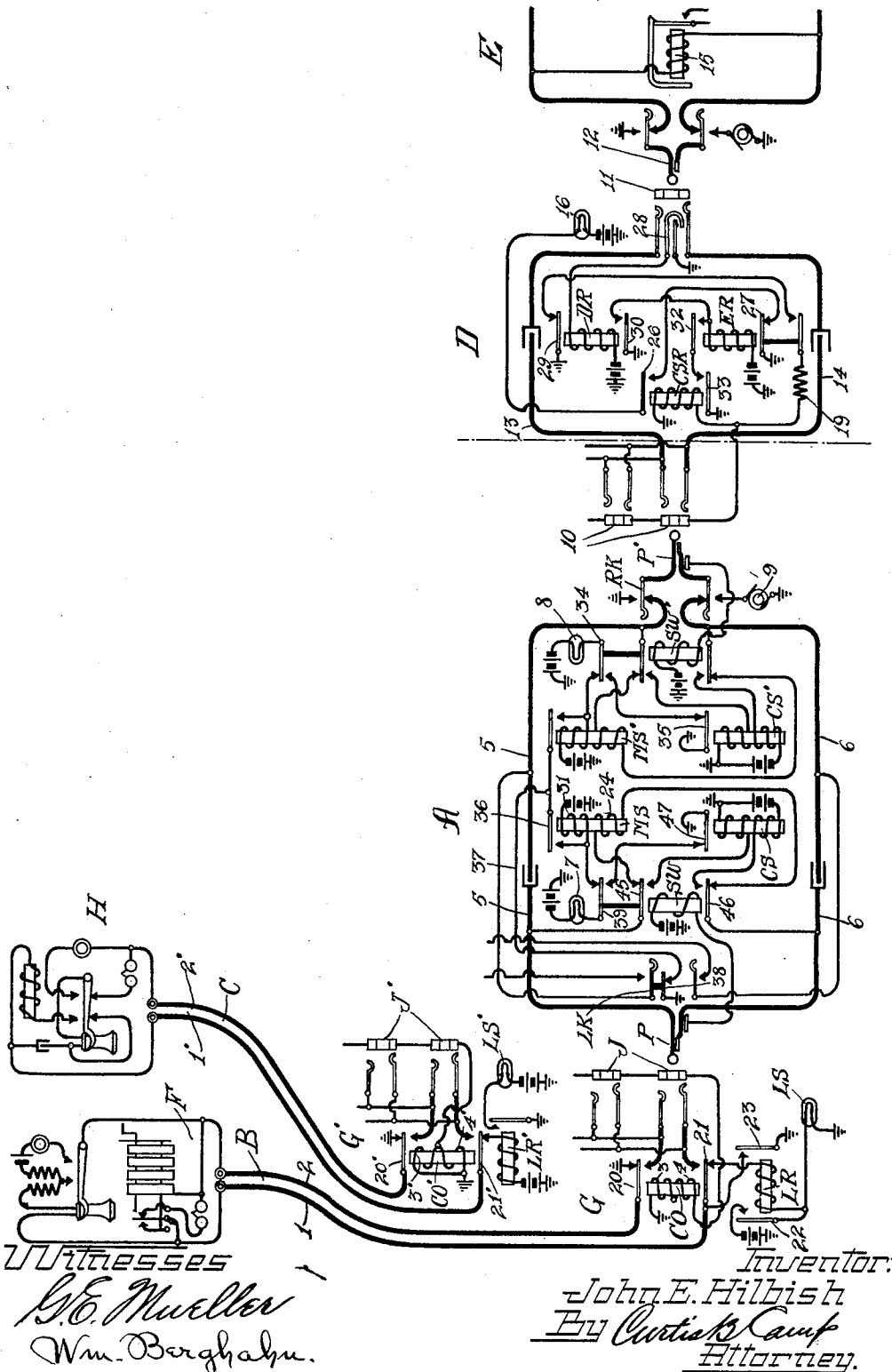


J. E. HILBISH.
RECORDING TOLL TRUNK CIRCUIT.
APPLICATION FILED FEB. 6, 1913.

1,119,016.

Patented Dec. 1, 1914.



UNITED STATES PATENT OFFICE.

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RECORDING TOLL TRUNK-CIRCUIT.

1,119,016.

Specification of Letters Patent.

Patented Dec. 1, 1914.

Application filed February 6, 1913. Serial No. 746,462.

To all whom it may concern:

Be it known that I, JOHN E. HILBISH, a citizen of the United States of America, residing in La Grange, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Recording Toll Trunk-Circuits, of which the following is a specification.

My invention relates to telephone systems and has more particularly to do with signal control means for trunk circuits such as are used in connection with universal cord circuits of a marginal relay type.

An object of my invention is to provide a trunk circuit for interconnecting a marginal relay cord circuit and a cord circuit of the same or different type at a distant operator's position, such trunk circuit having novel signal-control circuit arrangements for effecting the operation of supervisory signals at the trunk circuit and universal cord circuit.

A better understanding of my invention may be had by reference to the accompanying drawing in which the universal cord circuit A is illustrated and which may be used for interconnecting lines of different characters such as magneto lines B and common battery lines C. Lines B and C preferably terminate at operators' positions at the same switchboard, such operators' positions being equipped with universal cord circuits as A, for interconnecting these lines, but when a connection is desired between either of the lines as B and C and lines terminating at a different switchboard or different operator's position, the trunk circuit D is used for connecting the cord circuit A with a cord circuit as E terminating at such distant or different switchboard.

Referring now more in detail to the system illustrated, the line B has a magneto substation telephone F connected by line conductors 1, 2, to a line circuit G. This line circuit G comprises preferably a line relay LR and cut-off relay CO, a line signal LS and multiple connected jacks J.

The line C which is of a common battery type, has a well-known form of common battery substation telephone H connected by line conductors 1¹, 2¹, with a line circuit G¹ composed of apparatus similar to that of line circuit G and designated by like reference characters except for the addition of the suffix prime. The line circuits G and G¹

are preferably so arranged that they may be used for either magneto or common battery signaling by simply varying the connections of the line circuits and connecting the desired type of substation. The cut-off relays CO and CO¹ are preferably double wound relays, cut-off relay CO having its two windings 3, 4, connected in series so as to provide a high resistance path through this winding while the windings 3¹, 4¹, of CO¹ are connected in multiple so as to provide a comparatively low resistance path for the operation thereof.

Referring now to the universal cord circuit A, it comprises the talking strands 5, 6, connecting the plugs P and P¹, plug P being what is known as the answering plug and plug P¹ the calling plug. A listening key LK is provided and is adapted to connect an operator's testing and conversational telephone (not shown) in circuit with the talking strand of the cord circuit. Such circuits are of course well-known and a circuit as shown in a copending application of Chas. A. Simpson Serial No. 723,589, may be used. A pair of supervisory relays are associated with each end of the cord circuit A, the magneto supervisory relay MS being normally connected in bridge of the talking strands of the cord circuit, and the common battery supervisory relay CS being adapted to be substituted for the relay MS by the operation of a switching relay SW when connection is made with a common battery line as C. Three similar relays MS¹, CS¹, and SW¹ are associated with the calling end of the cord circuit. An answering supervisory lamp 7 is associated with the answering supervisory relays and a calling supervisory lamp 8 associated with the calling supervisory relays. A ringing key RK is provided for connecting the ringing generator 9 in circuit with the calling plug P¹.

The switching relays SW and SW¹ are preferably of comparatively low resistance so that when connection is made with a line having a high resistance cut-off relay as CO, sufficient current does not flow to energize the switching relay but the cut-off relay is energized. Thus when the switching relay is not energized the magnet MS remains in bridge of the circuit. When connection is made with a line having a low resistance path through the cut-off relay CO¹, sufficient current is allowed to flow through the

winding of the switching relay to effect its energization whereby the magneto supervisory relay MS is disconnected and the common battery supervisory relay CS substituted.

Trunk circuit D.—Should a calling subscriber desire a connection with a line terminating at another switchboard, and which is equipped with cord circuits as E, and which for example we will assume is a toll board, the local operator of the cord circuit A selects an idle trunk jack 10 at her position and thus extends a connection to a jack 11 before a recording toll operator, who then makes connection with the jack 11 by means of a cord circuit as E. The recording operator then makes a record of the number of the calling substation and also the number of the wanted line and orders the calling subscriber to give a disconnect signal. At the same time she withdraws the plug 12 of circuit E from jack 11 thus operating a disconnect signal 8 at cord circuit A, whereby the local operator withdraws plugs P and P¹. The toll operator thus has a record of the calling and called lines and by means of other circuits (not shown) she may connect the two lines for conversation. By use of this arrangement the calling subscriber cannot put through a toll call unless the correct number of his line is given.

Now as to the preferred construction of trunk circuit D, it comprises multiple connected out-going jacks 10 connected by strands 13, 14, to an incoming jack 11 located preferably at a recording toll operator's position. A calling signal relay CSR is connected to the jack 10 so that when connection is made to this jack by a calling plug P¹, switching relay SW¹ and relay CSR are connected in series, but relay CSR is of comparatively high resistance so as to allow sufficient current to flow through relay SW¹ to operate its contacts. But relay CSR is energized by this circuit to light the calling signal lamp 16 which is associated with the jack 11. A disconnect relay DR is associated with jack 11 and adapted to be energized when connection is made with said jack by a cord circuit E, this energization bringing about the energization of an effacing relay ER which effaces the signal 16. When the recording operator withdraws plug 12 from a jack 11, the disconnect relay DR deenergizes and places the low resistance winding 19 in multiple with the relay CSR so as to provide a low resistance energizing circuit for switching relay SW¹ and thereby bring about the energization of the disconnect lamp 8.

The cord circuit E may be of any type which may extend the talking conductors 13,

and 14 and I have shown a type adapted for interconnecting the ordinary magneto line. A drop 15 is shown bridged across the strands of cord E. An operator's telephone and listening key are of course provided but not shown.

Operation.—Assuming now that a subscriber at magneto substation F desires a connection with a line terminating at a distant switchboard and which we will assume is a toll line, the subscriber operates the hand generator at the substation in the usual manner to establish a flow of current through the line relay LK, which may be traced from ground at normal contact 20 of relay CO, line conductor 2, generator of substation F, line conductor 1, normal contact 21, winding of LR and line signal LS to ground. Relay LR is energized closing its alternate contacts 22, 23 whereby a locking circuit for LR is established and line signal LS is lighted by a circuit including alternate contact 22. The operator in response to this signal inserts a plug P in a jack J of the calling line whereby a circuit for cut-off relay CO is established including said relay and switching relay SW in series. Due to the comparatively high resistance of the winding of CO, said relay will energize but sufficient current does not flow to energize switching relay SW. Therefore, the magneto supervisory relay MS has its winding 24 maintained in bridge of the answering end of the cord circuit. Upon energization of CO, the circuit for LR is interrupted and therefore relay LR deenergizes interrupting the circuit for the line signal LS. The operator now connects her telephone set by means of the listening key LK, to ascertain the number of the wanted line and finding the wanted line is a toll line terminating at a different switchboard or operator's position, she tests trunk jacks 10 by means of touching the tip of the plug P¹ to the sleeve of the jack in a well-known manner and finding an idle jack inserts the plug therein. A circuit is thus established including the switching relay SW¹ and the trunk or calling signal relay CSR in series. Relay CSR is of sufficiently high resistance to prevent the energization of relay SW¹ but enough current flows through the winding of relay CSR to permit the energization thereof and attraction of its armature. Its contact 26 is therefore closed establishing a circuit for the trunk signal 16 traced from battery through said signal 16, alternate contact 26 and normal contact 27 to ground. The recording operator before whom the jack 11 terminates, in response to the lighting of lamp 16, inserts a plug 12 of a cord circuit E into jack 11 thereby closing the contacts 28 and establishing an operating circuit for disconnect relay DR traced from battery through the winding thereof to

ground at contacts 28. Relay DR therefore interrupts its normal contact 29 and thereafter closes its alternate contact 30 to cause the operation of effacing relay ER. Relay ER therefore interrupts its normal contact 27 whereby trunk signal 16 is effaced. The recording operator now connects her telephone set to ascertain the number of the called line and also the number of the calling line and then notifies the calling subscriber to hang up and give a disconnect signal as he will be called later on. I desire to state that this method of establishing toll connections is of course common practice but it will be apparent that the operator who answers the call at jack 11 may by the use of a cord circuit as E extend the connection to the wanted line. Assuming now that the calling subscriber is to be called back in a manner as stated, when the operator tells him to disconnect, he operates his hand generator, should it be a magneto line, to effect the operation of supervisory signal 7. At this time the recording operator also withdraws the plug 12 from the jack 11 to bring about the operation of the cord supervisory signal 8.

We will take up the operation of signal 8 first. Upon withdrawal of plug 12 from jack 11, contacts 28 are again interrupted whereby the circuit for disconnect relay DR is interrupted causing its deenergization and the closing of its normal contact 29. Although its alternate contact 30 is interrupted at this time, the relay ER does not deenergize as it is maintained operated through its alternate contact 32 and alternate contact 33 to ground. Therefore when normal contact 29 is closed, the low resistance path through resistance 19 is connected in multiple with the relay CSR so that sufficient current is permitted to flow through the switching relay SW¹ to cause its operation. That is, relay SW¹ attracts its armature closing the alternate contact 34 and thereby connecting supervisory signal 8 in circuit with the ground at normal contact 35 to cause the operation of signal 8.

Now as to the operation of signal 7, when the subscriber at the calling substation F operates the hand generator thereat for a disconnect signal, current flows through the bridged winding 24 of relay MS whereby the said relay is energized closing its alternate contact 36 to lock relay MS in its energized position, as the current from the hand generator is for a short period only. This locking circuit is traced from battery through the winding 31, alternate contact 36, conductor 37 to ground at normal contact 38. The closing of this alternate contact 36 also connects ground through normal contact 39 and thereby establishes an operating circuit for lamp signal 7. The operator at the cord circuit A upon observing

the two signals 7, 8, knows that disconnection is desired, and therefore withdraws plugs P and P¹ from their respective jacks. This interrupts the series circuit including relays CO and SW whereby relay CO restores, placing the line B at normal. Relay SW it will be remembered was not energized and therefore said relay remains at normal when plug P is withdrawn. Upon withdrawal of plug P¹, the circuit including relays SW¹ and CSR is interrupted effecting the restoration of these two relays. The restoration of SW¹ of course interrupts the circuit for signal lamp 8 due to the interruption of alternate contact 34. The supervisory signal 7 is still lighted so the operator throws the listening key LK, interrupting the grounded contact 38 to open the locking circuit for supervisory relay MS which restores and lamp 7 is thus extinguished.

Now as to the restoration of the apparatus of trunk circuit D. Upon said restoration of its relay CSR, the locking circuit for relay ER is interrupted at alternate contact 33 whereby said relay ER restores and relay DR having restored when plug 12 was withdrawn, trunk circuit D is at normal and available for use in establishing other connections.

In the operation of the system as just described it was assumed that the call originated at the magneto substation F. Now assuming the call originates at the common battery substation H, the supervisory apparatus at the answering end of cord circuit A operates differently, but the supervisory apparatus of the calling end of the cord circuit always operates the same when connection is made with a trunk circuit D, irrespective of the character of the calling line.

The subscriber at substation H to initiate a call removes his receiver from its switch-hook whereby a circuit is established in a well-known way for line relay LR¹ to effect the lighting of line signal LS¹. The local operator in response to this signal inserts plug P into a jack J¹ of the calling line and due to the low resistance path through the cut-off relay CO¹, both the relays CO¹ and SW are energized to attract their armatures and operate their contacts. The energization of CO¹ of course disconnects the line relay LR¹ and by the closing of alternate contacts 20¹, 21¹, connects the line conductors to the jack. The energization of the switching relay SW disconnects relay MS and by the closing of alternate contacts 45, 46, connects the common battery supervisory relay CS in bridge of the cord strands. The receiver at substation H being off its switch-hook, an energizing circuit for relay CS is established traced from battery to the lower winding of CS, alternate contact 46, the sleeve strand of the cord and

plug, out over the line, returning over the tip strand of the plug and cord, alternate contact 45 and the upper winding of CS to ground. Relay CS therefore interrupts its normal contact 47 so that the supervisory signal 7 does not light. The operator now finding that a toll call is desired extends the connection through a trunk circuit D in a manner as previously described.

To effect disconnection, the subscriber at substation H simply replaces the receiver upon its switch-hook whereby the circuit for supervisory relay CS is interrupted causing the deenergization thereof and the closing of its normal contact 47. This establishes a circuit for signal 7 so that when the other signal 8 is also lighted due to withdrawal of plug 12, the operator withdraws plugs P and P¹ from their respective jacks. The withdrawal of plug P¹ effaces lamp 8 in a manner as previously described and the switching relay SW of the answering end of cord A having been operated, it restores when the plug P is withdrawn, interrupting its alternate contact 39 and thereby causing the effacement of signal 7. The operator observing that the two signals 7 and 8 have been effaced by the withdrawal of the plugs does not operate the key LK. All of the apparatus being at normal once more, it is available for use in establishing other connections.

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

1. A telephone system comprising a connecting circuit, a signal and control relay therefor, a trunk circuit having out-going and in-coming terminals, a call signal relay for the trunk circuit, means for energizing said call relay upon connection made with the out-going terminal by said connecting circuit, a call signal associated with the incoming terminal operated responsive to said call signal relay, a second connecting circuit for connecting to the in-coming terminal of the trunk circuit, disconnect and effacing relays operated responsive to the said connection for effacing said call signal, said disconnect relay deenergizing upon disconnecting the second connecting circuit, and means effective upon such deenergization of the disconnect relay to energize said control relay at the first connecting circuit and operate its said associated signal.

2. A telephone system comprising a connecting circuit, a disconnect signal and control relay therefor, a trunk circuit having out-going and incoming terminals, a call signal relay for the trunk circuit connected to the out-going terminal, means for connecting said relays in a series energizing circuit upon connection made with said outgoing terminals by said connecting circuit, said series circuit being arranged to allow energization of the call relay but not of the

control relay, a signal at the incoming terminal of the trunk circuit operated upon said energization of the call relay, a second connecting circuit for connecting with the incoming terminal of the trunk circuit, disconnect and effacing relays for the trunk circuit operated responsive to the last said connection whereby said call signal is effaced, said disconnect relay being deenergized upon disconnecting the last said connecting circuit from the incoming terminal, and means for varying the circuit relation of the control and signal relays upon deenergization of the disconnect relay whereby said control relay is energized to operate the disconnect signal.

3. A telephone system comprising a universal cord circuit, a switching relay, a disconnect signal for the cord circuit, a trunk circuit having outgoing and incoming terminals, a call signal relay connected to the outgoing terminals, a series energizing circuit for said switching and call relays closed upon connection made between the cord circuit and said outgoing terminal, said series circuit being of such resistance as to allow the operation of the call relay but not that of the switching relay, a signal at the incoming terminal of the trunk circuit operated responsive to said operation of the call relay, a connecting circuit for connecting to the incoming terminal, means for effacing said call signal responsive to the latter connection, means for varying the energizing circuit of the switching relay responsive to a disconnection of the connecting circuit from the incoming terminals so as to operate the switching relay, and means for operating the disconnect signal of the cord circuit responsive to such energization of the switching relay.

4. A recording toll operator's trunk circuit comprising outgoing and incoming terminals conductively united, a call signal relay connected with the outgoing terminal adapted to be energized when connection is made thereto, a call signal associated with the incoming terminal and operated responsive to such energization of the call relay, disconnect and effacing relays, means whereby the said relays are energized when connection is made with the incoming terminals and the call signal is effaced, said disconnect relay being adapted to be deenergized when disconnection from the incoming terminal is subsequently effected, and means for lowering the effective resistance of the circuit extending from the outgoing terminal to a control relay responsive to such deenergization of the disconnect relay.

5. A telephone system comprising a toll trunk having outgoing and incoming terminals, a call signal relay energized when connection is made with the outgoing end of the trunk, a call signal at the incoming terminal

responsive to such energization of the call relay, disconnect and effacing relays adapted to be energized when connection is made with the incoming terminal whereby said signal is effaced, and means whereby when disconnection is made from said incoming terminal said disconnect relay is deenergized to alter the effective resistance of the circuit connections extending from the outgoing terminal.

6. A telephone system comprising a connecting circuit, a switching relay and a disconnect signal therefor, a toll trunk circuit having outgoing and incoming terminals, a call signal relay adapted to be energized when connection is made with the outgoing terminal of the trunk circuit, a call signal lighted upon energization of said call relay,

disconnect and effacing relays energized when connection is made with the incoming terminals of the trunk circuit to efface a call signal and when disconnection is made from the incoming terminals means are effected upon the deenergization of the disconnect relay to lower the resistance of the call relay to place a low resistance in multiple circuit with the call signal relay to allow the effective operation of the switching relay of the said connecting circuit.

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

JOHN E. HILBISH.

Witnesses:

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

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."