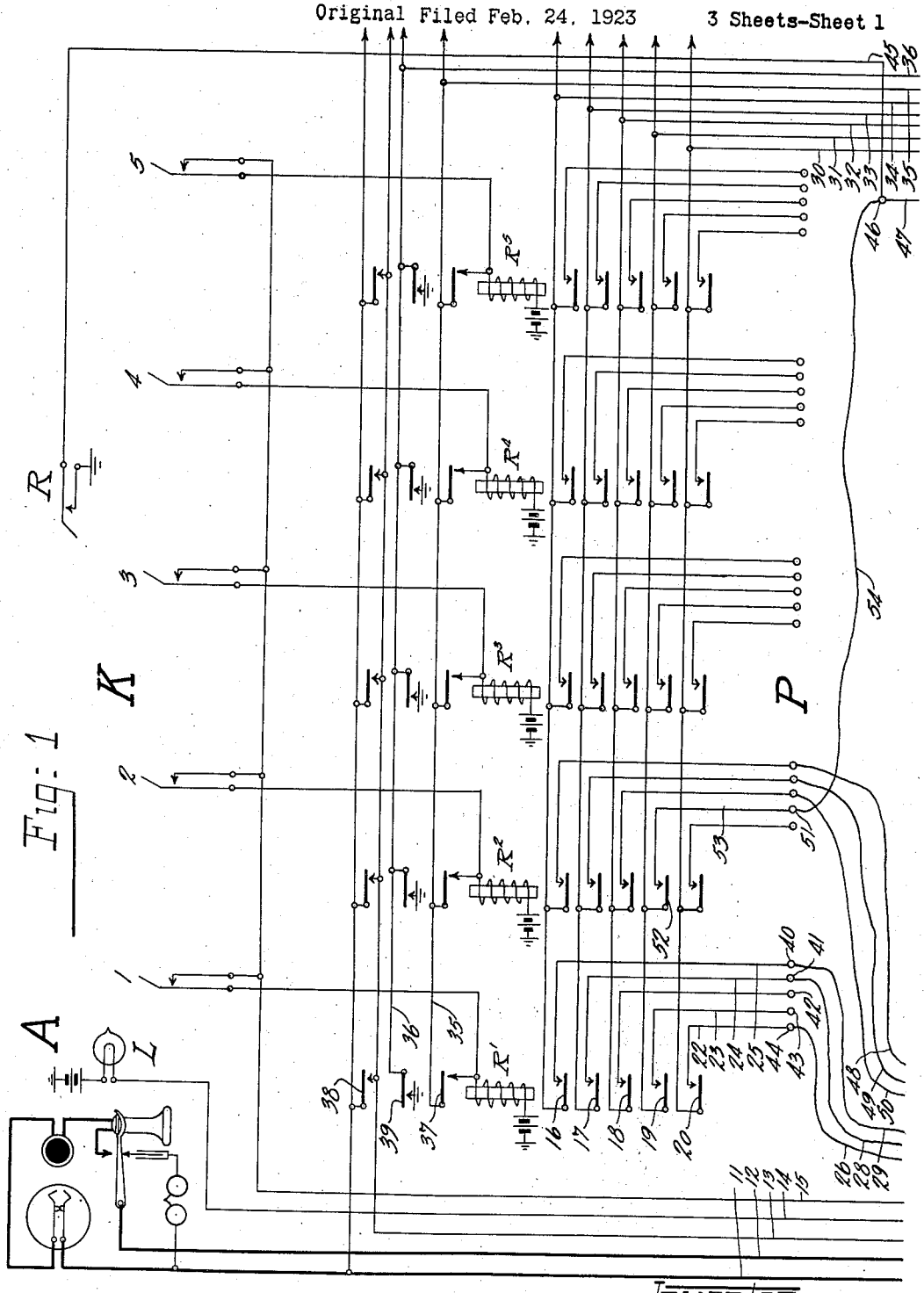
July 12, 1927. 1,635,805

J. WICKS

TELEPHONE SYSTEM

Original Filed Feb. 24, 1923 3 Sheets-Sheet 1



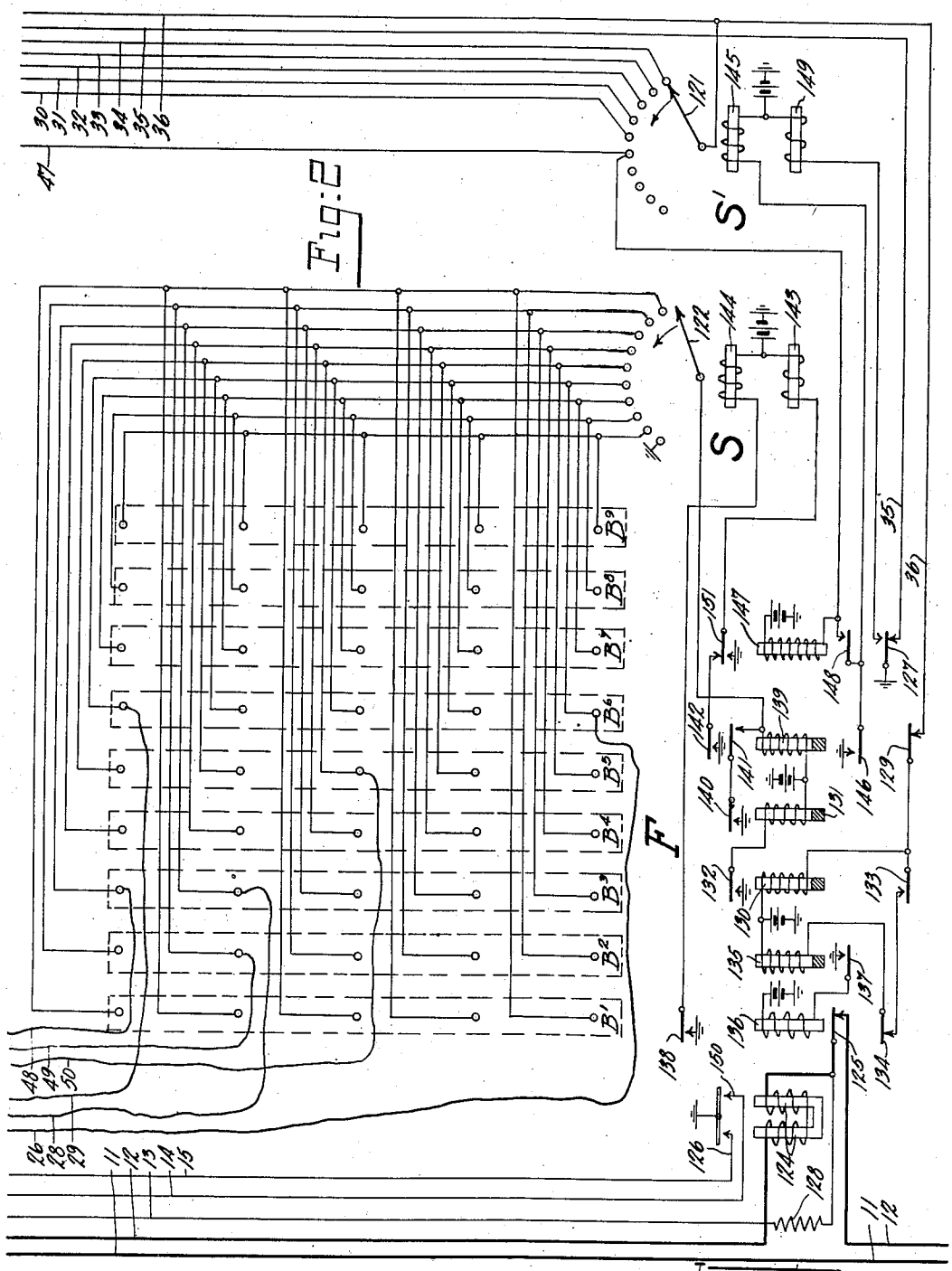
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TELEPHONE SYSTEM

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Original Filed Feb. 24, 1923 3 Sheets-Sheet 3

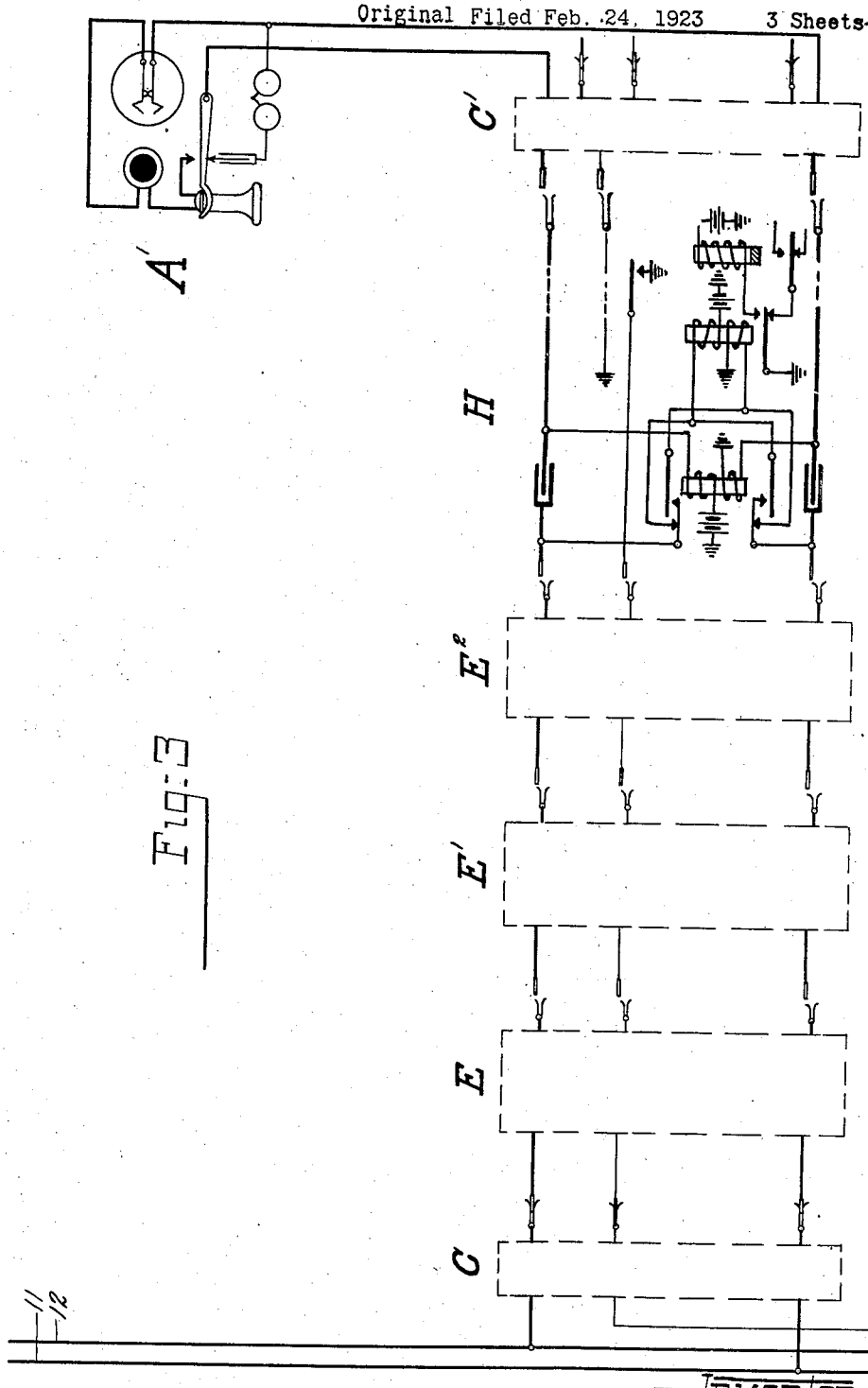


Fig. 3

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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

Application filed February 24, 1923, Serial No. 620,932. Renewed December 3, 1926.

The present invention relates in general to telephone systems in which connections may be established through the medium of subscriber controlled selector and connector switches.

It sometimes occurs that a subscriber at a given substation may have occasion to call certain telephones at very frequent intervals, and when this is the case the customary operation of the dial may prove burdensome. The object of the invention is to provide means whereby the subscriber at a special substation may obtain connection with any one of a limited number of other substations as the result of merely depressing a single key, the means in no manner interfering with the ordinary operation of the telephone.

The above object is accomplished by providing, in addition to the usual dial, a key controlled impulse sending device at the special substation. A plurality of keys are provided, the operation of any key causing the impulse sending device to deliver the trains of impulses necessary to establish a connection to the called substation represented by the key.

The object of the invention will be more fully pointed out hereinafter, reference being had to the accompanying drawings in which Figs. 1 and 2 represent the equipment at the special substation, while Fig. 3 represents diagrammatically the automatic switches necessary to establish a connection from a calling to a called substation.

Referring to Fig. 1, the automatic substation A has the usual talking, signalling, and impulse sending instrumentalities. In close proximity to the substation A is mounted the lamp L, the emergency release key R, and the sending keys K. A sending key is provided for each substation to which special service is desired.

Certain switch and relay equipment is also located at the special substation, a relay such as R′, R², etc., being associated with each key K. Each R relay is provided with a plurality of armatures, such as the armatures 16 to 20, inclusive, one armature being provided for each digit in the call number of a telephone in the system. For convenience in cross connecting, the working contact of each of the aforementioned armatures is connected to a punching or terminal P.

Referring to Fig. 2, the sending switch S and the sequence switch S′ are simple ten-point step-by-step switches, each of which is provided with a stepping magnet and a release magnet. The contacts in the bank of the sequence switch S′ are multipled to corresponding armatures of the R relays.

A bus-bar such as B′, B², etc., is provided for each of the first nine contacts in the bank of the sending switch S. Each bus-bar has a plurality of terminals in order to provide facilities for cross connecting with the punchings P.

The relay equipment F controls the operation of the sequence switch S′ and the sending switch S.

Referring to Fig. 3, the line switches C and C′, denoted by dotted rectangles, may be assumed to be of the well-known rotary type. The selectors E, E′ and E², which are denoted by dotted rectangles, may be assumed to be of the well-known vertical and rotary type. The connector H, shown in part only, may also be assumed to be of the well-known vertical and rotary type. The called substation A′ is similar to the substation A.

The normal operation of extending a connection to substation A′ from substation A may be described as follows; it being assumed that the call number of substation A′ is 63006. When the receiver at substation A is removed, the line switch C operates to extend the connection to an idle first selector, such as the selector E. The operation of the calling device for the first digit 6 will cause the selector E to raise its wipers opposite the sixth level of bank contacts, whereupon the selector will automatically rotate in search of an idle trunk line leading to a second selector. In the same way the digit 3 will operate a second selector E′, the digit 0 a third selector E², and the digits 0 and 6 a connector H, thus completing the connection to substation A′.

The operation of the key controlled calling device will now be described in a general way. It will be assumed that a certain key K is to be operated when it is desired to send out impulses corresponding to the number 54,325. The aforementioned key K

has in association an R relay, and cross connection must be made such that the operation of this relay will cause the transmission of a series of impulses representing the call number 54,325. The R relay in question has five armatures, which are in multiple with the first five bank contacts of the sequence switch S'. Since the first digit in the desired number is 5, the working contact of the first armature is cross connected to bus-bar B^5 which is multipled with the fifth contact in the bank of the sending switch. The working contact of the second armature is cross connected to bus-bar B^4, the working contact of the third armature is cross connected to bus-bar B^3, the working contact of the fourth armature is connected to bus-bar B^2, while the working contact of the fifth armature is cross connected to bus-bar B^5.

When the subscriber at the special substation removes his receiver the associated line switch operates to extend the connection to an idle first selector. The subscriber then depresses the key K associated with telephone 54,325, whereupon the associated R relay becomes operated. As the sequece switch is normally in first position ground is now placed upon the fifth contact in the bank of sending switch S. The relay equipment F immediately sends out a train of impulses to the first selector, the switch S advancing its wiper one step per impulse. When the grounded contact is reached, five impulses have been sent, the impulsing then ceases and the switch S returns to normal, whereupon the sequence switch advances to second position and grounds the fourth contact in the bank of switch S.

The relay equipment F now sends out a train of impulses to the second selector, the switch S operating as before. When the fourth contact is reached the impulsing ceases and the switch S returns to normal, whereupon the sequence switch advances to third position and grounds the third contact in the bank of switch S.

The relay equipment F now sends out a train of impulses to the third selector, the switch S operating as before. When the third contact is reached the impulsing ceases and the switch S returns to normal, whereupon the sequence switch advances to fourth position and grounds the second contact in the bank of switch S.

The relay equipment F now sends out a train of impulses to the connector, the switch S operating as before. When the second contact is reached the impulsing ceases and switch S returns to normal, whereupon the sequence switch advances to fifth position and grounds the fifth contact in the bank of switch S.

The relay equipment F now sends out another train of impulses to the connector, the switch S operating as before. When the fifth contact is reached the impulsing ceases and the switch S returns to normal, whereupon the sequence switch advances to sixth position and then restores to normal.

From the foregoing it will be seen that the connection has been built up in the same manner as though the impulses had been delivered direct from a dial. When the called party answers, the lamp L at substation A will light as an indication to the calling subscriber. The impulse sending device returns to normal when the receiver is restored at the calling substation.

The invention having been described in general, a detailed description will now be given of the operation. For this purpose it will be assumed that the key K' is associated with the called substation A', whose number is assumed to be 63,006. When the receiver is removed at substation A the line switch C, Fig. 3, is operated over line conductors 11 and 12. The polar relay 124 and the resting contact of armature 125, Fig. 2, are in series with conductor 12. The normal polarity of the calling line is such that the armature of polar relay 124 now makes contact with spring 126.

When the calling subscriber operates the key K' a circuit is closed from ground at the armature of the polar relay 124, spring 126, conductor 15, key K', relay R' to battery. Relay R', upon energizing, forms a locking circuit for itself independent of key K', which may be traced from ground at armature 127 and its resting contact, Fig. 2, conductor 35, armature 37 and its working contact, relay R' to battery. A further result of the energization of relay R' is the bridging of resistance 128 across line conductors 11 and 12 at armature 38. This resistance shunts the receiver at substation A during the time of impulsing, but does not render it entirely inoperative.

A further result of the energization of relay R' is the closure of a circuit traceable from ground, working contact and armature 39, conductor 36, resting contact and armature 129, relay 130 to battery. Relay 130 will energize over the above traced circuit and cause the operation of relay 131 at armature 132, whereupon the latter relay prepares a locking circuit for relay 139. Relay 130 also closes a circuit from grounded conductor 36, resting contact and armature 129, armature 133 and its working contact, resting contact and armature 134, relay 135 to battery. Relay 135 now energizes and closes the circuit of relay 136 at armature 137, whereupon relay 136 energizes and opens the circuit of relay 135 at armature 134. As relay 135 is slow-acting, it and relay 136 will continue to operate alternately at approximately ten cycles per second. Each time relay 136 energizes an impulse is de-

livered over the calling line, and, furthermore, the circuit to the stepping magnet 144 of the sending switch S is closed at armature 138.

As the first digit of the call number is 6 it follows that the cross connection must be such that the sixth contact in the bank of switch S will be grounded. When the wiper of switch S reaches the sixth contact a circuit may be traced from grounded conductor 36, wiper 121 of sequence switch S′ in first position, conductor 34, armature 16 and working contact, conductor 25, punching 40, jumper 29, to bus-bar B6, sixth contact in bank of switch S, wiper 122, relay 139 to battery. Relay 139, upon energizing, forms a locking circuit for itself independent of wiper 122, which may be traced from ground, working contact and armature 140, armature 141 and working contact, relay 139 to battery.

A further result of the energization of relay 139 is the opening of the circuit to relay 135 at armature 129. Thus, the impulsing will cease, as relay 135 cannot again energize when its circuit is again closed by the deenergization of relay 136. A still further result of the energization of relay 139 is the closure of a circuit through the release magnet 143 of switch S by way of armatures 142 and 151, whereupon the said release magnet operates to restore the wiper 122 to normal position. Relay 139 also closes the circuit of the stepping magnet 145 of the sequence switch S′ at armature 146, whereupon the stepping magnet operates to advance the wiper 121 to second position.

The foregoing operation has resulted in the sending of six impulses over the calling line. An explanation will now be given of the time interval necessary between series of impulses. When relay 139 operated it opened the circuit of slow-acting relay 130, which will now deenergize and open the circuit of slow-acting relay 131. Upon deenergizing, relay 131 will open the locking circuit of slow-acting relay 139. Relay 139, upon deenergizing, will open the circuit of release magnet 143 and stepping magnet 145. A further result of the deenergization of relay 139 is the closing of the circuit to relay 130 at armature 129, whereupon the cycle of operations is again started. The time interval introduced by the deenergization of slow-acting relays 130, 131, and 139 has been sufficient to allow the selector to seek an idle trunk.

As the second digit of the call number is 3 the cross connection must be such that the third contact in the bank of switch S will be grounded. When the wiper of switch S reaches the third contact in its bank a circuit may be traced from grounded conductor 36, wiper 121 of sequence switch S′ in second position, conductor 33, armature 17 and its working contact, conductor 24, punching 41, jumper 28, to bus-bar B^3, third contact in bank of switch S, wiper 122, relay 139 to battery. Relay 139 will operate as before to stop the impulsing, to release switch S, to advance switch S′ to third position, and to introduce the necessary time interval between series of impulses.

The foregoing operation has resulted in the sending of three impulses over the calling line.

Since the next digit in the call number is 0 it is not necessary to cross connect punching 42, as the tenth contact in the bank of switch S is permanently grounded. When the wiper of switch S reaches the tenth contact a circuit is closed through relay 139, whereupon the said relay operates as before to stop the impulsing, to release switch S, to advance the switch S′ to fourth position, and to introduce the usual time interval.

The foregoing operation has resulted in the sending of ten impulses over the calling line.

As the fourth digit in the call number is also 0, the punching 43 is not cross connected, and the sender operates as before to send ten impulses over the calling line and to advance the wiper of switch S′ to fifth position.

As the fifth digit of the call number is 6 the cross connection must be such that the sixth contact in the bank of switch S will be grounded. When the wiper of switch S reaches the sixth contact in its bank a circuit may be traced from grounded conductor 36, wiper 121, conductor 30, armature 20 and its working contact, conductor 22, punching 44, jumper 26, to bus-bar B^6, sixth contact in bank of switch S, wiper 122, relay 139 to battery. Relay 139 will operate as before to stop the impulsing, to release switch S, and to advance switch S′ to sixth position.

The foregoing operation has resulted in the sending of six impulses over the calling line.

When the wiper of switch S′ engages the sixth contact in its bank a circuit is closed from grounded conductor 36, wiper 121 in sixth position, relay 147 to battery. Relay 147, upon energizing, forms a locking circuit for itself, independent of the wiper 121, by way of armatures 146 and 148. A further result of the energization of relay 147 is the closure of a circuit for release magnet 149 of switch S′ at armature 127, whereupon the switch S′ restores to normal position. A still further result of the energization of relay 147 is the regrounding of the release magnet circuit of sending switch S at armature 151. Relay 147 also removes ground from conductor 35 at armature 127, thus causing the deenergization of relay R′. Relay R′, upon deenergizing, removes the

bridge 128 from across the calling line, and also removes ground from conductor 36 at armature 39. Therefore, relay 130 cannot again energize when relay 139 completes the cycle of operations by deenergizing. The final deenergization of relay 139 will open the locking circuit of relay 147 and the circuit of stepping magnet 145. Relay 147, upon deenergizing, will open the circuit of release magnets 143 and 149.

The operation of sending a train of impulses representing the number 63,006 is now complete, and all relays of the impulse sending device are at normal except polar relay 124. It may be assumed that the impulses so sent has resulted in extending the connection to the called substation A' in the same manner as previously explained in connection with the dialling of the number 63,006. When the called party answers the polarity of the calling line will be reversed by the back bridge relay of the connector H in the usual manner, and the polar relay 124 will move its armature into engagement with spring 150, thus causing lamp L to light as an indication to the calling subscriber.

If the subscriber at the special substation should depress a sending key in error, he may stop the action of the impulse sending device by depressing the emergency release key R. When key R is operated a circuit is closed from ground, key R, conductor 45, punching 46, conductor 47, relay 147 to battery. Relay 147 will operate as before explained to cause the release of the sending switch S and the sequence switch S', at the same time opening the locking circuit of the previously operated relay of the group of relays R' to R^5. The impulse sending device is now in normal position, but it is necessary that the calling subscriber restore his receiver to release the partially set up connection. The subscriber may then remove his receiver and make a new call.

When the conversation is completed, and the receiver at the calling substation restored, the release of the automatic switches will take place in the usual manner. The polar relay at the same time returns to normal and opens the circuit of lamp L.

If the called line has been busy the calling subscriber would have been advised of the fact in the usual manner.

While the invention has been disclosed in connection with a five digit system, it is to be understood that it is equally applicable in a system of any size. If a certain sending key is associated with a telephone whose call number consists of less digits than the number for which the sender has been constructed, it is desirable that the relay 147 be operated as soon as the last digit of the abbreviated call number has been sent. To illustrate this special feature the key K^2 has been cross connected to send a train of digits corresponding to the number 325. In order that the sender may be stopped after the impulses corresponding to the digit five has been sent, the punching 51 is cross connected to the special punching 46.

When the receiver is removed and the key K^2 operated the sender proceeds to send out a train of impulses corresponding to the number 325. This operation need not be discussed as it is the same as previously explained. When the wiper of sequence switch S' passes to fourth position, following the sending of the impulses representing the digit 5, a circuit may be traced from grounded conductor 36, wiper 121 in fourth position, conductor 31, armature 52 and its working contact, conductor 53, punching 51, jumper 54, special punching 46, conductor 47, through relay 147 to battery. Relay 147 now operates in the usual manner to restore the impulse sending device to normal.

The object and scope of the invention having been described, what is considered to be new and what it is desired to have protected by Letters Patent will be pointed out more fully in the appended claims.

What is claimed is:

1. In a telephone system, a subscriber's line, a calling device at the station on said line manually operable in accordance with each of the digits in a called telephone number to transmit a series of impulses over said line to the exchange, a second calling device comprising electrically operated means for automatically generating and transmitting series of impulses over said line in accordance with the digits in a called telephone number, a manually operable circuit closer for initiating the operation of the second calling device at the option of the subscriber, and automatic switches at the exchange responsive to the impulses generated by either calling device to connect said line with a called line.

2. In a telephone system, a plurality of subscribers' stations, a special station, a train of automatic switches at the exchange for extending a connection from said special station to said other stations, a calling device at said special station operable in accordance with the digits in any called telephone number for generating series of impulses to control said switches, and a second calling device at said special station having electrically operated means for generating and transmitting impulses in accordance with the digits in only a limited number of called telephone numbers for controlling said switches.

3. In a telephone system, a plurality of subscribers' stations, a special station, a train of automatic switches at the exchange for extending a connection from said special station to said other stations, a calling device at

said special station operable in accordance with the digits in any called telephone number for generating series of impulses to control said switches, and a second calling device at said special station having means for transmitting impulses in accordance with the digits in only a limited number of called telephone numbers for controlling said switches, said second calling device consisting of a key controlled sending mechanism adapted to transmit impulses in accordance with all the digits in a telephone number responsive to the actuation of a single key.

4. In a substation calling device, a set of keys, each key corresponding to a subscriber's telephone number, an impulse sender, and controlling means intervening between the said keys and sender such that the depression of any key will result in the transmission of series of impulses corresponding to the digits in the telephone number with which the key is associated.

5. In a substation calling device, a set of keys, each key corresponding to a subscriber's telephone number, an impulse sender, a plurality of circuits prepared upon the operation of one of said keys, and a counting device controlled over said circuits to cause said impulse sender to transmit impulses in accordance with the digits in the telephone number associated with the operated key.

6. In a substation calling device, a set of keys, each key corresponding to a subscriber's telephone number, an impulse sender, a plurality of circuits prepared upon the operation of one of said keys, a counting device for controlling said sender, and a control device for placing said counting device under the control of each circuit in turn, one after the other, whereby the sender is caused to transmit impulses in accordance with the digits in the telephone number associated with the operated key.

7. In a substation calling device, a set of keys, each key corresponding to a subscriber's telephone number, an impulse sender, and controlling means intervening between the said keys and sender such that the depression of any key will result in the transmission of series of impulses corresponding to the digits in the telephone number with which the key is associated, said controlling means including temporary control circuits and a distributing frame having facilities for shifting said circuits whereby the telephone numbers assigned to said keys may be changed at will.

8. In a substation calling device, a set of keys, each key corresponding to a subscriber's telephone number, an impulse sender, a plurality of circuits prepared upon the operation of one of said keys, a counting device controlled over said circuits to cause said impulse sender to transmit impulses in accordance with the digits in the telephone number associated with the operated key, and a distributing frame having temporary jumpers included in said circuits by means of which the telephone numbers assigned to said keys may be changed at will.

9. In a telephone system, a subscriber's line, automatic switches, a sender for interrupting the line circuit to control said switches, a plurality of keys, and means for operating said sender to set all said switches responsive to the actuation of a single key.

10. In a telephone system, a subscriber's line, other lines having telephone numbers each comprising a plurality of digits, a sender for transmitting impulses by interrupting a conductor of said first line, a plurality of keys, means responsive to the actuation of a single key for causing said sender to transmit impulses corresponding to the telephone number of one of said other lines, and automatic switches responsive to such impulses to complete the connection.

11. In a telephone system, a subscriber's line, automatic switches, a sender for interrupting the line circuit to control said switches, a plurality of keys, means for operating said sender to set all said switches responsive to the actuation of a single key, and means for placing a shunt around the telephone instrument on said line while the sender is controlling said switches.

12. In a telephone system, a subscriber's line, a set of keys, an impulse sender, means controlled by each key for causing said sender to transmit a complete telephone number, said keys being normally ineffective to control said sender when actuated, and a relay in series with the said line energized when the receiver is removed to render said keys effective.

13. A calling device for automatic telephone systems, comprising a group of keys, relays controlled by said keys, each relay having means for preparing a plurality of circuits, a sending device, a counting switch controlling said sending device, a sequence switch for placing said counting switch under the control of the several circuits associated with any relay successively, means for starting said sending device responsive to the actuation of any key, means whereby the sending device controls the counting switch, and means whereby the counting switch controls the sequence switch.

14. In a telephone system, a plurality of subscribers' stations, a special station, a train of automatic switches at the exchange for extending a connection from said special station to said other stations, a calling device at said special station operable in accordance with the digits in any called telephone number for generating series of impulses to control said switches, a second calling device at said special station having means for transmitting impulses in accord-

ance with the digits in only a limited number of called telephone numbers for controlling said switches, a supervisory lamp at said special station, and means operable when the called party answers for lighting said lamp as an indication to the calling party.

15. In a substation calling device, a set of keys, each key corresponding to a subscriber's telephone number, an impulse sender, controlling means intervening between the said keys and sender such that the depression of any key will result in the transmission of series of impulses corresponding to the digits in the telephone number with which the key is associated, an emergency release key, and means responsive to the depressing of said release key while said sender is operating for restoring said sender to normal position.

16. In a telephone system, an impulse sender comprising a rotary switch having a single wiper and only a single set of contacts accessible to said wiper, said switch adapted to rotate and release a plurality of times during the transmission of a series of impulses, a set of devices for controlling said switch, a sequence switch, and means controlled by a single manual operation of a single one of said devices for controlling said sequence switch to successively place a potential on only one contact at a time of said set to limit the number of impulses in each series transmitted and to limit the movement of said switch over said contacts.

17. In a telephone system, a calling line, a plurality of called lines some of which have a variable number of digits in their assigned telephone numbers, a set of devices on said calling line, each device corresponding to a separate subscriber's telephone number, and means responsive to and controlled by a single actuation of any one of said devices for transmitting a series of impulses corresponding in number to the number of digits in the telephone number of the called line which corresponds to the actuated device.

18. In a telephone system, a calling line, a control circuit including the line conductors of said calling line for setting a train of automatic switches to connect said line with a called line, a transmitting device for interrupting said control circuit to transmit a plurality of series of impulses to operate said switches, one series for each digit in the number of the called line, a sending switch controlled by said transmitting means during the transmission of impulses, said switch operating to count the impulses in each series and including means for terminating each series when the required number of impulses has been transmitted.

19. A sending device comprising a plurality of keys, and means for sending a plurality of series of impulses responsive to only a single manual operation of one of said keys including a reciprocating wiper having a plurality of impulse positions with means for advancing and releasing said wiper for each series of impulses.

In witness whereof, I hereunto subscribe my name this 17th day of February, A. D., 1923.

JOHN WICKS.