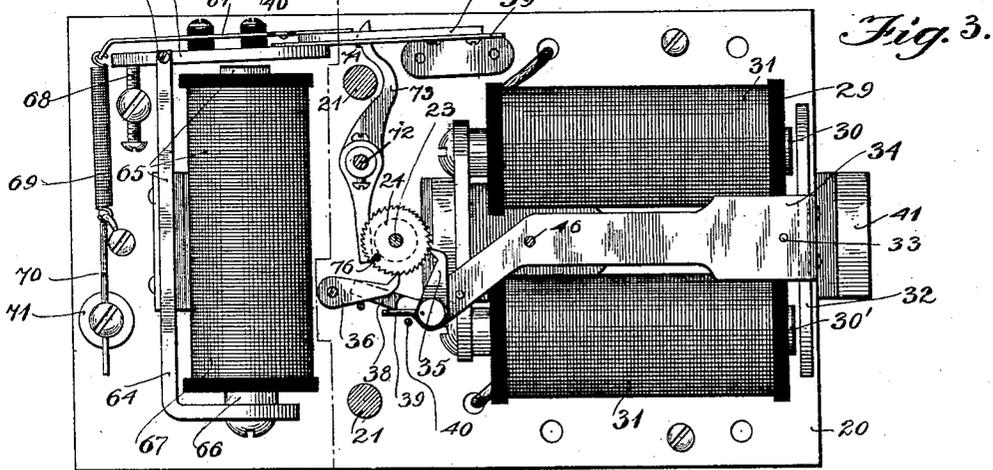
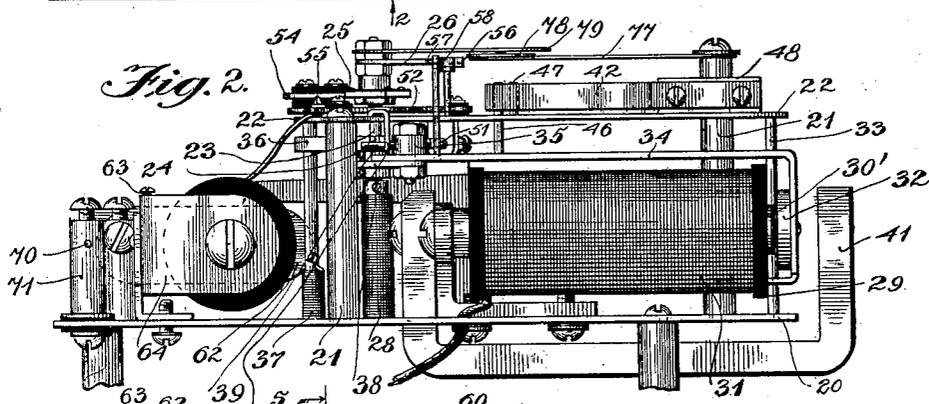
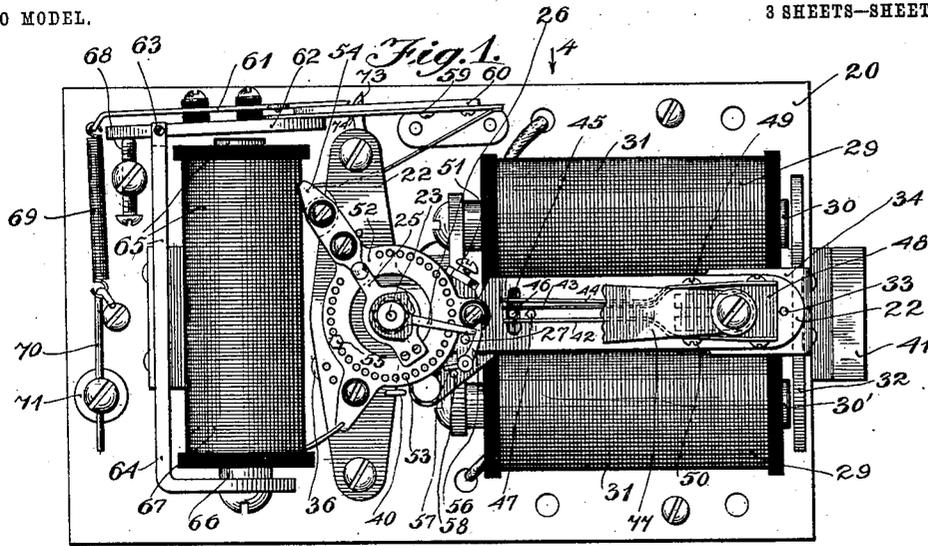


G. BABCOCK.
SELECTIVE SIGNALING SYSTEM.

APPLICATION FILED MAY 18, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.

Fig. 4.

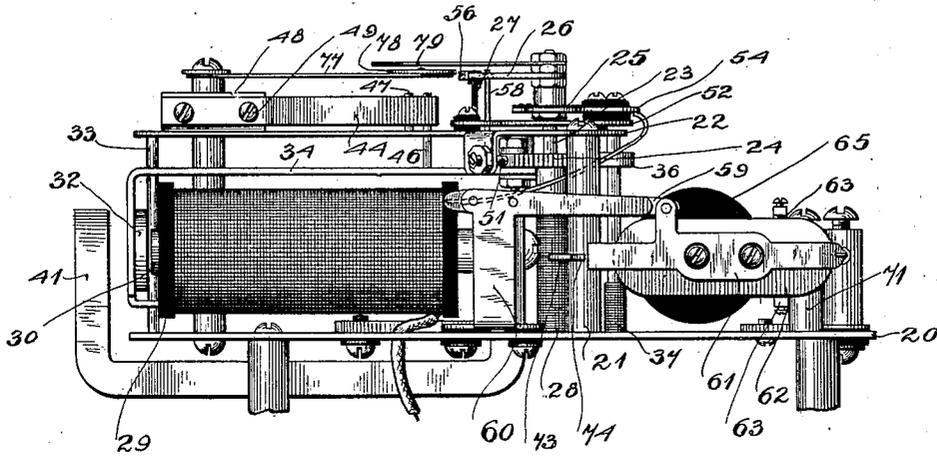
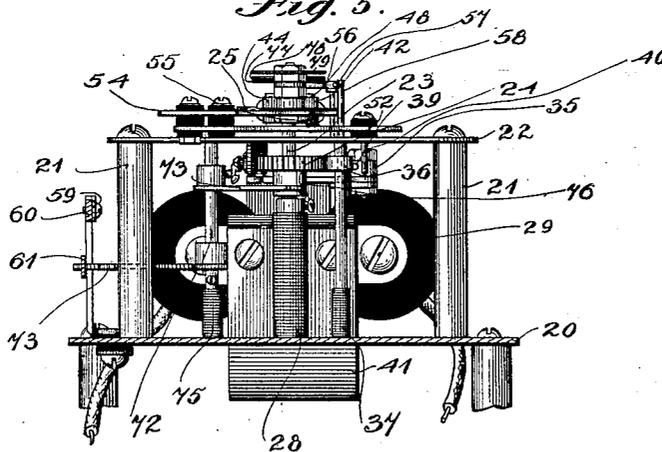


Fig. 5.



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3 SHEETS—SHEET 3.

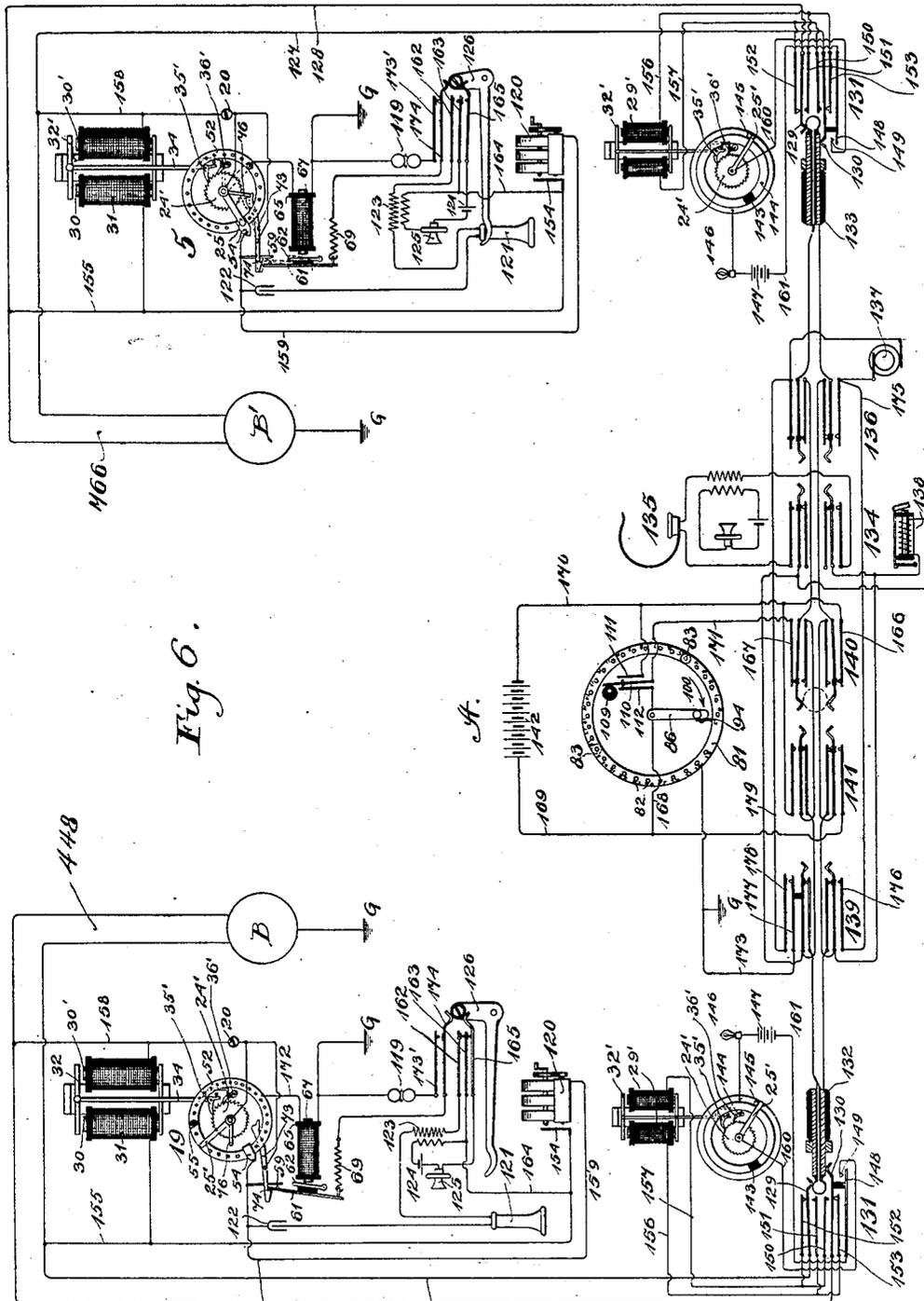


Fig. 6.

WITNESSES
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UNITED STATES PATENT OFFICE.

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SELECTIVE SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 763,351, dated June 28, 1904.

Application filed May 18, 1903. Serial No. 157,633. (No model.)

To all whom it may concern:

Be it known that I, GARRISON BABCOCK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Selective Signaling Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone systems, and more particularly to telephone systems employing multiparty lines—that is, telephone circuits to which a large number of subscribers may be connected, any one of which may be selected for signaling and conversation.

Selective signal multiparty-line systems have heretofore been used with more or less success; but difficulty has been experienced in maintaining such selective apparatus in working order, and as heretofore installed it has often given poor satisfaction because of frequent mistakes in calling the proper subscriber and because of the undue length of time required for operation. Difficulty has also been encountered on account of inductive effects, disagreeable cross-talk, and because a subscriber using the party-line has been subject to interference or listening in by other subscribers on the same line.

The prominent objects of my invention are to provide a multiparty telephone-line system which is positive and reliable in its operation, to provide a system free from cross-talk and inductive effects due to the use of grounded or third-wire circuits, to provide an improved system which shall utilize selective currents of a pulsating character which may be controlled by automatic mechanism at the central station, and to provide a system which cannot readily get out of adjustment and in which in case any of the apparatus does get out of adjustment or synchronism said apparatus may be readily adjusted from the central station by automatic means.

My invention provides a system of what is commonly known as the "step-by-step selective signaling system." It contemplates a

system in which any number of subscribers may be connected in multiple arc on the same metallic telephone-line running to a central station. I have found it desirable, however, not to provide lines for the accommodation of more than thirty or forty subscribers.

In accordance with my invention I equip the substation of each of the subscribers on a line with switching apparatus, the switches associated with the apparatus of all of the substations being adapted to move in synchronism when their controlling electromagnets are energized by a pulsating current controlled from the central station.

I preferably provide a circuit for the current which actuates the switch-controlling electromagnet, which circuit includes two metallic line-limbs and which does not include a common or ground return path to the central station. Automatic mechanism is provided at the central station for the purpose of controlling current impulses sent through the electromagnets controlling the switching apparatus at the various substations connected with the telephone-line, this automatic mechanism being made to operate in synchronism with the switching mechanism at each of the substations controlled thereby. The switch provided at each subscriber's substation is given a step-by-step movement, one step for each current impulse sent through the controlling electromagnets. A contact is provided for each subscriber's switch, located at a point such that when the switch-actuating magnet has received a number of current impulses corresponding to that subscriber's party-line number a switch will be brought into connection with the contact. This contact and the switch-arm form a closed connection for a circuit through a second electromagnet located at the corresponding substation, which second electromagnet controls switching mechanism to connect the telephone apparatus at that substation with the metallic line for conversation.

There is provided at the central station means whereby the movement of the automatic controlling apparatus in synchronism

with the step-by-step switch of the substation apparatus which is being built up may be made to close and complete the circuit through the above-mentioned second electromagnet at the substation at the same instant that the step-by-step switch passes over the contact corresponding with the substation number. Thus an electric circuit is completed through the second electromagnet, whereby the same is energized to cause an actuation of the switching mechanism adapted to connect the corresponding telephone set in bridge of the metallic line-limbs.

I further provide means in accordance with my invention whereby all of the subscribers' switches may be restored to their normal position upon the completion of a conversation over the line.

In connection with the restoring or releasing mechanism means are provided whereby the switching apparatus or the selective apparatus at all of the substations on any one party-line may be set into synchronism and step by automatic means controlled from the central station, whereby the necessity for re-adjusting and maintaining the substation apparatus by the linemen or repairmen is avoided. This is accomplished by providing means within the control of the central operator such that in case any of the switches upon the party-line should get out of synchronism and step the operator can bring all of the switches to one common synchronous position, which position may desirably be that occupied by all the switches when the party-line is not in use.

My invention provides improved features whereby an effective lockout is introduced to prevent the interruption of the use of the line by any one subscriber by another subscriber whose instruments are connected with the same bimetallic party-line.

Other features and objects of my invention will be fully brought out in the following detailed description thereof, in which I have shown but one preferred embodiment.

My invention will be readily understood by reference to the accompanying drawings, in all of which similar characters of reference indicate like parts.

Figure 1 is a plan view of the selective switching apparatus which is installed at each of the party-line substations. Fig. 2 is a side elevation of the same, taken in the direction of the arrow 2 of Fig. 1. Fig. 3 is a plan view with parts removed to more clearly indicate details of construction. Fig. 4 is a side elevation taken in the direction of the arrow 4 of Fig. 1. Fig. 5 is a cross-sectional view taken on line 5-5 of Fig. 3. Fig. 6 is a diagrammatic view illustrating the circuit connections to be used in electrically connecting and operating the devices illustrated in the other figures.

Referring more particularly to Figs. 1 to 5, inclusive, I have illustrated a base-plate 20,

upon which the pillars 21 support the T-shaped frame-piece 22. There is rotatably mounted within the base 20 and frame-piece 22 a shaft 23, which carries a ratchet-wheel 24 below the frame-piece 22 and a spring switch-arm 25 above the frame-piece 22. The shaft 23 also carries a projecting arm 26, which is normally held in engagement with the stop-pin 27, due to the slight tension of a spring 28, coiled about the shaft 23, one end of the spring being fastened to the shaft and the other to the base-plate 20.

There is mounted upon the base-plate 20 an electromagnet 29, having cores 30 30' and coils 31 31. An armature 32 for this electromagnet is provided on the shaft 33. The armature is rigidly connected with the lever-arm 34, which carries near its extremity a pivoted pawl 35, which is held by a concealed spring in engagement with the teeth of the ratchet-wheel 24. A relatively stationary pawl 36 is held by the spring 37 in engagement with the ratchet-wheel 24. A projection 38, secured to the end of the lever 34, serves upon a movement of the lever away from the shaft 23 to disengage the pawl 36 from the teeth of the ratchet-wheel 24. This same movement of the lever 34 away from the ratchet-wheel 24 causes a pin 39, projecting from the pawl 35, to engage a stop-pin 40, carried by the T-shaped frame-piece 22, thereby causing a disengagement of the pawl 35 from the ratchet-wheel 24.

A suitable opening in the base-plate 20 provides for the reception of the permanent magnet 41, which is fastened to the yoke of the electromagnet 29. This permanent magnet serves to polarize the armature 32, whereby the passage of a current through the electromagnet-coils 31 31 in one direction causes the attraction of the armature 32 to the pole-piece of the core 30, while the passage of a current through the electromagnet-coils in the reverse direction causes the attraction of the armature toward the pole-piece of the core 30'. The attraction of the armature toward the pole of the core 30', due to the passage of a suitable current impulse, causes a movement of the lever 34 toward the switch-shaft 23 a sufficient distance to advance the ratchet-wheel 24 one tooth, the pawl 36 dropping into a succeeding tooth of the ratchet-wheel, thereby retaining it in its advanced position, while the pawl 35 may slip back over the advanced tooth to engage the succeeding tooth upon the discontinuance of the passage of the current through the electromagnet-coils.

In order that the armature 32 and the lever 34 normally may be held and retained in the position shown in the figures, the flat springs 42, 43, and 44 are provided. An opening 45 is provided in the T-shaped frame-piece 22, through which opening there projects a pin 46, carried by the lever 34. A pin 47, secured to the frame-piece 22, limits the inward

movement of the springs 42 and 43. A movement of the lever 34 toward the switch-shaft 23 acts against the tension first of the spring 43 and upon the further continued movement against the tension of the spring 44, the two springs being provided in order that the initial movement of the lever 34 and armature 32 shall not be opposed by a too great resisting force or spring tension. The two springs 43 and 44 act in unison to prevent the armature 32 or lever 34 from sticking or catching in their alternate or abnormal position when attracted by the pole of the core 30' and repelled by the pole of the core 30. The pin 47 prevents the springs 43 or 44 from following up the movement of the pin 46 when it moves with the lever away from the switch-shaft 23. The spring 42 serves to restore the lever and its armature to the normal position shown after having been actuated by the attraction toward the pole of the core 30. The pin 47, it will be seen, also serves to retain the armature and the lever carried thereby in exactly the proper normal position when not under the influence of the energization of the electromagnet 29. An attraction of the armature 32 by the pole-piece of the core 30 causes a movement of the lever 34 away from the switch-shaft 23, whereby both the pawls 35 and 36 are disengaged from the teeth of the ratchet-wheel 24, thereby permitting the spring 28 to cause the backward rotation of the shaft 23 and the parts carried thereby until the arm 26 comes into contact with the stop-pin 27, thereby arresting the movement of the switch-carrying mechanism to retain it in its normal position shown in the drawings.

The springs 42, 43, and 44 are mounted upon a carrying-block 48, secured to the T-shaped frame-piece 22, there being provided adjusting-screws 49 and 50 for the purpose of regulating the tension of the springs. An adjusting-screw 51, carried on a downward projection of the frame-piece 22, provides a stop for limiting the movement of the pawl 35 to the space of one tooth of the ratchet-wheel 24. There is mounted upon the T-shaped frame-piece 22 a metal ring 52, this ring being insulated from the frame by suitable washers and bushings of hard rubber, as shown. The periphery of the ring is provided with a series of screw-threaded holes 53, the pitch of these holes corresponding with the pitch of the teeth of the ratchet-wheel 24. There is mounted upon a suitable projection of the ring 52 an insulated contact-piece 54. Within any of the screw-threaded holes 53 53 there may be screwed a contact-point 55. Thus in Figs. 1 to 5, inclusive, a contact-point 55 is shown in the seventh hole 53 of the ring 52. The pitch of the holes 53 and that of the teeth of the ratchet-wheel 24 being equal, it will be apparent that each step of the step-by-step rotation of the switch-arm 25 is equal to the arc distance between the successive holes 53. The

normal position of the switch-arm 25 is, as shown in the figures, in contact with the insulated contact-piece 54. The first step of the movement of the switch-arm is desirably sufficient to remove the switch-arm from its contact with the contact-piece 54 and to bring the switch-arm half-way to the first hole 53 of the ring 52. The second step brings the switch-arm directly above the first hole 53. The next succeeding step brings the switch-arm above the second hole, and so on. Thus it will be seen that eight current impulses through the electromagnet-coils 31 31 in the proper direction will cause eight steps of the switch-arm 25 to bring it in contact with the contact-screw 55. Similarly a proper number of current impulses through the electromagnet-coils will bring the switch-arm 25 into contact with a contact-screw 55, placed in any of the holes 53. The number of holes in the ring 52 is desirably made as great as the greatest number of substations which it will be desired at any time to connect with the single party-line, each substation connected with one party-line having a contact-screw 55 in some one of the holes 53 of the ring 52, the contact-screw for each substation being placed in a different hole from that of any other of the substations on the same line.

As will hereinafter be more fully explained, the switch-arm 25 is during each selecting operation stepped around above the ring 52 a number of steps as least as great as the number of telephone-substations connected with the party-line plus two. Upon the completion of the conversation with a telephone subscriber it is necessary to restore the selecting apparatus to its normal condition, in which the switch-arm 25 makes contact with the contact-piece 54. In order to cause this restoration, a current impulse is sent through the coils of the electromagnet 29 in such a direction that the armature 32 is attracted toward the pole of the core 30, whereby the lever 34 is given a movement away from the shaft 23. This disengages both of the pawls 35 and 36 from the ratchet-wheel 24, whereupon the spring 28 causes a backward rotation of the shaft 23 and the parts carried thereby until the arm 26 engages the pin 27.

In order that the shaft 23 and the rotating parts carried thereby may not rebound upon striking the pin 27 and during such rebound be stopped by the reengagement of the pawl 35 or 36, thereby leaving the switch-arm 25 out of electrical contact and connection with the contact-piece 54, I provide a pivoted detent 56, which is raised upon the backward movement of the arm 26, but which drops into position, as shown, to catch the arm 26, and thus prevent its forward rebound. The arm 26 is thus locked between the pin 27 and the catch of the detent 56. In order that the detent may be raised to permit a forward movement of the arm 26 upon the attraction

of the armature 32 toward the pole of the core 30', there is provided upon the detent 56 a projecting pin 57, adapted to be engaged by a stud 58, carried on the lever 34. An engagement of the pin 57 by the stud 58 upon the movement of the lever 34 toward the shaft 23 causes the detent 56 to rise, thereby disengaging the arm 26 to permit its forward movement, as hereinbefore described.

In order to connect the subscribers' telephone instruments in bridge of the metallic line-limbs, there is provided a telephone-connecting switch, comprising a spring-contact 59, carried upon an insulated support 60, and an insulated switch-arm 61, mounted upon the armature 62, which is pivotally mounted at 63 to the L-shaped iron yoke 64 of the electromagnet 65, whose core 66 carries the winding 67. An adjustable stop 68 serves to limit the retraction of the armature 62 from the pole of the core 66, due to the tension of the retracting-spring 69, the tension of this spring being adjustable by means of the rod 70 and its supporting-pillar 71. The electrical connection with the switch-arm 61, which will hereinafter be more fully explained, is desirably made through the supporting-pillar 71 and the spring 69, the pillar 71 being for this purpose insulated from the metal base 20.

There is mounted upon a suitable shaft 72 a detent-lever 73, having a catch 74 to engage the end of the switch-arm 61 to retain the switch-arm in its forward or attracted position after having been brought into this forward position by an energization of the electromagnet 65 and the consequent attraction of the armature 62. The shaft 72 is for this purpose provided with a spring 75, which tends to force the catch 74 into engagement with the end of the switch-arm 61. As will hereinafter more fully appear, it is desirable that at the time of releasing the switch-arm 25 of the selective apparatus to restore the same to its normal position in connection with the contact-piece 54 the telephone contact switch-arm 61 be released to break the contact which may have been made with the spring-contact 59.

There is provided upon the hub of the ratchet-wheel 24 a projection 76 in the nature of a cam-surface, this projection serving when in its normal position, with the switch-arm 25 in connection with the contact-piece 54, to engage the inner end of the lever 73 to trip the catch 74, thereby releasing the switch-arm 61, which may have been detained thereby. The first forward step of the ratchet-wheel 24 permits a disengagement of the inner end of the lever 73 by the projection or cam 76, whereupon the spring 75 gives the lever 73 a downward movement such that the catch 74 will be in position to engage and detain the switch-arm 61 upon its forward movement due to the attraction of the armature 62.

While it does not in any manner form an essential part of my invention, I have illustrated a subscriber's busy signal, which shall indicate to a subscriber whether or not the party-line with which his substation is connected is in use. There is supported by an arm 77, connected with one of the pillars 21, a colored disk 78, this disk being normally covered, and thereby protected from view by a shutter 79, mounted upon the upper end of the shaft 23. It will be seen that a forward movement of the shaft 23 carries the shutter 79 in a forward direction, whereupon the disk 78 is exposed to view, thereby indicating that the party-line is in use.

A release and restoration of the switch-arm 25 to its normal position returns the shutter 79 to its position above the disk 78.

While the precise method of operating the hereinbefore-described instruments will hereinafter more fully appear, it may be desirable to here state that the selective apparatus at the substations is adapted to be actuated in selecting and connecting the desired substation with the party-line by means of suitable current impulses in one direction through the coils of the electromagnet 29. The restoration of the apparatus to its normal condition is accomplished by the passage of a current impulse through the electromagnets 29 in a reverse direction. The operation of the telephone-connecting switch to connect the subscriber's telephone set in bridge of the metallic line-limbs is accomplished by sending at the proper instant a current impulse through the electromagnet 65.

In addition to the usual central-station apparatus required for the operation of a telephone system there is desirably provided at the central station automatic means for controlling and directing the current impulses sent out over a party-line for the purpose of operating the selective apparatus, as shown in Fig. 6.

I have diagrammatically illustrated what I may term an "automatic" selector, an insulated metal ring 81 being provided with a series of holes 82 82, within any of which may be inserted selector-pins 83 83. The crank 86 is provided with a switch-arm 94, whose position is such that a movement of a crank past a hole 82 into which one of the pins 83 has been inserted causes a rubbing contact between the end of the arm 94 and the pin 83, thereby causing an electrical connection between the insulated ring 81 and the crank-arm 86. Mechanism (not shown) connects the crank-arm with a cam 109, which upon rotation causes alternate contact of the contact-spring 110 with the contact-springs 111 and 112. To start the selector, the crank-arm is moved by the operator to the beginning of its stroke in the direction of the arrow, and upon release of the arm spring mechanism (not shown) serves to return the crank-arm, the cam 109 causing

alternate contact of the contact-springs upon the return of the arm.

In Fig. 6 I have diagrammatically illustrated the method of electrically connecting the here-
 5 in-before-described apparatus and the other devices well known to those skilled in the art and commonly employed in the operation of telephone systems.

I have illustrated a central station A, from
 10 which the bimetallic telephone-lines 448 and 766 extend each to a series of substations connected therewith. While the number of substations connected with these lines may be indefinite, I have illustrated in detail the appa-
 15 ratus for but one substation connected with each line, the circles B and B' indicating that other substations may be similarly connected with the telephone-lines. The substation connected with line 448 and whose apparatus is
 20 diagrammatically illustrated in detail may be station No. 19. The apparatus shown in detail connected with line 766 may be that at substation No. 5. There are provided at each of the substations a signal-bell 119 and a gen-
 25 erator 120, adapted to supply an intermittent or pulsating direct current of one polarity, and a receiver 121, adapted to be connected in circuit only through the condenser 122, the circuit through the receiver including
 30 the secondary of an induction-coil 123, whose primary is connected through the local battery 124 and a transmitter 125. The hook-switch 126 is provided for the accommodation of the receiver 121 when not in use, there being
 35 associated with the hook-switch certain switch-contacts, which will hereinafter be more fully described. The line-limbs 127 and 128 lead from the substation to the central station, where they are connected one with the
 40 tip-spring 129 and the other with the sleeve-spring 130 of a line-jack 131, the jack-springs being adapted for connection with the tip and sleeve contacts of an answering-plug 132 or a
 45 calling-plug 133 of an operator's suitable cord-connecting apparatus.

There are associated with the tip and sleeve springs of the jack 130 other contact-springs, whose purpose will hereinafter more fully appear.

50 Under normal conditions such as are shown in the drawings there is a continuous circuit through the tip-strand leading between the tip-contact of the answering and calling plugs and a continuous sleeve-strand between the
 55 sleeve-contacts of these plugs. The usual operator's ringing and listening keys are provided, the listening-key 134 serving to connect the operator's telephone set 135 in bridge of the cord-strands. The ringing-key 136
 60 serves to connect the ringing-generator 137 with the cord-strands leading to the calling-plug 133. This common ringing-key 136 is employed only when the calling-plug is inserted within the jack of a bimetallic circuit
 65 in which the ringing-current traverses the

two metallic line limbs. It is provided for the reason that it is frequently desirable to connect a party-line subscriber with a subscriber who has an individual line. This key
 70 136 performs no useful function and is not operated in any way when subscribers on two party-lines are connected one with the other, as will hereinafter be more particularly described. The clearing-out drop 138 may be
 75 connected in bridge of the cord-circuit, as shown. The cord-circuit is provided in addition to the usual listening-key and the common ringing-key with a selective ringing-key 139, which connects one terminal of the gener-
 80 ator 137 with the sleeve-strand of the cord-circuit and the other terminal of the generator 137 with the ground G. The calling-key 140 connects the automatic selector with the cord-strands leading to the calling-plug. The releasing-key 141 serves to connect the oper-
 85 ating-battery with the cord-strands leading to the calling-plug for the purpose of releasing and restoring the selective apparatus at the substations connected with a line to their normal condition. There is provided at the cen-
 90 tral station a battery or other source of current 142, adapted to supply current for the purpose of operating the selective apparatus. There is provided at the central station for each of the party-lines what may be called a
 95 "dummy" subscriber's selective device, this selective device comprising step-by-step switching mechanism, which is identical with that hereinbefore described as installed at each
 100 of the subscriber's substations, the switch-arm 25' of the dummy set, however, normally resting on a hard-rubber insulator 143. When stepped forward from the normal position, the switch-arm makes contact with a continuous
 105 metal ring 144. The forward movement of the switch-arm 25' may be limited by a stop-pin 145. The line signal-lamp 146 and a serially-connected battery 147 includes in its circuit the ring 144, the switch-arm 25', and con-
 110 tacts 148 and 149, associated with the spring-jack 131, these contacts being normally in connection one with the other when the cord-connecting plug is not inserted within the jack. The insertion of a plug within the jack
 115 causes a break in the circuit between the contacts 148 and 149. The electromagnet 29' of the dummy selective apparatus at the central station is normally connected, by means of contact-springs 150 and 151, with the jack-
 120 springs connected with the line-limbs 127 and 128. An insertion of a cord-connecting plug with the jack 131 causes a connection with the contact-springs 152 and 153, whereby the connection of the electromagnet with the line-
 125 limbs is reversed. The normal connection of the electromagnet 29' of the dummy selective apparatus at the central station with the telephone-line limbs is in such a direction with respect to the polarization of the dummy ar-
 130 mature that a current impulse over the line-

limbs adapted to cause a forward movement of the substation switch-arms causes a backward or releasing movement of the dummy switch-arm, and vice versa.

5 The operation of a telephone system in accordance with my invention may be described as follows: The selective apparatus at the substations connected with line 448 being in their normal position, as illustrated in Figs. 10 1 and 5, inclusive, the subscriber at station No. 19 on line 448, for instance, desiring a connection examines the target busy-signal to ascertain if the line is not in use by other subscribers. He then manipulates his ring- 15 ing-generator 120, this generator producing an intermittent or pulsating direct current in which the pulsations are all in one direction as distinguished from the well-known alternating generators in which the impulses are 20 first in one direction and then in the reverse direction. He then removes his telephone from its switch-hook. The generator 120 is provided with a contact-switch 154, which makes a connection with the armature-winding only when the generator is being operated by means of the hand-crank provided. 25 The plug 132 is normally not in the jack 131, as shown. A current therefore may be traced from the generator 120 through the following 30 circuit: from the switch 154, through the conductor 155, to the line-limb 128, the tip-spring 129, the contact 151, the conductor 156, the coils of the electromagnet 29' of the dummy instrument at the central station, to 35 the conductor 157, contact-spring 150, sleeve-spring 130, line-limb 127, conductor 158, to the frame 20 of the selective instrument at substation No. 19, through the frame 20 to the switch-arm 25, the contact-piece 54, and 40 through conductor 159 to the other terminal of the generator 120. It will be noted that the coils 31 of the electromagnets 29 at all of the substations connected with line 448 are connected in bridge of the metallic line- 45 limbs, the coils 31 at substation No. 19 being connected by way of the conductors 155 and 158. The polarization of the armatures 32 of the selective apparatus at all the substations is in the same direction, and the di- 50 rection of the current impulses generated by the generator 120 is such as to cause an attraction of the armatures 32 toward the poles of the cores 30 of the electromagnets 29. The consequent movement of the levers 34, if there 55 be any movement thereof, is in such a direction as to release the ratchet-wheel and cause a restoration of the switch 25 to its normal position. This effect, however, is merely incidental, as when the apparatus is properly 60 operated all of the switches 25 will be normally in connection with their associated contact-pieces 54, whereupon no releasing or restoration of the switches is necessary at the time of signaling by means of the generator 65 120, located at any of the substations. The

polarization of the dummy instrument at the central station and its direction of normal connection with the line-limbs 127 and 128 is such that the current from the generator 120, which 70 tends to release and restore the selective apparatus at the substations, will cause a forward movement of the switch-arm 25' of this dummy instrument. The number of forward impulses 75 given the switch-arm 25' is immaterial so long as there be sufficient impulses (one or more) to remove the switch-arm from the insulating-block 143. Upon this forward movement of 80 the switch-arm 25' the following circuit through the lamp 146 may be traced: from the battery 147, through the lamp 146, to the metal ring 144, the switch-arm 25', the conductor 160, the contact 149, the spring 148, which before the insertion of the plug of the cord-connecting apparatus within the jack is 85 in electrical contact with the contact 149, thence through the conductor 161 to the other terminal of the battery 147. The line signal-lamp 146 is thereupon caused to glow, thus giving the operator a visual signal to indicate 90 that a subscriber on line 448 desires a telephonic connection with some other subscriber. The dummy selective instrument placed at the central station thus serves the purpose of the line-relay, which is commonly employed 95 to control the illumination of a line signal-lamp. The operator answers the signal produced by the illumination of the lamp 146 by inserting the calling-plug 133 within the answering-jack 131. The insertion of the plug 100 within the jack 131 causes a break in the contact between the contacts 148 and 149, thus interrupting the circuit through the lamp 146, whereupon the lamp is extinguished, indicating that the signal has been answered by the 105 operator. At the same time the insertion of the plug within the jack 131 changes the direction of connection of the electromagnets 29' with the line-limbs 127 and 128, whereupon the movements of the armature 32' of the dummy instrument at the central station 110 are made to correspond with the movements of the armatures 32 of the selective apparatus connected in bridge of the corresponding line. The operator thereupon manipulates 115 her listening-key 134 to connect her telephone set in bridge of the cord-strands connected with the line-limbs 127 and 128, whereupon she may converse with the subscriber at substation No. 19 on line 448 over the follow- 120 ing circuit: from the condenser 122 at the subscriber's substation, through the receiver 121, the secondary winding of the induction-coil 123, the closed contact-springs 162 and 163 associated with the switch-hook 126, the conductor 164, the conductor 155, the line-limb 128, 125 tip-spring 129, the tip-strand of the cord-circuit leading to the tip-contact of plug 133, the operator's telephone set, the sleeve-strand of the cord-circuit leading to the sleeve-contact of plug 133, the sleeve-spring 130, line-limb 130

127, conductor 158, frame 20, switch-arm 25, contact 54, and condenser 122. The subscriber may impress voice-currents upon this circuit through the condenser 122 by means of a local circuit through the transmitter and primary of the induction-coil 123, this local circuit including the spring 165 associated with the switch-hook 126 and the local battery 124. The operator at the central station learns from the calling subscriber, first, the party-number of his own substation, (in this case No. 19,) and, secondly, the number of the substation with which the calling subscriber desires connection. Supposing the called substation to be No. 5, the operator first inserts a pin in hole No. 19 of the ring 81 of the automatic selector at the central station. She then turns the crank 86 in the direction indicated by arrow 100 to the beginning of its stroke. This movement of the crank 86 will release the mechanism of the automatic selector to be free to operate, due to the tension of the spring, (not shown,) thus returning the crank 86 to its normal position, (which in the present case may be supposed to be in the neighborhood of the hole 22.) The revolution of the cam 109 causes the intermediate contact-spring 110 to make contact first with the spring 112 and thereafter alternately with springs 111 and 112. Before releasing the crank 86 the operator manipulates her calling-key 140, thereupon breaking the cord-circuit connection with the plug 132 and connecting the strands of the cord-circuit leading to plug 133 with contact-springs 166 and 167. During the first quarter-revolution of the cam 109 the springs 110 and 112 are brought into contact with each other, whereupon the following circuit may be traced: from the spring 112, through the conductors 168 and 169, the battery 142, the conductor 170, the contact-spring 166, the sleeve-strand of the cord-circuit leading to the sleeve-contact of plug 133, the sleeve-spring of the jack 131, within which this plug has been inserted, the line-limb 127, conductor 158, electromagnet-coils 31 of all the selective apparatus connected in bridge of the line 448, conductor 155, line-limb 128, tip-spring 129, the tip-strand of the cord-circuit, contact-spring 167, conductor 171, to contact-spring 110. The current-flow through this circuit is in such a direction that the armatures 32 of all the selective apparatus are attracted toward the cores 30', thereby advancing the switch-arms 25 of all the selective apparatus associated with line 448 through one step. The cessation of the flow of current through this circuit, due to its interruption on account of the break in the contact between springs 110 and 112, permits the armatures 32 and associated levers 34 to resume their intermediate position, due to the tension of the springs 42 and 43. Upon the continued revolution of the cam 109 connection is made between the springs 110 and 111, this connection serving to short-circuit the cord-strands leading to the plug 133, whose contacts are connected with the line-limbs 127 and 128. This cycle of connections is repeated for each revolution of the cam 129. Each time there is an electrical connection made between the springs 110 and 112 a current impulse is sent over the line and through the electromagnets 29 of the selective apparatus in such a direction as to cause for each impulse one forward step of the switch-arms 25 at all of the substations connected with the party-line which is being set up for conversation. Each time there is an electrical connection made between the springs 110 and 111 the two metallic line-limbs are short-circuited at the central station. The purpose of this short-circuit connection between the metallic line-limbs between succeeding current impulses through the electromagnets of the selective apparatus is for the purpose of discharging any static charge to which the line may have been subjected during the preceding current impulse. I have found that this means for preventing static accumulations of electricity in the metallic line-limbs is of great advantage in preventing the false operation of the selective or signaling apparatus. Since there is one revolution of the cam 109 for each hole 82 passed by the plunger-connecting switch of the crank 86, there will be in the present instance twenty-three current impulses sent over the metallic line-limbs. The first of these impulses desirably brings all of the switch-arms 25 to their first position in advance of the contact-pieces 54, there desirably being provided for this position no hole 53 in the ring 52. Each succeeding impulse brings the switch-arms 25 above succeeding holes in the ring 52. Substation No. 19 on line 448 is provided with a contact-point 55 in hole 19 in the ring 52. Thus after twenty forward impulses of the switch-arm 25, due to the passage of twenty current impulses through the electromagnets 29, the switch-arms 25 at all of the substations will have been brought to a position above the holes No. 19 in the rings 52. Each substation having its contact-point 55 inserted in a different hole of the ring 52 there will be but one substation (No. 19) which has its contact-point 55 inserted in hole No. 19. Thus upon reaching this point the switch-arm 25 at substation No. 19 will make an electrical connection between the frame 20 and the insulated metal ring 52. Before reaching its position above the hole No. 19 the switch-arm 25 will have successively made contact with a contact-point 55, inserted in a preceding hole at some one of the other substations connected with line 448; but at the time of the closing of the circuit between the frame 20 and the ring 52 at substation No. 19 there will be no similar circuit through any other of the substations connected with the same line. It will be re-

membered that a pin has been inserted by the operator within hole No. 19 in the ring 81 of the automatic selector at the central station. Thus the switch-arm 94 upon reaching the hole No. 19 in the ring 81 will, in connection with the switch-arm 25, close the following circuit through the electromagnet 65: from the battery 142, through conductor 170, contact-spring 166, the sleeve-strand of the cord-circuit leading to the sleeve-contact of the plug 133, sleeve-spring 130 of the jack associated with line 448, line-limb 127, conductor 158, frame 20, switch-arm 25, contact-point 55, ring 52, through conductor 172, connected with the insulated ring 52, electromagnet-coil 67, ground G, through the ground to the grounded conductor 173 at the central station, ring 81, the pin inserted in hole No. 19, the switch-arm 94, the crank 86, conductors 168 and 169, back to the other side of the battery 142. The current-flow through this circuit causes the attraction of the armature 62, thereby causing a movement of the switch-arm 61 to make connection with the spring-contact 59, the catch 74 of the detent-lever 73 springing into position to catch and retain the telephone-connecting switch-arm 61 in connection with the contact 59. It will be remembered that the movement of the lever 73 to catch the switch-arm 61 will now be possible, as the cam projection 76 will be prevented from interfering on account of its rotation away from the normal position due to the advancement of the ratchet-wheel 24, with which it is associated. It will be seen that the controlling-circuit through the electromagnet-coil 67 is jointly controlled by a connection through the switch-arm 25 and a connection through the switch-arm 94 of the automatic selector at the central station. A completed circuit through the electromagnet-coil 67 can occur only when the switch-arm 25 makes connection with the contact-point 55 and when at the same time the switch-arm 94 makes connection with a pin 83, inserted in one of the holes 82 of the ring 81 of the automatic selector. Thus while the switch-arms 25 will have successively made contact with the contact-points 55, inserted in one of the holes at each of the substations connected with the line which is being set up, there will at the same time have been no connection afforded through the crank 86 and the switch-arm 94, for the reason that there will have been no pin inserted in any of the holes of the ring 81, corresponding with these other positions assumed by the switch-arms 25 of the selective apparatus at the substations. Thus while the crank of the automatic selector returns from its initial position to its normal position there will have been a circuit closed through but one electromagnet 65, whereupon the telephone-connecting switch-arm 61 at but a single substation (substation No. 19) will have been actuated and detained by the catch 74. The switch-arms 25 at all

of the substations will have been removed during this operation from their normal position in connection with the contact-pieces 54 to a position in the neighborhood of the hole 22, it being assumed that there are not more than twenty-one stations connected with the party-line. It will be remembered that the circuit through which the subscriber signaled the central operator by an actuation of a generator 120 included a connection between the contact-piece 54 and the switch-arm 25. This connection having been broken, it is apparent that no substation is in a condition whereby the actuation of the generator 120 may signal the central station or effect the release of the selective apparatus at the substations connected with the same line. In the same manner the circuit which was traced through the telephone instruments of the calling-substation in notifying the central operator of the connection desired included a connection between the contact-piece 54 and the switch-arm 25. This circuit having been broken, as hereinbefore described, there is no means by which the other substations connected with the same line may obtain telephonic communication either with the central operator or with each other. Thus there is provided a simple, efficient, and very effective lock-out, by reason of which the use of the telephone party-line by any one subscriber cannot be interfered with by any other subscriber connected with the same party-line.

The telephone-circuit for substation No. 19 may now be traced, as follows: from the sleeve-spring 130 of the line-jack 131, through line-limb 127, conductor 158, frame 20, detent-lever 73, switch-arm 61, contact 59, condenser 122, telephone-receiver 121, the secondary of the induction-coil 123, contact-spring 162, contact-spring 163, conductor 164, conductor 155, and line-limb 128, to the tip-spring 129 of the line-jack at the central station. The operator after having thus connected the telephone set of substation No. 19 of line 448 with the metallic line-limbs and having locked out all the other subscribers connected with the same line thereupon removes the plug 133 from the jack 131 and inserts the answering-plug proper, 132, within this jack and removes pin 83 from hole No. 19 of ring 81. Connection being desired with substation No. 5 on line 766, the operator inserts her calling-plug 133 in the line-jack 131 of this line 766. She inserts a pin 83 within hole No. 5 of the ring 81. The calling-key 140 is then manipulated, thus breaking the connection to that part of the cord-strands leading to the answering-plug and connecting the springs 166 and 167, which are the terminal springs of the automatic selector, with the part of the cord-strands leading to the contacts of plug 133. As has already been described in connection with substation No. 19 of line 448, the current impulses sent out from the automatic

selector upon the return of the crank 86 from its initial to its normal position cause a step-by-step advancement of the switch-arms 25 of all the selective apparatus connected with line 5 766 and of the switch-arm 25 of the dummy instrument associated with line 766 at the central station. The switch-arm 25 at substation No. 5 on line 766 in passing the contact 55 in the ring 52 causes, in connection with the 10 switch-arm 94 at the central station, the closure of a circuit from the battery 142 through the electromagnet 65, whereupon the telephone-connecting switch-arm 61 is attracted into the position indicated in dotted lines. As in the 15 case of the substations connected with line 448 the other substations connected with line 766 will have been locked out by this setting-up operation, whereupon the telephone set at substation No. 5 will alone have been connected in bridge of the line-limbs 127 and 128, for the reason that a pin 83 has been inserted in but the single hole No. 5 of the ring 81. The line signal-lamp 146, associated with the 20 called line, will not glow upon the forward movement of the switch-arm 25' of the dummy instrument, for the reason that the lamp-circuit through contacts 148 and 149 will have been broken by the insertion of the plug 133. After having thus caused the actuation of the 25 telephone-connecting switch-arm 61 to connect the subscriber's telephone set in bridge of the line-limbs the operator manipulates her selective ringing-key 139, whereby the ringing-generator 137 is connected in circuit through the bell 119 at substation No. 5 on line 766 30 through the following circuit: from one terminal of the generator 137, through conductor 175, to contact-spring 176, to the sleeve strand of the cord-circuit leading to the sleeve-contact of plug 133, through sleeve-spring 130 of the line-jack, line-limb 127 of line 766, conductor 158, frame 20, lever 73, switch-arm 61, spring 69, contact-spring 174, contact-spring 173', through the bell 119, the ground 35 connection G at substation No. 5, through the ground to the ground connection G at the central station, through conductor 173 to contact-spring 177, to contact-spring 178, and through conductor 179 to the other terminal 40 of the generator 137. The alternating or intermittent current traversing this circuit causes an actuation of the signal-bell 119, whereupon the subscriber at substation No. 5 is signaled. The subscriber upon answering 45 the signal removes his telephone-receiver 121 from the switch-hook 126, thereupon interrupting the normally closed circuit at the substation through the signal-bell 119 and serving to complete the connection by way of contact-springs 162, 163, and 165 50 through the subscriber's telephone set, as hereinbefore described for substation No. 19 on line 448. The desired subscribers now having their telephones respectively connected 65 in circuit, the operator restores her calling-

key 140 to its normal condition, thereby closing a continuous circuit through the cord strands to connect the subscriber at substation No. 19 on line 448 with substation No. 5 on line 766 for conversation. Upon the completion 70 of the conversation by the subscribers either one or both replaces his receiver upon the switch-hook 126, thereby opening the local circuit through the transmitter, opening the telephone-circuit through the receiver 121 and 75 secondary of the induction-coil 123, and closing a connection through the signal-bell 119 between the ground and the line-limb 127, this circuit being traced as follows: from the ground G, through signal-bell 119, contact-spring 173', contact-spring 174, spring 69, 80 switch-arm 61, lever 73, frame 20, to line 127, this circuit being subsequently broken. Either subscriber may notify the operator at the central station of the desired disconnection by a 85 slight rotation of the armature of the generator 120. The generator of each of the subscribers who have been connected for conversation may be connected in bridge of the telephone-line limbs. 90

A disconnect signaling-current may be traced from the generator at substation No. 19 on line 448, as follows: from the contact 154, through conductor 155, line-limb 128, tip-spring 129, tip-strand of the cord-circuit, 95 through the disconnect-drop 138, connected in bridge of the cord-strands, the sleeve-strand leading to the sleeve of the plug 132, the sleeve-spring 130, the line-limb 127, frame 20, lever 73, switch-arm 61, contact 59, conductor 100 159, to the other terminal of the generator 120. The current-flow over this circuit causes an actuation of the supervisory drop 138, thereby notifying the operator that the connected lines may be restored to their normal condition and interconnection between the lines removed. It will be remembered that the connection of the generator 120 with the line-limbs is in such a direction that the current impulses from this generator will tend to release 105 and restore the selecting apparatus at the various substations connected with the same line. As I may not wish to rely, however, upon this method for restoring the selective apparatus at the various substations to its normal condition, I provide at the central station a special 115 releasing-key 141, a manipulation of which causes a disconnection with the cord-strands leading to the answering-plug 132 and serves to connect the battery 142 across the cord-strands leading through the plug 133 to the line-limbs of line 766. It will be seen that the connection of the battery 142 with the telephone-line is upon the manipulation of the releasing-key 141 in a direction the reverse of 125 that established by a manipulation of the calling-key 140 and the automatic selector. Thus while the actuation of the calling-key and the automatic selector caused current impulses to be sent out over the line in such a direction 130

as to cause a forward step-by-step movement of the switch-arms 25 the manipulation of the releasing or restoring key 141 causes a connection in the reverse direction with the line-limbs, whereupon the armatures 32 of the selective apparatus at the various substations connected with a line which is being restored are attracted toward the cores 30 of their electromagnets 29, whereupon their levers 34 are actuated to disengage the pawls 35 and 36 from the ratchet-wheels 24, whereupon the springs 28 cause a restoration of the switch-arms 25 to their normal position in connection with the contact-pieces 54. In the same manner the switch-arm 25' of the dummy instrument at the central station connected with line 766 is restored to its normal position above the hard-rubber insulator 143. The operator thereupon removes the plug 133 from the jack connected with line 766 and also removes the plug 132 from the line associated with the line 448. In order to restore the selective apparatus connected with line 448 to its normal position, the operator then inserts the calling-plug 133 within the line-jack associated with this line and manipulates her releasing-key 141 to connect the terminals of the battery 142 across the line-limbs 127 and 128 of line 448, whereupon the flow of current through the associated electromagnets 29 causes the attraction of the armatures 32 toward the cores 30, thereby disengaging the pawls 35 and 36 from the ratchet-wheels 24 to permit the restoration of the switch-arms 25 to their normal position in connection with the contact-pieces 54. The removal of the calling-plug 133 from the line-jack associated with line 448 completes the operation, whereupon the connected lines are in connection either to transmit a calling-signal to the central station or to be set up for the purpose of signaling and telephonically connecting any of the substations on the line.

One of the provisions of my invention is a positive signal to notify the operator in case of her failure to restore a line to its normal condition before removing the plug of her cord connecting apparatus from the line-jack.

It will be remembered that upon setting up a line for conversation and lockout purposes the switch-arm 25' of the dummy instrument at the central station is stepped around to make electrical connection with the metal ring 144. The proper restoration of the line to its normal condition causes the restoration of the switch-arm 25' to its position in connection with the insulated block 143, whereupon the removal of the plug from the jack cannot cause the illumination of the lamp 146; but in case the plug is removed from the jack without first having restored the switch 25' to its normal position in connection with the insulating-block 143 there will upon the removal of the plug from the jack be a closed circuit through the lamp 146, this circuit being traced through

the connection between the ring 144 and the switch-arm 25' and through the connection between the contacts 148 and 149. The illumination of this lamp 146 upon the removal of a plug from the associated jack gives the operator a positive signal to indicate that she has not previously restored the line to its normal condition. Upon noting the illumination of the lamp 146, therefore, the operator again inserts her calling-plug 133 and manipulates her releasing-key 141 to restore the selective apparatus to its normal condition.

If, as may frequently happen, a connection is desired between a substation on any one party-line with another substation on the same party-line, the operator upon ascertaining by telephonic communication with the calling subscriber the number of the substation with which he desires connection inserts two pins within the ring 81 of the automatic selector. One of the pins corresponds in the number of the hole within which it is inserted with the party-number of the calling-substation and the other pin corresponds in the number of the hole within which it is inserted with the party-number of the called substation. The calling-plug 133 of her cord-connecting apparatus being inserted in the line-jack 131, associated with the given party-line, the operator manipulates her calling-key 140 and thereupon rotates the crank 86 of the automatic selector to its initial position. Upon releasing the crank 86 current impulses are sent out over the given party-line, there being a circuit established through the electromagnet 65 of the calling-substation as the switch-arm 94 makes electrical connection with the pin 83, inserted in the corresponding hole of the ring 81, and there being a circuit established through the electromagnet 65 at the called substation as the switch-arm 94 passes the pin inserted in the hole corresponding in number with the number of the called party. Thus the energization of the electromagnets 65 at both the calling and called substations will cause an actuation of the telephone-connecting switch-arms 61 to connect the telephone instruments at both the calling and the called substations in bridge of the same bimetallic party-line.

As in the case of the setting-up operation hereinbefore more particularly described, all the other substations on the same party-line will have been locked out by the removal of their switches 25 from the normal contact-pieces 54, whereupon the conversation between the proper calling and called subscribers may not be interfered with by other subscribers connected on the same line. In the same manner the central operator may connect at the same time any number or, indeed, all of the telephone sets at all of the substations on any one line in bridge of the bimetallic line-limbs. Thus the central operator may communicate simultaneously with all of the

subscribers on any one line, or any one subscriber may simultaneously talk to all the other subscribers connected on the same line.

If for any reason the actuation of the releasing-key 141 has failed to properly restore some one or any of the switches 25 to their proper normal position, the subsequent actuation of a generator 120 in attempting to signal the central operator will cause an impulse to flow through the electromagnets 29 to cause a restoration of the associated switches 25 to their normal position before the succeeding setting-up operation will have been begun by the central operator.

If for any reason the switch 25 at some one substation shall have gotten out of synchronism or step with the switches 25 at all the other substations on the same party-line, no serious difficulty can ensue, and the proper operation of the line will not be affected, except that it may happen that two subscribers will be signaled when it was intended that only one subscriber should be signaled, and, furthermore, each time the party-line is restored to its normal condition by an actuation of the releasing-key 141 or by an operation of the generator 120 the switches 25 at all of the substations will be returned to their normal positions in electrical connection with the contact-pieces 54. This feature of my invention is a great improvement over selective party-line systems heretofore proposed in which it has been necessary to send a lineman or repairman from the central station to some or all of the substations to set the step-by-step mechanism properly in synchronism, if for any reason, due to defective operation, the exact and proper step-by-step and synchronous relation between the step-by-step mechanisms at the various substations shall have been interfered with.

It will be seen that my invention provides means whereby the central operator may by a single or by repeated manipulations of her releasing-key 141 establish the proper synchronous and in-step relation of the selective apparatus in case this relation should for any reason be interfered with.

For purposes of simplicity in explanation I have herewith illustrated and described a form of cord connecting apparatus more particularly designed for use in answering calls coming in over single lines and for calling and signaling substations connected with party-lines such as herein described.

By means well understood by those skilled in the art cord connecting apparatus may be provided, such that the reversal of the plugs, as hereinbefore described, may be dispensed with, suitable keys being provided in such instances whereby the automatic selector may be connected either with the answering or with the calling plug, as desired.

The many advantages of my selective party-line system will be apparent to those skilled

in the art. While I have herein shown and described one preferred embodiment of my invention, it will be apparent that many modifications may be employed without departing from the spirit thereof. I do not, therefore, wish to limit myself to the precise disclosures herein set forth; but,

Having described my invention, I claim as new and desire to secure by Letters Patent—

1. In a selective signaling party-line system, the combination of a series of substations each equipped with a magnetic selective apparatus, an electrical circuit connected therewith, automatic means for causing electric-current impulses to traverse said circuit to cause the actuation of said selective apparatus, and automatic means for short-circuiting said circuit between succeeding current impulses.

2. In a selective signaling party-line system, the combination of a series of substations each equipped with a magnetic selective apparatus, an electrical circuit connected therewith, means for causing electric-current impulses to traverse said circuit to cause the actuation of said selective apparatus, and automatic means for short-circuiting said circuit between succeeding current impulses.

3. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, and switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact.

4. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors

through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, and switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact.

5. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms.

6. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural num-

ber of one-step advancements of said switch-arm, signaling apparatus at each substation, a second electromagnet at each of said substations, a switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms.

7. In a selective party-line system, the combination with two conductors, leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms.

8. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms, a contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, signaling apparatus at said substation, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet

to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause a forward rotation of said switch-arms, and at the instant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet.

9. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, and at the instant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet.

10. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, signaling apparatus at each substation, a second electromagnet at each of said substations, a switching mechanism controlled by

each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet.

11. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet.

12. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms, a contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said

switch-arm, signaling apparatus at said substation, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms.

13. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms.

14. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, signaling apparatus at each substation, a second electromagnet at each of said substations, a switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection be-

tween the associated switch-arm and the associated said contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms.

15. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms.

16. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms, a contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, signaling apparatus at said substation, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause a forward rotation of said switch-arm, and at the in-

stant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet.

17. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, and at the instant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet.

18. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, signaling apparatus at each substation, a second electromagnet at each of said substations, a switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward ro-

rotation of said switch-arms, and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet.

19. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet.

20. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms, a contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, signaling apparatus at said substation, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said contact, and means at the central station for automatically sending a plurality of electrical

impulses through said two conductors to cause the forward rotation of said switch-arm.

21. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause the forward rotation of said switch-arms.

22. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, signaling apparatus at each substation, a second electromagnet at each of said substations, a switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause the forward rotation of said switch-arms.

23. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said con-

ductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause the forward rotation of said switch-arms.

24. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms, a contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, signaling apparatus at said substation, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause a forward rotation of said switch-arm, and at the instant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet.

25. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and

said switch-arm, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause the forward rotation of said switch-arm, and at the instant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet.

26. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, signaling apparatus at each substation, a second electromagnet at each of said substations, a switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause the forward rotation of said switch-arms, and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet.

27. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and

said switch-arm, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, and means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause the forward rotation of said switch-arms, and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet.

28. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and a signaling-generator at each of said substations normally connected through the associated switch-arm and normal contact in bridge of said conductors.

29. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact

for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, and a signaling-generator at each of said substations normally connected through the associated switch-arm and normal contact in bridge of said conductors.

30. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, and a signaling-generator at each of said substations normally connected through the associated switch-arm and normal contact in bridge of said conductors.

31. In a selective party-line system, the com-

ination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, and a signaling-generator at each of said substations normally connected through the associated switch-arm and normal contact in bridge of said conductors.

32. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, means at the cen-

tral station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet, and a signaling-generator at each of said substations normally connected through the associated switch-arm and normal contact in bridge of said conductors.

33. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet, and a signaling-generator at each of said substations normally connected through the associated switch-arm and normal contact in bridge of said conductors.

34. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets

causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and a signaling-generator at each of said substations normally connected through the associated switch-arm and normal contact in bridge of said conductors.

35. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause the forward rotation of said switch-arms, and a signaling-generator at each of said substations normally connected through the associated switch-arm and normal contact in bridge of said conductors.

36. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of

current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause the forward rotation of said switch-arm, and at the instant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet, and a signaling-generator at each of said substations normally connected through the associated switch-arm and normal contact in bridge of said conductors.

37. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors to cause the forward rotation of said switch-arms, and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet, and a signaling-generator at each of said substations normally connected

through the associated switch-arm and normal contact in bridge of said conductors.

38. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position.

39. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said

second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet, and means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position.

40. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arms at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position.

41. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation

of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, and means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position.

42. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, and means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position.

43. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of

said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, and means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position.

44. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, means at the central station for automatically sending

a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet, and means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position.

45. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet, and means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position.

46. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations,

signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet, means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and means at the central station for sending a current impulse in the reverse direction through said conductors and the electromagnets connected therewith.

47. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conduc-

tors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and means at the central station for sending a current impulse in the reverse direction through said conductors and the electromagnets connected therewith.

48. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and means at the central station for sending a current impulse in the reverse direction through said conductors and the electromagnets connected therewith.

49. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said

substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet, means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and means at the central station for sending a current impulse in the reverse direction through said conductors and the electromagnets connected therewith.

50. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at

said substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, and a pulsating direct-current signaling-generator at each of said substations normally connected through said normal contact and the switch-arm in bridge of said two conductors, the direction of the current pulsations from said generators being such as to energize said first electromagnets in such a direction as to cause the restoration of said switch-arms to their normal position.

51. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, signaling apparatus at each substation, a second electromagnet at each of said substations, a switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, and a pulsating direct-current signaling-generator at each of said substations normally connected through said normal contact and the switch-arm in bridge of said two conductors, the direction of the current pulsations from said generator being such as to energize said first electromagnets in such a direction as to cause the restoration of said switch-arms to their normal position.

52. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations permanently connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a

forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each

5 of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations,

10 switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection

15 between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause

20 the forward rotation of said switch-arms and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet, means adapted

25 upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and

30 a pulsating direct-current signaling-generator at each of said substations normally connected through said normal contact and the switch-arm in bridge of said two conductors, the direction of the current pulsations from said

35 generators being such as to energize said first electromagnets in such a direction as to cause the restoration of said switch-arms to their normal position.

40 53. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said

45 substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arms at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a

50 circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said

55 switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said

60 substation, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet

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including a connection between said switch-arm and said second contact, means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms

70 to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and a pulsating direct-current signaling-generator at each of said substations normally

75 connected through said normal contact and the switch-arm in bridge of said two conductors, the direction of the current pulsations from said generators being such as to energize said first electromagnets in such a direction as to

80 cause the restoration of said switch-arms to their normal position.

54. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of

85 a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a

90 circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and

95 said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching

100 mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between

105 the associated switch-arm and the associated said second contact, means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and a pulsating direct-current signaling-generator at each of said substations normally connected

110 through said normal contact and the switch-arm in bridge of said two conductors, the direction of the current pulsations from said generators being such as to energize said first electromagnets in such a direction as to cause

115 the restoration of said switch-arms to their normal position.

55. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of

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a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substitution, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and a pulsating direct-current signaling-generator at each of said substations normally connected through said normal contact and the switch-arm in bridge of said two conductors, the direction of the current pulsations from said generators being such as to energize said first electromagnets in such a direction as to cause the restoration of said switch-arms to their normal position.

56. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advance-

ments of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms, means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and a pulsating direct-current signaling-generator at each of said substations normally connected through said normal contact and the switch-arm in bridge of said two conductors, the direction of the current pulsations from said generators being such as to energize said first electromagnets in such a direction as to cause the restoration of said switch-arms to their normal position.

57. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for said switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a second contact at one of said substations adapted to be engaged by its associated switch-arm upon the completion of a plurality of one-step advancements of said switch-arm, a second electromagnet at said substitution, switching mechanism controlled by said second electromagnet to connect said signaling apparatus in bridge of said conductors, the circuit through said second electromagnet including a connection between said switch-arm and said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between said switch-arm and said second contact to close a circuit through the associated second electromagnet, means adapted upon the passage of a current through said first electromagnets in the reverse direc-

tion to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and a pulsating direct-current signaling-generator at each of said substations normally connected through said normal contact and the switch-arm in bridge of said two conductors, the direction of the current pulsations from said generators being such as to energize said first electromagnets in such a direction as to cause the restoration of said switch-arms to their normal position.

58. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a rotatably-mounted switch-arm at each of said substations, an electromagnet at each of said substations connected in bridge of said conductors, a normal contact for the switch-arm at each of said substations, signaling apparatus at each of said substations normally connected in bridge of said conductors through a circuit including the said normal contact and said switch-arm, means whereby the passage of current impulses through said electromagnets in one direction causes a forward step-by-step rotation of said switch-arms to break the electrical connection with said signaling apparatus through said normal contact and said switch-arm, a contact at each of said substations each adapted to be engaged by the associated switch-arm upon the completion of a different plural number of one-step advancements of said switch-arm, a second electromagnet at each of said substations, switching mechanism controlled by each of said second electromagnets to connect the associated signaling apparatus in bridge of said conductors, the circuit through any one of said second electromagnets including a connection between the associated switch-arm and the associated said second contact, means at the central station for automatically sending a plurality of electrical impulses through said two conductors in one direction to cause the forward rotation of said switch-arms and at the instant of connection between the switch-arm at any substation and the associated contact to close a circuit through the associated second electromagnet, means adapted upon the passage of a current through said first electromagnets in the reverse direction to cause the restoration of said switch-arms to the normal position and the restoration of the switching mechanism controlled by said second electromagnet to its normal position, and a pulsating direct-current signaling-generator at each of said substations normally connected through said normal contact and the switch-arm in bridge of said two conductors, the direction of the current pulsations from said generators being such as to energize said first electromagnets in such a direction as to

cause the restoration of said switch-arms to their normal position.

59. In a selective signaling party-line system, the combination with two conductors forming a telephone-line leading from a central station to a series of substations, of a line-jack connected with said conductors at the exchange, operator's cord connecting apparatus having a plug for insertion in said jack to connect said line with another for conversation, a line-signal in a local signal-circuit, and electromagnetic switching mechanism normally connected with said line at the central exchange adapted upon the passage of a current in one direction to close a break in said local signal-circuit and adapted upon the passage of a current in the reverse direction to open the circuit through said local signal-circuit.

60. In a selective signaling party-line system, the combination with two conductors forming a telephone-line leading from a central station to a series of substations, of a line-jack connected with said conductors at the exchange, operator's cord connecting apparatus having a plug for insertion in said jack to connect said line with another for conversation, a line-signal in a local signal-circuit, electromagnetic switching mechanism normally connected with said line at the central exchange adapted upon the passage of a current in one direction to close a break in said local signal-circuit and adapted upon the passage of a current in the reverse direction to open the circuit through said local signal-circuit, said local circuit including normally closed switch-contacts associated with said line-jack, and means whereby the insertion of said plug within said line-jack causes a break in the circuit through the associated switch-contacts.

61. In a selective signaling party-line system, the combination with two conductors forming a telephone-line leading from a central station to a series of substations, of a line-jack connected with said conductors at the exchange, operator's cord connecting apparatus having a plug for insertion in said jack to connect said line with another for conversation, a line-signal in a local signal-circuit, electromagnetic switching mechanism normally connected with said line at the central exchange adapted upon the passage of a current in one direction to close a break in said local signal-circuit and adapted upon the passage of a current in the reverse direction to open the circuit through said local signal-circuit, said local circuit including normally closed switch-contacts associated with said line-jack, and means whereby the insertion of said plug within said line-jack causes a break in the circuit through the associated switch-contacts, and reverses the connection of said electromagnetic switching mechanism with said conductors.

62. In a selective party-line system, the combination with two conductors leading from a

central exchange to a series of substations, of a switch-arm at each of said substations, an electromagnet at each of said substations for controlling said switch-arm, a normal contact for said switch-arm, telephonic apparatus for each substation normally connected in bridge of said conductors through a circuit including said normal contact and switch-arm, automatic means at the central exchange for sending current impulses through said electromagnet to cause a forward step-by-step rotation of said switch-arm to break the electric connection with its normal contact and thereby to disconnect the telephonic apparatus from circuit, a second contact at each substation adapted to be engaged by said switch-arm after a number of current pulsations, said second contact being differently placed at each substation on a line to require different numbers of pulsations before the associated arm comes in contact therewith, a second electromagnet at each substation connected with the central exchange upon contact of the switch-arm with said second contact, automatic means for sending current to the substation through said second electromagnet when said switch-arm engages the second contact, and additional switching mechanism actuated by said second electromagnet to again connect said telephonic apparatus with the line.

63. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of an electromagnet at each of said substations, for controlling said switch-arm, a normal contact for said switch-arm, telephonic apparatus for each substation normally connected in bridge of said conductors through a circuit including said normal contact and switch-arm, automatic means at the central exchange for sending current impulses through said electromagnet to cause a forward step-by-step rotation of said switch-arm to break the electric connection with its normal contact and thereby to disconnect the telephonic apparatus from circuit, a second contact at each substation adapted to be engaged by said switch-arm after a number of current pulsations, said second contact being differently placed at each substation on a line to require different numbers of pulsations before the associated arm comes in contact therewith, a second electromagnet at each

substation connected with the central exchange upon contact of the switch-arm with said second contact, automatic means for sending current to the substation through said second electromagnet when said switch-arm engages the second contact, additional switching mechanism actuated by said second electromagnet to again connect said telephonic apparatus with the line, and automatic means at the central exchange for short-circuiting the telephone-circuit between succeeding current impulses.

64. In a selective party-line system, the combination with two conductors leading from a central exchange to a series of substations, of a switch-arm at each of said substations, an electromagnet at each of said substations, for controlling said switch-arm, a normal contact for said switch-arm, telephonic apparatus for each substation normally connected in bridge of said conductors through a circuit including said normal contact and switch-arm, automatic means at the central exchange for sending current impulses through said electromagnet to cause a forward step-by-step rotation of said switch-arm to break the electric connection with its normal contact and thereby to disconnect the telephonic apparatus from circuit, a second contact at each substation adapted to be engaged by said switch-arm after a number of current pulsations, said second contact being differently placed at each substation on a line to require different numbers of pulsations before the associated arm comes in contact therewith, a second electromagnet at each substation connected with the central exchange upon contact of the switch-arm with said second contact, automatic means for sending current to the substation through said second electromagnet when said switch-arm engages the second contact, additional switching mechanism actuated by said second electromagnet to again connect said telephonic apparatus with the line, and a signal-bell at each substation connected with the central exchange upon actuation of said additional switching mechanism by said second electromagnet.

In witness whereof I hereunto subscribe my name this 5th day of May, A. D. 1903.

GARRISON BABCOCK.

Witnesses:

LYNN A. WILLIAMS,
JOHN STAHR.