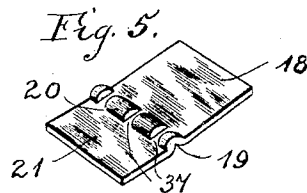
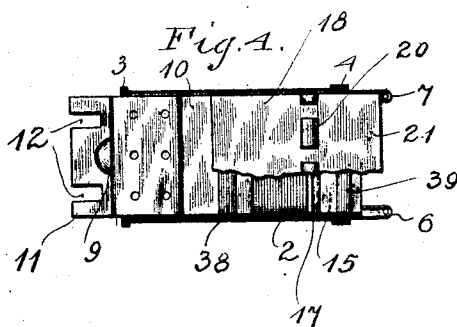
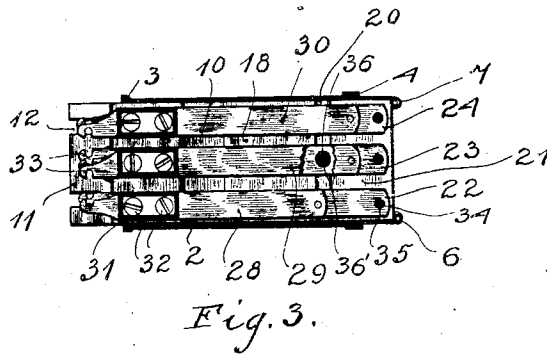
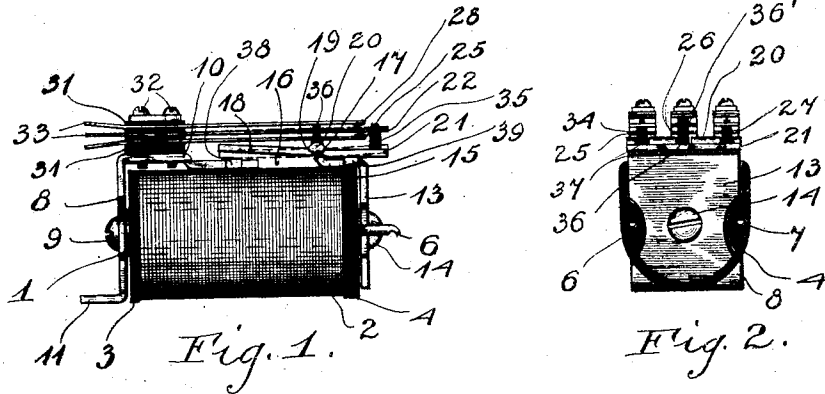


No. 853,292.

PATENTED MAY 14, 1907.

J. A. BIRSFIELD.  
CIRCUIT CHANGING APPARATUS.  
APPLICATION FILED MAR. 22, 1905.



WITNESSES:  
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Attorney

# UNITED STATES PATENT OFFICE.

JULES A. BIRSFIELD, OF ROCHESTER, NEW YORK, ASSIGNOR TO STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

## CIRCUIT-CHANGING APPARATUS.

No. 858,292.

Specification of Letters Patent.

Patented May 14, 1907.

Application filed March 22, 1905. Serial No. 251,390.

*To all whom it may concern:*

Be it known that I, JULES A. BIRSFIELD, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented a certain new and useful Improvement in Circuit-Changing Apparatus, (Case 6,) 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 circuit changing apparatus particularly to relays employed in the telephone art, and my invention includes various improved features of construction and arrangement which will appear in the following specification and in the accompanying drawing, in which

Figure 1 is an elevation side view of the relay. Fig. 2 is a front elevation thereof. Fig. 3 is a top view. Fig. 4 is a top view with the circuit changing springs removed, and Fig. 5 is an isolated view of the relay armature.

The relay consists of the core 1 upon which is mounted the coil 2 between the insulating end plates 3 and 4, the terminals 6 and 7 extending forwardly through the end plate 4 for connection with electrical conductors. The yoke of the relay consists of two L-shaped pieces, the vertical part 8 of the rear piece being secured to the core by the screw 9 and the horizontal part 10 extending longitudinally along the top of the coil 2. A rearward longitudinal extension 11 from the lower end of the vertical piece 8 is provided with the slots 12—12 for engaging under the head of screws by which the relay may be secured to a support and from which it can easily be withdrawn upon a slight loosening thereof. The vertical part 13 of the front yoke piece is secured to the front end of the core by the screw 14, while the longitudinal part 15 thereof extends rearwardly a distance to leave the gap 16. The end of the longitudinal part 15 is provided with the pivot edge 17 upon which is pivoted the armature plate 18. This pivot edge may be readily secured by bending the end of the part 15 upwardly through an angle of 45 degrees as shown. The armature plate 18 is provided with a transverse groove or pivot slot 19 which may be punched or pressed therein to form a ridge

20 at the top of the plate parallel to the slot. When the armature is in position with the pivot slot engaging the pivot edge, the front end of the armature will overlap the end of the top part 10 of the rear yoke piece and thus will serve to complete the magnetic circuit through the core and yoke members.

The armature plate is extended a distance to form the actuating lever or plate 21 which upon attraction of the armature serves to suitably actuate the spring switching mechanism. This spring switching mechanism may consist of any number of interrelated springs, and as shown, consists of three actuating springs 22, 23 and 24 normally in engagement with the contact springs 25, 26 and 27 respectively, and when the armature is attracted these actuating springs are carried into engagement with the alternating contact springs 28, 29 and 30 respectively. These springs at their rear ends are suitably insulated from each other by the insulating strips 31 and each set of springs is secured to the rear yoke piece 8 by means of screws 32, and for this purpose the rear part of this yoke piece may be offset upwardly a distance to allow sufficient space for the protruding ends of the screws 32. The end of each spring terminates in a terminal tip 33 to which suitable conductors may be soldered.

The front of each of the actuating springs has an opening 34 through which extends the neck portion of an insulating distance stud 35, these studs resting against the end 21 of the armature plate, and the actuating springs are sprung to normally press the end 21 downwardly to leave an air gap between the armature plate and the end of the rear yoke piece 10, the normal contact springs 25, 26 and 27 being then in engagement with the actuating springs. Upon current flow through the coil 2 the relay will be energized and the armature plate attracted toward the rear yoke piece and the actuating springs will be raised from engagement with the normal contact springs and into engagement with the alternating contact springs 28, 29 and 30. The alternating contact springs serve also for retaining the armature plate in position on its pivot and for this purpose the actuating springs and the normal contact springs are provided with openings 36

above the pivot edge through which the insulating studs 36 extend, these openings being larger in diameter than the diameter of these studs. To accommodate these studs 36 the ridge 20 is cut away to form level resting places 37 for the studs against the tops of which the alternating contact springs press and thus retain the armature plate on its pivot without preventing free oscillation thereof.

To prevent sticking of the armature I provide a band 38 of non-magnetic material about the end of the rear yoke piece below the end of the armature plate, and a similar band 39 encircles the top part 15 of the front yoke piece, these magnetic bands extending a slight distance above the level of the yoke pieces.

The yoke or pole pieces and the armature plate may be stamped from sheet material and the armature plate may be plane, or the parts 18 and 21 may be at a slight angle to each other depending upon the air gap desired between the armature end and the rear yoke or pole piece.

I thus produce a relay of very compact, neat and efficient design and built of few, very simple and inexpensive parts.

The arrangement of the switch springs need not necessarily be as shown, as this would vary according to the circuit changes desired to be accomplished by the relay.

I claim as new and desire to secure by Letters Patent:

1. In a relay, the combination with a core, of a coil thereon, a rear yoke piece secured to the core and extending along the top of the coil, a front yoke piece secured to the other end of the core and extending rearwardly a distance toward the rear yoke piece to leave an air gap between the pieces, a plate pivoted over the end of the front yoke piece, the rear part of said plate forming an armature and overlapping the end of the rear yoke piece, and switch springs secured to the rear yoke piece and extending forwardly over said plate and having engagement with the front part of said plate, current flow through said coil causing attraction of the armature part of the plate to cause actuation of said springs.

2. In a relay, the combination with a core, of a coil thereon, a rear yoke piece secured to the core and extending along the top of the coil, a front yoke piece secured to the other end of the core and extending rearwardly a distance toward the rear yoke piece to leave an air gap between the pieces, a plate pivoted over the end of the front yoke piece, the rear part of said plate forming an armature and overlapping the end of the rear yoke piece, and switch springs secured to the rear yoke piece and extending forwardly over said plate and having engagement with the front part of said plate, current flow through said coil causing attraction of the armature part of the plate to

cause actuation of said springs, said switch springs serving to hold said plate on its pivot.

3. In a relay, the combination with a core, of a coil thereon, a rear L-shaped yoke piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, an L-shaped front yoke piece secured to the front end of the core and extending rearwardly a distance to leave a non-magnetic gap between the yoke pieces, a pivot edge at the end of the front yoke piece, a plate of magnetic material pivoted on said edge along an intermediary line, the part of said plate to the rear of said pivot forming an armature, the part of said plate in front of said pivot forming an actuating lever, and circuit changing springs mounted at their rear ends on the rear yoke piece and being connected at their front ends with the actuating lever, said springs normally causing pressure against said lever to hold the armature part away from the rear yoke piece, current flow through said coil causing attraction of the armature part, whereby said circuit changing springs are actuated.

4. In a relay, the combination with a core, of a coil thereon, a rear L-shaped yoke piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, a front L-shaped yoke piece secured to the front end of the core and extending rearwardly a distance along the top of the coil to leave a non-magnetic gap between the ends of the yoke pieces, the end of the front yoke piece offering a pivot edge, a magnetic plate pivoted on said edge at an intermediary line, the rear part of said plate forming an armature, the front part of said plate forming an actuating lever, and switching mechanism mounted on the rear yoke piece and having connection with the actuating lever, said switching mechanism serving normally to depress said actuating lever to retain the armature out of contact with the rear yoke piece, current flow through said coil causing said armature to be attracted to complete the magnetic circuit through the yoke and causing said switching mechanism to be actuated, said switching mechanism serving also to retain said plate in position on said pivot edge.

5. In a relay, the combination with a core, of a coil thereon, an L-shaped rear pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, a front L-shaped pole piece secured to the front end of the core and extending rearwardly a distance along the top of the coil, a non-magnetic gap between the ends of the pole pieces, the end of the front pole piece being shaped to form a pivot edge, a plate of magnetic material pivoted at an intermediary line on said edge, the rear part of said plate

forming an armature and the front part thereof forming an actuating lever, and actuating and contact switch springs mounted at their rear ends on the rear pole piece and extending forwardly therefrom, the front end of the actuating springs having connection with said actuating lever and tending normally to depress said lever to retain the armature away from the rear pole piece and out of engagement with the contact springs, current flow through said coil causing energization of the relay, whereby the armature is attracted toward the rear pole piece, said actuating lever being raised to carry the actuating springs into engagement with the contact springs.

6. In a relay, the combination with a core, of a coil thereon, an L-shaped rear pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, a front L-shaped pole piece secured to the front end of the core and extending rearwardly a distance along the top of the coil, a non-magnetic gap between the ends of the pole pieces, the end of the front pole piece being shaped to form a pivot edge, a plate of magnetic material pivoted at an intermediary line on said edge, the rear part of said plate forming an armature and the front part thereof forming an actuating lever, and actuating and contact switch springs mounted at their rear ends on the rear pole piece and extending forwardly therefrom, the front end of the actuating springs having connection with said actuating lever and tending normally to depress said lever to retain the armature away from the rear pole piece and out of engagement with the contact springs, current flow through said coil causing energization of the relay, whereby the armature is attracted toward the rear pole piece, said actuating lever being raised to carry the actuating springs into engagement with the contact springs, said contact springs serving also to retain said plate in position on said pivot edge.

7. In a relay, the combination with a core, of a coil thereon, a rear L-shaped pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, a front L-shaped pole piece secured to the front end of the coil and extending rearwardly a distance along the top of the coil, the end of said front pole piece being turned upwardly to offer a pivot edge, a plate of magnetic material pivoted at an intermediary line on said edge, the rear part of said plate forming an armature and the front part thereof forming an actuating lever, and switching mechanism mounted on the rear pole piece and extending forwardly and having connection with said actuating lever, current flow through said coil causing attraction of said armature, whereby said lever and switching mechanism are actuated.

8. In a relay, the combination with a core, of a coil thereon, a rear L-shaped pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, a front L-shaped pole piece secured to the front end of the core and extending rearwardly a distance along the top of the core, there being a non-magnetic gap between the ends of said pole pieces, the end of said front pole piece being turned upwardly to an angle to offer a pivot edge, a plate of magnetic material pivoted at an intermediary line on said edge, the rear part of said plate forming an armature and the front part thereof forming an actuating lever, and switching mechanism consisting of actuating and contact springs mounted on the rear pole piece, the front end of the actuating springs having connection with said actuating lever and tending to normally depress said lever to hold the armature away from the rear pole piece, current flow through said coil causing energization of the relay, whereby the armature is attracted toward the rear pole piece, whereby said actuating lever is raised to carry the actuating springs into engagement with the contact springs, said contact springs serving also to retain said plate in position on its pivot edge.

9. In a relay, the combination with a core, of a coil thereon, a rear L-shaped pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, a front pole piece secured to the front end of the core, there being a non-magnetic gap between the end of the pole pieces, the end of the front pole piece forming a pivot edge, a plate of magnetic material pivoted at an intermediary line on said edge, the rear part of said plate forming an armature and the front part thereof forming an actuating lever, and switching mechanism mounted on the rear pole piece and having connection at its forward end with said actuating lever and tending normally to depress the actuating lever to hold the armature away from the rear pole piece, current flow through said coil causing attraction of the armature toward the rear pole piece, whereby said actuating lever is raised and the switching mechanism actuated.

10. In a relay, the combination with a core, of a coil thereon, a rear L-shaped pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, an L-shaped front pole piece secured to the front end of the core and extending rearwardly a distance along the top of the coil, there being a non-magnetic gap between the ends of the pole pieces, the end of said front pole piece being shaped to offer a pivot edge, a plate of magnetic material pivoted along an intermediary line on said edge, the rear part of said plate forming an armature and the front part thereof forming an actuating plate,

switching mechanism consisting of actuating and contact springs mounted on the rear pole piece, and insulating studs between the front ends of said actuating springs and said actuating lever, said actuating springs serving normally to depress said actuating lever to retain the armature away from the rear pole piece, current flow through said coil causing attraction of said armature toward the rear pole piece, whereby said actuating lever is raised and the relation between the actuating springs and contact springs changed.

11. In a relay, the combination with a core, of a coil thereon, a rear L-shaped pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, an L-shaped front pole piece secured to the front end of the core and extending rearwardly a distance along the top of the coil, there being a non-magnetic gap between the ends of the pole pieces, the end of said front pole piece being shaped to offer a pivot edge, a plate of magnetic material pivoted along an intermediary line on said edge, the rear part of said plate forming an armature and the front part thereof forming an actuating plate, switching mechanism consisting of actuating and contact springs mounted on the rear pole piece, insulating studs between the front ends of said actuating springs and said actuating lever, said actuating springs serving normally to depress said actuating lever to retain the armature away from the rear pole piece, current flow through said coil causing attraction of said armature toward the rear pole piece, whereby said actuating lever is raised and the relation between the actuating springs and contact springs changed, and insulating studs between said contact springs and said plate for holding said plate in position on its pivot.

12. In a relay, the combination with a core, of a coil thereon, a rear L-shaped pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, an L-shaped front pole piece secured to the front end of the core and extending rearwardly a distance along the top of the coil, there being a non-magnetic gap between the ends of the pole pieces, the end of said front pole piece being shaped to offer a pivot edge, a plate of magnetic material pivoted along an intermediary line on said edge, the rear part of said plate forming an armature and the front part thereof forming an actuating plate, switching mechanism consisting of actuating and contact springs mounted on the rear pole piece, insulating studs between the front ends of said actuating springs and said actuating lever, said actuating springs serving normally to depress said actuating lever to retain the armature away from the rear pole piece, current flow through said coil causing attraction of said armature toward the rear pole piece,

whereby said actuating lever is raised and the relation between the actuating springs and contact springs changed, and insulating studs engaging said plate over the pivot edge and engaged at their top by said contact springs, whereby said plate is retained on its pivot edge.

13. In a relay, the combination with a core, of a coil thereon, a rear pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, a front pole piece secured to the front end of the core and extending rearwardly a distance along the top of the coil to leave an air gap between the ends of the pole pieces, the end of said front pole piece being bent upwardly at an angle to offer a pivot edge, a plate of magnetic material having a transverse notch along an intermediary line or engaging said pivot edge, the rear part of said plate forming an armature and the front part thereof forming an actuating lever, switching mechanism mounted on the rear pole piece and consisting of actuating and contact springs, studs of insulating material disposed between the front ends of the actuating springs and said actuating lever tending to normally depress said lever to retain the armature away from the rear pole piece, and additional studs of insulating material engaging said plate over the pivot edge, said contact springs pressing on said additional studs, whereby to retain said plate on said pivot edge, current flow through said coil causing attraction of the armature part toward the rear pole piece whereby said actuating lever is raised and the circuit relations between said actuating springs and the contact springs changed.

14. In a relay, the combination with a core, of a coil thereon, a rear pole piece secured to the rear end of the core and extending forwardly a distance along the top of the coil, a front pole piece secured to the front end of the core and extending rearwardly a distance along the top of the coil, there being a non-magnetic gap between the ends of said pole pieces, the end of the front pole piece being shaped to offer a pivot edge, an armature plate pivoted on said edge, and switching mechanism for the relay serving to normally retain the armature away from the rear pole piece, current flow through said coil causing attraction of the armature to actuate said switching mechanism.

15. In a relay, the combination with a core, of a coil thereon, a pole piece secured to the rear end of the coil and extending forwardly a distance along the top of the coil, a front pole piece secured to the front end of the core and extending rearwardly a distance along the top of the coil, there being a non-magnetic gap between the ends of the pole pieces, the ends of one of said pole pieces being shaped to form a pivot edge, an arma-

ture plate pivoted on said edge and bridging said gap, and switching mechanism for the relay serving normally to maintain a gap between the armature and one of the pole pieces, current flow through said coil causing attraction of the armature to cause actuation of the switching mechanism.

16. In a relay, the combination with a core, of a coil thereon, a pole piece secured to one end of the core and extending a distance along the top of the coil, another pole piece secured to the other end of the core and extending a distance along the top of the coil, there being a non-magnetic gap between the ends of the pole pieces, the end of one of said pole pieces being bent at an angle to offer a pivot edge, an armature plate pivoted on said edge and bridging said non-magnetic gap, and switching mechanism mounted on one pole piece and engaging the armature to normally maintain an air gap between the armature and one pole piece, current flow through the coil causing actuation of the armature and of the switching mechanism.

17. In a relay, the combination with a core, of a coil thereon, a pole piece secured to one end of the coil and extending a distance along the top of the coil, a pole piece secured to the other end of the core and extending a distance along the top of the coil, there being a non-magnetic gap between the ends of the pole pieces, the end of one of said pole pieces being shaped to form a pivot edge, an armature plate pivoted on said edge and overlapping the other pole piece a short distance, switching mechanism mounted on one pole piece and normally having connection with the armature to maintain an air gap between the armature and the overlapped pole piece, current flow through the coil causing attraction of the armature and actuation of the switching mechanism, and a band of non-magnetic material encircling the end of the pole piece overlapped by said armature.

18. In a relay, the combination with a core, of a coil thereon, a rear pole piece secured to the core and extending along the top of the coil, a front pole piece secured to the other end of the core and extending rearwardly a distance toward the rear pole piece to leave an air gap between the pieces, means for removably securing the core to said pole pieces, a plate pivoted over the end of the front pole piece, the rear part of said plate forming an armature and overlapping the end of the rear pole piece, and switch springs secured to the rear pole piece and extending forwardly over said plate and having engagement with the front part of said plate, current flow through said coil causing attraction of the armature part of the plate to cause actuation of said springs.

19. In a relay, the combination with a core, of a coil thereon, a rear pole piece secured to the core and extending along the top of the coil, a front pole piece secured to the other end of the core and extending rearwardly a distance toward the rear pole piece to leave an air gap between the pieces, means for removably securing the core to said pole pieces, a plate pivoted over the end of the front pole piece, the rear part of said plate forming an armature and overlapping the end of the rear pole piece, and switch springs secured to the rear pole piece and extending forwardly over said plate and having engagement with the front part of said plate, current flow through said coil causing attraction of the armature part of the plate to cause actuation of said springs, said switch springs serving to hold said plate on its pivot.

In witness whereof, I hereunto subscribe my name this 13th day of March A. D., 1905.

JULES A. BIRSFIELD.

Witnesses:

CHARLES E. HAGUE,  
A. B. BLIDD.