

A. E. KEITH & J. & C. J. ERICKSON.
AUTOMATIC TELEPHONE EXCHANGE.

APPLICATION FILED NOV. 28, 1904. RENEWED MAR. 26, 1917.

1,286,180.

Patented Nov. 26, 1918
2 SHEETS—SHEET 1.

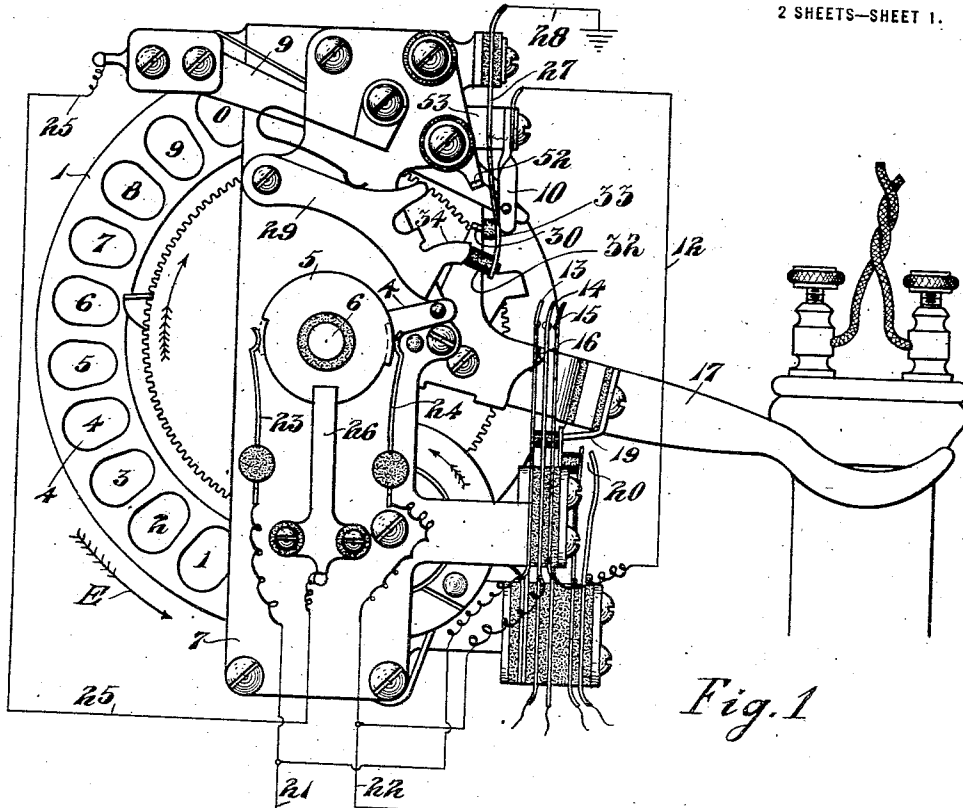
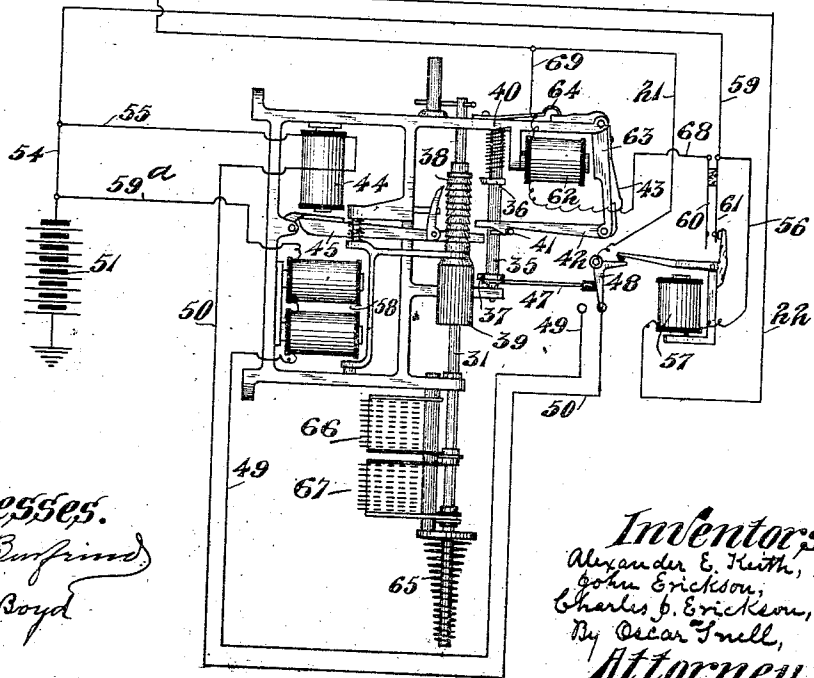


Fig. 1



Witnesses.
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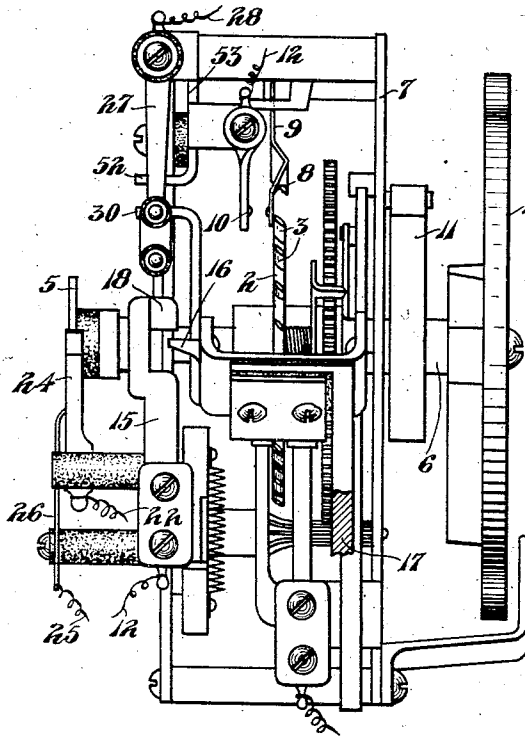


Fig. 2.

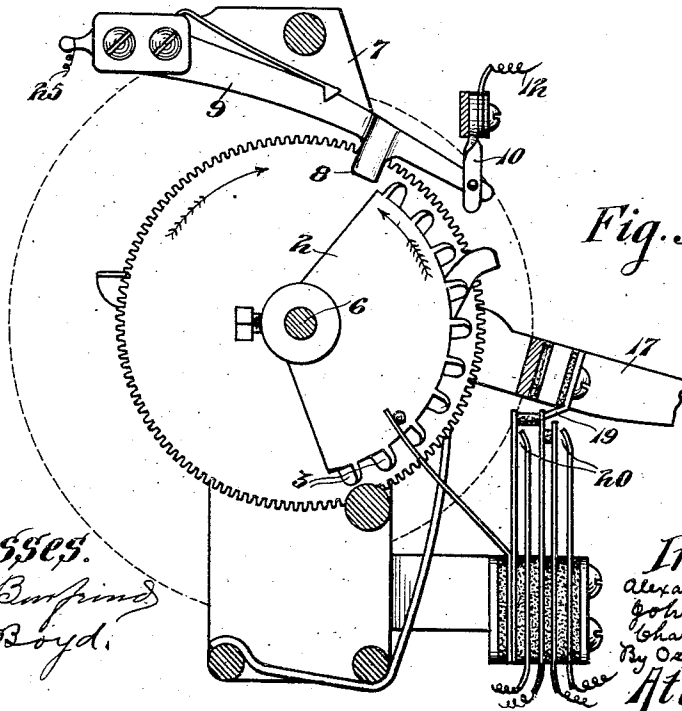


Fig. 3.

Witnesses.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC TELEPHONE-EXCHANGE.

1,286,180.

Specification of Letters Patent.

Patented Nov. 26, 1918.

Original application filed May 4, 1903, Serial No. 155,582. (Patent No. 1,151,541.) Divided and this application filed November 28, 1904, Serial No. 234,521. Renewed March 26, 1917. Serial No. 157,589.

To all whom it may concern:

Be it known that we, ALEXANDER E. KEITH, residing at Hinsdale, county of DuPage, and State of Illinois, and JOHN ERICKSON and CHARLES J. ERICKSON, both residing in Chicago, county of Cook, and State of Illinois, all citizens of the United States, have invented a new and useful Improvement in Automatic Telephone-Exchanges, of which the following is a specification.

Our invention relates to means for enabling the different subscribers of an electrical exchange to call each other by mechanism, preferably automatic, at the central exchange, such as is shown in our prior Patent No. 1,151,541, dated August 24, 1915, of which this is a divisional application.

The main object of our invention is to provide a mechanism by means of which circuits may be formed and over which electrical impulses may be sent intermittently and alternately, or simultaneously.

With this and other objects in view our invention consists in the improved construction and novel arrangement of parts of an exchange and the calling apparatus therefor, as will be hereinafter more fully set forth.

In the accompanying drawings in which the same reference numerals indicate corresponding parts in each of the views in which they occur:

Figure 1 is a view of an exchange embodying our invention, the calling device being shown in front elevation and the parts of the central exchange necessary to show its operation and also its connection with the calling device being shown diagrammatically.

Fig. 2 is a side elevation of the calling device.

Fig. 3 is a transverse vertical sectional view of the same.

In the form of calling device which we have shown for carrying out our invention, 1 indicates an actuator such as the ordinary finger disk, and 2 indicates a circuit closer which is in the form of a segment having fingers or projections 3 around its periphery, there being one more projection than there are finger holds in the actuator. The actuator, circuit closer, a stop arm 4, and also a circuit changer 5 are rigidly secured to a shaft 6 which is journaled in a suitable frame 7 but insulated therefrom.

The fingers or projections 3 are inclined

and are adapted to engage with a projection 8 on a flexible strip or make-and-break terminal 9, and force the free end of the terminal into engagement with a contact or terminal 10 when the segment 2 is being returned to its normal position, as by a suitable spring 11, but will move it in the opposite direction or away from the terminal 10, when the segment is being moved out of its normal position by the movement of the actuator in making a call.

The contact 10 is insulated from the frame 7 but is electrically connected by wire 12 with one of a group of three terminals, 13, 14 and 15, which are insulatingly secured to the frame. The other ends of these terminals are normally separated but are adapted to be forced into contact by a projection 16 on the telephone receiver hook 17 which engages with a projection 18 on one side of one of the terminals, as 13, when the hook is forced downward by the weight of the receiver after the call has been completed. The hook is also provided with a projection 19 which is adapted to separate the terminals of the talking and ringing circuits as shown at 20 when the hook is depressed. As said circuits form no part of this invention they are not shown otherwise than by said terminals.

The calling device is connected with the central exchange by means of two wires 21 and 22, each of which is bifurcated or provided with two terminals at the calling end. Two of said bifurcations are connected respectively with terminals 23 and 24 which are so located as to be engaged by the circuit changer 5, and the other bifurcations are connected respectively with the terminals 13 and 14. A wire 25 is connected at one end with the fixed end of terminal 9 and at the other end with a terminal 26 which is in constant contact with the circuit changer 5, the terminals 23 and 24 being so arranged as to be in alternate contact with the changer as by making the changer of two diameters and locating the terminals on diametrically opposite sides thereof. A flexible terminal 27 is insulatingly secured to the frame 7 with its free end in position to be moved into or out of engagement with an arm or contact point 52 and having its opposite end grounded, as by wire 28.

A shouldered lock-plate or arm 29 is pivotally secured to the frame in position to

engage with the stop arm 4 and hold the actuator 1 against movement until after a projection 30 on the hook 17 engages with and partly lifts the plate up when the hook is moved upward after the receiver has been removed to make a call. The plate also engages with an insulating button 32 on the end of the terminal 27 and normally holds the terminal out of engagement with the contact 52 until the hook is moved upward and the actuator has been partially rotated to make a call.

When the hook has raised the plate as far as it can by means of the projection 30, the terminal is still held away from the contact 52 by means of another button 33 on the terminal which engages with the projection 34 at the end of the plate which was originally in contact with the button 32. But as soon as the actuator has been given a partial rotation to make a call the stop arm engages with the under edge of the plate 29 and forces the plate upward until the nose or projection 34 passes above the button 33 and permits the terminal 27 to engage with the contact 52 and close the circuit to the ground through the wire 28.

The mechanism at the central exchange for establishing the electrical connections between the interconnecting wires of the different subscribers may be made of any desired construction. The particular mechanism used by us for changing the circuit from wire 21 to wire 22, so that, after the switch shaft 31 is moved vertically upward, and afterward revolved to the proper place it can then be released to the normal position, is shown diagrammatically in the lower portion of Fig. 1 where 62 indicates the release magnet, 63 the armature lever thereof, and 64 a stiff spring to hold said armature in the normal position. The shaft 31 is provided with means for contacting the terminals of two banks of points, 66 and 67.

35 is a detent shaft upon which are secured two detents 36 and 37 which engage respectively with the teeth of the vertical ratchet 38 and the rotary ratchet 39 on the switch shaft 31 when the instrument is being operated. A spring 40 holds said detents in yielding engagement with said ratchets.

A pin 41 projects from detent shaft 35 and is disposed in the path of movement of a bent lever catch-pawl 42, which latter is yieldingly held in position by spring 43.

At 44 is a vertical magnet whose armature is attached to lever 45 to which is pivoted a pawl for engaging vertical ratchet 38 in operating shaft 31 step by step vertically.

Lever 45 projects to within a short distance of detent shaft 35, so that, when this lever is operated by the vertical magnet 44, the outer end of the lever is adapted to strike the inwardly projecting end of release pawl 42, and remove the latter from engage-

ment with the detent shaft pin 41, and permit the detents 36 and 37 to be moved by virtue of spring 40, into engagement, respectively, with vertical ratchet 38 and rotary ratchet 39 at the proper time.

When the detent shaft 35 is operated so as to remove detents 36 and 37 from engagement with ratchets 38 and 39, a rod 47, having one end pivotally attached to detent 37 and the other tipped with insulation, contacts with and moves the switch lever 48 from connection with wire 49 to connection with wire 50, or into its normal position, thereby controlling the connection of the wire, 21 with the vertical and rotary magnets.

In operation, if it is desired to set a subscriber's telephone switch at the central exchange to communicate, for instance, with telephone number 35, first remove the telephone receiver from the hook when the lock plate or arm 29 at the calling device will be moved upward, when stop arm 4, and the shaft 6, and the finger-hold disk 1 are free to move.

Referring to Fig. 1, the operator now places a finger in contact with finger-hold No. 3, which is pulled down around in the direction indicated by arrow E, until the finger contacts a stop at the bottom and is withdrawn, when finger-hold disk 1 is released and by virtue of spiral spring 11 carried backward, together with shaft 6, and connected segment wheel 2 to the normal position.

In thus manipulating the finger-hold disk, the first movement downwardly causes the stop arm 4 to engage with the locking plate or arm 29 and complete its upward movement which will permit contact spring or terminal 27 to fall into electrical engagement with arm 52 of the insulated part 53 which is in electrical connection with pendant terminal 10.

Also in the first movement downwardly, the insulated circuit changer has been moved from the position shown in full lines to the position shown in the segmental broken lines in Fig. 1, out of contact with switch spring or terminal 24 and into contact with switch spring or terminal 23.

In the second or backward movement, on account of segment wheel 2 having one more beveled tooth than there are finger-holds on plate 1, as shown in said prior Patent No. 1,151,541 dated August 24, 1915, of which this is a divisional application, and this extra tooth being placed angularly ahead, relatively to the arrangement of the finger-holds, the segment wheel teeth operating spring arm 9, cause the latter to separately contact pendant terminal 10, four times instead of three, when the first three of these impulses pass from battery 51 wires 54 and 55, vertical magnet 44 wire 50 switch arm

48 line wire 21 then to the calling device, spring 23, disk 5, spring 26, wire 25, spring arm 9, terminal 10, part 53, arm or contact point 52, spring 27, wire 28 to ground, and by electro-magnet 44 operate main switch shaft 31 three upward steps.

But just before the last electrical impulse of the four above described, the circuit changer disk 5 has been moved from the position in contact with spring 23 to contact with spring 24, so that this last impulse passes from battery 51 through wire 54, wire 59, wire 56, auxiliary electro-magnet 57 and line wire 22, spring 24, disk 5, spring 26, wire 25, spring arm 9, pendant terminal 10, part 53, arm 52, spring 27 and wire 28 to ground, causing the auxiliary electro-magnet 57, to operate the switch arm 48 so that line wire 21 is moved out of connection with wire 50 and into connection with wire 49, which leads to the rotary electro-magnet 58.

Thus far main switch shaft 31 has been lifted three steps, and connection established with the rotary magnet, which before was cut out of circuit.

If now, the finger-hold disk is moved from the fifth hole to the stop, and six impulses sent over the line wires, five of these impulses would pass from battery 51 through wire 59, electro-magnet 58, wire 49, then the moved switch arm 48, wire 21, spring 23, disk 5, spring 26, wire 25, spring arm 9, pendant arm 10, part 53, arm 52, spring 27 and wire 28 to ground and thereby causing rotary magnet 58 to revolve shaft 31 five steps.

When the disk 5 changes the circuit from line wire 21 to 22 the effect is to simply operate the armature of auxiliary magnet 57, which would have no effect upon switch lever 48 since it would be in the second position in connection with wire 49.

In the manner described the switch shaft 31 would now have a wiper arm in electrical connection with contact point No. 35 of some subscriber's line not shown.

In the operation of release, a subscriber hangs the telephone on the hook when arm 17 descending in the manner hereinbefore described, causes the switch springs 13 and 14 to first contact, and thus connect line wires 21 and 22, then they are grounded simultaneously by being brought into contact with spring 15, which causes a simultaneous current over both main lines 21 and 22, with the result, that the auxiliary magnet is operated to close springs 60 and 61, when current passes from battery 51, through wires 54 and 59, springs 60 and 61, wire 68, release magnet 62, wire 69, to line 21, springs 13, 14 and 15, wire 12, contact point 10, its support 53, contact 52, terminal 27 and wire 28 to ground. As the current passes through magnet 62 its armature 63 is attracted which permits the hook arm 42, attached thereto,

to engage with the pin in lever 41, which projects from detent shaft 35, and when the circuit is broken by the additional descent of telephone lever 17, the strong spring 64 controlling lever armature 63 lifts the latter and withdraws the pawls 36 and 37 to the position shown clear of ratchets 38 and 39 and moves the rod 47 so as to return the switch lever when the main switch shaft 31 is free to return to its normal or initial position by virtue of gravity and the spring 65 at the lower end portion.

We claim as our invention:

1. The combination of two electric circuits extending from a subscriber's calling station to the central exchange, a calling device at the subscriber's station, said calling device having provisions for changing the circuit with which it is connected at each operation, switching mechanism at the central exchange adapted to be connected with said circuits, and a single releasing magnet for restoring said switching mechanism to normal.

2. The combination of two electric circuits extending from a subscriber's station to a telephone exchange, a calling device at the subscriber's station, said device having a circuit closer and a circuit changer, and also having provisions whereby the circuit changer connects the circuit closing device with either one or the other of said circuits, and switching mechanism at the exchange adapted for connection with said circuits.

3. The combination of two electric circuits, a calling device comprising a circuit closer and a circuit changer and having provisions whereby the circuit changer connects the circuit closer with first one and then the other of said circuits during operation of the calling device, and switching mechanism at the telephone exchange adapted to be connected with said circuits.

4. The combination with a pair of electric circuits, of a calling device at a subscriber's station, said calling device comprising a circuit closer and a circuit changer and having provisions whereby the circuit changer shifts the connection of the calling device from one circuit to the other at the close of the operation of the calling device, and switching mechanism at a telephone exchange adapted for connection with said circuits.

5. The combination with two electric circuits, of a calling device at a subscriber's station, said calling device comprising a circuit closer adapted for closing the circuit a plurality of times during one operation, and a circuit changer adapted to change the connection of the calling device from one of said circuits to another, said circuit changer being combined with mechanism whereby it shifts the connection of the calling device from one circuit to the other during the

operation of the circuit closer, whereby certain current impulses made by the circuit closer during one operation pass over one circuit and the remainder over the other circuit, and switching mechanism at a telephone exchange adapted for connection with said circuits.

6. The combination with two electric circuits, of a calling device having a circuit closer adapted to close the circuit a plurality of times at each operation and also having a circuit changer adapted to connect the calling device with either one or the other of said circuits, said calling device having provisions whereby the circuit changer shifts connection from one circuit to the other during the operation of the circuit closer so that all but one of the current impulses caused by the circuit closer pass over one line and the last one passes over the other line, and switching mechanism at a telephone exchange comprising two motor devices included in separate local circuits and an electromagnet combined with a switch for connecting one of said electric circuits with one and the other of said local circuits, said electromagnet being included in said last mentioned line circuit and the circuit changer of the calling device being adapted to cause the current impulses to pass first over the circuit arranged for connection with said local circuits and then over the circuit containing said electromagnet.

7. A device of the character described comprising an electric circuit including a circuit-closer at the calling station, switching mechanism comprising a plurality of motor devices controlled by the circuit closer, means for inserting said motor devices alternately in the circuit, two devices arranged for alternate operation and controlling the said inserting means, and a single releasing magnet for restoring said devices to normal.

8. In a telephone system, two circuits extending to the substation, switching mechanism comprising a plurality of motor devices, a device for automatically inserting said motor devices alternately in one circuit, said inserting device having controlling means included in the other circuit, and having an auxiliary controlling device adapted for inclusion in one circuit, circuit closing mechanism adapted to be thrown into and out of operation, and an additional circuit-closing means adapted for operation independent of said circuit closing mechanism, for closing the circuit in which the auxiliary controlling device is included, substantially as set forth.

9. In a telephone system, a subscriber's line, a calling device therefor, motor devices for switching mechanism, a circuit in which these devices are adapted to be alternately

inserted, a circuit-closer in the circuit controlled by said calling device and adapted when operated to control the inserted motor device, a plurality of independent means controlling the insertion of said motor devices in their circuit, and mechanism arranged to actuate one of the controlling means.

10. A device of the character described comprising motor devices for switching mechanism, a circuit in which these devices are adapted to be alternately inserted, a circuit-closer in the circuit and adapted when operated to control the inserted motor device, independent electrically actuated means controlling the insertion of the motor devices in their circuit, a contact device in circuit with one of said controlling means, and locking mechanism actuated in unison with the contact device for holding the circuit-closer out of operation, substantially as set forth.

11. A device of the character described comprising two electric circuits, a circuit-closer at the calling station, switching mechanism comprising motor devices alternately insertible in one and the same circuit and when so inserted adapted to be controlled by said circuit-closer, means included in the other circuit and controlling the insertion of the motor devices in their circuit, and a circuit-changer at the sub-station for automatically inserting the motor devices in the circuit thereof, substantially as set forth.

12. A device of the character described, comprising an electric circuit including a circuit-closer at the calling station, switching mechanism comprising a plurality of motor devices controlled by the circuit-closer, means for inserting the motor devices alternately in the circuit, devices for reversely operating the inserting means, and mechanism controlled by the operation of one and arranged to control the operation of the other of the said reversely operating devices, substantially as set forth.

13. A device of the character described comprising an electric circuit-closer at the calling station, switching mechanism comprising a plurality of motor devices controlled by the circuit-closer, means for inserting the motor devices alternately in the circuit, devices for reversely operating the inserting means, means adapted to actuate one of said reversely operating devices, and mechanism controlled by the other of said reversely operating devices, and arranged to insert said first-named reversely operating device in the circuit, substantially as stated.

14. A device of the character described comprising two electric circuits, a circuit-closer at the calling station, switching mechanism at the exchange comprising a plurality

of motor devices controlled thereby and insertible in one circuit, and inserting means, devices for reversely operating said inserting means, one of said reversely operating devices being included in each circuit, one of said devices consisting of a single magnet for restoring both of said devices to normal.

15. In a telephone system, two electric circuits extending to the substation, a circuit-closer at the calling station, and switching mechanism comprising a plurality of motor devices controlled thereby and insertible in one circuit, an inserting means, a device for operating the inserting means in one direction and included in the other circuit, and a device insertible in the first named circuit for operating the said inserting means in the other direction, substantially as stated.

16. In a telephone system, two electric circuits extending to the substation, a circuit-closer at the calling station, and switching mechanism comprising a plurality of motor devices controlled thereby and insertible in one circuit, and inserting means, devices for reversely operating the inserting means, one of said reversely operating devices being included in the other circuit and the other device being insertible in the first named circuit, and mechanism controlled by the included device, and controlling the inserting of the insertible device in the first named circuit, substantially as set forth.

17. A device of the character described comprising circuit closing means at the calling station, switching mechanism comprising motor devices and means for alternately inserting said motor devices in circuit with said circuit-closing means, automatic mechanism at the calling station for controlling the insertion of said motor devices in circuit with the circuit-closing means, and a release mechanism for returning the motor devices to their initial positions, substantially as set forth.

18. A device of the character described comprising an electric circuit including a circuit-closer at the calling station, alternately operating motor devices for switching mechanism insertible in the circuit, another circuit including means for controlling the insertion of said motor devices in their circuit, means included in the first named circuit for removing the inserted motor device therefrom, and contact means for closing said circuits, substantially as set forth.

19. A device of the character described comprising an electric circuit including a circuit-closer at the calling station, alternately operating motor devices insertible in the circuit, another circuit including means for controlling the insertion of said motor devices in their circuit, means for removing the inserted motor device therefrom, contact means for closing said circuits, and

means for holding the circuit-closer out of operation, when the contact means is actuated, substantially as set forth.

20. In a telephone system, two electric circuits extending to the substation, motor devices controlled thereby, a switch for the motor devices in one of said circuits, a magnet in the other, release mechanism adapted to be controlled by said magnet, means for actuating said switch in one direction automatically, and manually operated means for closing the circuit to actuate the release mechanism, substantially as set forth.

21. In a telephone system, two electric circuits extending to the substation, motor devices controlled thereby, a switch for said motor devices in one of said circuits and release mechanism adapted to be controlled by the other, a magnet for controlling the movement of the switch in each direction, one of said magnets also controlling the release mechanism, substantially as set forth.

22. In a telephone system, two electric circuits extending to the substation, switching mechanism controlled thereby, a switch in one of said circuits and release mechanism adapted to be controlled by the other, a magnet for controlling said release mechanism, and means for moving said switch in one direction and simultaneously therewith passing a current through said magnet, substantially as set forth.

23. In a telephone system, two electric circuits extending to the substation, switching mechanism controlled thereby, a side switch mechanism and release mechanism, a magnet for controlling each of said mechanisms, and means for passing a current through the release magnet only when the side switch magnet is energized, substantially as set forth.

24. In a telephone system, two electric circuits extending to the substation, switching mechanism controlled thereby, a switch and release mechanism, a magnet for controlling said switch and release mechanism, an angular lever adapted to simultaneously operate the switch and close a circuit through the release magnet, and another magnet for operating said lever, substantially as set forth.

25. In a telephone system, two electric circuits extending to the substation, switching mechanism at the central office controlled thereby, a magnet in each circuit, a switch, means controlled by one magnet for moving said switch in one direction, and means controlled by the other magnet for moving it in the other direction, said last magnet alone controlling the release of said mechanism, substantially as set forth.

26. In a telephone system, two electric circuits extending to the substation, switching mechanism controlled thereby, a magnet in each circuit, a switch and release mechanism, a lever for each magnet, one of which is

adapted to move the switch in one direction and the other one is adapted to control the release, and means connected with the release for moving the switch in the opposite direction, substantially as set forth.

27. A device of the character described comprising two electric circuits, switching mechanism controlled thereby, a magnet in each circuit, a switch lever, release mechanism including a spring-pressed ratchet shaft for engaging with the switching mechanism, a lever connected with the armature of each magnet, one of which moves the switch lever in one direction and the other one controls the shaft, and a rod connected with the shaft for moving the switch lever in the opposite direction, substantially as set forth.

28. A device of the character described comprising two electric circuits, switching mechanism controlled thereby, a magnet in each circuit, a switch lever, release mechanism including a spring-pressed ratchet shaft for engaging with the switching mechanism, a pin on said shaft, a lever connected with the armature of each magnet, one of which moves the switch lever in one direction, a catch pawl connected with the other lever for engaging with said pin, means for disengaging said lever from the pin, and a rod connected with the shaft for moving the switch lever in the opposite direction, substantially as set forth.

29. In a telephone system, two electric circuits extending to the substation, each of which is provided with a magnet and one of them with two terminals, switching mechanism controlled by said circuits, a switch lever, release mechanism, means connected therewith for moving said lever in one direction, means for moving said lever in the opposite direction, and a single release magnet for controlling the release of said mechanism, substantially as set forth.

30. In a telephone system, two electric circuits extending to the substation, motor devices controlled thereby, a switch controlled over one of said circuits and a magnet in the other, release mechanism adapted to be controlled by said magnet, and means including said magnet for simultaneously operating said switch and release mechanism, substantially as set forth.

31. In a telephone system, lines divided into groups, a switch including a contact arm having vertical motion to select groups and rotary motion in a plane at right angles thereto to connect with a line in the predetermined group, a magnet for causing the vertical motion, a magnet for causing the rotary motion, a circuit controller, and means operated over the line to successively bring said magnets under the control of said circuit controller, including an arm adapted by one movement to open circuit through the

first magnet and close circuit through the second magnet.

32. In a telephone system, lines divided into groups, a switch including a contact arm having vertical motion to select groups and rotary motion in a plane at right angles thereto to connect with a line in the predetermined group, a side switch successively controlling the circuits of the operating magnets thereof.

33. In a telephone system, lines divided into groups, a switch including a contact arm having vertical motion to select groups and rotary motion in a plane at right angles thereto to connect with a line in the predetermined group, a switch wiper, a plurality of controlling magnets adapted to be successively brought into circuit with said wiper, and means including a magnet for controlling said wiper.

34. In a telephone system, lines divided into groups, a switch including a contact arm having vertical motion to select groups and rotary motion in a plane at right angles thereto to connect with a line in the predetermined group, a pair of operating magnets, a relay mechanism, a circuit controller, means operated by said relay mechanism to first open circuit through one magnet and to thereafter close circuit through the other, to remove one magnet from the control of said circuit controller, and a line circuit for controlling said relay mechanism.

35. In a telephone system, lines divided into groups, an automatic switch including a contact arm having one motion to select groups, and then another motion in a plane at right-angles to the first motion to find a line in the selected group, an electromagnet controlling the actuation of said switch, a line over which the said magnet is controlled, another magnet controlled over the same line for disconnecting the first magnet therefrom, and a single release magnet for controlling the release of said switch.

36. In a telephone system, a circuit, an automatic switch, a controlling magnet therefor included in said circuit, and an electromagnet automatically controlled over said circuit to disconnect therefrom the controlling magnet of said automatic switch, and a single release magnet for releasing the switch after it has operated.

37. In a telephone system, an automatic switch having a line wiper, a magnet for moving said wiper in one plane, a second magnet for moving said wiper in a second plane, a step-by-step switching device for shifting connection from said first magnet to said second magnet, and a single release magnet for controlling the release of said step-by-step switching device and said automatic switch.

38. In a telephone system, an automatic

switch having a line wiper, a magnet for moving said wiper in one plane, a second magnet for moving said wiper in a second plane, a step-by-step switching device for shifting connection from said first magnet to said second magnet, a single release magnet for controlling the release of said step-by-step switching device and said automatic switch, and a switching magnet for controlling said step-by-step switching device, said switching magnet having under its control a one step switch for controlling the circuit of said release magnet.

39. In a telephone system, a subscriber's station and a line therefor, a calling device at the station adapted at each operation thereof to transmit automatically a series of impulses over one side of the line followed by a final impulse over the other side of the line, a switching mechanism controllable over the said line and having primary and secondary operating magnets responsive to successive series of impulses, and switching means responsive to said final impulses to shift the control from one magnet to the other.

40. In a telephone system, a subscriber's line, a switching mechanism having primary and secondary operating movements and controllable over said line, a calling device at the station on said line adapted upon successive operations thereof to transmit suc-

cessive series of impulses over the line to control the movements of said switching mechanism, and a circuit controller in said switching mechanism responsive to the last impulse of a series to cause the "change over" from one movement to the other.

41. In a telephone system, a subscriber's line, a calling device at the station on said line comprising a pair of cooperating contact members, subscriber controlled means adapted at each operation to cause said contact members to make and break contact with each other a plurality of times to produce current changes in the said line, an automatic switch at the exchange, and a plurality of operating magnets and an electromagnetic circuit changer in said switch all adapted to be controlled by said contact members, the said circuit changer being effective to shift the control of said contact members from one of said magnets to the other.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ALEXANDER E. KEITH.
JOHN ERICKSON.
CHARLES J. ERICKSON.

Witnesses:

W. S. BOYD,
W. LEE CAMPBELL.