

UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 610,704, dated September 13, 1898.

Application filed September 3, 1897. Serial No. 650,441. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Telephone Systems, (Case No. 25,) 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 party telephone-lines, each connecting a plurality of subscribers' stations with the central office, and has for its object the improvement of the systems of selective signaling employed in connection therewith and the provision of an improved form of secrecy-switch at the substations and suitable circuits for controlling the same.

My invention in its preferred embodiment is of especial utility in such a party-telephone-line system as is shown in my application, Serial No. 622,264, filed February 6, 1897. It may be used to advantage in connection with other systems.

Systems have been devised wherein electromagnetically-controlled detents at the subscribers' stations of a party-line were employed to lock the telephone-switches at the unselected or idle stations in position to exclude the telephones (both receivers and transmitters) thereat from the line to prevent interruption when any station is using the main circuit. Normally these detents are removed from engagement with the switches, so that any station may use the line when it is otherwise idle. When a subscriber of the party-line is called, however, means are provided at the central office for causing the engagement of the detent at the unselected stations with the switches thereat and freeing the detent at the selected station from its switch. To this end all of the switches are first locked and then the detent at the selected station is removed when the signal at the selected station is being operated. If the called subscriber responds before the signaling has ceased, he may cut his telephone instruments into circuit; but if the signal should cease before his response the detent will again lock the switch, so that it will be necessary for

the operator to resignal to release the hook. It frequently happens, however, that the spring engagement of the telephone-switch with the detent after the telephone is removed is too strong to permit of this second disengagement of the detent.

One object of my invention herein is to provide means controlled at the central office for locking the switches at the unselected or idle stations and maintaining the switch at the selected or busy station free during the connection of the switching apparatus at the central office with the party telephone-line, so that the called subscriber may cut his instruments into line any time after being signaled.

In party telephone-lines employing mechanical obstructions in the path of the bell-clapper tongues in combination with relays for removing the obstructions to permit the actuation of the selected bell false signals are conveyed to the unselected stations. This is especially true in some systems where direct currents of unlike sign are employed to operate the relays and pulsating currents of unlike signs for the operation of the bells, the direct current of a particular sign serving to actuate the armature operated by pulsating current of the same sign to impart a single stroke to the bell at an unselected station. This difficulty is also present in systems employing a centralized battery for supplying transmitter-circuits at the subscribers' stations and bell-magnets adapted to respond to ringing-currents of unlike sign.

My improved form of secrecy-switch may be described in general terms as consisting in its preferred embodiment of a spring-switch for controlling the association of the substation instruments with the party-line, a detent operated by an electromagnet controlled at the central office, which, according to its position, is adapted to prevent or permit the operation of the switch, and an automatic telephone-hook having separable engagement with the spring-switch, so that when the apparatus is locked from the line by the aforesaid detent the switch-hook at any idle station may be vibrated by the subscriber without changing the circuit condition of the apparatus or injuring the same. Other constructions are contemplated, however.

I will explain my invention by reference to the accompanying drawings, which illustrate the preferred embodiment thereof.

In the drawings, Figure 1 is a diagrammatic illustration of a telephone system equipped in accordance with my invention. Fig. 2 is a top perspective view of an improved form of switching mechanism which I prefer to employ in the system shown in Fig. 1. Fig. 3 is a front elevation of the signal-receiving apparatus and the secrecy-switch such as I prefer to employ at the subscribers' stations of the party-line. Fig. 4 is a detail sectional view of a portion of the switching mechanism illustrated in Fig. 3 along line 4 4.

Like letters and figures refer to like parts throughout the different views.

The party telephone-line extends in two limbs a a' from the substations to the exchange, where it terminates in the line-springs a^2 a^3 , normally in circuit with the line-indicator a^4 . I will particularly describe the apparatus at the substations.

Referring to Figs. 1, 3, and 4, each telephone-station is provided with a telephone-receiver b , transmitter b' , automatic hook b^2 , and a spring-switch b^3 , having separable engagement with a post b^4 , carried by the hook. The circuit through the transmitter at each station is opened at b^3 when the receiver is upon its hook or when the switch b^3 is locked. When the receiver is off its hook and when the telephone-line is united with the cord-circuit, the switch b^3 being unlocked, current from the centralized battery finds a path over the limbs a a' through a bridge-conductor including the receiver and transmitter, as is well understood by those skilled in the art. An electromagnet b^5 , responsive to direct current and having the middle of its winding grounded, is included in a bridge between the limbs of the line at each station. Electromagnets b^6 , responsive to direct currents, are grounded through one-half of the coils of magnets b^5 . The magnets b^6 at stations 1, 2, 3, and 4 are connected with limb a' , while magnets b^6 at stations 5, 6, 7, and 8 are connected with limb a . Each magnet b^6 serves to control the position of each mechanical obstruction b^7 , normally interposed in the path of the clapper-operating armature b^8 of electromagnet b^9 . The magnets b^9 are responsive to pulsating currents. The magnets b^9 at stations 1, 2, 3, and 4 are connected with limb a and grounded through each remaining half of the windings of magnets b^5 , while the magnets b^9 at stations 5, 6, 7, and 8 are connected with limb a' and grounded through each remaining half of the magnets b^5 at said stations. The armatures of the electromagnets b^6 b^9 are polarized, so as to be operated only when a current of proper sign is passed through said magnets, as will be more fully hereinafter set forth. The armature of magnet b^5 is not polarized. Each armature b^8 is provided with a downward extension c , having a nose c' , which is normally main-

tained in the position shown by the spring c^2 . A longitudinally-reciprocating arm c^3 , normally in the position shown in Fig. 1 at stations 1, 4, and 6, is adapted to be operated by the bell-crank lever c^4 , carrying the armature of magnet b^5 and pivoted at c^5 . A horizontal pin c^9 is normally in position to be moved into engagement with the shelf or bracket c^{10} at the idle stations, whereby as the bell-crank lever is being brought by its magnet from its normal idle position shown in Fig. 1 to the position shown in Fig. 3 the free end of lever c^3 is guided into engagement with the nose c' , when the extension c is in the position shown. A detent c^{11} projects downward and engages the spring-switch b^3 and prevents the elevation thereof when the parts are in the position shown in Fig. 3, in which position the apparatus at the unselected stations have been placed when connection has been established with a single station of the party-line. With the parts in the position shown in Fig. 3 it is obvious that the automatic hook at any unselected station may be operated by the subscriber without injuring the apparatus or altering the circuit condition thereof, since the spring-switch b^3 is maintained in its depressed position by the interlocking parts, while the post b^4 is in separable engagement with the upper surface of the switch.

I have described how the switches at the unselected stations are locked. I will now describe how the switch at the selected station is made free during the connection of the cord-connecting apparatus with the party-line, so that the switch is free to include the telephones (preferably both the receiver and transmitter) with the line not only while the signal is being set but at any time after. To this end I prefer the mechanism shown most clearly in Fig. 3. I link an arm e' at e^2 to the bell-crank lever c^4 and provide a spring e^5 , which tends to elevate the link. I provide a loop e^6 about the arm e' , which is mounted upon the stem e^7 , carried by the arm c^3 . Assuming that a grounded source of direct current has first been closed through magnets b^6 b^5 , (one-half of each magnet b^5 and a magnet b^6 at each station being grounded in a limb of the telephone-line,) the arm c^3 is advanced horizontally, since the detent c^{11} slides upon the switch. When the post c^9 first enters into engagement with shelf c^{10} , the loop e^6 is slightly elevated relative to the arm e' . As the post is advanced the loop is brought into engagement with the arm e' , so that a gradually-increasing tension is placed upon the spring e^5 , until finally the spring is stretched and arm e' depressed to the position shown. It will be observed, referring to Fig. 3, that when the arm c^3 is engaged with the nose c' the post c^9 is placed to the right of the shelf c^{10} . Upon including ringing-current in circuit with magnet b^9 nose c' is disengaged from detent c^{11} , whereupon the spring e^5 contracts and elevates loop e^6 , and consequently the arm c^3 and detent c^{11} , which

may be said to be composed in part of the contiguous end of arm c^3 . The spring-switch b^3 is now free from the detent c^{11} not only during the operation of magnet b^9 , but during the connection of the line with the operator's cord-circuit, so that the selected subscriber may respond at any time. The nose c' and portion c^{11} make together one form of stop adapted when properly actuated to prevent or permit of the operation of the switch b^3 . I do not wish to be limited, however, to the precise detaining mechanism shown.

It will be readily understood by reference to Fig. 1 that when none of the apparatus of the party telephone-line is in use any subscriber of said line may signal the central office by removing his receiver from its hook or support. The post c^9 being to the left of the shelf c^{10} when the party-line is idle, the switch b^3 is permitted to connect the terminals b^{10} of a bridge-conductor b^{11} upon the removal of the receiver from its hook. To indicate to the subscribers at the remaining stations that the party-line is in use, I provide a target e , supported upon arm e' , which is secured to the bell-crank lever. This target when the apparatus is idle is concealed below the opening e^3 in the screen e^4 . When the bell-crank levers are actuated by the magnets b^5 , the arms e' are elevated thereby to present the target before the openings. The target is provided with two colors—as, for example, white and red. The red color is shown in solid black, while the white color covers the remaining upper portion of the target. At the idle stations but one color—the white—is displayed when the line is in use. At the busy station both colors are preferably displayed, so that a called subscriber will know that he is the particular subscriber with whom connection is desired. At the idle stations the loop limits the elevation of the arm e' in opposition to the spring e^5 , so that the targets e' are caused to present their white surfaces at the idle stations. At the busy station, however, the arm e' is lifted completely to display both colors.

In Fig. 1 I have shown the apparatus at stations 1, 4, and 6 complete. At stations 2, 3, 5, 7, and 8 I have shown the various electromagnets properly connected in circuit. The rest of the apparatus is similar to that shown at the remaining stations. The illustration of the substation apparatus in Fig. 1 is diagrammatic only for the sake of clearness. The precise mechanical construction that I prefer to employ is illustrated in Fig. 3.

Having particularly described the substation apparatus, I will now describe the apparatus at the exchange which I prefer to employ and its coöperation with the apparatus at the substations.

The bell-magnets at stations 1, 3, 5, and 7 are responsive to positive pulsating currents, while the bell-magnets at the remaining stations are responsive to negative pulsating

currents. The relays at stations 1, 2, 5, and 6 are responsive to positive direct currents, while the relays at the remaining stations are responsive to negative direct currents.

I have not deemed it necessary to illustrate the operator's telephone apparatus, since the association thereof with the cord-connecting apparatus is well understood by those skilled in the art.

Each cord-connecting apparatus which I prefer to employ comprises a connecting-plug f , an answering-plug g , and repeating-coils h and i , connected between the sleeve and tip of plug f and disposed in inductive relation with repeating-coils k and l , connected between the tip and sleeve of plug g . I preferably employ keys of the construction shown in Fig. 2, each key corresponding to a substation of the party-line. There are three distinctive positions for each key: first, the normal, when the cord-connecting apparatus is idle; second, the ringing position, in which the direct and pulsating currents are thrown upon the line to operate the bell at the selected station, and, third, the talking position, in which the centralized talking-battery is thrown onto line. An index or pointer rotating with the cylinder is provided to indicate the distinctive positions of the key. The keys are rotated in the direction indicated by the arrows. Each key preferably employs a cylinder of insulating material, upon which are mounted plates m n and o p , the plates m n being electrically connected, as are plates o p . Two broader strips of metal q and r are mounted upon the cylinder.

Brushes s , s' , s^2 , s^3 , s^4 , and s^5 are adapted to make contact with the various metallic plates upon the cylinder as it is rotated to its various positions. I provide a source of direct or straight current t , which is provided with a central grounded connection which serves to operate the relays of the selected stations when the keys are in one position, as a centralized battery when the keys are in another position, and to operate magnets b^5 at all stations when connected to line at all to display all signals and initially lock all switches. A source of positive pulsating current u and negative pulsating current v are employed for signaling.

Referring to Figs. 1 and 2, the key 1^a , corresponding to substation 1, has its brush s connected to the negative side of the battery t , the positive side of said battery being connected with brushes s' s^5 . Brush s^2 is connected with the tip-strand of the connecting-plug, while brush s^3 is connected with the sleeve-strand. Brush s^4 is connected with the source of positive pulsating current u . The brushes of the keys 2^a , 3^a , 4^a , 5^a , 6^a , 7^a , and 8^a , corresponding, respectively, with the subscribers 2, 3, 4, 5, 6, 7, and 8, are connected with the battery t and with one or the other of the sources of pulsating current. The circuits may be readily traced.

The operation of the system is as follows:

A subscriber desiring communication, for example, with subscriber No. 1 of the party-line signals the operator, who ascertains the connection desired. The operator thereupon
 5 inserts the connecting-plug in the spring-jack of the party-line and rotates the selective key 1^a to the ringing position. As the key is being rotated to this position the strip q is first brought into contact with brushes $s' s^2$.
 10 A grounded source of positive direct current (a portion of battery t) is thus included in circuit with the relay b^6 , (confining our attention at present to the action of the apparatus at the selected station,) whose armature is
 15 actuated to remove the mechanical obstruction from the path of the armature of the bell-magnet. When the key finally assumes the ringing position, the plate r is brought into contact with the brushes $s^3 s^4$, whereby
 20 the source u of positive pulsating current is included in circuit with the bell-magnet whose armature is free to operate. The target, as heretofore explained, displays both of its colors at the opening in the screen at the
 25 called station. The switch b^3 at the same time is free to close the bridge, including the transmitter and receiver upon the removal of the latter. The particular transmitter-circuits shown are well known to those
 30 skilled in the art. After having signaled the subscriber the operator shifts the key to the position shown in Fig. 2, whereby the source of pulsating current is removed from line
 35 and the centralized battery included in circuit with the transmitter at the called station. In this position the brushes s and s^2 are electrically connected by the plates m and n , while the brushes s^3 and s^5 are electrically connected by the plates o and p .
 40 The instant either grounded portion of battery t is included in circuit with either limb of the telephone-line to operate relay b^6 to free the armature of the selected bell magnets b^5 at all of the stations are operated with
 45 the results as aforesaid. Middle ground connections are taken from the magnets b^5 for the purpose of directing grounded battery through the same from either limb, so that the telephone-switches may be locked and
 50 signals displayed immediately upon establishing connection with the party-line.

In ringing when the positive direct current is thrown upon limb a' the relay at station 2 is also operated to remove the mechanical
 55 obstruction from the path of the armature of the bell-magnet at that station; but since the bell-magnet is responsive only to negative pulsating currents its armature will not be actuated. The bells at stations 3 and 4 will not
 60 be operated, since the relays are responsive to currents of negative sign only. The relays at stations 5, 6, 7, and 8 are connected with the limb of the line over which no battery-current is being directed. The bells at these
 65 stations will therefore not ring.

In connecting the complete grounded bat-

tery t in circuit with both limbs of the telephone-line I shift the polarity of the battery so that the positive direct current which was previously included in circuit with limb a' is
 70 included in circuit with limb a , while the negative side of the battery is thrown upon limb a' . If this were not done, the bells at station 2 would receive a single stroke. The means
 75 I have preferably employed for changing the polarity of the battery t consists in such a switch or key as is shown most clearly in Fig. 2, which corresponds with station 1. Considering the key corresponding to station 1,
 80 when the index points to the word "Ring" the plate q electrically connects the springs $s' s^2$, whereby the positive side of the battery is connected with the tip-strand of the cord-circuit. When the index points to the word
 85 "Talk," as shown, the tip-strand is disconnected from the positive pole of the battery and is connected with the negative pole of the battery, the positive pole being connected with the sleeve-strand. The changes in circuit connections effected by the keys corresponding to station 1 and the remaining keys
 90 may readily be traced by an inspection of Fig. 1, and I do not therefore deem a detailed description to be essential. When the centralized battery is thus reversed by the key
 95 corresponding to station 1, the relays b^6 and magnets b^9 at stations 3 and 6 tend to attract their armatures. To prevent false signals at these stations, I so construct or adjust the armatures of the relays b^6 that they will be
 100 attracted subsequently to the armatures of the bell-magnets. The armatures of the bell-magnets at the stations 3 and 6 upon being attracted are pressed against the obstructions b^7 , which upon the subsequent operation of
 105 the armatures of the relays b^6 are brought into engagement with catches or notches b^{12} in the bell-magnet armatures. The necessary adjustment of the armatures of relays b^6 may be had by adjusting the retractile
 110 springs connected therewith. The further elevation of the obstructions is thereby prevented and false signals obviated. To prevent the negative portion, or that portion of the battery which would operate the relays,
 115 from being thrown upon the line before the remainder of the centralized battery is included in circuit with the bell-magnets, I provide a switch which is adapted simultaneously
 120 to connect both limbs of the telephone-line with both portions of the battery. This switch, as is shown in Fig. 2, has an eccentric or cam surface upon the cylinder having an abrupt ending, whereby the brushes s , s^2 , s^3 , and s^5 are brought simultaneously
 125 into contact with plates m , n , o , and p , respectively.

I have particularly described the operation when substation 1 is the called station and the manner in which the defects heretofore
 130 existing in systems of this class are overcome. The operation may be readily traced out when

any of the remaining stations is the called station, and the manner in which the defects are overcome will be readily understood.

I have used the term "pulsating currents" in the broad sense of any ringing-current. In the claims I use the term "signal-bell" in the sense of any signal-receiver, and I speak of a "ground connection" in the sense of a connection with a third return-conductor.

It is obvious that changes may be readily made from the preferred embodiment of my invention herein shown and described, and I do not therefore desire to be limited to the precise features of construction shown; but,

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

1. The combination with a spring-switch for controlling the association of a telephone with a telephone-line, of an actuating device, as b^2 , having separable engagement with the said spring-switch and which, when operated in one direction, serves to actuate the spring-switch to open the telephone-circuit, and means independent of the actuating device for directly engaging and maintaining the spring-switch in the position in which it has been placed by the actuating device, and an electro magnet for operating said means, whereby the circuit through the telephone may be maintained open and the actuating device, by reason of its separable engagement with said spring-switch, may be changed as to position independently of said electromagnet and spring-switch, substantially as described.

2. The combination with a switch for controlling the circuit through the telephone, of an actuating device for engaging said switch to move the same to open the circuit through the telephone, when actuated in one direction, said device being movable independently of said switch, when actuated in an alternative direction, means independent of said device for directly engaging and maintaining the switch in the position in which it has been placed by said actuating device, and an electromagnet for operating said means, the said actuating device being movable independently also of said electromagnet and means, whereby the circuit through the telephone may be maintained open and the said actuating device may be altered in its position independently of said electromagnet, means and switch, substantially as described.

3. In a secrecy-switch, the combination with a spring-switch for controlling the association of the telephone with the telephone-line, of a movable telephone-support having a separable engagement with the spring-switch, which support serves, when depressed, to actuate said switch to open the circuit through the telephone, a stop for directly engaging the spring-switch to hold the same stationary independently of the telephone-support, and electromagnetic means for bringing the stop into direct engagement with the

spring-switch, whereby the operation of the spring-switch is prevented when said support is relieved of its weight and permitted to rise, substantially as described.

4. In a secrecy-switch, the combination with a switch, of a suitable circuit including the transmitting-telephone controlled thereby, a movable support for the receiving-telephone having a separable engagement with said switch and serving to actuate the same when depressed to open the circuit through the transmitter, said switch, when freed from the influence of the telephone upon the support, serving to close the circuit through the transmitter, means independent of the telephone-support for directly engaging and maintaining the switch in the position in which it has been placed by said telephone-support, and electromagnetic means acting independently of said support for operating said means, whereby the operation of the switch in a direction to close the transmitter-circuit may be prevented when said support is relieved of its weight and permitted to rise, substantially as described.

5. In a secrecy-switch, the combination with a spring-switch, of suitable circuits including the transmitter and receiver controlled thereby, a supporting-hook for the receiver having separable engagement with the spring-switch and serving when depressed to actuate said switch to open circuit through the receiver and transmitter, said switch when freed from the actuating influence of the telephone-support serving to close circuit through the receiver and transmitter, a detent adapted directly to engage the spring-switch and to maintain the same in a depressed position independently of the supporting-hook, and an electromagnet adapted to engage the detent with the spring-switch, the telephone-hook by reason of its separable engagement with the spring-switch being free to vibrate independently of said switch when the latter is engaged by said detent, substantially as described.

6. In a secrecy-switch, the combination with a spring-switch b^3 for controlling the continuity of the telephonic circuit or circuits at the subscriber's station, of a hook b^2 for supporting the receiver and having separable engagement with the spring-switch, said hook, through the influence of the receiver supported thereon, serving to actuate the spring-switch to open the telephonic circuit or circuits at the subscriber's station, a detent c^{11} directly engaging the spring-switch independently of said hook, a stop c' , and an electromagnet for interposing said detent between said stop and spring-switch, whereby the spring-switch may be maintained in a position to which it has been actuated by said hook, in which position of the switch the continuity of the telephonic circuit or circuits is broken, the said hook, by reason of its separable engagement with the spring-switch, being free to vibrate independently of the

spring-switch when the same is locked in position by the aforesaid stop and detent, substantially as described.

7. In a telephone apparatus, the combination with a spring-switch b^3 for controlling the continuity of the telephonic circuit or circuits at the subscriber's station, of a telephone-hook b^2 having separable engagement therewith, and through the influence of the receiver when supported thereon adapted to open said circuit or circuits, a swinging arm c^3 , an electromagnet b^5 for actuating said arm, a shelf c^{10} , a pin c^9 mounted upon the arm c^3 adapted to engage the shelf when the said pin is in an intermediate portion of its travel and thereby guide the arm c^3 in its travel, a detent c^{11} also carried by the arm c^3 , a signal-bell having a clapper-supporting armature, an electromagnet for operating the same, a nose or extended portion c' of said armature normally in position to engage the arm c^3 when the same is actuated by the electromagnet b^5 , a second electromagnet b^6 controlling a mechanical obstruction as b^7 normally disposed in the path of the armature b^8 , the latter electromagnet when actuated being adapted to remove the obstruction from the path of the armature, thereby permitting the disengagement of the nose c' from the arm c^3 upon the actuation of the armature b^8 , whereby the switch b^3 is permitted to close the telephonic circuit or circuits at the subscriber's station, substantially as described.

8. The combination with a switch for controlling the continuity of a telephonic circuit or circuits at the subscriber's station, of a signal-bell, a bell-magnet, an armature therefor supporting the bell-clapper, means for supporting the receiver, the receiver being adapted through the agency of said means to actuate said switch to open the telephonic circuit or circuits at the subscribers' stations, a detent, and an electromagnet adapted to interpose the same between said bell-armature or an extension thereof and said switch to prevent the operation of the switch upon the removal of the telephone from its support, substantially as described.

9. The combination with a telephone-switch, of means for supporting the receiver, said receiver being adapted through the agency of said means to operate the switch to open the telephonic circuit or circuits at the subscriber's station, a stop, as c' , an electromagnet, a detent, as c^{11} , adapted to be interposed between said stop and switch by said electromagnet, a second electromagnet adapted to withdraw the stop from engagement with said detent, and means for withdrawing said detent from the path of said stop when thus disengaged, substantially as described.

10. The combination with a telephone-switch, of means for supporting the receiver, said receiver being adapted through the agency of said means to operate the switch to open the telephonic circuit or circuits at the subscriber's station, a stop, as c' , an elec-

tromagnet, a detent, as c^{11} , adapted to be interposed between said stop and switch by said electromagnet, a bell, an electromagnet for operating said bell, an armature for the latter electromagnet carrying the stop c' which is disengaged from the detent upon the actuation of the bell-magnet, and a spring for removing the detent from the path of stop c' when thus disengaged, substantially as described.

11. The combination with a telephone-switch b^3 , of a swinging arm c^3 , a lever c^4 linked to said arm, an electromagnet for operating said lever, a swinging arm e' also actuated by said magnet, a spring e^5 adapted to draw the arm e' away from arm c^3 , a stem e^7 removably engaging at its upper end the arm e' , a post c^9 carried by arm c^3 , a detent c^{11} carried by the arm c^3 , a stop c' , a shelf c^{10} adapted to engage post c^9 and thereby guide the detent into engagement with nose c' and at the same time actuate the arm e' in opposition to spring e^5 through the agency of stem e^7 , a bell-actuating magnet, and an armature therefor which carries the stop c' , the spring e^5 being adapted upon the withdrawal of said stop from engagement with detent c^{11} to elevate said detent from the path of stop c' , said stop and shelf being relatively so disposed that a space is left between the same in which the post c^9 is adapted to be placed when the arm c^3 is actuated by the lever c^4 , substantially as described.

12. In a signal-receiving apparatus or bell for party telephone-lines, the combination with a bell-magnet having an armature for operating the bell-clapper, said magnet being adapted to repeatedly actuate said armature when included in circuit with ringing-current, a second electromagnet operated by direct current, a mechanical obstruction, as b^7 , controlled thereby and normally adapted to prevent the operation of the bell-magnet and adapted to be removed by its magnet from the path of the bell-magnet armature, the latter armature being provided with a catch, as b^{12} , disposed in the path of the obstruction, said catch and mechanical obstruction being adapted to engage each other when direct current to which both the aforesaid magnets are responsive is included in circuit therewith, whereby the bell-magnet is prevented from imparting a single stroke to the bell when it is energized by direct current, substantially as described.

13. In a signal-receiving apparatus or bell for party telephone-lines, the combination with a bell-magnet having a clapper-operating armature which is adapted to be repeatedly actuated by the magnet when included in circuit with signaling-current, a second electromagnet responsive to direct current, a mechanical obstruction b^7 moving with the armature of said magnet and normally interposed in the path of the bell-magnet armature, the armatures of said electromagnets being so adjusted relatively, or so construct-

ed, that the bell-magnet armature will respond more quickly to direct current passing through its magnet than will the armature controlling the mechanical obstruction, whereby, when said magnets are included in circuit with direct current to which they are responsive, the bell-magnet armature is brought into firm engagement with the mechanical obstruction, whereby said obstruction is preserved in the path of the bell-magnet armature and the operation of the bell prevented, substantially as described.

14. In a telephone system, the combination with a party telephone-line extending from two substations to an exchange, of telephone-transmitters at the subscribers' stations, a centralized source of direct current for supplying current thereto, signal-bells in circuit with the telephone-line responsive to signaling-current of unlike sign, a source of ringing-current for operating each bell, switching mechanism for directing ringing-current through the selected bell, and switching apparatus for directing current from said centralized source over the telephone-line through the transmitter at the selected station in one direction or the other, according to the polarity of the bell at the unselected station, whereby the operation thereof may be prevented, substantially as described.

15. In a telephone system, the combination with a party telephone-line extending in two limbs from the central office to a plurality of subscribers' stations, transmitter-circuits at the subscribers' stations connected or adapted to be connected in circuit with the telephone-line, signal-bells at each station connected or adapted to be connected in circuit with the telephone-line, mechanical obstructions, one at each station, interposed in the paths of the armatures of the magnets of the bells, relays connected with the limbs of the telephone-line and in ground branches extending therefrom for controlling said mechanical obstructions, one relay being located at each station, the relays at the different stations being responsive to currents of unlike sign, a centralized battery having a ground connection at an intermediate portion thereof, switching mechanism at the central office adapted to include a portion of the battery between said ground connection and one pole of the battery in circuit with a limb of the telephone-line to actuate a relay at the selected station to remove the mechanical obstruction from the path of the armature of the bell-magnet, a source of ringing-current adapted to be directed over the line and through the selected bell to operate the same, and a switch for connecting the aforesaid portion of the battery with the other limb of the line and at the same time connecting the remaining portion of the battery with the first limb of the line, substantially as described.

16. In an operator's key, the combination with a rotating cylinder, contact-brushes s s' s^2 s^3 s^4 s^5 , two of which are connected or adapt-

ed to be connected with the strands of the cord-circuit, a centralized battery having each pole connected with a brush, a source of calling-current connected with the remaining brush, insulated contact-plates suitably mounted upon a rotating element, said contact-plates being adapted when the key is in one position to include the source of ringing-current in the cord-circuit, the key in another position serving to disconnect the ringing-current from the cord-circuit, and to include the centralized battery in circuit with the strands of the cord-circuit, and in a third position to remove the centralized battery from circuit with the cord-strands, substantially as described.

17. In an operator's key, the combination with a rotating cylinder having an eccentric or cam surface, brushes s s^2 s^3 and s^5 adapted to ride upon the cylinder, plates provided upon the concentric surface of the cylinder adapted to electrically connect brushes s with s^2 and s^3 with s^5 , said brushes being brought suddenly into contact with said plates when the cam-surface upon the cylinder is passed, and a source of current connected or adapted to be connected with said brushes, substantially as described.

18. In a telephone system, the combination with a party-line extending from a plurality of subscribers' stations to the central office, of a switch at each subscriber's station for controlling the continuity thereof of a telephonic circuit or circuits, means at each station for locking said switches in position to prevent the actuation thereof to complete at any station or stations the continuity of the telephonic circuit or circuits, electromagnetic apparatus at each station for unlocking the switch thereat, switching apparatus at the exchange for uniting subscribers for conversation, and means for operating said electromagnetic apparatus at the selected station for releasing the switch thereat from its locking engagement, which means is controlled by said switching apparatus, said switching apparatus and the last-aforesaid means controlled thereby serving to maintain the switch at the selected station free, substantially as described.

19. The combination with a telephone-circuit, of a switch for opening and closing said telephone-circuit, means for actuating the same, an electromagnet acting independently of said means, and additional means for maintaining said telephone-circuit open operating independently of said actuating means and controlled by said electromagnet, substantially as described.

20. In a telephone system, the combination with a party-line extending from a plurality of subscribers' stations to the central office, of a switch at each subscriber's station for controlling the continuity thereof of the telephonic circuit, means at each station for locking said switches in position to prevent the actuation thereof to complete at any station

or stations the continuity of the telephonic
circuit, an electromagnet at each station for
operating said means to unlock the switch
thereat to permit of the completion of the tele-
5 phonic circuit, cord-connecting apparatus at
the exchange for uniting subscribers for con-
versation, a battery, suitable circuit connec-
tions therefor for including the battery in
circuit with the magnet at the selected sta-
10 tion, said cord-connecting apparatus being
adapted to include said battery in circuit with
the telephone-line to maintain the switch at

the selected station unlocked, signals at the
subscribers' stations of the party-line, a sig-
naling-generator, and suitable apparatus at 15
the exchange for including the signal at the
selected station in circuit with the generator,
substantially as described.

In witness whereof I hereunto subscribe my
name this 26th day of August, A. D. 1897. 20
WILLIAM W. DEAN.

Witnesses:

GEORGE L. CRAGG,
JOHN W. SINCLAIR.