No. 785,397. PATENTED MAR. 21, 1905.

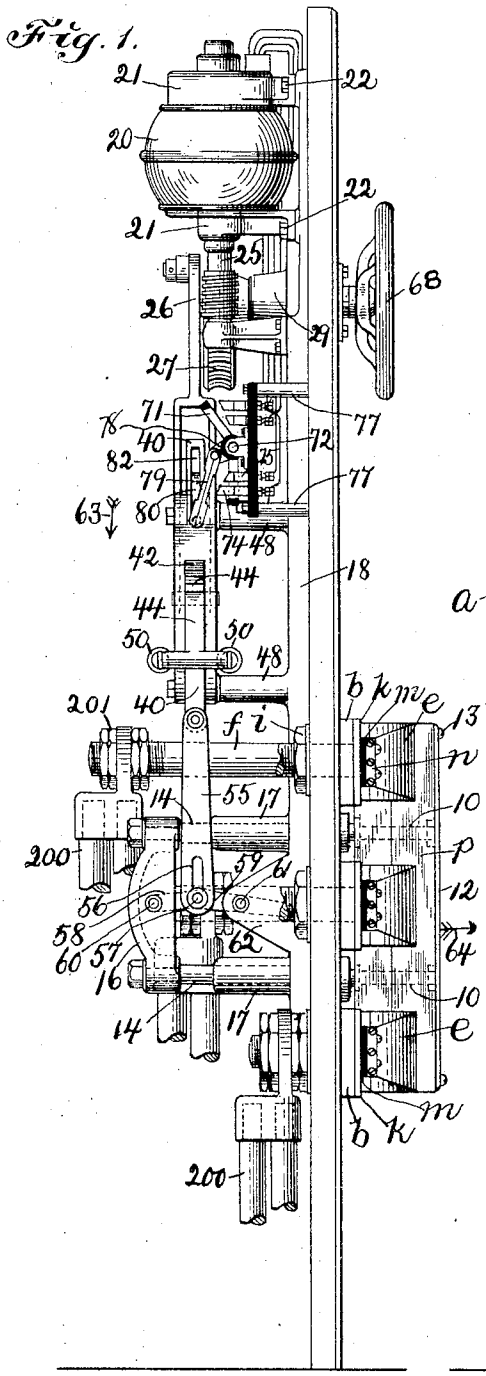
J. M. ANDERSEN.

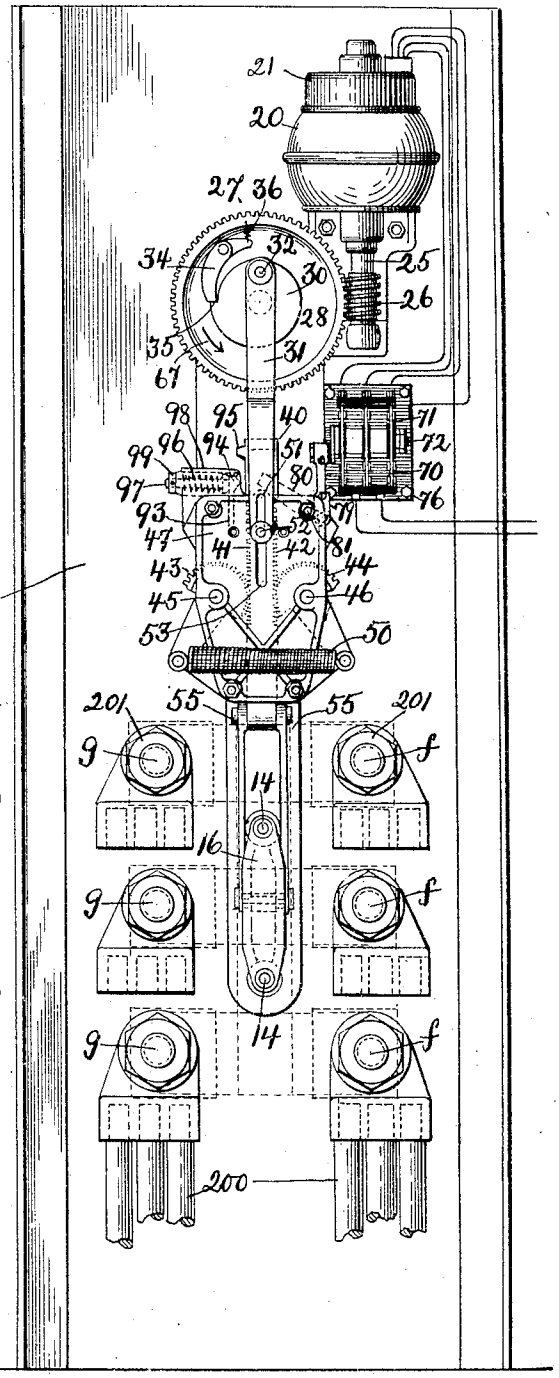
POWER OPERATED SWITCH.

APPLICATION FILED AUG. 29, 1902.

3 SHEETS—SHEET 1.

Fig. 1.





Witnesses:

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J. Murphy.

Fig. 2.

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Johan M. Andersen

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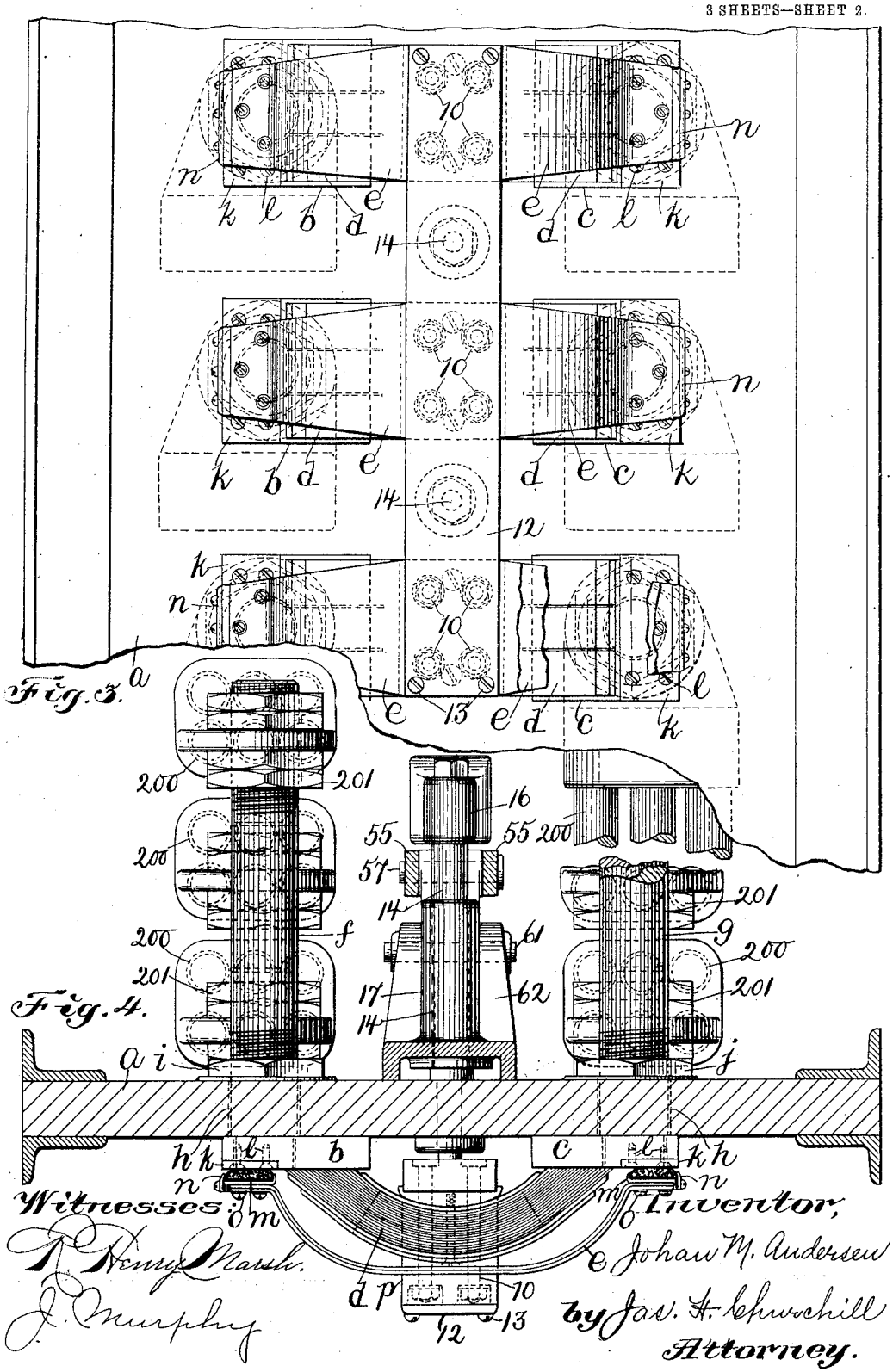
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J. M. ANDERSEN.

POWER OPERATED SWITCH.

APPLICATION FILED AUG. 29, 1902.

3 SHEETS—SHEET 2.



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J. M. ANDERSEN.

POWER OPERATED SWITCH.

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3 SHEETS—SHEET 3.

Fig. 5.

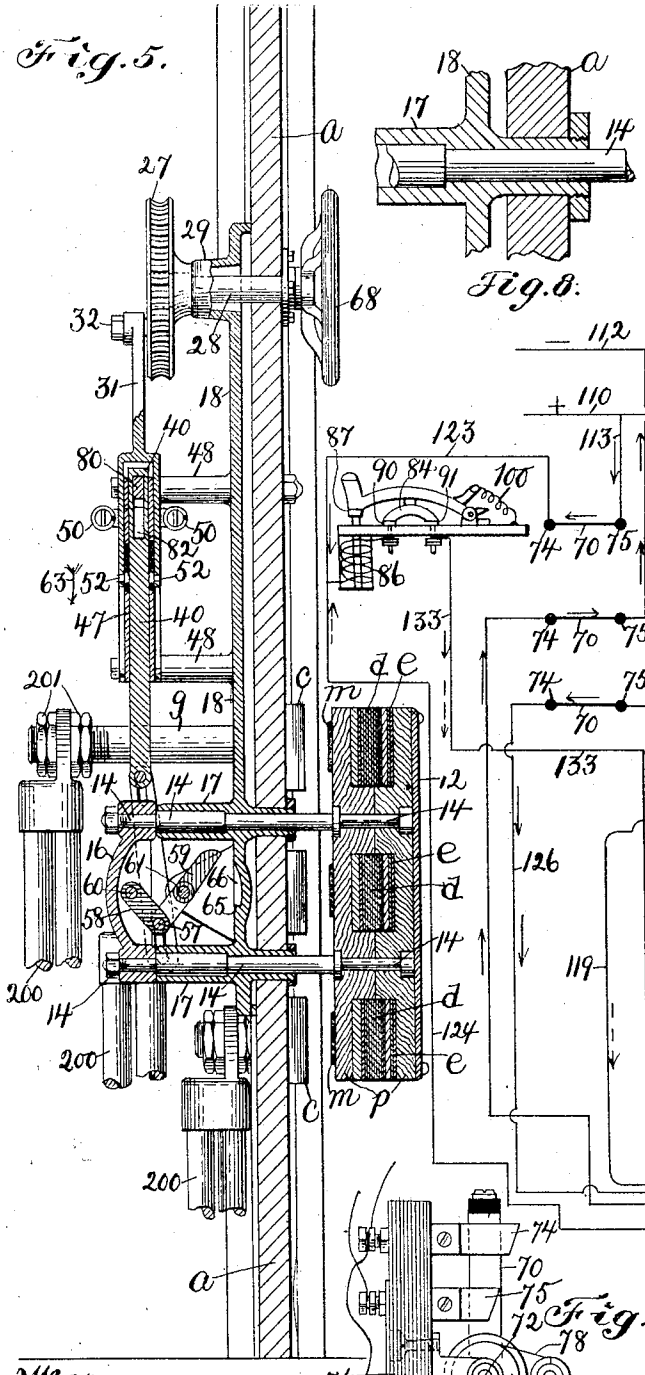


Fig. 8.

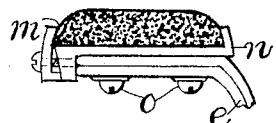


Fig. 9.

Fig. 6.

Fig. 7.

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PHOTO LITHOGRAPHED BY SACHETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 785,397. Patented March 21, 1905.

UNITED STATES PATENT OFFICE.

JOHAN M. ANDERSEN, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO ALBERT ANDERSON, OF BOSTON, MASSACHUSETTS.

POWER-OPERATED SWITCH.

SPECIFICATION forming part of Letters Patent No. 785,397, dated March 21, 1905.

Application filed August 29, 1902. Serial No. 121,415.

To all whom it may concern:

Be it known that I, JOHAN M. ANDERSEN, a citizen of the United States, residing in Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Power-Operated Switches, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to a circuit-controller or switch, and more particularly to a switch designed for controlling circuits carrying currents of substantially great amperage. For this purpose I employ a switch having one or more substantially large and heavy terminals or contact members which are moved substantially in an instant into their operative and inoperative positions by power in contradistinction to being operated by hand, and preferably by an electric motor which is operatively connected with the movable member of the switch by an intermediate mechanism, as will be described.

Provision is made for operating the switch through the intermediate mechanism independent of the electric motor.

Provision is also made for automatically controlling the circuit of the motor, as will be described.

These and other features of this invention will be pointed out in the claims at the end of this specification.

Figure 1 is a side elevation of a power-operated electric switch embodying this invention, the switch being shown in its closed position; Fig. 2, a front elevation of the switch shown in Fig. 1; Figs. 3 and 4, details, on an enlarged scale, to be referred to; Fig. 5, a vertical longitudinal section of the switch shown in Figs. 1 and 2 with the parts in the position they occupy when the switch is open; Fig. 6, a diagram of circuits to be referred to, and Figs. 7, 8, and 9 details to be referred to.

Referring to the drawings, *a* represents an upright support, of marble, slate, or other suitable insulating material. The upright support *a* has located on one face or side, which may be termed the "front" side, one or more sets of fixed or stationary contact members *b c*, with which coöperate one or more movable contact members *d e*, herein shown as two in number and which may be designated the "main" member *d* and the "auxiliary" member *e*. In the present instance I have shown three sets of stationary contact members *b c* arranged on the upright support *a* one above the other and with which coöperate three sets of movable contact members *d e;* but I do not desire to limit my invention to any particular number of sets of contact members, as one or more may be employed, according to the number of circuits to be governed. The contact members *b c* may be secured to the support *a* in any suitable or desired manner, and in the present instance they are provided with threaded stems or rods *f g*, (see Fig. 4,) which are extended through suitable holes *h* in the base or support *a* and are provided with clamping-nuts *i j*, by turning up which the contact members *b c* are drawn up tightly against the front face of the support *a*. The terminals or contact members *b c* may and preferably will be provided with removable pieces or sections *k*, secured thereto by screws *l* and constituting auxiliary stationary contact members, with which coöperate removable buttons or pieces *m*, of carbon or other suitable conducting material, and which are inserted into suitable holders or jaws *n*, (see Figs. 4 and 9,) detachably secured, as by screws *o*, to the opposite ends of a metal spring or springs constituting the auxiliary movable contact member *e*. The main movable contact member *d* may and preferably will be composed of a plurality of strips or leaves of spring metal.

The contact members *d e* are secured to a support or carrier *p*, which may and preferably will be made in two parts or halves (see Fig. 5) provided with suitable notches or recesses which register with one another and receive in them the main springs *d* and the auxiliary spring *e* and which parts or halves are firmly secured together by suitable bolts or screws 10. (See dotted lines Fig. 4.) The screws or bolts 10 may be concealed by a plate or cover 12, detachably secured to the carrier

p by the screws 13. The carrier p is movable toward and from the front face of the base or support a, and the said carrier is sustained and guided in its movements, as herein shown, by suitable guide-rods 14, (see Fig. 5,) extended through the support a, and provided at the rear side thereof with a cross-head or tie-bar 16, which coöperates with suitable bosses 17, projecting from a metal plate or frame 18, suitably fastened to the rear portion of the insulating base or support a.

The contact-carrier p in accordance with this invention is moved by motive power, preferably an electric motor 20, which may be of any suitable or desired construction and, as herein shown, is supported in suitable bearings 21, affixed to the metal frame 18, as by bolts or screws 22. The electric motor 20 is designed to reciprocate the movable carrier p in a direction substantially at right angles to the support a by intermediate mechanism movable in a plane substantially at right angles to that in which the said carrier is moved. The intermediate mechanism referred to may and preferably will be made as herein shown and as will be described.

The armature-shaft 25 of the motor 20 is provided with a worm 26, which drives a worm-gear 27, loose on a shaft 28, extended through the support a and having bearings in a metal boss or bushing 29. (See Figs. 1 and 5.) The shaft 28 at its rear end has fast on it a disk or plate 30, to which a rod or bar 31 is eccentrically connected, as at 32, and the eccentric disk is adapted to be coupled or rotatively connected with the worm-wheel 27 by a pawl 34, pivoted to the worm-wheel and normally held by a spring 36 in engagement with a tooth or projection 35 on the eccentric disk 30. The eccentric-rod 31 is forked at its lower end to straddle a rack-bar 40, provided at its opposite sides or edges with rack-teeth 41 42, with which engage toothed segmental gears or levers 43 44, pivoted at 45 46 to a metal plate or frame 47, which is secured to studs or bosses 48, projecting from the plate or frame 18. The levers 43 44 are connected together by springs 50. The forked ends of the eccentric rod or bar are provided with slots 51, into which extend pins or projections 52 on the rack-bar, which latter is guided in its movement by a slot 53 in the plate or frame 47. The rack-bar 40 has pivotally connected to its lower end preferably two links or bars 55, provided at their lower ends with slots 56, into which is extended the connecting-pin 57 of toggle-levers 58 59, the lever 58 being pivoted at 60 (see Fig. 5) within the cross-head 16 and the lever 59 being pivoted at 61 to a lug or ear 62 on the plate or frame 18. It will thus be seen that the longitudinal movement of the rack-bar 40 in one direction—namely, in the direction indicated by the arrow 63, Figs. 1 and 5—will move the toggle-levers at an angle to each other and into the position shown in Fig. 5 and will positively move the cross-head 16 and the contact-carrier in a direction substantially at right angles to the direction of movement of the rack-bar—namely, in the direction indicated by the arrow 64 in Fig. 1—and thus open the switch. The movement of the rack-bar 40 in the direction opposite to that indicated by the arrow 63 will bring the toggle-levers substantially into line with each other, as shown in Fig. 1, and will move the cross-head and carrier p in the direction opposite to that indicated by the arrow 64, and thus close the switch.

The toggle-lever 59 has coöperating with it a stop, herein shown as a shoulder 65, (see Fig. 5,) formed by a recess 66 in the plate or frame 18.

In the operation of the apparatus as thus far described rotation of the armature-shaft of the electric motor produces rotation of the worm-gear 27 in the direction indicated by the arrow 67, Fig. 2. The worm-gear 27 by means of the pawl 34 rotates the eccentric disk 30 in the same direction, and with the parts in the position shown in Fig. 2 the eccentric disk 30 moves the eccentric-bar 31 down until the upper end of the slot 51 engages the pin or projection 52 on the rack-bar, whereupon further rotation of the disk 30 effects downward movement of the eccentric bar or rod and the rack-bar 40 practically as one piece. The downward movement of the rack-bar turns the segmental levers 43 44 until they are substantially in line with each other, during which movement of said levers the springs 50 are elongated or placed under tension. When the rack-bar 40 has been moved sufficiently far to bring the levers 43 44 substantially in line with each other, the upper ends of the slots 56 in the bars or links 55 are engaged with the pin 57 of the toggle-levers, so that on farther downward movement of the rack-bar the toothed levers will be carried beyond the center line through their pivots, and the springs 50 will then contract and complete the movement of the rack-bar and the links 55 substantially in an instant, thus moving the toggle-levers out of line with each other and into the position shown in Fig. 5.

During the movement of the toggle-levers from the position shown in Fig. 1 to that shown in Fig. 5 the cross-head 16 is moved toward the support a in a plane substantially at right angles to the plane in which the rack-bar is moved, and by reason of the movable contact members being connected with the cross-head the said contact members are moved away from their coöperating fixed members, thus opening the circuit including said members substantially in an instant. Provision is made for interrupting the circuit of the motor substantially at the same time the power-switch is opened.

The circuit of the motor 20 is governed by a suitable switch, preferably such as herein shown, (see Figs. 1, 2, and 7,) and comprising two sets 70 71 of contact-arms, which are mounted to turn simultaneously in opposite directions. The sets 70 71 are fast on a rock-shaft 72, and each set comprises three arms, which coöperate with three sets of terminals or contact members 74 75, secured to a base 76, of insulating material, which is fastened to posts or bosses 77 on the metal plate or frame 18. The rock-shaft 72 is provided with a crank or arm 78, which is connected by a link 79 with one arm of a lever 80, pivoted at 81 to the plate or frame 47 (see Fig. 2) and having its other arm extended into a slot 82 in the upper end of the rack-bar 40. (See Figs. 1, 2, and 5.) It will thus be seen that when the rack-bar 40 is moved in the direction indicated by the arrow 63 to open the power-operated switch the upper wall of the slot 82 will engage the lever 80 and turn it on its pivot, so as to disengage the set 70 of blades or contact-arms from their coöperating terminals 74 75 and in an instant later engages the set 71 of blades or contact-arms with their coöperating terminals 74 75 at or about the time the rack-bar reaches the end of its down movement and at or about the time the power-operated switch is opened. In this manner the circuit of the motor is interrupted.

The circuit of the motor is completed between the contact-arms 71 and their coöperating terminals 74 75, but is open at a switch 84. (Represented in the diagram Fig. 6.) The switch 84 may be located in close proximity to or any desired distance away from the power-operated switch. If it is desired to close the power-operated switch, the operator first closes the switch 84, which completes the motor-circuit through a relay or magnet 86, which latter attracts its armature 87 and through the latter keeps the switch 84 in its closed position, and thus maintains the circuit of the motor after the hand of the operator is removed. The motor is thus maintained in motion until the eccentric disk 30 has been turned by the pawl 34 and worm-gear 27 toward the position shown in Fig. 2.

During the rotation of the cam-disk from the position represented in Fig. 5 toward that shown in Fig. 2 the eccentric rod or bar 31, which at such time has the lower wall of its slot 51 in engagement with the pin 52 on the rack-bar, lifts the latter and turns the toothed levers 43 44 in the reverse direction until the said levers are substantially in line with each other, at which time the links or bars 55 will have been lifted sufficiently to engage the lower wall of their slots 56 with the pivot-pin 57 of the toggle-levers 58 59, and on the continued rotation of the eccentric disk 30 the toothed levers 43 44 will be carried beyond the center line and placed under the influence of their springs 50, which immediately complete the up movement of the rack-bar, the links 55, and toggle-levers 58 59, thereby bringing the latter substantially into line with each other substantially in an instant, and consequently bringing the movable contact members of the power-operated switch into engagement with the stationary members or terminals substantially in an instant, thus effecting the closing of the circuit including the power-operated switch.

On the upward movement of the rack-bar the lower wall of the slot 82 engages the lever 80 and turns the latter on its pivot into the position shown by dotted lines in Fig. 2, thereby rocking the shaft or pivot 72 of the switch controlling the motor and interrupting the circuit between the contact-arms 71 and their coöperating terminals and establishing the motor-circuit between the contact-arms 70 and their coöperating terminals. The motor-circuit when interrupted between the contact-arms 71 and their terminals 74 75 is also interrupted at the magnet 86, which becomes deënergized, thereby permitting the movable member of the switch 84 to be withdrawn out of contact with its coöperating terminals 90 91 by the spring 100. As soon, however, as the key or hand-switch 84 is closed the magnet 86 is again energized, and the circuit of the motor is maintained closed until interrupted by the switch controlled by the rack-bar 40. In Fig. 6 I have shown a diagram of circuits which illustrates the operation of the motor-switch.

Referring now to Fig. 6, 110 112 represent the positive and negative line-wires of a suitable source of supply. The positive wire 110 is connected by wires 113 114 to terminals 75 of the switch operated by the rack-bar 40, and the negative wire 112 is connected by wires 115 116 to a second set of terminals 75 of said switch. The third set of terminals 75 is connected one to one armature-brush 117 of the motor 20 by wire 118 and the other by wire 119 to one end of the field 120 of said motor. The other end of the field 120 is connected by wire 121 with the middle terminal 74 and by wire 122 with the corresponding terminal 74 on the other side of the switch. The third terminal 74 on one side of the switch is connected by wire 123 with one end of the coil of the magnet 86, which is also connected by wire 124 with the corresponding terminal 74 on the other side of the switch. The remaining terminals 74 are connected one by wire 125 with the wire 118 and the other by wire 126 with the field-coil 120. The coil of the magnet 86 is connected to the terminal 90, which is adapted to be connected by the switch 84 with the terminal 91, which is connected by wire 133 with the armature-brush 134. The movable blades or contact-arms 70 are represented by full lines and the blades or contact-arms 71 by dotted lines in said figure.

Assuming the contact members or blades 70 in their full-line position (shown in Fig. 6) and also assume that the operator has closed the switch 84, the circuit through the motor 20 may be traced as follows: The current from the line 110 flows as indicated by the full-line arrows—namely, through the line 113, blade 70, wire 123, magnet 86 to terminal 90, thence by switch 84, terminal 91, wire 133, brush 134, through the armature-brush 117, wire 118, blade 70, wire 126, field-coil 120, wire 121, middle blade 70, and wire 115 to negative wire 112. When the motor-switch is reversed by the rack-bar 40, as above described, and the blades 71 occupy the position indicated by dotted lines, the current flows through the motor in the same direction as before, and assuming that the hand-operated switch is closed the circuit through the motor is indicated by dotted arrows and may be traced as follows: from the positive wire 110 by wire 114, blade 71, wire 124, magnet 86, terminal 90, switch 84, terminal 91, wire 133, brush 134, through the armature, thence by brush 117, wires 118 125, blade 71, wire 119, field-coil 120, wire 122, middle blade 71, and wire 116 back to the negative line 112.

In order to insure the springs 50 becoming effective to move the rack-bar at substantially the same time—namely, when the toothed levers have been moved beyond their center a given point or distance—I have provided additional means for moving the rack-bar, so as to cause the springs 50 to become effective as soon as the rack-bar has carried the levers 43 44 a predetermined distance beyond their center. This result is accomplished, as shown in Fig. 2, by an upright pawl or dog 93, pivoted to the frame or plate 47 and having at its upper end a projection or nose 94, beveled in opposite directions and which normally projects into the path of movement of a projection or lug 95 on the side of the rack-bar. The lug 95 is also beveled in opposite directions. The dog or pawl 93 is normally pressed forward into the path of movement of the lug 95 on the rack-bar by a spring 96, which encircles a rod 97 within a hollow boss or housing 98, attached to the frame or plate 47. The rod 97 extends through the end of the hollow boss 98 and is provided with a nut 99, which limits the forward movement of the pawl or dog 93. The nut 99 also serves to effect the proper adjustment of the dog or pawl 93 with relation to the path of movement of the lug 95. The dog or pawl 93 is positioned with relation to the rack-bar so that the said dog will engage the projection 95 on the rack-bar as the spring-actuated levers approach their center line.

On the movement of the rack-bar in one direction—as, for instance, downward—the beveled under surface of the lug 95 engages the beveled upper surface of the nose 94 and the movement of the rack-bar places the spring 96 under tension or compression. At or about the time the lug or projection 95 passes by the nose 94 of the dog the spring 96 becomes active and forces the beveled under surface of the nose 94 into engagement with the beveled upper surface of the lug 95 and imparts to the rack-bar a slight push, which assists the springs 50, which are then in their effective position with the levers 43 44 beyond their center, to move the rack-bar downward. The same action takes place on the up movement of the rack-bar. It will thus be seen that by means of the beveled lug 95 on the rack-bar and the beveled nose 94 on the dog, together with the spring 96, the springs 50 are rendered effective at substantially the same distance beyond the center line of the levers under all conditions.

The bolts *f g*, attached to the fixed terminals or contact members, have secured to them the line-terminals 200, which may be hung upon the bolts and secured thereon by the nuts 201.

I prefer to employ a main movable contact member *d* and an auxiliary contact member *e* and to provide for the main member being disengaged from the fixed contact members *b c* before the auxiliary contact member, as in this way the spark is reduced in size and occurs only between the removable sections *k* of the fixed members and the removable carbon pieces *m* of the movable contact member. The sections *k* and the carbon blocks *m* may be quickly and easily renewed at a minimum expense, and they save the main contact members, enabling the latter to be used for a substantially long or indefinite time without renewal.

In case of accident to the motor 20 the power-switch can be operated by hand—namely, by turning the hand-wheel 68, which rotates the eccentric disk 30 and moves the rack-bar and the parts operated by it in the manner above described.

In order to cushion the blow occasioned by the movement of the guide-rods 14 when the power-operated switch is opened, the said guide-rods are enlarged at their rear end to practically form pistons, and these enlarged portions move in the bosses 17, which practically form cylinders, the air between the front end of the pistons and the front end of the cylinders acting as a cushion to deaden the blow of the pistons against the end of the cylinders or bosses. On the return movement—namely, when the power-switch is closed—the spring contact members relieve the blow.

I claim—

1. In an apparatus of the class described, the combination with a base or support, of stationary contact members located on one side of said support, a movable contact member coöperating with said stationary contact members, a carrier for said movable contact member, a guide for said carrier extended through said support, an electric motor located on the op-

posite side of said support and secured thereto, and mechanism connecting said motor with said guide to operate, substantially as described.

2. In an apparatus of the class described, the combination with a base or support, of stationary contact members located on one side of said support, a movable contact member coöperating with said stationary contact members, a carrier for said movable contact member, a guide for said carrier extended through said support, an electric motor located on the opposite side of said support and secured thereto, and mechanism connecting said motor with said guide, and means to move said mechanism independent of said motor, substantially as described.

3. In an apparatus of the class described, the combination with a base or support, of stationary contact members located on one side or face of said support and provided with removable sections, a movable contact member comprising a main member coöperating with said stationary contact members and an auxiliary member coöperating with the removable sections of said stationary members, a carrier for said movable contact member, a guide for said carrier extended through said support, an electric motor located on the opposite side of said support and secured thereto, and mechanism connecting said motor with said guide, substantially as described.

4. In an apparatus of the class described, the combination with a movable contact member, a reciprocating carrier therefor movable bodily in a substantially straight path, a rotary power-operated motor, a reciprocating mechanism movable in a path substantially at right angles to that in which the carrier is moved, means for connecting said reciprocating mechanism with said carrier to positively move the said carrier and its contact member bodily in opposite directions in a path substantially at right angles to that in which said reciprocating mechanism is moved, means for connecting said reciprocating mechanism with said rotary motor, and means for moving said reciprocating mechanism independent of said motor, substantially as described.

5. In an apparatus of the class described, the combination with an electric motor provided with an armature-shaft having a worm, of a worm-gear in engagement with said worm, a shaft on which said worm-gear is loosely mounted, an eccentric disk fast on the shaft on which said worm-gear is mounted, means to detachably connect said worm-gear with said eccentric disk, a movable contact member, and mechanism operatively connected with said contact member and with said eccentric disk, substantially as described.

6. In an apparatus of the class described, the combination with a bodily-movable contact member, a reciprocating carrier therefor movable bodily in a substantially straight path, means to guide said carrier in its bodily movement, a power-operated motor, a reciprocating mechanism operated by said motor and moved by the same for only a portion of its movement in a path substantially at right angles to that in which the said contact member is moved, and positively yet loosely connected with said carrier to move it and said contact member bodily in opposite directions in a path substantially at right angles to the path in which said reciprocating mechanism is moved, and means actuated by partial movement of said mechanism in one direction by said motor to effect movement of the said mechanism in the same direction substantially in an instant and beyond the point to which it is moved by said motor, substantially as described.

7. In an apparatus of the class described, the combination with a movable contact member, and a bodily-movable carrier therefor, toggle-levers connected to said carrier, a slotted link loosely connected with said toggle-levers, a rack-bar loosely connected with said link, toothed levers engaging the opposite sides of said rack-bar, a spring connecting said levers, a slotted eccentric rod or bar loosely connected with said rack-bar, an eccentric disk to which said eccentric bar is connected, a worm-gear, means to detachably connect the said worm-gear with said eccentric disk, and an electric motor having its armature-shaft provided with a worm which meshes with said worm-gear, substantially as described.

8. In an apparatus of the class described, the combination with a movable contact member, a reciprocating bar loosely yet positively connected with said contact member, a power-operated rotary motor, means for connecting said motor with said reciprocating bar, and a spring coöperating with said bar to move it independent of said motor, and means for moving said bar by hand independent of said motor, substantially as described.

9. In an apparatus of the class described, the combination with a bodily-movable contact member, of a reciprocating carrier for said contact member movable bodily in a substantially straight path, means to guide said carrier in its bodily movement, a rotary motor, a reciprocating mechanism actuated by said rotary motor for a predetermined distance in a path substantially at right angles to the path in which said carrier reciprocates, means actuated by said reciprocating mechanism and positively yet loosely connected with said carrier to positively move the latter bodily in opposite directions in a path substantially at right angles to that in which said reciprocating mechanism is moved, and means actuated by movement of the said reciprocating mechanism to effect further movement of said mechanism substantially in an instant and beyond the point to which it is moved by said motor, substantially as described.

10. In an apparatus of the class described, the combination with a movable contact member, a bodily-movable carrier therefor, a rotary power-operated motor, a reciprocating mechanism connected with said carrier to positively move the said carrier and its contact member in opposite directions, and means for connecting said reciprocating mechanism with said rotary motor, and a rotatable device for effecting reciprocation of said mechanism independent of said rotary motor.

11. In an apparatus of the class described, the combination with a movable contact member, a reciprocating bar loosely yet positively connected with said contact member, a power-operated rotary motor, means for connecting said motor with said reciprocating bar, and a spring coöperating with said bar to move it independent of said motor, and a device operated by the movement of the bar to assist the latter in its movement and cause the said spring to become effective at substantially the same time under all conditions, substantially as described.

12. In an apparatus of the class described, the combination with a base or support, of stationary contact members secured to one face of said support, a movable contact member cooperating with said stationary members, a carrier for said movable contact member bodily movable toward and away from said stationary contact members, guide-rods attached to said carrier and extended through said support, a cross-head connecting said guide-rods on the rear side of said support, toggle-levers connected with said cross-head, a slotted link engaging the center pin or pivot of said toggle-levers, a rack-bar connected with said slotted link, toothed levers engaging said rack-bar, a spring connecting said levers, an eccentric-rod connected with said rack-bar, a disk to which said eccentric-rod is attached, a worm-gear, a clutch to connect the worm-gear with the eccentric disk, a shaft provided with a worm in engagement with said worm-gear, means to rotate said shaft, substantially as described.

13. In an apparatus of the class described, the combination with a base or support, of stationary contact members secured to one face of said support, a movable contact member cooperating with said stationary members, a carrier for said movable contact member bodily movable toward and away from said stationary contact members, guide-rods attached to said carrier and extended through said support, a cross-head connecting said guide-rods on the rear side of said support, toggle-levers connected with said cross-head, a slotted link engaging the center pin or pivot of said toggle-levers, a rack-bar connected with said slotted link, toothed levers engaging said rack-bar, a spring connecting said levers, an eccentric-rod connected with said rack-bar, a disk to which said eccentric-rod is attached, a worm-gear, a clutch to connect the worm-gear with the eccentric disk, a shaft provided with a worm in engagement with said worm-gear, means to rotate said shaft, a shaft on which said eccentric disk is mounted, and means accessible from the front of said support for rotating said shaft and eccentric disk independent of the worm-gear, substantially as described.

14. In an apparatus of the class described, the combination with a movable contact member, a carrier for said contact member, a guide-rod attached to said carrier and provided with an enlarged portion forming a piston, a cylinder in which said enlarged portion or piston reciprocates, a power-operated motor, and mechanism connecting said power-operated motor with said guide-rod, substantially as described.

15. In an apparatus of the class described, in combination, a bodily-movable contact member, a reciprocating carrier therefor movable bodily in a substantially straight path, a power-operated motor, a longitudinally-reciprocating mechanism movable in a plane substantially at right angles to that in which the bodily-movable carrier is moved, means movable in the same direction as said reciprocating mechanism for positively yet loosely connecting said reciprocating mechanism with said motor and said carrier, and means actuated by partial movement of said reciprocating mechanism in one direction by said motor to complete the movement of said mechanism substantially in an instant and independent of said motor, substantially as described.

16. In an apparatus of the class described, the combination with a movable contact member, of a bodily-movable carrier therefor, a power-operated motor, and mechanism operatively connected with said power-operated motor and with said bodily-movable carrier, and placed into effective condition by said motor to bodily move said carrier and its contact member substantially in an instant and independent of the said motor, and means to detachably connect said mechanism to said motor to permit the said mechanism to be operated by hand, substantially as described.

17. In an apparatus of the class described, the combination with a bodily-movable contact member, a reciprocating carrier therefor movable bodily in a substantially straight path, a rotary power-operated motor, longitudinally-reciprocating mechanism movable in a plane substantially at right angles to that in which the bodily-movable carrier is moved, means for positively yet loosely connecting said mechanism with said motor and said carrier, and means actuated by partial movement of the said reciprocating mechanism in one direction by said motor to complete the movement of said mechanism substantially in an instant and independent of said motor.

18. In an electric switch, a supporting-plate

having a plurality of holes through it, stationary contact-plates on one side of said supporting-plate adjacent each hole, a plurality of movable contact members, rods to which said members are secured which pass through said holes, a yoke to which said rods are connected, a supporting-frame at the opposite side of said supporting-plate, a toggle connected at one end with said rods, and at the other end with said supporting-frame, and means for operating said toggle.

19. In an electric switch, a supporting-plate having a hole through it, stationary contact-plates on one side of said supporting-plate, a rod passing through said hole, a movable contact member attached to said rod, a supporting-frame at the opposite side of said supporting-plate having a guideway, a guide-block on the rod movable in said guideway, a toggle connected at one end with said rod and at the other end with said supporting-frame, and means for operating said toggle.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHAN M. ANDERSEN.

Witnesses:
JAS. H. CHURCHILL,
J. MURPHY.