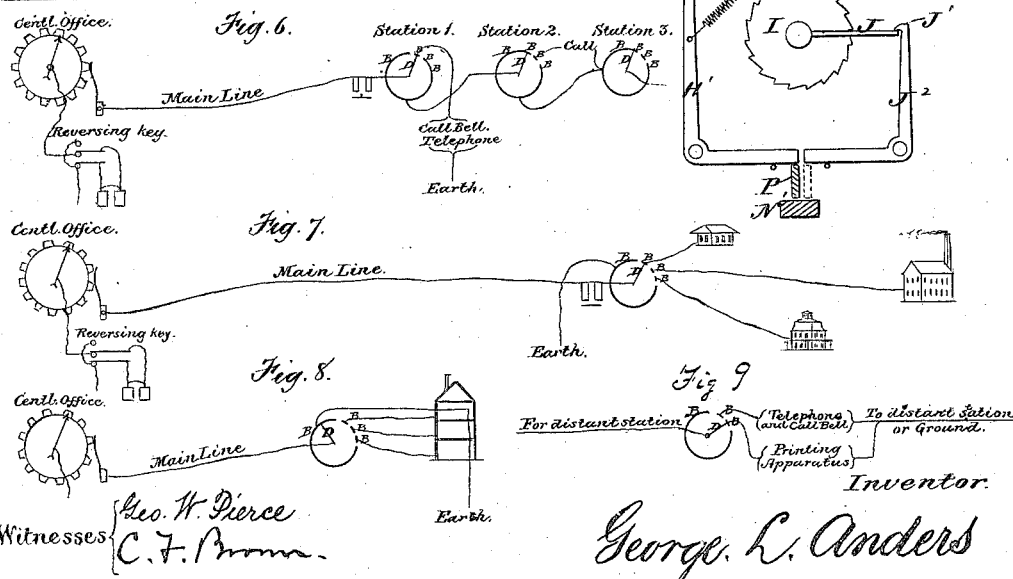
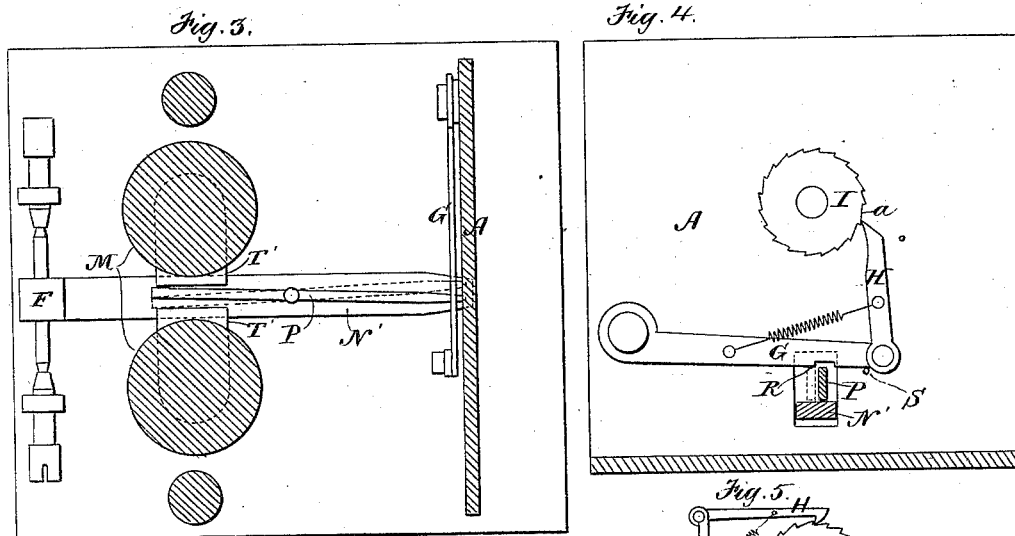
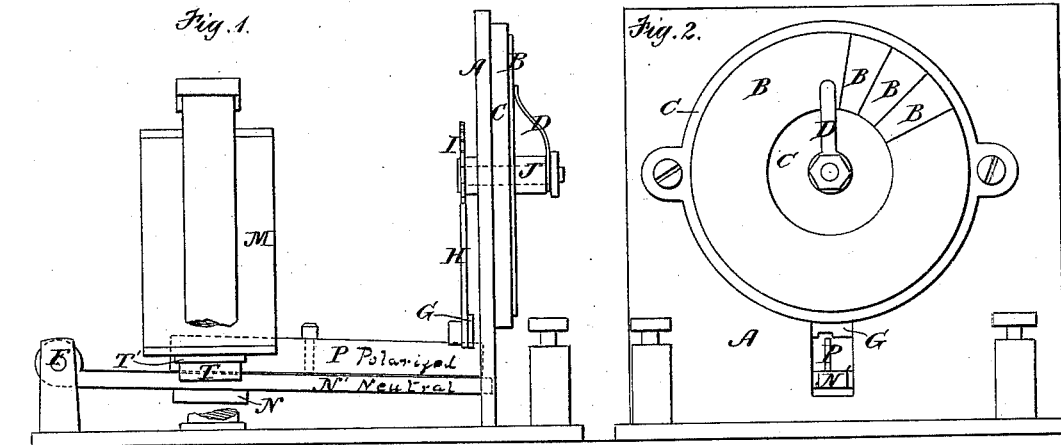


G. L. ANDERS.

TELEGRAPH AND TELEPHONE SWITCH.

No. 306,457.

Patented Oct. 14, 1884.



UNITED STATES PATENT OFFICE.

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TELEGRAPH AND TELEPHONE SWITCH.

SPECIFICATION forming part of Letters Patent No. 306,457, dated October 14, 1884.

Application filed October 25, 1878. Patented in England December 7, 1878, No. 5,292.

To all whom it may concern:

Be it known that I, GEORGE LEE ANDERS, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telegraph-Switches, of which the following is a specification.

The general object of this invention is to enable particular instruments for signaling or communicating intelligence of a series of two or more located on or connected with the same circuit or line wire to be brought into action by an operator at a distant point on the line. These instruments can be located at the same station or in branches radiating therefrom, or they can be placed at or in branches connected with the line-wire at different stations along the line. In the former case one apparatus can by its movement control the operation of the instruments, and allow one or another to be brought into action by the distant operator. In the latter an apparatus at each station is employed, which allows the signaling or other instrument or instruments connected therewith to be operated after a predetermined number of changes in the electrical condition of the circuit. By making this number of changes different for each station it will be seen that the operator can call or communicate with any station to the exclusion of the others.

In connection with such an apparatus as indicated, or a series of them, in order that the same may be set with certainty at the required point or points, unison or adjusting mechanism is employed whereby the said apparatus can be brought to a definite starting-point. The adjustment or setting at a normal point is most advantageously effected by operating the apparatus by currents or electrical impulses of one polarity and adjusting or setting it by the aid of a current or impulses of opposite polarity.

As herein shown, the several signaling or other instruments are brought into action by switch mechanism for making and breaking suitable contacts, so as to connect in with the circuit through the controlling apparatus the several instruments, as may be required, and the controlling apparatus or switch represent-

ed is operated by a ratchet or step-by-step movement, which at a predetermined point allows the desired signaling or other instrument to be operated.

The invention or portions thereof is particularly useful in telephonic systems for calling the operators to their instruments where there are a number of stations located on one circuit, the same line being used for communicating intelligence, and also for operating the controlling apparatus. The ordinary telephone call-bells, which can be operated independently of the controlling apparatus, may be employed. They may be placed in shunts of the main circuit or in ground-wires at the several stations.

Another very important application of the invention is to enable any one of a series of branches to be connected or disconnected with a common line-wire at the will of a distant operator. The controlling apparatus is located in this common wire, and takes the place of a branch office and ordinary switch operating by hand.

It is one of the principal features of this invention that intelligence is transmitted over the same line-wire that is traversed by the currents or electrical impulses for operating the controlling apparatus or switch mechanism.

In order that the invention and the means whereby it is or may be carried into effect may be fully understood, the same will now be described in connection with the accompanying drawings, which form a part of this specification, and which represent an electromagnetic switch constructed in accordance with the said invention, and the application of one and of a series of such switches to control the operation of a number of instruments.

Figure 1 is a side view of a controlling apparatus or switch; Fig. 2, a front view of the same; Fig. 3, a plan partly in section, and Fig. 4 a back view partly in section, showing the operating pawl and ratchet. Fig. 5 is a similar view to Fig. 4, and shows another arrangement of operating devices. Fig. 6 is a diagram illustrating the application of controlling apparatus or switches to a line hav-

ing several stations on the same circuit emanating from a central office. Fig. 7 is a similar diagram, in which a number of stations are connected by branches with a common apparatus or switch, and Figs. 8 and 9 diagrams illustrating special adaptations.

Similar letters of reference refer to like parts.

A is a plate on which is rigidly fixed, but electrically insulated therefrom, a suitable number of contact points or plates, B, arranged in a circular series. The points B are preferably segments of any desired length cut from a flat annular plate or ring attached to an insulating plate, C, and said points are arranged around a shaft or arbor carrying a contact-arm, D, which, when rotated, makes and breaks contact successively with the contact-points. This arrangement may be regarded as an ordinary telegraph-switch of small proportions; but the arm D is operated electro-mechanically from any point in the telegraph-line, as will be described. The arbor of the contact-arm is provided with a ratchet-wheel, I, which is located on the opposite side of the plate A, said arbor revolving freely in a sleeve, J, rigidly fixed in the plate A. The ratchet-wheel has as many teeth as there are positions of contact on the series of contact-points.

In the drawings I show an electrical switch having twenty positions; but the ring from which the contact-points are cut is divided into four parts, three of which are insulated each from the others, the remainder of the ring being undivided and forming a single contact. The contact-arm D, its arbor, and ratchet-wheel receive a step-by-step movement from an electro-magnet acting on a lever carrying a suitable pawl, which engages the teeth of the ratchet. There are many means of accomplishing the movement of this contact-arm.

I prefer to use, as the most simple and effective means, an electro-magnet having a duplex action, which is shown and described in a patent granted to me dated November 1, 1870, for printing-telegraph.

I will now describe the arrangement and operation of the electro-magnet as used in this particular device.

M is an ordinary electro-magnet having two armatures, N P, arranged in a vertical position, with its poles T downward, and having lateral poles T' T'. The armature N is neutral, and is attached to a lever, N', which is pivoted at F.

On the upper side of the lever N', and between the extremities thereof, is pivoted the armature P, which is polarized, one of its extremities being between the lateral poles T' of the electro-magnet, which gives thereto a lateral movement in one direction or the other, according to the direction of the exciting-current. The mechanism described rotates the contact-arm step by step when the electro-magnet is excited by a succession of electric currents of one polarity, as will be readily seen, the armature-lever N' vibrating vertically with

the polarized armature which imparts motion to the lever G, the latter rotating the ratchet I through the pawl H. The object of this polarized armature is to give a duplex or primary and secondary action to the neutral armature, for the purpose which I will now describe.

In a switch or a series of switches adapted to be operated from a distant point it is necessary that each switch should be moved to a predetermined or normal point in its rotation, and then automatically stopped in such manner that a special and distinct operation will be required to start it again, so that the operator will be able to start the contact-arm of the switch from a normal point whenever it is desired to set the switch, thus enabling the switch to be set with certainty and accuracy, and rendering it possible to correct any switch in the circuit that becomes accidentally disarranged. This automatic stoppage of the switch is preferably effected by the armature P in connection with a downward projection, R, on the lever G, and a tooth, a, longer than the others on the ratchet I, as I will now describe.

The above-described step-by-step rotation of the contact-arm is effected by exciting the electro-magnet with currents of such polarity that the polarized armature will be removed from under the projection R of lever G, as shown in full lines in Fig. 4; hence the movement given by the armature P to the lever G will be less than if said armature were under said projection, the movement being just sufficient to give the pawl H a movement corresponding to the length of any tooth of the ratchet, excepting the longer tooth a, so that the pawl will engage with each of the ratchet-teeth in succession until it reaches the long tooth a, the length of which is such that the pawl in its next downward movement cannot pass below the point of the tooth a, said movement being limited by a stop, S, so that the pawl becomes inoperative and the contact-arm is stopped so long as the polarity of the exciting-currents through the magnet M remains unchanged. Now, by reversing the polarity of said currents, the armature P will be attracted to the other lateral pole of the magnet, as shown in dotted lines in Figs. 3 and 4, and thus caused to project under the shoulder R of the lever G, as shown in dotted lines in Fig. 4, so that the vertical movement of the armature P will give a greater movement to the lever G and pawl H than before, this movement being sufficient to give the ratchet I an additional impulse through the tooth preceding the long tooth a, thus bringing the point of the tooth a within reach of the pawl H in its next descent. The switch is now released, and can be operated as before by again reversing the polarity of the current, the armature P being thus drawn to its former position, when it will not co-operate with the projection R.

A modification of the switch stopping and

starting mechanism is shown in Fig. 5, in which the ratchet I is rotated by a pawl, H, and bell-crank lever H', operated by vertical vibrations of the polarized armature P when the latter is in one position. The arbor of the ratchet is provided with an arm, J, which comes in contact once during each rotation with a catch or detent, J', located on a bell-crank lever, J². The catch or detent arrests the rotation of the ratchet and switch until reversal of the polarity of the exciting-currents, which changes the position of the polarized armature and causes the latter to tilt the lever J² and thus release the arm J.

By the use of my improvement an operator can still connect or disconnect any particular station or office in a telegraph-line and communicate with the same in a series of such stations, thereby avoiding the necessity of "calling" each office on the line, as illustrated in diagram shown in Fig. 6. In this figure are shown at the central office a battery connected to line by a reversing-key and a mechanical circuit-breaker provided with a pointer, so as to show the number of changes in the electrical condition of the circuit from the normal or starting point, and at these stations signal-controlling apparatus or switches. The latter have only two contact-plates, B, which for convenience may be called the "normal contact" and the "signal-contact." At station 1 a call-bell and telephone are located in a ground-wire connected with the small or signal contact. At station 2 a call is indicated as located in a shunt of the main circuit connected with the signal-contact of the switch thereat. It will be seen from an inspection of the drawing that the signal-contact at station 2 is one division farther from the normal point. At station 3 the call-branch is not shown. It would be connected at one end with the normal contact and at the other with a signal-contact one step farther to the right than that at station 2. The signal-contacts at other stations, when such there are, would be each one step farther than the preceding. The position of the electro-magnet is shown at station 1. At this and at second station the line from the central office, or preceding station, or "line in" is connected through the coils of the magnet with the contact-arm D. The line to the next station is connected with the large or normal contact-plate B. At station 3 "line out" is shown connected with the contact-arm and "line in" with the normal contact. The electro-magnet may be placed either in line in or line out.

The operation of a line thus constructed will be readily understood. Supposing all the apparatus to be adjusted to the normal or starting point, as shown in Figs. 1 to 5, a current of the polarity required to shift the polarized armature P into the position shown in dotted lines, Figs. 4 and 5, is sent by means of the reversing-key, and all the ratchet-disks and contact-arms D are advanced one step into the position shown in Fig. 6, bringing station 1

into direct communication with the central office and cutting off all beyond. If station 3, say, is to be called, then a current of opposite polarity is sent over the line, which first operates the apparatus at station 1, breaking the ground and connecting the line from central office with the line beyond, and then advances the contact-arms at the other stations. On breaking the circuit the armatures fall back, and on again completing it all the contact-arms are again advanced. The call at station 3 would now be in circuit.

The breaks and completion of the circuit can be made by the mechanical circuit-breaker at the central office, and the pointer will automatically indicate the station whose signal can at the time be operated.

The call-bells usually used on telephone-lines which are adapted to be rung by the rapidly-alternating currents of a magneto-generator can be employed, and they will not disturb the signal-controlling apparatus. These signals being well known and forming in themselves no part of this invention, the word "call," or "call-bell and telephone," is deemed a sufficient indication.

As shown in Figs. 7 and 8, one apparatus or switch located at any convenient point in an electrical circuit is arranged to connect and disconnect branch offices attached to it, thereby saving a number of main wires from that point to the point of operation. The contact-plates B correspond with the number of branch offices.

In Fig. 8 a common ground-wire united at one end to the large normal contact-plate connects the terminals of all the branch lines, and can be used to call the central office by any of the branch offices.

In Fig. 9 is shown apparatus for connecting in the circuit at will either a telephone and call or a printing apparatus located at the same station. Line in is indicated by the words "for distant station," line out by words "to distant station."

An additional ground or branch wire (not shown) would be connected with the normal contact-plate, as represented in Figs. 7 or 8.

Having thus fully explained the invention and the manner of carrying the same into effect, what I claim is—

1. An electrical switch operated by one or more magnets excited by currents of one polarity, and adjusted by mechanism operated by currents of opposite polarity, said switch having contacts for changing the connection of the circuit through the coils of said magnets.

2. An electric apparatus comprising an electro-magnet and mechanism controlled by said magnet for bringing into action one or another of a number of instruments, in combination with unison mechanism controlled by the same magnet for adjusting or setting the apparatus at a definite or normal starting-point, substantially as described.

3. The combination, with a telephone or

- telegraph line, and a series of shunts or ground-wires normally disconnected from the circuit, and located one or more at each station on the line, of a series of electro-magnetic switches
5 having their electro-magnets in the telegraph or telephone line aforesaid, and constructed, substantially as described, so as to connect the shunts or ground-wires with the line-wire, as set forth.
- 10 4. The combination, with a telegraph or telegraph line, of one or more electric switches operated step by step to alter the electrical connections of the line, and unison or adjusting mechanism for setting the said switches at
15 a definite starting-point, substantially as described.
5. In a telegraph or telephone line, a series of electro-magnetic switches operated from a given point to connect in with the circuit
20 through the switch-magnets a ground-wire or shunt at any station by a determined number of electrical changes or impulses different for each switch, in combination with unison devices, substantially as described.
- 25 6. The combination, with a neutral and po-

larized armature, ratchet-disk turning in a fixed plane and pawl, of one or more levers having their axes of oscillation parallel to the axis of said disk, and operated by said armatures for controlling the position of said disk.

7. A switch composed of a rotary contact-arm connected in a telegraphic circuit, and a series of contacts arranged in the path of the arm, and connected with separate telegraph-wires, combined with automatic means for stopping the arm when it reaches a predetermined normal point, and electro mechanical mechanism operated, first, by currents of one polarity to rotate the arm until it is automatically stopped; and, second, by a current or currents of an opposite polarity to start the arm from its normal point.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 23d day of October, 4
1878.

GEORGE LEE ANDERS.

Witnesses:

C. F. BROWN,
GEO. W. PIERCE.