

No. 757,031.

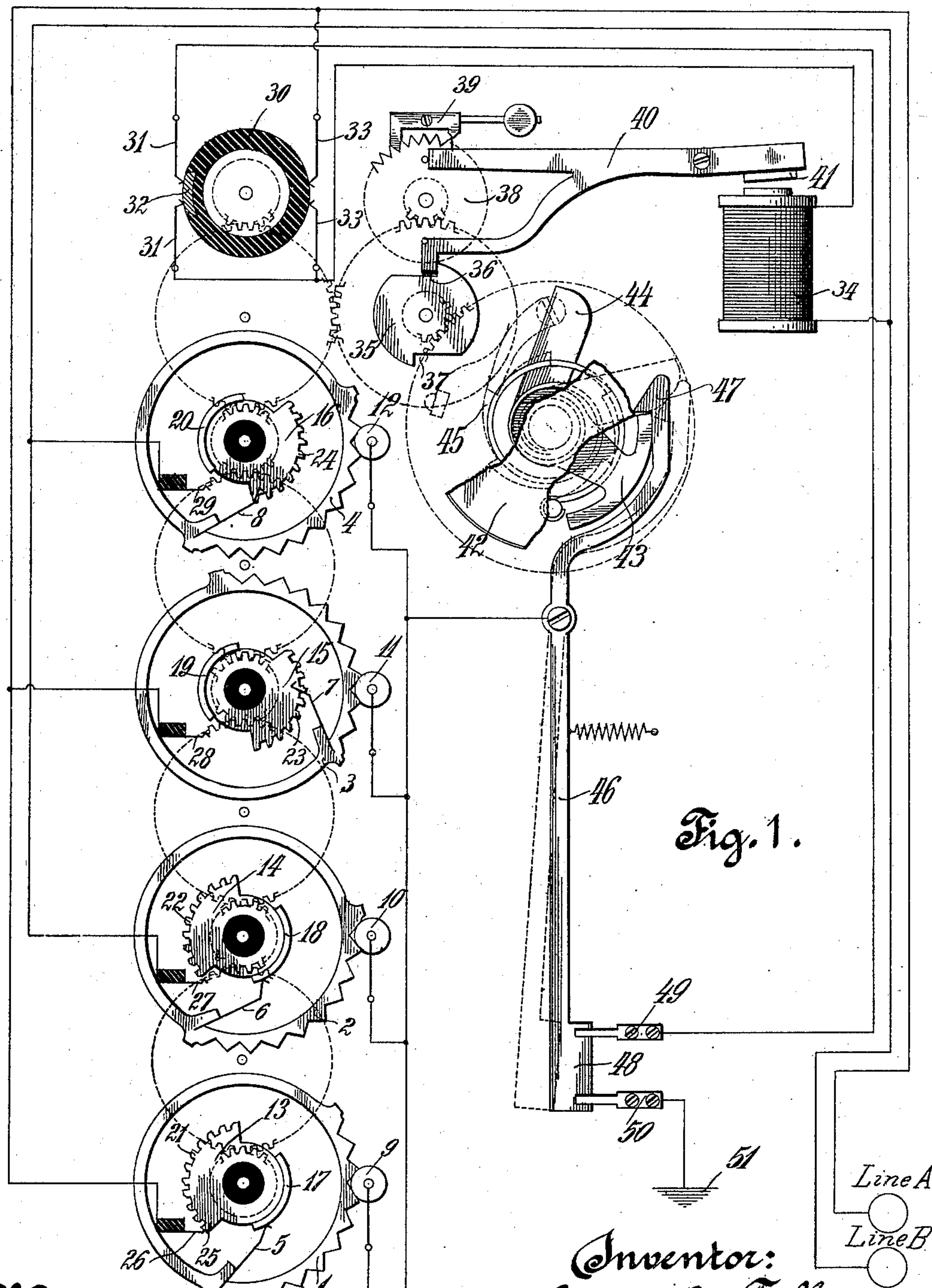
PATENTED APR. 12, 1904.

E. A. FALLER.  
SEMI-AUTOMATIC TELEPHONE EXCHANGE.

APPLICATION FILED JULY 1, 1903.

NO MODEL.

4 SHEETS—SHEET 1.



Witnesses:  
Ralph Julian Sachers  
Morse Gidon.

Inventor:  
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per F. H. Richards,  
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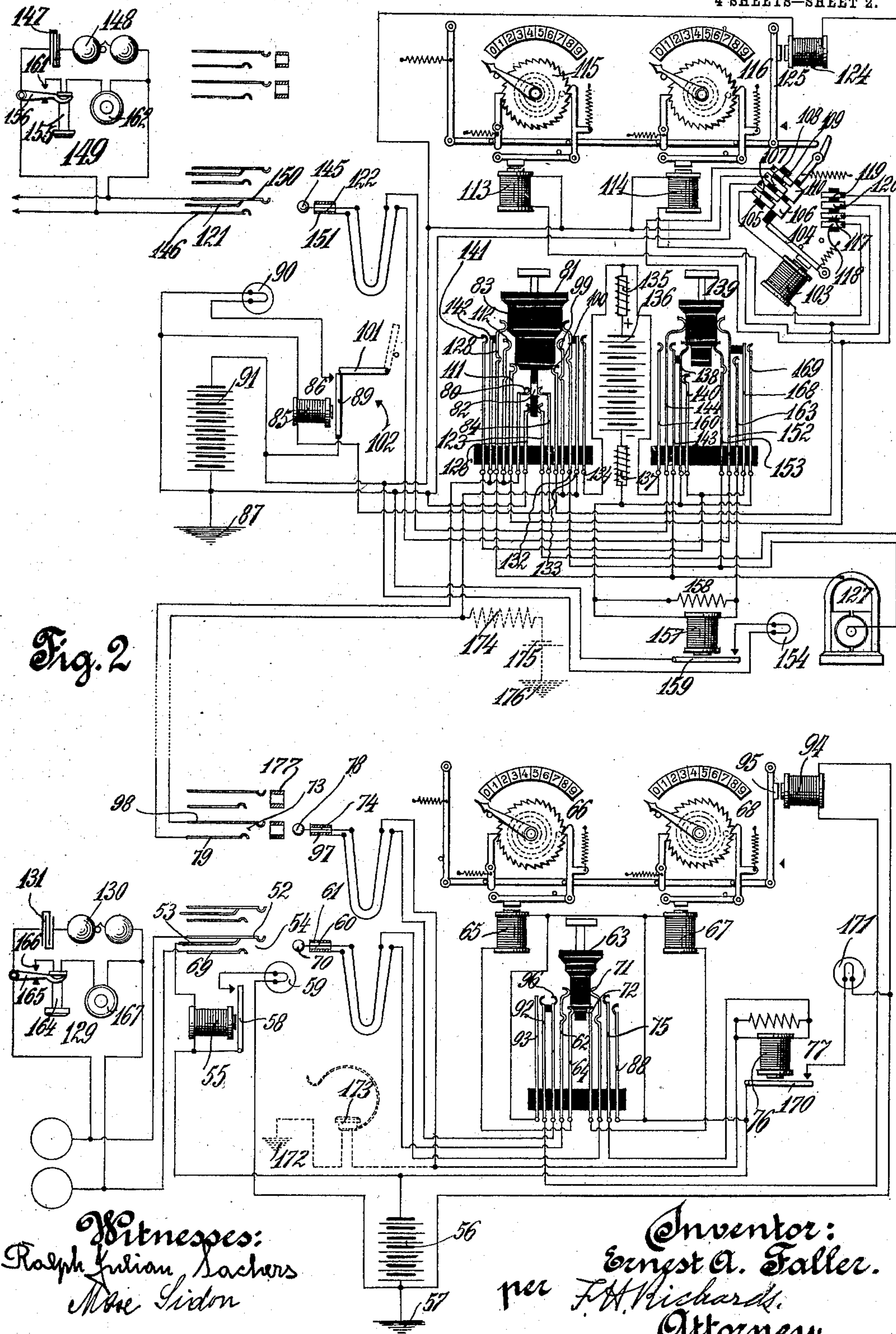
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4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

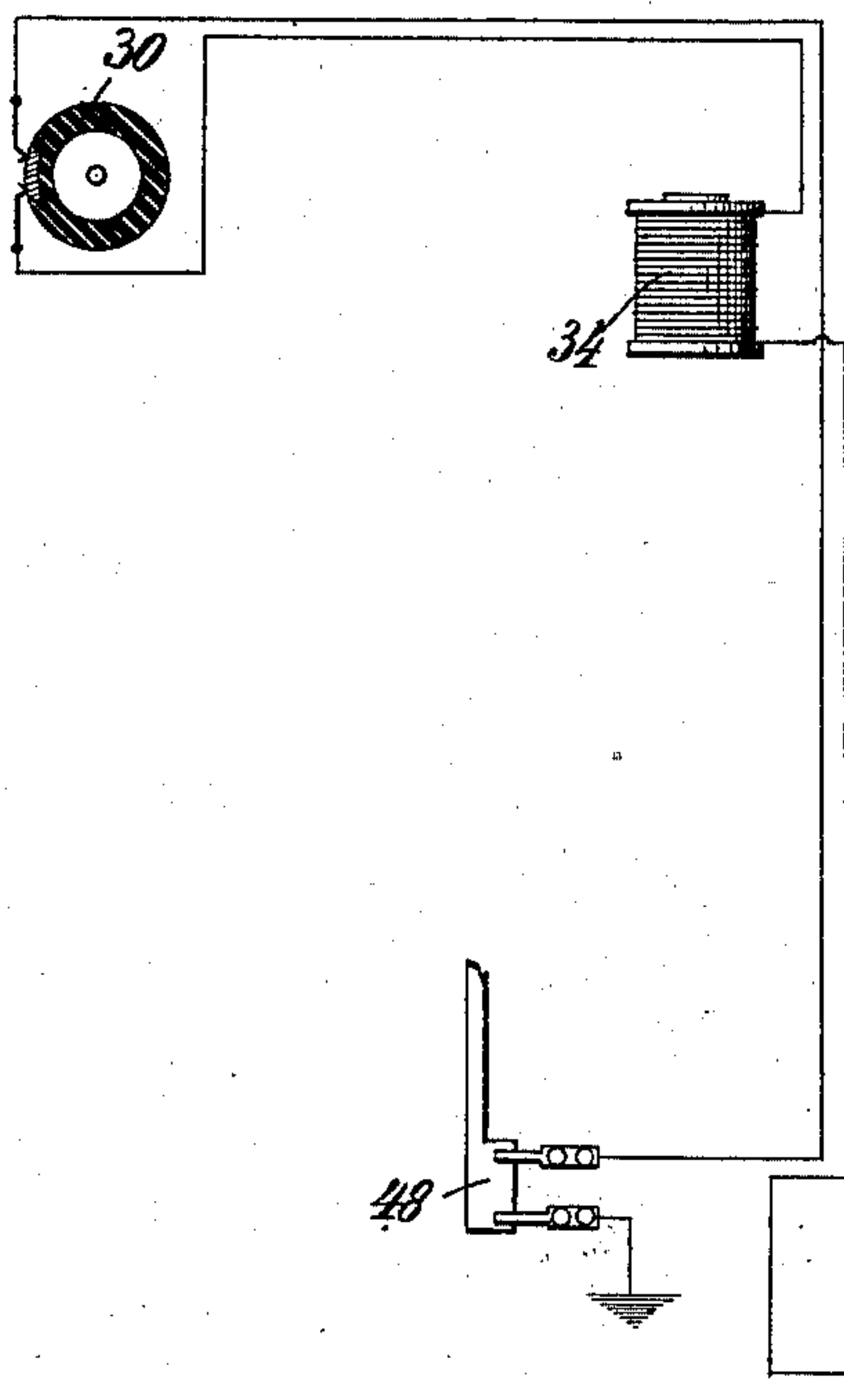


Fig. 3

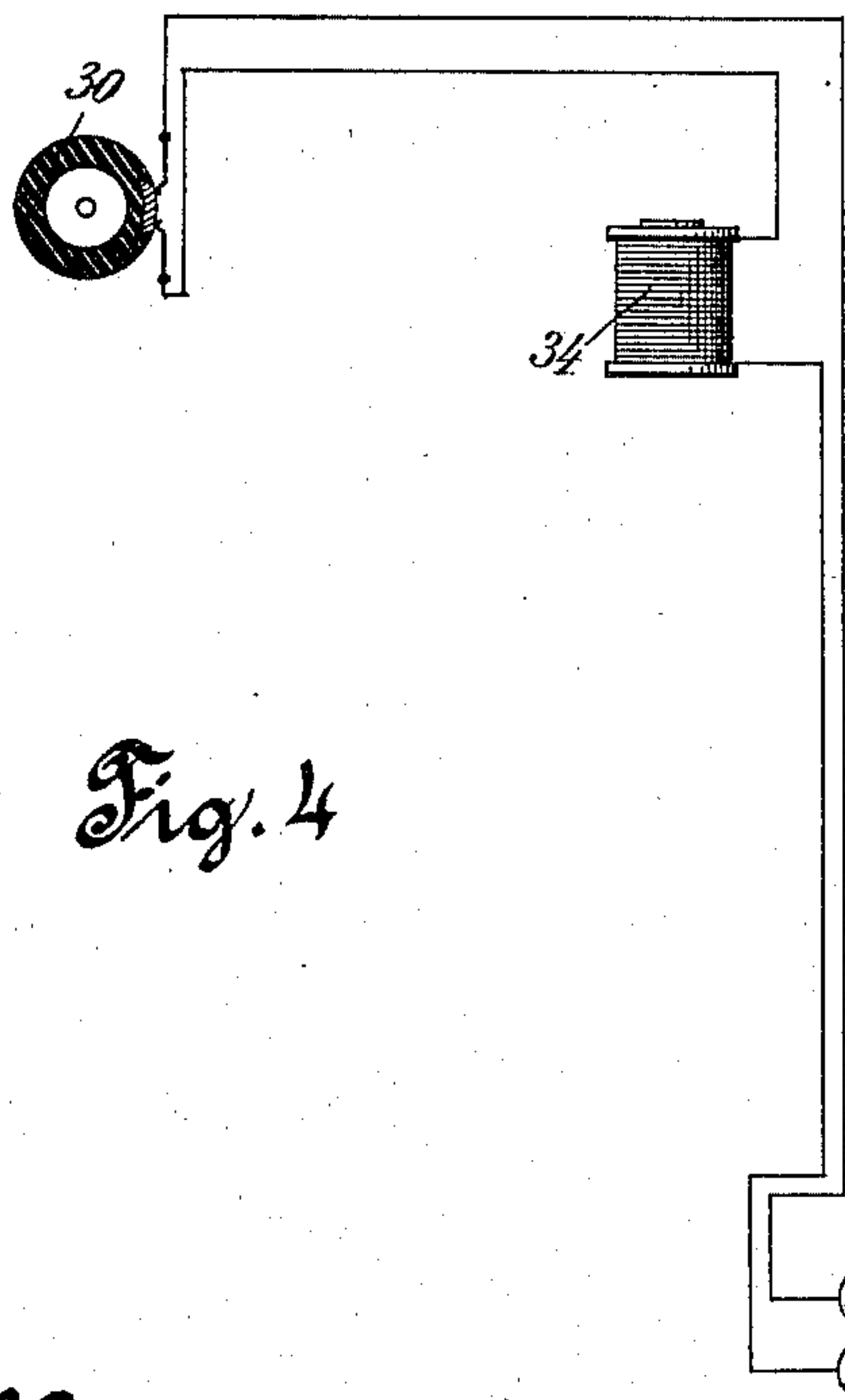
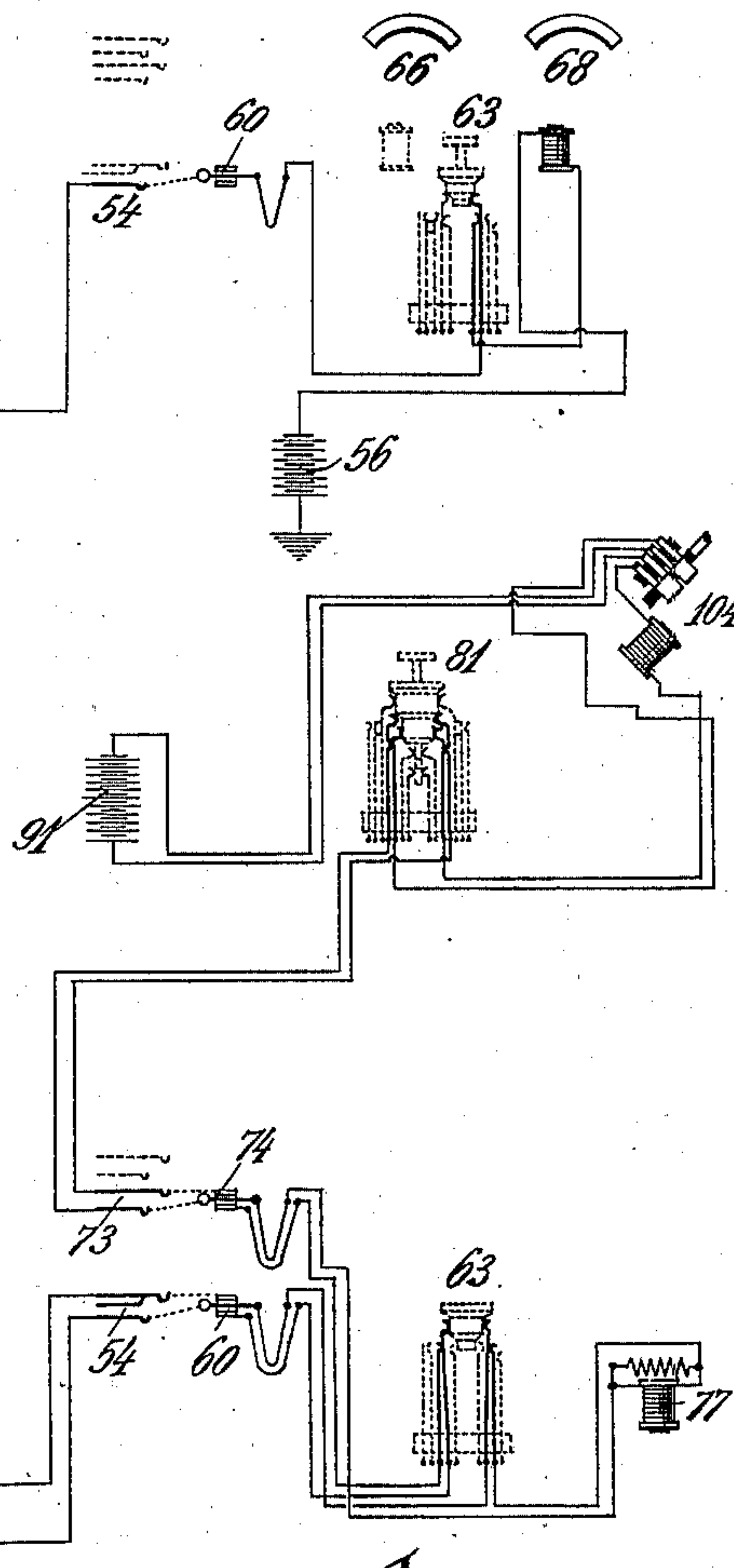


Fig. 4



Witnesses:  
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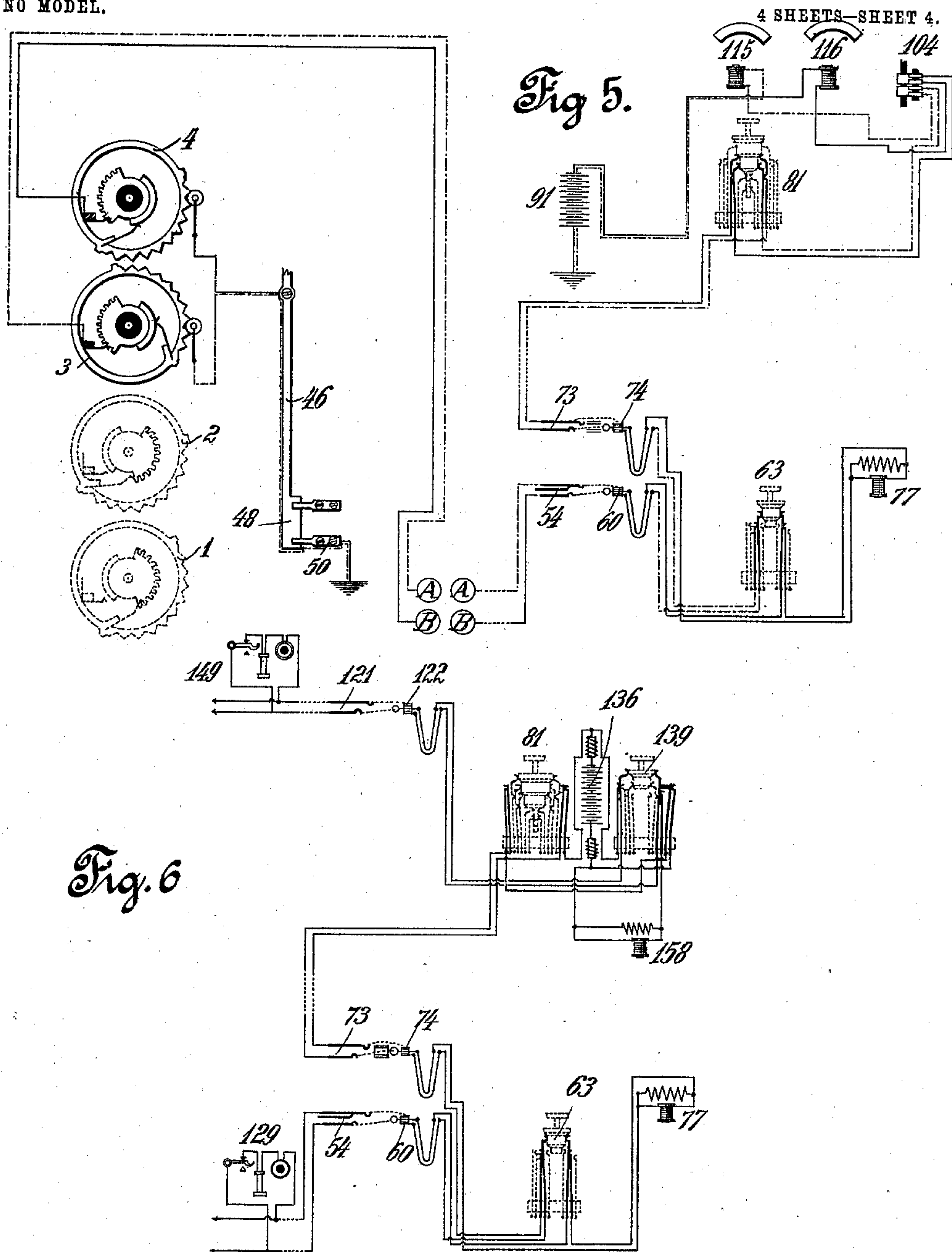
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# UNITED STATES PATENT OFFICE.

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JAMES W. CHISHOLM, OF NEW YORK, N. Y.

## SEMI-AUTOMATIC TELEPHONE-EXCHANGE.

SPECIFICATION forming part of Letters Patent No. 757,031, dated April 12, 1904.

Application filed July 1, 1903. Serial No. 163,968. (No model.)

*To all whom it may concern:*

Be it known that I, ERNEST A. FALLER, a citizen of the German Empire, residing in New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Semi-Automatic Telephone-Exchanges, of which the following is a specification.

The present invention refers to telephonic apparatus, especially that class of the same in which a preestablished signal is used to identify the called subscriber. It refers more particularly to a class of telephonic apparatus which is called "semi-automatic"—that is, apparatus in which part of the functions necessary to establish a connection between a calling subscriber and a called subscriber is done by mechanical devices, while the other part is done by a human operator.

The object of the present invention is to provide mechanical means for receiving and recording at an exchange a signal characteristic of the called subscriber and hand-controlled means for establishing the connection between the calling subscriber and the exchange as well as between the latter and the called subscriber.

It is known in the art that in modern telephony there are two distinct acts performed for the purpose of establishing a connection between two subscribers, of which only one act is strictly based upon telephony, this act being the actual transmission of articulate speech. All prior steps necessary to accomplish this final result belong, properly speaking, to the art of transmitting signals.

The present invention retains the human operator for the purpose of interconnecting at will the calling subscriber with the exchange and the called subscriber, but provides signaling apparatus the operation of which is initiated by the subscriber and in turn by the operator, but the actual transmission of which is entirely automatic. The connections between the subscribers and the exchange are identical with the present connections, and consist of two metallic conductors and a ground-return. Each subscriber is represented at the exchange by one jack only. No multiples are

required, and exchanges of any size without limitation may be constructed upon this principle. This new system is adapted to any desired subdivision, the subdivisions being absolutely identical.

In the accompanying drawings, forming part of the present application, the invention is illustrated in diagrammatical form with one sending apparatus and one recording-station divided into a local and a trunk exchange. It is obvious that any number of sending apparatus can be connected with the recording-station and that the recording-station itself may either be of the identical construction shown or may be suitably modified without departing from the spirit of the invention.

Figure 1 of the drawings is a diagrammatic view of the sending apparatus. Fig. 2 is a diagrammatic view of the recording-station, showing also the telephone sets of a calling and a called subscriber. Fig. 3 is a diagram illustrating the circuit for starting the sending apparatus. Fig. 4 is a similar diagram of the circuit for restarting the sending apparatus after the transmission of the first group of selective signals. Fig. 5 illustrates the circuits for the transmission of part of the signaling impulses, and Fig. 6 illustrates the circuits finally established for carrying on the conversation.

The sending apparatus (illustrated in Fig. 1 of the drawings) forms part of an application for Letters Patent, Serial No. 162,601, filed June 22, 1903, and its construction will not be claimed in the present application. It consists generally of a series of number-rings 1 2 3 4, each provided with a contact-spring 5 6 7 8 and having indentations on the outside, and diametrically opposite thereto numerals, letters, or other characters forming in combination the characteristics of the subscribers connected to the exchange. Adapted to rest in the indentations of the number-rings are rollers 9 10 11 12, electrically connected to the frame of the machine. Located within the number-rings 1 2 3 4 are character-disks 13 14 15 16, each having an upturned controlling-rim 17 18 19 20 and a series of teeth 21 22 23 24 diametrically opposite to the rims.



The character-disk 13 has an additional or eleventh tooth 25 for a purpose hereinafter to be set forth. The character-disks 13 14 15 16 are arranged in pairs, so that at times the disks 13 and 15 are connected, through the stationary contact-springs 26 and 28, to the line A, leading from the sending apparatus to the exchange, and the disks 14 and 16, through the springs 27 and 29, to the line B. The numeral-ring 1 and disk 13 represent the thousand numeral, ring 2 and disk 14 the hundred numeral, ring 3 and disk 15 the ten numeral, and ring 4 and disk 16 the unit numeral, of the signal to be sent and representing the called subscriber. The sending apparatus is furthermore provided with a rotating insulating contact-disk 30, having on its periphery a contact-piece 32, capable of alternately bridging either the contact-springs 31 or the contact-springs 33.

The device for storing energy consists of a rotatable knob 42, rigidly connected to a lever 43 and acting against the cam 44. It is capable of winding a spiral spring 45, which by means of suitable ratchet devices is held under tension when the knob 42 returns to its normal position. This device drives a notched disk 35, and by means of intermediate gears (shown in Fig. 1 in dotted lines) is capable of rotating the insulated disk 30, as well as all the character-disks 13, 14, 15, and 16. The rotation of the same is controlled by an escapement device 38 39, which is held from rotating by the lever 40, one arm of which forms an armature 41 of the magnet 34. The lever 43 of the winding-knob 42 is capable of entering a notch at the head 47 of the double-armed lever 46, which lever carries a contact-piece 48, capable of bridging the ground-springs 49 and 50.

The exchange or recording-station may be divided, as indicated in Fig. 2 of the drawings, into two parts, one representing a local exchange for the sole purpose of connecting a calling subscriber to a trunk-line, whereas the trunk-exchange is used for connecting a trunk-line with a called subscriber. Each exchange, taken as a whole, consists of a series of subscribers or answering jacks 54, each section having as many jacks as there are subscribers connected to the exchange, of a number of trunk-jacks 73, corresponding to the size of the exchange and the amount of trunking done with same, a number of answering-plugs 60 and trunking-plugs 74, all based upon the percentage system, well known in the art, and a corresponding number of connecting-plugs 122. For each set of plugs there is provided at the exchange a trunking-key 63, a ring-back key 81, and a connecting-key 139. Furthermore, for each individual subscriber connected to the exchange a line-relay 58 and a line-lamp 59, for each trunk-plug at the local exchange or section a clearing-out relay 77 and a clearing-out lamp 171,

and at each trunk exchange or section a clearing-out relay 158 and a clearing-out lamp 154. At each local station or section is a trunk-recorder 66 and 68 for recording the thousand and hundred numerals of the called subscriber's number, at the trunk exchange or section a station-recorder 115 and 116 for receiving and recording the tens and units numerals of the number of the called subscriber. The local exchange or section is furthermore provided with a recorder-reset 94 and the trunk exchange or section with a recorder-reset 125. The mechanical operation of the recorder-reset is well known in the art and does not form part of the present invention. Each exchange is provided with suitable operating and talking batteries and the trunk-exchange with a number of trunk-lamps 90. The busy-test device of the local section consists of the busy-test receiver 173, grounded at 172, and the busy-test rings 177, and of the trunk exchange or section of the busy-test resistance 174, a busy-test cell 175, and a ground 176.

The arrangement of an exchange according to the present invention is in a general way quite similar to the now existing switchboards. The subscribers' jacks and the trunking-jacks are arranged on a vertical board, and in proximity to each answering-jack is its lamp. On a nearly-horizontal shelf below the board holding the jacks are the plugs and the keys mentioned hereinbefore.

*Operation of the semi-automatic exchange.*—The first act at the exchange indicating the desire of one subscriber to talk to one of the other subscribers is the lighting of a lamp, and the operator at the exchange plugs immediately the jack belonging to this lamp with an answering-plug. Thereupon the lamp is extinguished and the operator operates the trunking-key, and thereby causes the recording of the trunk-line desired—that is, of the thousand and hundred numerals at the trunk-recorder. Having noticed the number desired, the operator at the local section takes a trunking-plug and plugs the trunking-jack corresponding to the desired number, and thereby establishes connection between the calling subscriber and the trunk-exchange or trunk-section to which the called subscriber is connected. In further manipulating the trunking-key one of the trunk-lamps 90 at the trunk exchange or section is lighted, indicating to the operator at the trunk-exchange that connection is desired with one of the subscribers at that exchange or section. The operator at the trunk exchange or section thereupon operates the ring-back key, and thereby causes the balance of the signal characteristic of the called subscriber to be received at the trunk exchange or section recorded at the station-recorder of the same. Having noticed the number desired, the operator at the trunk exchange or section now



plugs the answering-jack corresponding to the number desired with the connecting-plug and operates the ring-back key, whereby a circuit is established between the magneto-generator 127 at the exchange and the calling subscriber, indicating to the same that the connection has been established. The operator now operates the connecting-key, whereby a circuit is established between the magneto-generator and the called subscriber, indicating to him that communication is desired with him. The called subscriber thereupon takes his receiver 155 from the receiver-hook, and thereby lights the lamp 154, and the talking-circuit is now established. Having finished the conversation, the called subscriber by hanging his receiver on the hook extinguishes the lamp 154. The operator at the trunk-exchange thereupon pulls out the connecting-plug and restores the connecting-key and ring-back key to their initial position, whereby the lamp 171 at the local exchange is extinguished. In noticing this the operator at that exchange withdraws the trunking-plug and the answering-plug and resets the trunking-key, and everything is restored to its original order. In operating the device the subscriber at the sending-station preestablishes the signal by setting the number-rings 1 2 3 4 to the desired combination representing the number of the called subscriber. Then he turns the knob 42, and thereby winds the sending apparatus. In releasing the knob 42 the contact-piece 48 of the double-armed lever 46 has made contact with the ground-springs 49 50, and a circuit is established as follows: from ground 51 at the sending apparatus to the ground-spring 50, the frame of the sending apparatus, the roller 9, resting in an indentation of the thousand number-ring 1, the contact-spring 5 of the number-ring 1, the controlling-rim 17 of the character-disk 13, the eleventh tooth 25, the stationary spring 26 in contact therewith, over the line A to the local exchange, the upper springs 52 53 of the answering-jack 54, which are now in contact, the line-relay 55, to and through the battery 56 to ground 57 at the local exchange. The effect of this current is to attract the armature 58 of the line-relay 55 at the local exchange and close a local circuit through this armature 58, the line-lamp 59, and the battery 56, whereby the line-lamp 59 is lighted. The operator at the local exchange sees the line-lamp 59 lighted and puts the answering-plug 60 into the corresponding jack 54. By doing this contact between the two upper springs 52 53 of the answering-jack 54 is broken, and the line-lamp 59 is extinguished. It also puts the upper spring 52 of the answering-jack 54, representing line A, in connection with the sleeve 61 of the answering-plug 60 and makes further connection to the second spring 62 on the left-hand side of the middle line of the trunking-key 63. The operator now depresses the trunking-key 63 to its first

working position, and contact is made thereby between the second spring 62 and the first spring 64 on the same side, the magnet 65 of the thousand trunk-recorder 66, the operating-battery 56, and to ground 57. In a similar way the line B has been prepared to the magnet 67 of the hundred trunk-recorder 68—i. e., from ground 51 at the sending apparatus to the ground-spring 50, the frame of the sending apparatus, the roller 10, resting in an indentation of the hundred number-ring 2, the contact-spring 6 of the number-ring 2, the controlling-rim 18 of the character-disk 14, the teeth 22 of the character-disk 14, the stationary spring 27 to come in contact therewith, over the line B to the local exchange, the lower spring 69 of the answering-jack 54, the tip 70 of the answering-plug 60, the second spring 71 on the right-hand side of the middle line of the trunking-key 63, the first spring 72 on the same side, now in contact with the second spring 71, the magnet 67 of the hundred trunk-recorder 68, the battery 56, and to ground 57. Simultaneously with the former two circuits a third circuit has been established, as follows: from ground 51 at the sending apparatus over both ground-springs 50 49, now bridged by the connecting-piece 48 of the double-armed lever 46, to the upper pair of contact-springs 31 31, normally bridged by the contact-piece 32 on the insulating-disk 30, the magnet 34 of the sending apparatus, over line B to the local exchange, the lower spring 69 of the answering-jack 54, the tip 70 of the answering-plug 60, the second spring 71 on the right-hand side of the middle line of the trunking-key 63, the first spring 72 on the same side and normally in contact with the second spring 71, the magnet 67 of the hundred trunk-recorder 68, the battery 56, and to ground 57. The effect of this current just described is to release the sending apparatus by energizing the magnet 34 of the same. In doing so the stationary contact-spring 26 of the thousand-character disk 13 leaves the eleventh tooth 25 of the same, the contact-springs 26 27 glide over the teeth 21 22, respectively, and the selecting impulses representing the thousand and hundred numerals of the selected signal are sent simultaneously from the sending apparatus over both lines A and B to the local exchange and recorded at the trunk-recorders 66 68. The operator at the local exchange notes the number recorded and plugs the trunking-jack 73 corresponding to this number with the trunking-plug 74, which forms a cord-circuit with the answering-plug 60 before used. The operator presses now the trunking-key 63 into the second working position, breaks thereby connection between the first and second springs 64 62 and 72 71 on both sides of the middle line of the trunking-key and continues thereby the circuit of the line B, as follows: from the third spring



75 on the right-hand side of the middle line of the trunking-key 63 now in contact with the second spring 71 to the magnet 76 of the clearing-out relay 77, the tip 78 of the trunking-plug 74, the lower spring 79 of the trunking-jack 73, over the trunk-line B to the trunk-exchange, the second spring 80 on the left-hand side of the middle line of the ring-back key 81, a connecting-piece 82 near the lower end of the movable button 83 of the ring-back key 81, now in contact with the second spring 84 on the right-hand side of the middle line of the ring-back key 81, the magnet 85 of the trunk-relay 86 to ground 87. The energization of the magnet 76 of the clearing-out relay 77 causes the closing of a circuit through the armature 170, the clearing-out lamp 171, and the battery 56 and the lighting of the lamp 171. The second, 71, third, 75, and fourth, 88, spring on the right-hand side of the middle line of the trunking-key 63 are now in contact, and the line B, through the fourth spring 88 of the trunking-key 63, is therefore placed on battery 56 and to ground 57. The magnet 85 of the trunk-relay 86 will be energized, attracts its armature 89, and closes a local circuit through the same, the trunk-lamp 90, and the operating-battery 91, and thereby causes the trunk-lamp 90 to light. The armature 89 of the trunk-relay 86 normally retains a target-annunciator 101, which drops when the magnet 85 of the trunk-relay 86 is energized for the purpose of making a lasting indication that a trunk-line call has come into the exchange. This target-annunciator 101 may be placed out of operation, if so desired, as indicated in dotted lines. A contact 102 may be provided for in order to close a circuit for inquiry or night-bell. When the operator at the local exchange presses the trunking-key 63 in the final working position, the fourth spring 92 and the fifth spring 93 on the left-hand side of the middle line of the trunking-key 63 are brought in contact and a circuit closed from spring 92 to the magnet 94 of the recorder-reset 95, the battery 56, and back to the spring 93, whereby the trunk-recorders 66 68 are restored to their normal condition. The operator at the trunk-exchange sees the trunk-lamp 90 light and presses the ring-back key 81 to the first working position. This act extinguishes the trunk-lamp 90, because it removes the contact-piece 82 of the movable button 83 of the ring-back key 81, normally connecting the second springs 80 84 to the left and right hand side of the middle line, from the said springs 80 84. By depressing the trunking-key 63 into the second working position the operator at the local exchange has also continued the line A, as follows: from the second spring 62 on the left-hand side of the middle line of the trunking-key 63 to the third spring 96 on the same side, now in contact with the second spring 62, the sleeve 97 of the trunking-plug 74, the upper spring 98 of the trunking-jack 73,

the trunk-line B to the trunk-exchange, the fourth spring 99 on the right-hand side of the middle line of the ring-back key 81, where the line remains open for the present. The operator at the trunk-exchange in pressing the ring-back key 81 to the first working position throws the trunk-lines A and B, respectively, through the magnet 34 of the sending apparatus as follows, commencing at one side of the magnet 34 of the sending apparatus: to the lower contact-springs 33 33, now bridged by the pin 32 of the insulating-disk 30, over line A to the local exchange, the upper contact-spring 52 of the answering-jack 54, the sleeve 61 of the answering-plug 60, the second spring 62 on the left-hand side of the middle line of the trunking-key 63, the third spring 96 on the same side, the sleeve 97 of the trunking-plug 74, the upper spring 98 of the trunking-jack 73, the trunk-line A to the trunk-exchange, the fourth spring 99 on the right-hand side of the middle line of the ring-back key 81, the third spring 100 on the same side of the ring-back key 81, the magnet 103 of the sender-restarter 104, the first spring 105 of the restarting-switch 104, now bridged by the blade 106 of the switch, the second spring 107 of the same, the operating-battery 91, the third spring 108 of the said restarting-switch, the fourth spring 109 of the same, now bridged by the blade 110 of the switch, the third spring 111 on the left-hand side of the middle line of the ring-back key 81, the fourth spring 112 on the same side, over the trunk-line B, the lower spring 79 of the trunking-jack 73, the tip 78 of the trunking-plug 74, the magnet 76 of the clearing-out relay 77, the third spring 75 on the right-hand side of the middle line of the trunking-key 63, the second spring 71 on the same side of the same, the tip 70 of the answering-plug 60, the lower spring 69 of the answering-jack 54, the line B to the magnet 34 of the sending apparatus. The magnet 34 of the sending apparatus and the magnet 103 of the sender-restarter 104 at the trunk-exchange are now energized simultaneously, and the sender is thereby restarted, and at the same time the switch of the sender-restarter 104 is thrown over and brought in contact with the second set of contact-springs, and by throwing this switch the trunk-lines A and B have become connected with the magnets 113 114 of the ten and unit station-recorders 115 116 in the following way: from ground 51 at the sending apparatus to the ground-spring 50, the connecting-piece 48 of the double-armed lever 46, the frame of the sending apparatus, the roller 11, now resting in one of the indentations of the ten numbering 3, the contact-spring 7 of the same, the controlling-rim 19 of the ten character-disk, which is now in the reversed position to that shown in the drawings, Fig. 1, the teeth 23 of the same, the stationary contact-spring 28, over line A to the local exchange, the upper



spring 52 of the answering-jack 54, the sleeve 61 of the answering-plug 60, the second spring 62 on the left-hand side of the middle line of the trunking-key 63, the third spring 96 on the same side of the key 63, the sleeve 97 of the trunking-jack 74, the upper spring 98 of the trunking-jack 73, the trunk-line A to the trunk-exchange, the fourth spring 99 on the right-hand side of the middle line of the ring-back key 81, the third spring 100 on the same side now in contact therewith, the second contact-spring 117 from below of the sender-restarter 104, the first contact-spring 118 thereof, now bridged by the blade 106 of the switch, the magnet 113 of the ten station-recorder 115, the operating-battery 91, and to ground 87. The circuit for recording the unit impulses is as follows: from ground 51 at the sending apparatus to the ground-spring 50, the contact-piece 48 of the double-armed lever 46, the frame of the sending apparatus, the roller 12, resting in one of the indentations of the unit number-ring 4, the contact-spring 8 of the same, the controlling-rim 20 of the unit character-disk 16, the teeth 24 of the same, the stationary contact-spring 29 over line B to the local exchange, the lower spring 69 of the answering-jack 54, the tip 70 of the answering-plug 60, the second spring 71 on the right-hand side of the middle line of the trunking-key 63, the third spring 75 on the same side of the key 63, the magnet 76 of the clearing-out relay 77, the tip 78 of the trunking-plug 74, the lower spring 79 of the trunking-jack 73, the trunk-line B to the trunk-exchange, the fourth spring 112 on the left-hand side of the middle line of the ring-back key 81, the third spring 111 on the same side, now in contact therewith, the top contact-spring 119 of the sender-restarter 104, the second contact-spring 120 from the top, now bridged by the blade 110 of the switch, the magnet 114 of the unit station-recorder 116, the operating-battery 91, and to ground 87. This causes the second half of the signal to be received and recorded at the station-recorders 115 116. The operator at the trunk-exchange noting the number thereupon plugs the connecting-jack 121 corresponding to the number with the connecting-plug 122 and presses the ring-back key 81 into the second working position. In doing this the operator has closed for a moment the following local circuit: from the first spring 123 on the right-hand side of the middle line of the ring-back key 81 to the magnet 124 of the recorder-reset 125, the operating-battery 91, and the first spring 126 on the left-hand side of the middle line of the ring-back key 81, both springs having been bridged by the contact-piece 82 of the ring-back key 81. This causes the energization of the magnet 124 of the recorder-reset 125 and brings the station-recorders 115 116, as well as the switch of the sender-restarter 104, back to normal

position. The operator at the trunk-exchange now depresses the ring-back key 81 in the second working position, and thereby closes the following circuit: from the frame of the magneto-generator 127 to the fifth spring 128 on the left-hand side of the middle line of the ring-back key 81, the fourth spring 112 on the same side now in contact with the fifth spring 128, over the trunk-line B to the local exchange, the lower spring 79 of the trunking-jack 73, following the path of the line B as established through the local exchange heretofore, over the subscriber's line B to the telephone set 129 of the sending apparatus, the ringer 130 and condenser 131 of the same, the subscriber's line A, back to the local exchange, the upper contact-spring 52 of the answering-jack 54, the circuit heretofore established through the local exchange, the trunk-line A to the trunk-exchange, the fourth spring 99 on the right-hand side of the middle line of the ring-back key 81, the fifth spring 132 on the same side now in contact with the fourth spring 99, back to the magneto-generator 127. This notifies the calling subscriber, by ringing his bell 130, that the line is open. The operator having brought the ring-back key 81 in the third or last position establishes a circuit as follows: from the trunk-line A to the trunk-exchange, the sixth spring 133 on the right-hand side of the middle line of the ring-back key 81, the seventh spring 134 on the same side now in contact with the sixth spring 133, an impedance-coil 135, the positive pole of the talking-battery 136, through the talking-battery 136 to the negative pole thereof, a second impedance-coil 137, the second spring 138 on the left-hand side of the middle line of the connecting battery-key 139, the first spring 140 on the same side now in contact with the second spring 138, the seventh spring 141 on the left-hand side of the middle line of the ring-back key 81, the sixth spring 142 on the same side now in contact with the seventh spring 141, and to the trunk-line B. The operator now depresses the connecting-key into its first working position. This breaks the contact between the first, 140, and the second, 138, spring on the left-hand side of the middle line of the connecting battery-key 139, but closes a circuit from the frame of the magneto-generator 127 to the third spring 143 on the left-hand side of the middle line of the connecting battery-key 139, the fourth spring 144 on the same side now in contact with the third spring, the tip 145 of the connecting-plug 122, the lower spring 146 of the connecting-jack 121, the condenser 147 and the ringer 148 of the called subscriber's telephone set 149, the upper spring 150 of the connecting-jack 121, the sleeve 151 of the connecting-plug 122, the second spring 152 on the right-hand side of the middle line of the connecting battery-key 139, the first spring 153 on the same side now in contact with the



second spring 152, and back to the magneto-generator 127. As long as the operator keeps the connecting battery-key 139 in the first working position, the bell 148 of the called subscriber will ring. The operator thereupon presses the connecting battery-key 139 into the final working position and at the same time watches the clearing-out lamp 154. If this lamp 154 should not light, the operator brings the connecting battery-key 139 back into the first position, and thereby rings the bell 148 again, until finally the lamp 154 does light, which indicates that the called subscriber has removed his receiver 155 from the hook 156, and thereby closed the circuit over his line which is normally open at the condenser 147 of his apparatus, and the magnet 157 of the clearing-out relay 158 becoming energized closes a local circuit through the armature 159 of the magnet 157, the clearing-out lamp 154, and the battery 91. Leaving the connecting battery-key 139 at the second or final working position and the receiver 155 of the called subscriber off the hook 156, a circuit is established as follows: from the positive pole of the talking-battery 136, through the impedance-coil 135, the fifth spring 160 on the left hand side of the middle line of the connecting battery-key 139, the fourth spring 144 on the same side now in contact with the fifth spring 160, the tip 145 of the connecting-plug 122, the lower contact-spring 146 of the connecting-jack 121 over the subscriber's line to the receiver-hook 156, the upper hook-contact 161, the receiver 155 and transmitter 162 of the called subscriber back over the subscriber's line to the upper spring 150 of the connecting-jack 121, the sleeve 151 of the connecting-plug 122, the second spring 152 on the right-hand side of the middle line of the connecting battery-key 139, the third spring 163 on the same side now in contact with the second spring 152, the magnet 157 of the clearing-out relay 158, the impedance-coil 137, to the negative pole of the talking-battery 136. The circuit connecting the receiver 164 and transmitter 167 of the calling-subscriber's telephone set 129 with the talking-battery 130 has been described hereinbefore, but by depressing the connecting battery-key 139 the first, 140, and second, 138, springs on the left-hand side of the middle line of the same have been disconnected, but the fourth, 168, and fifth, 169, springs on the right-hand side have now been connected, and conversation may be had between the two subscribers over the circuits herein described and illustrated in Fig. 6. The called subscriber in hanging up his receiver 155 opens the circuit through the clearing-out relay 158. The armature 159 of the same is thereby released, and the local circuit containing the clearing-out lamp 154 is broken, whereupon the clearing-out lamp 154 is extinguished, and the operator at the trunk-exchange pulls out the connecting-plug 122

and brings the keys 81 and 139 back to normal position. The same act is now taking place at the local exchange. The operator at that part of the apparatus thereupon removes the trunking-plug 74 and the answering-plug 60 as soon as he sees that the clearing-out lamp 171 is extinguished, and everything is thereby restored to its normal condition.

The operator at the local exchange may apply a busy test to the trunk-lines by touching the tip 78 of the trunking-plug 74 to the ring 177 of the trunking-jack 73. Should the trunk-line be busy, a circuit would be closed from ground 172 at the local exchange, the busy-test receiver 173, the tip 78 of the trunking-plug 74, the ring 177 of the trunking-jack 73, all rings 177 being connected together, the upper spring 98 of the trunk-line A if a plug should be in any other of the jacks, the trunk-line A to the trunk-exchange, the resistance 174, the busy-test cell 175 to ground 176, and the operator would hear the familiar click in the receiver commonly used for testing purposes.

As new and useful is claimed and desired to be secured by Letters Patent of the United States—

1. The combination with a series of individual sending apparatus and a common recording-station, of means for the simultaneous transmission of variable signals from each of the sending apparatus to the recording-station, and a plurality of common recording means for the signals at the recording-station each controlled by one part of the variable signals.

2. A semi-automatic telephone system, containing two conductors and a ground return, indicating means at an exchange operated by current passing over a circuit containing one conductor and the ground, a signal-sender started by current passing over a circuit containing the other conductor and the ground, means for the simultaneous transmission of a plurality of variable electric signals over both said circuits, and means for restarting the sending apparatus by current passing over a circuit containing both conductors.

3. The combination with sending and recording apparatus, of three circuits connecting the same and formed by two conductors and a ground return, one circuit comprising one conductor and the ground adapted to start the sending apparatus, another circuit comprising both conductors adapted to restart the sending apparatus, and the third circuit comprising the other conductor and the ground and adapted in common with the first circuit to transmit variable electric signals.

4. The combination with a series of individual sending apparatus and a recording-station common to a group of the same, of means for the transmission of variable signals from each of the sending apparatus to the recording-station of its group, and a plurality of



ing-stations to its recording-station, said send- 65  
ing-stations containing displaceable selective  
devices and make-and-break devices both di-  
vided into groups or sets, each group or set  
of make-and-break devices adapted to make  
contact with the corresponding group of se- 70  
lective devices at successive periods and there-  
by transmitting signals to a plurality of re-  
cording means at the recording-station, each  
of the recording means controlled by one part  
only of the entire signal. 75

10. An electric signaling system comprising sending-stations connected in groups to recording-stations and organized to transmit divided variable signals from each of the sending-stations to its recording-station, said sending-stations containing displaceable selective devices and automatic make-and-break devices both divided into groups or sets, each group or set of make-and-break devices adapted to make contact with the corresponding group of selective devices at successive periods and thereby transmitting signals to a plurality of recording means at the recording-station, each of the recording means controlled by one part only of the entire signal.

11. An electric signaling system comprising sending-stations connected in groups to recording-stations and organized to transmit divided variable signals from each of the sending-stations to its recording-station, said sending-stations containing displaceable selective devices and rotatable make-and-break devices divided into groups or sets, each group or set adapted to make contact with the selective devices at successive periods and thereby transmitting signals to a plurality of recording means at the recording-station, each of the recording means controlled by one part only of the entire signal.

12. An electric signaling system comprising 105  
sending-stations connected in groups to re-  
cording-stations and organized to transmit  
divided variable signals from each of the send-  
ing-stations to its recording-station, said send- 110  
ing-stations containing displaceable selective  
devices and axially-supported make-and-break  
devices divided into groups or sets, each group  
or set adapted to make contact with the select-  
ive devices at successive periods and thereby  
transmitting signals to a plurality of record- 115  
ing means at the recording-station, each of  
the recording means controlled by one part  
only of the entire signal.

13. An electric signaling system comprising sending-stations connected in groups to re- 120  
cording-stations and organized to transmit di-  
vided variable signals from each of the send-  
ing-stations to its recording-station, said send-  
ing-stations containing rotatable selective de-  
vices and make-and-break devices divided into 125  
groups or sets, each group or set adapted to  
make contact with the selective devices at suc-  
cessive periods and thereby transmitting sig-



nals to a plurality of recording means at the recording-station, each of the recording means controlled by one part only of the entire signal.

14. An electric signaling system comprising  
5 sending-stations connected in groups to recording-stations and organized to transmit divided variable signals from each of the sending-stations to its recording-station, said sending-stations containing rotatable selective devices  
10 vices and automatic make-and-break devices divided into groups or sets, each group or set adapted to make contact with the selective devices at successive periods, and thereby transmitting signals to a plurality of recording  
15 means at the recording-station, each of the recording means controlled by one part only of the entire signal.

15. An electric signaling system comprising  
20 sending-stations connected in groups to recording-stations and organized to transmit divided variable signals from each of the sending-stations to its recording-station, said sending-stations containing rotatable selective devices and rotatable make-and-break devices  
25 divided into groups or sets, each group or set adapted to make contact with the selective devices at successive periods and thereby transmitting signals to a plurality of recording means at the recording-station, each of the recording  
30 means controlled by one part only of the entire signal.

16. An electric signaling system comprising  
35 sending-stations connected in groups to recording-stations and organized to transmit divided variable signals from each of the sending-stations to its recording-station, said sending-stations containing rotatable selective devices and axially-supported rotatable make-and-break devices divided into groups or sets,  
40 each group or set adapted to make contact with the selective devices at successive periods and thereby transmitting signals to a plurality of recording means at the recording-station, each of the recording means controlled by one  
45 part only of the entire signal.

17. The combination with signal-sending stations and a receiving-station, of means at the sending-station for dividing an entire electrical signal into groups or sets comprising a  
50 plurality of separate variable signals, means for simultaneously transmitting the variable signals forming a group or set, means for successively transmitting the groups or sets forming the entire signal, and means at the receiving-station for recording the signal sent.  
55

18. The combination with signal-sending stations and a receiving-station, of means at the sending-station for preestablishing an entire electrical signal, means for dividing the  
60 same into groups or sets comprising separate variable signals, means for causing the simultaneous transmission of the separate variable signals forming a group or set, means for causing the successive transmission of the groups  
65 or sets forming the entire signal, and means at

the receiving-station for recording the separate variable signals.

19. The combination with signal-sending stations and a receiving-station, of means at the sending-station for preestablishing an entire electrical signal, means for dividing the  
70 same into groups or sets comprising separate variable signals, means for causing the simultaneous transmission of the separate variable signals forming a group or set, means for  
75 causing the successive transmission of the groups or sets forming the entire signal, and means at the receiving-station for successively recording the groups or sets forming the entire electrical signal and for simultaneously  
80 and separately recording the variable signals forming the groups or sets.

20. The combination with means for dividing an entire electrical signal into groups or sets of separate variable signals, of means for  
85 simultaneously sending the separate variable signals forming a group or set, means for simultaneously but separately receiving said separate variable signals forming said groups or sets, means for successively sending the  
90 groups or sets forming the entire signal, and means for simultaneously and separately receiving the separate variable signals forming the successive groups or sets.

21. The combination with a plurality of signal-sending apparatus and a recording-station, said sending apparatus being adapted to simultaneously transmit groups or signals, each group comprising more than one variable signal, of signal-receiving means at the recording-station for simultaneously receiving the  
100 variable signals forming a group, and hand-operated means at the recording-station adapted to connect any of the signal-sending apparatus with the receiving means.  
105

22. The combination with a plurality of signal-sending apparatus and a recording-station, said sending apparatus being adapted to simultaneously transmit groups of signals, each group comprising more than one variable signal, and each sending apparatus containing selective devices and make-and-break devices divided into groups or sets, each group or set adapted to make contact with the selective  
110 devices at successive periods, of signal-receiving means at the recording-station for simultaneously receiving the variable signals forming a group, and hand-operated means at the recording-station adapted to connect any of the signal-sending apparatus with the receiving means.  
120

23. The combination with a plurality of signal-sending apparatus and a recording-station, said sending apparatus being adapted to simultaneously transmit groups of signals, each group comprising more than one variable signal, and each sending apparatus containing selective devices and automatic make-and-break devices divided into groups or sets, each group or set adapted to make contact  
130



periods, of signal-receiving means at the recording-station for simultaneously receiving the variable signals forming a group, and hand-operated means at the recording-station adapted to connect any of the signal-sending 70 apparatus with the receiving means.

28. The combination with a plurality of signal-sending apparatus and a recording-station, said sending apparatus being adapted to simultaneously transmit groups of signals, each group comprising more than one variable signal, and each sending apparatus containing displaceable selective devices and rotatable make-and-break devices divided into groups or sets, each group or set adapted to make contact with the selective devices at successive periods, of signal-receiving means at the recording-station for simultaneously receiving the variable signals forming a group, and hand-operated means at the recording-station adapted to connect any of the signal-sending apparatus with the receiving means.

29. The combination with a plurality of signal-sending apparatus and a recording-station, said sending apparatus being adapted to simultaneously transmit groups of signals, each group comprising more than one variable signal, and each sending apparatus containing displaceable selective devices and axially-supported make-and-break devices divided into groups or sets, each group or set adapted to make contact with the selective devices at successive periods, of signal-receiving means at the recording-station for simultaneously receiving the variable signals forming a group, and hand-operated means at the recording-station adapted to connect any of the signal-sending apparatus with the receiving means.

30. The combination with a plurality of signal-sending apparatus and a recording-station, said sending apparatus being adapted to simultaneously transmit groups of signals, each group comprising more than one variable signal, and each sending apparatus containing rotatable selective devices and make-and-break devices divided into groups or sets, each group or set adapted to make contact with the selective devices at successive periods, of signal-receiving means at the recording-station for simultaneously receiving the variable signals forming a group, and hand-operated means at the recording-station adapted to connect any of the signal-sending apparatus with the receiving means.

31. The combination with a plurality of signal-sending apparatus and a recording-station, said sending apparatus being adapted to simultaneously transmit groups of signals, each group comprising more than one variable signal, and each sending apparatus containing rotatable selective devices and automatic make-and-break devices divided into groups or sets, each group or set adapted to make contact with the selective devices at successive periods, of signal-receiving means at the re-



5 cording-station for simultaneously receiving the variable signals forming a group, and hand-operated means at the recording-station adapted to connect any of the signal-sending apparatus with the receiving means.

32. The combination with a plurality of signal-sending apparatus and a recording-station, said sending apparatus being adapted to simultaneously transmit groups of signals, each group comprising more than one variable signal, and each sending apparatus containing rotatable selective devices and rotatable make-and-break devices divided into groups or sets, each group or set adapted to make contact with the selective devices at successive periods, of signal-receiving means at the recording-station for simultaneously receiving the variable signals forming a group, and hand-operated means at the recording-station adapted to connect any of the signal-sending apparatus with the receiving means.

33. The combination with a plurality of signal-sending apparatus and a recording-station, said sending apparatus being adapted to simultaneously transmit groups of signals, each group comprising more than one variable signal, and each sending apparatus containing rotatable selective devices and axially-supported rotatable make-and-break devices divided into groups or sets, each group or set adapted to make contact with the selective devices at successive periods, of signal-receiving means at the recording-station for simultaneously receiving the variable signals forming a group, and hand-operated means at the recording-station adapted to connect any of the signal-sending apparatus with the receiving means.

34. A telephone system comprising subscribers' stations and a central exchange, signal-sending means at the subscribers' stations adapted to send simultaneously more than one variable signal forming a group and to send successively the groups forming an entire signal, signal-receiving means at the central exchange adapted to receive simultaneously but separately the variable signals forming a group and successively the groups forming

the entire signal, one or more loop-circuits at the exchange, and means for connecting any two subscribers' stations through one of the loop-circuits.

35. A telephone system comprising subscribers' stations and a central exchange, signal-sending means at the subscribers' stations adapted to send simultaneously more than one variable signal forming a group and to send successively the groups forming an entire signal, signal-receiving means at the central exchange adapted to receive simultaneously but separately the variable signals forming a group and successively the groups forming the entire signal, one or more loop-circuits at the exchange and hand-operated means for connecting any two subscribers' stations through one of the loop-circuits.

36. A telephone system comprising subscribers' stations and a central exchange, signal-sending means at the subscribers' stations adapted to send simultaneously groups of more than one variable signal, and to send successively the groups forming an entire signal, signal-receiving means at the exchange for each of the variable signals forming a group, one or more loop-circuits at the exchange, and means for connecting any two subscribers' stations through one of the loop-circuits.

37. A telephone system comprising subscribers' stations and a central exchange, signal-sending means at the subscribers' stations adapted to send simultaneously groups of more than one variable signal, and to send successively the groups forming an entire signal, signal-receiving means at the exchange for each of the variable signals forming a group, one or more loop-circuits at the exchange, and hand-operated means for connecting any two subscribers' stations through one of the loop-circuits.

In testimony whereof I have hereunto set my hand, in the presence of two subscribing witnesses, this 29th day of June, 1903.

ERNEST A. FALLER.

In presence of—

RALPH JULIAN SACHERS,  
K. O. CHISHOLM.