

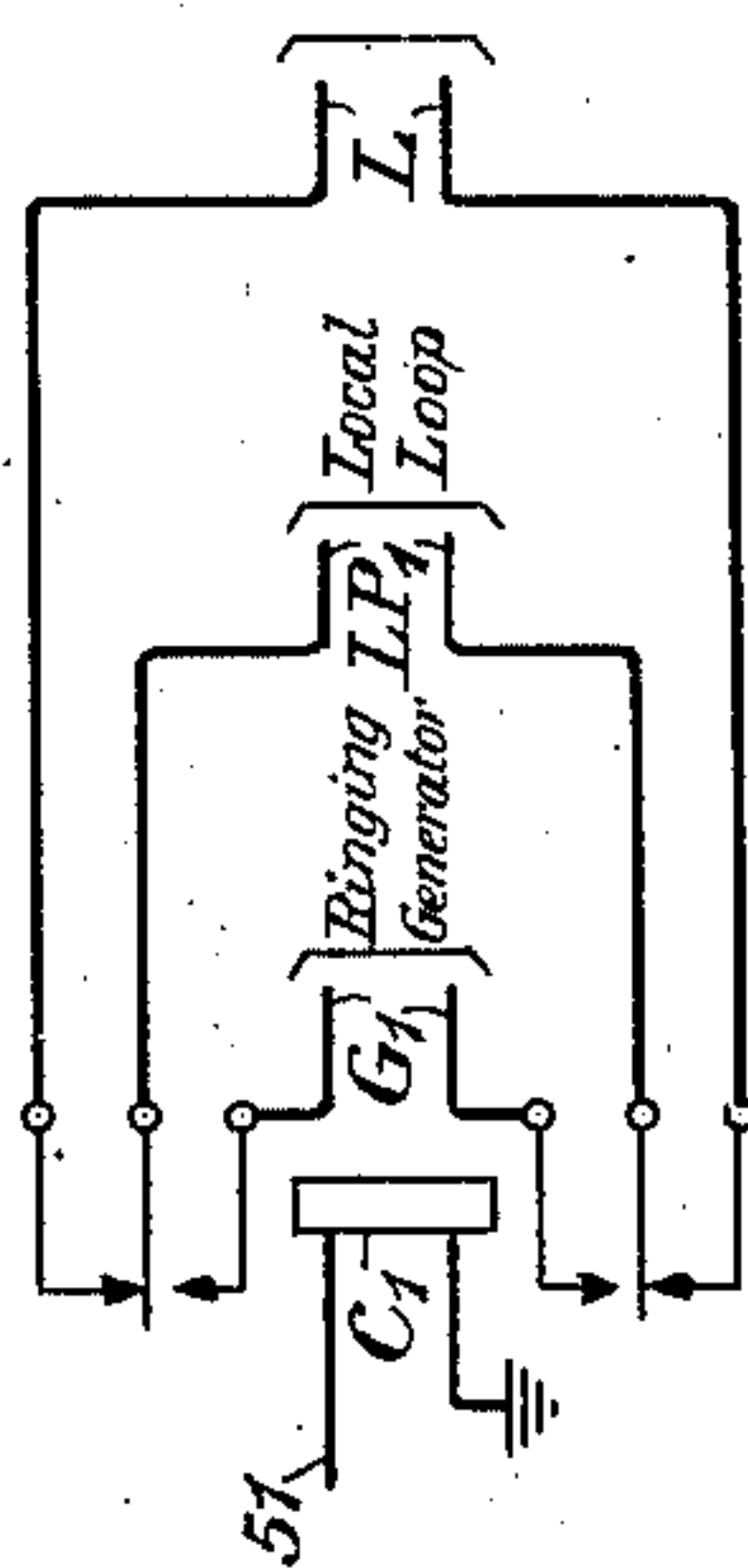
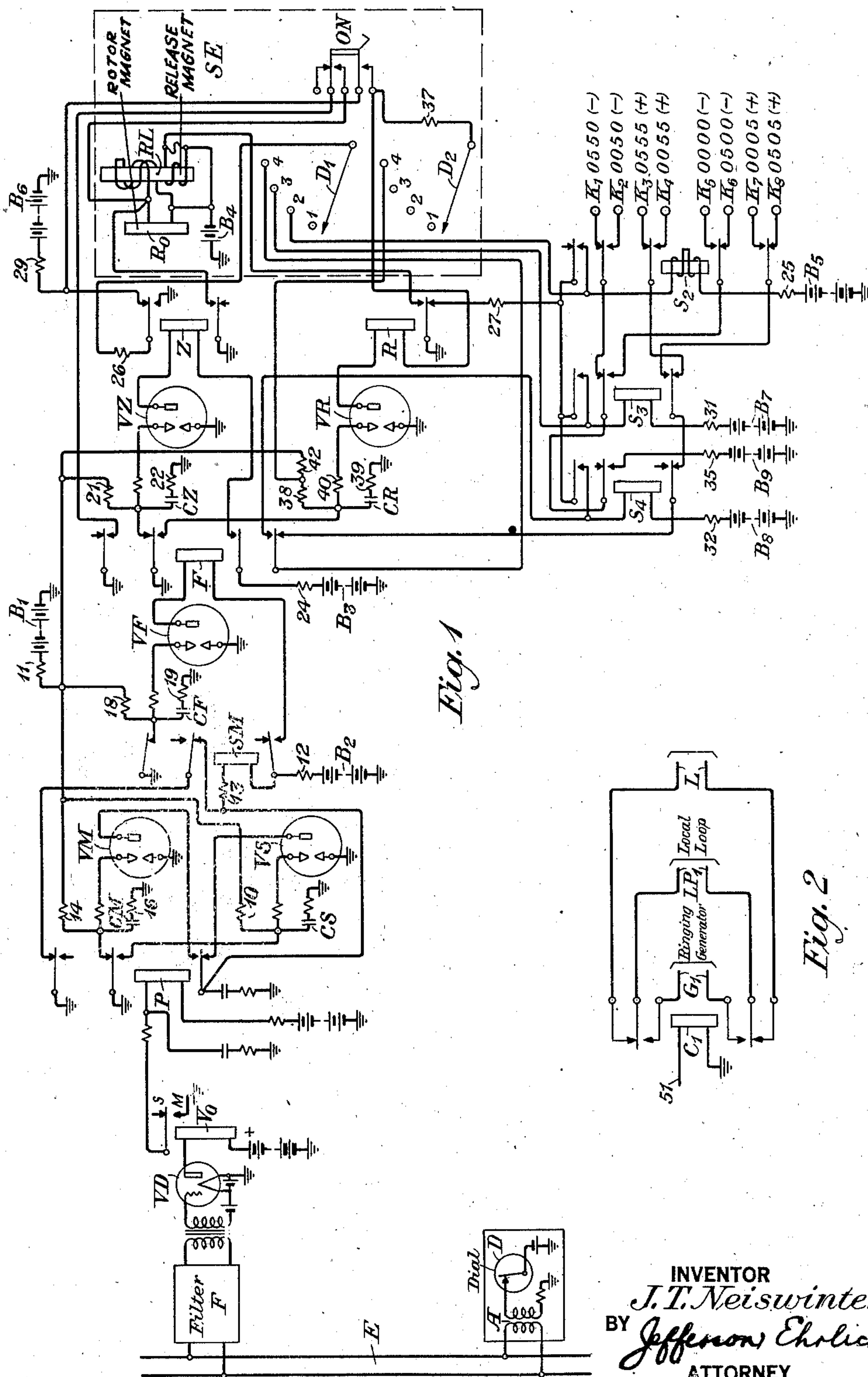
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SIGNALING APPARATUS

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SIGNALING APPARATUS

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1

This invention relates to signaling systems and more particularly to apparatus for selectively transmitting signals to any one of a plurality of different points.

One form of signaling or ringing system in use at present, for example, for signaling any one of a plurality of parties connected to a telephone or other line involves the simultaneous transmission of a predetermined number of dots and dashes to a plurality of parties. These dots and dashes produce currents which are rendered audible at each party's station. The dots and dashes assigned to a particular party form a distinctive code which is different from the code assigned to all other parties and, although all parties hear all of the codes, the only party who will answer the call will be the one whose ringing code has been received. This type of ringing system requires all of the parties to listen to all of the codes received so that each party may be ready to respond only to the code assigned to him.

In order to provide a more selective and positive ringing system, a novel arrangement has been devised requiring, among other things, a standard dial at each subscriber's office and apparatus at the central office to respond to the manipulations of the dial at any subscriber's office. In the proposed arrangement, a subscriber's dial may be operated a predetermined number of times in accordance with a prearranged code, and the dial will produce a corresponding number of groups of clicks or surges. Each group of clicks or surges will be impressed upon a transformer or repeating coil which is connected to the main line, whereupon a series of alternating current spurts will be transmitted over the line to the central office. At the central office the received currents will actuate apparatus including a rotary selector to select any one of a plurality of lines to the exclusion of all other lines. Only one of the parties will be signaled by the calling party.

To illustrate the invention it may be assumed that a calling party has dialed four digits such as 0505 in succession in accordance with one of the preassigned codes. The first digit—which is zero—will produce a long train of spurts which will clear the apparatus at the central office and prepare it to respond to the remaining three digits 505 which are employed to selectively signal one of the various subscribers' stations. The system is arranged to condition the central office apparatus for switching operations only when a digit such as No. 0 is the first digit, but the remaining digits determine the subscriber's line

2

which will be connected directly to the calling party through the central office.

One of the objects of this invention is to selectively signal any one of a plurality of stations by spurts caused by operation of the dial and to prevent the signal from effecting the switching operation unless the first digit dialed is a predetermined digit. If the first digit required is a zero—which produces a long series of spurts—the switching apparatus will then, and only then, be prepared by this digit while on the other hand the central office apparatus will be substantially non-responsive to ordinary voice currents.

The switching apparatus of this invention includes a rotary selector so connected to the system that the selector will be operated only when the first dialed digit is the predetermined digit. The rotary selector will then be stepped by each additional dialed digit to assist in signaling the desired station.

This invention will be better understood from the more detailed description hereinafter following when read in connection with the accompanying drawing in which Figure 1 represents one embodiment of the invention, and Fig. 2 illustrates one of the various circuits controlled by the switching apparatus of Fig. 1.

The general operation of the system will now be outlined. Assume that the subscriber operates dial D to dial No. 0. This will cause a long train of alternating current spurts to be transmitted over line E, as described in my Patent No. 2,367,042, issued January 9, 1945. Relay P will follow the train of spurts to control the subsequent equipment. Relay SM will be released with the first operation of relay P, and it will remain released during the receipt of the spurts of the first digit. Relays F and Z, however, will be operated in that order in response to the spurts of the first digit. The rotor magnet R₀ of selector SE will be operated to advance the selector arm D₁ to its first contact No. 1 and at the same time close the off-normal contacts ON.

During the interval between the successive groups of spurts of the first and second digits dialed by dial D, tube VS will become ionized, relay SM will become operated, and relays F and Z will release. If the second dialed digit is a No. 5—thereby producing a substantially shorter train of spurts—relay F will operate and in turn step the arm D₁ of selector SE to its second contact No. 2. However, if the second digit were a No. 0 instead of a No. 5, both relays F and Z would be again operated in that order, the selector SE would also step its arm D₁ to its contact

3

No. 2 and relay S₂ would be operated and locked up. The third dialed digit, if a No. 5, will operate relay F and at the same time step the arm D₁ of selector SE, but relay S₃ will remain unoperated. However, if the third digit is a No. 0, both relays F and Z will be operated, arm D₁ of the selector stepped to contact No. 3, and relay S₃ operated. Similarly, the fourth digit will cause either relay F or relays F and Z to operate, depending upon whether the fourth digit is No. 5 or No. 0, and then step arm D₁ to its contact No. 4, and then operate relay S₄ only if the fourth digit is No. 0. The relays S₂, S₃ and S₄ will be arranged to apply voltage to one of eight terminals K₁—K₈ to selectively ring the station connected to the particular terminal having the applied voltage. After the arm D₁ of selector SE has reached its last terminal and a predetermined interval of time has elapsed, relay R will be operated, whereupon the release magnet RL of selector SE will be operated to restore all of the relays and the selector arm D₁ to their initial condition. The system is so arranged that relay R will be operated also if there is a delay of a predetermined interval in dialing the four digits of the code, in which case all of the apparatus will also be restored to its initial condition.

The description of the operation of the system has thus far been general. More specifically the apparatus operates as follows:

When dialing No. 1, for example, the primary circuit of transformer A is opened once and closed once by the contacts of dial D. With the opening of this primary circuit, a surge of current traverses the primary of transformer A, and a similar and second surge traverses the primary of transformer A with the closure of the primary circuit. Each of the two surges of current in the primary of transformer A, therefore, produces a complete and independent cycle of current in the secondary of transformer A. Thus by dialing No. 1, two complete waves or cycles are transmitted by transformer A to line E. Hence by dialing No. 5, ten complete cycles will be transmitted over line E. Furthermore, by dialing No. 0 (which is equivalent to dialing a No. 10) twenty complete cycles are transmitted over line E. These cycles are, of course, not pure sine waves, but transients. As the dial D is of a type which is generally timed to produce these twenty cycles in about one second, the transients produced and transmitted over line E will be at a twenty-cycle rate. Similar transients are produced upon dialing any other number. However, the number of transients produced and transmitted over line E will simply be twice the number dialed by dial D. Hence when dialing No. 5, ten transients will be produced and transmitted over line E, and these ten transients will occur within about one-half of a second.

The filter F is intended to pass that portion of the frequency band of the transients which lies at approximately 1,000 cycles. That is, filter F may pass all currents between about 800 cycles and 1,200 cycles and substantially suppress currents of all other frequencies. In general, filter F transmits to tube VD current of about 1,000 cycles interrupted twenty times per second. In other words, filter F transmits separate and distinct spurts of 1,000 cycle current every twentieth of a second.

Each such spurt of 1,000 cycle current will render the grid of tube VD positive with respect to its cathode 1,000 times per second, but the relay V₀, being too sluggish to follow the 1,000 cycle

4

pulses of rectified current, will operate and release twenty times per second. Each 1,000 cycle spurt will cause the armature of relay V₀ to close its M contact. The armature of relay V₀ will, of course, be released from its contact S between successive 1,000 cycle spurts. Hence relay V₀ will follow the 1,000 cycle spurts, becoming operated upon receipt of each such spurt and released when no such spurt is present. The armature of relay V₀ will, therefore, translate the successive spurts of 1,000 cycle current into mechanical vibrations occurring at a rate which is determined by the interruptions of the 1,000 cycle spurts received through filter F.

In the idle condition, relay V₀ and P are released. Condenser CS is charged by battery B₁ through a circuit which includes resistors 10 and 11. The voltage across condenser CS is sufficient to ionize the gas between the control electrodes of tube VS and hence relay SM is operated, the operating circuit including battery B₂, resistor 12, the winding of relay SM, resistor 13, the lower armature and back contact of relay P, the anode and lower control electrode of tube VS and ground. Relay SM remain locked in its operated condition during the idle period, the locking circuit including battery B₂, resistor 12, the winding of relay SM, resistor 13, the inner upper armature and make contact of relay SM, the back contact and outer upper armature of relay P and ground. During the idle condition the other tubes will remain in deionized condition and all other apparatus will be unoperated.

Upon the receipt of the first transient transmitted over line E through filter F pursuant to the operation of dial D, relay V₀ will become operated and in turn cause relay P to operate. The operation of relay P removes ground from the winding of relay SM previously provided by circuits including the lower and upper inner armatures of relay P. Relay SM, therefore, releases. The operation of relay P transfers the winding of relay SM from the anode circuit of tube VS to the anode circuit of tube VM, the new circuit for relay SM including battery B₂, resistor 12, the winding of relay SM, resistor 13, the lower armature and make contact of relay P, the anode and lower control electrode of tube VM and ground. Condenser CM, previously grounded through the upper inner armature and back contact of relay P, is now ungrounded and charged by battery B₁ over a circuit which includes battery B₁, resistor 11, resistor 14, condenser CM, resistor 16 and ground. The constants of resistor 14 and condenser CM are so chosen that the normal length of the spurt received by a dial operation will not be sufficient to allow the condenser voltage to reach the value required to ionize the gas within tube VM and hence relay SM will remain released. At the same time condenser CS will discharge to ground connected to the inner upper armature and make contact of relay P.

At the end of the pulse, relays V₀ and P will release. Condenser CS will then begin to receive a charge from battery B₁ over the previously described circuit of resistors 10 and 11. The constants of resistor 10 and condenser CS are so chosen that during the normal interval between two successive pulses or spurts the condenser voltage will not reach the value required to ionize the gas within tube VS and, therefore, relay SM will remain released. At the same time condenser CM will discharge to ground connected to the inner upper armature and back contact of relay P.

Relay V₀ and P follow the successive spurts or

pulses transmitted by the operation of dial D, these relays both operating with each spurt received and releasing at the end of each spurt. Assuming that the spurts produced by dial D are those coming from a dial of normal speed, condensers CM and CS will be alternately charged and discharged, as already noted. However, the charging intervals of condensers CM and CS are insufficient to allow these condensers to reach the ionization voltages of tubes VM and VS, respectively, and, therefore, relay SM will remain released.

As long as relay SM remains released, condenser CF will be receiving a charge from battery B₁ over a circuit which includes battery B₁, resistors 11 and 18, condenser CF, resistor 19 and ground. The constants of condenser CF and resistor 18 are so chosen that the voltage on condenser CF will not reach the value required to ionize the gas of tube VF unless condenser CF has been receiving a charge from battery B₁ for at least a predetermined interval of time as, for example, three-tenths of a second. When condenser CF is charged for that length of time, tube VF will become ionized and cause relay F to operate. The operating circuit for relay F includes battery B₂, resistor 12, the lower armature and back contact of relay SM, the winding of relay F, the anode circuit of tube VF and ground. By dialing the digit No. 5 at dial D, there will be produced a train of spurts extending over about five-tenths of a second in a normal speed dial. Such a series of pulses will cause relay F to operate and remain operated for about two-tenths of a second. This margin of two-tenths of a second is provided to allow relay F to operate even in response to proper dial of somewhat faster dials.

The operation of relay F removes ground from condenser CZ previously connected thereto by the inner upper armature and back contact of relay F. Condenser CZ then begins to receive a charge from battery B₁ over a circuit which includes battery B₁, resistor 11, resistor 21, condenser CZ, resistor 22 and ground. Resistor 21 and condenser CZ are so chosen that the voltage on condenser CZ will not reach the value required to ionize the gas within tube VZ unless the received train of dial pulses lasts for a predetermined interval of time such as seven-tenths of a second. When a series of spurts of that duration is received, tube VZ will become ionized and relay Z will become operated. The operating circuit for relay Z includes battery B₃, resistor 24, the lower inner armature and make contact of relay F, the winding of relay Z, the anode circuit of tube VZ and ground. In tube VZ, as in other tubes, the anode circuit includes the anode or plate electrode and the lower input electrode which in each case may be grounded as shown.

Tube VZ will become ionized and relay Z operated in response to the pulses produced when dialing a No. 0, but will not respond to the pulses corresponding to the dialing of a No. 5. Thus the apparatus at the central office or switching point will distinguish between the two groups of spurts corresponding to Nos. 5 and 0.

The apparatus at the central office is so set up that a number, such as No. 0, must be dialed initially to prepare the apparatus for subsequent switching operations and to prevent false operation of the apparatus in response to undesired signals or spurts. When a No. 0 is dialed, the rotor magnet R₀ of selector SE will be operated, the operating circuit of the magnet including battery B₄, the winding of the magnet R₀, the

lower armature and make contact of relay Z and ground. In response to the operation of the magnet, the arms D₁ and D₂, which are mounted on a common shaft, will be stepped to their contacts No. 1 and at the same time close the off-normal contacts ON. If a No. 5 had been dialed instead of No. 0, the relay Z would not have been operated and magnet R₀ would have remained unoperated.

At the end of the train of spurts corresponding to the first digit dialed, relays V₀ and P release, as already explained. The release interval is sufficient to allow condenser CS to become charged by battery B₁ to the voltage required to ionize tube VS. Relay SM then operates by the completion of its circuit through the anode path of tube VS and relay SM then locks in its operated position. The locking circuit includes battery B₂, resistor 12, the winding of relay SM, resistor 13, the upper inner armature and make contact of relay SM, the upper outer armature and back contact of relay P and ground. The operation of relay SM releases relay F by opening its circuit at the back contact of the lower armature of relay SM. Moreover, relay Z becomes released due to the opening of its circuit at the make contact of the lower inner armature of relay F. The central office equipment is now ready to receive the second series of spurts or pulses corresponding to the second digit dialed by dial D.

If the second digit dialed is No. 0, both relays F and Z will be operated in the manner already outlined hereinabove. In response to the operation of relay Z, the rotor magnet R₀ will again be energized over the circuit completed through the lower armature and front contact of relay Z. Consequently the arms D₁ and D₂ of the selector SE will advance to their No. 2 contacts. As the arm D₁ reaches its No. 2 contact, relay S₂ will become operated over a circuit including battery B₅, resistor 25, the winding of relay S₂, contact No. 2 and arm D₁ of the selector, resistor 26, the upper armature and make contact of relay Z and ground. Relay S₂ will also be locked in its operated position, the locking circuit comprising battery B₅, resistor 25, the winding of relay S₂ and its uppermost armature and make contact, resistor 27, the lower armature and back contact of relay R and ground.

If the second digit dialed is No. 5 (instead of No. 0), relay F will be operated but relay Z will remain unoperated. The rotor magnet R₀ will also be energized over a circuit which includes battery B₄, the winding of magnet R₀, the upper swinger and make contact of the off-normal switch ON, the upper outer armature and make contact of relay F and ground. The opposite terminals of the winding of relay S₂ will be connected to batteries B₅ and B₆ over a circuit which includes battery B₅, resistor 25, the winding of relay S₂, the arm D₁ and its contact No. 2, resistor 26, the upper armature and back contact of relay Z, resistor 29, battery B₆ and ground. As these two batteries are of equal potentials, relays S₂ will remain unoperated.

If the third digit dialed is No. 0, relays F and Z will be operated and the arms D₁ and D₂ will be stepped to their third contacts No. 3. The operation of relay Z will cause relay S₃ to become operated over a circuit including battery B₇, resistor 31, the winding of relay S₃, arm D₁ and its contact No. 3, resistor 26, the upper armature and make contact of relay Z and ground. However, if the third digit is a No. 5, relay F will be operated and arms D₁ and D₂ stepped to contact No. 3,

but relay Z will remain unoperated. Consequently relay S₃ will remain unoperated.

If the fourth digit dialed is No. 0, relays F and Z will be operated, the arms D₁ and D₂ stepped to their contacts No. 4, and relay S₄ then operated. The operating circuit for relay S₄ includes battery B₈, resistor 32, the winding of relay S₄, the lower armature and make contact of relay F, arm D₁ and its contact No. 4, resistor 26, the upper armature and make contact of relay Z and ground. If the fourth digit is a No. 5, relay F will be operated, arms D₁ and D₂ stepped to their contacts No. 4, but relay Z will remain unoperated. Consequently relay S₄ will remain unoperated.

Thus it will be observed that the selector arms D₁ and D₂ will be successively stepped by the second, third and fourth digits to contacts Nos. 2, 3 and 4, if these digits are either No. 5 or No. 0. Each No. 0 digit will operate relays F and Z and then operate relays S₂, S₃ and S₄ in response to the second, third or fourth No. 0 digit, respectively. If these three digits are all No. 5, none of the relays S₂, S₃ and S₄ will be operated.

The inner upper two armatures and the lower two armatures of relay S₂ are associated with eight different contacts K₁-K₈, as shown. Fig. 2 illustrates one of eight different subscribers' lines each of which is connected to one of the eight contacts K₁-K₈. Conductor 51 of Fig. 2 may be connected, for example, to contact K₁ of Fig. 1. The relays S₂ to S₄ are employed to connect a source of potential of predetermined polarity to one of the eight contacts K₁ to K₈ so as to apply voltage of said polarity to one of eight conductors such as conductor 51 of Fig. 2, as will now be explained.

When the code 0550 is dialed by dial D, relays S₂ and S₃ will be unoperated because the second and third digits of the code were 5's and not 0's. Relay S₄ will be operated because the fourth digit of the code dialed is a No. 0. Hence the negative potential of battery B₉ will be applied to contact K₁ (and to conductor 51 of Fig. 2) over a circuit which includes battery B₉, resistor 35, the inner upper armature and make contact of relay S₄, the inner upper armature and back contact of relay S₃, the second upper armature and back contact of relay S₂ to contact K₁. Relay C₁ of Fig. 2 operates in response to that applied potential and connects the ringing generator G₁ to the local loop LP₁ through the two inner make contacts of relay C₁. If code 0505 is dialed, relay S₃ will be operated, and relays S₂ and S₄ will be unoperated. Positive potential is then applied to contact K₈ over a circuit which includes battery B₆, resistor 29, upper armature and back contact of relay Z, resistor 26, arm D₁ and its contact No. 4, lower outer armature and back contact of relay F, lower armature and back contact of relay S₄, lower armature and make contact of relay S₃, lower outer armature and back contact of relay S₂ to contact K₈. The positive potential so applied will reach a relay similar to relay C₁ corresponding to a different party to ring that party. So it is with each of the other coded signals dialed, the coded signals being shown adjacent to contacts K₁ to K₈.

It will be observed that contacts K₁, K₂, K₅ and K₆ receive negative potentials and that contacts K₃, K₄, K₇ and K₈ receive positive potentials. By having opposite potentials applied to contacts K₁ and K₈, for example, these two contacts may be connected to a single circuit which may include oppositely poled rectifiers or polar relays or other means to separately transmit these pulses to two

relays, such as C₁ of Fig. 2, corresponding to two different parties. Thus, one of the latter relays will be energized by positive potentials applied to the associated circuit to signal one of the parties and the other relay will be similarly energized by negative potentials applied to the same associated circuit to signal the other of the parties.

After the local loop LP₁, for example, receives a ringing signal, relay C₁ will be released and the subscriber connected to loop LP₁ will be connected to line L which is in turn connected to the calling party having dial D over a switchboard circuit of well-known type (not shown). The subscriber having loop LP₁ may also be connected to other parties by similar apparatus.

After the arms D₁ and D₂ reach their contacts No. 4, condenser CR will receive a substantial charge from battery B₆ over a circuit which includes battery B₆, resistor 29, the lower swinger of the off-normal switch ON and its make contact, resistor 37, arm D₂ and its contact No. 4, resistor 38, condenser CR, resistor 39 and ground. After a predetermined interval of time, such as two seconds, the charge on condenser CR will reach a value sufficient to ionize the gas of tube VR to which it is connected by resistor 43. Relay R will then operate over a circuit including battery B₆, resistor 29, the lower swinger of switch ON and its contact, the winding of relay R and the anode circuit of tube VR. Relay R will cause the release magnet RL to become energized over a circuit including battery B₄, the lower or operating winding of the release magnet RL, the armature of relay R and its make contact to ground. This clears all of the mechanism of selector SE. The operation of relay R also opens the locking circuits of relays S₂, S₃ and S₄ previously established by the uppermost outer armatures and their respective make contacts, and hence these relays release if previously operated. Relay R is employed primarily to clear out the apparatus as will be further explained hereinafter.

In the idle condition of the system condenser CR is charged from battery B₁ over a circuit which includes in addition to battery B₁, the resistor 11, resistor 42, resistor 38, condenser CR, resistor 39 and ground. Resistor 42 is a very large resistor so as to restrict the charging current to a very low rate. However, condenser CR will gradually receive a potential sufficient to ionize the gas of tube VR. But relay R will not be operated because its circuit is open at the contact of the lower swinger of switch ON. When the first No. 0 is dialed, the lower swinger contact will be closed to complete the circuit of relay R, but relay R will remain unoperated. This is because condenser CR will be discharged by the grounded path provided by the inner upper armature and make contact of relay F and the consequent de-ionization of tube VR.

During the brief intervals between the dialing of the various digits of any one of the codes, relay F will release and condenser CR will begin to receive a charge from battery B₁ through the circuit of resistor 42. The intervals between digits are not large enough to allow condenser CR to reach the ionizing potential of tube VR. Relay R will then remain unoperated and the selector SE will not be cleared by its release magnet RL. Relay R and the release magnet RL will only be operated after a longer interval of time, such as four seconds, has elapsed after relay F has released. When this latter larger interval of time has elapsed, relay R will be operated so as to clear the selector and to release any of the relays

S₂ to S₄ that may have been operated previously.

After the last or fourth digit of a code has been dialed, condenser CR will receive a charge from battery B₆ over a circuit which includes the lower swinger of switch ON and its contact, resistor 37, arm D₂ and its No. 4 contact and resistor 38. The resistance of this charging circuit is of lower value so as to enable tube VR to ionize in a shorter predetermined time interval, such as two seconds. This is the interval of time during which the ringing generator circuit G₁ of Fig. 2, for example, is connected to the local loop LP₁. This charging circuit will be opened when the selector magnet RL operates.

The circuit interconnecting tubes VS and VM and relay SM is arranged to prevent the repeated operation of relay F' in response to voice signals. In the case of normal speech the first syllable may cause relays V₀ and P to operate and thereby release relay SM. Condenser CF' will then start to charge. But condenser CF' requires a predetermined time interval, such as three-tenths of a second, to reach the ionizing voltage of tube VF'. Condenser CM will also start to charge when relay P operates. If the syllable is longer than a predetermined interval, such as fifty milliseconds, tube VM will ionize and operate relay SM, thus discharging condenser CF'. If there is a pause between syllables which is longer than the interval between two adjacent spurts of 1,000 cycle current, tube VS will become ionized, thereby operating relay SM and discharging condenser CF'. In either case relay F' will not be operated and the apparatus controlling the ringing generator will not be operated. Low level speech signals are even less likely to operate relay F' because such signals are less likely to operate relays V₀ and P. It is to be especially noted that false operations of the apparatus can only occur in response to four successive operations of relay F', the operations of relay F' occurring within a predetermined time interval, such as four seconds, of each other and, moreover, the first operation of relay F' must be of sufficient duration to operate relay Z or slightly less than the time required to dial a No. 0, i. e., about seven-tenths of a second.

It will be noted that the selector SE is of the rotary type and is illustrative of step-by-step selectors generally. It will be understood that other forms of selectors, whether of the rotary type or not, may be employed in place of selector SE within the scope of this invention.

The values assigned to the various constants of the apparatus are given merely to aid in understanding the invention and are not to be construed as limitations on the apparatus.

While this invention has been shown and described in certain particular embodiments merely for illustrative purposes, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. Apparatus for selecting any one of a plurality of lines, comprising means for producing a series of A. C. spurts approximately of a predetermined frequency and of a first predetermined length or a second series of A. C. spurts approximately of the same predetermined frequency and of a second predetermined length, the different groups of spurts corresponding to different codes, a rotary switch, means responsive only to the A. C. spurts of the first predetermined length to

step said switch off normals, means responsive to the A. C. spurts corresponding either to the first or second predetermined lengths to further step said switch, a plurality of control elements each connected to one of the steps of the rotary switch, each control element being separately operated only in response to the A. C. spurts of the first predetermined length, means including said control elements for selecting one of the lines to the exclusion of all other lines, and means to release the switch and said control elements in response to spurts other than those of the first or second predetermined lengths.

2. Apparatus for selecting any one of a plurality of lines, comprising a pulsing device for producing series of pulses, the number of pulses in each series being a variable number, a step-by-step sequence device, means for measuring the number of pulses produced by the pulsing device in each series, means controlled by said measuring means only when it responds to a plural impulse series of a given number for moving the sequence device a step from normal condition, means controlled by said measuring device for thereafter stepping the sequence device one step for each succeeding impulse series but only if said series is either of two predetermined numbers, a plurality of relays, means controlled by said sequence device for sequentially preparing said relays for operation one for each step, means controlled by said measuring means for operating the prepared relay when the corresponding impulse series corresponds in number of impulses to one of said predetermined numbers, and means controlled jointly by said relays to select one of the lines.

3. Apparatus for selecting any one of a plurality of lines, comprising means for producing successive groups of pulses, said means controlling the number of pulses in any one group, a step-by-step sequence switch, means responsive to a group of pulses of predetermined number to step said switch off normal, means for progressively stepping said switch one step at a time in response to each subsequent group of pulses if the group has more than a predetermined number of pulses, a plurality of relays one corresponding to each step of said switch, means controlled by said switch for preparing said relay for operation, one relay being prepared for operation at each step of said switch, means for operating each of said prepared relays only when the pulses of the corresponding group are of a predetermined number, and means controlled jointly by said relays to select one of said lines.

4. Apparatus for selecting any one of a plurality of lines, comprising means for producing successive groups of pulses, said means controlling the number of pulses in any one group, a step-by-step switch, means responsive to a group of pulses of a first predetermined number to step said switch off normal, means for progressively stepping said switch one step at a time in response to each group of pulses if the group has more than a second predetermined number of pulses, a plurality of relays, one associated with each step of said switch, means for operating each of said relays when the pulses of the corresponding group equals the first predetermined number, and means controlled jointly by said relays to select one of said lines.

5. Apparatus of selecting any one of a plurality of lines, comprising means for producing successive groups of pulses, said means controlling the number of pulses in any one group, a step-by-step switch, means responsive to a group of pulses

11

of a first predetermined number to step said switch off normal, means for progressively stepping said switch one step at a time in response to each group of pulses if the group has more than a second predetermined number of pulses, a plurality of relays, one associated with each step of said switch, means for operating each of said relays when the pulses of the corresponding group equal the first predetermined number, means controlled jointly by said relays to select one of said lines, and means to release said switch and said relays after said switch has been stepped a predetermined number of times.

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10

15

12

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