Dec. 27, 1949 E. H. AYERS ET AL 2,492,726

ELECTRIC SWITCH

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Fig. 1.

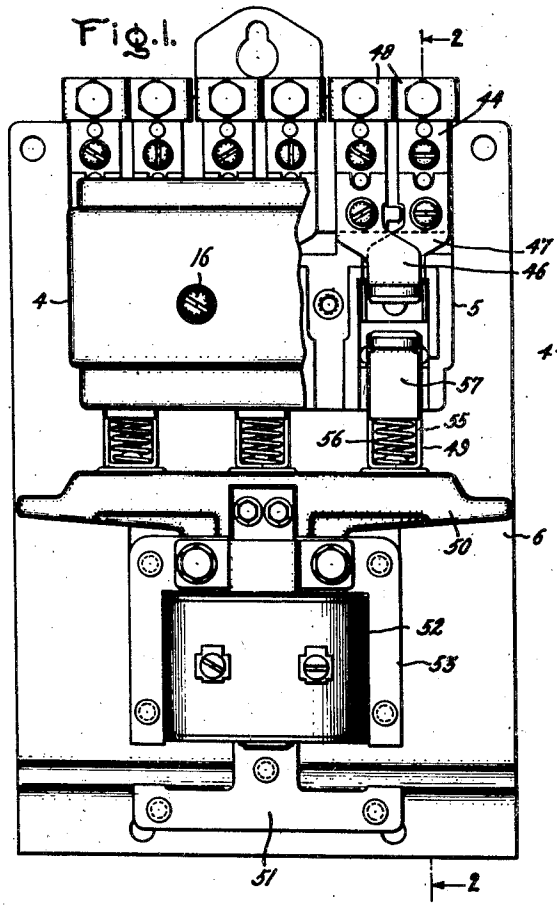


Fig. 2.

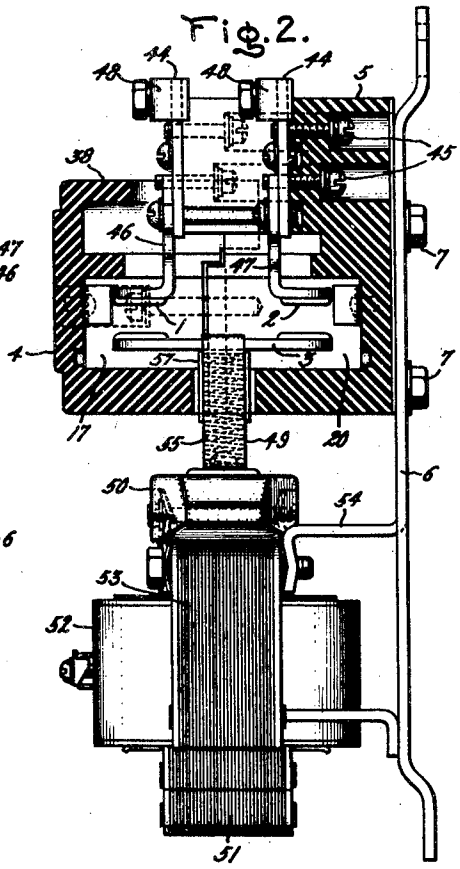


Fig. 3.

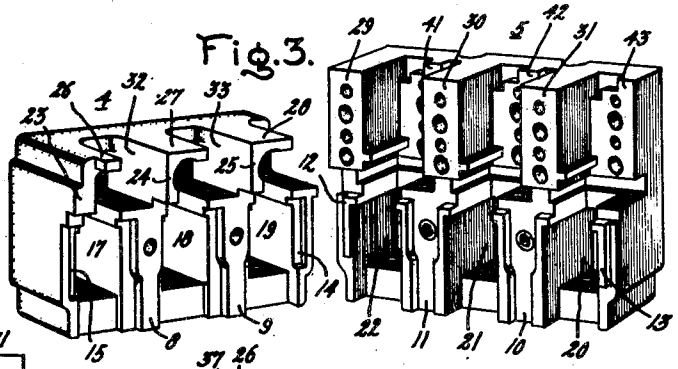


Fig. 4.

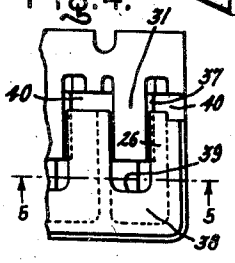
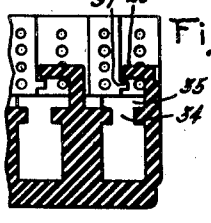


Fig. 5.



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ELECTRIC SWITCH

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5 Claims. (Cl. 200—144)

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Our invention relates to electric switches, more particularly to electromagnetically operated switches of the type known as contactors, and has for its object a simple, reliable and inexpensive contact supporting and arc extinguishing means for contactors having a front section readily removable to give access to the switch contacts.

In carrying out our invention in one form we utilize two cooperating members made of molded electrically insulating material providing for each set of stationary and movable contacts a double arc chamber to assure rapid extinguishment of the arc, consisting of a lower chamber in which the contacts are mounted provided with an upper opening leading into an upper chamber having in turn an upper opening and walls for changing the direction of gas flow resulting from arcing between the contacts and means for collecting deposits of dirt and of metals and other materials resulting from arc interruption.

For a more complete understanding of our invention reference should be had to the accompanying drawing, Fig. 1 of which is a front elevation view of the contactor embodying our invention; Fig. 2 is a sectional view along the line 2—2 of Fig. 1 looking in the direction of the arrows; Fig. 3 is a view in perspective of the two cooperating contact supporting and arc extinguishing members, Fig. 4 is a fragmentary plan view of the members 4 and 5 in assembled relation, while Fig. 5 is a fragmentary sectional view along the line 5—5 of Fig. 4 looking in the direction of the arrows.

Referring to the drawing, we have shown our invention in one form as applied to a contactor having a plurality of pairs of stationary contacts cooperating with each pair of which is a movable bridging contact member. Only one of these sets of switch contacts is shown in detail, this set comprising the stationary contacts 1 and 2 cooperating with which is a movable bridging member 3 biased downward by gravity to an open circuit position as shown.

The three sets of contacts are enclosed in a structure formed by two cooperating switch contact enclosure members 4 and 5 (Fig. 3) made of a molded electrically insulating heat refractory material having good heat conductivity, preferably an inorganic compound, such as a cold molded mixture of asbestos and Portland cement. The member 5 is mounted in a suitable support such as a metal plate 6 by means of lag screws 7 which cooperate with tapped metal inserts molded in the member 5. The plate 6 is in

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turn mounted on suitable supporting means in an upright position, as seen in the drawing. By means of projecting abutments 8 and 9 which fit in complementary recesses 10 and 11 in the member 5 and walls 12 and 13 on the member 5 which fit in recesses 14 and 15 in the member 4, the member 4 is fitted on the member 5 in a predetermined positional relation therewith as shown in Figs. 1 and 2, the bottom and side walls of the two members being flush with each other, but the member 4 being somewhat shorter. The two members are separably secured together by two screws 16 inserted in countersunk holes in the member 4 and cooperating with tapped metal inserts in the member 5.

It will be observed that the member 4 is formed with walls forming three rectangular cavities 17, 18 and 19, having top openings, which register or match respectively with three identical cavities 20, 21 and 22 in the member 5 to form three horizontally extending rectangular arc chambers each provided with a rectangular top opening and in each of which is mounted a set of switch contacts.

Moreover, the member 4 is provided with three upwardly extending walls 23, 24 and 25 joined by the front wall of the member 4 and provided with overhanging tops 26, 27 and 28. The longer contact supporting walls 29, 30 and 31 on the member 5 extend respectively in a predetermined spaced relation with the overhanging front wall thereby to form restricted top outlet openings. It will be noted that the flat opposite sides 32 and 33 of two of the top walls 24 and 25 are in closely spaced relation with the left hand sides as seen in Fig. 3 of the longer walls 31 and 30 respectively of the member 5.

This construction provides three identical arc chambers formed by the pairs of cooperating cavities 17, 20, etc., each of which is provided with a restricted top opening 34 (Fig. 5) leading into an upper chamber 35. The upward flow of heated gas resulting from arcing during the circuit interruption is further impeded by a horizontal wall 37 on the wall 31 of the member 5 just below the wall 26.

Moreover, the front wall of the member 4 is provided with an overhanging portion 38 between the walls 26 and 27 whereby a restricted top opening 39 for the chamber 35 is formed in front of the wall 31. A similar overhanging portion is provided between the walls 27 and 28 and at the right hand side of the wall 28 as seen in Fig. 3. An additional top opening 40 is provided for each of the upper chambers 35 between the

ends of the walls 26, 27 and 28 and the back or short walls 43, 42 and 41 of the member 5.

The longer walls 29, 30 and 31 and also the back or shorter walls 41, 42, and 43 in alternate relation with the longer walls form supports for terminal strap members 44 each of which, as shown clearly in Fig. 2, is secured in place by two screws 45 inserted in countersunk holes from the rearward side of the member 5. On their lower ends the terminal members 44 of each pair of walls such as 31 and 43 have secured to them in electrically conducting relation contact supporting straps or members 46 and 47 (see Figs. 1 and 2) the lower ends of which extend respectively obliquely to the right and left toward each other downward into the arc chamber 17, 20. The lower ends of the straps 46 and 47 are bent at right angles respectively to the left and the right as seen in Fig. 2 and carry the contacts 1 and 2 positioned in the upper end of the arc chamber. A clamping member 48 is provided on the upper end of each strap 44 by means of which an electrical conductor can be secured in electrically conducting relation with the strap thereby to connect the switch in circuit with the motor or other electric apparatus to be controlled. It will be noted that the pairs of strap members 44, 46 extend through the openings 39 and 40.

Each bridging contact 3 is mounted resiliently on a post 49 the lower end of which is mounted on a transversely extending bracket 50 made of molded electrically insulating material and mounted in turn on the upper end of an armature 51 of an operating magnet provided with a coil 52 and a magnet iron structure 53. The magnet is mounted on a resilient bracket 54 as described and claimed in our copending Patent No. 2,434,096.

Preferably as shown each supporting post 49 consists of a U-shaped strap 55 secured at its lower end to the bracket 50, preferably by molding it in the bracket, and having its upper ends bent over toward each other at right angles. The bridging member 3 extends through the strap and is held by a helical spring 56 against the upper ends of the strap. An inverted U-shaped strap 57 has its base extending through the strap 55 between the spring and the bridging member with its sides embracing the spring and the open sides of the strap 55. This construction forms, it will be observed, a square post. An aperture is provided for the post in the bottom center of the arc chamber between the ends of the shortened bottom walls of the members 4 and 5. Preferably as shown, the posts fit closely in their apertures thereby to close substantially the bottom wall of the arc chamber against the escape of hot gases.

By means of the two intercommunicating chambers, one above the other, the lower one containing the switch contacts, improved electrical insulation is obtained between the contacts in adjacent chambers whereby arc-overs between them are prevented, particularly after operation for long periods of time. This improved insulation is obtained in part by additional creepage and air gap distances provided by the upper chamber, particularly by the barriers, such as 32 and 27, along which an electric current must creep through dirt or dust deposits to go from one contact in the chamber 17 to the adjacent one in the chamber 18.

Collections of dirt and metal deposts can accumulate on the overhanging walls 26, 27 and 28, while the vertical walls 32 and 33 still provide good electrical insulation between the contacts in

adjacent chambers, i. e. from phase to phase. The overhanging walls 26, 27 and 28 further serve the purpose of deflecting the vertically rising arc or mass of gases from the lower chambers and causing them to make a right-angle turn, or something greater, before they pass out of the upper arc chambers. This deflection of the arc and hot gases serves to more quickly cool and extinguish the arc and, moreover, positively confines the arc more closely to the insulating structure. In other words, the overhanging walls prevent the movement out of the upper chambers of excessively long arcs such as would otherwise be produced when the circuit is opened on heavy overloads and which might result in shortcircuiting of the phases. It will be observed that the two members 4 and 5 are shaped in such manner that they can be formed easily in a single ram molding press.

While we have shown a particular embodiment of our invention, it will be understood, of course, that we do not wish to be limited thereto since many modifications may be made and we therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In an electric switch, a structure made of electrically insulating material providing a plurality of pairs of inter-communicating upper and lower arc chambers, said upper arc chambers having substantially horizontal top and bottom walls, each said top wall being formed at least in part by an overhanging top on at least one side wall of each of said upper chambers extending toward the other side wall and providing a restricted and vertically directed exhaust vent opening for hot gases escaping from the connected lower chamber, a pair of stationary switch contacts mounted on said structure in each of said lower chambers, a bridging contact in each of said lower chambers cooperating with said stationary contacts, the bottom walls of said lower chambers having each a bottom opening, and operating means for said bridging members extending through said bottom openings.

2. In an electric switch, interfitting front and rear insulating structures, said structures having cooperating cavities providing a plurality of lower arc chambers each having a top opening and a bottom opening, said rear structure having a plurality of upwardly extending walls above said lower chambers adjacent said top openings and said front structure having a plurality of second upwardly extending walls projecting between said first walls, said second upwardly projecting walls having overhanging tops for deflecting and cooling hot gases escaping through said top openings from said lower chambers, said front structure having also a plurality of upper cavities between said second upwardly extending walls and providing with said second upwardly extending walls a plurality of upper arc chambers having bottom walls each said upper arc chambers communicating with the associated lower arc chambers through said top openings, a pair of stationary contacts in each said lower arc chamber mounted on one of said structures, a bridging contact member in each said lower arc chamber cooperating with said stationary contacts, and operating means for said bridging members extending through said bottom openings.

3. In an electric switch, a first contact enclosure member made of electrically insulating material

and provided with a plurality of cavities having top openings, a second contact enclosure member made of electrically insulating material, means for detachably securing said second member to said first member, said second member being provided with a plurality of lower cavities having top openings and matching with the cavities in said first member to form lower arc chambers and having also a plurality of upper cavities a plurality of spaced-apart first upwardly extending walls on one of said members above said lower arc chambers and adjacent said top openings, a plurality of spaced-apart second upwardly extending walls on the other of said members having overhanging tops projecting toward said first walls, said first and second walls and said upper cavities defining upper arc chambers having bottom walls and communicating through said top openings with said lower arc chambers, said second walls being of lesser height than said first walls thereby to form vertically directed restricted top vent openings from said upper arc chambers, a pair of stationary switch contacts fixedly mounted in each of said lower chambers, a bridging member in each of said lower chambers cooperating with said stationary contacts, the bottom wall of said matching cavities terminating in spaced relation to provide a bottom opening for each of said lower chambers, and operating means for said bridging members extending through said bottom openings.

4. In an electric switch a first contact enclosure made of electrically insulating material provided with a back wall and spaced-apart projecting walls and with a plurality of cavities below said projecting walls having top openings, a second contact enclosing member made of electrically insulating material, means for detachably securing said second member to said first member, said second member being provided with lower cavities having top openings and disposed in matching relation with the cavities of said first member to form lower arc chambers, and being provided also with upper cavities, a plurality of spaced-apart upwardly extending walls on said second member between said upper cavities, said walls on said first and second member defining with said upper cavities, upper arc chambers having bottom walls and communicating through said top openings with said lower chambers, said walls on said second member being of lesser height than and extending between said projecting walls on said first member and having overhanging tops extending toward said projecting walls to define restricted upper vent openings from said upper chambers, a pair of stationary switch contacts

in each of said lower chambers, supporting means for said contacts extending through said top openings and secured to said first member, a bridging contact member in each of said chambers cooperating with said stationary contacts, the bottom walls of said matching cavities terminating in spaced relation to provide a bottom opening for each of said lower chambers, and operating means for said bridging contact members extending through said bottom openings.

5. In an electric switch, a rear contact enclosure member made of electrically insulating material and providing a plurality of spaced-apart cavities having top and bottom openings, said rear enclosure member having a plurality of upwardly extending walls above said cavities and adjacent said top openings, a front contact enclosure member made of electrically insulating material and providing a plurality of spaced-apart lower cavities interfitting with the cavities in said rear enclosure member to form a plurality of lower arc chambers, said front enclosure member having above said lower cavities a plurality of spaced-apart upper cavities and a plurality of upwardly extending walls intermediate said upper cavities, the extending walls of said front enclosure member projecting rearwardly between the upwardly extending walls of said rear enclosure member and being of lesser height with overhanging tops, said upper cavities and all said upwardly extending walls defining a plurality of upper arc chambers having bottom walls and upwardly directed restricted top vent openings, a pair of spaced-apart fixed contacts mounted in each said lower arc chamber, a bridging contact member in each said lower arc chamber, and operating means for said bridging contact members extending through the said bottom openings of said lower arc chambers.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,227,434	Bierenfeld	Jan. 7, 1941
2,236,580	Sandin et al.	Apr. 1, 1941
2,244,061	Graves, Jr.	June 3, 1941
2,254,768	Bierenfeld	Sept. 2, 1941
2,293,452	Boehne	Aug. 18, 1942
2,363,606	Maseng	Nov. 28, 1944
2,394,090	McFarland, Jr.	Feb. 5, 1946
2,416,164	Ellis et al.	Feb. 18, 1947