

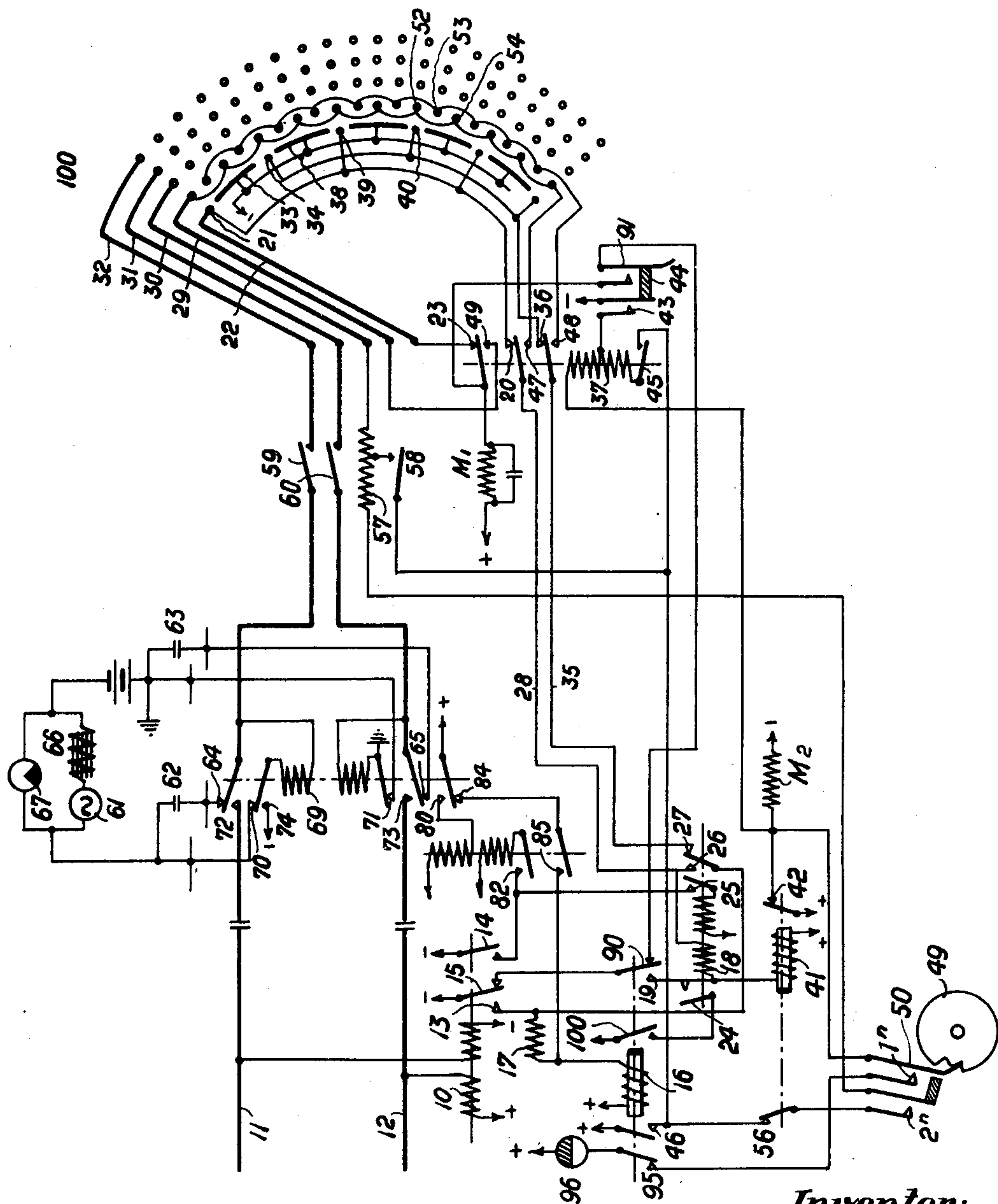
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AUTOMATIC TELEPHONE SYSTEM

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AUTOMATIC TELEPHONE SYSTEM.

Application filed November 9, 1925, Serial No. 67,977, and in Germany November 10, 1924.

The invention relates in general to electrically operated selectors and more particularly to means for preventing unnecessary operations of said selectors in cases when the receiver of a called station is raised and then replaced without numerical impulses being sent from the station to the selector for the purpose of setting the selecting member of the selector into some particular contact position.

A known means for preventing such unnecessary operations consists in providing the calling station with impulse transmitters that always send out a preliminary impulse before the first actual selecting impulse that affects the selector is sent in. A disadvantage of this arrangement is that the normal type of impulse transmitter or dial has to be departed from and constructed so that, in a decimal system, eleven impulses are sent to the exchange apparatus instead of 10.

By the arrangement according to the present invention the necessity of altering the normal senders or dials is done away with.

For this purpose there is provided in combination with a numerical selector having a plurality of selectable contact positions and a member for selecting said positions, a relay arrangement for sending a selector-operating impulse from a line relay contact to the selector only after the line relay has been energized twice by current impulses.

The relay arrangement consists of the line relay with an armature that is pulled up by current flowing through a pure metallic circuit to the calling station, a second relay whose armature drops back sluggishly and which is energized whenever said line relay is energized, and a third relay that is energized through a contact of the second relay when the line relay is deenergized by an interruption of the current in said metallic circuit, means being provided for energizing the operating magnet of the numerical selectors when the line relay is energized again while the third relay remains energized.

Another feature of the invention relates more particularly to selectors of the type described in my copending patent appli-

cation Serial No. 19,556, filed March 30th 1925. By this feature of the invention the auxiliary switch employed with the final selectors for effecting the units selecting operation is replaced by a simple relay.

Another feature of the invention relates to an improved means for sending out, and cutting off, the ringing current sent from a final selector to a wanted subscriber. These features will be more fully explained hereinafter with reference to the drawing.

The drawing illustrates the circuit arrangement of a final selector or connector whose brushes are moved by spring power as explained in the aforesaid application.

The calling stations may be connected by one or more line switches, line finders, coordinate or crossbar switches or the like to the trunk 11, 12 which leads to the final selector 100.

It will be assumed that a calling subscriber desires to establish a connection with line No. 33. On the calling station being connected through to the trunk 11, 12, the impulse receiving relay or line relay 10 is energized in the ordinary manner through the loop that extends to the calling station and closes its contacts 13, 14 while opening its contact 15. At contact 13 the release relay 16 is energized by current flowing from the negative pole of the battery through 13, resistance 17, winding of 16 to the positive pole. The calling station now sends in three tens selecting impulses, i. e. the line loop is interrupted thrice. At the first interruption which causes the armature of the line relay 10 to drop back, the commutating relay 18 is energized by a current that flows from the negative pole through contacts 15, 19 left winding of relay 18, relay contact 20, bank contact 21, selector brush 22, relay contact 23, operating magnet or controlling magnet M^1 of the selector to the positive pole. The resistance of the relay 18 is so great that the magnet M^1 is not energized by this circuit. The relay 18 however closes its contacts 24, 25, 26 and opens its contact 27. When the line relay 10 is energized again after the first interruption of the line current and after the energization of the relay 18, the left hand winding of this relay is short circuited by the negative pole being directly connected

through contact 13 and contact 26 to the wire 28. The operating magnet M^1 of the selector thus receives a stronger current impulse that flows from the negative pole through
 5 13, 26, 28, 20, 21, 23, M^1 to the positive pole and this suffices to energize this magnet so that it attracts its armature and releases the brush carrier so that the brush driving spring drives the brushes 22, 29, 30, 31, 32 off
 10 the first bank contact set and brings the brush 22 into contact with the long bank contact 33. The operating magnet M^1 then continues to receive current through the contact 33 until the next short intermediate contact
 15 34 is reached. In this position of the brushes the magnet M^1 is deenergized and a detent (not shown) drops into a tooth of a tooth wheel fixed on the brush shaft so that the shaft and its brushes are stopped. To
 20 prevent the commutating relay 18 from being immediately deenergized when the brush 22 leaves the first bank contact 21, there is provided, in addition to the locking contact 24 that keeps the left winding energized until
 25 the brush 22 moves away from contact 21, an additional locking winding with a locking contact 25 that remains closed and receives current through contact 14 of the line relay 10 until this relay is deenergized by the second
 30 interruption of the line loop. When the line relay is now deenergized a second time after the second interruption of the line loop the contact 14 is opened and the relay 18 is deenergized so as to open the
 35 contacts 24, 25, 26 and close contact 27. On the ensuing reenergization of the line relay 10 after the second interruption of the line loop the operating magnet M^1 receives an energizing impulse that flows from the negative
 40 pole through contact 13, back contact 27 of the commutating relay 18, contact 36 of relay 37, bank contact 34, brush 22, contact 23 of relay 37, magnet M^1 to the positive pole. The operating magnet M^1 pulls the
 45 detent away from the toothed wheel fixed on the brush shaft, so that the brush driving spring rotates the brushes further and thus moves brush 22 away from bank contact 34. As long as the brush 22 glides along the long
 50 bank contact 38 the operating magnet M^1 remains energized, but it is deenergized as soon as the brush 22 reaches the next intermediate bank contact 39. At the third interruption of the line current that flows through
 55 the line relay 10 the commutating relay 18 is again energized in a circuit that extends from the negative pole through contacts 15, 19 left winding of relay 18, wire 28, contact 20, bank contact 39, brush 22, relay contact
 60 23, magnet M^1 to the positive pole. In consequence of the high resistance of the left hand relay winding of 18, this relay but not the magnet M^1 is energized. At the same time a locking current is sent through the
 65 left hand winding of relay 18 through a

circuit that extends from the negative pole through contact 101 of relay 16, contact 24 of relay 18, left winding of this relay conductor 28, contact 20, bank contact 39, brush
 70 22, relay contact 23, magnet M^1 to the positive pole. On the line relay 10 being now energized a third time the controlling magnet M^1 is energized in a circuit that extends from the negative pole through contacts 13,
 75 26, 28, 20, 39, 22, 23, M^1 to the positive pole. This causes the selector brushes to rotate to the next short bank contact 40.

The brushes have now been advanced by three tens selecting impulses to the third group of bank contact sets. Although only
 80 four bank contact sets are shown in the drawing in each group there are in reality ten such contact sets.

A pause now ensues in the dialling operation between the sending of the tens and
 85 units series of selecting impulses and the change over relay 41, which was kept energized during the tens dialling operation by current impulses through contacts 15 and
 90 19, is now deenergized and at contact 42 closes a circuit for the switching relay 37 and the rewinding relay M^2 whose function it is to rewind the brush propelling spring of the selector. The energizing current for
 95 the relay 37 flows from the positive pole through contact 42, upper winding of relay 37, contact 43 of the off-normal switch 44 to the negative pole. The off-normal switch
 100 44 was operated when the brushes of the selector left their normal position. The switching relay 37 establishes a locking circuit for itself at contact 45, this circuit extending from the negative pole through 43,
 105 lower winding of 37, contact 45, contact 46 of the release relay 16 to the positive pole. The switching relay 37 disconnects the conductors 28, 25 from the innermost bank contact row and connects them through contacts
 110 47, 48 to the second innermost bank contact row that is wiped over by brush 29. The relay 37 also disconnects the magnet M^1 from the brush 22 and connects it through
 contact 49 to the brush 29.

The current impulse that flows through
 115 contact 42 and the winding magnet M^2 causes a notched disk 49 to execute a short rotary step and to close a contact 1". The other contact 2" is only closed when the contact spring 50 rides up on the top edge of
 120 the disk 49 and this only happens when the change over relay sends another current impulse through the winding magnet M^2 after all the units selecting impulses have been sent in.

When the units selecting impulses commence coming in, the first interruption of
 125 the line current that flows through the line relay 10 results in the energization of the commutating relay 18 by a circuit that flows from the negative pole through contacts 15,
 130

19, left winding of 18, conductor 28, contact 47, bank contact 52, brush 29, armature contact 49, magnet M^1 to the positive pole. At the ensuing energization of the relay 10 the left hand winding of the commutating relay 18 is short-circuited as already described through the contacts 13 and 26 so that the magnet M^1 is energized and the relay 18 is deenergized. The selector brushes now glide forward to the next bank contact set and the brush 29 stops on the bank contact 53. At a second deenergization of the line relay 10 due to the second interruption of line loop in the units dialling operation, the commutating relay 18 is deenergized and when the line relay 10 is then energized again the magnet M^1 is energized by a current that flows from the negative pole through 13, 27, 48, bank contact 53, brush 29, relay contact 49, magnet M^1 to the positive pole. The selector brushes now glide forward to the next bank contact set so that the brush 29 stops on the bank contact 54. At the third interruption of the current through the line relay 10 during the units dialling operation the commutating relay is again energized by a current that flows through the contacts 15 and 19, left winding of relay 18, conductor 28 contact 47, bank contact 54, brush 29, contact 49, magnet M^1 to the positive pole, and on the ensuing third energization of the line relay 10 the relay 18 is again short-circuited and the magnet M^1 fully energized so that the selector brushes execute a third units step and thus reach the desired line No. 33.

As the line relay 10 is now maintained energized the change over relay 41 that received impulses through contacts 15 and 19 allows its armature to drop back, whereby the winding magnet M^2 receives a second current impulse and rotates the disk 49 a second step so as to close the contact 2". By this means the positive pole is connected through contacts 46, 56, 2" to the test relay 57. If the wanted line No. 33 is free the test relay 57 is energized and closes its contacts 58, 59, 60. Contact 58 causes a part of the winding of the test relay to be short-circuited and thus places a busy potential on the wanted line.

The closure of contacts 59, 60 causes the ringing current generator 61 to be connected through condensers 62, 63 and relay contacts 64, 65 to the wanted line. The ringing current also flows through a retardation coil 66. During certain intervals the ringing current generator 61 sends its entire current through the retardation coil 66 and the interrupter 67 and during these intervals no ringing current flows to the wanted subscriber. When the wanted subscriber responds a relay 69 is energized by a continuous current that flows from the battery 68. This current flows either through the inter-

rupter 67 in a by-path to the retardation coil 66 and the ringing current generator 61, or through the retardation coil and the generator 61 and through contacts 70, 71 of the feed current relay 69. When the feed current relay 69 is thus energized it opens its contacts 64, 65, 71, 70 and closes its contacts 72, 73 and 74. At contacts 72, 73 the calling station is extended to the wanted line and at contact 74 the top winding of the feed current relay 69 is connected directly to the battery. At contact 80 the relay 69 closes an energizing circuit for a back release relay 81. This relay closes a locking circuit for itself at its contact 82 which extends through contact 14 of the line relay to the negative pole of the battery.

Assuming that the wanted subscriber replaces his receiver first, the release relay 16 is deenergized by the positive pole of the battery being directly connected through contacts 84, 85 to the winding of relay 16. This causes the release relay 16 to let its armature drop back so as to disconnect the positive pole of the battery from the test relay 57. This relay then opens its contacts to prevent the ringing current generator from being reconnected to the wanted line. When the calling subscriber also replaces his receiver the line relay 10 is deenergized and the magnet M^1 receives current in a circuit extending from the negative pole through 15, contacts 90, 91, M^1 to the positive pole. The brush-driving spring now rotates the brushes forward into their initial or normal position, in which the off-normal contact 91 is opened and the magnet M^1 is deenergized. The latter releases the detent which drops into a tooth of the toothed wheel mounted on the brush shaft and the brushes are thus stopped in their normal position. The driving spring is rewound by the magnet M^2 that receives current impulses in a circuit extending from the negative pole through M^2 , contact 1", release relay contact 95, interrupter 96 to the positive pole. When the spring is fully rewound the contact spring 50 drops into the notch of the disk 49 so as to open the contacts 1" and 2" and stop the impulses that flow through contact 1" to the magnet M^2 .

From the foregoing description it is apparent that if a calling subscriber raises his receiver and then replaces the same without sending in any selecting impulses a current will flow from the negative pole through contacts 15, 19, left winding of the commutating relay 18, conductor 28, contact 29, operating magnet M^1 to the positive pole. The relay 18 will be energized, but the operating magnet M^1 of the selector 100 will not. As soon as the release relay 16, which is sluggish in deenergizing, opens its contacts 101 the relay 18 is deenergized together with the relay 41 and all parts of the selector are

thus restored to normal without any operation of the operating magnet M^1 having taken place.

I claim:

5 1. A numerical selector comprising a bank of contacts, brushes, a power device for driving the brushes over said bank, an impulse responsive contact, a controlling magnet for positioning said brushes, a relay which is
10 alternately energized and deenergized during the operation of said impulse responsive contact, and circuits including contacts of said relay and alternate contacts of said bank for intermittently energizing said con-
15 trolling magnet.

2. A numerical selector for telephone systems comprising sets of conversational bank contacts, a selector controlling bank contact associated with each set of conversational
20 bank contacts, a first controlling wire connected to alternate controlling bank contacts, a second controlling wire connected to other alternate controlling bank contacts, a brush adapted to wipe over all said controlling
25 bank contacts, a power device for driving said brush, a controlling magnet for positioning said brush, an impulse responsive line relay, a commutating relay which is alternately energized and deenergized during
30 the operation of said line relay, and circuits closed by the line relay and including contacts of the commutating relay, said controlling bank contacts and said brush for intermittently energizing said controlling magnet.

3. A numerical selector comprising a bank of contacts, brushes, a power device for driving the brushes over said bank, an impulse responsive contact, a controlling magnet for positioning said brushes, and a relay for in-
40 termittently connecting the controlling magnet to said impulse responsive contact through sets of alternate bank contacts.

4. A remote control system comprising metallic circuit lines, an impulse producer in each line, power driven selectors each comprising a line relay adapted to respond to impulses through said impulse producers,
45 bank contacts, power driven brushes, a brush stopping wheel, a detent for engaging with said wheel, a controlling magnet for operating said detent to position said brushes, and a relay for intermittently connecting the controlling magnet to a contact of the
50 line relay through sets of alternate bank contacts.
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5. In a telephone system, calling lines, wanted lines, a device for connecting calling lines to wanted lines, a ringing current generator, a retardation coil, a battery, a relay
60 having coils for conducting current from said battery to a wanted line through said generator and retardation coil, and means for intermittently sending ringing current to a wanted line from said generator through
65 said retardation coil.

6. In a telephone system, calling lines, wanted lines, a selector for connecting calling lines to wanted lines, a ringing current generator, a retardation coil, a battery, a relay having coils for conducting current
70 from said battery to a wanted line through said generator and retardation coil, and means for intermittently sending ringing current to a wanted line from said generator through said retardation coil. 75

7. In a telephone system calling lines, wanted lines, selector brushes for connecting calling lines to wanted lines, a relay, a ringing current generator, parallel paths for connecting the ringing current generator to said
80 brushes, a condenser in one said path, and a winding of said relay in the other said parallel path.

8. In a telephone system, calling lines, wanted lines, selector brushes for connecting
85 calling lines to wanted lines, a connection-extending and cut-off relay, a ringing current generator, a retardation coil, parallel paths for connecting the ringing current generator through said retardation coil to
90 said brushes, a condenser in one said path, a winding of said relay in the other said parallel path for energizing the relay to extend a calling line to a wanted line and cut-off the ringing current generator from the
95 wanted line, and an intermittently closed circuit for intermittently diverting all the current given out by the generator from the wanted line.

9. In a telephone system, calling lines, wanted lines, selector brushes for connecting
100 calling lines to wanted lines, a connection-extending and cut-off relay, a ringing current generator, a retardation coil, parallel paths for connecting the ringing current generator through said retardation coil to said
105 brushes, and a condenser in one said path, a winding of said relay in the other said parallel path for energizing the relay to extend a calling line to a wanted line and cut-off the ringing current generator from the wanted
110 line.

10. In a telephone system, calling lines, wanted lines, selector brushes for connecting calling lines to wanted lines, a connection-
115 extending and cut-off relay, a ringing current generator, a retardation coil, parallel paths for connecting the ringing current generator through said retardation coil to said brushes, a condenser in one said path, said condenser being common to a plurality of said relays, a winding of said relay in the other said parallel path for energizing the relay to extend a calling line to a
120 wanted line and cut-off the ringing current generator from the wanted line, and an intermittently closed circuit for intermittently diverting all the current given out by the generator from the wanted line.

11. In a telephone system, calling lines, 130

wanted lines, selector brushes for connecting calling lines to wanted lines, a connection-extending and cut-off relay, a ringing current generator, a retardation coil, parallel paths for connecting the ringing current generator through said retardation coil to said brushes, and a condenser in one said path, said condenser being common to a plurality of said relays, a winding of said relay in the other said parallel path for energizing the relay to extend a calling line to a wanted line and cut off the ringing current generator from the wanted line. 10

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