47 operates to transmit ten impulses through the rotary magnet in series with the relay 74, whereby the shaft is rotated onto the contacts of the desired line.

The ringing current from the generator R is then supplied to the called line in the usual manner. When the called subscriber removes his receiver, or as soon thereafter as the ringer relay deenergizes if it is energized at the time, the ringing current is cut off and the called substation is provided with talking current.

It will now be explained how a subscriber, by operating the key L' at his telephone, may place a signaling tone upon his line which will indicate to the calling subscriber that the called party is out, or for various other reasons cannot answer the call, whereupon the calling subscriber will place his receiver on the switch-hook and release the connection, whereby a trunk line will not be kept busy an unnecessary length of time. The operations of the key L' bridges the high resistance relay 104 across the line conductors 94 and 96. Should the subscriber at substation A' be called at this time, a circuit is closed through the relay 104 during the intermittent periods that the relay 49 is in a deenergized position. This energizing circuit for the relay 104 extends from ground G¹⁹ through the back-bridge relay 48, springs 89, springs 90, wiper 38, over the conductor 94, relay 104, springs 107, key L', thence back over the conductor 96, springs 91, conductor 83, wipers 36, springs 97, springs 99^a, and through the relay 48 to battery B. The relay 104 operates to break its own circuit at the springs 107 and thus operates to rapidly interrupt the circuit, thereby placing a buzz or tone on the line of the calling subscriber every time the ringing relay deenergizes.

The release of the connection is accomplished in the usual manner by the calling subscriber returning his receiver to the switch hook, whereby the switches are returned to their normal positions.

It will now be explained how the apparatus K and the clock O are adapted to be connected with a subscriber's line to ring his bell at a certain time. Opposite each numeral there is a suitable contact point, such as shown at 155, with which the hour hand (which is made of a conducting material) is arranged to come into contact as

it rotates. Connected to each contact 155 by means of lead 156 are one or more relays 122 having one terminal connected to the battery lead 100. A key K' is also provided, one side of which is grounded and the other connected in any suitable manner to a contact associated with any of the numerals for the purpose of making electrical connection, by means of both the hour and minute hands, with the relay 122. These contacts may be placed anywhere on the dial and the leads 156 connected to any contact, according to the hour a subscriber wishes to be called. The relay 123 is a ringing relay and is energized by the energization of the relay 122 from ground G²³. It is thus seen that to call a subscriber, say at six o'clock, the attendant connects certain springs of the relays 122 and 123 by means of leads 157, 158 and 159 to the normal conductors of the said subscriber's line, and also connects the relay 122 to the lead 156 and operates the key K'. When the minute and hour hands are passing over the contacts 150 and 155, respectively, at the same time, a circuit is closed from ground G²² through the springs of the key K', contact 150, through the minute and hour hands to the contact 155, lead 156 and through the relay 122 to battery B. The relay 122, upon energizing, places a guarding potential on the private contacts of the connectors that have access to the line being called, said potential extending from ground G²³ through the springs 160 and 161. The cut-off winding 80 is also energized from the same point to operate the armature 82 to close the contact of springs 91 and to disconnect the line switch from the called line. The circuit of the relay 123 is also closed from ground G²³ through the springs 160 and 161 and through said relay to the battery lead 100. The relay energizes to bridge the ringing generator R' across the line, which sends out alternating current to ring the bell at the substation A'. There may be as many springs 162, 163 and 164 on the relays 123 and 122, respectively, as they are capable of controlling for the purpose of calling a plurality of subscribers, or if there should be more subscribers to be called at a certain hour than one set of relays could handle, a plurality of said sets may be put into service. Furthermore, the metal contact 150 with which the minute hand connects may be of any suitable length, so as to prolong the length of time that electrical connections are maintained to keep the ringing relay 123 energized.

It will thus be seen that I have devised a very useful system, and while I have illustrated the various features of my invention in connection with an automatic telephone system of a well-known type, it will, of course, be understood that my invention

is not in any way limited to use in such a system. It is obvious that the substation circuit could be employed with other forms of systems, either automatic or manual. Likewise, other modifications could be made in the enunciator system and in connection with the other features of my invention.

What I claim as my invention is:—

1. In a telephone system, a calling and called line, a telephone for the called line, automatic progressively movable switching means for connecting the two lines in a talking circuit, means controlled by the calling subscriber for signaling the called subscriber, said means comprising a bridge normally across said called line including a receiver and a condenser, a pair of springs in said bridge controlled by a switch-hook, a transmitter, and means controlled by the operation of the switch-hook for disconnecting said condenser from said bridge and connecting the transmitter in bridge with said receiver.

2. In a telephone system, a calling and called line, a telephone for the called line, automatic progressively movable switching means for connecting the two lines in a talking circuit, means controlled by the calling subscriber for signaling the called subscriber, said means comprising a bridge normally across said called line including a receiver and a condenser, a pair of springs in said bridge controlled by a switch-hook, a transmitter, means controlled by the operation of the switch-hook for disconnecting said condenser from said bridge and connecting the transmitter in bridge with said receiver, and an impulse-transmitting device included in said bridge with said transmitter.

3. In a telephone system, a calling and a called line, a receiver and a condenser normally in bridge of said called line, automatic progressively movable means for establishing a communicating circuit between said lines and for signaling said called line through said bridge, and a signaling apparatus bridged across the called line whereby a signal is transmitted automatically from the called line to the calling line when the communicating circuit is established.

4. In a telephone system, a calling and a called line, a receiver and a condenser normally in bridge of said called line, automatic progressively movable means for connecting the two lines and for signaling said called line through said bridge, an interrupter magnet bridged across the called line, and means for energizing said magnet to thereby transmit a signal back to the calling line.

5. In a telephone system, a calling and a called line, a telephone for the called line, automatic progressively movable switching means for connecting the two lines in a

5 talking circuit, means controlled by the calling subscriber for signaling the called subscriber, said means comprising a bridge normally across said called line including
 10 a receiver and a condenser, a pair of springs in said bridge controlled by a switch-hook, a transmitter, and means controlled by the operation of the switch-hook for disconnecting said condenser from said bridge and connecting the transmitter in bridge with said
 15 receiver, and other means associated with the called line for signaling the calling line.

6. In a telephone system, a calling and a called line, a telephone for the called line,
 15 automatic progressively movable switching means for connecting the two lines in a talking circuit, means controlled by the calling subscriber for signaling the called subscriber, said means comprising a bridge normally across said called line including a receiver and a condenser, a pair of springs in
 20 said bridge controlled by a switch-hook, a transmitter, means controlled by the operation of the switch-hook for disconnecting said condenser from said bridge and connecting the transmitter in bridge with said receiver, an impulse-transmitting device included in said bridge with said transmitter, and other means associated with the called
 25 line for signaling the calling line.

7. In a telephone system, a calling and a called line, a receiver and a condenser normally in bridge of said called line, automatic progressively movable means for establishing
 30 a communicating circuit between said lines and for signaling said called line through said bridge, a signaling apparatus bridged across the called line whereby a signal is transmitted automatically from the called line to the calling line when the communicating circuit is established, and other means associated with the called line for signaling the called line to announce the time.

8. In a telephone system, a calling and a called line, a receiver and a condenser normally in bridge of said called line, means for connecting the two lines, and for signaling said called line through said bridge, an
 45 interrupter magnet bridged across the called line, means for energizing said magnet to thereby transmit a signal back to the calling

line, and other means associated with the called line for signaling the called line to announce the time.

9. In a telephone system, a calling line and a called line, automatic progressively movable means for connecting the two, a bridge normally across the called line including a receiver and condenser, a pair of
 55 springs in said bridge controlled by the switch hook, a transmitter, and means controlled by the operation of the switch hook for disconnecting said condenser from said bridge and connecting the transmitter in
 60 bridge with the receiver, and means across the called line for signaling the calling line.

10. In a telephone system, a calling line and a called line, automatic progressively movable means for connecting the two, a
 65 bridge normally across the called line including a receiver and condenser, a pair of springs in said bridge controlled by the switch hook, a transmitter, and means controlled by the operation of the switch hook
 70 for disconnecting said condenser from said bridge and connecting the transmitter in bridge with the receiver, means across the called line for signaling the calling line, and a manual device for removing said last
 75 means from across the called line.

11. In a telephone system, a calling line and a called line, automatic progressively movable means for connecting the two, a bridge normally across the called line including a receiver and a condenser, a pair of
 80 springs in said bridge controlled by the switch hook, a transmitter and means controlled by the operation of the switch hook for disconnecting said condenser from said bridge and connecting the transmitter in
 85 bridge with the receiver, means across the called line for signaling the calling line, and a manual device for removing said last means from across the line, said last means
 90 comprising a magnet and signaling current impulses controlled thereby.

Signed by me at Chicago, Cook county, Illinois, this 16th day of October, 1913.

ALBERT ANDERSEN.

Witnesses:

G. YANOWSKI,
 RAY STOKELY.