G. W. DONNAN.

ELECTROMAGNETIC SWITCH OPERATING MECHANISM.

APPLICATION FILED OCT. 6, 1909.

955,391. Patented Apr. 19, 1910.

3 SHEETS—SHEET 1.

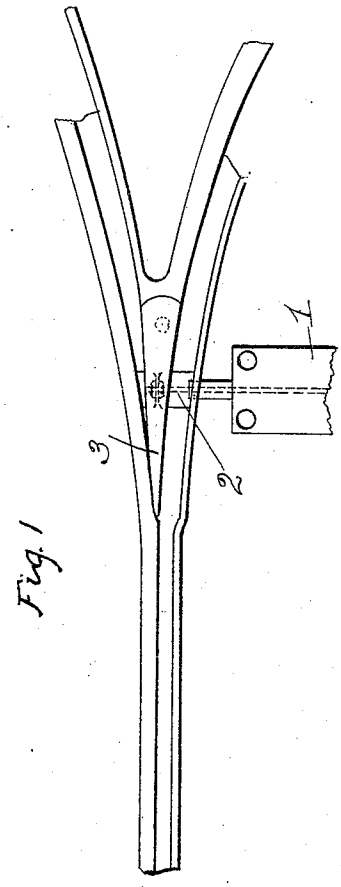


Fig. 1

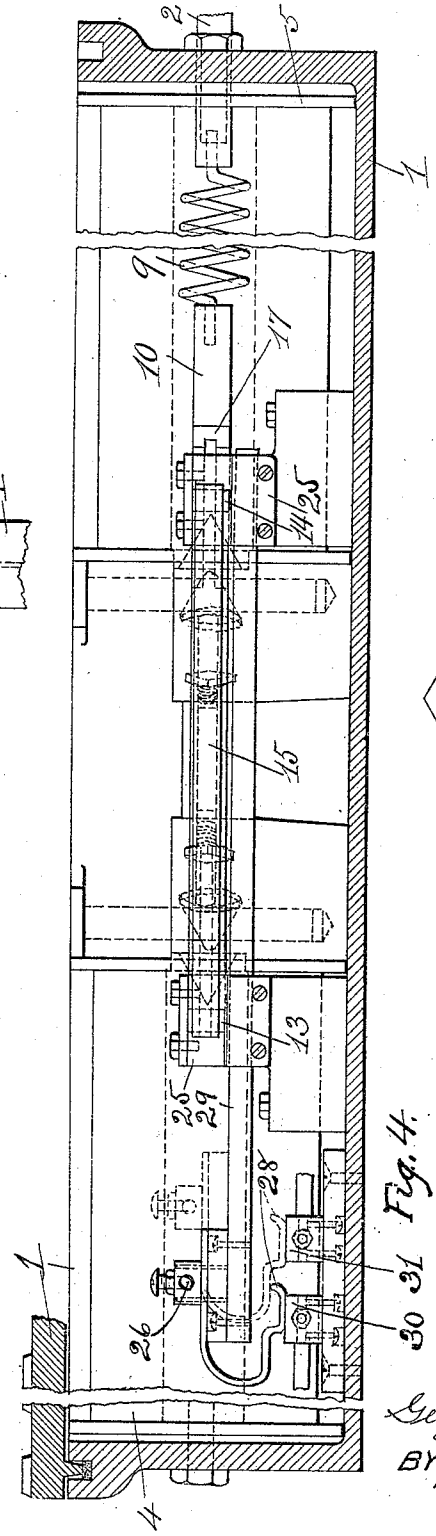


Fig. 4.

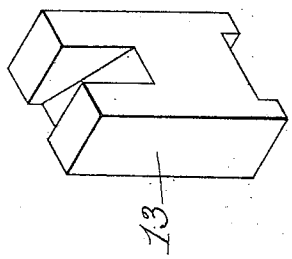


Fig. 5.

WITNESSES:

J. Donsbach.

E. Bakeman.

INVENTOR

George W. Donnan,

BY Mosher & Curtis

ATTORNEYS.

G. W. DONNAN.

ELECTROMAGNETIC SWITCH OPERATING MECHANISM.

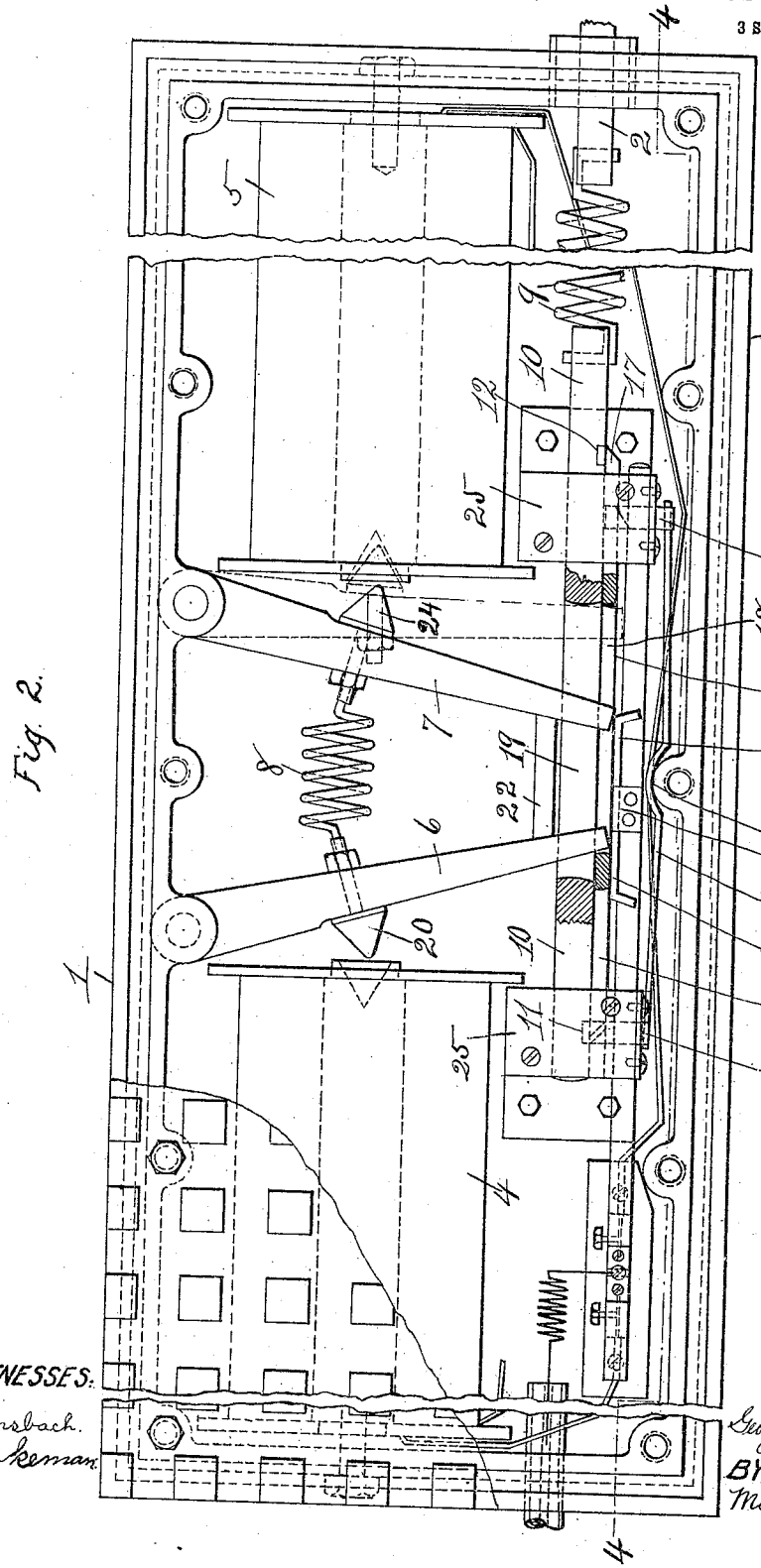
APPLICATION FILED OCT. 6, 1909.

955,391.

Patented Apr. 19, 1910.

3 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

J. Donsbach.

E. Bakeman.

INVENTOR

George W. Donnan,

BY

Mosher & Curtis,

ATTORNEYS.

G. W. DONNAN.

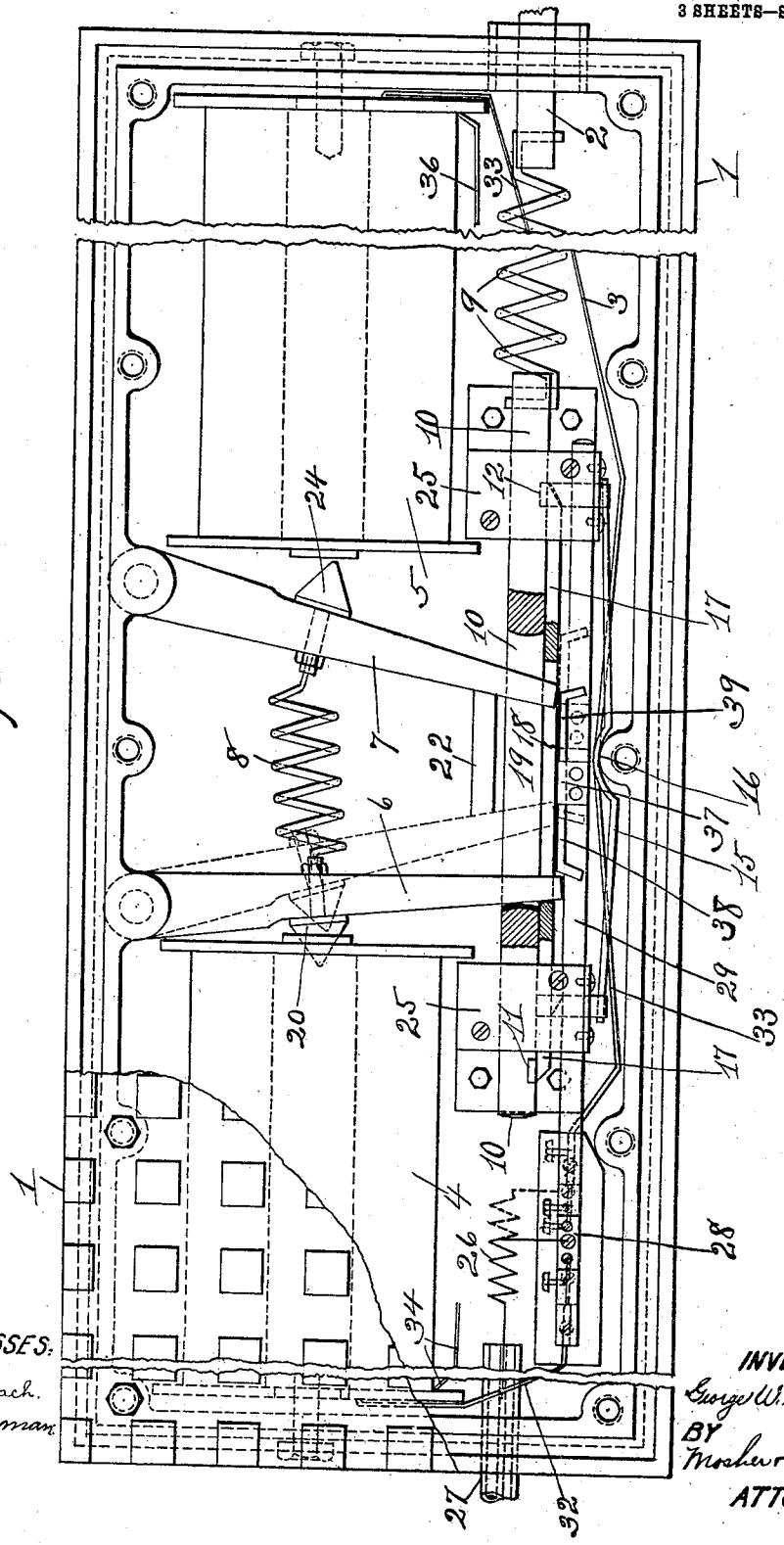
ELECTROMAGNETIC SWITCH OPERATING MECHANISM.

APPLICATION FILED OCT. 6, 1909.

955,391. **Patented Apr. 19, 1910.**

3 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

J. Donsbach.

E. Bakeman.

INVENTOR

George W. Donnan

BY

Mosher & Curtis

ATTORNEYS

UNITED STATES PATENT OFFICE.

GEORGE W. DONNAN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO KENDRICK RAILWAY SWITCH COMPANY, OF SCHENECTADY, NEW YORK, A CORPORATION OF NEW YORK.

ELECTROMAGNETIC SWITCH-OPERATING MECHANISM.

955,391. Specification of Letters Patent. Patented Apr. 19, 1910.

Application filed October 6, 1909. Serial No. 521,201.

To all whom it may concern:

Be it known that I, GEORGE W. DONNAN, a citizen of the United States, residing at Schenectady, county of Schenectady, and State of New York, have invented certain new and useful Improvements in Electromagnetic Switch-Operating Mechanism, of which the following is a specification.

The invention relates to such improvements and consists of the novel construction and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings, and the reference characters marked thereon, which form a part of this specification.

Similar characters refer to similar parts in the several figures therein.

This invention is especially adapted for operating the switches of street-railways, but it may also be advantageously employed in many situations where it is desired to actuate a reciprocating member first in one direction and then in the opposite direction by the use of electromagnetic mechanism.

Certain objects of the invention are to render more certain and accurate the operation of the reciprocating member; to lock the reciprocating member against accidental movement during the intervals between successive operations of the same by an electromagnetic mechanism; and, in its preferred application to a street railway-switch, to yieldingly hold the tongue of the switch in the last selected position, either open or closed, between successive operations of the electromagnetic mechanism.

Other objects will appear in connection with the following description.

Figure 1 of the drawings is a top plan view of my improved switch-operating mechanism for street-railways partly broken away. Fig. 2 is a plan view on a larger scale of the box containing the electromagnets and the mechanism operated thereby to induce the throwing of the switch-tongue to open or close the switch. Fig. 3 is a similar view with certain of the parts in different positions caused by operation of the electromagnetic mechanism. Fig. 4 is a vertical, longitudinal section of the same taken on the broken line 4—4 in Fig. 2. Fig. 5 is a view in isometrical perspective of one of the spring-catches detached.

Referring to the drawings wherein the invention is shown in preferred form, 1, represents a box containing the electromagnetic mechanism; 2, a reciprocating member in the form of a shaft extending exteriorly of the box and adapted to be operated by said electromagnetic mechanism; and, 3, the movable tongue of a street railway-switch adapted to be thrown first in one direction and then in the opposite direction by successive operations of the electromagnetic mechanism.

Mounted within the box, 1, are a pair of electromagnets, 4 and 5, the armatures for which are mounted upon the respective levers, 6 and 7, said levers being drawn toward each other and away from the respective magnets, and against the stop, 22, by the coil-spring, 8, when said electromagnets are not energized. The shaft, 2, is connected by a stiff coil-spring, 9, with a reciprocating shaft, 10, capable of sliding movements in the bearings, 25, mounted upon the interior of the box, said shafts being in line with each other. The shaft, 10, is provided on one side with two notches, 11 and 12, so arranged that at the end of the movement of the shaft, 10, to the right, as shown in Fig. 2, the notch, 11, is in line with, and adapted to receive, the spring-catch, 13; and at the end of the movement of said shaft in the opposite direction the notch, 12, is in line with, and adapted to receive, the spring-catch 14.

The catches, 13 and 14, reciprocate in slideways in the bearings, 25, at right angles to the respective slideways for the shaft, 10, and are yieldingly forced inward by means of a leaf-spring, 15, the middle of which bears upon the side-wall of the box at, 16, and the respective ends upon the catches 13 and 14. The inner end of each of the catches, 13 and 14, is bifurcated, the bifurcation having a beveled bottom-wall, and being adapted to freely receive a slide-bar, 17, the opposite ends of which are beveled to correspond with and engage said beveled surfaces on the respective catches, 13 and 14.

The oscillatory ends of the levers, 6 and 7, are adapted to play in an elongated slot, 18, in the slide-bar, 17, one end-wall of said slot being adjacent to one of said levers at one end of the slide-movement of the bar, 17, and the other end-wall of said slot being adjacent to the other of said levers at the other end of the slide-movement of said bar. The ends of the levers, 6 and 7, also play in

an elongated slot, 19, in the slide-shaft, 10, which slot, 19, is of somewhat greater length than the slot 18.

The parts being in the position shown in Fig. 2, when the electromagnet, 4, is energized by an electric current, the lever, 6, and the armature, 20, mounted thereon will be drawn toward the magnet, 4, bringing the end of said lever into engagement with the left end-wall of the slot, 18, and thereby forcibly driving the slide-bar, 17, to the left, as shown in Fig. 2, causing its inclined end to engage and force outwardly the catch, 13, until the bifurcated arms at its inner end are withdrawn from the notch, 11, in the slide-bar, 19. Immediately thereafter the continued movement of said lever, 6, causes it to engage the left end-wall of the slot, 19, in the slide-shaft, 10, thereby driving said shaft to the left until the notch, 12, is brought opposite the catch, 14, by which time the righthand end of the slide-bar, 17, has been withdrawn out of the path of said catch, leaving the same free to spring into the notch, 12, to lock the slide-shaft, 10, in its new position. The movement thus imparted to the slide-shaft, 10, is transmitted through the coil-spring, 9, and the slide-shaft, 2, causing the switch-tongue to be thrown in one direction; but the amplitude of the movement of the slide-shaft, 10, is preferably greater than that required for the throwing of the switch-tongue, so that after the switch-tongue has been thrown into engagement with one of the rail-flanges at the end of its movement in the desired direction, the slide-shaft, 10, continues to move in the same direction, and, in the operation just described, exerts tension upon the coil-spring, 9, thereby tending to yieldingly hold the switch-tongue in its last selected position.

The operation just described serves to move the various parts from the position shown in Fig. 2 to that shown in Fig. 3, in which positions they respectively remain until the current is cut off from the electromagnet, 4, thereby releasing the lever, 6, to the action of the spring, 8, whereby said lever is withdrawn against the stop, 22, to the position indicated by dotted lines in Fig. 3.

With the parts in the position shown in Fig. 3 (assuming the lever, 6, to occupy the dotted position therein) if the electromagnet, 5, be energized by an electric current, the lever, 7, and the armature, 24, mounted thereon will be drawn toward the magnet, 5, bringing the end of said lever into engagement with the right end-wall of the slot, 18, and thereby forcibly driving the slide-bar, 17, to the right, causing its inclined end to engage and force outwardly the catch, 14, until the bifurcated arms at its inner end are withdrawn from the notch, 12, in the slide-shaft 10. Immediately thereafter the continued movement of said lever, 7, to the right causes it to engage the right end-wall of the slot, 19, in the slide-shaft, 10, thereby driving said shaft to the right until the notch, 11, is brought opposite the catch, 13, by which time the righthand end of the slide-bar, 17, has been withdrawn out of the path of said catch, leaving the same free to spring into the notch, 11, to lock the slide-shaft, 10, in its new position. The movement thus imparted to the slide-shaft, 10, is transmitted through the coil-spring, 9, and the slide-shaft, 2, causing the switch-tongue to be thrown in the opposite direction from that in which is was last previously moved; and the amplitude of movement of the slide-shaft, 10, being greater than that required after thus throwing the switch-tongue, the coil-spring, 9, will be compressed after the movement of the tongue has been arrested by its engagement with the rail-flange, thus tending to yieldingly hold the switch-tongue in its last selected position.

At the end of the last described operation, the various parts of the electromagnetically operated mechanism occupy the respective positions shown in Fig. 2, except that the lever, 7, occupies the position indicated by dotted lines therein, so long as the magnet, 5, continues to be energized. As soon as the magnet, 5, is deënergized, the lever, 7, is automatically moved by the action of the spring, 8, from the position indicated by dotted lines to that indicated by solid lines in said Fig. 2. An electric current for energizing the magnets is supplied by the insulated wire, 26, which enters the box, 1, at 27. An electric current can be transmitted to said wire, 26, in any known manner, when it is desired to operate the reciprocating member 2.

When my invention is employed for operating the switch of an electric railway, some known means under the control of the motorman on the car may be employed to connect the wire, 26, with the necessary source of electrical energy. Within the box, 1, the wire, 26, is flexibly connected with a switch contact-member, 28, carried by a slide-bar, 29, reciprocatory in slideways in the bearings, 25. Located within the case in the path of the contact-member, 28, are a pair of switch-contacts, 30 and 31, the contact, 30, being connected by wire, 32, with one end of the winding of the electromagnet, 4, the other end of which winding is connected with the ground by wire, 34; and the contact, 31, being connected by wire, 33, with one end of the winding of the electromagnet, 5, the other end of which winding is connected with the ground by the wire 36. Mounted upon the slide-bar, 29, is a plate, 37, having spring-arms, 38 and 39, extending

just opposite the slotted portion of the slide-bar, 17, in the path of the swinging ends of the respective levers 6 and 7. When the movable contact-member, 28, is in engagement with the fixed contact, 30, which position is necessary for energizing the electromagnet, 4, the spring-arm, 38, will lie in the path of the swinging end of the lever, 6, and will be depressed as said lever passes out of engagement therewith; but immediately after the passage of the lever, 6, out of engagement with said spring-arm, 38, the latter springs back into the return path of said lever, so that said lever is caused by its return movement induced by the spring, 8, to engage and force to the right the spring-arm, 38, and the slide-bar, 29, thereby shifting the movable contact-member, 28, from the fixed contact, 30, to the fixed contact, 31, adapted for energizing the electromagnet, 5, and causing the spring-arm, 39, to be moved into the path of the end of lever, 7, in position to be similarly operated when the electromagnet, 5, is energized. In this manner each operation of the device induced by one of the electromagnets leaves the electrical connection formed by the switch-contacts, 28, 30 and 31, such that the next transmission of an electric current to the device will energize the other of said electromagnets.

For certain purposes of the invention, I do not wish to be limited to the employment of the slots, 18 and 19, as the principal function of said slots is accomplished by the end-walls thereof, which serve as abutments to engage the ends of the levers, 6 and 7; and the slide-shaft, 10, and slide-bar, 17, may be provided in any known manner with abutments or offsets adapted to be engaged by said levers to accomplish the desired movements of the several members.

What I claim as new and desire to secure by Letters Patent is—

1. In an apparatus of the class described, and in combination, an electromagnet; means for transmitting at certain times a current of electricity thereto; a reciprocatory member; a catch interlockable with said reciprocatory member to prevent movement thereof; a catch-releasing member; an armature for said electromagnet; and an electromagnetically-actuated member engageable successively with said catch-releasing member and said reciprocatory member.

2. In an apparatus of the class described, and in combination, a pair of electromagnets; armatures therefor; a reciprocatory slide-bar; a pair of automatic catches, one interlockable with said slide-bar at one end of its movement, and the other interlockable therewith at the other end of its movement; a catch-releasing member engageable with each of said catches; and a pair of levers connected with the respective armatures, each engageable successively with said catch-releasing member and said slide-bar when electromagnetically actuated.

3. In an apparatus of the class described, and in combination, a pair of electromagnets; armatures therefor; a reciprocatory slide-bar; a pair of automatic catches, one interlockable with said slide-bar at one end of its movement, and the other interlockable therewith at the other end of its movement; a catch-releasing member engageable with each of said catches; a pair of levers connected with the respective armatures, each engageable successively with said catch-releasing member and said slide-bar when electromagnetically actuated; switch-mechanism adapted to connect either of said electromagnets with an electrical supply-conductor; and means whereby said switch-mechanism is actuated to connect one of said electromagnets with said supply-conductor by the return-movement of the lever actuated by the other of said electromagnets.

4. In an apparatus of the class described, and in combination, a movable switch-tongue or the like; means for limiting the movement of said tongue; a tongue-operating member having a spring-connection with said tongue; electromagnetic mechanism adapted when energized to impart to said tongue-operating member a movement of greater amplitude than that of the switch-tongue, whereby said tongue is moved to the limit of its movement and yieldingly retained thereat; and an automatic catch adapted to interlock with said tongue-operating member at the end of its electromagnetically induced movement.

5. In an apparatus of the class described, and in combination, a movable switch-tongue or the like; means for limiting the movement of said tongue in opposite directions; a tongue-operating member; a coil-spring connecting the tongue-operating member with said tongue; electromagnetic mechanism adapted to impart to said tongue-operating member at certain times a movement in one direction, and at certain times a movement in the opposite direction, each of greater amplitude than that of the switch-tongue; a catch adapted to automatically interlock with said tongue-operating member at the end of its electromagnetically induced movement in either direction; and means for automatically freeing said tongue-operating member from said catch in advance of the electromagnetically induced movement of said member in either direction.

6. In an apparatus of the class described, and in combination, a pair of electromagnets; armatures therefor; a lever connected with the armature of each of said electromagnets; a reciprocatory member having an abutment in the path of movement of said lever connected with one of said armatures when the electromagnet for that armature is

energized when said member is at one end of its movement, and having an abutment in the path of movement of said lever connected with the other of said armatures when the electromagnet for said other armature is energized when said member is at the other end of its movement.

7. In an apparatus of the class described, and in combination, a pair of electromagnets; armatures therefor; a lever connected with the armature of each of said electromagnets; a reciprocatory member having an abutment in the path of movement of said lever connected with one of said armatures when the electromagnet for that armature is energized when said member is at one end of its movement, and having an abutment in the path of movement of said lever connected with the other of said armatures when the electromagnet for said other armature is energized when said member is at the other end of its movement; switch-mechanism adapted to connect either of said electromagnets with an electrical-supply-conductor; a reciprocating switch-operating member; a pair of spring arms carried by said switch-operating member, one located in the path of movement of a lever induced by energization of one of said electromagnets when said switch-operating member is in position to connect said electromagnet with said supply-conductor, and the other in the path of movement of a lever induced by energization of the other of said electromagnets when said switch-operating member is in position to connect said other electromagnet with said supply-conductor, each of said spring arms being adapted after the passage of the engaging lever to spring back into the return path thereof, whereby the switch is automatically operated by each return movement of a spring-arm-engaging lever.

In testimony whereof, I have hereunto set my hand this 15th day of September, 1909.

GEORGE W. DONNAN.

Witnesses:
FRANK C. CURTIS,
J. DONSBACH.