No. 803,486. PATENTED OCT. 31, 1905.

G. H. HILL.

MAGNETICALLY OPERATED SWITCH.

APPLICATION FILED JUNE 18, 1904.

2 SHEETS—SHEET 1.

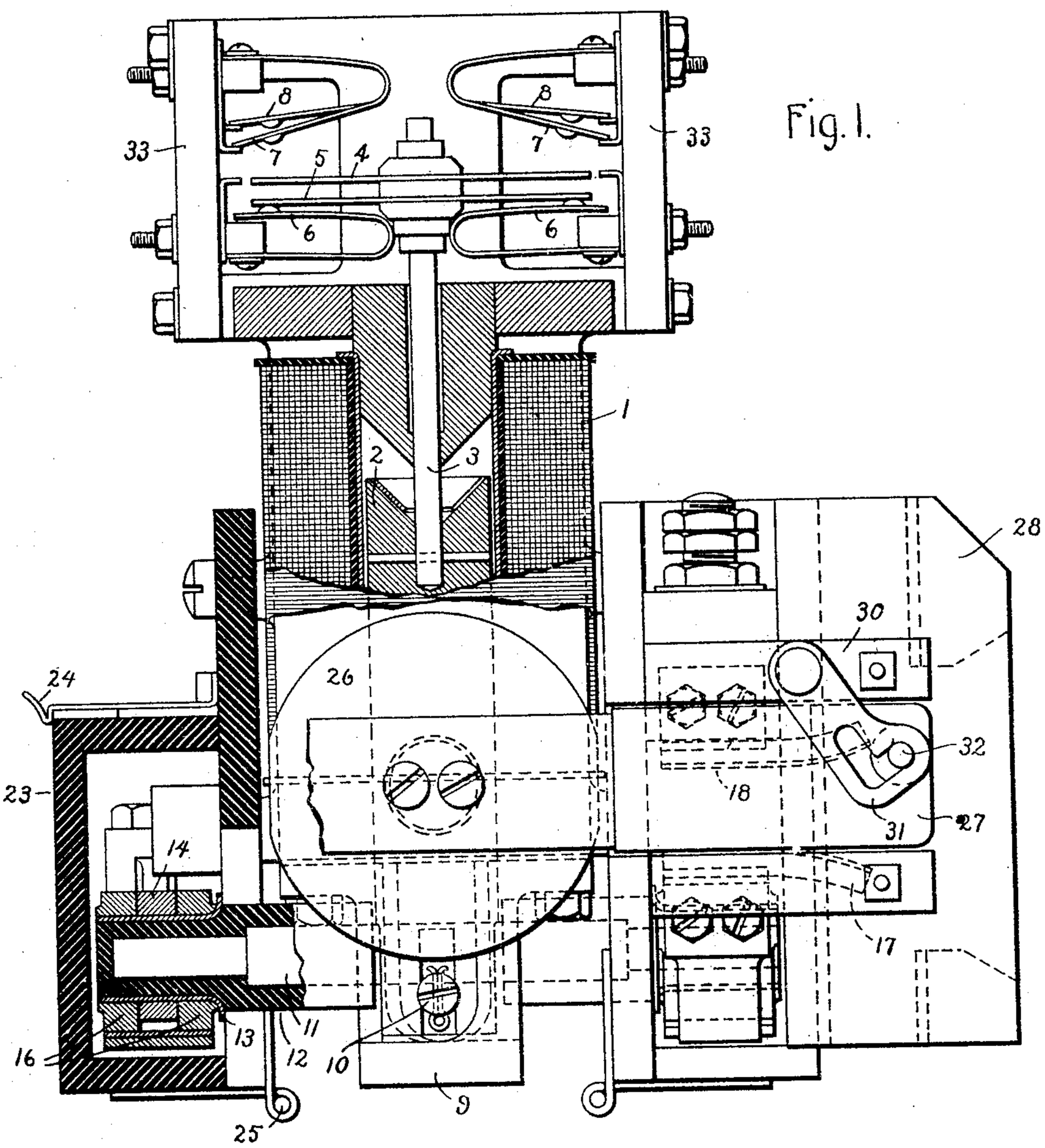

Fig. 1.

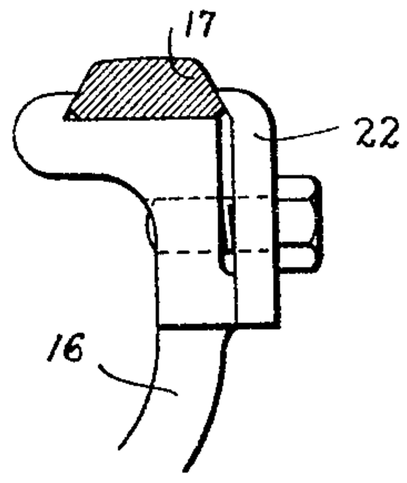

Fig. 5.

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2 SHEETS—SHEET 2.

Fig. 2.

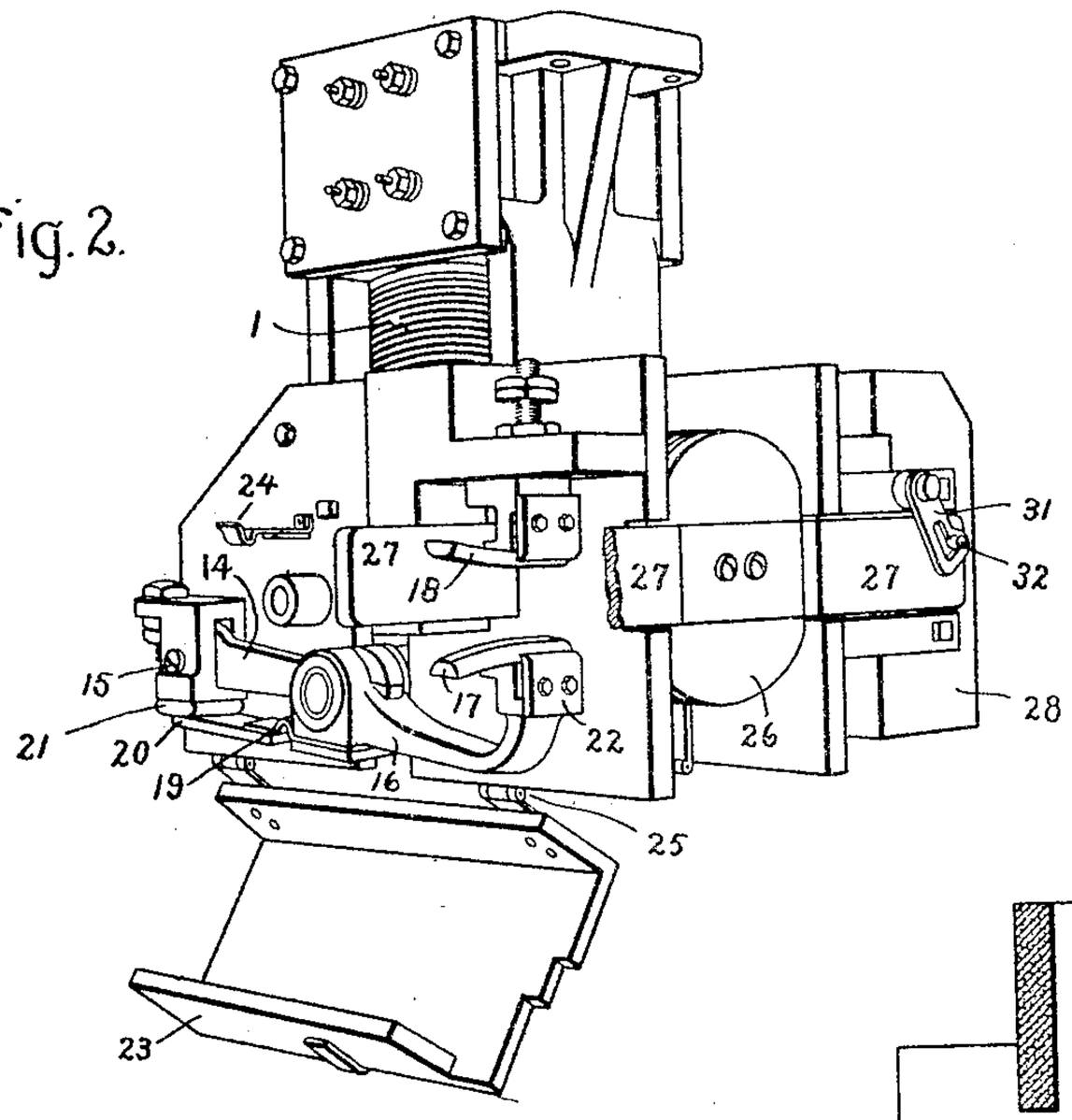


Fig. 4.

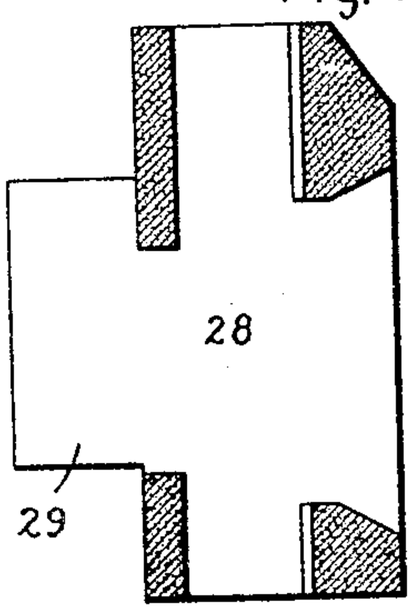
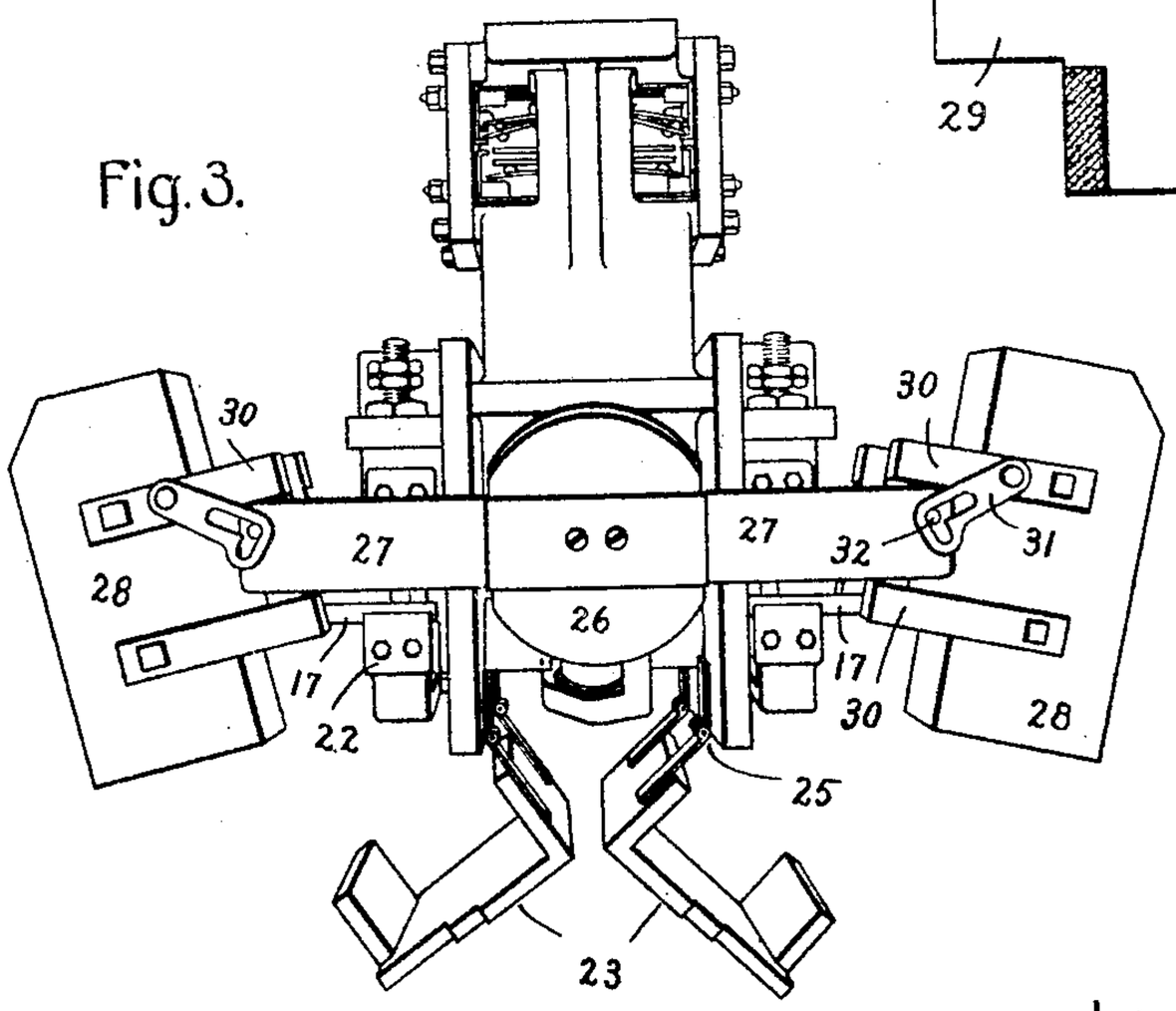


Fig. 3.



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J. Ellis Glen.
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UNITED STATES PATENT OFFICE.

GEORGE H. HILL, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MAGNETICALLY-OPERATED SWITCH.

No. 803,486. Specification of Letters Patent. Patented Oct. 31, 1905.

Application filed June 18, 1904. Serial No. 213,067.

To all whom it may concern.

Be it known that I, GEORGE H. HILL, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Magnetically-Operated Switches, of which the following is a specification.

My invention relates to magnetically-operated switches for electric circuits, and has particular reference to magnetically-operated circuit-closers of the type known as "contactors." In my patent, Serial No. 762,409, granted June 14, 1904, I have described a control system for electric motors employing a plurality of such contactors. In this system each contactor comprises a single magnet-coil and two switches in separate motor-circuits arranged to be controlled by the single coil. This coil also controls contacts which in the first place establish proper connections for energizing the coil and when the coil is energized establish a maintaining-circuit for the coil and also close the circuit for the operating-coil of a second contactor. In such a system certain characteristics are particularly desirable in the construction of the contactor. In the first place the contactor should form a compact unit, simple in operation and economical in construction. All live parts of the contactor, and particularly the moving parts, should be carefully insulated and inclosed. On the other hand, all parts should be readily accessible for inspection and repair. Contacts in the motor-circuits should be sufficiently heavy to carry the load and in closed position should make contact under strong pressure. Since the current in the motor-circuit is large, suitable provision should be made for extinguishing the arc when the contactor opens.

The object of my present invention is to provide a suitable form of construction for such contactors which shall meet the requirements above set forth, and to accomplish this end my invention comprises a number of novel features which will appear in the following specification and which are pointed out specifically in the appended claims.

My invention will best be understood by reference to the accompanying drawings, in which—

Figure 1 shows a side elevation, partly in cross-section, of a contactor constructed and arranged in accordance with my invention. Figs. 2 and 3 show perspective views of the same. Fig. 4 shows a cross-section of the arc-chute employed in my contactor, and Fig. 5 shows a detail of the contacts of the motor-circuits.

In the drawings, 1 represents the actuating-coil of a contactor provided with a movable core 2. The core 2 carries a spindle 3, which supports two sets of bridging members 4 and 5. When the coil 1 is deënergized and its core 2 is in its lowest position, as shown, the bridging member 5 is in engagement with the spring-contacts 6 6 and forms therewith the proper circuit connections for energizing coil 1. When coil 1 is energized and core 2 is raised, bridging members 4 are brought into engagement with the two sets of stationary spring-contacts 7 7 and 8 8. It will be seen that bridging member 4 will engage the contact 7 7 before bridging member 5 leaves the contacts 6 6. Bridging member 4, together with the contacts 7 7, form the maintaining-circuit for the magnet-coil, and consequently this circuit is closed before the circuit of the magnet-coil is broken. The contacts 8 8 close the circuit for the operating-coil of the succeeding contactor. The specific connections which have been here briefly outlined form no part of the present invention and are fully described in my former patent referred to above. The walls 33, which support the stationary contacts, serve to inclose and protect this position of the switch mechanism. When coil 1 is deënergized, core 2 is supported at its lower end by the support 9. Core 2 carries at its lower end the pin 10, upon which is supported the shaft 11. The shaft 11 is provided at each end with the insulating-bushings 12, (shown in cross-section in Fig. 1,) and surrounding the bushings 12 are metallic bushings 13. Loosely journaled on the bushings 13 at opposite ends of the shaft 11 are the links 14, which are pivoted at 15, as shown in Fig. 2. These links 14 act to guide the shaft 11 when core 2 is raised and lowered. Also loosely journaled on the bushings 13 at each end of shaft 11 are the members 16, which carry the movable contacts 17. This is clearly shown in Fig. 2. The contact 17, which may be formed of a single piece of rolled copper, is beveled, as shown, and is clamped to the member 16 by the clamp 22, member 16 being recessed to receive the beveled edge of con-

tact 17. This is shown in detail in Fig. 5. Engaging member 16 and holding it in the position shown is a spring 19, the other end of which carries the member 20, which is pressed by spring 19 against the fixed abutment formed by the contact 21 and rubs thereon when the shaft 11 is raised and lowered.

18 represents the stationary contacts arranged to be engaged by the movable contacts 17 when the operating-coil is energized. The distance between contacts 17 and 18 is proportioned with reference to the travel of the core 2 of the operating-coil, so that the two contacts are brought into engagement with each other before the core 2 reaches the upper limit of its travel. This has two results. In the first place the buckling of spring 19, produced by the continued upward movement of the core, results in a stronger pressure of the member 20 on the contact 21 and of contact 17 on contact 18 and at the same time produces a rubbing of contact 17 on contact 18. Thus good contact is assured, not only by pressure, but by friction between the engaging surfaces of the contacts at which the circuit is made and broken.

23 represents insulating-covers which are hinged at 25 and are held in closed position by the spring-clips 24. This is shown clearly in cross-section in Fig. 1. These insulating-covers serve to inclose the live parts of the contactor which are included in the motor-circuit and at the same time may readily swing away, as shown in Figs. 2 and 3, to permit inspection and repair.

26 represents a blow-out coil which is provided with parallel pole-pieces 27, extending on opposite sides of both sets of contacts in the motor-circuit.

The contacts 17 and 18 are curved away from each other at their tips, as shown, so that the arc in traveling outward along the contacts under the influence of the magnetic field produced by the pole-pieces 27 will be lengthened, and consequently more easily ruptured. To inclose the arc produced between the contacts and to insulate the pole-pieces 27 therefrom, I provide the arc-chute 28, formed of insulating non-combustible material. One of the arc-chutes 28 is shown in cross-section in Fig. 4. It will be seen from this figure that the central portion of the arc-chute is hollowed out to admit the tips of the contacts 17 and 18, as shown in dotted lines in Fig. 1, and to provide both a vertical and a horizontal chute for the arc. The sides of the arc-chute are extended by the wings 29, (shown in Fig. 4,) which extend inside of the pole-pieces 27 and serve to insulate them effectively from the arc and also to act as guides for moving the chute into and out of position. The arc-chute 28 is provided with supporting-bars 30, which loosely engage the pole-pieces 27. The upper supporting-bars 30 are provided with the pivoted links 31, the ends of which are formed with an L-shaped slot which engages a pin 32 on the pole 27. This construction holds the arc-chutes firmly in place and yet permits ready removal for inspection and repair and supports the chutes in the removed position. Thus from an inspection of Fig. 1 it will be seen that the weight of the chute, which is supported from the pin 32, tends to hold the chute in position and that it is impossible to slide the chute outward without raising the link 31. By raising the link 31, however, so as to bring the other leg of the L-shaped slot into engagement with pin 32, the arc-chute may be readily withdrawn into the position shown in Fig. 3, affording access to the contacts. In this position the pin 32 still acts as a support for the arc-chute and prevents it from completely falling off. To further protect the pole-pieces from arcs, the ends may be coated with any suitable insulating material, such as porcelain enamel.

Although I have shown a contactor designed particularly for use in the system of control described in my former application mentioned above, my invention is not limited in all its features to use in this particular system. The arrangement of contacts may be varied, as desired, to meet the different requirements of a different system of control employing different circuit connections. Such modifications will be obvious to those skilled in the art, and I aim in the appended claims to cover all such modifications.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In combination, a magnet-coil, a movable core therefor, a shaft supported by said core, pivoted links engaging opposite ends of said shaft, and switch-contacts supported on opposite ends of said shaft.

2. In combination, a magnet-coil, a movable core therefor, a shaft supported by said core, and spring-pressed switch-contacts loosely journaled on opposite ends of said shaft and insulated therefrom.

3. In combination, a magnet-coil, a movable core therefor, a shaft supported by said core, insulated bushings on said shaft, and spring-pressed contacts loosely journaled on said bushings.

4. In combination, a magnet-coil, a movable core therefor, a shaft supported by said core, a contact member loosely journaled on said shaft, a spring, one end of which engages said contact member and the other end of which bears against a fixed abutment, and a stationary contact adapted to be engaged by said contact member and so positioned that said spring is placed under tension when said member is moved to closed position by said core.

5. In combination, a magnet-coil, a movable core therefor, a shaft supported by said core, a contact member loosely journaled on said

shaft, a flat spring, one end of which engages said contact member and the other end of which presses against a fixed abutment, and a stationary contact adapted to be engaged by said contact member and so positioned that it is engaged by said member when said coil is energized before said core reaches its closed position, whereby said spring is buckled and produces a wiping movement of said contacts.

6. In combination, a magnet-coil, a movable core therefor, a shaft supported by said core, switch members supported at opposite ends of said core, and hinged insulating-covers inclosing said members.

7. In combination, switch-contacts, a blow-out coil therefor having pole-pieces extending on opposite sides of said contacts, and an insulating arc-chute removably supported between said pole-pieces and inclosing said contacts.

8. In combination, switch-contacts, a blow-out coil therefor having pole-pieces extending on opposite sides of said contacts, an arc-chute inclosing said contacts, pivoted links carried by said chute, and pin-and-slot connections between said links and said pole-pieces, whereby said chute is removably supported between said pole-pieces.

9. In combination, switch-contacts, a blow-out coil therefor having pole-pieces extending on opposite sides of said contacts, an arc-chute inclosing said contacts, pivoted links carried by said chute and having L-shaped slots at their ends, and pins on the pole-pieces adapted to engage said slots.

10. In combination, a magnet-coil, a movable core therefor, a member supported by said core, switch-contacts supported at opposite ends of said member, and a blow-out magnet located between said switch-contacts and having pole-pieces extending on opposite sides of both switch-contacts.

11. In combination, a magnet-coil, a movable core therefor, a member supported by said core, switch-contacts supported at opposite ends of said core, a blow-out magnet located between said switch-contacts, and parallel pole-pieces at opposite ends of said blow-out magnet extending on opposite sides of both switch-contacts.

In witness whereof I have hereunto set my hand this 17th day of June, 1904.

GEORGE H. HILL.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.