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TRUNK CIRCUITS.

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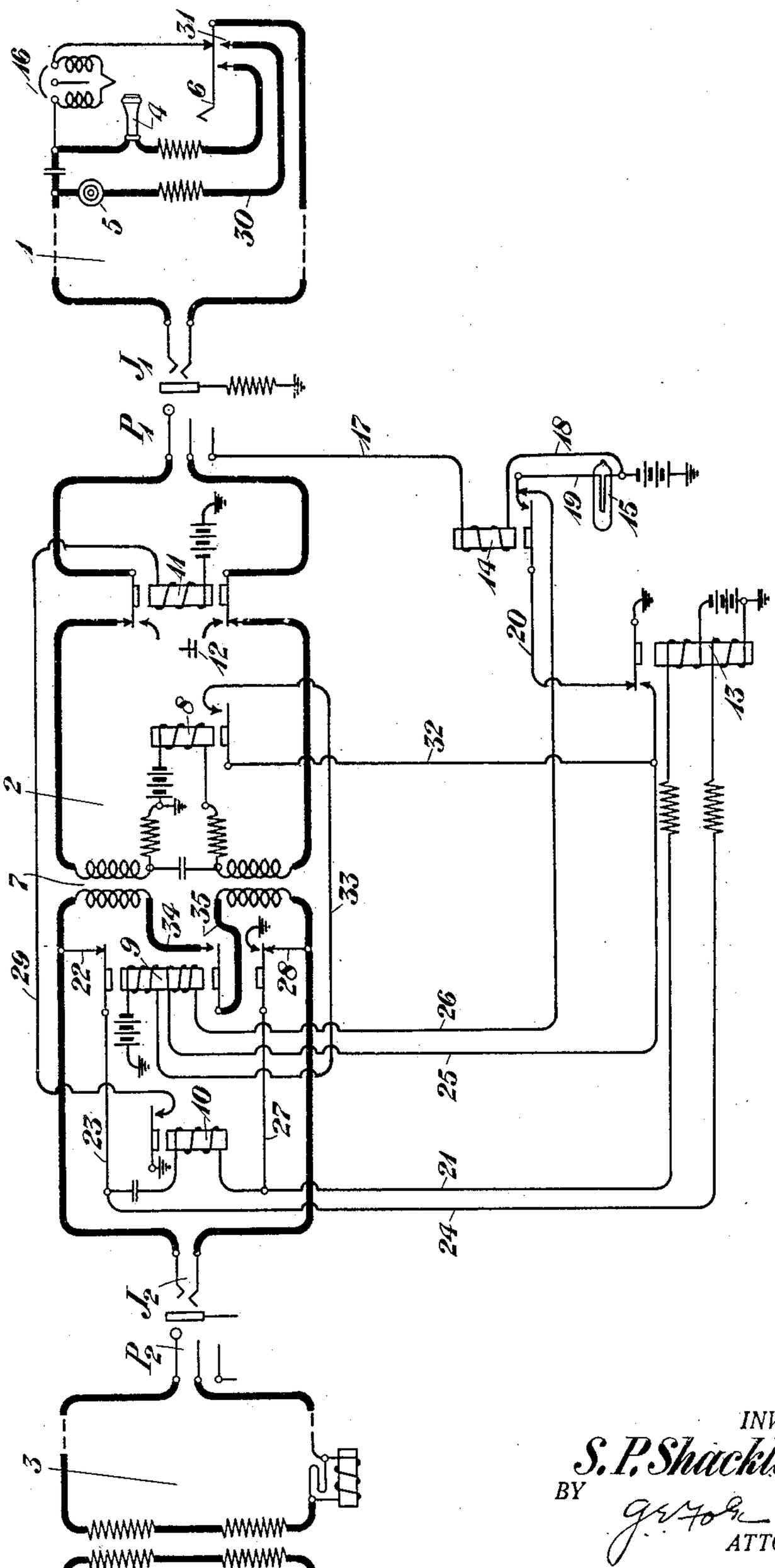
1,370,562. Patented Mar. 8, 1921.



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TRUNK-CIRCUITS.

1,370,562. Specification of Letters Patent. Patented Mar. 8, 1921.

Application filed June 4, 1919. Serial No. 301,629.

To all whom it may concern:

Be it known that I, SAMUEL P. SHACKLETON, residing at New York, in the county of Bronx, and State of New York, have invented certain Improvements in Trunk-Circuits, of which the following is a specification.

This invention relates to telephone circuits and more particularly to means for eliminating disturbances on such circuits from current impulses, commonly known as subscriber's switchhook impulses.

In a telephone system, and particularly where a call is built up over a number of circuits such as a long distance line, a toll cord, and a toll switching trunk, the removal of the receiver from the switchhook at the subscriber's station is apt to cause a sudden impulse or rush of current to be transmitted over the circuits in such a system. These current impulses are commonly termed switchhook impulses and may be of sufficient magnitude to cause a disagreeable noise in the supervisory apparatus associated with the system or have a tendency to cause the operation of relays which control the ringing and signaling equipment of the system, thereby giving rise to false ringing or signaling or other disturbances. Accordingly, it is the general purpose of this invention to provide arrangements which will prevent these switchhook impulses from interfering with the normal and desired operation of the telephone system. Other and further purposes and features will be clear from the detailed description of the invention.

The purposes of this invention are accomplished by providing in the trunk circuit, whereby the connection is established with the subscriber's substation, a normally open circuit including one of the windings of the transformer usually included in such trunk circuit. Accordingly the initial current impulse caused by the removal of the receiver from the switchhook will not be transmitted through the transformer and will have no effect on the other circuits in the system. Relay means are associated with the other winding of the transformer, which operate when the receiver is removed from the switchhook, and control other relay means whereby the aforementioned normally open circuit will be closed and transmission may take place over the system. In the time interval required for the operation of these relay means, the initial surge of energy, or switchhook impulse, will have been dissipated and by the time the transformer is closed the current will have fallen to normal value and accordingly will cause no disturbance over the system.

The invention may be more fully understood from the following description when taken in connection with the accompanying drawing, in which is illustrated a circuit diagram of a preferred form of the invention. In the drawing a portion of the circuit arrangements employed at one end of a long distance telephone connection are illustrated, terminating in the substation 1. A connection may be established with the substation 1 by means of the toll switching trunk 2, and the toll switching trunk 2 may in turn be connected with a toll cord 3, only a portion of which is illustrated. The toll switching trunk 2 terminates in the plug P_1 adapted to coact with jack J_1, and in the jack J_2 with which the plug P_2 of the toll cord 3 is adapted to coöperate. At the substation 1 are illustrated a receiver 4, a transmitter 5, a switchhook 6 and the usual signaling apparatus 16. Included in toll switching trunk 2 is the transformer 7, the left hand winding of which is included in a circuit which is normally open. Included in a bridge across the tip and ring conductors of trunk 2, which are associated with jack J_2, is the relay 10 which responds to ringing current transmitted from toll cord 3. The ringing relay 10 controls the relay 11 which, when operated, connects a source 12 of ringing current to the tip and ring conductors of trunk 2 which are associated with plug P_1. This ringing current may be of a frequency suitable for operating the signaling apparatus at the subscriber's substation 1, which frequency has in practice been in the neighborhood of approximately 20 cycles. Associated with the right hand windings of transformer 7 is the relay 8 which is operated when the subscriber at substation 1 responds to the ringing signal by removing the receiver from the switchhook. The relay 8 controls the operation of the relay 9, upon the operation of which the normally open circuit which includes the left hand windings of transformer 7 will be closed and transmission may take place over the system. The relays 13 and 14 control the su-

pervisory signal 15 as will be pointed out later.

The operation of the invention is as follows: Whenever the trunk circuit 2 is connected to substation 1 by inserting the plug P_1 in the jack J_1, supervisory lamp 15 will be operated. Whenever the toll cord 3 is connected with trunk 2 by inserting the plug P_2 in jack J_2, the supervisory lamp 15 will be operated. However, if the toll cord 3 is connected to the trunk 2 at the same time that the trunk 2 is connected to substation 1, the supervisory signal 15 will be extinguished. The circuit arrangements involved in connection with the above are as follows: When the plug P_1 is inserted in the jack J_1, the following circuit will be closed: from ground, sleeve contacts of jack J_1 and plug P_1, conductor 17, winding of relay 14, conductor 18, to battery and ground. This will energize relay 14 and close the following circuit provided plug P_2 is not associated with jack J_2: from ground and battery, filament of signal lamp 15, conductor 19, make contact and armature of relay 14, conductor 20, normal contact and armature of relay 13, to ground. The closing of this circuit will operate signal lamp 15. On the other hand, if the plug P_1 were not associated with the jack J_1, but the plug P_2 was inserted in the jack J_2, the following circuit would be closed: from ground through the lower winding of relay 13, conductors 24 and 23, contact and armature of relay 9, conductor 22, tip conductors of jack J_2 and plug P_2, supervisory relay in toll cord 3, ring conductors of jack J_2 and plug P_2, conductor 28, normal contact and armature of relay 9, conductors 27 and 21, upper winding of relay 13, to battery and ground. The closing of this circuit will operate relay 13 and thereby close the following circuit: from ground, armature and make contact of relay 13, conductor 25, lower winding of relay 9, conductor 26, normal contact of relay 14, conductor 19, filament of signal lamp 15, to battery and ground. The closing of this circuit will operate the supervisory signal 15. The relay 9 will be operated on the closing of this circuit but relay 13 will then be held operated by the following circuit: from ground, through make contact and armature of relay 9, conductors 27 and 21, upper winding of relay 13 to battery and ground. It will be seen that when the plug P_2 is inserted in the jack J_2 at the same time that the plug P_1 is inserted in the jack J_1, the above traced circuits for the supervisory signal 15 and relay 9 will be held open by the operation of both relays 13 and 14 and neither the supervisory signal 15 or relay 9 will be operated. When the toll cord 3 has been connected with the trunk 2 and the trunk 2 has been connected with substation 1, ringing current transmitted from the toll cord 3 will be transmitted over the following circuit: from the tip conductor of cord 3, tip contacts of plug P_2 and jack J_2, tip conductor of trunk 2, conductor 22, normal contact and armature of relay 9, conductor 23, winding of relay 10, conductor 27, armature and normal contact of relay 9, conductor 28, ring conductor of trunk 2, ring contacts of jack J_2 and plug P_2 to the ring conductor of cord 3. This ringing current will operate relay 10 and thereby close the following circuit: from ground, armature and contact of relay 10, conductor 29, winding of relay 11, to battery and ground. This will operate relay 11 which will pull up its armatures and connect the tip and ring conductors of trunk 2 to the source 12 of ringing current suitable for operating the signaling apparatus at the subscriber's substation. When the subscriber at substation 1, in response to the ringing signal transmitted from source 12, removes the receiver 4 from the switchhook 6, the following circuit will be closed: from ground, upper right hand winding of transformer 7, tip conductor of trunk 2, tip contacts of plug P_1 and jack J_1, over the tip conductor of the subscriber's line, through transmitter 5, over conductor 30, switchhook contact 31, ring conductor of the subscriber's line, ring contacts of jack J_1 and plug P_1, ring conductor of trunk 2, lower right hand winding of transformer 7, winding of relay 8, to battery and ground. This last mentioned battery serves to furnish the source of current supply for the talking circuit. Furthermore the closing of this circuit will operate the relay 8. It is pointed out that when the receiver is removed from the switchhook and the last mentioned circuit is completed, that the initial impulse of current, known as the switchhook impulse, which is transmitted over this circuit, may be of a greater magnitude than the current employed in the normal operation of the system. If this initial impulse of current were transmitted through the transformer 7 and out over the other circuits associated with the system, it might cause disagreeable disturbances in supervisory apparatus associated with the system, or might cause the operation of relay means in the system whereby signaling apparatus might be caused to operate falsely. However, when this initial impulse of current is transmitted through the right hand windings of transformer 7, the circuit including the left hand windings of transformer 7 is open and none of this initial current impulse will be transmitted through the transformer 7 and out over the other circuits of the system. As the relay 13 was operated when the plug P_2 was inserted in the jack J_2, the operation of relay 8 will close the following circuit: from ground,

armature and make contact of relay 13, conductor 32, armature and contact of relay 8, conductor 33, upper winding of relay 9, to battery and ground. The closing of this circuit will operate relay 9 which previously was operated only when trunk 2 was connected to cord 3 but not to substation 1, and relay 9 will pull up its armature and connect the upper left hand winding of transformer 7 over conductor 34, contact and armature of relay 9 and over conductor 35, to the lower left hand winding of transformer 7. Accordingly the transformer 7 will now operate and transmission may take place over the trunk circuit 2. In the time interval required for the operation of relays 8 and 9, the initial current impulse caused by the removal of the receiver from the switchhook will have been dissipated and the current reduced to normal value for satisfactory operation of the system.

As has been formerly pointed out when the plug P_2 was inserted in jack J_2 a circuit was closed from the ground and battery associated with relay 13, over conductors 21 and 24, over conductors 27 and 23, over conductors 28 and 22, and out over the ring and tip conductors of jack J_2 and plug P_2 and through supervisory signaling apparatus in the toll cord 3. It was also pointed out that when relay 9 operated and opened this circuit that relay 13 was held operated by ground applied to the lower armature and contact of relay 9. When this first mentioned circuit is opened by the operation of relay 9 the supervisory signaling apparatus included in the circuit in the toll cord will operate and inform the toll operator that the subscriber at substation 1 has responded. In former arrangements it has been necessary to provide a condenser between the left hand windings of transformer 7 so that the battery and ground applied to this circuit controlling the supervisory apparatus in the toll cord would not affect transformer 7. With the arrangements of this invention the condenser may be omitted and a saving in equipment costs attained. The operation of relay 9 also opens the bridge across the tip and ring conductors of trunk 2 which includes the relay 10 and thus prevents the relaying of a ringing impulse after the subscriber has answered. Accordingly any accidental ring after the subscriber has answered will not be as objectionable as it will have to be transmitted through the transformer 7 which is inefficient at low frequencies and the losses therein will appreciably decrease such ringing current.

While the arrangements of the invention have been specifically illustrated as associated with a toll switching trunk and in a long distance connection, they might equally well be used in other types of trunk circuits such as in local connections. Furthermore, while the invention has been disclosed in certain specific arrangements which have been deemed advisable, it is understood that it is capable of embodiment in many and widely varied forms without departing from the spirit of the invention as defined in the appended claim.

What is claimed is:

A substation, a trunk circuit associated therewith, a transformer in said trunk circuit, a toll cord associated with said trunk, a talking circuit in said trunk and substation, one of the windings of said transformer being included in said talking circuit, the other winding of said transformer being included in a normally open circuit, a relay in said talking circuit, a bridge across the talking conductors of said trunk including signaling apparatus, a relay controlled by said first mentioned relay, means controlled by said second mentioned relay for closing said normally open circuit and for opening said bridge, and supervisory signaling means in said toll cord controlled by said second mentioned relay.

In testimony whereof, I have signed my my name to this specification this 3rd day of June 1919.

SAMUEL P. SHACKLETON.