

F. G. AGRELL.
 SENDER FOR SELECTIVE SYSTEMS.
 APPLICATION FILED AUG. 3, 1907.

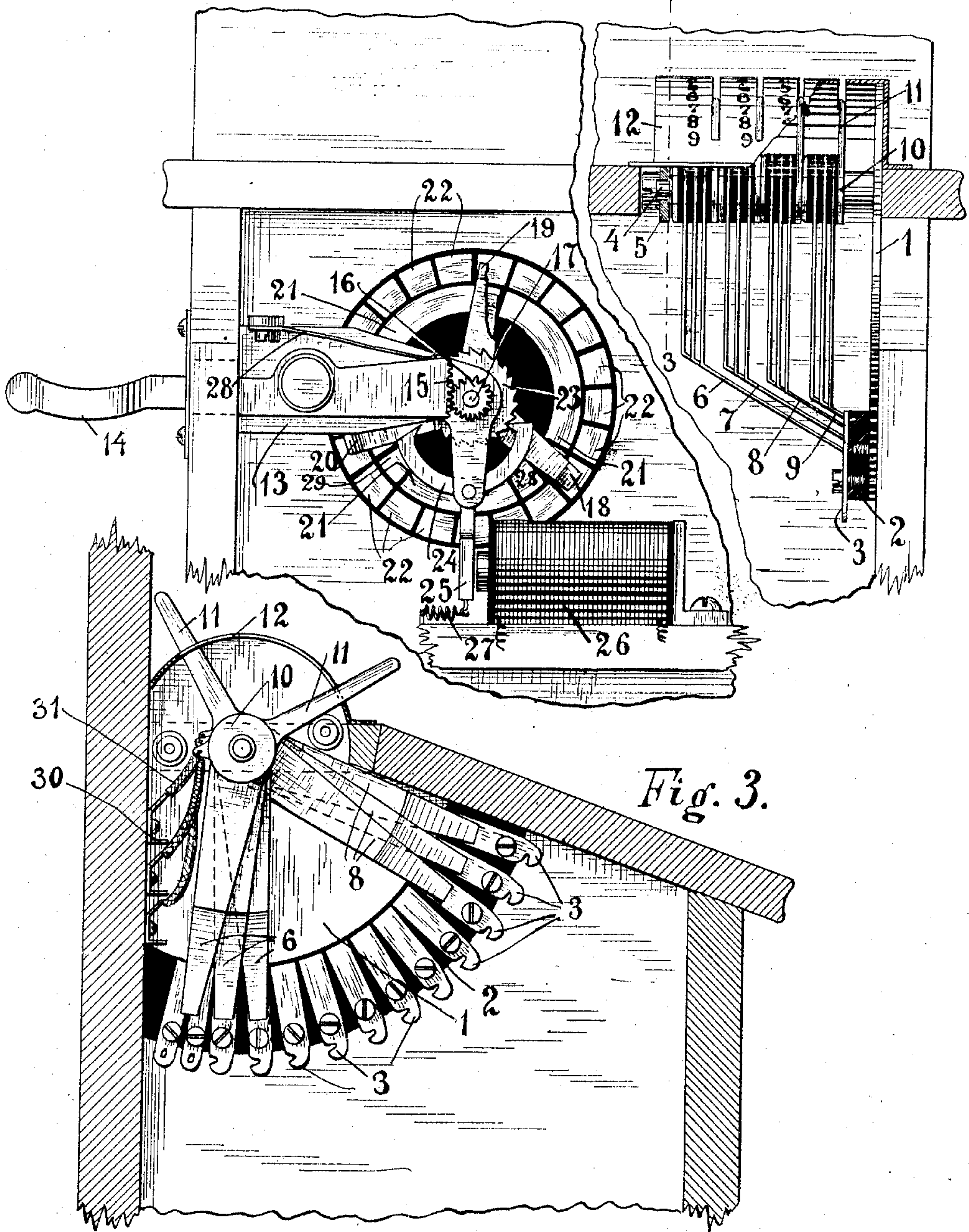
927,469.

Patented July 13, 1909.

2 SHEETS—SHEET 1.

Fig. 2.

Fig. 1.



Witnesses:
B. L. Gouldrock.
J. Edward Golder.

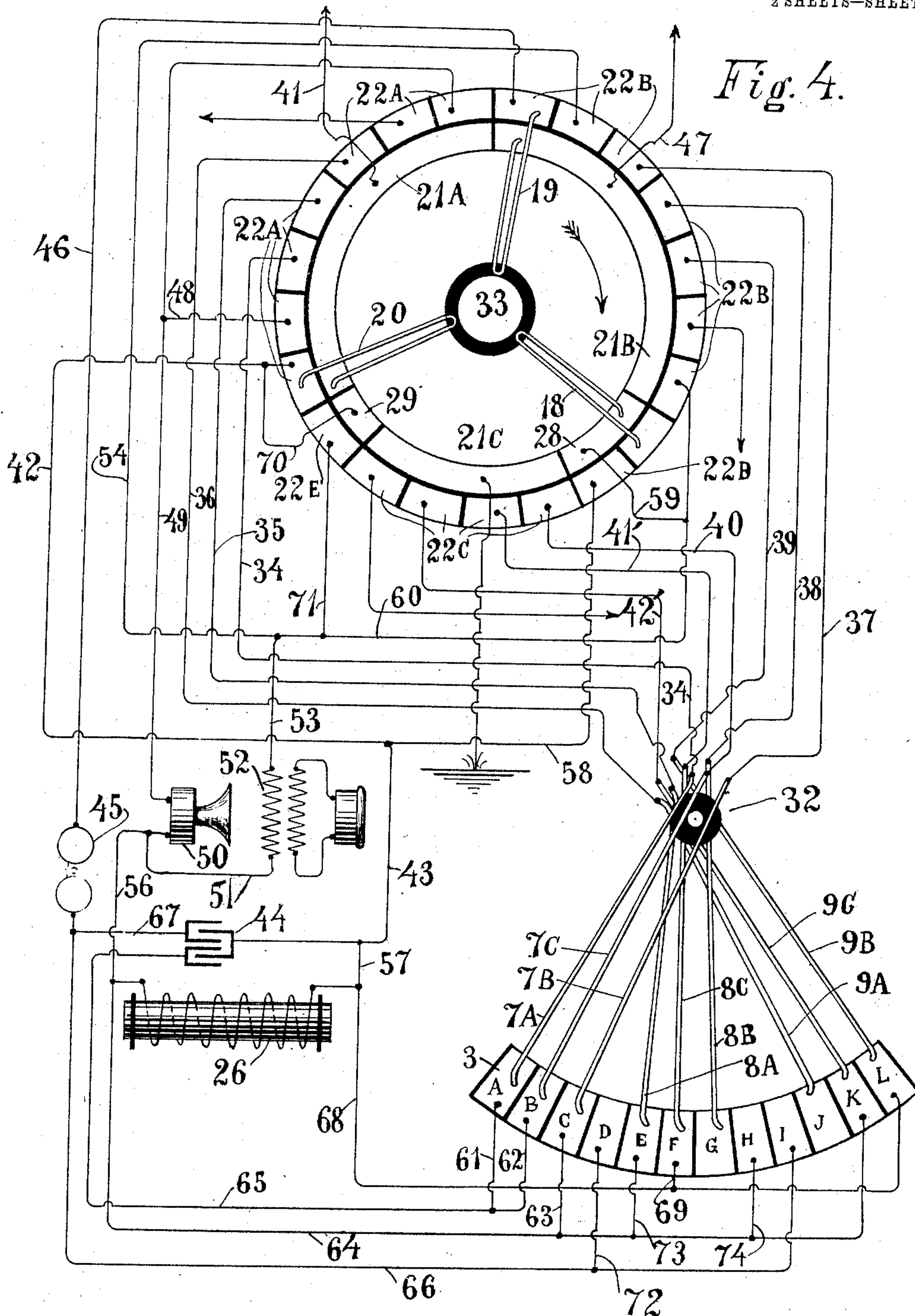
Fram Gunnar Agrell Inventor
 By his Attorney *Lewis J. Doolittle*

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2 SHEETS—SHEET 2.



Witnesses:
C. B. Fouldrock.
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By his Attorney Lewis J. Noshick

UNITED STATES PATENT OFFICE.

FRANS GUNNAR AGRELL, OF STOCKHOLM, SWEDEN.

SENDER FOR SELECTIVE SYSTEMS.

No. 927,469.

Specification of Letters Patent.

Patented July 13, 1909.

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To all whom it may concern:

Be it known that I, FRANS GUNNAR AGRELL, a subject of the King of Sweden, and a resident of Stockholm, Sweden, have invented certain new and useful Improvements in Senders for Selective Systems, of which the following is a specification.

This invention relates to signal switches for telephone instruments and more particularly to switches which are used at a subscriber's station in a telephone system where the connections between different subscribers are made by an electro-mechanical exchange by the selective operation of a number of relays. A telephone system of this kind has been described in my co-pending application Ser. No. 389,855 and a selective relay system in my co-pending application Ser. No. 338,309.

The object of this invention is to provide a switching arrangement at the subscriber's station which after having been set for the number of the subscriber to be called automatically makes the connections necessary to select the desired subscriber and operate the connecting devices at the exchange so as to make a connection between the calling and the called subscriber. To accomplish this result I provide two switches at the subscriber's station, one that is to be set by the subscriber in a position corresponding to the number desired and another operating in conjunction with a switch hook and adapted to send out the impulses for which the first switch has been set in the right succession and also to perform the functions of an ordinary hook switch.

In the accompanying drawings like parts have been given similar reference numbers.

Figure 1 is a section of a wall set provided with the switching arrangement to be described and shows the switch which is to be set by the subscriber in order to send the impulse required to operate the selecting system. Fig. 2 is a front view of said wall set with the front wall removed showing the switch hook and the switching mechanism which operates in conjunction with said hook to provide for the right succession of the different impulses required to select a number of four digits. Fig. 3 is a section on the line 3-3 in Fig. 1, showing the contacts, brushes and levers of the first mentioned switching mechanism. Fig. 4 is a diagram showing one way of connecting up a telephone instru-

ment provided with a switching device embodying my invention.

Referring now to Figs. 1 and 3, at 1 is shown a plate upon which the first switching mechanism, which hereinafter will be called the signal controller, is mounted. Upon said plate is an insulating segment 2 carrying contact plates 3. Twelve such plates are provided. On a shaft 4 mounted between the plate 1 and the support 5 are pivotally mounted four sets of brushes, 6, 7, 8 and 9, each set consisting of three brushes insulated from each other and from their carrier 10 which has a lever 11 by means of which the brushes can be turned so as to take any of the ten positions possible.

As shown in Fig. 3, the three brushes belonging to one set engage adjacent contact plates and it will be seen from the diagram, Fig. 4, that when a brush advances to the next plate a new combination is produced so that the twelve contacts give ten different combinations. I have assumed that the number to be selected has four digits, corresponding to a total number of subscribers equal to ten thousand. For smaller exchanges the number of sets can be reduced and for larger exchanges it has to be increased. The levers 11 of the brush sets pass through slots in a cover 12 upon which are placed figures ranging from 0 to 9, as shown in Fig. 1, and indicate the corresponding positions of the contact brushes.

As seen in Fig. 1, the different sets of brushes go clear of each other so that any set can take any of the ten positions independently of the others. Each brush is connected to a lug 30 by means of a flexible conductor 31.

Referring now to Fig. 2, a switch hook 14 is mounted upon a supporting plate 13. The inner end of the hook has a geared segment 15 which engages a pinion 16 mounted upon a shaft 17 which carries three brushes 18, 19 and 20 insulatedly mounted thereon. These brushes engage contact plates 21 and 22, 28 and 29. Mounted upon the shaft 17 is also an escape wheel 23 which is engaged by a pawl 24 operated by an armature 25 of an electro-magnet 26 arranged so that when the current is broken the pawl releases the escape wheel and advances it one tooth. Every tooth of said escape wheel corresponds to a certain position of the switch. The

switch hook is kept in its lowered position by means of the receiver (not shown in the drawing) and is raised by means of the spring 28 when the receiver is taken off the hook, releasing the escape wheel tooth for tooth as will be described hereinafter. During this movement the switch arms 18, 19 and 20 will sweep over one third of the circle, making seven different connections. Of these seven positions four are used for sending impulses of the selecting operation, one is used for connecting the instrument in the ordinary way for receiving an incoming signal and the two other positions are used to connect the talking circuit of the instrument to the line.

Before describing the operation of the device in use it may be mentioned that in the automatic system referred to the current is broken away from the line at the exchange for a moment after a step of the connecting and selecting operations is completed. The electro-magnet 26 is so connected in the circuit at this time that whatever position the switches may have it is always in the circuit, except for this short interval between these successive operations. Thus it will be seen that as soon as a step of the operation is completed the electro-magnet 26 will operate the pawl 24 so as to release the escape wheel 23 one step and advance the consecutive switch to the next position.

Referring now to Fig. 4, 32 represents diagrammatically the signal controller and 33 the consecutive switch. To avoid confusion and complication of the drawing I have shown only three sets of brushes 7, 8 and 9 corresponding to the first three digits of the number to be selected. They are connected to the segments of the outer ring of the consecutive switch 33 in the following manner: Assuming 7 to be the set of brushes that is to make the connections for selecting the first digit, 8 a set of brushes corresponding to the second digit and 9 a set of brushes for the third digit, it will be seen from the diagram that corresponding brushes, for instance, 7^A, 8^A and 9^A are connected by lines 34, 35 and 36 to adjacent contacts 22^A, brushes 7^B, 8^B and 9^B are connected by means of the leads 37, 38 and 39 to adjacent contacts 22^B and the brushes 7^C, 8^C and 9^C are connected by means of the leads 40, 41' and 42' to adjacent contacts 22^C. In the inner ring there are two segments 21^A and 21^B each occupying one third of the circumference. Each of these segments is connected to one side of the lines, respectively. The inner ring is occupied by the three contacts 21^C, 28 and 29. 21^C is connected to ground. The brushes 18, 19 and 20 each ride over its third of the circumference and each have two blades electrically connected, one of which rides upon the contacts of the outer ring and one upon the contacts of the inner ring. The switch is shown in the diagram in its rest position and in this

position connects the bell and the condenser to the line, as in an ordinary common battery set. If ringing current is sent out on the line 41 it will go to the segment 21^A and from there to the brush 20, to the lowest segment 22^A on the diagram, through lead 42, lead 43, condenser 44, bell 45, lead 46, to the uppermost segment 22^B through the switch arm 19, to the segment 21^B, and from there out on the line 47 back to the station. The bell will now ring and when the called subscriber takes the receiver off the hook the switch will advance one step in the direction of the arrow. The talking circuit is thus formed and can be traced from line 41, segment 21^A, brush 20, second segment 22^A, lead 48, lead 49, transmitter 50, lead 51, induction coil 52, lead 53, lead 54, second segment 22^B, brush 19, to segment 21^B and back to the line 47. From the transmitter 50 a part of the current goes through the lead 56, through the electro-magnet 26, lead 57, lead 43, lead 58, to the segment 22^C, and from there through the brush 18, segment 28, lead 59, lead 60 to lead 54, which means that the inductive coil is shunted by the inductive resistance of the electro-magnet 26. During the whole conversation the magnet 26 will thus be energized and the switch 33 will be kept in its second position during that time. When the subscriber puts his receiver on the hook 14 again the switch will go back to its position of rest.

When the subscriber calls up the switch will advance one step as before, forming the talking circuit and putting in the relay 26. This signals the exchange in the manner described in my co-pending application Ser. No. 389,855 and causes the subscriber's line to be connected with a selecting circuit. During this operation the current will be broken once, which causes the electro-magnet 26 to release and advance the switch 33 one step, so that it now is in its third position. In this position the both sides of the line 41 and 47 and the ground are connected to brushes 7^A, 7^B and 7^C, respectively.

Assuming now that the subscriber has set the brushes for the number desired previous to taking the receiver off the hook 14 and assuming that the position is the same as that represented in the diagram, corresponding to "059...", the following connection will be made: From brush 7^A which is connected to the line 41 current goes to the segment 3^A, lead 61, lead 62, contact plate 3^B, to brush 7^C, which is connected to ground, and from brush 7^B, contact 3^C, lead 63, lead 64, electro-magnet 26, lead 57, three-way condenser 44, lead 65, lead 62, contact 3^B, to brush 7^C and ground. This gives one of the combinations mentioned in my co-pending application Ser. No. 389,855 and the current going through these circuits selects the thousand digit. When this connection is performed

the current will be broken away from the line and the relay 26 will advance the switch 33 to its fourth position where the brushes 8 are connected to both sides of the line and the ground, respectively. This set of brushes is set on the number 5 making the connection from brush 8^A which is now connected to the line 41, segment 3^B, lead 73, lead 64, electro-magnet 26, and from there through lead 68, lead 69, to contact 3^F and the brush 8^C which is connected to ground, the current going to said circuit selects the desired hundred digit and when this operation is performed the current in relay 26 is broken, causing it to release the switch one more step so that it now occupies the fifth position in which the brush 9^A, 9^B and 9^C are connected to both sides of the line and ground, respectively. A connection is now formed between the one side 47 of the line through the brush 9^B, contact 3^L, lead 68, electro-magnet 26, lead 64, to segment 3^K and to the brush 9^C which is connected to ground. The current going through said connections selects the ten-digit and when operation is performed current is broken through the electro-magnet 26, allowing the switch 33 to advance to its sixth position in which the brushes 6 (not shown in Fig. 4) are connected to the line and ground, respectively. The current through said circuit will select the unit digit of the number desired and when this operation is performed the current will be broken in electro-magnet 26, allowing the switch 33 to advance to its seventh and final position, which is the talking position of the calling subscriber. The connections of this position are the same as in the second position. The talking current goes from line 41, to segment 21^A, brush 20, last segment 22^A, lead 49, transmitter 50, lead 51, induction coil 52, lead 60, last segment 22^B, brush 19, segment 21^B, to the other side 47 of the line and the electro-magnet 26, shunting the induction coil on the one side through lead 56 and on the other side through lead 43, lead 42, lead 70, segment 29, brush 18, segment 22^E, lead 71 and lead 60.

It now only remains to show the seven other combinations that can be obtained by the signal controller 32 in addition to the three already described. If a set of brushes, for instance, 7^A, 7^B and 7^C, are set in the third position, i. e., where brush 7^A makes contact with contact 3^C, the connection can be traced from the one side 41 of the line, which is assumed to be in connection with brush 7^A, through contact 3^C, lead 63, lead 64, electro-magnet 26, lead 57, lead 43, condenser 44, lead 67, leads 66 and 72, to segment 3^D, brush 7^C, which is assumed to be in connection with ground, and from the other side of the line 47, through brush 7^B, segment 3^E, lead 73, lead 64, electro-magnet 26, lead 57,

lead 43, condenser 44, lead 67, lead 66, lead 72, contact 3^D, and through brush 7^C to ground. In this combination both sides of the line are directly connected together and also to ground through a condenser.

In the second position (7^A on 3^B) 7^A is connected through segment 3^B, lead 62, lead 65, condenser 44, lead 67, lead 66, lead 72, segment 3^D, to brush 7^B, and also through said condenser, lead 43, lead 57, magnet 26, lead 64, lead 63, contact 3^C connected to brush 7^C and ground. Thus both sides of the line are connected to ground through the three-way condenser.

In the fourth position (7^A on 3^D) 7^A is connected through contact 3^D, lead 72, lead 66, condenser 44, lead 43, 57, electro-magnet 26, lead 64, lead 73, contact 3^E, and brush 7^C to ground, and 7^B is connected directly to ground through contact 3^F, lead 69, lead 68 electro-magnet 26, lead 64, lead 73, segment 3^E, and brush 7^C.

The fifth combination (7^A on 3^E) has been already described.

In the sixth combination (7^A on 3^F) 7^A is connected directly to 7^B over a contact 3^F, lead 68, electro-magnet 26, lead 64, lead 74, and contact 3^H.

In the seventh combination (7^A on 3^G) 7^B is connected through contact 3^I, lead 66, lead 67, condenser 44, lead 57, electro-magnet 26, lead 74, contact 3^H, to 7^C and ground, that is one side 47 of the line is connected through the condenser to ground. In the next position (7^A on 3^H) the same connection will be made with the exception that brush 7^A is connected to ground instead of 7^B, so that in this combination the side 41 of the line will be connected to ground through the condenser.

In the ninth position (7^A on 3^I) 7^A is connected to 7^B through 31, lead 66, lead 67, condenser 44, lead 57, electro-magnet 26, lead 64, and contact 3^K. In this combination both sides of the line are connected through a condenser.

The tenth combination (6^A on 3^J) has already been described.

The influence of the different connections upon the switching devices of the exchange is set out in my above mentioned co-pending applications. It is not thought necessary to describe the same here as this application has to do with the switching devices by means of which the connections mentioned can be easily obtained in a simple manner.

From the above description and the accompanying drawings illustrating my invention it may be seen that I have provided a switching mechanism at a subscriber's station which, after having been set to the position corresponding with the desired number, will automatically make the connections necessary for transmitting the impulses required to select this number when the receiver is re-

moved from the hook. It is believed that for the first time in the history of telephony the real automatic signal transmitter has been devised. The advantage of such a device over devices where the selection is performed step by step by the subscriber will be self evident.

As many changes could be made in the above construction and many apparently widely different embodiments of my invention designed without departing from the scope thereof, I intend that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative merely of an operative embodiment of my invention and not in a limiting sense.

What I claim is:—

1. In a device adapted to make different connections between a number of conductors, the combination of a number of sets of connecting members normally disconnected from the conductors and each adapted to make any one of several different connections, means for predetermining the connection to be made by any set of connecting members, and means for successively connecting the sets of connecting members with the conductors.

2. In a device adapted to make different connections between a number of conductors, the combination of a number of sets of connecting members normally disconnected from the conductors and each adapted to make any one of several different connections, means for predetermining the connection to be made by any set of connecting members, and means for automatically connecting the sets of connecting members in succession.

3. In a device adapted to make different connections between a number of conductors, the combination of a number of sets of switch arms normally disconnected from the conductors, a number of contacts adapted to be engaged by said switch arms, connections between said contacts corresponding to the different connections to be obtained, means for varying the relative position of said switch arms and contacts, and means for connecting the sets of switch arms to the conductors in succession.

4. In a device adapted to make different connections between a number of conductors, the combination of a number of sets of switch arms normally disconnected from the conductors, a number of contacts adapted to be engaged by said switch arms, connections between said contacts corresponding to the different connections to be obtained, means for varying the relative position of said switch arms and contacts, and means for automatically connecting the sets of switch arms to the conductors in succession.

5. In a signal transmitter adapted to make

different connections between a number of conductors, the combination of a number of sets of connecting members normally disconnected from the conductors and adapted to make any one of the different connections, a switch adapted to connect said sets of connecting members to said conductors in succession, a switch hook mechanically connected to said switch and adapted when said hook moves from the one to the other of its extreme positions to cause said switch to connect one after the other of the sets of connecting members to the conductors, and means for arresting the movement of said switch in any of its positions and for releasing the same step by step.

6. In a signal transmitter for the operation of selecting devices by means of different connections between three conductors, the combination of a number of sets of switch arms adapted to ride over contacts, each set being pivotally mounted and provided with means for setting the same in different positions with relation to said contacts, there being as many sets of switch arms as there are digits in the number to be selected and each set being provided with three contact members each adapted to be connected to one of the conductors, aforesaid contacts being so connected by means of condensers and resistances that for each position of a set in relation to said contacts a connection corresponding to the number of said position is formed between the contact members of said set, a switch adapted to connect the contact members of each set to the conductors, a switch hook adapted to connect mechanically to said switch so that when said hook is moved from the one to the other of its extreme positions said switch will take its several positions in succession, and means for arresting said switch in any of its several positions and for releasing said switch step by step.

7. In a signal transmitter for the selective operation of selecting devices by means of different connections between three conductors, of which the third conductor may be ground, the combination of a number of sets of pivotally mounted switch arms each having three contact springs, the number of sets corresponding to the number of digits to be selected, a number of contacts adapted to be engaged by said contact springs, each position of said switch arms forming a connection with said contacts corresponding to one digit of the number to be selected, means for moving said arms independently into different positions, a switch adapted to complete said connections with the conductors, a switch hook mechanically connected to said switch so that when said hook moves from one to the other of its extreme positions said switch will take its several positions in succession, an electro-magnet,

and means controlled by the armature of said electro-magnet adapted to arrest the movement of said switch while current passes through said electro-magnet and to
 5 release and advance said switch step by step successively through its several positions as the current is broken.

8. In a signal transmitter for the selective operation of selecting devices by means of
 10 different connections between three conductors, of which the third conductor may be ground, the combination of a number of sets of pivotally mounted switch arms each having three contact springs, the number of
 15 sets corresponding to the number of digits to be selected, a number of contacts adapted to be engaged by said contact springs, each position of said switch arms forming a connection with said contacts corresponding to
 20 one digit of the number to be selected, means for moving said switch arms independently into different positions with relation to said contacts, a switch adapted to complete said connections of each set successively and
 25 automatically to the conductors, said switch being also adapted to alternately connect the ringing and talking circuits as the receiver is placed on or removed from the hook, a switch hook mechanically connect-
 30 ed to said switch so that when said hook moves from one to the other of its extreme positions the switch will take its positions in succession, an electro-magnet, and means controlled by the armature of said electro-
 35 magnet for alternately holding, and releasing and advancing said switch step by step

as the current is flowing or broken, the winding of said electro-magnet operating in the connecting circuit of said contacts so that the switch is arrested in its movement as
 40 long as the current passes therethrough.

9. In a signal transmitter for the selective operation of selecting devices by means of different connections between three con-
 45 ductors, the combination of a number of sets of contact brushes, each set comprising three brushes each adapted to be connected through a contact to one of said conductors, a number of contacts adapted and arranged
 50 to be connected for the operation of said selecting devices, means for moving said sets of contact brushes into several different positions in engagement with said contacts, a
 55 switch arranged and adapted to connect each of said sets of contact brushes to said conductors successively through several positions, a switch hook adapted to operate said
 60 switch mechanically, and electrically operated means adapted to advance said switch intermittently and successively through its
 65 several positions or to hold the same in any one of said positions, the operation of said last named means being determined auto-
 matically by the operation of the several devices of the system with which it is used.

Signed at New York city in the county of New York and State of New York this 30th day of July A. D. 1907.

FRANS GUNNAR AGRELL.

Witnesses:

LEWIS J. DOOLITTLE,
 H. W. FORSYTH.