

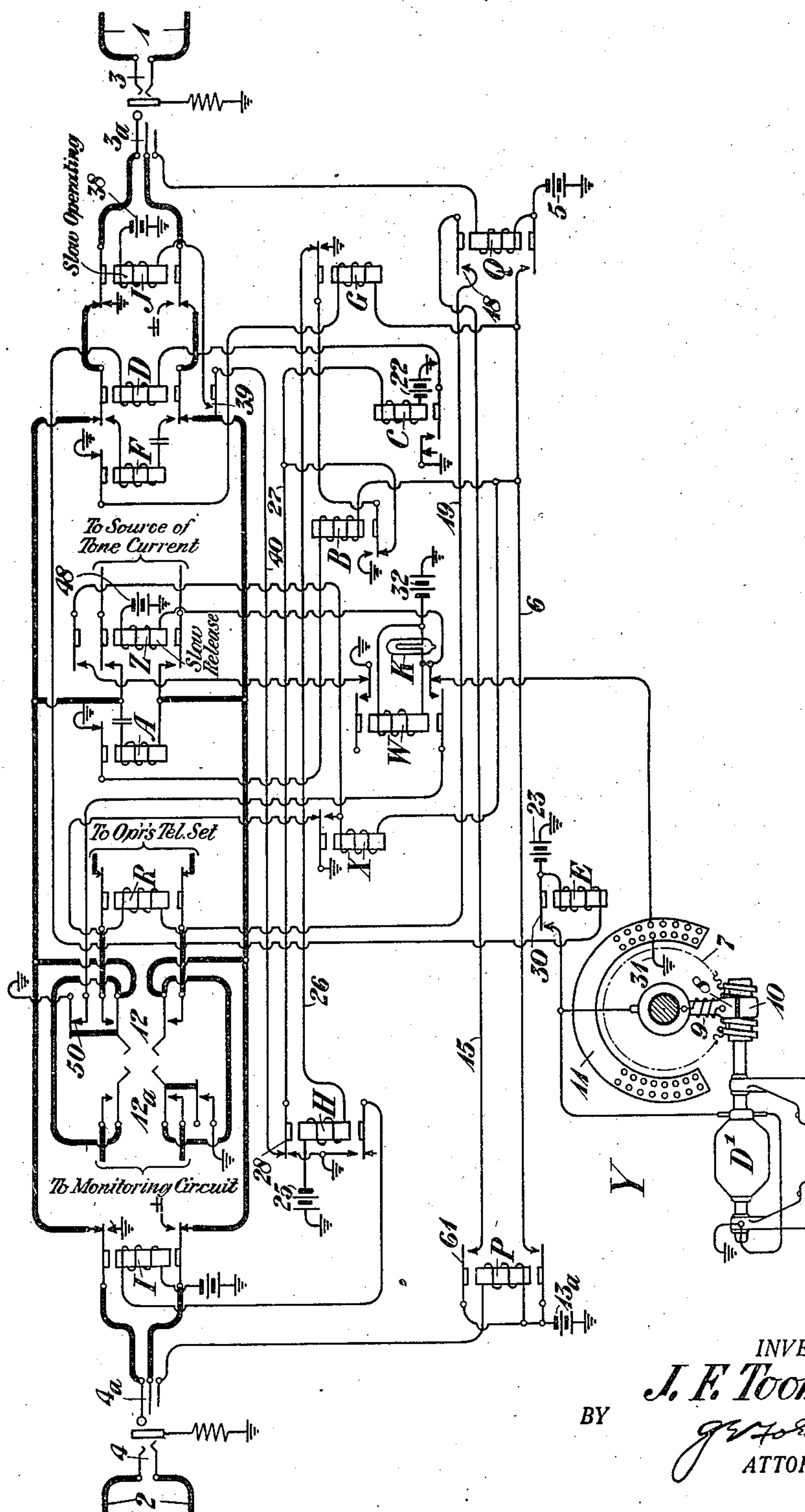
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J. F. TOOMEY

SIGNALING CIRCUITS

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SIGNALING CIRCUITS.

Application filed November 24, 1919. Serial No. 340,133.

To all whom it may concern:

Be it known that I, JOHN F. TOOMEY, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Signaling Circuits, of which the following is a specification.

This invention relates to signaling circuits, particularly to cord circuits for interconnecting long distance lines.

A toll line which is built up of a plurality of separate lines interconnected by the toll cords now in common use, has the disadvantage that the operator at one terminal of the line can signal through to the other end of the line only by calling the operator at the next intermediate station, who then relays the call to the next station, and so on until the other terminal of the line is finally reached. The primary object of the present invention is to associate apparatus with the toll cords, which will automatically relay a ring from one section of the line into the other, without the intervention of the intermediate operator, so that the built up line is in this respect equivalent to a direct line. The apparatus is preferably so arranged that when the terminal operators signal each other, the signals associated with the cords at the intermediate offices are not caused to operate.

Another feature of the invention is the provision of means whereby the operators at the intermediate offices cannot challenge or connect their telephone sets to the toll line, although they may monitor or listen in on the circuit. The abnormal transmission loss which occurs when the operator's telephone set is connected to the circuit is thus avoided.

Still another feature of this invention is that the operator at the originating office can cause the disconnect signals at all the other offices associated with the line to operate simultaneously, so that the built up connections may be cleared promptly and expeditiously. The operation of the disconnect signal at any office is indicated to the originating operator by means of a tone, preferably distinctive of the office at which the signal has operated.

A good understanding of the above and various other features of the invention may be had from the following description thereof, having reference to the accompanying

drawing showing one form and arrangement of circuits embodying the invention.

In this view, reference characters 1 and 2 designate the conductors of long distance transmission lines, which terminate in jacks 3 and 4 on the switchboard of a toll office, and which extend to the east and west distant offices, respectively, not shown on the drawing. For establishing connection between lines 1 and 2, the operator at the intermediate office is provided with cord circuits (only one of which is shown) having plugs 3^a and 4^a. Associated with this cord is a circuit controller Y, which is shown and described in my co-pending application for patent on "circuit controllers," Serial No. 329,801 filed October 10, 1919.

This controller comprises, briefly, a motor having an armature D' and a field which is not shown. This motor rotates by means of worm gearing a disc 7 of magnetic material. A contact arm 8, also of magnetic material, is mounted loosely on the shaft of disc 7 and provided with a magnetizing winding 9, which when energized causes the arm to move into engagement with the disc and rotate therewith. An insulated contact brush 10 at the extremity of arm 8, is provided to bridge contact points mounted on a stationary segment 11 of insulating material. The time interval, which elapses between the time when the motor begins to operate and the time when the brush reaches any one of the contact points, is fixed and easily adjustable, being determined by the angular distance of the contact point from the initial position of the contact arm. When the magnetizing winding 9 is de-energized, the arm 8 is forced away from the disc 7 by means of a spring (not shown in the drawing), so that the arm falls back to its initial position without operating the contacts during its return movement. A further description of the various features of this circuit controller may be had by reference to my above mentioned co-pending application. Various relays and other translating devices which are commonly used in the art and need therefore no separate description are also associated with the cord circuit, and these devices co-operate in the manner I shall now describe to accomplish the objects and features of the invention.

If the operator at the east distant office

desires to be connected by the operator at the intermediate station with the transmission line 2, she applies signaling current to line 1 and causes thus the operation of the usual signaling lamp (not shown) adjacent jack 3. The intermediate operator answers this signal by inserting the plug 3^a of the back cord into jack 3. This causes the energization of a relay Q, current flowing from a battery 5 associated with relay Q through the sleeve contact of the jack, to ground. Relay Q applies battery potential to the conductor 6, so that relays B and G, the windings of which are connected in parallel to this conductor, are energized. She then operates the talking key 12, whereby her telephone set is connected with the line conductors, and ascertains with which line the operator at the east distant office desires to be connected. She then establishes the desired connection—in this case, by inserting plug 4^a into the corresponding jack 4. A relay P now becomes energized by current flowing from battery 13^a, through the winding of the relay and through the sleeve contact of the jack 4 to ground. This causes the energization of a relay R, current flowing from battery 13^a over the front contact 61 of relay P conductor 15, contact 18 of relay Q, conductor 19, relay R, to ground at the normally closed back contact of a relay X. Relay R consequently operates its front contacts and disconnects, thus, the operator's telephone set from the contacts of the talking key, so that the operator at the intermediate station is unable to challenge on the line as long as the connection remains established. Interference with the circuit by the operator at the intermediate station is thus prevented. She may, however, listen in or monitor on the circuit at any time by operating the monitoring key 12^a, the contacts of which are associated with the usual monitoring circuit which is of high resistance so that the transmission efficiency of the circuit is practically unimpaired.

In case the operator at the east distant office desires to signal, while the connection is up, to the operator at the west distant office, she applies signaling current to the line 1 and causes thus the energization of a relay A at the intermediate station, the circuit of this relay being bridged across the switchboard conductors of the cord. The relay A opens its contact and causes thus the de-energization of relay B. The contact of the last-mentioned relay establishes now a circuit for a relay C, which circuit extends from battery 22, through the winding of relay C, through the back contact of relay B and the front contact of relay G, to ground. Relay C applies ground at its front contact to the circuit of relays D and E, which are connected

in series to a battery 23, so that these relays become energized. Relay D closes its front contacts, thus disconnecting relay A from the source of the signaling current and connecting thereto instead a relay F, so that relay A recloses the circuit of relay B and relay F opens that of relay G. Relays B and G are thus caused to close the circuit of a relay H, which circuit extends from battery 25, through the winding of relay H, through wire 26, back contact of relay G and front contact of relay B, to ground. The circuit of relay C, which heretofore extended through the back contact of relay B and the front contact of relay G, now passes through wire 27 and front contact 28 of relay H to ground. Relay H causes the operation of a relay I, by means of which signaling current from a source associated with its front contacts is caused to flow into the conductors of line 2. As soon, therefore, as signaling current is applied to line 1 by the east distant operator, it is relayed to line 2 by means of relay I and the relayed current continues to flow as long as the ringing impulse continues.

At the termination of the ring, relay F releases and causes, thus, the re-energization of relay G, which in turn releases the relay H. This relay opens its contacts and causes, thus, the de-energization of relays I, C, D and E, so that all the apparatus is returned to the position it occupied before the beginning of the ring.

The above-mentioned relay E controls by means of contact 30 the operation of the circuit controller Y. This relay, it will have been observed, is energized when the ringing current comes in over line 1 and remains energized while the ring continues. The operation of the controller Y has no effect, however, for rings of less than a pre-designated duration, say less than five seconds, because the contact brush 10 in this case is not brought into engagement with any circuit controlling contact. In case, however, the ring continues for five seconds, brush 10 will be caused to bridge the contacts 31, so that current flows from battery 32, through a disconnect signal lamp K and through a relay W, in parallel with the lamp, through contact 31 of the controller, to ground. The operator is thus given the disconnect signal. The contact 31, however, is closed only for a short interval because at the end of the five second ring relay E is de-energized, as explained hereinbefore, so that the arm of the circuit controller drops back to its normal position. Lamp K nevertheless remains lit, its circuit being held closed by relay W which has a locking circuit extending over the contact 50 of the talking key to ground.

The disconnect signal is given simultaneously at the west distant office and at any

other intermediate office associated with the built-up line, each of these offices being provided with like signaling apparatus. A rapid clearing of the line may therefore be effected. When the operators at these offices receive the disconnect signal they take down the cords and operate the talking key so that the signal, and also the remaining apparatus, are restored to the positions shown in the drawings.

A relay Z, energized simultaneously with relay W by current from a battery 48, connects a source of distinctive tone current to the conductors of line 1, so that the east distant operator may ascertain whether or not the disconnect signal has actually been received at the intermediate office. It should here be noted that the moment the intermediate operator receives the disconnect signal, she is free to use the line and connect her telephone set thereto, for the reason that the relay R is de-energized by the action of the relay X. The circuit of the last mentioned relay extends from the wire 6 (which is supplied with current by batteries 5 and 13^a) through the winding of the relay X, through a front contact of relay Z and a back contact of relay W to ground. This circuit is closed momentarily when the operator actuates the talking key, because slow release relay Z does not open its front contact until after relay W has closed its back contact. The momentary closure of this circuit suffices to cause relay X to close a locking circuit extending to ground through its front contact. The relay thus opens the circuit of relay R and holds the same open until the operator takes down the cord. With relay R de-energized the operator is free to talk over the line.

In case the operator at the west distant office desires to signal, while the connection is up, to the operator at the east distant office, she associates ringing current with the line 2 which current causes the energization of relay A at the intermediate station. Relay A releases relay B, so that relay C is energized by current from battery 22 flowing in the circuit extending through the back contact of relay B and the front contact of relay G. Relay C causes the energization of relays D and E, and relay D closes the circuit of a slow operating relay J, which circuit extends from battery 38, through the winding of relay J, the contact 39 of relay D, conductor 40, back contact 28 of relay H, wire 27, back contact of relay B and front contact of relay G, to ground. Relay J associates current from a source of ringing current connected to its front contacts with the conductors of line 1 and relays, thus, the ring coming in over line 2 to line 1. Relay E controls, as before, the operation of circuit controller Y.

Although I have herein shown and de-

scribed only one form and arrangement of apparatus embodying the invention, it is readily understood that many changes and modifications may be made therein within the scope of the following claims, without departing from the spirit and scope of the invention.

What I claim is:

1. In combination, a plurality of transmission lines, a cord circuit for associating said lines, an operator's telephone set, means operative when said cord circuit is associated with said lines for disconnecting said set from said lines, and means operative selectively by signaling current in accordance with its duration for restoring the connection of said set to said lines.

2. In combination, a plurality of transmission lines, a circuit for associating said lines, a disconnect signal for said circuit, and means operated by the flow of signaling current in one of said lines for relaying signaling current into another of said lines, and also for selectively causing the operation of said signal provided the current is of proper predetermined duration.

3. In combination, a station, a plurality of telephone lines extending therefrom, means for at times operatively connecting said lines at said station, a disconnect signal associated with said means, a source of characteristic signaling current at said station, and means responsive to the operation of said disconnect signal for applying said source to one of said lines.

4. In combination, a telephone line, a plurality of offices associated with said line, signals associated with said offices, and selective means whereby said signals may be caused to operate only from end to end, except for a predetermined duration of signaling current whereupon they will all operate simultaneously.

5. In combination, a plurality of transmission lines, a cord circuit for associating said lines, an operator's telephone set, and means operative when said cord is associated with said lines for disconnecting said set from said lines, and means operative selectively by signaling current in accordance with its duration for restoring the connection of said set to said lines.

6. In combination, a toll line comprised of a plurality of sections and cord and circuits for associating said sections, a relay associated with each cord circuit for severing the conductors of the cord into two parts, a translating device for each part responsive to ringing current therein, and means selectively responsive to said devices for associating ringing current with one section of the line or the other.

7. In combination, a cord circuit comprised of a plurality of sections, a relay normally responsive to ringing current in

either section of said circuit, a second relay normally unresponsive to ringing current in either section of said circuit, and means actuated by ringing current in one of the sections for rendering said second relay responsive and said first relay unresponsive to current in said section.

8. In combination, a built up line comprised of a plurality of sections, disconnect signals associated with said sections, operator's signals associated with the terminals of the line, and means responsive to the duration of a ring on the line for selectively operating said signals.

9. In combination, a toll line comprised of a plurality of sections, a cord circuit for associating said sections, a relay associated with said cord responsive to ringing current in said line, a source of ringing current, a second relay responsive to the first for associating said source with said line, a signal locally associated with said cord circuit, and selective means to actuate the same by ringing current.

10. In combination, a toll line comprised of a plurality of sections, a cord circuit for associating said sections, a relay associated with said cord and responsive to ringing current in either section of said line, means for associating ringing current with one section of the line, means for associating ringing current with the other section of the line, and means for causing the actuation of one or the other of said means according to the direction of the incoming ring.

11. In combination, a station, a plurality of transmission lines extending therefrom, a cord circuit for connecting any two such lines, an operator's telephone set associated with said cord circuit, means to disconnect it automatically when a connection through the cord circuit is established, and means to re-establish the connection of said set by

signaling current on the line through the cord circuit.

12. In combination, a station, a plurality of telephone lines extending therefrom, a cord circuit at the station for connecting any two of said lines, and selective means at said station to relay signaling current through the station and selectively to actuate a locally associated signal in accordance with the duration of said signaling current.

13. In combination, a station, a plurality of telephone lines extending therefrom, a cord circuit at said station for connecting any two such lines, and selective means to signal on the line to said station and simultaneously to establish an operative connection for an operator's talking set at said station.

14. In combination, a line comprising a series of sections, cord circuits connecting them, and means to signal selectively from one end of the line to the other end, or from one end of the line simultaneously to all the cord circuit stations.

15. In combination, a station, a plurality of telephone lines extending therefrom, a cord circuit for connecting any two of said lines, means for signaling through and selectively to said station, and local means for holding a signal to said station until the cord circuit is disconnected.

16. In combination, a station, a plurality of telephone lines extending therefrom, a cord circuit for connecting any two such lines, a disconnect signal at said station actuated by signaling current on a line connected to the cord circuit, and means to signal back from the station to the line until the cord circuit is disconnected.

In testimony whereof, I, have signed my name to this specification this 22nd day of November, 1919.

JOHN F. TOOMEY.