(No Model.) 2 Sheets—Sheet 1.

A. B. STROWGER & A. E. KEITH.

MULTIPLE CUT-OUT FOR TELEPHONE SYSTEMS.

No. 589,798. Patented Sept. 7, 1897.

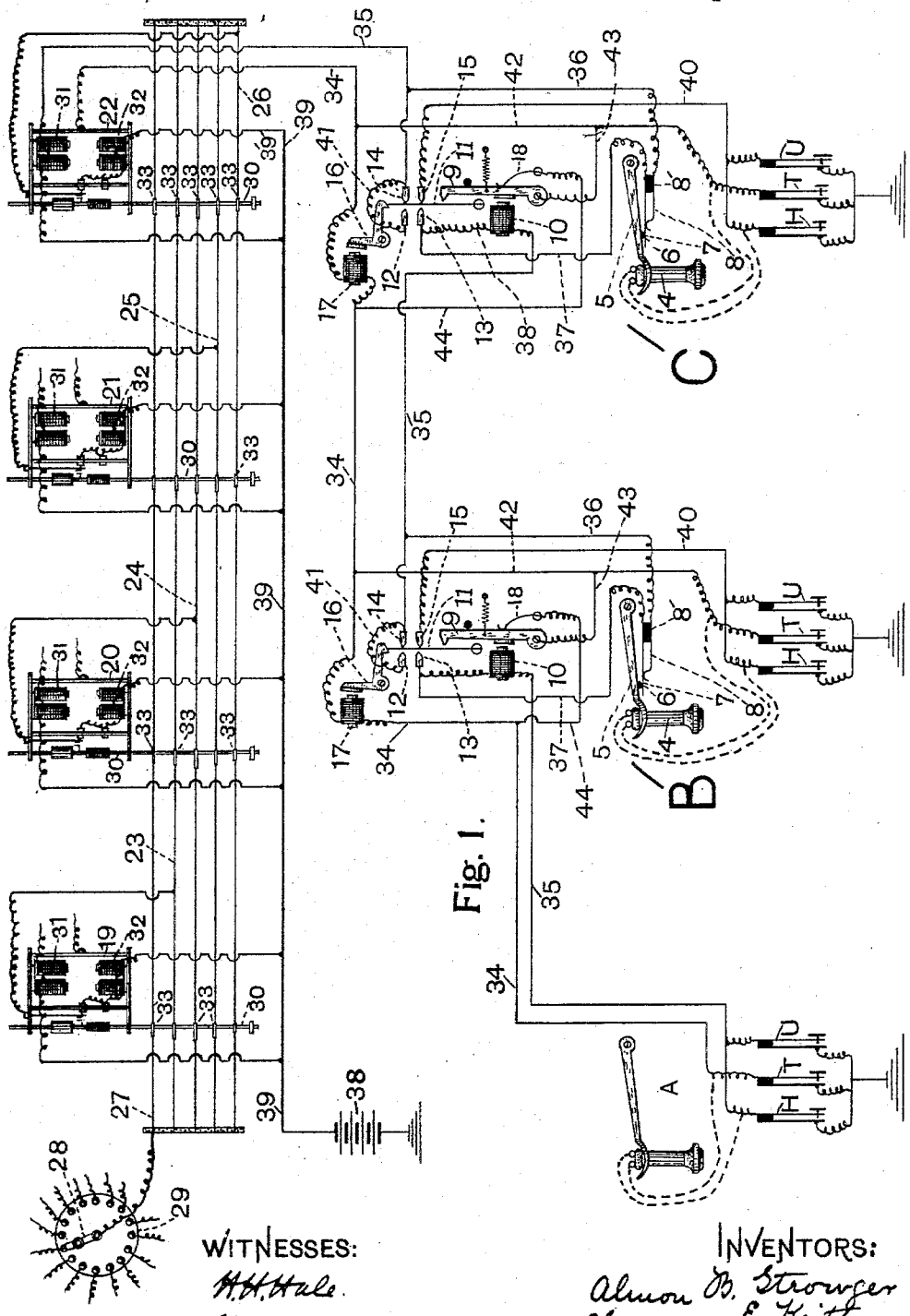

Fig. 1.

WITNESSES:
H. H. Hale.
F. C. Boyd.

INVENTORS:
Almon B. Strowger
Alexander E. Keith
By Their atty Oscar Snell

(No Model.) 2 Sheets—Sheet 2.

A. B. STROWGER & A. E. KEITH.

MULTIPLE CUT-OUT FOR TELEPHONE SYSTEMS.

No. 589,798. Patented Sept. 7, 1897.

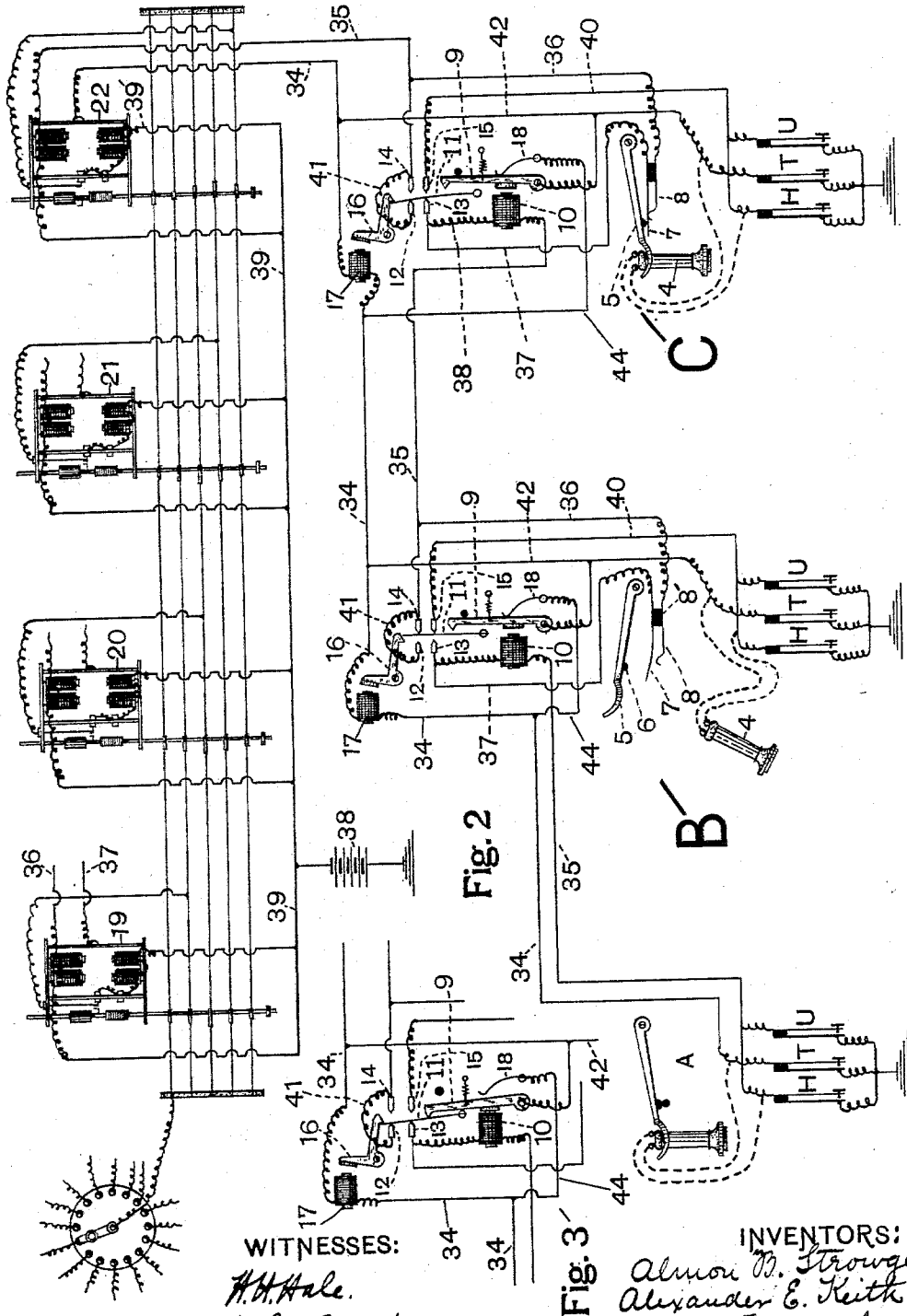

Fig. 2

Fig. 3

WITNESSES:
H. B. Hale.
F. C. Boyd.

INVENTORS:
Almon B. Strowger
Alexander E. Keith
By their atty. Oscar Snell

UNITED STATES PATENT OFFICE.

ALMON B. STROWGER AND ALEXANDER E. KEITH, OF CHICAGO, ILLINOIS.

MULTIPLE CUT-OUT FOR TELEPHONE SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 589,798, dated September 7, 1897.

Application filed February 19, 1896. Serial No. 579,846. (No model.)

To all whom it may concern:

Be it known that we, ALMON B. STROWGER and ALEXANDER E. KEITH, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Multiple Cut-Out for Telephone and Telegraph Systems, of which the following is a specification.

Our invention relates to telephone, telegraph, and other similar apparatus, but is herein shown and described as applied to a telephone system.

Our object is to provide means whereby two line-wires instead of serving to connect one telephone set with a central exchange may serve to connect a plurality of telephone sets therewith, the mechanism and electrical connections being such that but one operator may connect at a time, all the others being automatically cut out from the normally common circuit, as is fully explained hereinafter and is illustrated in the accompanying drawings, in which—

Figure 1 is a diagrammatic view of the several parts and electrical connections which in combination form our invention, the same being shown in the normal position to illustrate the first course of the currents of electricity which serve to operate the combined cut-out and switch apparatus. Fig. 2 is a diagrammatic view similar to Fig. 1, but with several of the parts in a changed position to show the course of the current after part of the combined cut-out and switch is operated. Fig. 3 is a detached portion of Fig. 2, showing the action of an automatic cut-out, which is fully described hereinafter.

Similar letters and figures indicate like parts throughout the several views.

Grouped at B and C mechanism is shown which accompanies each telephone set, and consists of signal-keys H, T, and U, telephone 4, and the usual lever 5, upon which it is suspended, this lever having a piece of insulating material 6 at the under side to contact a metal spring 7, which in turn contacts another metal spring 8, when the telephone-receiver is hung on the lever, these springs being attached at the fixed end to a piece of insulating material 8'.

At 9 is a lever to which is attached the armature of an electromagnet 10, the lever being held back against a stop by means of a spring, as shown.

At 11 is a metal spring-arm attached to a pin at one end, and the upper free end may be vibrated either way, so as to simultaneously contact terminals 12 and 13 on one side or terminals 14 and 15 on the other.

The spring-arm 11 projects beyond the terminals, and when in contact with terminals 12 and 13 the end of the arm may be engaged by the hook shown at the end of the lower arm of bell-crank lever 16, which has an armature attached to the other arm, which is operated by virtue of electromagnet 17.

At 18 is a spring attached at one end, and the other end contacts the lever 9 when it is in the normal position shown in Fig. 1, but is out of contact therewith when the lever has been moved to the position shown in Fig. 3.

At 19, 20, 21, and 22 are representations of automatic telephone-exchange machines, which have, respectively, interconnecting wires 23, 24, 25, and 26 and an interconnecting wire 27, which latter wire terminates at the switch-arm 28 of the manual exchange-board 29.

The several automatic telephone-exchange machines shown each have a shaft 30, which is operated by means of magnets 31 and 32 to cause the switch-arm or wiper 33, attached to the shaft, to contact the interconnecting wires shown or an additional number of such wires, as may be required, this kind of automatic telephone-exchange shown being the subject of Letters Patent of the United States No. 540,168, dated May 28, 1895.

In both Figs. 1 and 2 at A are shown the signal-keys and telephone common to groups B and C, but in group A are not shown the magnets 10 and 17 nor any of the mechanism operated by them, since group A represents the extreme end of the series of substations connected with the same line and none of the above-named cut-out and switching mechanism is required at this terminal station, since the electric current for energizing magnets 10 and 17 at substation B is controlled at keys H, T, and U at station A and the electric currents for energizing magnets 10 and 17 at substation C is controlled at keys H, T, and U at some preceding substation, such as A or B, &c., and so on, as is

still further explained in the description hereinafter of the courses of the currents.

An ordinary magneto-telephone is represented in the drawings to obviate complication, but it must be understood that a regular battery-telephone and all the signal-bell-ringing apparatus may be attached to this system without detracting from the essential features of the invention.

It must be understood that the telephone-exchange machine 22 at the extreme right hand of the drawings is the only one which is directly connected to the line-wires 34 and 35, to which are connected, successively, the three substations A, B, and C.

The operation of this system is as follows: Supposing that a person at substation B desires to connect with the telephone-exchange machine 19 and with the telephone at some substation which is connected with this exchange by wires 36 and 37, the first operation is to remove the telephone 4 from the lever 5, when the lever will rise by virtue of the spring connected therewith and assume the position shown in Fig. 2, substation B, when springs 7 and 8 move out of contact, which disconnects substation A and any other intermediate stations between substations A and B. If now signal-key H is operated at station B, the course of the current is from battery 38 at the central station through wire 39, thence through wire 39′, then through the exchange-switch 22, thence through line-wire 35 to wire 36 at substation C, through spring 8, spring 7, wire 37, then wire 38′, electromagnet 10, line-wire 35, to terminal 14 of substation B, to spring-arm 11, terminal 15, wire 40, signal-key H, to ground. This current energizes magnet 10 at all substations between substation B and the central exchange, causing lever 9 to be depressed against spring-arm 11, which disconnects terminals 14 and 15 and connects terminals 12 and 13 and holds these latter terminals in contact therewith by the falling of the bell-crank lever 16, whose hook engages the end of the spring-arm 11, as shown in Fig. 3, and after the current is released still holds the spring-arm in this position, as shown in Fig. 2 at substation C. The foregoing operations of removing the telephone from lever 5 thus cuts out all substations between substation B and the central exchange by the disconnection of terminals 14 and 15 of all of said intermediate stations. It will thus be seen that a person at substation B is in "possession of the line" to the exclusion of all others. It will be seen that after this operation the current divides at the junction of the lines 35 and 36, one portion thereof passing from terminal 14 through wire 41 to terminal 12, spring-arm 11, terminal 13, wire 38′, and uniting with the other current at the junction of wires 37 and 38′, the other portion from line 35 passing into wire 36, springs 8 and 7, and wire 37 to wire 38′, as before stated.

The lifting of telephone 4 at substation C will not affect substation B, for the whole current will not divide at the junction of wires 35 and 36, but proceed through terminals 14 and 12, as before stated.

The manner in which the several cut-outs and switches are made to assume their normal positions is as follows: Referring to Fig. 2, Sheet 2, station B, first press key H, when current passes from battery 38 through wires 39 and 39′, through the telephone-exchange machine 22, to line-wire 35, where the current divides (if springs 7 and 8 under lever 5 are in contact) at the junction of wires 35 and 36 of substation C, one portion thereof passing from terminal 14 through wire 41 to terminal 12, spring-arm 11, terminal 13, wire 38, and uniting with the other portion of the current at the junction of wires 37 and 38′, the other portion from line 35 passing into wire 36, springs 8 and 7, and wire 37 to wire 38′, as before stated, thence in full current through magnet 10, line-wire 35, to terminal 14 of substation B, thence to spring-arm 11, terminal 15, wire 40, and key H to ground.

In the passage of the current as last described it energizes magnet 10 of substation C and, depressing lever 9, breaks the contact therewith of spring 18, as shown in Fig. 3, and, while holding key H in contact and at the same time depressing key T, causes current to pass from battery through wire 39 to 39′, through the exchange-machine 22, thence through line-wire 34 to magnet 17 of substation C, thence by line-wire 34 to wire 42, to key T, to ground, whereby magnet 17 at substation C is energized, causing the hook of bell-crank lever 16 to disengage from the end of spring-arm 11, which breaks contact with terminals 12 and 13, and arm 11 springs into contact with terminals 14 and 15, which is the normal position. This operation of release last described is usually performed automatically by hanging up the telephone-receiver instead of by manipulating the signal-keys described, and forms a part of the subject of application for Patent of the United States for electrical exchanges, Serial No. 556,229, filed July 17, 1895.

After spring-arm 11 has been set to the position shown in Fig. 2 at substation C or any other station between substation B and the central exchange 22, if the key T at substation B is manipulated for any purpose the force of the current from battery 38 would pass directly through magnet 17 of substation C, if this magnet had no shunt, and cause it to operate bell-crank lever 16 and disengage the hook thereof from the end of spring-arm 11 and thus bring these parts back to the normal position, but to prevent this a shunt-circuit is provided for magnet 17 by way of wire 42 from wire 34 to wire 43, lever 9, spring 18, and wire 44 to line-wire 34 at the opposite side of magnet 17, not enough current passing through this magnet on account of its much higher resistance than the shunt-wires, which are very short, to energize the magnet

sufficient to attract the armature of bell-crank lever 16 and release the spring-arm 11.

We claim as our invention—

1. The combination, with a central station, of a series of substations, an electrical circuit common to all of the stations, a switch, a locking device and two magnets for each substation, one of the magnets being connected with one of the wires and the other magnet being connected with the other wire, and means for moving the switch in one direction by one of the magnets and causing it to automatically engage with the locking device, and means for releasing the switch by the other magnet, and means for completing the circuit through either of the substations, substantially as set forth.

2. The combination, with a central station, of a series of substations, an electrical circuit common to all the stations, a switch, two magnets, a lock, operating mechanism, a shunt around the switch provided with two terminals and a holder for the telephone-receiver in each substation, said holder being adapted to close the terminals when the receiver is in position, one of the magnets being connected with one line of the circuit, and the other magnet being connected with the other line, and means for moving the switch into engagement with the lock by one of the magnets and for releasing it by the other magnet, substantially as set forth.

3. The combination with a telephone or other electric circuit extending between a central station and a series of substations on the same line, each substation normally in electrical connection with the central station, of mechanism at the substations consisting of an automatic cut-out adapted to be actuated by the removal of the telephone and break connection between the central station and all substations preceding the one at which the before-mentioned cut-out is operated, each substation except the last or terminal substation in the circuit having apparatus comprising two electromagnets, one magnet in the circuit of each line, one of such magnets adapted to operate a cut-out and break the circuit of the substation in which it is located, while the other magnet serves to release the cut-out whereby it may return to the normal position, the currents for operating these magnets being controlled by means located at some preceding substation, substantially as hereinbefore described.

In testimony that we claim the foregoing we have hereunto set our hands, this 7th day of September, 1895, in the presence of witnesses.

ALMON B. STROWGER.
ALEXANDER E. KEITH.

Witnesses:
JOSEPH HARRIS,
OSCAR SNELL.