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W. T. POWELL

SUBSTATION CIRCUIT

Filed March 8, 1920

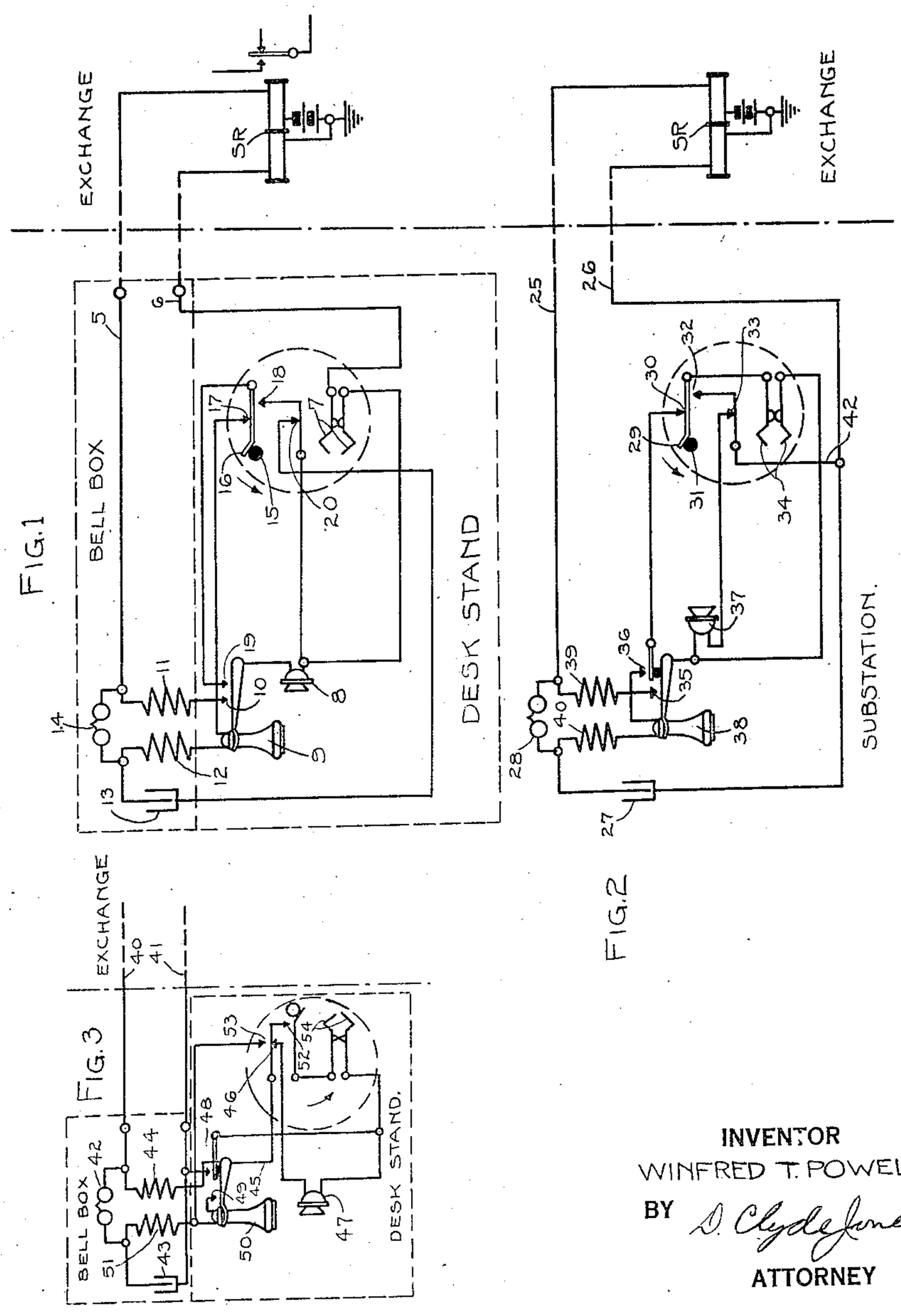

FIG.1

FIG.2

FIG.3

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SUBSTATION CIRCUIT.

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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 Substation Circuits, of which the following is a full, clear, concise, and exact description.

This invention relates to sub-station circuits, and more particularly to sub-station circuits for use in automatic telephone systems.

In the well known two wire system wherein automatic switches at the exchange are operated in response to impulses caused by interruptions of a metallic circuit at the sub-station, it is necessary to provide means to eliminate or prevent dial noises from the receiver and to provide means for reducing or eliminating the impedance in such impulsing circuit, due to the presence of the transmitter or microphone.

It is the object of the present invention to provide a simple circuit arrangement whereby the dial noises do not reach the receiver and in which the impedance of the transmitter or microphone is removed from the signaling circuit during the setting of the automatic switches.

In the accompanying drawing Fig. 1 represents one form of improved sub-station circuit in which that portion thereof included within the dotted rectangle at the upper left hand corner of this figure represents the equipment that is provided in the bell box, whereas the portion of the drawing included within the lower rectangle represents the receiver switchhook, transmitter and dial impulse sender of the desk stand. At the extreme right of this figure there is shown an impulse or stepping relay located at the exchange which is controlled by the impulses transmitted from the dial sender. Figs. 2 and 3 represent a modified form of sub-station circuit. At the left of the dotted line there is shown the apparatus and circuits of the bell box and desk stand, whereas at the extreme right of this figure there is shown the impulse or stepping relay located at the exchange.

While reference is made in this description to the use of these circuits in a desk stand, it will be understood that they are equally effective for use in a wall telephone set. The dial sender indicated within the dotted circle and referred to in this disclosure may be of the mechanical structure of that shown in the patent to Keith, #1,279,352, patented September 17, 1918.

Referring to Fig. 1, 5 and 6 represent the line conductors terminating in the windings of the stepping relay SR located at the exchange and at their other ends in the binding posts of the bell box. The conductor 6 extends from the bell box to the impulse springs 7 of the dial sender and then includes the transmitter or microphone 8, to the normally open contacts of the switch hook. When these contacts are closed by the removal of the receiver from the switch hook, the circuit is extended through switch hook contact 10, primary winding 11 of the induction coil, to the line conductor 5. The receiver is included in a circuit in series with the secondary winding 12 of the induction coil and the condenser 13 in shunt of the transmitter 8. The usual ringer is connected in a bridge extending between the two circuits just described. By reference to the dial sender above referred to it will be seen when the dial is moved off normal in the direction of the arrow, that the bushing 15 disengages the spring 16, causing it to disengage its contact 17 and close contact 18 and open contact 20 of the make-before-break combination.

The operation of this circuit is as follows:—The subscriber on initiating a call removes the receiver 9 from its switch hook and then moves the dial sender in the direction indicated by the arrow. As soon as the bushing disengages the spring 16, contact 17 is opened thus interrupting the receiver circuit. At the same time spring

16 engages the make contact 18 and opens the break contact 20 of the make-before-break combination. The opening of the break contact 20 opens the ringer and thus prevents the "tapping" of the bell during impulsing, while the make contact places a short circuit about the transmitter or microphone, so that the impulsing circuit now extends from grounded battery, line conductor 5, primary winding 11 of the induction coil, contacts 10 and 19 of the switch hook, spring 16, contact 18, impulse springs 7, line conductors 6, left hand winding of the stepping relay SR to ground. As is well known to those familiar with the operation of automatic systems, this impulsing circuit is intermittently completed during the retrograde movement of the dial sender, and when this dial sender reaches its normal position at the close of the series of impulses, the bushing 15 will cause the spring 16 to engage contact 17 and to disengage the contact 18 of the make-before-brake combination and to close the contact 20 of this combination of springs. It will thus be seen that in this arrangement the receiver and ringer circuits are opened and the transmitter or microphone shunted during the transmission of impulses with the use of only four cords between the bell box and desk-stand.

In Fig. 2 the numerals 25 and 26 designate the line conductors terminating at the exchange in the windings of the stepping relay SR. Normally a circuit is closed in bridge of these conductors including a condenser 27 and the usual ringer 28, while the receiver 38 and transmitter 37 are included in other bridges of said conductors.

The dial sender spring assembly of this modified circuit arrangement also has a spring 29 which is normally held against contact 30 by bushing 31. This spring assembly also includes a make-before-break combination of springs as in the previous arrangement which are indicated by the contacts 32 and 33. The dial sender is also provided with the well known impulse springs 34. The switch hook is provided with two sets of springs insulated from each other and designated 35 and 36. The well known transmitter or microphone is shown at 37, and the receiver appears at 38, while the windings of the induction coil are shown at 39 and 40.

In the operation of this modified sub-station circuit, when the subscriber removes his receiver 38 from the switch hook, the sets of springs 35 and 36 are closed in the well known manner. The subscriber then operates his dial sender in the direction indicated by the arrow causing the spring 29 to disengage contact 30 at the same time closing contact 32 and opening the contact 33. As the dial returns to normal, the impulse springs 34 engage and disengage each other making and breaking the impulse circuit which extends from grounded battery, right hand winding of the stepping relay SR, conductor 25, primary winding 39 of the induction coil, switch hook contacts 35, impulse springs 34, spring 29 and contact 32, conductors 42 and 26, and left hand winding of stepping relay SR to ground. As soon as the dial sender is restored to normal the bushing 31 engages spring 29 to close the contact 30 in the receiver circuit and also closes the contact 33 in the transmitter circuit, but opens the contact 32 of the make-before-break combination. With the dial sender in this position and with the receiver removed from the switch hook the sub-station circuits are in condition for conversation. In the circuit of Fig. 2 it will be noted that the ringer circuit is not open as in the case of the circuit of Fig. 1, so that it will be necessary to bias the ringer 28 in order to prevent "tapping" of the bells during dialing.

In this last mentioned arrangement but three cords are necessary between the bell box and the desk stand. These three conductors are shown leading from the primary winding 39 and from the secondary winding 40 of the induction coil, while the third conductor is represented at 42. It will thus be seen that efficient sub-station circuits in which the dial noises and the impedance and resistance of the transmitter or microphone have been eliminated from the signaling circuit are provided, and this is accomplished with the use of a relatively simple spring assembly in the dial sender with a minimum number of conductors between the bell box and the desk stand.

In Fig. 3 there is shown a still different arrangement of sub-station circuit in which the receiver is shunted and the transmitter circuit opened during the transmission of impulses. In this arrangement the dial impulse sender is provided with a make-before-break spring assembly as in the case of the other sub-station circuit of the present disclosure. The conductors 40 and 41 terminate at one end in a stepping relay (not shown) located at the exchange. The other ends of these conductors are connected to the binding posts of the bell box. The ringer 42 which must be biased, is serially included with the condenser 43 in a bridge of these two conductors. A second bridge of these conductors which is normally open at the switchhook, includes the primary winding 44 of the induction coil, conductor 45, contact 46, transmitter 47, spring 48 insulated from but controlled by the switch hook and its contact, to conductor 41. The circuit of

the receiver 50 includes the secondary winding 51 of the induction coil and the contacts 49 controlled by the switch hook.

On initiating a call the subscriber removes his receiver from its switch hook thereupon closing contact springs 48 and 49. The subscriber then operates his dial in the direction of the arrow which closes contacts 52 and 53 and opens contact 46. In the retrograde movement of the dial the impulse springs 54 will be intermittently interrupted to cause interruptions in the signaling circuit extending from the exchange over conductor 41, switch hook spring 48 and its contact, impulse springs 54, contact 52, now closed, conductor 45, primary winding 44 of the induction coil, and conductor 40 to the exchange. It will be noted at this time that the circuit including the transmitter 47 is opened at contact 46, and that a shunt circuit is closed at contact 53 about the receiver 50. This shunting of the receiver prevents the dial noises reaching the receiver, and the opening of the transmitter circuit prevents the impedance of the transmitter from disturbing the character of the impulses transmitted.

What I claim is:—

1. In a substation circuit for automatic telephone systems, the combination of a line circuit, a transmitter included therein, a condenser bridged to said line circuit, a receiver, an induction coil, means for placing said receiver and a winding of said induction coil in inductive relation to said line circuit, an impulse sender, means controlled thereby for sending impulses over said line circuit, and means controlled by said impulse sender when in an off normal position for reducing the effect of the impedance of said transmitter in said signaling circuit, for opening the circuit controlling said receiver, whereby a change of potential in the receiver is prevented during the sending out of impulses and for opening the condenser bridge.

2. In a substation circuit for automatic telephone systems, the combination of a line circuit comprising two sides, a receiver, a transmitter, an induction coil, means for placing the primary winding of said induction coil in series with the transmitter and the line branches and the receiver in inductive relation to said primary winding, a condenser bridged to said line sides, an impulse sender for sending impulses over said line sides in series, and means for reducing the impedance effect of said transmitter in said line sides during the transmission of impulses, for opening the circuit controlling the said receiver and for opening said condenser bridge.

3. In a substation circuit for automatic telephone systems, the combination of a line circuit comprising two sides, a condenser bridged to said line sides, an induction coil, a transmitter connected in series with the primary winding of said induction coil, a receiver connected in series with the secondary winding of said induction coil, means for connecting the primary winding of said induction coil in series with said line sides, an impulse sender having means for sending impulses over said line sides in series, and further means for reducing the impedance effect of said transmitter in said line sides, for opening the circuit leading to said receiver and for opening said condenser bridge when said impulse sender is moved from its normal position.

4. In a telephone system, a line, a substation for said line, a bridge across said line, a microphone in said bridge, an impulse sender for said substation connected in series with both sides of said line, an induction coil, a shunt around said microphone including one winding of the induction coil and a condenser, and means for reducing the impedance effect of said transmitter in said line and for opening the circuit including said one of the windings of said induction coil when said impulse sender is moved from its normal position.

5. In a telephone system, a line having two conductors, an impulse sender for said line for sending impulses over said conductors in series, a bridge across said line, a switch hook in said bridge controlling the impulse sending circuit, impedance in said bridge, means for controlling said impedance, said means being under the control of said impulse sender, a second bridge connected across said line, a third bridge between said other two bridges, said bridges being the only ones across the line, a receiver in said last bridge, a signal in said second bridge, and means also controlled by said impulse sender for opening the circuit leading to said receiver whereby dial noises are eliminated therefrom and for opening said second bridge.

6. In a substation telephone set, a line circuit, a bridge of said line including a transmitter, a second bridge of said line including a receiver, a third bridge of said line including a condenser, said first and second bridges being normally open, means controlled by the switch hook for closing said normally open bridges, an impulse sender comprising a pair of impulse springs in series with one line circuit, and means controlled by said impulse sender for reducing the impedance effect of the transmitter, and for opening the second and third bridges.

7. In a substation circuit for automatic telephone systems having in combination an impulse sending device, an induction coil, a signaling circuit including the primary

winding of said induction coil, a receiver in series with the secondary winding of said induction coil, a circuit for electrically connecting said receiver to said signaling circuit whereby impulses in said signaling circuit are normally reproduced in said receiver, a switch hook, and means controlled thereby for completing said signaling circuit, said impulse sender having means for generating impulses in said signaling circuit and also having a make-before-break spring assembly connected in said circuits for eliminating dial noises from the receiver and for reducing the impedance effect of the transmitter in said signaling circuit.

In witness whereof, I hereunto subscribe my name this 5th day of March, A. D. 1920.

WINFRED T. POWELL.