

April 28, 1925.

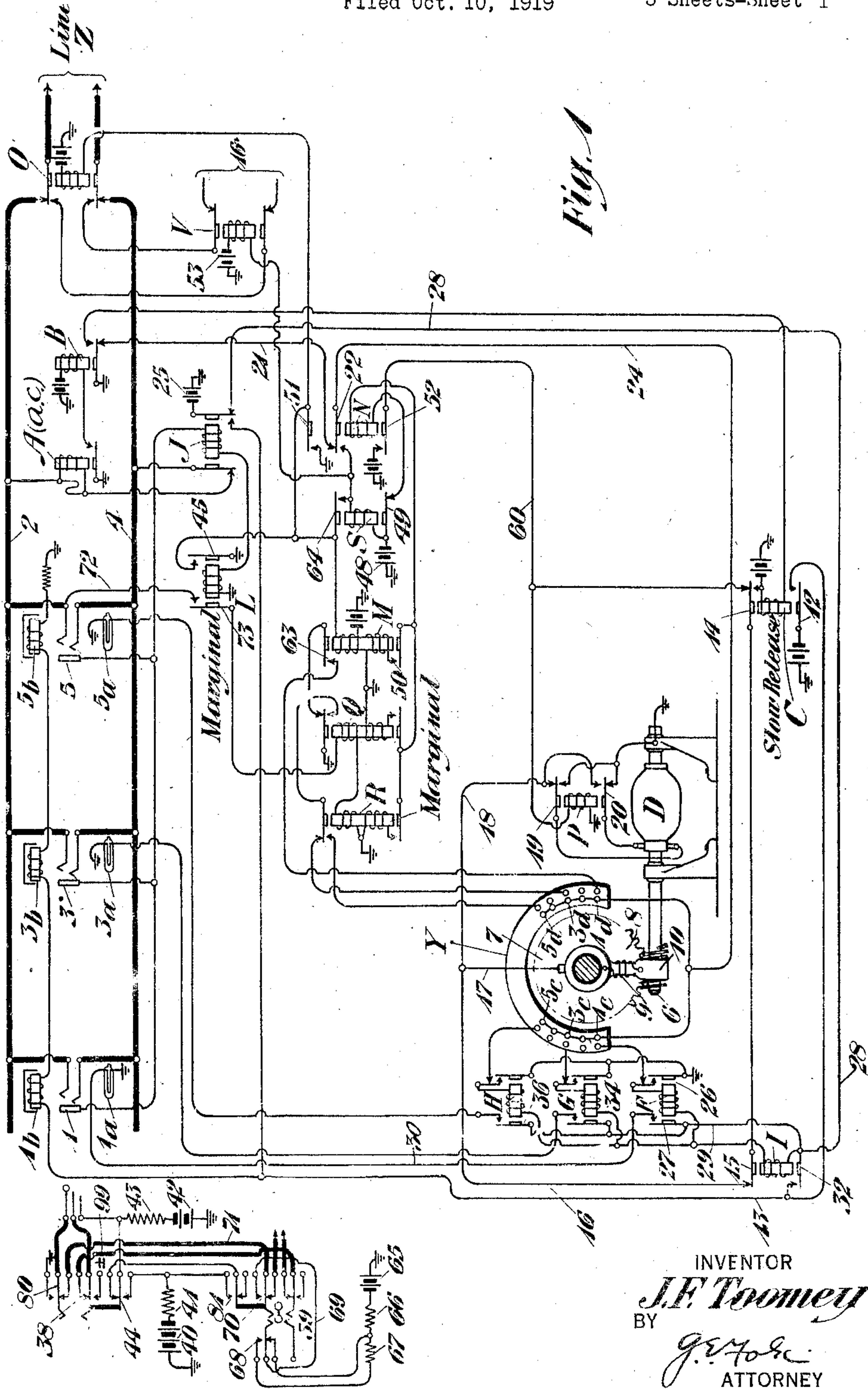
J. F. TOOMEY

1,535,269

SELECTIVE SIGNALING APPARATUS AND CIRCUITS

Filed Oct. 10, 1919

3 Sheets-Sheet 1



INVENTOR
J. F. Toomey
BY
J. F. Toomey
ATTORNEY

April 28, 1925.

1,535,269

J. F. TOOMEY

SELECTIVE SIGNALING APPARATUS AND CIRCUITS

Filed Oct. 10, 1919

3 Sheets-Sheet 2

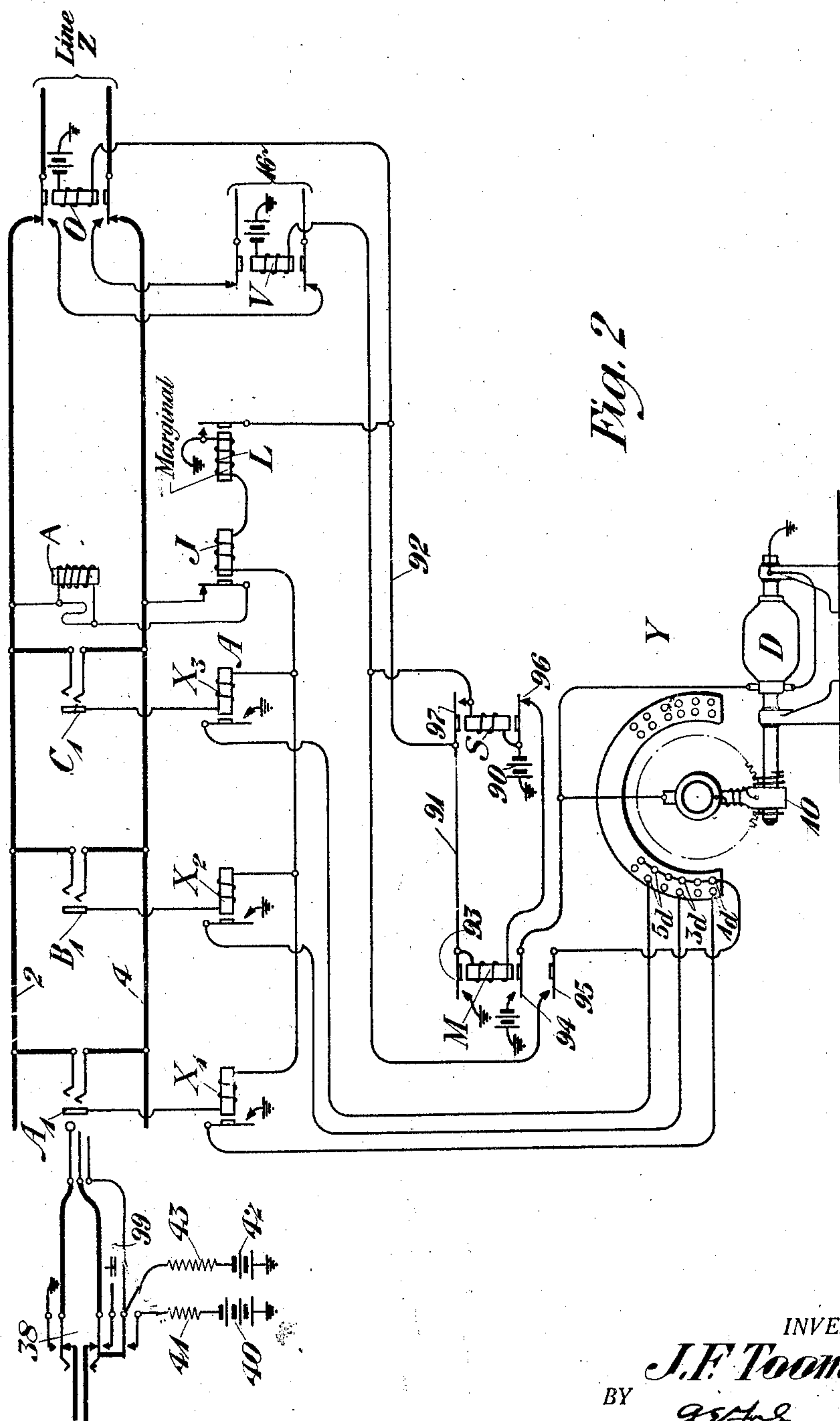


Fig. 2

INVENTOR.
J. F. Toomey
BY *gator*
ATTORNEY

April 28, 1925.

1,535,269

J. F. TOOMEY

SELECTIVE SIGNALING APPARATUS AND CIRCUITS

Filed Oct. 10, 1919

3 Sheets-Sheet 3

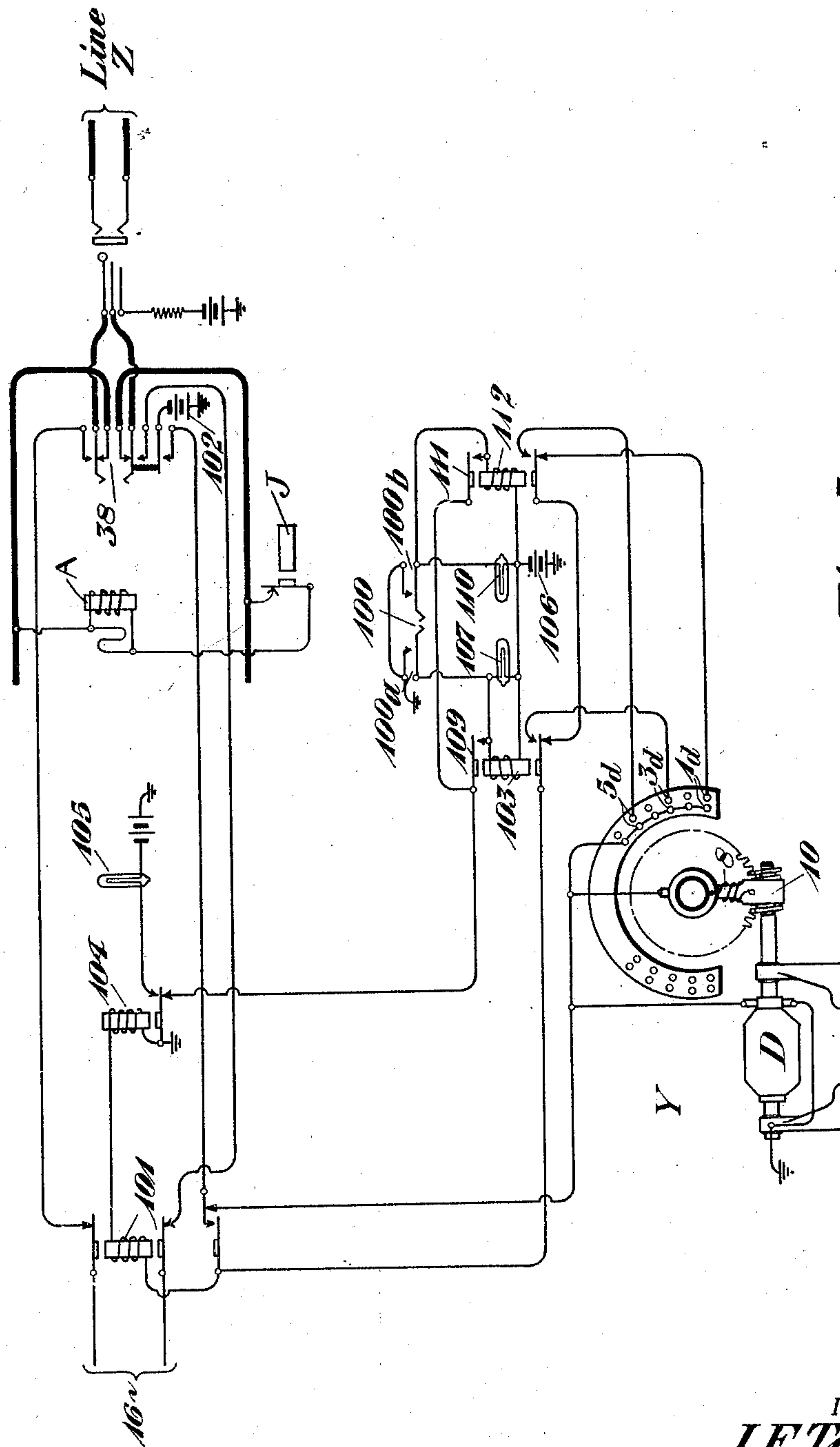


Fig. 3

INVENTOR.
J. F. Toomey
BY *g e f o r*
ATTORNEY

Patented Apr. 28, 1925.

1,535,269

UNITED STATES PATENT OFFICE.

JOHN F. TOOMEY, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

SELECTIVE SIGNALING APPARATUS AND CIRCUITS.

Application filed October 10, 1919. Serial No. 329,802.

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 Selective Signaling Apparatus and Circuits, of which the following is a specification.

This invention relates to selective signaling apparatus and circuits; and is described herein in connection with a selective ringing arrangement for a telephone system, it being readily understood that it is not thus limited in use but applicable to other electrical systems.

The arrangement of this invention provides for selective signaling over a telephone line by the use of ringing currents differing in duration. Apparatus is provided at each office associated with a line, whereby only one of the several operator's positions associated with the line is caused to receive an incoming call signal according to the length of the ring; this apparatus being arranged also to send out ringing currents of various duration so that the operators may signal selectively to the positions at other offices associated with the line.

A good understanding of the invention may be had from the following description thereof, reference being had to the accompanying drawings in which Fig. 1 is a diagrammatic view of one form of signal sending and receiving circuits embodying the invention; Fig. 2 is a view similar to Fig. 1 showing one modification of the signal sending circuits; and Fig. 3 is a view showing another modification of the signal sending circuits.

Similar characters of reference designate similar parts in each of the several views.

In Fig. 1 of the drawings, reference character Z designates a long distance telephone line which is associated by means of a relay O with switchboard conductors 2 and 4. Jacks 1, 3 and 5 have their tip and ring contacts bridged across the switchboard conductors, these jacks corresponding respectively to the inward, outward and through operators' positions. Signaling or answering lamps 1^a, 3^a and 5^a are provided adjacent the above mentioned jacks for indicating incoming calls, and busy signals 1^b, 3^b and 5^b are employed for indicating at each position whether or not the line is busy. Apparatus is provided for selecting only one of the an-

swering lamps 1^a, 3^a and 5^a to respond to a ring coming in on line Z according to the length of the ring, this apparatus comprising a circuit controller Y, which is fully described in my copending application for patent on "circuit controllers" Serial No. 329,801 filed of even date herewith. The controller comprises, briefly, a motor having an armature designated D and a field not shown in the drawing, which motor rotates a disk 7 of magnetic material, by means of worm gearing 6. A contact arm 8, also of magnetic material, is mounted loosely on the shaft of disk 7 and provided with a magnetizing winding 9 which, when energized, causes the arm to move into engagement with the disk and rotate therewith. An insulated contact brush 10 at the extremity of arm 8 is provided to bridge contact points, certain of which are designated in the drawing by reference characters 1^c, 3^c, 5^c and 1^d, 3^d and 5^d. Brush 10 operates these contacts consecutively in clockwise or counterclockwise order according to the direction of rotation of motor D; and 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 deenergized, the arm 8 is forced away from the disk 7 by means of a spring (not shown in the drawings), so that the arm falls back to its initial position without operating the contacts during its return movement. Further description of the various features of this circuit controller may be had by reference to my above mentioned copending application.

The operation of the circuits of this invention is as follows: When ringing current is applied to line Z at a distant office not shown in the drawing, the current flows over the line into switchboard conductors 2 and 4, and operates the relay A which is bridged across the switchboard conductors through the normally closed back contact of a relay J. Relay A closes the circuit of a relay B and causes the same to apply ground to the circuit of a relay C. This relay operates and causes current to flow over its contact 12 and wire 13 through the

busy signals 1^b, 3^b and 5^b in series, thus indicating immediately that the line is in use. Relay C also causes current to flow over its front contact 14, through contact 15 of relay I, wires 16 and 17, through the magnetizing winding 9 and through the frame of the controller to ground, thus energizing this winding and causing the arm to revolve with the wheel 7 which is now being rotated in clockwise direction by motor D, the armature circuit of which is in parallel with winding 9, extending through wire 18 and the back contact 19 of a relay P, through the motor armature and back contact 20 of relay P to ground. The circuit controller Y is thus caused to begin to operate the moment the operator at the distant office applies ringing current to the line.

Relays A and B remain operated only as long as the signaling current continues to come in over the line. As soon as the current ceases, relay B applies ground to the wire 21, which is connected over the back contact 22 of relay N and through a wire 24 to the inside contact points of the circuit controller Y. If the duration of the ringing current is, say, one second, and if the time it takes for contact brush 10 of the controller to reach the contact point 1^c is also one second, the above described connection of ground to the inside contact points of the controller will take place at the time when the brush 10 is bridging the contact points 1^c, so that current flows for a short interval of time from a battery 25, through the back contact of relay J, wire 28, windings of relay I and F in series through contact point 1^c to ground at relay B. Relays F and I are thus energized and lock up through the armature 26 of relay F, which is connected to ground. Relay F closes at contact 27 the circuit of the answering lamp 1^a, so that current flows there-through from battery 25 over the back contact of sleeve relay J, through wires 28 and 29, front contact 27 of relay F and wire 30 through the filament of the lamp 1^a. A ring of one second duration causes thus the response of the inward answering lamp. The relay I which, as before noted, is locked up through the contact 26 of relay F, opens at contact 15 the circuit of motor D and magnetizing winding 9 so that the circuit controller ceases to operate, and arm 8 returns to its initial position. The relay C, which is of the slow release type, opens its contacts shortly after relay B becomes deenergized, and the busy signals which were previously supplied with current through the contact 12 of relay C, as hereinbefore noted, are now energized by current from battery 25 flowing over the back contact of relay J, through conductor 28, contact 32 of relay I and wire 13. The lamp 1^a, the busy signals, and relays F and I, are thus

maintained energized, the remainder of the apparatus having been returned to its normal inoperative position.

When the inward operator answers by inserting the plug of her cord circuit into jack 1, she causes current from the sleeve battery 42 of the plug to energize relay J, the circuit of which is in series with a marginal relay L, the purpose of which is described hereinafter, it being sufficient to note for the present that the current from battery 42 is insufficient to energize relay L. The relay J opens its back contacts and thus deenergizes relays F and I, so that lamp 1^a is extinguished. The busy signals, however, remain energized by current from battery 25 through the front contact of the sleeve relay J. When, finally, the operator takes down the connection, she breaks the circuit of relay J and thus causes the deenergization of the busy signals, so that all of the apparatus is again restored to the normal inoperative position shown in the drawing.

When the incoming signaling current is of a duration longer than one second, say three seconds, relay B is not deenergized until the brush 10 of the controller Y is in engagement with the contact points 3^c, so that in this case the relays G and I are operated instead of relays F and I, relay G being in parallel with relay F, but connected to contact point 3^c. The energization of relay G causes the closure at contact 34 of the circuit of the answering lamp 3^a, so that the outward operator's position receives the signal. If the incoming signal is of still longer duration, say five seconds, the circuit controller causes the energization of relays H and I, relay H being connected to contact point 5^c. Relay H closes at contact 36 the circuit of lamp 5^a, so that the signal is received by the operator at the "through" position. It is thus apparent that by the apparatus of this invention any number of different operator's positions may be selectively signaled, according to the length of the ring coming in on the line.

The apparatus of Fig. 1 is arranged also to send ringing current of various durations over the line for the purpose of signaling selectively to other operators' positions at other offices associated with the line.

For causing a ring of, say, one second duration, the operator inserts the plug of her cord into one of the jacks 1, 3 or 5 so that current from the sleeve battery 42 flows through a resistance 43 into the sleeve circuit comprising relays J and L. Relay J operates and sets the busy signals as described hereinbefore. The operator now depresses the ringing key 38 associated with the cord circuit, which key causes current from a battery 40 in series with a resistance 41 to flow through contact 44 into the sleeve circuit. This battery is of higher potential than bat-

tery 42, so that more current flows through the sleeve circuit, enough to operate marginal relay L, which closes contact 45 and causes the energization of relays M and O.

5 Relay O operates its contacts and causes ringing current to enter line Z from a source associated with the back contacts of a relay V, the frequency of this source being generally 16 cycles, although any other suitable

10 frequency may be employed. It should be noted that the energization of relay O also acts to prevent the flow of ringing current into line Z from a source 99 associated with the contacts of the ringing key 38, this source

15 being provided so that the cord may be used with the commonly employed type of line jacks not equipped with the selective signaling features of this invention. The relay M locks up through its contact 50 which

20 is connected in series with the winding of a relay N through contact 49 of a relay S to a battery 48. Relay N is thus energized and closes contact 51 so that the circuit of relay O remains complete when relay L is

25 deenergized as the operator releases the ringing key 38. The relay N closes also contact 52, so that current flows from battery through contact 52, wire 60, through the winding of relay P, which by closing its

30 front contacts reverses the circuit of the motor D traced hereinbefore. The closure of contact 52 also causes the circuit controller Y to begin operating, current being furnished to the armature of motor D and to

35 the winding 9 through contact 52 of relay N, wire 60, back contact 14 of relay C, contact 15 of relay I, conductors 16, 17 and 18, through winding 9 and motor D in parallel. The circuit controller Y is thus caused to

40 commence operating when the ringing current begins to flow into the line, the direction of rotation, however, being counter-clockwise because motor D is operating in the reverse direction. Relay N causes, furthermore,

45 the connection of relays V and S in parallel to the inner contact points of the circuit controller, the connection being from battery 53 and relay V, and from battery 48 and relay S, in parallel, through front

50 contact 22 of relay N, wire 24 to the inside contact points of the circuit controller. Relay M, moreover, when it became energized, applied the ground on the armature of relay Q to the contact point 1^a of the controller

55 Y, through the front contact 63 of the relay M, so that the moment the brush 10 on the contact arm 8 bridges the contact points 1^a, i. e. one second after ringing current was first applied to line Z, relays S and V become

60 energized. Relay V opens its back contacts, thus stopping further flow of the ringing current into line Z. Relay S opens contact 49 and causes thus the deenergization of relays M and N, which relays stop

65 the operation of controller Y and restore the

relays O and P to their normal positions. A signaling impulse of one second duration is thus sent over the conductors of line Z.

In case the operator holds the ringing key 38 depressed for more than one second, relay L is still energized at the time when the circuit of relay S is closed by controller Y. Relays O and M in this case remain energized through contact 45 of relay L and relay S is held closed by a locking circuit which

75 extends from battery 48 through the winding of relay S, through contact 64 of relay S and contact 45 of relay L to ground. Relay V remains energized through the same contacts. The re-energization of relay N is

80 thus prevented by relay S; the reapplication of ringing current to the line from the source associated with the contacts of relay V is obviated by relay V, and the flow of current into the line from the source 99 is

85 prevented by relay O. In this manner I am enabled to make the duration of the signaling impulses independent of the length of time the ringing key is depressed.

For the purpose of applying ringing current of different duration to the line, say for three seconds, the operator does not depress key 38, but throws key 39 to the left. This key is arranged to operate both left and

90 right contact springs when thrown to the left, but only the right contact springs when thrown to the right. The operation of the key causes the current from battery 40 to flow into the sleeve circuit through contact

95 81 of key 39 and contact 44 of key 38, this current causing the operation of marginal relay L which, as hereinbefore explained, brings about the operation of relays M, N and O so that the ringing current commences

100 to flow over the line and the circuit controller Y begins to operate. Key 39 also occasions the flow of current from a battery 65, through resistances 66 and 67 in series, contact 68, wire 69, contact 70, conductor 71

105 and contact 80 of key 38 through the tip contacts of the plug and jack into conductor 2, from which conductor it flows through wire 72, contact 73 of relay L, through the windings of relays Q and R in series. Relay

110 R is marginal and does not operate with the strength of current presently flowing there-through. Relay Q, however, closes its front contact, and connects the ground on its armature through the back contact of relay

115 R to the outside contact point 3^a of circuit controller Y. The operation of the other apparatus is the same as described hereinbefore for the one second ring, except of course, that because of the energization of

120 relay Q there is no ground connected to contact 1^a of the circuit controller. When, therefore, the brush 10 reaches contact 1^a after an interval of one second, relays V and S fail to respond, so that ringing current

125 continues to flow until at the end of three

130

seconds the brush 10 reaches contacts 3^d, at which time relays V and S are energized and stop further flow of the ringing current into line Z, as explained hereinbefore.

5 When the operator desires to impress current of still different duration on line Z, say five seconds, she throws key 39 to the right so that current from battery 40 enters the sleeve circuit as before, and current from
10 battery 65 flows through resistance 66, contact 68, wire 69, contact 70, wire 71 and contact 80 of key 38 into the tip side of the cord and through relays Q and R as before. Relay R is now furnished with sufficient current to close its front contacts, the current in
15 the circuit being of a larger value than before because the resistance 67 is not in circuit. Relay R causes the ground on the armature of relay Q to be connected to the
20 contact point 5^d of the controller Y. The operation of the other apparatus is the same as hereinbefore described, the relays V and S being energized to stop the flow of ringing current at the end of a period of five
25 seconds.

In a modification of the invention I employ instead of the selective ringing keys in the cord circuit, separate jacks at each operator's position for sending the ringing currents of different durations over the line. This modification is illustrated in Fig. 2, in which A₁, B₁ and C₁ designate the jacks at one of the operator's positions, for example, the inward position. The cord circuit used
30 with this arrangement is similar to the one illustrated in Fig. 1, except, of course, that it is not provided with the selective key 39. Each of the above jacks is provided with a sleeve circuit, which comprises a relay X₁,
40 X₂ or X₃, respectively, in series with relays J and L. When the operator wishes to send a ring over the line of, say, one second duration, she associates the plug of her cord with the jack A₁, so that current from battery 42
45 in the cord flows through relays X₁, J and L, thus energizing relays X₁, J and L, setting the busy signals which are not shown in this figure. Relay L, being marginal, does not close its contact until the operator
50 depresses ringing key 38, thus associating battery 40 with the sleeve circuit, similarly as in the arrangement of Fig. 1. Relay L connects ground to the winding of relay O, and thus starts the ringing impulse over
55 line Z. Relay L also connects ground to the winding of relay M, so that the same is energized by current from a battery 90, through the back contact 96 of relay S. Relay M closes a locking circuit through contact 93
60 and relay O is maintained closed by the same contact, so that the operator may release ringing key 38. The relay L being thus restored to its normal unenergized condition. The circuit controller Y has in the mean-
65 time commenced operating, its circuit hav-

ing been closed through contact 94 of relay M. The relays S and V are connected in parallel through the contact 95 of relay M to the inside contact points of the said controller Y so that both of these relays are en-
70 energized when, after a period of one second, the contact brush 10 of the controller bridges the contact points 1^d, the outside contact point being connected to ground through the
75 contact of the relay X₁. Relays S and V are, therefore, energized one second after ringing current begins to flow over the line, and relay V, by opening its back contacts, prevents the further flow of the ringing current
80 into the line conductors. Relay S causes the deenergization of relay M by opening its back contact 96 and relay M opens the circuits of relay O and of circuit controller Y, thus restoring the apparatus to its normal position.

In case the operator holds the ringing key 38 depressed for a period of time longer than one second, relay L remains energized at the time when relays S and V are oper-
85 ated. In this case relay S is held up through a locking circuit, which extends through the contact of 97 of relay S and through the
90 contact of relay L; relay V remains closed through a circuit which extends through the same contacts and relay O remains closed through the contact of relay L. These re-
95 lays thus operate to prevent the further application of ringing current to the line no matter how long the operator holds the key depressed.

For the purpose of sending a ring of different duration over line Z, say three seconds, the operator associates her cord with the jack B₁ instead of A₁ and thus occasions the energization of relay X₂ instead of relay
100 X₁. Relay X₂ connects ground to the outside contact point 3^d so that relays S and V do not operate until three seconds after the flow of the ringing current has begun. Finally, if the operator desires to send a
105 five second ring over the line she associates the plug of her cord with jack C₁ so that relay X₃ becomes energized and connects ground to contact point 5^d. Relays S and V thus cause the discontinuation of the ring-
110 ing current after a period of five seconds. Any other number of signals of different duration may thus be sent over the line by use of additional jacks. The signal receiving apparatus associated with the above
115 described type of sending apparatus may be similar to the receiving apparatus described with reference to Fig. 1 and has not been shown in this view to prevent unnecessary complications.

In still another form of embodiment of the invention, I associate the time element circuit controller with the operator's cord circuit, as shown in Fig. 3. In this form of the apparatus the operator is provided, as
120 before, with the regular ringing key 38 and
130

in addition, with a master ringing key 100, comprising contacts 100^a and 100^b, which key may be common to all the cords of the same position. In using this arrangement the operator associates the plug of the cord with the jack of the line Z and depresses the ringing key 38. This causes ringing current from a source associated with the armatures of a relay 101, to flow over the tip and ring contacts of key 38 into the conductors of the telephone line. The operation of the ringing key connects also the battery 102 with the motor D and the magnetizing winding 8 of the arm of the circuit controller Y, thus causing the same to commence operating. Battery 102 is also connected to the inside contact points of the controller, so that when the contact brush 10 of the controller bridges, after a period of one second, the contact point 1^a current from battery 102 flows through these contact points and through the back contact of relays 112 and 103 in series through the windings of relays 101 and 104, so that both of these relays are energized and close their front contacts. Relay 101 thus disconnects the source of signaling current from the telephone line, and relay 104 closes the circuit of the pilot signal lamp 105, which thus serves to indicate to the operator that a ringing impulse of one second duration has been sent out over the line and that she may release the ringing key. Relay 101 serves also to open the circuit of the controller Y, so that the apparatus is restored to its normal condition.

In case the operator desires to send out a ringing impulse of longer duration, say three seconds, she depresses key 38 and operates also the master ringing key 100, in such a manner that the contact 100^a is closed. The operation of key 38 causes, as before, the commencement of the flow of ringing current into the line conductors and the beginning of the operation of the circuit controller Y. The closure of contact 100^a causes current to flow from battery 106, through relay 103 and lamp 107 in parallel, through contact 100^a to ground, so that the lamp 107 is lighted and relay 103 closes its front contacts. The operator may now release the master key, for relay 103 retains itself energized through a locking circuit extending through contact 109 of relay 103 and through the back contact of relay 104. Lamp 107 is supplied with current through the same circuit and serves to indicate that a three second signal is being applied to the line. The relay 103 has in the meantime disconnected relays 101 and 104 from the contact point 1^a and connected the same through the front contact of relay 103 to contact point 3^a. When, therefore, the controller bridges contacts 1^a, relays 101 and 104 fail to operate, and, in fact, do not respond until the

brush 10 bridges contacts 3^a, three seconds after the beginning of the ring. Relays 101 and 104 then operate, similarly as described hereinbefore, to discontinue the ring and to light the pilot lamp 105 to signal to the operator that she may release the ringing key 38. Relays 101 and 104 also open the circuits of controller Y, relay 103 and lamp 107, thus restoring the apparatus to its normal position.

In case the operator desires to send a ring of five seconds duration over the line, she depresses key 38 as before, and operates contact 100^b of the master ringing key. Battery 106 now energizes relay 112 and lamp 110, the circuits of which remain closed through the contact 111 of relay 112, when the operator releases the master key. Relay 112 causes the connection of relays 101 and 104 to the contact points 5^a of controller Y, so that these relays operate after a signal of five seconds duration. The circuits of the present modification may be used in conjunction with the receiving circuit arrangement shown in Fig. 1 or in conjunction with any other suitable receiving arrangement.

Although all the above described forms of embodiment, of the invention are arranged for use with a system employing signaling currents of only three different durations, it is readily understood that the apparatus may be arranged for use with any other desirable number and lengths of periods. Many other 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 controller, an actuating circuit therefor, another circuit actuated thereby after an interval of time determined by the duration of current in the actuating circuit, means for causing the commencement of the operation of said controller, and means associated with said actuated circuit for causing the cessation of the operation of said controller.

2. In combination, a motor, a controller driven thereby, a plurality of contacts actuated by the controller after predetermined intervals of time, means for causing the commencement of the operation of said controller, circuits associated with said contacts for causing the cessation of the operation of the motor and disengagement of the controller therefrom, and means for selectively rendering certain of said circuits ineffective to cause cessation of the operation of the controller.

3. In combination, a circuit, a source of current, means for associating said source with said circuit, a contact, a circuit controller for operating said contact after an interval of time determined by the duration

of current in the actuating circuit, a motor driving said controller and actuated by current in said circuit, means for causing the said controller to begin its operation when
 5 said source is associated with said circuit, and a device associated with said contact for causing the disconnection of said source from said circuit when said contact is operated by said controller.

10 4. In combination, a circuit, a source of current therefor, a device for associating said source with said circuit, a plurality of contacts, a controller for operating said contacts successively after predetermined inter-
 15 vals of time, a motor to drive said controller, and selective means associated with said contacts to cause said source to be removed from said circuit after one of said predetermined intervals of time, and to stop said
 20 motor and disengage it from said controller.

5. In combination, a telephone line, a ringing key, a source of ringing current and means actuated by said key for applying
 25 said source to said line for any one of several predetermined periods of time, and means for selectively determining one of those periods.

6. In combination, a telephone line, a ringing key, a source of ringing current,
 30 means actuated by said key for applying said source to said line, selective means for determining the length of time said source is applied and means for rendering the length of time during which said source is
 35 associated with the line unaffected by the time during which said key is operated.

7. In combination, a telephone line, a plurality of ringing keys, a source of ringing
 40 current, and a single controller selectively actuated by said keys for applying said source to said line for selected predetermined intervals of time, and for restoring said controller to its initial condition at the end
 45 of each such interval of time.

8. In combination, a telephone line, a source of ringing current, a cord circuit, a
 50 plurality of ringing keys associated therewith, means actuated by said keys for applying said source to said line, means for causing the disconnection of said source from
 55 said line after predetermined intervals of time, circuits responsive to the strength of current therein for selectively governing said last mentioned means, and means controlled by said keys for governing the
 strength of current in said circuits.

9. In a telephone system, a line, a plurality of operators' positions associated
 60 therewith, and a single controller for selectively signaling to said operators' positions according to the length of a ring over said line, and means to restore said controller actuated automatically at the end of each such
 ring over the line.

10. In combination, a circuit, a circuit
 65 controller responsive to the duration of current in said circuit, a motor to drive said controller, devices associated with said controller and selectively operated thereby, accord-
 70 ing to the duration of current in said circuit, and means to disengage said motor from said controller in accordance with the selective operation of said devices.

11. In combination, a circuit, a relay gov-
 75 erned by current in said circuit, a circuit controlling device, means for causing the commencement of the operation of said device when said relay is energized, means for
 80 causing the cessation of the operation of said device when said relay is deenergized, contacts governed by said controller and operated selectively according to the length of
 time during which said controller is caused to operate, signal circuits associated with
 85 said contacts, a motor for said controller and means to stop the motor and disengage the controller therefrom upon such cessation of operation.

12. In combination, a circuit, a relay re-
 90 sponsive to currents in said circuits, a circuit controlling device, means for causing said controlling device to operate while said relay is operated, contacts governed by said
 95 controller and operated successively thereby after predetermined intervals of time, circuits associated with said contacts, means associated with said circuits for causing ces-
 100 sation of the operation of said controller when said relay ceases to operate, signal devices associated with said contacts and selectively operated thereby, a motor for said
 controller and means to stop the motor and disengage the controller therefrom upon such
 cessation of operation.

13. In a telephone system, a line, means
 105 for sending ringing current over said line, busy signals and operator's signals associated with the line, means for causing the response of the busy signals at the com-
 110 mencement of a flow of ringing current and means for causing the response of an operator's signal at the end of such flow.

14. In combination, a circuit, a single con-
 115 troller associated with said circuit for causing flow of current therein of selectively predetermined duration, and means for indicating the cessation of flow of said current, and for automatically restoring the control-
 120 ler to its initial position.

15. In combination, a telephone line, a
 125 ringing key, means associated with said key for causing a flow of ringing current of selectively predetermined duration over said line, and a device for indicating the completion of said flow of ringing current.

16. In a telephone system, a line, a single
 circuit controller, an operator's signal, means
 for causing said controller to actuate said

signal in response to a flow of ringing current of a certain duration on said line, a ringing key, a source of ringing current and means governed by said controller upon an
5 initial operation of said key for associating said source with said line for a predetermined period of time.

17. In combination, a telephone line, a
10 controller, means operated by said controller selectively in response to incoming ringing current of predetermined duration, and means selectively operated to cause said controller to put ringing current of predetermined duration on the line.

18. In combination, a telephone line, a
15 controller, means operated by said controller selectively by movement one way from normal position in response to incoming ringing current of predetermined duration, and
20 means selectively operated to cause said controller by movement the opposite way to put ringing current of predetermined duration on the line.

In testimony whereof, I have signed my name to this specification this 9th day of
25 October 1919.

JOHN F. TOOMEY.