No. 780,164. PATENTED JAN. 17, 1905.

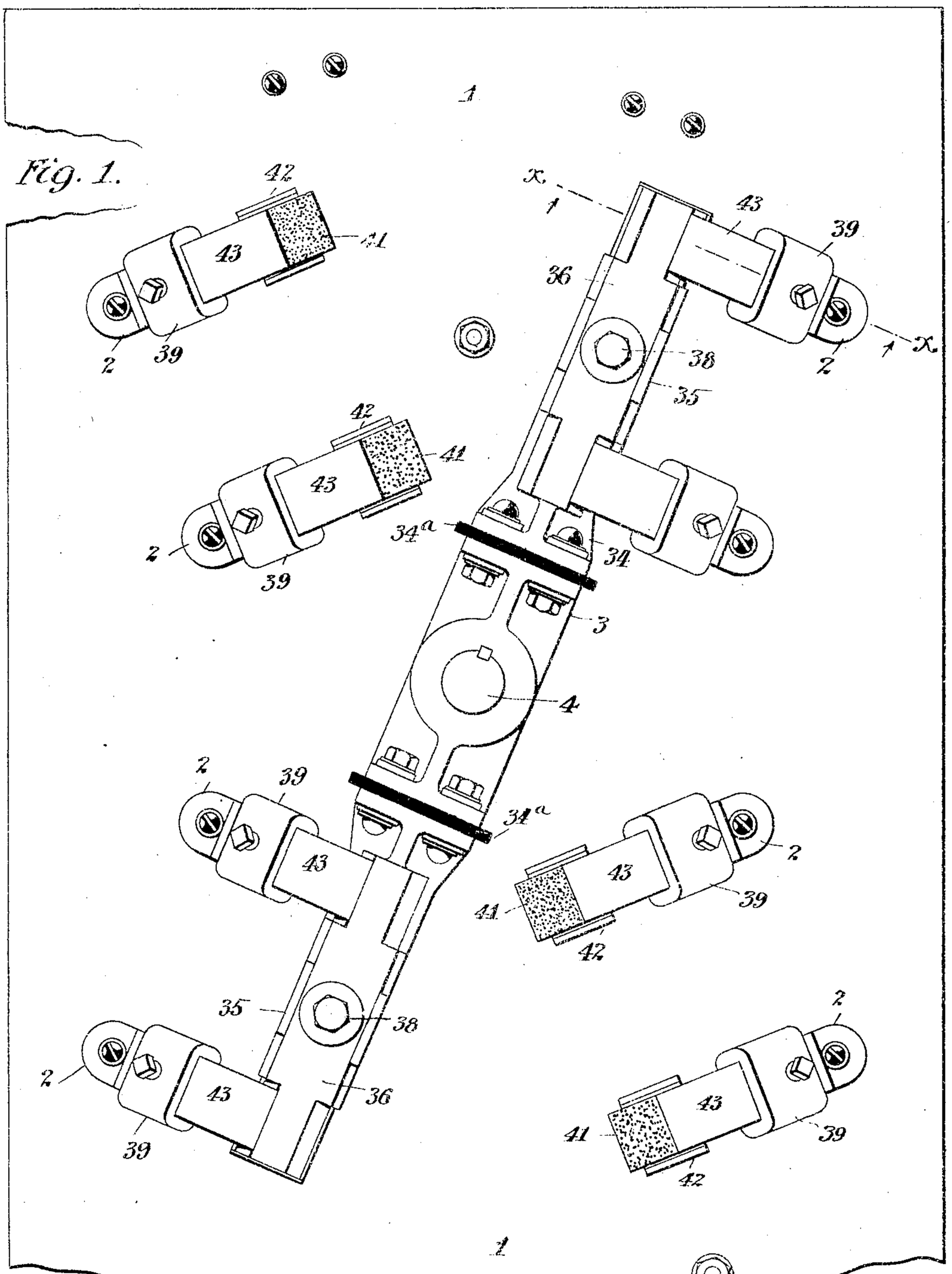
J. W. ESKHOLME.

SWITCH MECHANISM.

APPLICATION FILED DEC. 2, 1901.

4 SHEETS—SHEET 1.

Fig. 1.



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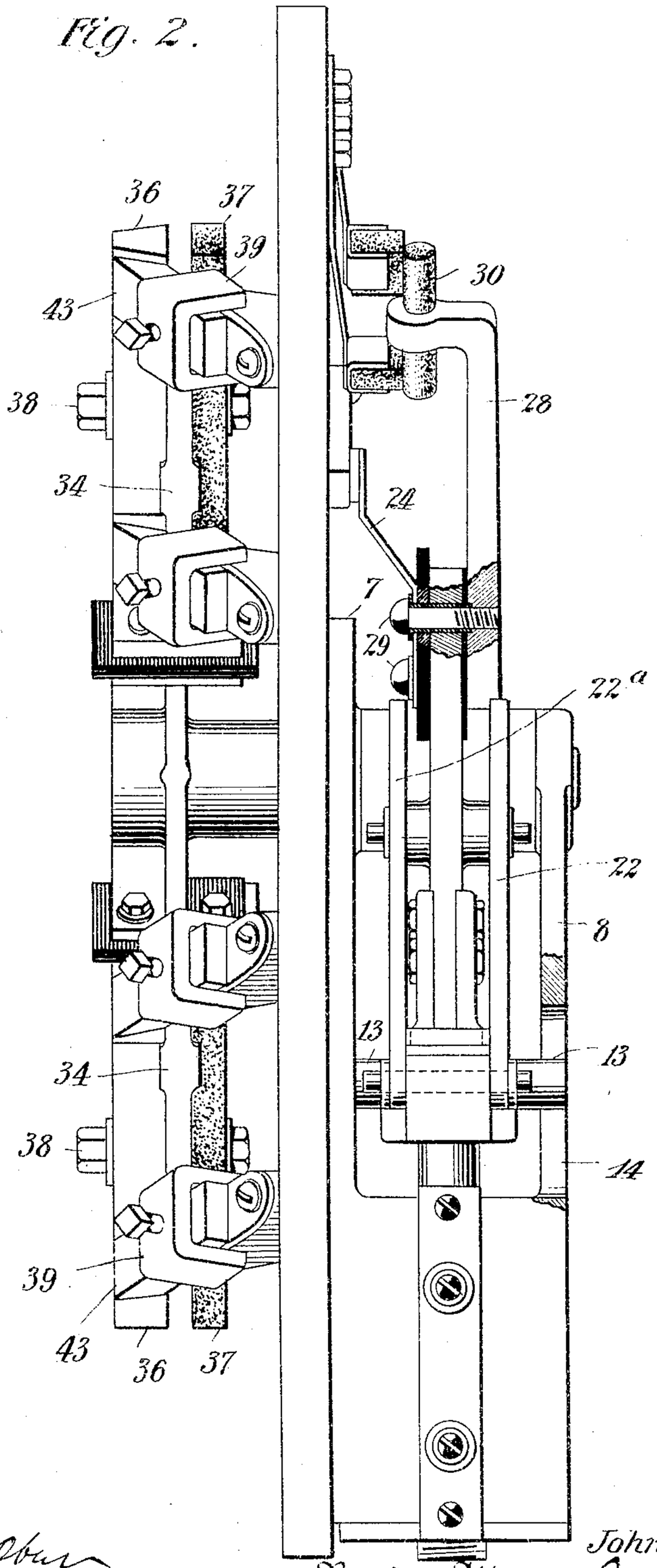
4 SHEETS—SHEET 2.

Fig. 2.



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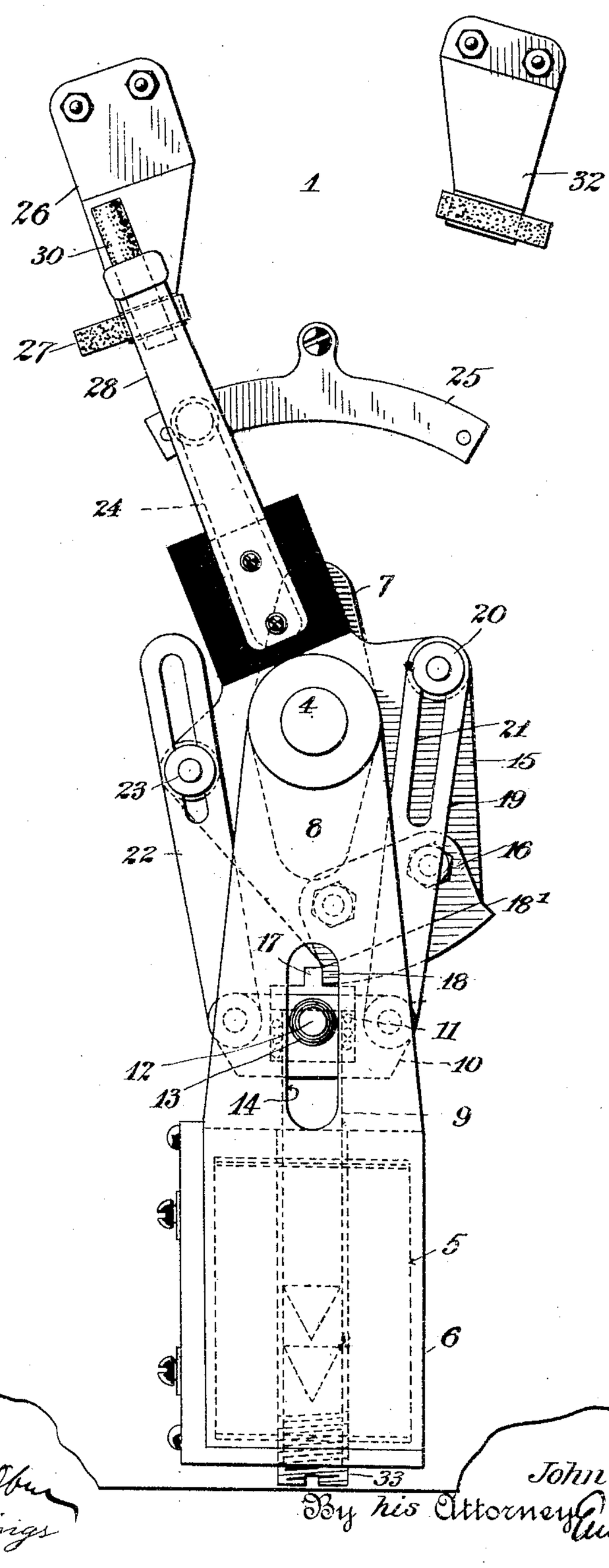
4 SHEETS—SHEET 3.

Fig. 3.



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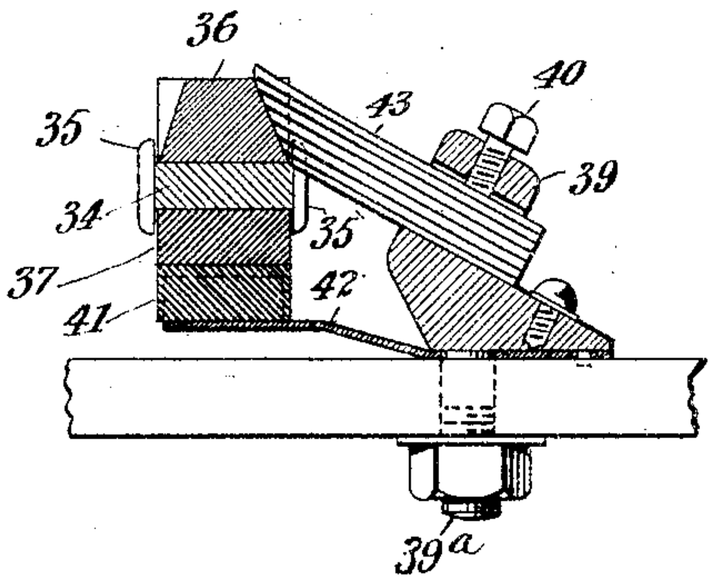
4 SHEETS—SHEET 4.

Fig. 4.



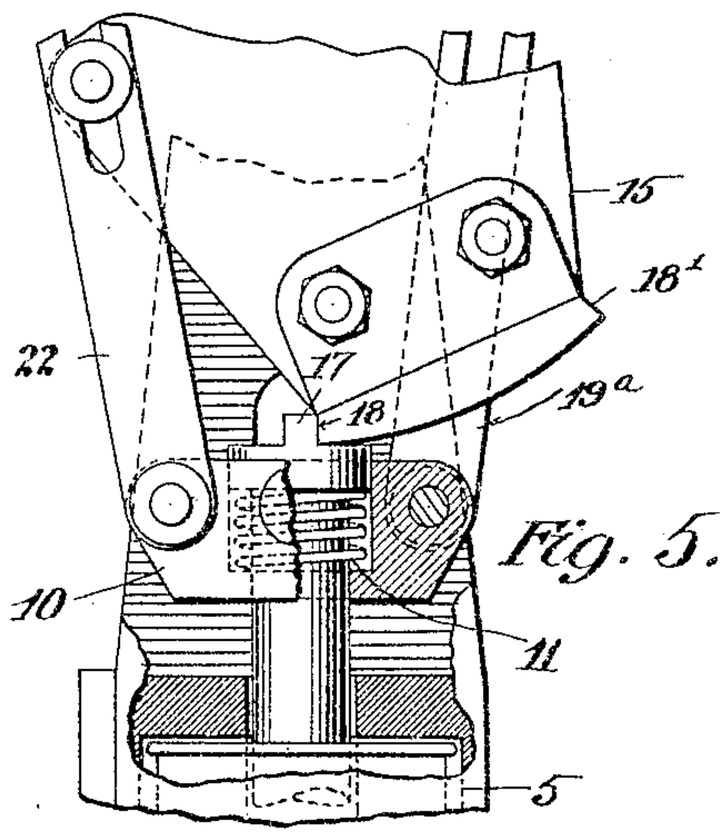
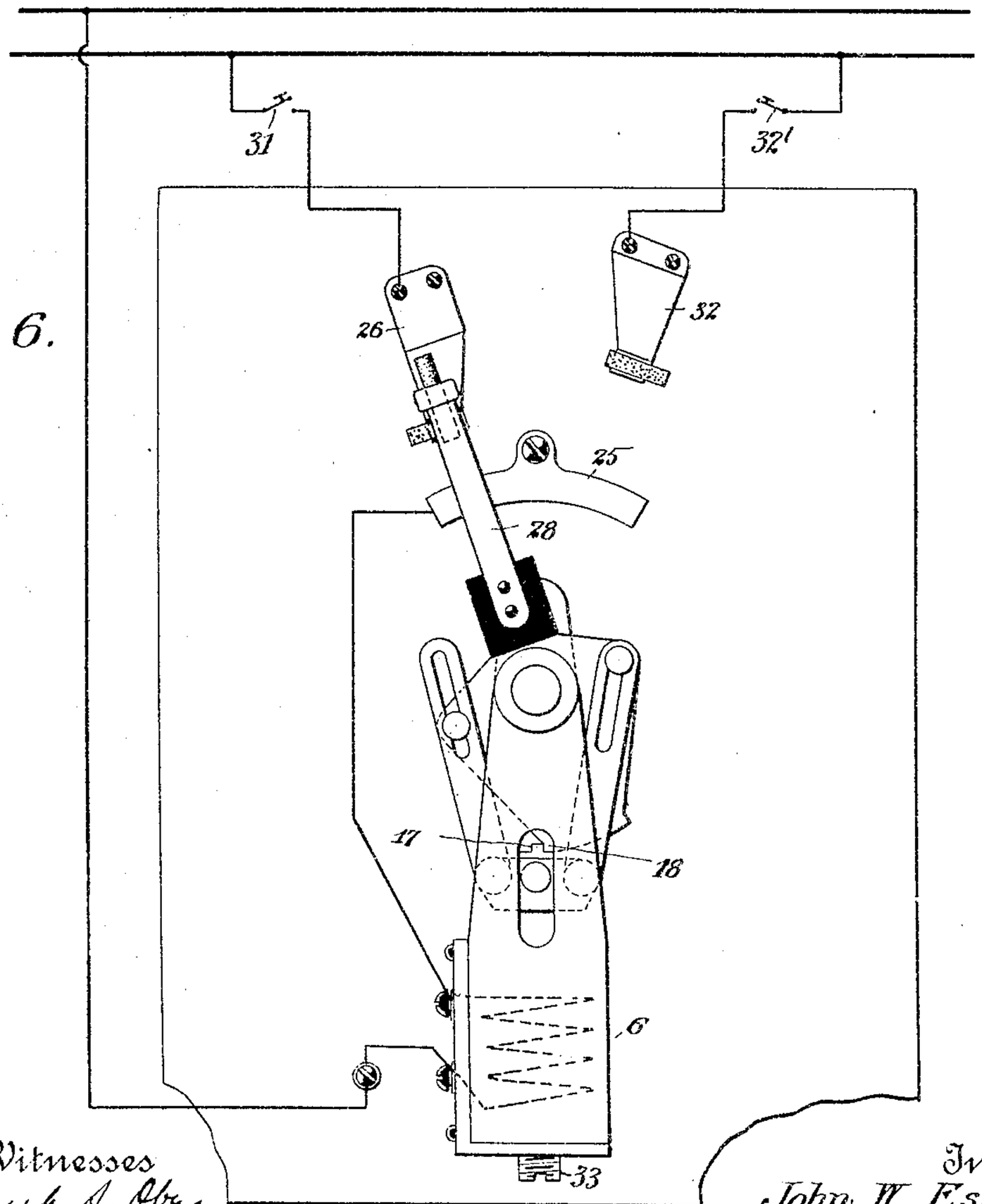


Fig. 5.

Fig. 6.



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No. 780,164. Patented January 17, 1905.

UNITED STATES PATENT OFFICE.

JOHN W. ESKHOLME, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO C. & C. ELECTRIC COMPANY, A CORPORATION OF NEW JERSEY.

SWITCH MECHANISM.

SPECIFICATION forming part of Letters Patent No. 780,164, dated January 17, 1905.

Application filed December 2, 1901. Serial No. 84,298.

To all whom it may concern:

Be it known that I, JOHN W. ESKHOLME, a citizen of the United States, residing at Westfield, New Jersey, have invented certain new and useful Improvements in Switch Mechanism, of which the following is a clear, full, and exact description.

My invention relates to an improvement in switch mechanisms; and my object is to improve the construction of the same.

My invention will be defined in the claims.

In the drawings illustrating the preferred embodiment of my invention, Figure I shows a side elevation of the front of the switch-slate, the main switch-arm, and stationary terminals. Fig. II shows a side view of the mechanism of Fig. I and also a side view of the actuating mechanism located behind the slate. Fig. III shows in elevation the rear of the slate and the switch-actuating mechanism. Figs. IV and V show details, Fig. IV being a section on line $x\,x$ of Fig. I; and Fig. VI shows a view similar to Fig. III and illustrating the electrical connections.

In the above preferred embodiment of my invention I have provided an electric switch which may be opened and then closed by successive applications of the same source of power, preferably by a single electromagnet. I prefer to throw the switch-arm in opposite directions, and I have also provided means by which the actuating parts are automatically restored after the power has been applied to a position ready to be again operated on by the next application of the power, such as the next energizing of a magnet. When an electromagnet is used as the power-transmitting device, I prefer to provide and have shown a device whereby the magnet-circuit is automatically opened after the switch has started to move and before it has completed its throw, and I have also in the present embodiment provided means which are given a momentum to carry the switch to the end of its throw and restore the actuating mechanism to its operative relation to the power-transmitting device. In the construction illustrated I have also provided a lock for the switch, preferably for each of its thrown positions, and means whereby a single application of the power will automatically unlock the switch and then throw the same. The embodiment illustrated also has an improved means for increasing the magnetic effect of the magnet-solenoid for a given separation of its cores, and the switch-terminal construction shown is advantageous for one reason—that the terminals may be easily separated. I have also illustrated one embodiment of a construction by which destructive arcing across the terminals is to a great extent prevented. Other advantages will be evident from the following description of this preferred embodiment of my invention illustrated in the drawings.

1 is a slate upon which may be mounted one or more stationary terminals 2 2, and 3 represents generally a switch-arm adapted to open and close the switch, preferably by being thrown in opposite directions, as illustrated. This switch-arm may be keyed to a shaft 4, passing through the slate.

5 is a suitable power-transmitting device, preferably a single electromagnet located in an iron-clad box 6. This box 6 may have a plurality of extensions 7 8, Fig. 2, through which the shaft 4 passes and by which the switch mechanism is concentralized.

9 is a part which is moved by the power-transmitting device and in the present embodiment consists of an armature, such as a core, for the solenoid-magnet 5. By "armature" I merely mean a part which furnishes a path for the magnetic lines of force. This core is formed of soft iron and in the present embodiment is moved in the same direction whenever the magnet is energized. In order to connect the core 9 with the switch-arm, I prefer to provide a head 10 (see Fig. V) made of brass or other non-magnetic material, which has a hole therethrough, in which the core 9 may move, if desired, and 11 is a spring located between shoulders on said head and core to normally raise the core to the position shown. This spring also relieves the parts from the shock of a sudden application of the power.

12 represents pins on head 10, carrying roll-

ers 13, which work in slots 14 in the extensions 7 and 8.

In the present embodiment I have provided an oscillating yoke 15, fixed to shaft 4 and carrying a foot 16 of brass to prevent the magnetic effect from causing the parts to adhere.

In order to lock the switch in one or both of its thrown positions, I prefer to provide a lug 17 on the top of core 9, which engages behind toe 18 on the foot 16. When the magnet is energized, the core moves the lug away from toe 18 against the force of the spring 11, and thus unlocks the switch.

A slotted arm 19 may be pivoted to head 10, and yoke 15 may carry a lug 20, located in the slot 21, which is adapted to engage the end of said slot. The core 9, head 10, slotted arm, and oscillating yoke 15 therefore form a connecting means between the power-transmitting device and the switch to throw the same, and this is the preferable construction.

I prefer to relieve the parts from the effect of the power applied after the switch-arm has opened the switch and allow the momentum of the parts to complete the throw of the switch. In the present embodiment of this feature of my invention I have provided a spring-arm 24, carried by but insulated from the yoke 15 and bearing upon a contact-segment 25, which is electrically connected with one end of the coil of the magnet. The other end of the coil may be connected to one main, as shown in Fig. VI. The other main may be connected to a spring-contact 26, carrying a carbon terminal 27.

28 is a second arm carried by but insulated from oscillating yoke 15 and electrically connected to arm 24 by screws 29, which also fasten both arms to the yoke. The arm 28 carries a carbon contact-pencil 30, which engages with carbon terminal 27. A normally open push-switch 31 may be located at any desired point in the magnet-circuit to close the same and cause the main switch to be opened. A similar spring-contact 32 may be provided in a separate similarly normally open circuit, if desired, with which the carbon pencil 30 engages to partially close the energizing-circuit through the magnet, ready for another energizing thereof. When the carbon pencil 30 leaves the contact 27, the energizing-circuit is broken and the momentum imparted to the different parts, such as the main switch-arm 3 or yoke 15, will carry the switch to the end of its intended throw opposite to the position shown in Fig. I.

In order to return the parts to a position where they will be operated on to close the main switch by the next energizing of the magnet, I prefer to provide the yoke 15 and head 10 with a slotted arm 22 and lug 23, similar to the arm 19 and lug 20. The lug 23 will move up in the slot as arm 28 moves to the right, and after the energizing-circuit has been opened lug 23 will strike the end of the slot and raise head 10 and core 9 to its normal position and lug 17 will snap behind toe 18′ and lock the switch in its opposite position. The magnet-circuit will then be reclosed as far as the push-switch 32′, ready to close the main switch by the closing of this push-switch. As shown in Fig. II, I prefer to provide duplicates 19ª and 22ª of the slotted arms 19 and 22, located on the rear side of the yoke 15.

In order to increase the magnetic effect of the magnet on the core 9, I have provided a supplemental core 33 and have beveled the adjacent ends of both cores in the same general direction, in the present embodiment by tapering one end and countersinking the other. Now if core 9 had to move one-half an inch before it touched core 33 the distance between the adjacent faces of the beveled ends of the cores would be considerably less than one-half an inch, and the magnetic effect across this smaller air-gap would be much greater than it would be across the one-half-inch air-gap which would be present if the ends of the cores were cut off square across. The core 33 is preferably stationary, but may be adjusted toward or from core 9 by the screw-threads thereon, as shown.

In the ordinary knife-switch the spring-jaws of the terminal firmly clasp the switch-blade and hold it in place, and considerable power has to be exerted against the force of these jaws to open the switch, and, furthermore, the greatest force is required to start the movement of the switch-blade. In order to overcome these objections, I have provided a switch-terminal construction in which one of the terminals includes a spring-conductor which tends to force said terminals apart, and the lock heretofore described holds the terminals in contact against the force of this spring. It follows that when the switch is unlocked the spring tends to force said terminals apart, and a much smaller power is required to open the switch, as the movement is assisted instead of opposed by the spring-terminal.

Referring now to Figs. I and IV, 34 is an iron support for the contact portions, preferably having lugs 35 thereon. This support may carry a copper contact portion 36 and a carbon contact portion 37 between the lugs 35 and held in place by the bolt 38, which may allow a slight movement of the contact portions, so that they will automatically adjust themselves to slight variations in the faces of the other terminals. In the present embodiment I have shown the spring which tends to force the terminals apart as a stationary spring-brush 43, preferably of copper, held in a conducting-support 39, having a threaded bolt 39ª and nut by which it may be fastened to the slate and which may also serve as a binding-post. The brush preferably stands at an angle to the plane of movement

of the movable terminal. The brush may be adjusted by set-screw 40. I prefer to bevel the contact portion 36 and the end of the brush, as shown. 41 is preferably a carbon contact portion held on spring 42, and thus forms part of the stationary terminal. This brush and carbon terminal therefor forms a substantially V-shaped terminal adapted to receive the other terminal, but which tends to separate the terminals.

I have also improved the construction of separable switch-terminals by providing a terminal which is composed of a plurality of conducting contact portions, one of said portions being preferably of copper or other material of low resistance and the other of said portions being a comparatively refractory substance—carbon of a greater resistance, for example—which latter portion keeps the circuit closed through the separable terminals after the circuit directly between the copper portion and the other terminal has been broken. Referring to Fig. IV, I have in this embodiment of this feature of my invention provided a copper conducting portion for each terminal consisting of brush 43 and block 36, and the circuit is closed through these portions when the switch is completely closed. I also prefer to provide two carbon portions 37 and 41, one for each terminal. The copper portions would be likely to be fused by an arc between them when the switch is opened if some protection were not provided to either cut down the current or to keep the circuit closed through a more refractory substance until after the copper portions have been separated. In the present embodiment the carbon block 41 projects beyond the point of contact of the two copper portions, so that when they are separated the circuit is still closed through the carbon portions. The carbon blocks preferably short-circuit the current around the air-gap formed between the contact-faces of said copper portions when they are separated. The carbon blocks form a circuit, preferably of a higher resistance than that through the copper portions when in contact, but of a lower resistance than that of so small an air-gap between said copper portions as would result in the formation of a destructive arc. Consequently in the embodiment illustrated, although a slight spark may pass between the copper portions when they are separated, the current will short-circuit through the carbon blocks before a destructive arc will form. Even if an arc should form between the carbon blocks when they are separated they will not be injured, or if injured may be easily and cheaply replaced. In the embodiment shown I automatically introduce an increasing resistance after the circuit directly between the copper portions has been opened and before the circuit through the carbon blocks is broken by sliding the carbon blocks on each other, whereby the extent of the surfaces thereof in contact with each other is gradually decreased until the switch is completely opened. This gradually increases the resistance of the circuit and tends to prevent the formation of an arc between the carbon blocks.

I am aware that many variations from the present embodiments of the features of my invention may be made without departing from the scope of my invention as claimed, and I therefore do not desire to be limited to the constructions herein specifically described and illustrated.

What I claim is—

1. In combination a movable electric terminal, a power-transmitting device, a part moved by an application of said power and connected with said terminal to throw the same in one direction, a device also moved and given momentum by said application of power, and adapted by its momentum to restore said movable part to a position ready to be again acted on by said power-transmitting device.

2. In combination a switch adapted to be opened and closed, a power-transmitting device, a part moved by an application of said power and connected with said switch to open and then close the same by successive movements of said part in one direction, a device also moved and given momentum by said application of power and adapted by its momentum to restore said movable part to a position ready to be again acted on by said power-transmitting device.

3. In combination a movable electric terminal, a power-transmitting device, a part moved by an application of said power and connected with said terminal to throw the same in opposite directions by successive movements of said part in one direction, a device also moved and given momentum by said application of power and adapted by its momentum to restore said movable part to its normal position ready to be again acted on by said power-transmitting device.

4. In combination a movable electric terminal, an electromagnet, a part moved by said magnet when energized and connected with said terminal to throw the same in one direction, a device also moved and given momentum when said magnet is energized, and adapted by its momentum to restore said movable part to a position ready to be again moved by said magnet.

5. In combination a switch adapted to be opened and closed, a power-transmitting device, a part adapted to be moved thereby, and connecting means between said movable part and switch adapted to throw said switch, and a second connection between said movable part and switch adapted to restore said movable part to its normal position, all by a single application of said power.

6. In combination a switch, an electromagnet and an energizing-circuit therefor, a part adapted to be moved thereby, connecting means between said movable part and switch adapted to throw said switch and restore said movable part to a position ready to be again operated on by said magnet, and means to automatically open said energizing-circuit before said switch has completed its throw.

7. In combination a switch, an electromagnet and an energizing-circuit therefor, a part adapted to be moved thereby, connecting means between said movable part and switch adapted to throw said switch and restore said movable part to a position ready to be again operated on by said magnet, and means to automatically open said energizing-circuit before said switch has completed its throw and partially close the same when said switch completes its throw.

8. In combination a switch, an electromagnet and an energizing-circuit therefor, an armature adapted to be moved thereby, connecting means between said armature and switch adapted to throw said switch and restore said armature to a position ready to be again operated on by said magnet, and means to automatically open said energizing-circuit before said switch has completed its throw.

9. In combination a switch, an electromagnet and an energizing-circuit therefor, an armature adapted to be moved thereby, connecting means between said armature and switch adapted to throw said switch and restore said armature to a position ready to be again operated on by said magnet, said connecting means including an oscillating part and a plurality of arms connecting it and said armature, and means to automatically open said circuit before said switch has completed its throw.

10. In combination a switch, an electromagnet, connecting means between said magnet and switch to open and then close said switch by successive energizings of said magnet, means to automatically open the circuit through said magnet before said switch completes its throw, and a part moved and given momentum by said magnet and adapted to cause said switch to complete its throw.

11. In combination a switch, an electromagnet, connecting means between said magnet and switch to open and then close said switch by successive energizings of said magnet, means to automatically open the circuit through said magnet before said switch completes its throw and a part moved and given momentum by said magnet and adapted to cause said switch to complete its throw and partially reclose the magnet-circuit.

12. In combination a switch, an electromagnet, an armature adapted to be moved in one direction thereby, an oscillating part connected with said switch to throw the same, a slotted arm and stop connection between each side of the axis of said oscillating part and said armature to throw said switch and return said armature to its normal position when said magnet is energized.

13. In combination a switch, an electromagnet, an armature adapted to be moved in one direction thereby, an oscillating part connected with said switch to throw the same, means to open the energizing magnet-circuit before said switch has completed its throw, a slotted arm and stop connection between each side of the axis of said oscillating part and said armature to throw said switch and return said armature to its normal position when said magnet is energized.

14. In combination a switch, a lock for said switch in one of its thrown positions, an electromagnet, an armature adapted to be moved in one direction thereby, means operated by said armature to unlock said switch, an oscillating part connected with said switch to throw the same, and a slotted arm and stop connection between each side of the axis of said oscillating part and said armature adapted to throw said switch and return said armature to its normal position when said magnet is energized.

15. In combination, a switch, a lock to hold said switch in one of its thrown positions, a single electromagnet, and means to automatically unlock said switch and throw the same in opposite directions by the power generated by successive energizings of said magnet.

16. In combination, a switch, a lock to hold said switch in one of its thrown positions, a single electromagnet, a device moved by said magnet to automatically unlock said switch, and a part engaged by said device in its movement and adapted to throw said switch in opposite directions by the power generated by successive energizings of said magnet.

17. In combination, a switch, a single electromagnet, a movable armature therefor, a lock to hold said switch in each of its thrown positions and fixed to said armature and operated to release said switch by a movement of said armature, a connection between said armature and switch to throw the same in opposite directions by the power generated by successive energizings of said magnet, and a spring device between said armature and connection whereby said switch is unlocked before it is thrown.

18. In combination a switch adapted to move in opposite directions to open and close a circuit, an electromagnet, a movable armature therefor, an oscillating part connected with said switch and having a plurality of abutments, a lug carried by said armature and adapted to engage one or another of said abutments on said oscillating part to hold said switch in either of its thrown positions, a slotted arm and stop connection between each side of the axis of said oscillating part and

said armature to rock the same, and a spring device interposed between said movable armature and connection whereby the movement of said armature first unlocks said switch and then causes the same to be thrown.

19. In combination a switch adapted to be opened and closed, a pivoted oscillating part connected with said switch and adapted to open the same as said oscillating part moves in one direction and close said switch as it moves in the opposite direction, a power-transmitting device, a part moved thereby, and two connecting devices from said latter part to said oscillating part, one on each side of said pivot, and adapted to throw said switch and restore said movable part to a position ready to be again acted on by said power-transmitting device.

20. In combination a switch adapted to be opened and closed, a pivoted oscillating part connected with said switch and adapted to open the same as said oscillating part moves in one direction and close said switch as it moves in the opposite direction, an electromagnet, a part moved thereby, and two connecting devices from said latter part to said oscillating part, one on each side of said pivot, and adapted to throw said switch and restore said movable part to a position ready to be again acted on by said magnet.

21. In combination a switch, an electromagnet, and an energizing-circuit therefor, a part adapted to be moved thereby, connecting means between said movable part and switch adapted to throw said switch and restore said movable part to a position ready to be again operated on by said magnet, means to automatically open said energizing-circuit before said switch has completed its throw, a second energizing-circuit for said magnet, means to automatically partially close said latter circuit as said switch completes its throw, and a second switch in each of said energizing-circuits adapted to completely close said circuits at will.

22. In a switch in combination a switch-arm and a switch-terminal having spring-jaws, one of said jaws consisting of a brush having a beveled face and longitudinally adjustable, the other jaw comprising a spring carrying a carbon face, said carbon face and beveled portion of said brush forming a V-shaped opening.

23. In combination, a switch, a single magnet, a circuit therethrough, a normally open operating-switch in said circuit, means to open and close said first switch by the power generated by two directly successive energizings of said magnet, a second circuit through said magnet having a break therein and also provided with a second normally open operating-switch in addition to said break, and means operated when said first switch is thrown and adapted to open said first circuit and close said break in said other circuit.

24. In combination, a switch, a single magnet, a circuit therethrough, a normally open hand-operated switch in said circuit, means to open and close said first switch by the power generated by two directly successive energizings of said magnet, a second circuit through said magnet having a break therein and also provided with a second normally open hand-operated switch in addition to said break, and a switch operated by the power of said magnet when energized and adapted to cause an additional break in said first circuit and close said break in said other circuit.

25. In combination, a switch, a work-circuit through the same, a single magnet, a branch circuit through said magnet, a normally open operating-switch in said branch circuit, means to open and close said first switch by the power generated by two directly successive energizings of said magnet, a second branch circuit through said magnet having a break therein and also provided with a second normally open operating-switch in addition to said break, and means operated when said first switch is thrown and adapted to open said first branch circuit and close said break in said other branch circuit.

26. The combination with an electric switch, of means constructed and arranged to successively open and close said switch, a single electromagnet acting always in the same direction upon its armature for operating the same and adapted to open said switch by an energizing of said magnet and to close the same by the next energizing of said magnet, and means whereby the coil breaks its own circuit after it has actuated the switch and immediately closes a second circuit through said magnet, and a normally open switch in each of said magnet-circuits provided with means normally holding the same open.

27. The combination with an electric switch, of means constructed and arranged to throw said switch in one direction to open the same and in the opposite direction to close the same, a single electromagnet acting always in the same direction upon its armature for throwing said switch in said opposite directions by successive energizings of said magnet, means for automatically breaking the magnet-circuit after it has actuated said switch, and a normally open manually-operated switch in said magnet-circuit.

Signed at Westfield, New Jersey, this 23d day of November, 1901.

JOHN W. ESKHOLME.

Witnesses:
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