April 6, 1965 MASAYOSHI KAWABATA ETAL 3,177,331

ELECTROMAGNETIC SWITCH

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Fig. 1.

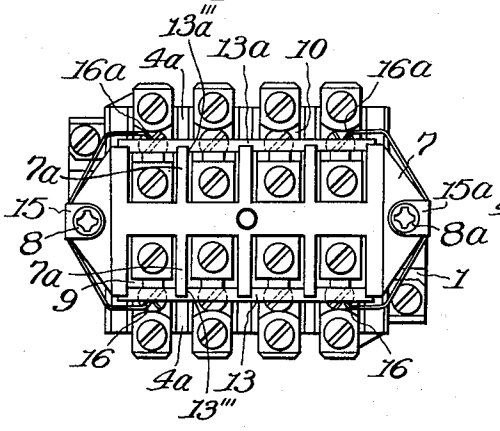


Fig. 3.

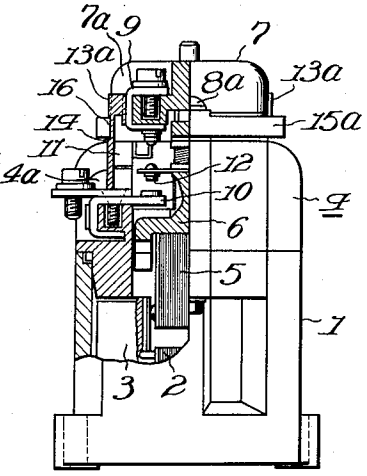


Fig. 2.

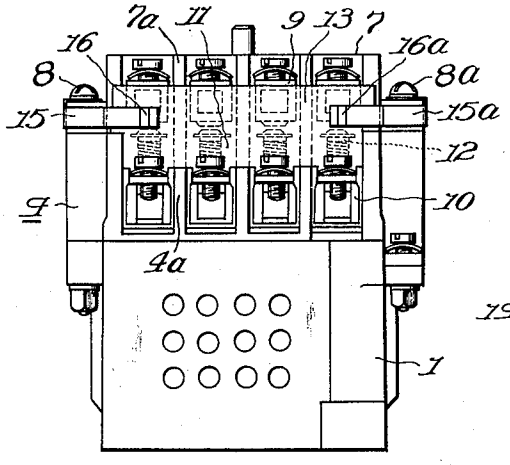


Fig. 4.

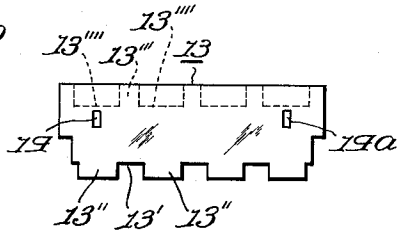

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Fig. 5.

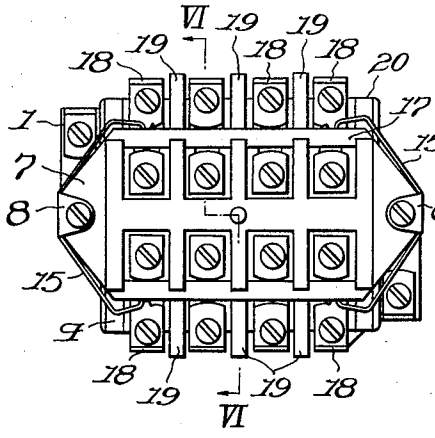


Fig. 6.

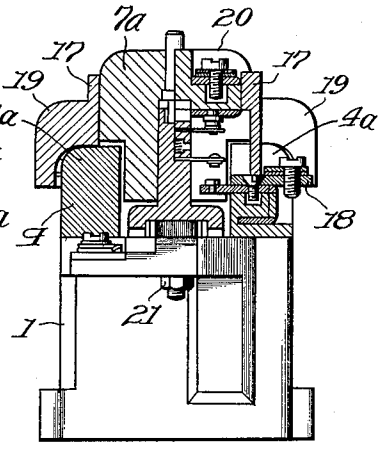


Fig. 7.

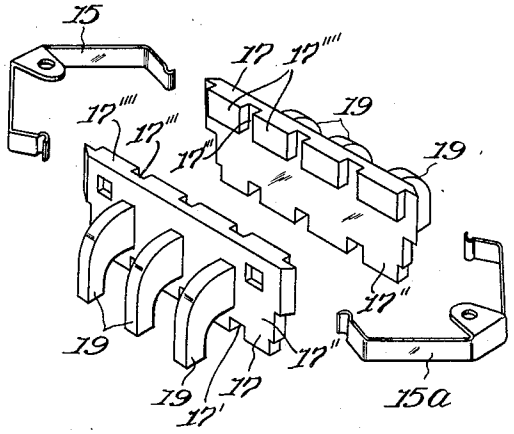

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Fig. 8.

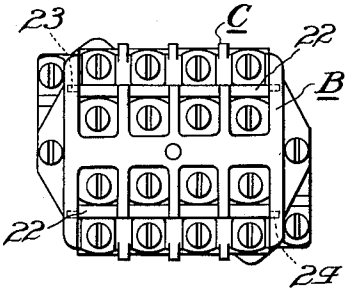



Fig. 9.

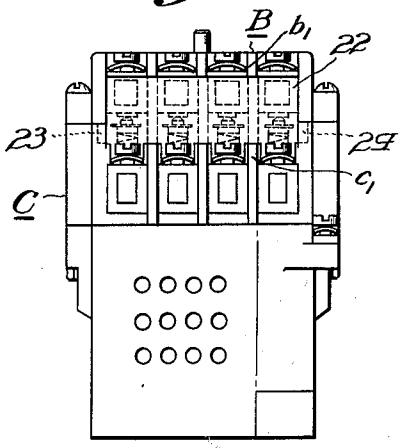



Fig. 10.

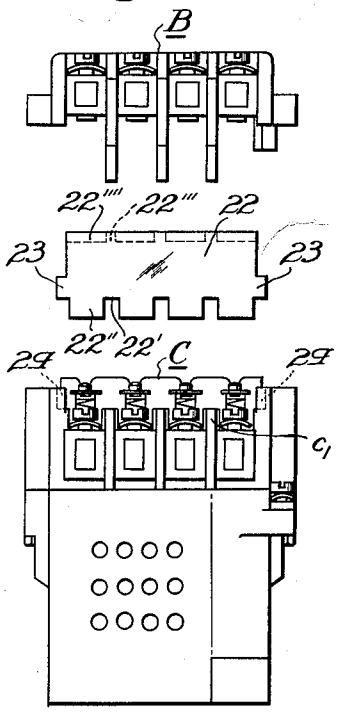



Fig. 11.

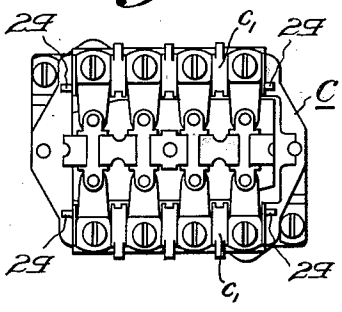
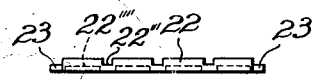



Fig. 12.



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# ELECTROMAGNETIC SWITCH

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Claims priority, application Japan, Oct. 29, 1960 (utility model), 35/54,208; Dec. 29, 1960 (utility model), 35/65,396

5 Claims. (Cl. 200—168)

This invention relates to electromagnetic switches and more particularly to a new and improved type of dustproof construction for electromagnetic contactors.

In a conventional electromagnetic switch of the type wherein a coil and stationary iron core are contained within the base structure of the electromagnetic switch, and the moving iron core and moving contact support are contained in a freely slidable manner within a stationary contact support mounted on the basic structure, the plurality of moving contacts which are arranged in a row on the moving contact support are disposed opposite the stationary contacts at recessed window portions on both sides of the stationary contact support. Consequently, such a conventional electromagnetic switch has had the disadvantage of accumulation and adhesion of dust on the contacting members, whereby satisfactory contacting condition could not be obtained. For this reason, such electromagnetic switches have heretofore been rendered dustproof by enclosing the entire structure within a housing made of transparent plastics or steel sheet. Such a measure has been uneconomical.

It is an object of the present invention to provide a new and simple type of dustproof construction for electromagnetic switches of this type.

The manner in which the foregoing objects and other objects of this invention may best be achieved will be more clearly apparent by reference to the following detailed description when taken in conjunction with the accompanying illustrations in which the same and equivalent parts are designated by the same reference numerals or letters, and in which:

FIG. 1 is a plan view of one representative embodiment of the present invention;

FIG. 2 is a side elevational view of the embodiment shown in FIG. 1;

FIG. 3 is a front elevational view, partly in section, in a direction perpendicular to that of FIG. 2;

FIG. 4 is a plan view of a transparent cover used in the embodiment shown in FIGS. 1, 2, and 3;

FIG. 5 is a plan view showing another embodiment of the present invention;

FIG. 6 is a front elevational view, in section taken along the line VI—VI of FIG. 5;

FIG. 7 is an exploded, perspective view showing the principal parts of the embodiment shown in FIGS. 5 and 6;

FIG. 8 is a plan view showing yet another embodiment of the present invention;

FIG. 9 is a side elevational view of the embodiment shown in FIG. 8;

FIG. 10 is an exploded, elevational view of the embodiment shown in FIGS. 8 and 9, showing its state wherein the upper stationary contact assembly and dustproofing plate are separated from the lower stationary contact assembly;



FIG. 11 is a plan view showing the lower stationary contact assembly shown in FIG. 10; and

FIG. 12 is a plan view of a dustproofing cover suitable for the embodiment shown in FIGS. 8 through 11.

Referring first to FIGS. 1 through 4, the structure of the electromagnetic switch comprises essentially a base structure 1, in which a stationary iron core 2 and a coil 3 are enclosed; a lower stationary contact support 4, in which a moving iron core 5 and a moving contact support 6 are enclosed in a freely slidable manner; and an upper stationary contact support 7. The foregoing three essential parts are held rigidly together as a single body by assembly screws 8 and 8*a*. The upper stationary contact support 7 supports upper stationary contacts 9 in a row; and the lower stationary contact support 4 supports lower stationary contacts 10 also in a row. Window portions 11 are provided in aligned disposition on the two sides of the said upper and lower stationary contact supports. The upper and lower stationary contacts 9 and 10 are separated by means of partition walls 4*a* and 7*a* formed on both sides of the respective contact supports 4 and 7. Moving contacts 12 are disposed in the said window portions 11 and are confronted above and below by the stationary contacts 9 and 10. The window portions 11 on each side are covered and sealed completely by a transparent cover 13 and 13*a*, which are held tightly in place by elastic clamp members 15 and 15*a* having bent ends 16 and 16*a* which fit, respectively, into holes 14 and 14*a* cut out in the cover 13 and 13*a*. The transparent covers 13 and 13*a* are provided respectively with engaging recesses 13′ and 13*a*′ at their upper portions confronting the partition walls 4*a* formed on both sides of the lower contact support 4, and the lower ends of the projections 13″ and 13*a*″ defined by the recesses 13′ and 13*a*′ project to the depth contacting with the lower surface of the stationary contact 9. Furthermore, the upper inside portions of the transparent covers 13 and 13*a* are provided respectively with vertical slots 13‴ and 13*a*‴ confronting the partition walls 7*a* formed on both sides of the upper stationary contact support 7, and the inward directed projections 13⁗ and 13*a*⁗ formed by the vertical slots 13‴ and 13*a*‴ are attached so as to be in contact with the outside surface of the upper stationary contact 10. The elastic clamp members 15 and 15*a* need not be rigidly fixed at their central portions by screws 8 and 8*a* as illustrated, but may be anchored in any other suitable manner, for example, by fitting said clamp members 15 and 15*a* into slots.

As illustrated in FIGS. 1 to 4, since the partition walls of the contact supports are engaged with the engaging recess 13′ and 13*a*′ or vertical slots 13‴ and 13*a*‴ of the transparent covers 13 and 13*a*, rightward and leftward movement of the transparent covers 13 and 13*a* is avoided. Furthermore, the lower ends of the projections 13″ and 13*a*″ of the transparent covers 13 and 13*a* are in contact with the upper surface of the lower stationary contact 9 and the upper projections 13⁗ and 13*a*⁗ are made so as to be in contact with the outside surface of the upper stationary contact 10, so that the window portions 11 is completely covered from both sides. Accordingly, even when the electromagnetic switch is mounted in any position entering of airborne dust through the window portions is effectively precluded.

The above-described construction has an advantage in that, when the electromagnetic switch is to be disassembled, or when only the upper contacting parts are to be disassembled, the transparent covers can be easily removed by removing the elastic clamp. Furthermore, the above-described construction affords an electromagnetic switch of simple dustproof form which enables observation, from the outside, of the condition of the contacting parts.

The above-described construction, however, does not provide protection and partitioning of the terminals on the lower row of terminals. If said protection and partitioning were to be provided by terminal partition walls formed on the electromagnetic switch structure, their fabrication would be difficult and entails a high cost since they would be required to protrude outwardly from the side of the contactor structure.

Effective protection and partitioning of the aforesaid terminals can be provided in a simple manner by modifying the transparent covers 13 and 13*a* of the above-mentioned embodiment illustrated in FIGS. 1 through 4. The modified covers, which are illustrated in FIGS. 5 through 7 and are designated therein by the reference numeral 17, are provided on their outside surfaces with partition plates 19, 19, . . . of suitable configuration formed integrally thereon and so disposed as to be positioned in alignment with the partitions 4*a* to jointly therewith form upstanding partitions between the terminals 18, 18, . . . of the lower row when the covers 17 are assembled in place. The transparent cover 17 is provided with engaging recess 17′ at the upper portion confronting the partition walls 4*a* formed on both sides of the lower contact support 4, and the lower end of the projection 17″ defined by the recess 17′ projects to a depth for contacting the lower surface of the stationary contact 9. Furthermore, the upper inside portion of the transparent cover 17 is provided with vertical slots 17‴ confronting the partition walls 7*a* formed on both sides of the upper stationary contact support 7, and the inward projection 17⁗ formed by the said vertical slots 17‴ are attached so as to be in contact with the outside surface of the upper stationary contact 10. The covers 17 may be held in place, for example by elastic clamp members 15 and 15*a* anchored by screws 8 and 8*a* in exactly the same manner as in the first embodiment illustrated in FIGS. 1 through 4.

Under certain conditions, the means of holding the dust-proofing covers as described above, that is, such means as elastic clamp members or snap on clamps and screw anchoring, may be disadvantageous because of failure or breakage due to their exposed positions.

An embodiment of the invention wherein the covers are held tightly in position without the use of such means as elastic clamping members is illustrated in FIGS. 8 through 12. The internal construction of the electromagnetic switch illustrated in FIGS. 8 through 12 is the same as that of the electromagnetic switch illustrated in FIGS. 1 through 4 except the manner of attaching the covers 22 is different. The transparent cover 22 is provided with engaging recesses 22′ at the upper portion confronting the partition walls $c_1$ formed on both sides of the lower contact support 4, and the lower end of the projection 22″ defined by the said recesses 22′ projects sufficiently to contact the lower surface of the stationary contact 9. Furthermore, the upper inside portion of the transparent cover 22 is provided with vertical slots 22‴ confronting the partition walls $b_1$ formed on both sides of the upper stationary contact support 7, and the inward projections 22⁗ formed by the vertical slots 22‴ are in contact with the outside surface of the upper stationary contact 10. Briefly stated, covers 22 are clamped in position by and between the upper stationary contact support B and the lower stationary contact support C. Each cover 22 is provided at its two ends with lugs 23, which are so formed as to fit into corresponding recesses 24 formed in the lower stationary contact support C. During assembly of the support B and C, the dust-proofing covers 22 are first placed in position so that their lugs 23 fit into their respective recesses 24 in the support C; then the support B is placed thereon and screwed or otherwise fastened down so as to clamp the covers 22 between itself and the lower support C.



The above-described construction affords positive and tight retention of the covers 22 so as to prevent them from rattling or from slipping off because of such effects as impacts and vibrations. Furthermore, this construction affords easy and low-cost fabrication, facility in assembly and disassembly, and a functional, esthetic design.

While a few particular embodiments of the present invention have been described, it will be obvious that many changes and modifications can be made in the above described details without departing from the nature and spirit of the invention, and it is to be understood that the invention is not to be limited to the details described herein except as set forth in the appended claims.

What is claimed is:

1. In a dust-proof switch, a base structure, an upper stationary contact support and a lower stationary contact support mounted on said base structure, an array of upper stationary contacts and an array of lower stationary contacts mounted respectively on said upper and lower supports extending along a length of said switch means on said base structure mounting movable contacts for electrical connection with respective ones of said stationary contacts, electromagnetic means housed in said base structure for actuating said movable contacts, arrays of upper terminals for connection to said upper stationary contacts and an array of lower terminals for connection to said lower stationary contacts disposed along a side of the switch the improvement which comprises dust-proof covers means comprising said upper support having partitions extending between the upper terminals, said lower support having partitions extending between the lower terminals, a transparent cover-piece having slots for receiving the partitions on said upper support and spaced recesses for receiving the partitions on said lower support and extending along a part of said side of the switch completely enclosing and defining a dust-proof space with said supports and base structure in which said movable and stationary contacts are visible from externally of the switch for viewing the operation thereof.

2. In a dust-proof switch according to claim 1, including a snap-on resilient clamp holding the dust cover-piece in position.

3. In a dust-proof switch according to claim 2 including at least one screw holding said upper support on said base and passing through said clamp.

4. In a dust-proof switch, a base structure, an upper stationary contact support and a lower stationary contact support mounted on said base structure, an array of upper stationary contacts and an array of lower stationary contacts mounted respectively on said upper and lower supports extending along a length of said switch, means on said base structure mounting movable contacts for electrical connection with respective ones of said stationary contacts, electromagnetic means housed in said base structure for actuating said movable contacts, arrays of upper terminals for connection to said upper stationary contacts and an array of lower terminals for connection to said lower stationary contacts disposed along both sides of the switch, the improvement which comprises dustproof covers means comprising said upper support having partitions extending between the upper terminals, said lower support having partitions between the lower terminals, two transparent cover-pieces having slots for receiving the partitions on said upper support and spaced recesses for receiving the partitions on said lower support and extending along a part of both said sides of the switch completely enclosing and defining two dust-proof spaces with said supports and base structure in which said movable and stationary contacts are visible from externally of the

switch for viewing the operation thereof, and each cover-piece having projections extending laterally therefrom and each disposed between each two successive ones of said lower terminals substantially in registry with said partitions on said lower support and each configured to jointly with the last mentioned partitions define upstanding partitions between said lower terminals.

5. In a dust-proof switch according to claim 4, including a snap-on resilient clamp clamping both said side cover-pieces and biasing them toward each other.



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