

Aug. 25, 1925.

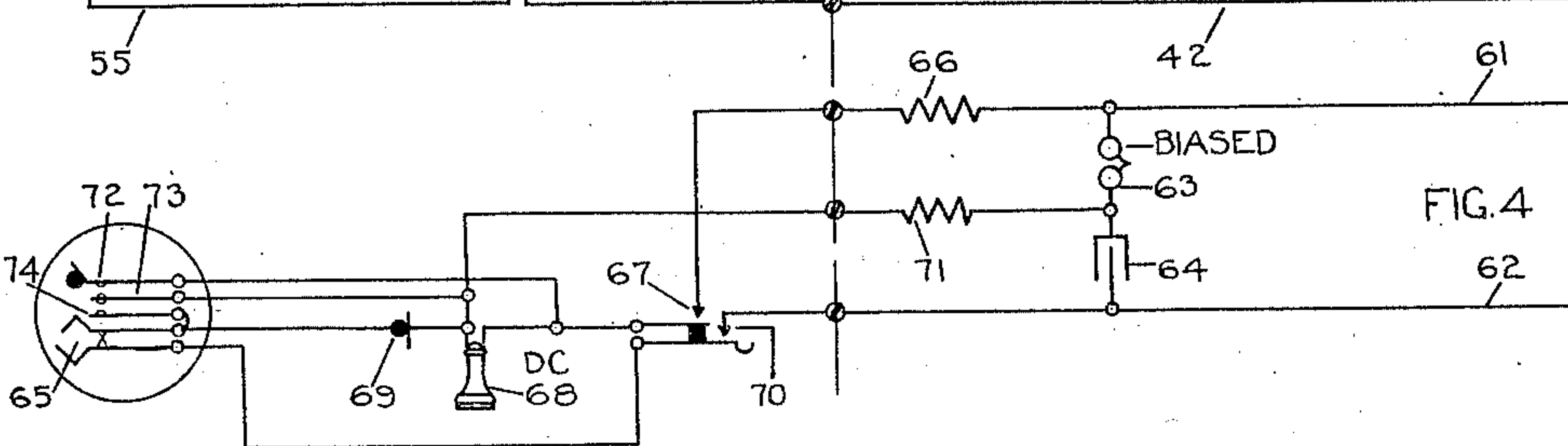
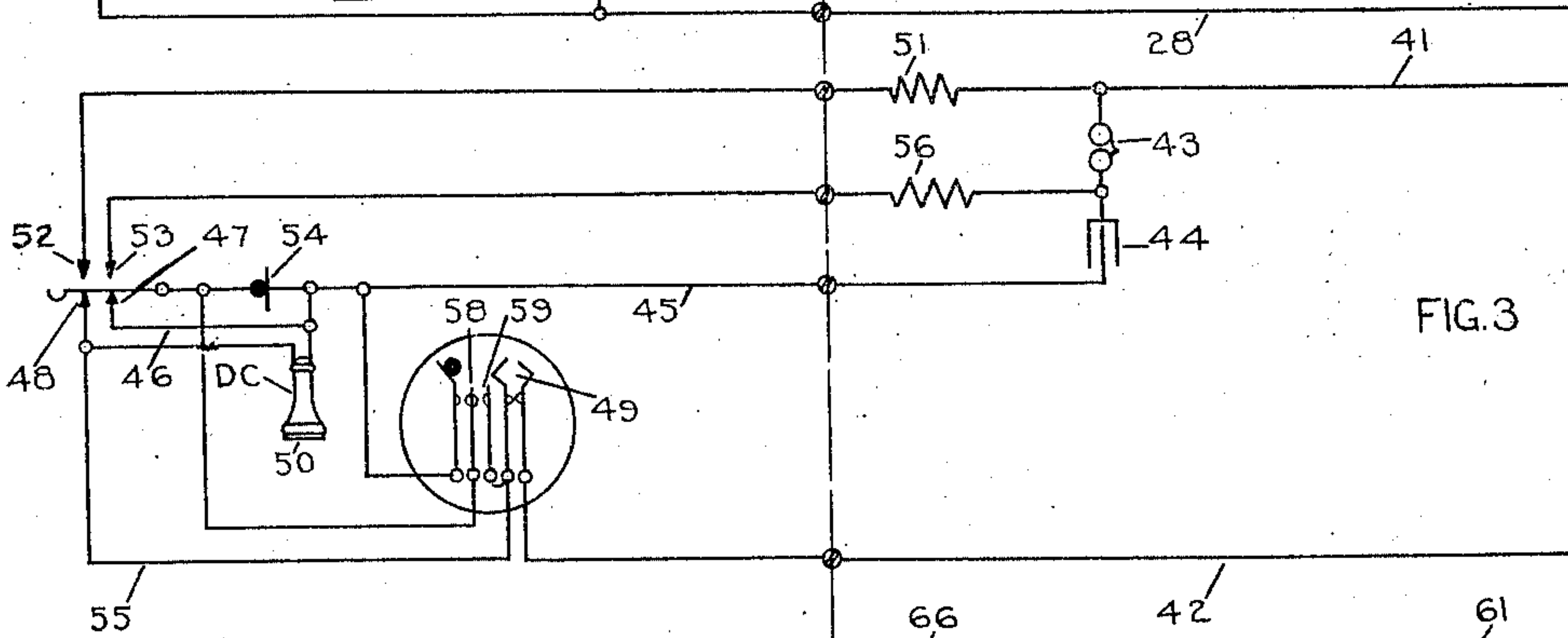
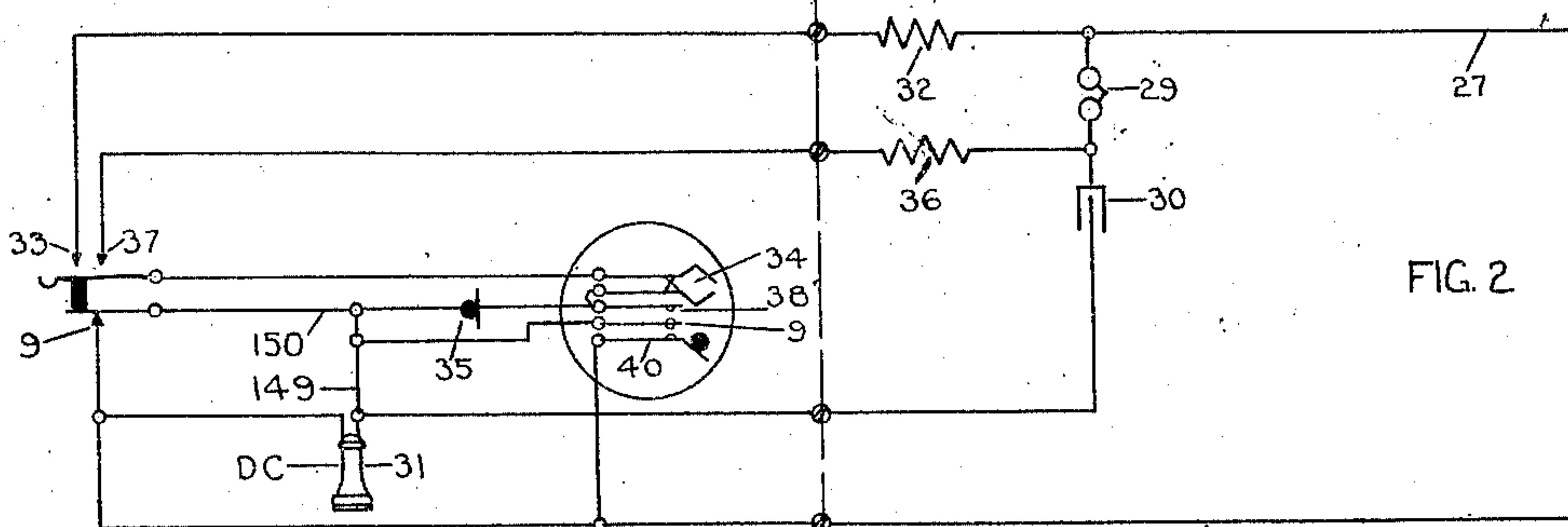
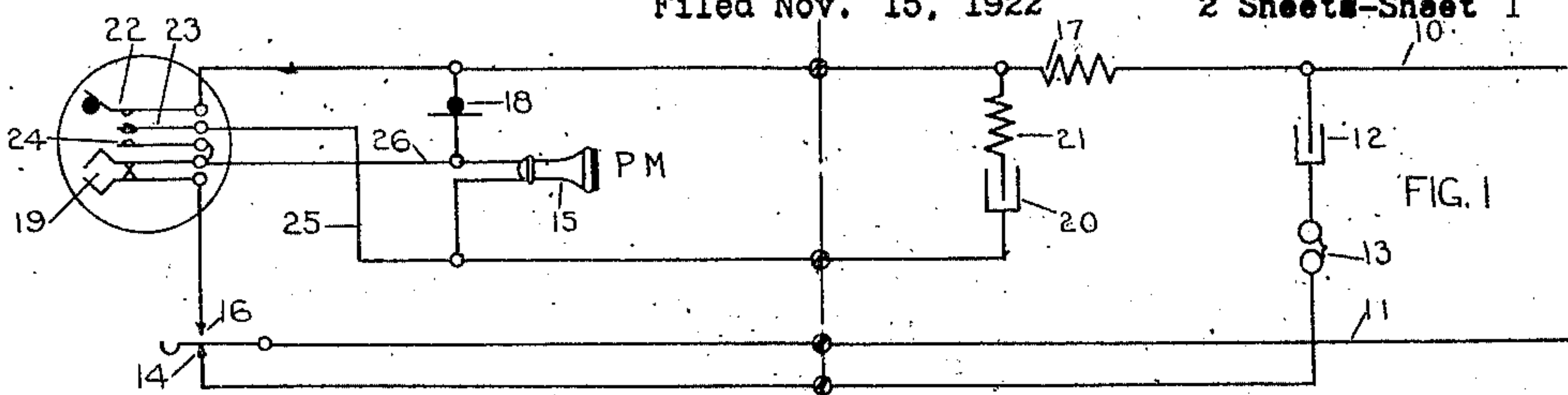
1,551,171

W. T. POWELL

AUTOMATIC TELEPHONE SUBSTATION CIRCUITS

Filed Nov. 15, 1922

2 Sheets-Sheet 1



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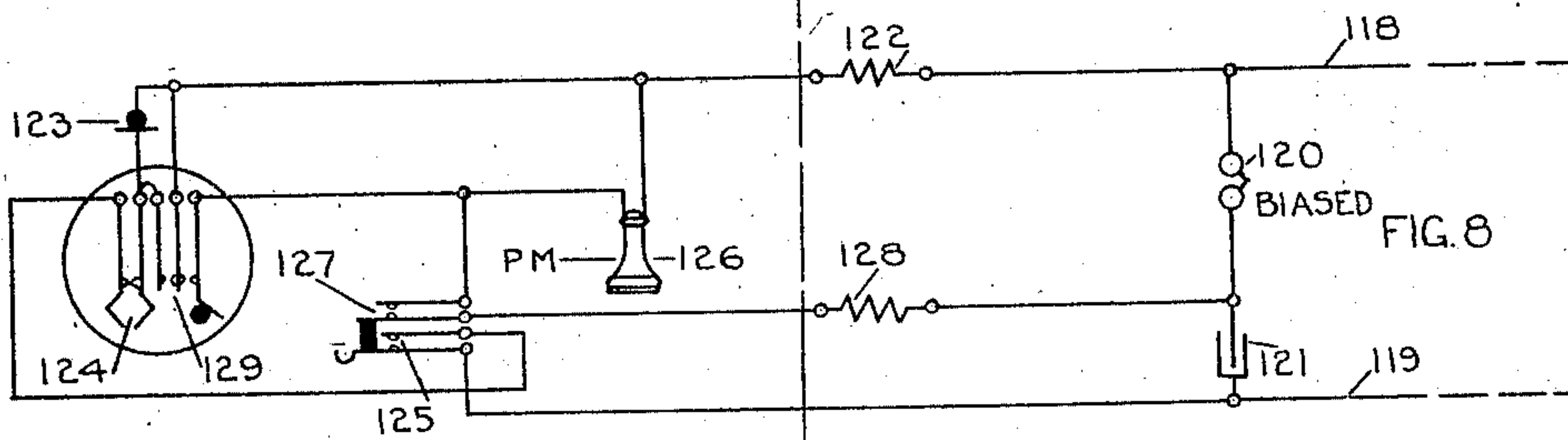
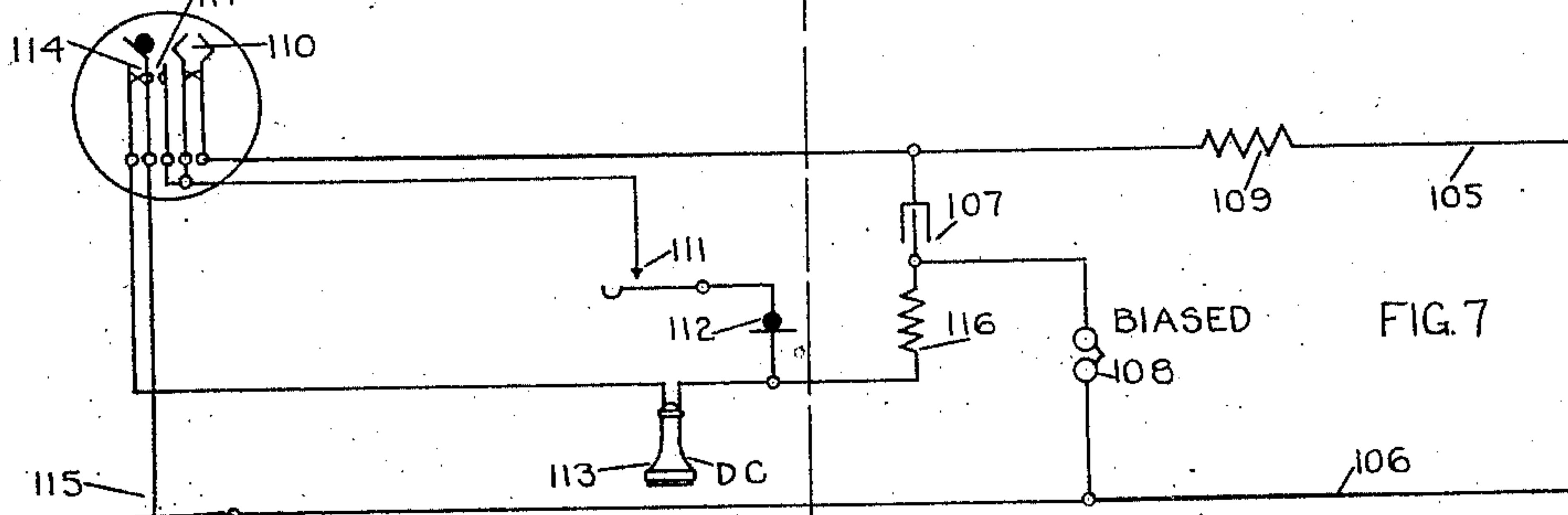
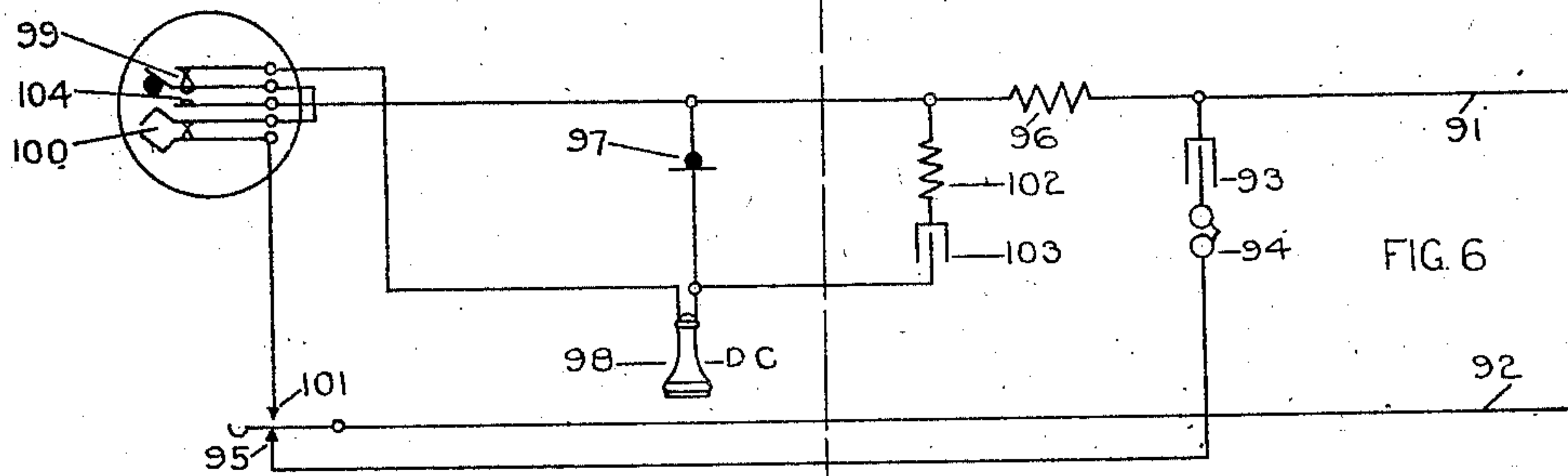
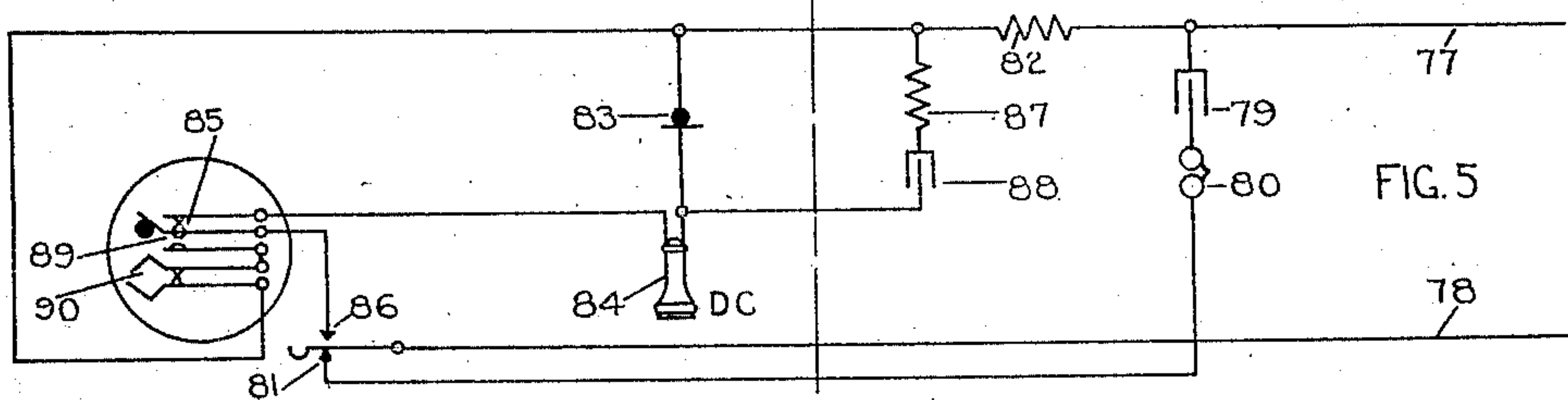
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2 Sheets-Sheet 2



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Patented Aug. 25, 1925.

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UNITED STATES PATENT OFFICE.

WINFRED T. POWELL, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

AUTOMATIC TELEPHONE SUBSTATION CIRCUITS.

Application filed November 15, 1922. Serial No. 601,143.

To all whom it may concern:

Be it known that I, WINFRED T. POWELL, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Automatic Telephone Substation Circuits, of which the following is a full, clear, concise, and exact description.

This invention relates to substation circuits of the type employed in automatic telephone systems.

In the telephone substation circuits employed in automatic telephone systems it is imperative that the impulses generated by the impulse transmitter be perfectly transmitted without interference from the microphone transmitter; also in said substation circuits it is necessary to prevent the noises from the impulse transmitter being heard in the telephone receiver. The present invention is of special use in substation circuits where the well known desk stand and bell box are employed; in such an arrangement it is essential that the number of conductors extending between the bell box and the desk stand be small.

The present invention, therefore, has for its purpose substation circuits in which the microphone transmitter is disabled during the operation of the impulse transmitter and in which the telephone receiver is likewise disabled during the transmission of impulses while the number of conductors between the bell box and the desk stand are reduced to the minimum.

In the drawings, Figures 1, 2, 3, 4, 5, 6, 7, and 8 represent modified circuit arrangements to accomplish the above-outlined results. In each of these figures the portion thereof at the left of the dotted line represents the desk stand while the portion of each figure at the right of the dotted line represents equipment within the bell box.

The impulse transmitter referred to in this disclosure may be similar to that disclosed on pages 34 and 35 of "Automatic Telephony" by Smith and Campbell, first edition, when the shunt springs are rearranged in a manner to be pointed out.

It is believed that the invention will best be understood by describing the arrangement of the conductors in the various modifications of the present invention. Refer-

ring, first of all, to Fig. 1, conductors 10 and 11 are the conductors of the well known telephone line which connect the substation to the main exchange. Conductor 10 is normally bridged to conductor 11 through the condenser 12 and the substation signal or ringer 13. This bridge is controlled through the contacts 14 of the well known type of hook-switch which maintains contacts 14 closed when the receiver 15 is suspended from the switch-hook. A second bridge across the line conductors 10 and 11 is normally open at contacts 16 until the receiver 15 is removed from the switch-hook. This second bridge is traceable from line conductor 10, primary winding of the induction coil, through the microphone transmitter 18, impulse springs 19, normally opened contacts 16 of the hook-switch, to the line conductor 11. A third bridge including the receiver 15, a second condenser 20 and the secondary winding of the induction coil 21 is connected at one end to the second bridge at a point between the microphone transmitter 18 and the impulse springs 19 of the mentioned impulse transmitter while the other end of this third bridge is connected to the second bridge at a point between the primary winding 17 of the induction coil and the microphone transmitter 18. It will be seen that, in addition to the impulse springs 19, the impulse transmitter is also provided with shunt springs designated 22, 23 and 24. These springs, it will be noted, are normally open except when the impulse springs 19 are being opened and closed under the action of the impulse transmitter at which time they are closed.

The operation of this substation arrangement is substantially as follows: The subscriber when he desires to initiate a call, removes his receiver 15 from the hook-switch, at which time the hook-switch springs 16 are closed so that the second mentioned bridge including the microphone transmitter and the impulse transmitter are connected across the line conductors 10 and 11. The subscriber then operates his impulse transmitter, permitting the springs 22, 23 and 24 to come into engagement. The impulse transmitter on its retrograde movement intermittently opens and closes the impulse springs 19 until the impulse transmitter has

completed its operation, at which time shunt springs 22, 23 and 24 are opened and the impulse springs 19 remain closed. It will thus be seen that during the period that the impulse springs 19 are intermittently operated, a shunt circuit is closed about the microphone transmitter 18 so that the impulses are transmitted to the main exchange, through conductor 10, primary winding 17 of the induction coil, impulse springs 22, 23 and 24 through the impulse springs 19, hook-switch contacts 16 and line conductor 11 to the main exchange. At this time also the receiver 15 is included in a closed circuit including conductor 25, shunt springs 23 and 24, and conductor 26. The microphone transmitter 18 is also short-circuited at this time by conductor 26 and shunt springs 22 and 23. When the substation of Fig. 1 is called, alternating signaling current is transmitted from the main exchange through line conductor 10, the condenser 12 and ringer 13 in series, normally closed hook-switch contacts 14, through the lower line conductor 11 to the main exchange. The subscriber at the substation on hearing the signal removes the receiver from the switch hook, at which time the second mentioned bridge circuit is closed across the conductors 10 and 11 and the first bridge is opened. The second mentioned bridge is, of course, a portion of the conversational circuit.

In the arrangement shown in Fig. 2 the line conductors 27 and 28 represent the well known telephone line terminating at their ends in the main exchange and in the terminals of the well-known form of bell box. As here shown, the ringer 29 is normally bridged across these conductors in a circuit including the condenser 30, the conductors 149 and 150 and contacts 9. A second bridge across these conductors includes the primary winding 32 of the induction coil, hook-switch contacts 33, impulse springs 34, microphone transmitter 35, the receiver 31, through the line conductor 28. A third bridge including the secondary winding 36 of the induction coil terminates at one end in the conductor between the ringer 29 and the condenser 30 and at its other end in the normally opened contacts 37 of the hook-switch, which connects this last mentioned bridge to the second bridge at a point between the primary induction coil 32 and the impulse springs 34. In this arrangement also the shunt springs consist of three normally opened springs and, as in the case of the first described arrangement, these springs short circuit the microphone transmitter 35 and the telephone receiver 31.

In the modification disclosed in Fig. 3, the line conductors 41 and 42 are normally bridged by a circuit including the ringer 43, the condenser 44, conductors 45 and 46, nor-

mally closed hook-switch contacts 47 and 48, conductor 55, impulse springs 49 to line conductor 42. A second bridge across these conductors which is closed only when the receiver 50 is removed from the switch-hook is traceable from the conductor 41, primary winding 51 of the induction coil, normally opened contacts 52 of the hook-switch, microphone transmitter 54, receiver 50, conductor 55, impulse springs 49 to the line conductor 42. A third bridge including the secondary winding 56 of the induction coil is connected to the first mentioned bridge at a point between the ringer 43 and the condenser 44. The other end of this bridge is connected by the hook-switch contacts 53 to said second bridge at a point between the primary winding 51 of the induction coil and the microphone transmitter. In this instance also the shunt springs 57, 58 and 59 short circuit the microphone transmitter 54 and the receiver 50.

In the arrangement shown in Fig. 4 the conductors 61 and 62 represent the two sides of the telephone line. These conductors are permanently bridged by a conductor including the biased ringer 63 and the condenser 64. It should be mentioned that this ringer is biased in order to prevent the so-called "tapping" of the bell when the impulse springs 65 of the impulse transmitter are operated. A second bridge across the conductors 61 and 62 is completed when the subscriber removes his receiver from its switch hook and is traceable from conductor 61, primary winding 66 of the induction coil, hook-switch contacts 67, through the receiver 68, microphone transmitter 69, the impulse springs 65, hook-switch contacts 70 to the line conductor 62. A third bridge including the secondary winding 71 of the induction coil is connected to the first bridge at a point between the ringer 63 and the condenser 64. The other end of this bridge is connected to said second bridge at a point between the microphone transmitter 69 and the receiver 68. The shunt springs include normally opened springs 72, 73 and 74. These shunt springs, as previously described, are closed during the period that the impulse springs 65 are intermittently operated and serve to short circuit the receiver and microphone transmitter.

In Fig. 5 a slightly different arrangement of the substation circuit is disclosed. The line conductors 77 and 78 are normally bridged by a conductor including the condenser 79, ringer 80 and the normally closed hook-switch contacts 81. A second bridged circuit is connected to the mentioned line conductors and extends from conductor 77, primary winding 82 of the induction coil, microphone transmitter 83 and the telephone receiver 84 in series, normally closed shunt springs 85 of the impulse transmitter, nor-

5 mally open contacts 86 of the hook-switch to the conductor 78. A third bridge including the secondary winding 87 of the induction coil and a second condenser 88 is connected at one end to said second bridge at a point between the primary winding 82 of the induction coil and the microphone transmitter 83. The other end of this third bridge is connected to said second bridge at a point between the microphone transmitter 83 and the receiver 84. In this instance, during the transmission of impulses, the springs 85 are open and the springs 89 are closed, from which it will be seen that the microphone transmitter and the telephone receiver are on open circuit during the time that the impulses are being transmitted through the mentioned line conductors. The impulse circuit is traceable from conductor 77, primary winding 82 of the induction coil, impulse springs 90, shunt springs 89, contacts 86 to the line conductor 78.

25 In the arrangement diagrammatically shown in Fig. 6 the line conductors 91 and 92 are normally bridged by a conductor including the condenser 93, the ringer 94 and the normally closed hook-switch contacts 95. A second bridge is connected across the line conductors from conductor 91, primary winding 96 of the induction coil, microphone transmitter 97 and the receiver 98 in series, normally closed contacts 99 of the shunt springs, impulse springs 100, normally open hookswitch contacts 101 to the conductor 92. A third bridge including the secondary winding 102 of the induction coil and the condenser 103 is connected to said second bridge at a point between the primary winding of the induction coil 96 and the microphone transmitter 97. The other end of said bridge is connected to said second bridge at a point between the microphone transmitter 97 and the receiver 98. During the transmission of impulses the shunt springs 99 are open and the springs 104 are closed so that the circuit for transmitting impulses to the main exchange now extends from line conductor 91, primary winding 96 of the induction coil, contacts 104, impulse springs 100, hookswitch springs 101 and line conductor 92 to the main exchange.

55 In the modified form shown in Fig. 7 the line conductors 105 and 106 are permanently bridged by the conductor including a condenser 107 and a biased ringer 108. A second bridge across these conductors is traceable from conductor 105, primary winding 109 of the induction coil, impulse springs 110, hook-switch contacts 111, microphone transmitter 112, receiver 113, normally closed shunt springs 114, hook-switch contacts 115 and line conductor 106. A third bridge including the secondary winding 116 of the in-

duction coil is connected to said bridge at a point between the condenser 107 and ringer 108, and at its other end is connected to said second bridge at a point between the microphone transmitter 112 and the receiver 113. It will be noted in this instance that the shunt springs 114 are opened during the operation of the impulse transmitter so that the microphone transmitter and receiver are placed on open circuit at this time. The circuit over which the impulses are transmitted to the main exchange extends from conductor 105, primary winding 109 of the induction coil, impulse springs 110 normally opened shunt springs 117, hookswitch contacts 115 to conductor 106.

In the disclosure of Fig. 8 the line conductors are shown at 118 and 119. These conductors are permanently bridged by a circuit including the biased ringer 120 and the condenser 121. A second bridge extends from conductor 118, through primary winding 122 of the induction coil, microphone transmitter 123, impulse springs 124, normally opened hook-switch contacts 125 to line conductor 119. A third bridge including the permanent magnet receiver 126, the normally opened hook-switch contacts 127 and the secondary winding 128 of the induction coil is connected at one end to said first bridge at a point between the ringer 120 and the condenser 121. The other end of said third bridge is connected to said second bridge at a point between the primary winding 122 of the induction coil and the microphone transmitter 123. Here also the shunt springs generally designated 129, close shunt circuits about microphone transmitter 123 and the receiver 126 so that the impulse circuit extends from conductor 118, primary winding 122 of the induction coil, shunt spring contacts 129, impulse springs 124, hook-switch contacts 125 and line conductor 119.

What is claimed is:—

1. In a substation circuit arrangement, two line conductors, a bridge across said conductors including the primary winding of an induction coil, a microphone and a telephone receiver, a normally closed bridge across said conductors including a signal and a condenser, a third bridge including a secondary winding of said induction coil, said third bridge being connected to said first bridge at a point between said signal and said condenser, the other end of said third bridge being connected to said second bridge at a point between said microphone and said primary winding of said induction coil, a hookswitch serving to close said first and third bridges, an impulse sender having a pair of impulse springs and a plurality of shunt springs arranged to be closed when said impulse springs are operated to render said microphone and telephone re-

ceiver inoperative, and an impulse path extending across said line conductors including a portion of said first bridge and extending through said pair of impulse
5 springs.

2. In a substation circuit arrangement, two line conductors, a bridge across said conductors including the primary winding of an induction coil, a microphone and a
10 telephone receiver, a normally closed bridge across said conductors including a signal and a condenser, a third bridge including a secondary winding of said induction coil, said third bridge being connected to said
15 first bridge at a point between said signal and said condenser, the other end of said third bridge being connected to said second bridge at a point between said microphone and said primary winding of said induction
20 coil, a hookswitch serving to close said first and third bridges, an impulse sender having a pair of impulse springs and three normally open shunt springs arranged to be closed when said impulse springs are being
25 actuated, said shunt springs when closed functioning to render said microphone and telephone receiver inoperative, and an impulse path across said line conductors including a portion of said first bridge and
30 extending through said impulse springs and through the shunt springs.

3. In a substation circuit arrangement, an induction coil, a signal and a condenser forming one unit, a microphone, a telephone receiver, an impulse sender, and a switch-
hook forming a second unit, two line con- 35 ductors, a bridge across said conductors including the primary winding of said induction coil, said microphone and said telephone receiver, a normally closed bridge 40 across said conductors including said signal and said condenser, a third bridge including the secondary winding of an induction coil connected across said first and second bridges, said hookswitch functioning to 45 close said first and third bridges, an impulse sender having a pair of impulse springs and a plurality of shunt springs arranged to be closed when said impulse sender is operated, said shunt springs when 50 closed serving to render said microphone and said telephone receiver inoperative, an impulse circuit including a portion of said first bridge and extending through said impulse springs, the connections for said 55 bridges between said first and second units including not more than four conductors.

In witness whereof, I hereunto subscribe my name this 14th day of November A. D. 1922.

WINFRED T. POWELL.