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MAGNETIC ARC EXTINGUISHING MEANS.

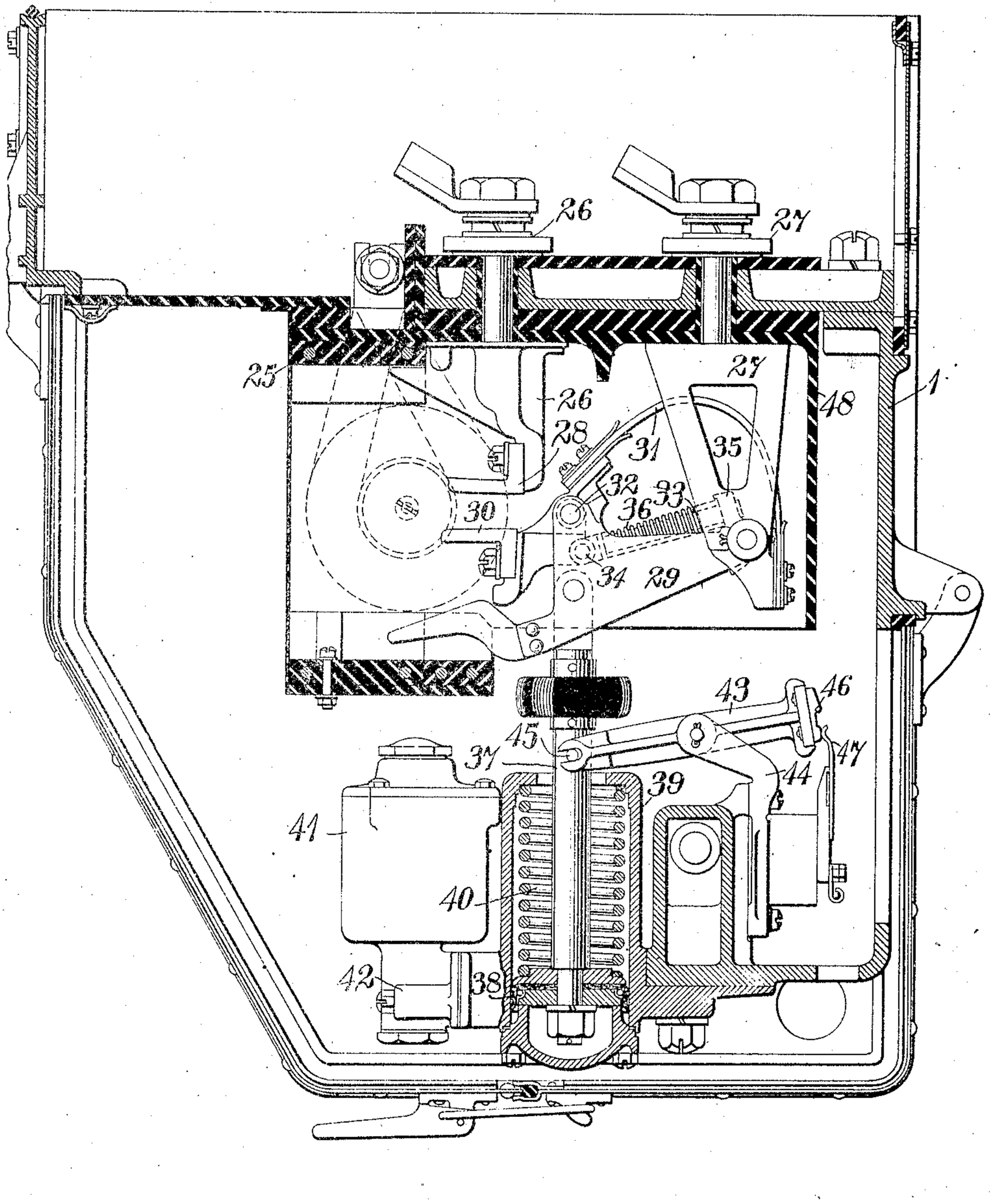
APPLICATION FILED DEC. 4, 1905.

934,573.

Patented Sept. 21, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

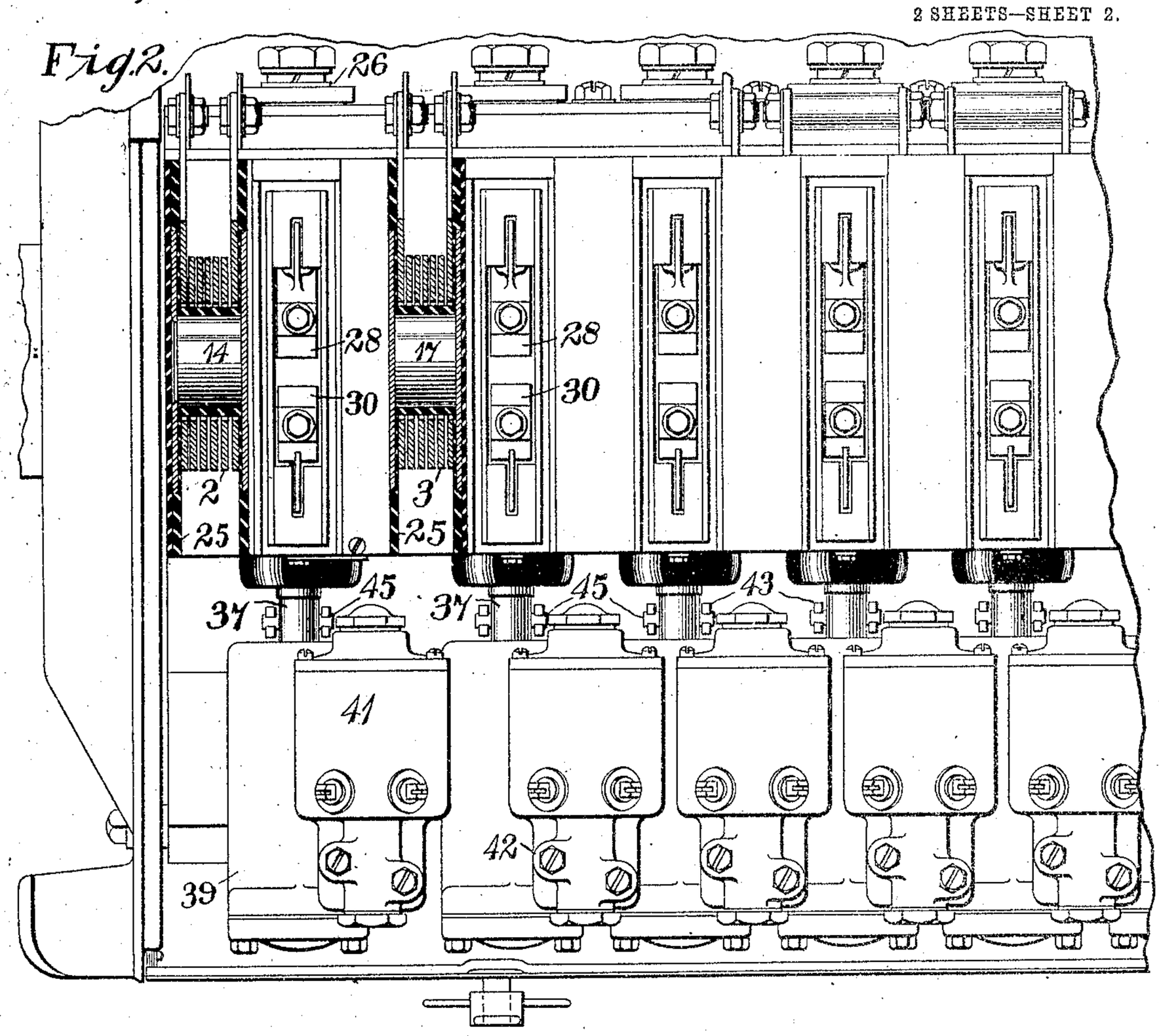
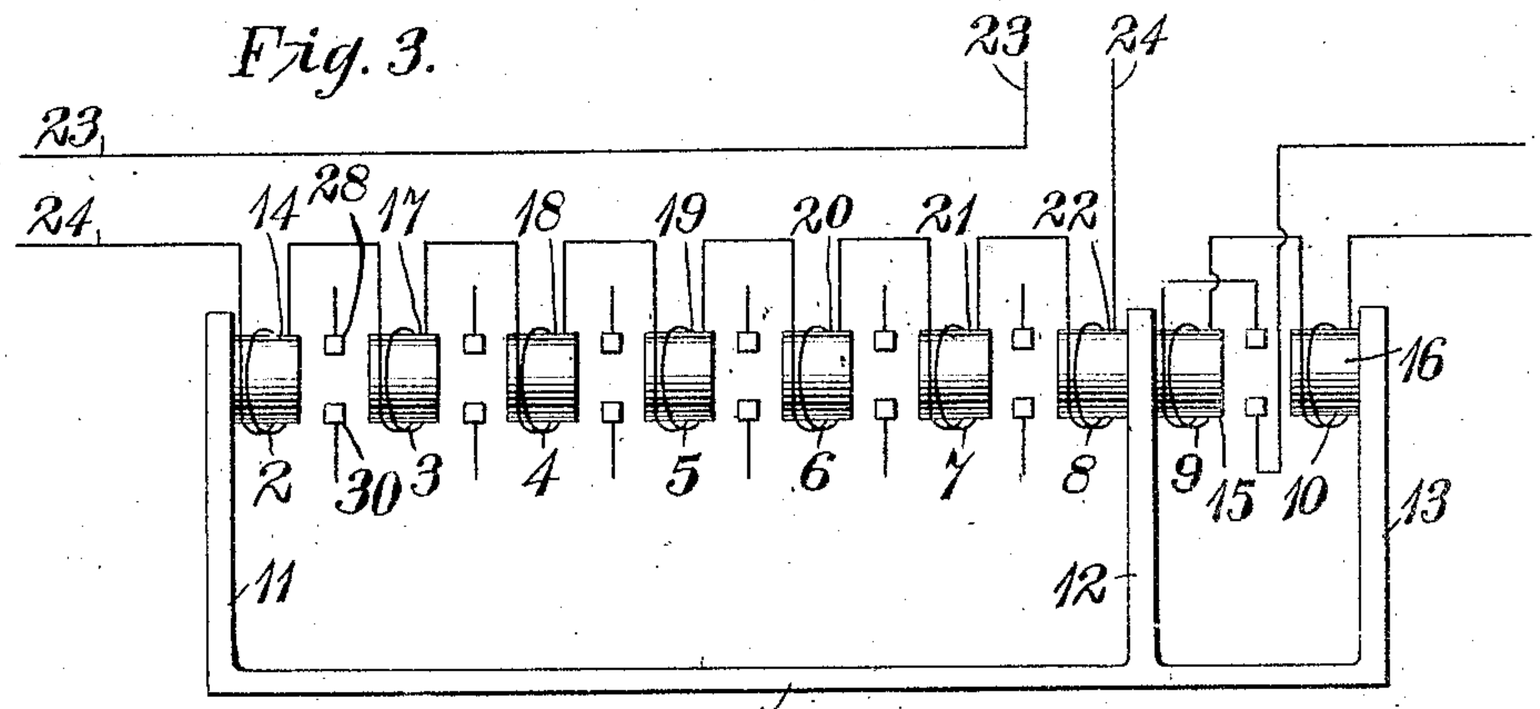


Fig. 3.



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MAGNETIC ARC-EXTINGUISHING MEANS.

934,573. Specification of Letters Patent. Patented Sept. 21, 1909.

Application filed December 4, 1905. Serial No. 290,156.

To all whom it may concern:

Be it known that I, OLOF A. SANDBORGH, a citizen of the United States, and a resident of Swissvale, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Magnetic Arc-Extinguishing Means, of which the following is a specification.

My invention relates to magnetic means for extinguishing electric arcs at the terminals of circuit interrupting devices and particularly to such means as are adapted for use with devices which are employed for the interruption of relatively large electric currents in the control of electric motors.

The object of my invention is to provide means for the purpose indicated above that shall be simple in arrangement and that shall effectually maintain a suitable magnetic field at the contact terminals of circuit interrupting devices with a minimum expenditure of magnetizing energy.

Magnetic blow-out devices, as heretofore constructed, have usually involved the expenditure of considerable magnetizing energy in order to maintain a relatively weak magnetic field at the air-gap in which the arcing occurred, by reason of excessive magnetic leakage, in the form of stray fields, which uselessly consumed energy. For example, in the turret type of electric vehicle motor control, illustrated and described in Patent No. 773,832, granted November 1, 1904, to George Westinghouse, a blow-out magnetizing coil is located in the center of the turret, while projections of magnetizable material extend outwardly from the central core portion near to the circuit terminals of the interrupters which are equally disposed about the circumference of the turret structure. With this arrangement, there is a strong magnetic field across the air-gap between the projecting arms and near the center of the turret where it is of no value. Magnetic cores have also often been made of U-shape, the magnetizing coil being located at the yoke while the arcing terminals to be protected were located between the extremities of the arms. In such cases a large amount of the magnetic flux followed other than useful paths. These losses were enhanced when a large number of switches were located in a group and the distribution of the fields was not always uniform, so that destructive arcing sometimes occurred at a certain set of interrupters while others in the same group were well protected.

My invention is specially well adapted for the protection of a multiple switch control system involving a plurality of circuit interrupting devices which open and close the controlled circuits at frequent intervals and it provides a magnetic circuit in which a field of maximum strength is concentrated at the air-gap where the circuit interruption occurs. The several coils are so wound and connected that the several magnetizing effects produced thereby are in the same direction, so that a magnetic circuit of a single path is produced and the leakage tendency is reduced to a minimum. This construction may readily be further combined with electro-magnetically controlled switch groups in which contact terminals of relatively small size are held in engagement with each other by comparatively high fluid-pressure.

In the accompanying drawings, Figure 1 is a sectional elevation of a multiple unit switch group protected with the blow-out arrangement of my invention. Fig. 2 is a partial front elevation of the switch group illustrated in Fig. 1, parts of which are shown in cross-section to disclose my improved construction, and Fig. 3 is a diagrammatic view of a complete magnetic circuit, parts of which are shown in Figs. 1 and 2.

Referring to the drawings, the multiple unit switch group comprises a magnetizable frame or yoke 1 which constitutes a return circuit for the magnetic field induced by a plurality of magnetizing coils 2, 3, 4, 5, 6, 7, 8, 9 and 10. The yoke 1 is provided with projections 11, 12 and 13 and pole pieces 22, 14, 15 and 16 which are attached to or are integral with said projections. Between the projections 11 and 12, a series of magnetizable members 17, 18, 19, 20 and 21 are disposed at substantially equal intervals and are respectively magnetized by coils 3, 4, 5, 6 and 7. The coils 2 to 8, inclusive, are connected in series relation and are energized from any convenient source through supply conductors 23 and 24. The magnetizable members 17, 18, 19, 20 and 21, which are interposed between the pole pieces 14 and 15, are supported by frames or boxes 25 of non-magnetizable material, such as fullerboard. A series of similar circuit interrupters are lo-

cated in the air-gaps formed between the pole pieces and the several intermediate magnet members and each comprises a movable contact arm 29 and stationary terminal members 26 and 27 which are attached to the frame 1 by bolts and are insulated therefrom by washers and bushings (see Fig. 1). The stationary terminal member 26 is provided with an arcing terminal piece 28, the extremity of which is located directly in the magnetic circuit which is provided as indicated above. The movable contact arm 29 is pivotally mounted upon the stationary member 27 and is provided with a contact piece 30 which is movably connected thereto and corresponds to the stationary terminal piece 28 with which it may engage, when an electric circuit is completed from stationary member 27 through the movable arm 29, to the stationary member 26. The contact piece 30 is connected to the stationary member 27 by a flexible shunt 31, so that the resistance is reduced between the members and its motion about the pivot 32, upon which it is mounted, is limited by a connecting rod 33, one end of which is attached to a pivot 34 the center line of which is slightly removed from that of the pivot 32, and the other end of which is longitudinally movable in a bushing 35 with which the arm 29 is provided. The terminal piece 30 is rotated about the pivot 32, as far as the connecting rod 33 will permit, by a compression spring 36. The terminal piece 30 is moved into and out of engagement with the terminal piece 28 by a connecting rod 37 which acts upon the movable arm 29 and receives its motion from a piston 38 with which it is connected. The piston 38 is located in a fluid-pressure cylinder 39 and normally holds the circuit interrupter in its open position by reason of a compression spring 40 which is interposed between one end of the cylinder and the piston. The switch may be closed by the action of fluid-pressure that is admitted into the cylinder by a valve 42 the operation of which is governed by an electro-magnet 41. The extremity of the terminal piece 30 moves into engagement with the terminal piece 28 first, and as the two members are separated, circuit is finally broken at this point by reason of the action of the spring 36, already explained. The extremities of the terminal pieces 28 and 30 are separated slightly from each other when the switch is completely closed, so that roughening of such extremities by arcs will not prevent perfect engagement of the main portions of the contact surfaces.

In order that the several switches may be electrically interlocked, relay switches are provided, each of which comprises a contact carrying arm 43 that is pivotally mounted, near its middle point, upon a stationary projection 44 which is supported from the frame 1 and stationary engaging contact fingers 47. One extremity of the arm 43 is slotted to engage a pin 45 on the connecting rod 37 so that the motion of the connecting rod imparts of a rocking motion to said arm. The outer extremity of the arm 43 is provided with contact pieces 46 which engage the stationary contact fingers 47.

The stationary members 26 and 27, together with the movable arm 29 of each switch, are surrounded by a box 48 of insulating material, which is similar to and is assembled between the boxes 25 in which the magnetizable core members are located. By locating the several switch members and the various core members in separate boxes, any one may be readily removed and replaced in case of accident to its parts, which is of decided advantage, particularly in railway vehicle service. The magnet coils 2, 3, 4, 5, 6, 7, 8, 9 and 10 may preferably be wound with comparatively large size strap conductor of relatively few turns so that the resistance of the windings connected in series is comparatively low and may be included in the motor circuit without appreciable loss.

In order to support the series switches and their parts, the frame 1 must have considerable section of material which adequately serves as a return circuit for the magnetic flux induced by the several magnetizing coils, and although the magnetic lines may be considerably scattered through the return portion of the circuit, they will obviously be concentrated at the points of circuit interruption so that relatively large currents may be flowing through the circuit at the time of interruption without materially damaging the contact terminals, since the arcs, which would otherwise occur to a greater or less extent, are extinguished in accordance with well known principles.

It is sometimes desirable to protect certain of the circuit interrupters independently on account of the necessity for reversing the current therethrough, and in that case, an intermediate projection of magnetizable material, such as projection 12, which is provided with pole pieces 22 and 15, may be introduced between the end projections 11 and 13. When this projection is introduced, as shown in Fig. 3, the magnetizing windings 9 and 10 are connected together and in series with the interrupter which is located between them and a magnetic circuit is induced through pole piece 16, projection 13, a portion of yoke 1, projection 12 and pole piece 15, while the main magnetic flux produced by the windings 2, 3, 4, 5, 6, 7 and 8 passes through pole piece 14 and intermediate magnet members 17, 18, 19, 20 and 21, pole piece 22, projection 12, yoke 1 and the projection 11. With this arrangement, it is possible to protect an interrupting device which may be located in the air-gap between

the pole pieces 15 and 16 without energizing the windings 2, 3, 4, 5, 6, 7 and 8.

Although I have illustrated and described my invention in connection with a multiple switch group, such as is employed for the control of railway vehicle motors, it is not restricted thereto and may be advantageously applied for the protection of circuit interrupting devices in general, and I desire that variations which do not depart from the spirit of my invention shall be included within its scope.

I claim as my invention:

1. In a controller for electric circuits, the combination with a plurality of independently actuated and electrically controlled switches, comprising a series of stationary contact terminal members and corresponding movable contact members, of means for extinguishing electric arcs at the terminals of the contact members said means comprising a plurality of magnetizable members severally located between adjacent switches, a series of magnetizing windings for said members and a supporting frame for the various switch parts which constitutes a return magnetic circuit.

2. In a controller for electric circuits, the combination with a plurality of independently actuated switches each of which comprises a stationary contact member, a movable member hinge-connected thereto, a second stationary contact member, a terminal member yieldably connected to said movable member and adapted to engage the second stationary member, a fluid-pressure cylinder, a piston in said cylinder and a connecting rod having its extremities attached, respectively, to the movable member and to the piston, of means for extinguishing electric arcs at the terminals of the contact members, said means comprising a plurality of magnetizable members severally located between adjacent switches and near their terminals, a series of magnetizing coils which surround the magnetizable members and induce a magnetic field therein and a supporting frame for the various switch parts which constitutes a return circuit for the magnetic flux induced by the magnet coils.

3. In a control system for electric circuits, the combination with a plurality of interrupting devices comprising stationary contact members and movable contact members adapted to engage said stationary members, of means for extinguishing electric arcs at the terminals of the contact members said means comprising a plurality of magnetizable members severally located between adjacent switches and near their terminals, a series of magnetizing coils which surround the magnetizable members and induce a magnetic field therein and a supporting frame for the various switch parts which constitutes a return circuit for the magnetic flux induced by the magnet coils.

4. In a controller for electric circuits, the combination with a plurality of independently actuated switches comprising a stationary contact member, a movable member hinge-connected thereto, a second stationary contact member, a terminal member yieldably connected to said movable member and adapted to engage the second stationary member, a fluid-pressure cylinder governed by an electrically actuated magnet valve, a piston in said cylinder and a connecting rod, the extremities of which are attached respectively to the movable member and to the piston, a contact-carrying arm pivotally mounted near its middle point, one extremity being so connected to said connecting rod by a lost motion connection that the motion of the connecting rod produces a rocking motion in said arm, contact pieces mounted upon the opposite end of the arm and insulated therefrom, and stationary fingers that engage said pieces, of means for extinguishing electric arcs at the terminals of the contact members said means comprising a plurality of magnetizable members located between the several switches near their terminals, a series of magnetizing coils which surround the magnetizable members and induce a magnetic field therein, and a supporting frame for the various switch parts which constitutes a return circuit for the magnetic flux induced by the magnet coils.

In testimony whereof, I have hereunto subscribed my name this 29th day of November, 1905.

OLOF A. SANDBORGH.

Witnesses:
HOWARD L. BEACH,
BIRNEY HINES.