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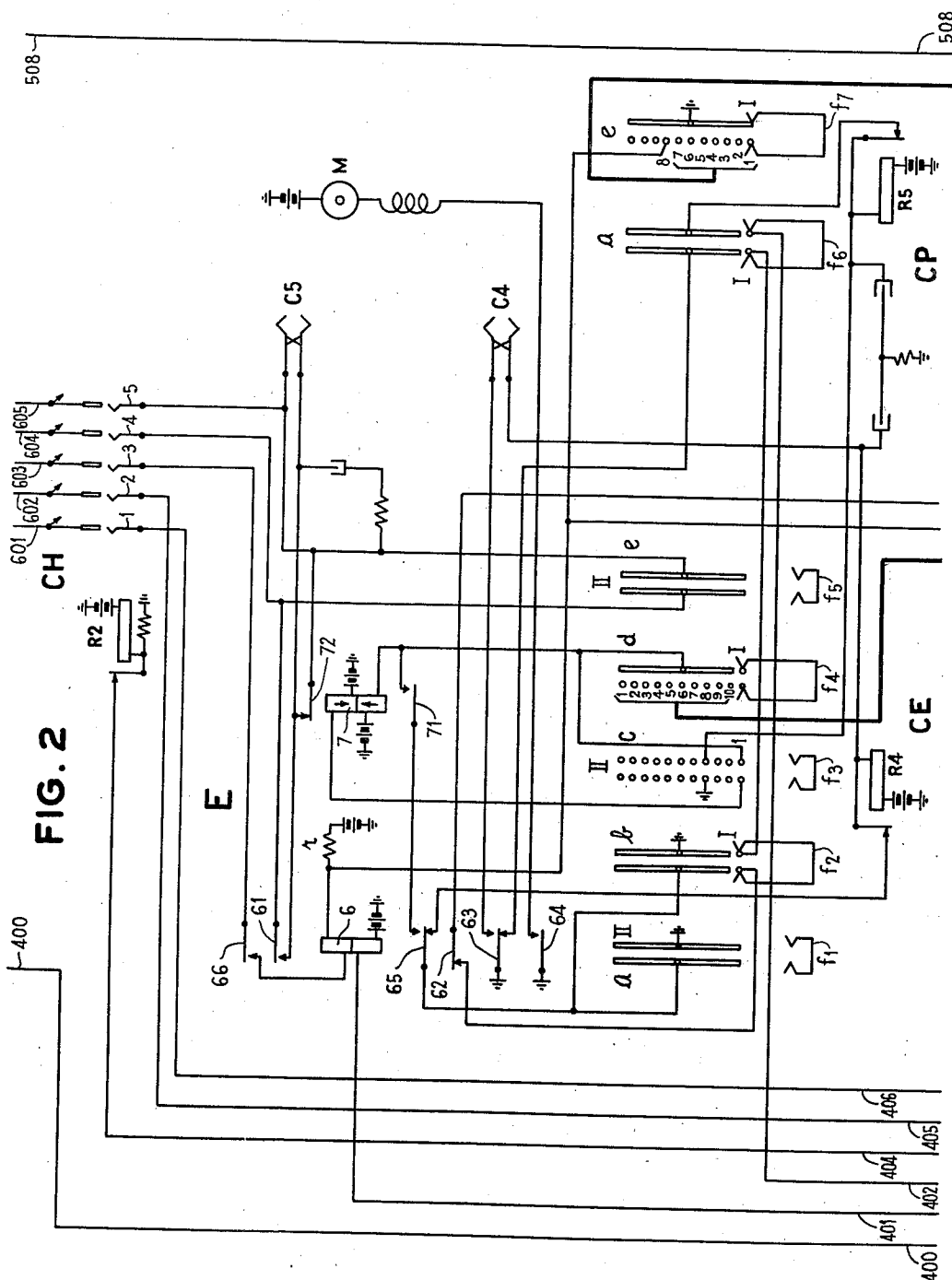
A. HÉRON

2,172,579

KEY SENDER

Filed Feb. 6, 1936

3 Sheets-Sheet 2



INVENTOR.

AMEDEE HERON

BY

R B Richardson
ATTORNEY.

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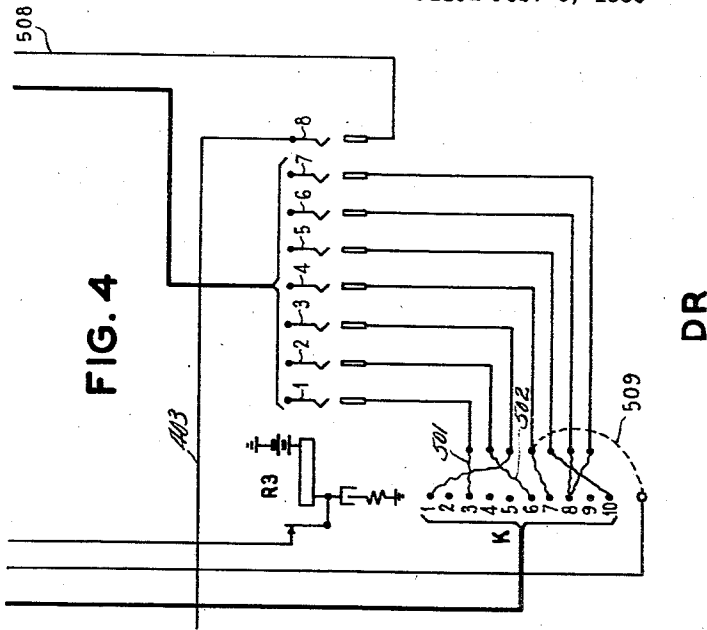
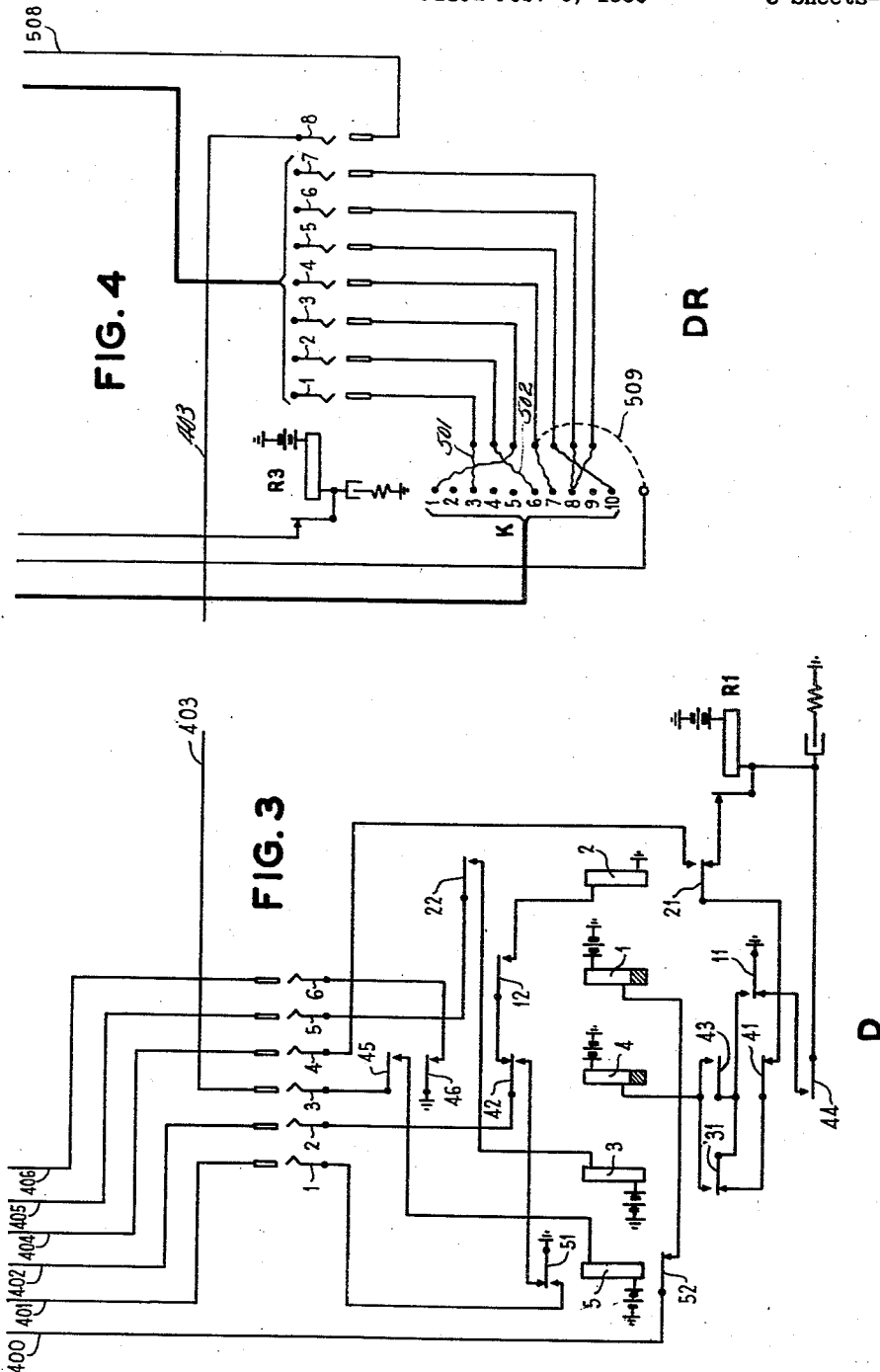
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BY

INVENTOR.
AMEDEE HERON

R. E. Richardson
ATTORNEY.

UNITED STATES PATENT OFFICE

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KEY SENDER

Amédée Héron, Paris, France, assignor, by mesne assignments, to Associated Electric Laboratories, Inc., Chicago, Ill., a corporation of Delaware

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7 Claims. (Cl. 179—90)

The present invention relates to an impulse train sending device enabling a subscriber to transmit over a line, by the simple depression of a button or key, the digits characteristic of a desired subscriber for the purpose of causing the setting of the switches in one or more distant exchanges.

A characteristic feature of the invention consists in the use of a group of call preparing relays individual to each subscriber's station, by means of which all the calls which can be set up from the calling station to a certain number of predetermined subscribers are registered, the facility for effecting some or all of these calls being common to all the stations.

Another characteristic of the invention resides in the use, in combination with the above relay groups, of a distributor and a plurality of translating and sending devices which are common to all the stations of the same system, the setting of the calling relays of an individual relay group in the calling position, which setting is effected by a manual operation at the calling station, bringing about the seizing of a free impulse train sender, and also bringing about the sending of impulses over a trunk line by the said impulse sender corresponding to the number of the called station, the control of the transmission of the said impulses being effected by the group of calling relays.

Another characteristic of the invention resides in the ability to set up calls from any of the stations to subscribers whose call numbers may comprise different numbers of digits by means of the group of calling relays and the impulse sender.

The foregoing and other features will be described hereinafter with reference to the accompanying drawings, comprising Figs. 1, 2, 3, and 4, which are circuit diagrams showing sufficient of the apparatus involved to enable the invention to be explained and understood. Fig. 1 shows the subscriber's station equipment, Fig. 2 shows a sending device E and a finder CH, Fig. 3 shows a distributor, and Fig. 4 shows a translating switch.

The arrangement of the system is as follows:

In a telephone installation comprising a certain number of subscriber such as P1 (see Fig. 1) of a private branch exchange which is connected by trunk lines to a public automatic system, each of these subscribers can set up calls automatically over these trunk lines to a number of predetermined subscribers belonging to the public system

by operating two buttons and without having to operate a dial.

For this purpose each subscriber's station such as P1 is provided with a set of buttons C1 each associated with a different trunk line, and a set of buttons C2 forming a keyboard in association with his usual telephone.

Each of these latter buttons corresponds to the number of a particular subscriber with whom communication is desired. The numbers of these subscribers may contain any number of digits.

All the buttons provided at the stations such as P1 for operating the relays return to normal when the pressure of the hand is removed.

A certain number of sender devices E (Fig. 2) are placed at the disposal of the stations such as P1. These devices are controlled by a single distributor D (Fig. 3).

Each sending device E contains relays 6 and 7, associated with the rotary switches CH, CE, and CP, and a motor M for producing impulses. Each sending device also has associated with it a translating switch DR, Fig. 4.

Moreover, a series of calling relays such as 10-20 is associated with each series of keyboard buttons such as C2, these relays being used to mark the number of the desired subscriber on the contact bank of the translating switch DR of the sending device E in use.

In order to call a subscriber of the public exchange, for example, the subscriber at station P1 first removes his handset and then transitorily presses on the button corresponding to a trunk line such as L1 and then releases the button.

When he hears the dial tone in his receiver the subscriber at station P1 momentarily presses the key-board button such as C2 corresponding to the number of the desired subscriber. The various members of the translating and sending equipment are thereby set in operation, the call is transmitted over the trunk line and the translating and sending equipment releases.

The station P1 is then in the same position as if the call had been set up to the called subscriber by means of the ordinary dial.

The detailed operation is as follows:

When subscriber P1 wishes to call a subscriber of the public exchange, a station whose number comprises 7 digits, for example, he momentarily presses the button corresponding to a trunk line such as L1, as was mentioned above. This button is presented in Fig. 1 by C1.

Relay 9 (Fig. 1) energizes in the following circuit: working contact C1, lower winding of relay 9, battery. Relay 9 locks up over its upper wind-

ing at contact 91 by way of a switchhook contact of the station P1 which is not represented in these drawings. Station P1 loops the trunk line L1 over resting contact 83, working contact 92, contact 1 of button C3, working contact 93, and resting contact 84. At working contact 94 relay 9 prepares a circuit extending to the device E (Fig. 2).

Station P1 is now connected to the first selector in the public exchange. When subscriber P1 hears the dial tone in his receiver he depresses transitorily the button C2 corresponding to the number of the subscriber he wishes to call.

The button C2 energizes one of the relays 10, 11, or 12, etc., and one of the relays 20, 21, or 22, etc., so as to establish a closed circuit between a conductor 601 and a conductor such as 538 leading to the test contact of a set of bank contacts in the translating switch DR, a circuit identifying the call number to be transmitted.

The number of relays 10, 11, 12, etc., and 20, 21, 22, etc., associated with the station P1 varies with the number of connections to be set up. If the number of subscribers who can be called is for example 36 the station P1 will have 6 relays of the series 10, namely, 10, 11, 12, 13, 14, and 15, and 6 relays of the series 20, namely, 20, 21, 22, 23, 24, and 25.

If the number of subscribers which can be called from station P1 is 49 there will be 7 relays of the series 10 and 7 of the series 20, and so on.

The contact springs of contacts 102, 112, 122, etc., are all connected together and to conductor 601. The latter conductor is individual to station P1 and is multiplied to all the wiper 1 contacts of the contact sets in the banks of trunk finders CH which are allocated to station P1. There are as many contact sets allocated to station P1 as there are trunk lines, and each trunk line has as many appearances in the banks of the trunk finders CH as there are stations such as P1. Working contact 102 is connected to the contact springs 202, 212, 222, etc. Working contact 112 is connected to contact springs 203, 213, 223, etc., and similarly for contacts 122, 132, etc. Moreover, the working contacts 202, 203, 204, 212, 213, 214, etc., are individually connected to the conductors such as 538 leading to the test contacts of the contact sets in the banks of translating switches DR, these contact sets corresponding to the numbers of the subscribers which the station P1 can call by means of his keyboard.

We shall assume that the button C3 is connected to relays 10 and 21. Depression of this button will then cause these two relays to energize. The relays hold up over the following circuits: battery, winding of relay 10, working contact 101, resting contact 301, winding of relay 31, resting contact 2 of button C3, earth; and for the other relay: battery, winding of relay 21, working contact 211, resting contact 301, winding of relay 31, resting contact 2 of the button C3, earth. Relay 31 energizes. At working contact 311 it energizes a relay in the distributor D. At working contact 312 it prepares a further circuit for the distributor D.

The distributor D is now set in operation so as to associate the calling station with a free sending device E. Relay 1 energizes over the following circuit: battery, winding of relay 1, resting contact 52, lead 400, resting contact 302, working contact 311, earth. The circuit for the rotary magnet R1 of the distributor is completed through battery, winding R1, contact of the rotary magnet, resting contact 21, resting contact 41, resting

contact 31, working contact 11, earth. The brushes of the distributor step over the bank contacts until a free device E is found.

A free device E is characterized by battery on the lead 402 at the distributor bank. The battery via rotary magnet R3 is only connected to lead 402 in the distributor bank if the switches CE and CP of the sending device E are in the rest position, i. e., if their wipers f2 and f6 are set respectively on the contacts 1 of the banks b and a of the switches CE and CP. It will be assumed that the wipers of the distributor are brought to rest on the particular device E which is shown, the circuit for the rotary magnet R1 being broken at resting contact 21 by the operation of relay 2 which operates over the following circuit: earth, winding of relay 2, working contact 12, resting contact 42, wiper 2 of the distributor, bank contact, lead 402, wipers of bank a of switch CP in position 1, wipers of bank b of switch CE in position 1, resting contact 62, stepping contact of rotary magnet R3 of the translating switch, winding of magnet R3, battery. In this circuit only relay 2, whose resistance is large compared with that of R3, is energized.

The trunk finder CH is then set in operation by its rotary magnet R2 which energizes over the following circuit: battery, winding of R2, stepping contact, lead 404, bank contact of the distributor, wiper 4, working contact 21, resting contacts 41 and 31, working contact 11, earth.

At working contact 22 relay 2 prepared a circuit for bringing the finder CH to rest by means of relay 3. The latter relay energizes when the wipers associated with R2 find the trunk line used for the call at its contact set which is allocated to station P1, i. e., when the following circuit is closed: battery, winding of relay 3, working contact 22, wiper 5 of the distributor, bank contact, lead 405, wiper 2 of the finder CH, bank contact, lead 602, resting contact 85, working contacts 94 and 312, earth. At resting contact 31 relay 3 breaks the circuit for the rotary magnet of the finder CH, which is thereupon brought to rest. Relay 4 energizes over the circuit: battery, winding of relay 4, working contacts 31 and 11, earth, and sets up a locking circuit over working contacts 43 and 11 and earth.

At working contact 42 relay 4 closes the circuit for the rotary magnet R3 of the translating switch DR, this circuit being completed over: battery, winding of rotary magnet R3, stepping contact, resting contact 62, normal position of CE and CP, lead 402, bank contact of the distributor D, wiper 2 of the distributor, working contact 42, resting contact 51, earth.

The translating switch DR is stepped round by its rotary magnet R3 until its wipers close a stopping circuit for relay 5 in the distributor, i. e., the circuit: battery, winding of relay 5, working contact 45, wiper 3 of the distributor D, bank contact, lead 403, wiper 8 of the translating switch DR, bank contact of DR, lead 508, circuit closed by the combination of a relay of the series 10, and a relay of the series 20, lead 601, bank contact of the finder CH, wiper 1, lead 406, bank contact of the distributor D, wiper 6, working contact 46, earth.

At resting contact 51 relay 5 breaks the stepping circuit for the translating switch which is thus brought to rest. Relay 6 of the sending device E is energized over the circuit: working contact 51, wiper 1, bank contact, lead 401, lower winding of relay 6 and battery; and holds up over: battery, resistance r, upper winding of 6, 75

working contact 66, wiper 3 of the finder CH, bank contact, lead 603, winding of relay 8, working contacts 94 and 312, earth.

Relay 8 energizes. At contacts 81x and 82x it connects the leads of the trunk line L1 to the sending device E, and transitorily disconnects the station P1 from this trunk line at contacts 83 and 84.

Relay 8 opens contacts 85. At working contact 86 it supplements the energizing circuit of relay 31 and of the relays of the series 10 and 20. At working contact 87 relay 8 completes the circuit for relay 39 which energizes. At contact 301 relay 30 prepares the opening of the circuit of relay 31; at resting contact 302 it opens the starting circuit of the finder D.

In the distributor D relay 2 falls back on the operation of relay 4 by the opening of its circuit at contact 42, and this results in the deenergizing of relay 3 whose circuit is opened at working contact 22. Relay 1, which is slow to release, then falls back, its circuit having been broken at contact 52 by the operation of relay 5, this circuit also being broken at contact 302 on the operation of relay 39. The rotary magnet R1 is then energized in the circuit: battery, winding of R1, working contact 44, resting contact 11, earth. The magnet R1 attracts its armature. Shortly afterwards relay 4, which is slow to release, falls back, its circuit having been broken at contact 11. The circuit for the rotary magnet is thus opened at contact 44, and the armature in falling back advances the wipers of the distributor D to the next contact set in the bank. The release of the distributor D is completed on the return to normal of the relay 5 whose locking circuit is opened at working contact 45.

The registering device E contains two rotary switches CE and CP which up to the present have not functioned.

The sender switch CE comprises a rotary magnet R4 and 5 banks of contacts a, b, c, d, e, which are brushed by a series of wipers f1, f2, f3, f4, f5 so arranged that at rest only the wipers f2 and f4 are set on their contacts 1; the other wipers of f1, f3 and f5 do not engage with their respective contact leads a, c, e until the wipers f2, f4 have passed over all the contacts of levels b and d, and vice versa.

The rotary switch CP is arranged differently. The wipers f6 and f7 are extended so that when one extremity of the wipers has passed over the contacts a, b the other extremity engages in its turn with contact 1 of the levels a and b.

Relay 6 on operating loops at contacts 61 wipers 4 and 5 which are connected to the trunk line L1, and at contact 65 prepares a circuit for relay 7. At contact 63 it closes the circuit for the rotary magnet R4 of the sender, this circuit being completed over: earth, contact 63, impulse contact C4, rotary magnet R4, battery. Magnet R4 thereupon energizes. At contact 64 relay 6 completes the circuit for the impulse generator M which opens the impulse contacts C4 and C5 at regular intervals.

The sender switch CE is stepped around under the influence of the impulses produced by the impulse contact C4.

The wipers 1, 2, 3, 4, 5, 6, and 7 of the translating switch DR are wired to the bank contacts b of switch CP so that as wiper f7 is advanced step by step the wipers of the translating switch DR are successively earthed. The bank contacts of the translating switch DR are wired to a translation field K. This translation

field comprises a cross-connecting rack on one side of which are terminals to which the various contact sets of switch DR are wired and on the other side of which are ten common terminals or digit bus bars numbered 1 to 10, inclusive. Thus each contact set of switch DR can be cross-connected to digit bus bars in accordance with the subscriber's number to which it corresponds. The particular contact set shown in the drawings is cross-connected in the proper manner to send out the number 3617088. The digit bus bars of the translation field K numbered from 1 to 10 are wired in reverse order to the contacts of the bank d of switch CE.

Under the influence of the impulse contacts C4 the switch CE steps its wipers. Wiper f4 leaves rest position 1 and passes over contacts numbered 10, 9, 8, etc., of bank d. On arriving at contact 3 of bank d the wiper f4 completes an energizing circuit for relay 7 over: battery, lower winding of relay 7, contact strip d, wiper f4, contact 3 of level d, bus bar 3 of the translation field K, connecting wire 501, bank contact of the translating switch, wiper 1, contact 1 of level b of switch CP, wiper f7, contact strip b earth.

Relay 7 which is energized locks up over working contacts 71 and 65, contact strip b, wiper f2, and earth.

At contact 72 relay 7 removes the short-circuit from the impulse contact C5 and while the switch CE continues its course impulses are sent to the public automatic exchange by way of wipers 4 and 5 of CH and working contact 61. Three impulses are thus transmitted over the trunk line before wiper f3 connects the two first contacts of level C in the switch CE. Relay 7 then falls back and again short-circuits the impulse contact C5 at contact 72. Relay 7 is a differential relay. The circuit for the upper winding of relay 7 is completed over: battery, relay winding, the two first contacts of level C and wiper f3 contacts 71, 65, contact strips a, wiper f1 and earth.

The two windings of relay 7 being in opposition the relay falls back. As the switch CE continues its course wiper f3 passes to the 4th contact of bank C and completes the circuit for the rotary magnet R5 of switch CP which thereupon steps its wipers to position 2 on its contact bank.

A further series of impulses proceeding from the impulse contacts C5 is not transmitted over the trunk line until the switch CE has returned to its original position, i. e., until wiper f4 has arrived in its first position and passed along on its second rotation. Six impulses are now sent over the trunk line under control of wiper 2 of the translating switch which is now connected to earth through contact number 2 of bank b of CP. The transmitting of these impulses commences when relay 7 is energized again and its circuit is completed over: battery, winding of relay 7, contact strip d, wiper f4, contact 6 of bank d, bus bar 6 of the translation field K, connecting wire 502, bank contact, wiper 2, contact 2 of bank b of switch CP, wiper f7, contact strip b, earth.

The other digits 1, 7, 0, 8, 8, are then transmitted under the same conditions, while the switch CP moves to contact 3 of bank b. When this occurs the upper winding of relay 6 and relay 3 becomes short-circuited on account of the circuit, earth, contact segment b of CP, wiper f7, contact 3 of bank b, resistance r and battery, having been established.

The return to normal of relay 8 reestablishes the connection between the trunk line and the

station P1 at contacts 83 and 84 without any danger of the current being disconnected by this switching operation, since the exchange line remains looped by wiper f5 and the two contact segments e of switch CE until relay 8 has returned to normal.

The return to normal of relay 6 arrests the operation of the motor M at working contact 64, and also stops the stepping of switch CE, over contact 63. The latter switch, however, is returned to normal by a circuit over: battery, winding of R4, stepping contact, resting contact 65, contact segments a, wiper f1 and earth.

Switch CP is returned to normal by the circuit: battery, rotary magnet R5, stepping contact, segments a and wiper f6, contact 63, earth.

If the number of the called subscriber contains less than 7 digits, 3 digits, for example, a special connection is made at the translating field K. The fourth bank contact of the contact set corresponding to such 3 digit number is cross-connected to a special terminal which in turn is connected to the end of the resistance r. Under these conditions when the wiper f7 of CP reaches the 4th contact, i. e., when three series of impulses have been transmitted, relays 6 and 8 fall back as has been explained above, a short-circuit having been established as follows: earth, contact segment b of CP, wiper f7, contact 4 of level b, wiper 4 of the translating switch, bank contact 4, lead 509, resistance r, battery. The release of the switches CE and CP is effected as above.

The return to normal of relay 8 causes the release of relays 30 and 31 and also the relays of the series 10 and 20.

The holding circuit for relay 31 and the relays of the series 10 and 20 actually passes through contact 86. On the opening of the latter contact these relays deenergize and are unable to set up another holding circuit over contact 301, since relay 30 being slow to release does not restore contact 301 until a moment after relay 8 has deenergized. In this way all the relays associated with the keyboard of station P1 return to normal, as does the apparatus in the sending device E. The station P1 is connected directly to the exchange and only relay 9 remains energized.

While a call is being set up it is possible to cancel the latter by operating the cancelling button C3. Operation of this button also enables the station P1 to set up fresh calls without having to replace the receiver.

On depressing the key C3 for a sufficient time the apparatus of the automatic exchange is released on account of the line loop having been broken at contact 1 of the key C3. If the number of the public exchange subscriber who is being called has not yet been completely transmitted by the sending device the relays 31, 30, and two relays of the series 10 and 20 are still energized. The depression of key C3 will therefore cause the locking circuit of relay 31 and the two relays of the series 10 and 20 to be broken at contact 2 of C3, and the release of relay 31 will effect the release of the other switching devices as described above.

In order to set up a fresh call over the same trunk line it is only necessary to press momentarily on the button of the series C2 which corresponds to the desired subscriber.

As the sending devices E are common to all the stations P1 having calling keyboards it may happen that all these sending devices E (whose number will obviously be less than that of the stations P1) will be engaged in calls when a further sub-

scriber P1 tries to set up a call by means of one of his keyboard buttons. In this case this new call will be registered when the subscriber P1 presses one of the buttons C2, by means of his registering relays of the series 10 and 20, but it will not be transmitted over the trunk line chosen by the station P1 until one of the engaged registering devices becomes free. The new call is not lost, therefore, but simply deferred. The condition when all the registering devices are engaged may be indicated at the station P1 either by an audible signal in the receiver or by a visual signal arranged close to the cancelling button C3, these signals being controlled, for example, by a device arranged in the distributor D, but not represented in the drawings.

What is claimed is:

1. In combination, a subscriber's station, a line, means for connecting said station to said line, a group of keys, each key corresponding to a different telephone number, register relays controlled by said keys, a translator switch having positions each associated with a telephone number, means including certain of said relays and keys for operating said translating switch to one of said positions, a sender, means for associating said sender with said line, and means for operating said sender in a manner controlled by the position of said translating switch to transmit impulses over said line representing the digits of the number corresponding to an actuated key.

2. In combination, a group of subscribers' stations, each station having a group of keys, and each key being associated with a telephone number which may be called from the associated station, a plurality of senders for common use by said stations, and means responsive to the actuation of any one of said keys at any station for completing a circuit, means responsive thereto for selecting an idle sender and for operating it to transmit impulses representing the digits of the telephone number associated with the actuated key.

3. In combination, a group of subscribers' stations, each station having keys corresponding respectively to telephone numbers that may be called, trunk lines, means for connecting a calling station with a trunk line, a group of common senders, means responsive to the actuation of a key at the calling station for causing an idle sender to be associated with the trunk line in use and prepared to transmit impulses over the trunk line representing the digits of the number corresponding to the actuated key before any of such impulses are transmitted over the trunk line, and means effective thereafter for operating said sender to transmit said impulses.

4. In combination, a plurality of subscribers' stations, a plurality of trunk lines, individual number registering means at each station, means for connecting a calling station with a trunk line, a plurality of senders, means including a finder for connecting an idle sender with the trunk line in use over a set of finder contacts individual to the calling station, a translator switch associated with said sender which is set under control of the registering means at the calling station, and means for operating said sender under control of said translating switch.

5. In a telephone system, a plurality of stations, a plurality of trunks, means for connecting any calling station with any trunk, a finder, contact sets in said finder equal in number to the product of the number of stations times the num-

ber of trunks, and means controlled from the calling station for advancing said finder to the set of contacts which is individual to such station and to the trunk with which it is connected.

5 6. A system as set forth in claim 5, characterized by the provision of a translating device and a sender individual to the finder, means for setting the translating device under control of means individual to the calling station, and
10 means for operating the sender under control of the translating device to transmit impulses over the connected trunk line.

7. In an automatic switching system, a station having a group of keys, each key corresponding

to a number including a plurality of digits, a line associated with said station, a plurality of senders, means responsive to the actuation of one of said keys at said station for selecting any idle one of said senders, for associating it with said line, and for preparing it to transmit impulse trains over said line in accordance with the particular number corresponding to said actuated key, before any of such impulse trains are transmitted over said line, and means effective thereafter for operating said sender to transmit said impulse trains. 10

AMÉDÉE HÉRON.