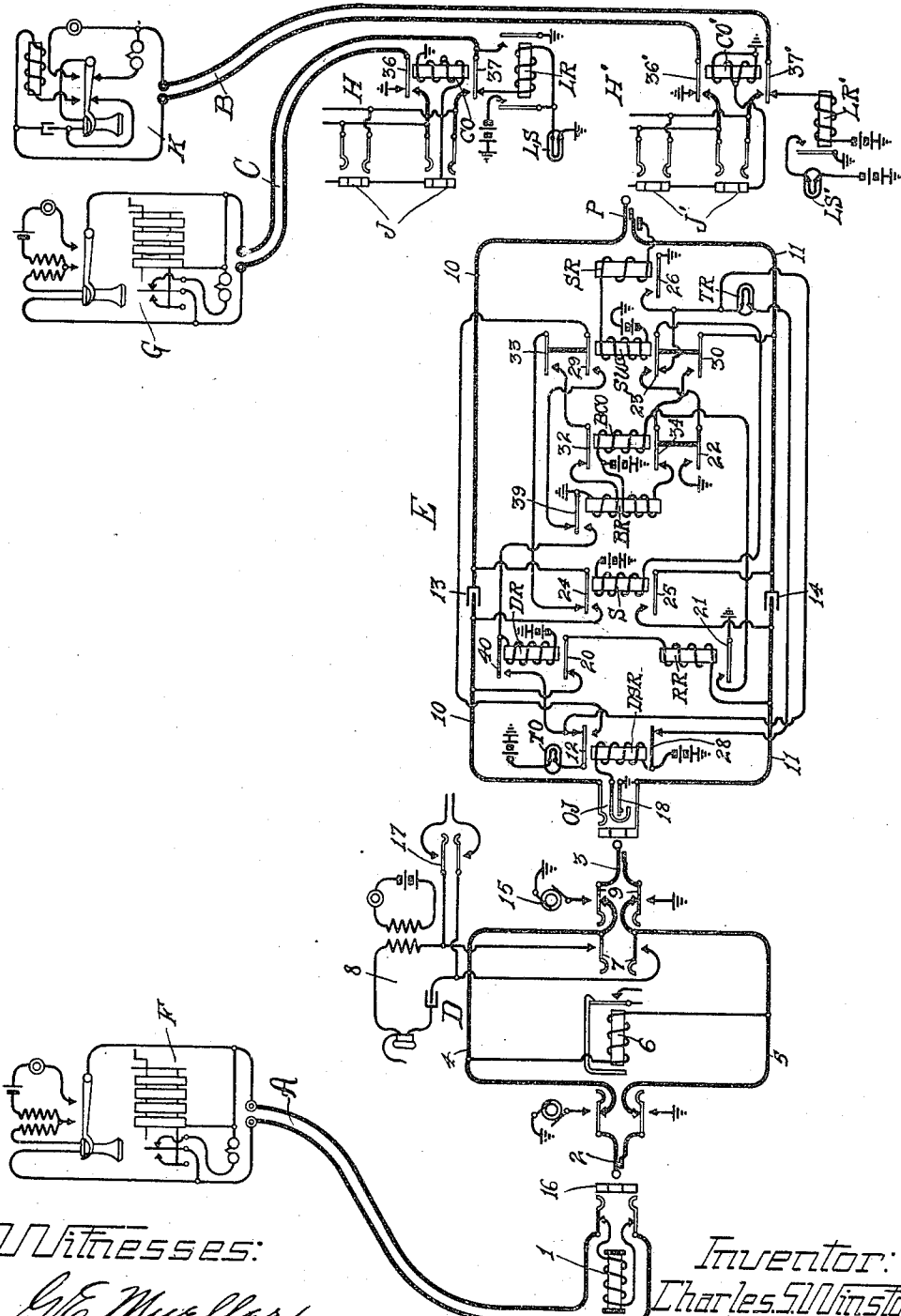


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TOLL TRUNK CIRCUIT.
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TOLL-TRUNK CIRCUIT.

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To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, a citizen of the United States of America, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Toll-Trunk Circuits, of which the following is a specification.

My invention relates to universal toll trunks, that is toll trunks used for extending connection from an operator's cord circuit, such as a toll operator's cord circuit, to telephone lines of various characters, local battery or magneto, and common battery lines.

An object of my invention is to provide a universal toll trunk of this character having simple and positive circuit arrangements, the new features thereof being more particularly referred to in the ensuing specification and claims.

In the accompanying drawing I have illustrated a telephone exchange system including the trunk circuit of my invention, the system illustrated being the preferred arrangement.

The system shown is adapted for interconnecting telephone lines such as magneto lines A, which terminate in jacks 16 at an operator's position, and lines terminating at a different operator's position such as lines B and C. It is to be understood that there are a number of lines as A terminating at an operator's position equipped with cord circuits D for interconnecting these lines while the distant operator's position is equipped with suitable cord circuits for interconnecting jacks as J and J¹ which are the terminals of lines B and C. When connection is desired between the lines of these different positions, the universal toll trunk E is used.

Referring now more in detail to the apparatus and circuit arrangements employed, the line A connects the magneto substation F with the jack 16, a line drop 1 being connected to said line and adapted to be operated when a call is initiated from the telephone F.

The cord circuit D which is used for interconnecting the lines A, is of a simple bridged drop clearing out type having an answering plug 2, and calling plug 3 connected by conductors 4, 5, having a clearing out drop 6 connected in bridge thereof. A

listening key 7 is provided for connecting the operator's set 8 to the cord, and a ringing key 9 is provided for connecting the ringing generator 15 in circuit. For convenience we shall refer to the operator that controls cord circuit D as the toll or originating operator.

Now as to the lines terminating at the distant operator's position, these lines are of different characters and are known as local or magneto lines, and common battery lines C and B respectively. The line C connects a magneto substation telephone G to a line circuit H at the central office which line circuit comprises a cut-off relay CO, line relay LR, line signal LS and multiply connected line jacks J.

Line B which is the common battery type, connects a well-known form of common battery substation telephone K to the line circuit H¹ at the central office, which line circuit comprises apparatus similar to that of line circuit H except that it is differently connected. The cut-off relays CO and CO¹ are of the convertible type and preferably have two windings, these windings being connected in series in relay CO so as to provide a high resistance path while these windings are connected in multiple in CO¹ so as to provide a low resistance path.

Now as to the universal toll trunk E, it comprises an out-going terminal preferably in the form of an out jack OJ, connected by strands 10, 11, to an incoming terminal preferably in the form of a plug P which is positioned before a toll trunk operator having access to the lines C and B. A disconnect signal relay DSR is connected to the out terminal OJ and is adapted to be energized when connection is made to this terminal, and subsequently deenergized upon disconnection, to effect the lighting of the trunk disconnect signal TR which is positioned before the toll trunk operator and associated with its plug P.

It might be well to mention at this time that all of the ringing of the called line is controlled by the toll or originating operator, that is the toll operator of cord D, preferably using the ringing generator 15 connected to the ringing key 9 of the toll operator's cord circuit.

As already referred to the universal cord circuit E is adapted to connect with either the common battery line B or a local or

magneto line as C and I have provided a pair of relays SW and SR connected to the third contact of plug P. The switching relay SW is preferably of a higher resistance than the sleeve relay SR, and when connection is made to a magneto line in which the circuit to the cut-off relay is of a high resistance, relay SR energizes but relay SW remains inert. But when connection is made to a common battery line as B in which a low resistance path is provided through the cut-off relay CO, both relays SR and SW operate. Although relay SW is of a higher resistance than relay SR, it does not energize in series with the cut-off relay CO due to its adjustment and the amount of work it has to perform. The relay SW has several sets of contacts to operate while the relay SR has only one set of contacts to operate. Therefore the relay SW is wound to a higher resistance than the relay SR so that the best operation of these relays may be secured under the different operating conditions. Thus when connection is made with a common battery line the switching relay SW operates to connect the bridging relay BR in circuit with the called line which relay serves to feed talking battery to the called line and also acts as a ringing disconnect and supervisory relay. Due to the fact that relay BR is connected in bridge of cord circuit E when a common battery line is connected with, means are provided for cutting this relay out of circuit while the ringing current is being applied, and to this end the ringing relay RR is adapted to operate the bridge cut-off relay BCO while the ringing current is on. Also due to the fact that circuit E is universal, inductive devices are provided in the form of condensers 13, 14 which condensers need remain in effective circuit only when connection is made between the magneto line as A and common battery line as B. Therefore these condensers are short circuited by the shunting relay S when connection exists between two magneto lines as A and C. I also provide means whereby the shunting relay S may be energized to shunt the condensers 13, 14, when ringing current is being applied while connection is made to a common battery line as B, and to this end the relay S is adapted to be energized to shunt condensers 13, 14, whenever the ringing relay RR is energized. I also preferably arrange toll trunk E so that ringing relay RR is cut out of circuit during a conversational connection to a common battery line so as to remove this bridge connection. Therefore a disconnect relay DR is provided which energizes when the called subscriber at a common battery substation as K responds.

Operation: Assuming now that the subscriber at substation F desires a connection with a magneto or local battery substation

G, he operates the hand generator in the usual manner thereby throwing the drop 1. The toll operator thereupon inserts a plug 2 into the jack 16 and connects her telephone 8 in circuit by means of the listening key 7 and finding that a connection is desired with a line terminating at a distant switchboard, communicates by means of an orderwire key 17 with a toll trunk operator having access to the wanted line, giving the toll trunk operator the number of the line wanted. The trunk operator then notifies the toll operator of the trunk circuit to use at the same time inserting the plug P of this trunk into the jack J of the called line without any test. The act of inserting the plug P into jack J connects relays SW, SR and CO in series whereupon relays SR and CO operate their contacts but the switching relay SW in this instance does not operate for reasons hereinbefore set forth. The closing of contacts 26 of SR closes a circuit for the lamp TO, lighting said lamp as the usual guard signal. Therefore, upon insertion of the plug 3 into the out jack OJ by the toll operator, the contacts 18 of the jack are closed, energizing the disconnect signal relay DSR, and by the interruption of normal contact 12, causes effacement of lamp TO. The toll or originating operator after inserting the plug 3, listens to ascertain the condition of the called line, and finding it idle, operates the ringing key 9 in the usual manner to connect the ringing generator 15 in circuit with the conductors 10, 11, of the trunk circuit and thus in connection with the called line C. This connection of ringing current operates the ringing relay RR each time the key 9 is actuated this operating circuit being traced from generator 15, tip of plug 3 and jack OJ, conductor 10, normal contact 20, the winding of RR, conductor 11 and the sleeve contacts of jack OJ and plug 3 to the grounded ringing key contact. This operation of RR when connection exists with a magneto line is only incidental and without effect as it will be remembered that relay SW is not energized and therefore relay BR is not in circuit. Also shunting relay S was energized when the plug P was inserted this having been brought about as follows: Upon said energization of relay SR, its alternate contact 26 closed establishing an operating circuit for the shunting relay S traced from said grounded contact 26, normal contact 23, and the winding of S to battery. Relay S therefore closed its alternate contacts 24, 25 to short circuit the condensers 13, 14 and thus establish a more effective ringing and talking circuit, as it will be remembered that two local substations are connected. Therefore when the toll operator throws the ringing key 9 to connect the ringing generator 15, the circuit for the ringing current through substation

G traverses a path including the heavily marked conductors of the trunk circuit E and line circuit C, this ringing circuit being effective to operate the call bell at substation G which call bell is connected in bridge of the line conductors. The subscriber at G removes his receiver in response to this signal and the two substations F and G are connected for conversation. After the subscribers have finished their conversation they replace their receivers upon their respective switch-hooks and operate their hand generators in the usual manner whereby the clearing out drop 6 of the cord circuit D operates in the usual manner. The toll operator observing the clearing out signal of the cord circuit D, withdraws plugs 2 and 3 from their respective jacks, the withdrawal of plug 3 causing the interruption of the circuit of disconnect signal relay DSR whereupon this relay restores establishing a circuit for the trunk operator's disconnect signal TR. This circuit may be traced from battery through normal contact 28 of relay DSR, lamp TR, to ground at alternate contact 26. Lamp TR therefore lights indicating to the trunk operator that disconnection is desired and she withdraws plug P from jack J whereupon the circuit through relays SW and SR is interrupted causing the restoration of relay SR. Its alternate contact 26 is therefore interrupted interrupting the circuit for the relay S and the trunk lamp TR whereupon they are restored to normal. Trunk T is therefore available for use in establishing other connections.

Assuming now the subscriber at F desires connection with a common battery line as B, the assignment of a trunk E is the same as before but when the toll trunk operator inserts plug P into the jack J¹ of the common battery line, the cut-off relay CO¹ being of low resistance, sufficient current flows through relays SR and SW to cause the operation of both of them. The operation of SR lights lamp TO as before. Upon operation of SW, its alternate contacts 29, 30, are closed connecting the bridging relay BR in bridge of the conductors 10, 11, of the trunk circuit. This circuit for relay BR may be traced from ground through the upper winding thereof, normal contact 32, alternate contact 33, and normal contact 24 to conductor 10 while the circuit through the other winding may be traced from battery through said other winding, normal contact 34 and alternate contact 30 to conductor 11. This relay is of course in bridge of the line conductors of the called line B but due to the interposition of the condenser in circuit at the substation, the relay BR does not operate until the receiver thereat is removed. Although relay SR operates as before and its alternate contact 26 is closed, due to the fact

that normal contact 23 of the switching relay SW is also interrupted, the closure of alternate contact 26 at this time does not operate the shunting relay S. The cut-off relay CO¹ having operated its alternate contacts 36¹, 37¹ are of course closed in the usual manner.

Now as to the ringing operation, after the toll operator has inserted the plug 3 into the jack OJ, and relay DSR is operated to efface lamp TO, the ringing key 9 is operated and thereby connects the generator 15 and ground to the conductors 10, 11. A circuit is thus established through the ringing relay RR as before causing its operation and the closing of its alternate contact 21 which effects the operation of the bridge cut-off relay BCO each time the ringing key is operated. The operation of relay BCO disconnects the bridging relay BR during the ringing period and also upon the closing of alternate contact 22 each time the relay BCO is operated, a circuit for relay S is established traced from said grounded contact 22, alternate contact 23, and the winding of S to battery. Relay S therefore closes its alternate contacts 24, 25 to short circuit the condensers 13, 14, and thereby establish a more effective ringing circuit each time the ringing key 9 is operated.

The subscriber at substation K in response to the operation of the call bell thereat removes his receiver whereby a circuit for the bridging relay BR is established, traced from ground through the upper winding thereof, normal contact 32, alternate contact 33, normal contact 24, conductor 10, the tip contacts of plug P and jack J¹, alternate contact 36¹, line conductors and substation K, alternate contact 37¹, sleeve contacts of the jack and plug, conductor 11, alternate contact 30, normal contact 34, and the lower winding of BR to battery. The relay BR therefore closes its alternate contact 39 establishing an operating circuit for the disconnect relay DR which interrupts its normal contact 20 to interrupt the circuit for the ringing relay RR and by the closing of its alternate contact 40 a locking circuit for DR is established to ground at alternate contact 26 so that relay DR cannot deenergize until the plug P is withdrawn. Also, responsive to the operation of relay BR, its normal contact 39 is interrupted thereby interrupting the circuit for the signal TO whereby the toll operator knows that a response has been secured from the called substation.

After the subscribers have finished conversation, the subscriber at K replaces the receiver upon its switch-hook in the usual manner whereby the circuit for the bridging relay BR is interrupted causing its restoration. Relay BR therefore again closes its normal contact 39 establishing a circuit for the toll operator's disconnect lamp TO as be-

fore and the subscriber at F having given a ring-off operation to his hand generator and thereby operated drop 6, the toll operator withdraws plugs 2, 3, from jacks 16, OJ. This withdrawal of plug 3 of course interrupts the circuit for relay DSR whereupon said relay restores closing its normal contact 28 and thereby establishing a circuit for the toll trunk operator's disconnect signal TR which circuit is traced from battery through normal contact 28, lamp TR to ground at alternate contact 26. The trunk operator observing this signal withdraws plug P from its jack whereupon relays SW and SR restore, the restoration of relay SR causing the interruption of its alternate contact 26 and thereby the restoration of signal TR and relay DR while the restoration of switching relay SW disconnects the bridging relay BR from the trunk conductors. The restoration of the cut-off relay CO¹ restores the line circuit and thus the apparatus being at normal is available for use in establishing other connections.

While I have illustrated and described a specific form of my invention, it is to be understood that many changes and modifications thereof may be made and I do not desire to be limited to the exact structure as described but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent, is:

1. A telephone system comprising local battery or magneto and common battery telephone lines, line circuits of different character for said lines, a universal toll trunk for extending connection from a calling line to said lines, as called lines, a bridging battery supply relay, a switching relay adapted when operated to connect said bridging relay in bridge of the trunk circuit, a sleeve relay, means for energizing the switching relay and sleeve relay when connection is made to a common battery line and for energizing the sleeve relay but not the switching relay when connection is made with a local battery line, and a guard signal for said trunk circuit operated responsive to such operations of the sleeve relay.

2. A telephone system comprising local battery or magneto and common battery telephone lines, line circuits of different character for said lines, a universal toll trunk for extending connections from a calling line to said lines as called lines, outgoing jack terminals for said trunk circuit and incoming terminals for said trunk for connecting to said line circuits, a bridging battery supply relay, a switching relay and circuit connections whereby said bridging relay may be connected in bridge of the incoming end of the trunk circuit, and means for energizing the switching relay when con-

nection is made to a common battery line but where said relay is not energized when connection is made with a local battery line.

3. A ring-through universal toll trunk comprising an outgoing terminal and an incoming terminal, conductors uniting said terminals, condensers interposed in said conductors, a ringing relay in bridge of said conductors at the outgoing end thereof, said ringing relay being operated by ringing current when applied to the outgoing terminals of the trunk, and a shunting relay responsive to such operations of the ringing relay for short circuiting said condensers when the ringing current is applied.

4. A ring through universal toll trunk comprising outgoing and incoming terminals, conductors uniting said terminals, condensers interposed in said conductors, a ringing relay in bridge of said conductors at the outgoing end thereof, said ringing relay being operated by ringing current when applied to the outgoing terminals of the trunk, a shunting relay responsive to such operations of the ringing relay for short circuiting said condensers when the ringing current is applied so as to provide a more effective ring-through circuit, a bridging relay adapted to be connected in bridge of said conductors at the incoming end of the trunk circuit, means for connecting the bridging relay in such bridged connection, a disconnect relay having contacts included in the operating circuit of the ringing relay, and means for operating the disconnect relay controlled by said bridging relay.

5. A telephone system comprising lines of different characters, a cord circuit for extending a calling line to a universal toll trunk circuit said toll trunk circuit extending the calling line to the called lines of different characters, sleeve and switching relays in said toll trunk energized upon connection of the toll trunk with a common battery line, a source of battery supply, a bridging relay bridged across the toll trunk conductors when said switching relay is energized to connect said battery source with the trunk when said trunk is connected to a common battery line, and when said trunk is connected to a magneto line said switching and bridging relays remain inert whereby said battery source is not connected to the trunk circuit.

6. A toll trunk circuit comprising outgoing and incoming terminals, sleeve and switching relays at the incoming end of the trunk circuit said sleeve and switching relays energized when said trunk circuit is connected to a common battery line, a bridging relay said bridging relay being bridged across the trunk conductors when said switching relay energizes, a bridging cut-off relay, and means actuated when ringing current is impressed upon the line to ener-

gize the said bridging cut-off relay to open the circuit of said bridging relay to prevent said relay from operating during the ringing operation.

5 7. A telephone system comprising local battery and common battery lines, line circuits of different character for said lines, a universal link circuit for extending connections from a calling line to said lines as
10 called lines, an out-going terminal for said link circuit and an incoming terminal for said link circuit for connecting to said line circuits, inductive paths normally uniting
15 said terminals, means for applying ringing current to said out-going terminal, and automatic means responsive to the application of ringing current for changing said inductive paths to conductive paths.

20 8. A telephone system comprising a plurality of lines, a link circuit for connecting to a calling one of said lines, a trunk circuit for connecting to a called one of said lines, a pair of terminals for said trunk circuit
25 normally united by an inductive path, means for uniting a terminal of said link circuit to one terminal of said trunk circuit for extending a call in the direction of the called line, a ringing current generator associated
30 with the said terminal of the link circuit for applying ringing current to the called line, and means responsive to the application of ringing current to the trunk circuit for automatically substituting a conductive
35 path in place of the said inductive path so that the ringing current is conductively connected to the line circuit of the called line.

40 9. In a telephone system, a called subscriber's line, a link circuit provided with a calling terminal, a trunk circuit provided with a pair of terminals and having an in-

ductive path normally connecting said terminals, a ringing current generator associated with the terminal of said link circuit, means for connecting the terminal of
45 said link circuit to a terminal of said trunk circuit for extending a call in the direction of the called line, means for connecting the said ringing current generator to said trunk
50 circuit for signaling the called subscriber, and automatic means responsive to said connection for substituting a conductive path for said inductive path.

10. A telephone system comprising a link
55 circuit for extending a connection from a calling line to a called line, an out-going terminal and a calling terminal for said link circuit, an inductive path normally uniting the terminals of said link circuit,
60 means for applying ringing current to the said outgoing terminal, and means responsive to the application of ringing current for replacing the said inductive path by a conductive path.
65

11. In a telephone system, a trunk circuit provided with an outgoing terminal and an incoming terminal, a pair of strands normally uniting said terminals, impedance elements normally connected in said strands,
70 means for applying ringing current to the outgoing terminal of said trunk circuit, and automatic means responsive to the application of ringing current for shunting the said
75 impedance elements.

Signed by me at Chicago, county of Cook, and State of Illinois, in the presence of two witnesses.

CHARLES S. WINSTON.

Witnesses:

G. E. MUELLER,
B. O'BRIEN.