Feb. 26, 1957 H. W. ECKLES 2,783,317

STARTING SWITCH FOR ELECTRIC MOTORS

Filed June 14, 1954

Fig. 1.

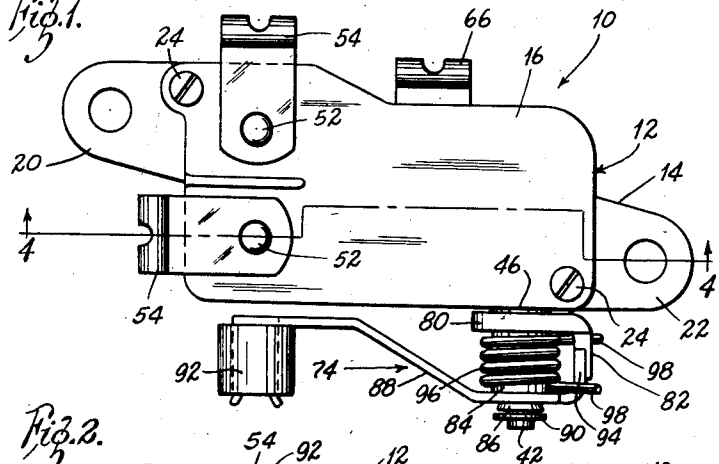


Fig. 2.

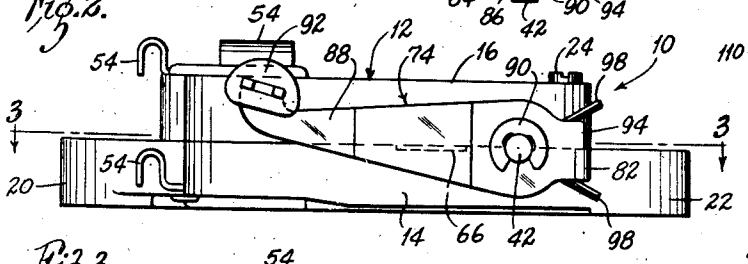


Fig. 3.

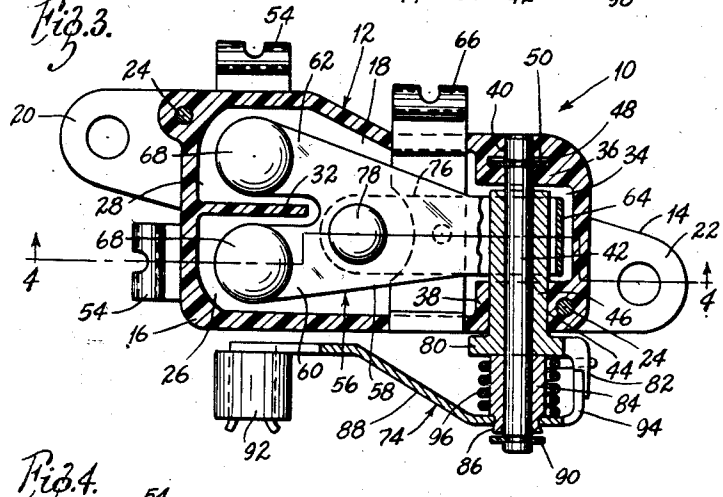


Fig. 4.

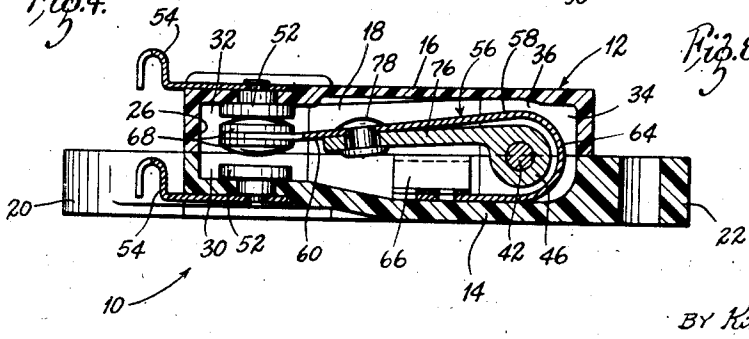


Fig. 5.

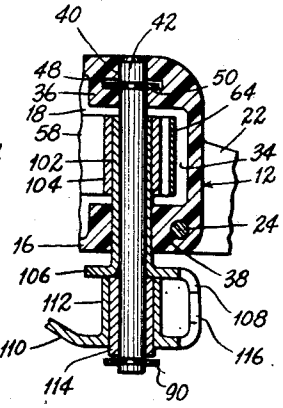


Fig. 6.

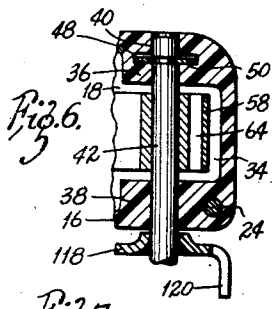


Fig. 7.

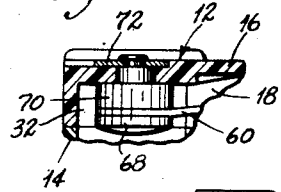
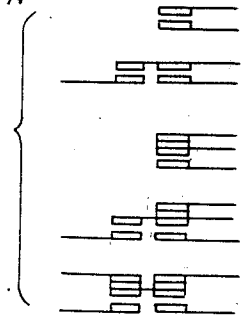


Fig. 8.



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STARTING SWITCH FOR ELECTRIC MOTORS

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12 Claims. (Cl. 200—6)

The present invention relates generally to electric switches, and more particularly to a novel switch arrangement which lends itself readily for use as a starting switch in various types of electric motors.

Notwithstanding that the use of starting switches for electric motors is quite old in the motor art, it appears that there has not heretofore been produced a motor starting switch which is fundamentally adapted to the requirements of various sizes and types of motors. It is, therefore, an object of the present invention to provide a starting switch for electric motors which may be readily adapted to the specific requirements of various sizes and types of motors.

It is another object of the invention to provide a novel motor starting switch which may be connected for use in a variety of different types of starting circuits.

It is another object of the invention to provide a motor starting switch which has dual moving contacts operable in a double-throw arrangement.

It is another object of the invention to provide a novel motor starting switch in which a substantially constant contact pressure is maintained despite maximum override of an actuating arm.

It is another object of the invention to provide a novel motor starting switch in which dual, double-throw contacts are totally enclosed.

The foregoing and additional objects and advantages will be apparent from the following description taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a top plan view of a motor starting switch conforming to the teachings of the present invention;

Fig. 2 is a side elevation thereof;

Fig. 3 is a horizontal sectional view taken generally along the line 3—3 of Fig. 2;

Fig. 4 is a vertical sectional view taken generally along the line 4—4 of Figs. 1 and 3;

Fig. 5 is a fragmentary horizontal sectional view similar to the right hand end of Fig. 3, but showing a modified connection of the actuating arm to the switch;

Fig. 6 is a view similar to Fig. 5, but showing a further modified arrangement of the switch actuating mechanism;

Fig. 7 is a fragmentary sectional view similar to the upper left hand portion of Fig. 4, but showing a modified contact construction; and

Fig. 8 is a schematic representation of five different switching arrangements to which the present starting switch lends itself.

Referring to the drawings more particularly by means of reference numerals, 10 indicates generally a motor starting switch constructed in accordance with the teachings of the present invention. The switch 10 comprises an enclosure 12 within which the contacting parts of the switch are mounted and to the exterior of which various terminals are secured, as will appear.

The enclosure 12 is divided into a base portion 14 and a cover portion 16, and as is apparent from the drawings, these parts fit together to provide a switch chamber 18 (Figs. 3 and 4). The base portion 14 here disclosed includes integral apertured tabs 20 and 22 by means of which the switch 10 may be mounted on a motor frame. The cover portion 16 is attached to the base portion 14 by means of screws or rivets 24. Both the base portion 14 and the cover portion 16 of the enclosure 12 are formed from non-conductive material such as Bakelite.

While the specific shape of the chamber 18 is not critical, the general shape clearly illustrated in Figs. 3 and 4 is recommended for its convenience, as well as its economy of space requirement. It will be observed that one end of the illustrated chamber 18 is divided so as to form "stalls" 26 and 28. These stalls are formed by virtue of mating partitions 30 and 32 which are integral with the portions 14 and 16, respectively. At its opposite end, the chamber 18 takes the form of an alcove 34 flanked by relatively thick side wall portions 36 and 38. The wall portions 36 and 38, which are clearly coextensive between the portions 14 and 16, are bored coaxially as illustrated, the common axis being at the dividing plane between the portions 14 and 16. Thus, as best indicated in Fig. 3, the wall 36 is provided with a bore 40 adapted rotatably to receive a pivot pin 42, and the wall 38 is provided with a bore 44 adapted rotatably to receive a flanged sleeve 46. It may also be noted at this point that the wall portion 36 is formed with a central circular recess 48 for receiving a retaining washer 50. The depicted arrangement wherein the bore 40, the bore 44, and the recess 50 are all formed half in the lower portion 14 and half in the upper portion 16 of the enclosure 12 obviously makes for simplified assembly of the switch parts.

Directing attention now to the electrical conducting elements of the switch 10, it will be noted that both the lower enclosure portion 41 and the upper enclosure portion 16 are provided with a plurality of individual switch contacts 52 and associated terminals 54. As best illustrated in Fig. 4, two switch contacts 52 are disposed in opposed relation within the stall 26, and it will be understood that two additional contacts 52 may be similarly disposed within the stall 28. The contacts 52 are preferably of the button type and are adapted for riveted securement in conducting contact with the terminals 54, as is conventional. As is apparent from Fig. 1, the terminals 54 may be extended from their point of securement in any appropriate direction.

A movable pole assembly 56 is disposed within the chamber 18 for cooperation with the stationary contacts 52. The assembly 56 includes a leaf spring 58 formed from a resilient conducting material such as silicon bronze sheet. From Figs. 3 and 4, it will be seen that the leaf spring 58 is formed at one end to provide twin tab-like projections 60 and 62 which are accommodated in the stalls 26 and 28, respectively. From this fork end, the spring 58 is narrowed gradually to a width which is appropriate, not only for accommodation within the alcove 34, but to provide bias for a predetermined contact pressure, as will appear. The comparatively narrow portion 64 of the spring 58 is bent around at a predetermined radius so as to return upon itself, as clearly depicted in Fig. 4. This turned back or turned under end of the spring 58 has secured thereto, as by welding or soldering, a terminal strip 66 which, from Figs. 3 and 4 is seen to extend completely across the floor of the chamber 18, up the inside walls of the lower enclosure portion 14, and to emerge through channel-like openings provided at the upper edge of these side walls. One end, of course, is extended beyond the enclosure 12 in the same manner as the terminals 54. Again, it will be seen that this arrangement provides for quick and accurate assembly of parts.

Returning to the forked end of the leaf spring 58, each of the tab-like projections 60 and 62 is provided with conventional button contacts 68 welded to the upper or

lower surface, as the case may be, of the spring 58. Any of the arrangements shown schematically in Fig. 8 may be employed, depending upon the type of service to be demanded of a particular switch 10. Preferably in cases where there is no requirement for say an upper contact 52 and mating contact 68, the arrangement of Fig. 7 is used. In this view, a dummy contact 70 and a plain washer 72 may be used in place of the contact 52 and terminal 54 that would otherwise be employed. It will be noted that the depth of the dummy contact 70 is approximately equal to the combined depth of a contact 52 plus a contact 68, so that use of a dummy contact makes unnecessary any substitution for the contact 68 which would normally be used at the point under discussion.

From the illustration of Fig. 4, it is obvious that the forked end of the leaf spring 58 is movable so as to enable the contacts 68 to make selective engagement with either the upper or the lower contacts 52. It will be understood also that the spring tension of the leaf spring 58 may be established to provide a desired predetermined approximate contact pressure with the parts in their illustrated positions. From experience with switches of generally similar type, it has been learned that a four ounce contact pressure is suitable for motor starting switches.

An actuating assembly 74 is provided for moving the contacts 68 between the upper and lower sets of contacts 52. As is clear from the drawings, this assembly 74 incorporates the previously mentioned pin 42 and flanged sleeve 46, as well as the retaining washer 48. Considering now the sleeve 46, it will be observed that this member is provided with an integral tab-like extension 76 which underlies the upper portion of the leaf spring 58 and is secured thereto by means of a rivet 78. The sleeve 46 also incorporates a flange 80 which has an L-shaped extension 82. Both the sleeve 46 and a retaining sleeve 84 having an end portion 86 of reduced diameter are assembled on the pin 42. An actuating arm 88 is assembled on the reduced end portion 86, the latter being thereafter flared to secure the arm 88 thereon. An appropriate retaining washer 90 prevents the sleeve 84 and the arm 88 from slipping off the pin 42. The extended free end of the arm 88 is formed in any conventional manner to receive an appropriate pad 92 for engagement and actuation by a centrifugal actuator (not shown). The pivoted end of the arm 88 is provided with a bent over extension 94. A torsion spring 96 is disposed around the sleeve 84 and has projecting ends 98 which engage the arms 82 and 94.

As is clear from the drawings, the spring 96 cooperates with the actuating arm 74 and the sleeve 46 so that pivotal movement of the former is conveyed through the spring 96 to the latter.

Figs. 5 and 6 show modifications of the actuating assembly. The arrangement of Fig. 5 substitutes for the sleeve 46 an assembly which includes an inner sleeve 102 to which is secured an outer sleeve 104, the extended tab-like portion corresponding to the element 76 for securement to the spring 58 being a part of the outer sleeve 104. The inner sleeve 102 is extended externally of the enclosure 12, being provided with an external flange 106 and an extended projection 108. An actuating arm 110 is illustrated in Fig. 5 as being formed with a hub portion 112 disposed over a spacer sleeve 114. A projection 116 is provided for the actuating arm 110 to correspond with the projection 94 on the actuating arm 88. Although not illustrated in Fig. 5, it will be understood that a torsion spring similar to the spring 96 will be operatively disposed around the hub portion 112 so as to cooperate between the projections 108 and 116 in the manner heretofore described.

Fig. 6 shows a still further modified form of actuating mechanism wherein a tab-like element corresponding to the element 76 for securement to the spring 58 is secured directly to the pin 42. Thus, the sleeve corresponding to either the previously described element 46 or the element 102 is eliminated. In substitution therefor, there is a flanged collar 118 secured as by welding to the pin 42, and this collar 118 is provided with a projection 120 for cooperation with a torsion spring similar to the spring 96.

It may be mentioned at this point that the spring 96 is formed with a spring rate which is so related to the resilience of the leaf spring 58 as to enable, first, the absorption of the biasing action of the leaf spring 58 and, subsequently, the imposition of added stress thereto sufficient to establish and maintain a predetermined contact pressure between the lower set of contacts 52 and 68.

In use, the switch 10 of the present invention is electrically connected into a motor starting or other appropriate electrical circuit, the connections being made to the terminal strip 66 and to any appropriate combination of the several illustrated terminals 54. As previously mentioned, any of the arrangements schematically depicted in Fig. 8 may be employed, as well as others which will occur to those skilled in the pertinent art. Assuming then that the switch 10 is assembled for conventional cooperation with a centrifugal actuator incorporated in an electric motor, for example, it is clear that pivotal movement of the actuating arm 88 will be transmitted through the torsion spring 96 to the leaf spring 58 and the movable contacts 68 will be moved out of engagement with the upper contacts 52 and into engagement with the lower contacts 52. With the switch 10 thus actuated, the previously mentioned relation between the spring rate of the torsion spring 96 and the resilience of the leaf spring 58 serves to establish a predetermined contact pressure. It will be observed, however, that this pressure is limited through the resilient action of both of these springs, so that the actuating arm 88 can override the remaining elements of the actuating assembly 74 with minimum build-up of pressure. It will be particularly observed that, with the arrangement shown, the setting of the present switch 10 for point clearance and for override, as well as the setting for end play in a motor, will not be critical.

Clearly, there has been provided a motor starting switch which fulfills the objects and advantages sought therefor.

It is to be understood that changes in the form of the elements, substitution and rearangement of parts, and substitution of equivalent elements, which will be obvious to those skilled in the art, are contemplated as being within the scope of the invention which is limited only by the claims which follow.

What is claimed is:

1. A starting switch for electric motors comprising a box-like enclosure of dielectric material, a plurality of stationary electric contacts disposed within said enclosure, individual terminal means secured to each of said stationary contacts and extending from the exterior of said enclosure to the exterior thereof, an elongated leaf element disposed within said enclosure, said leaf element being of electrical conducting material and having a movable end and a fixed end, said movable end being provided with at least one movable electric contact and said fixed end being provided with terminal means extending to the exterior of the enclosure, said leaf member being under resilient flexing strain so as to bias the movable contact mounted thereon in a predetermined direction relative to a stationary contact mounted within the enclosure, and actuating means for further flexing the leaf member so as to move said movable contact in a direction counter to that in which it is biased.

2. The combination of claim 1 wherein the actuating means is connected to the leaf means at a point intermediate the ends of the latter.

3. The combination of claim 2 wherein the leaf element is formed with a substantially constant radius bend of approximately 180 degrees, the actuating means being connected to the leaf element at a point intermediate the electric contact thereon and the 180 degree bend therein.

4. The combination of claim 1 wherein the actuating

means comprises a first pivoted member having a free end connected to the leaf element, a second pivoted member having a free end adapted for engagement and movement by an actuating device, said first and second pivoted members having a common pivotal axis, and a resilient yieldable element interconnecting said first and second pivoted members whereby an initial movement of said second pivoted member may be extended to said first pivoted member and a subsequent movement of said second pivoted member may be absorbed by said resilient yieldable element substantially without extension thereof to said first pivoted element.

5. The combination of claim 4 wherein the leaf element is bent back upon itself to form a bend of substantially constant radius, the axis of said bend coinciding substantially with the common axis of said first and second pivoted members.

6. The combination of claim 5 wherein interengageable stop means are provided on said first and second pivoted members for limiting relative pivotal movement of said first and second pivoted members in one direction, said interconnecting resilient yieldable element being prestressed so as to bias said stop means toward each other.

7. A starting switch for electric motors comprising a hollow enclosure of dielectric material, a plurality of stationary electric contacts including an upper stationary contact and a lower stationary contact in opposed relation, individual terminal means secured to each of said plurality of stationary contacts and extending to the exterior of said enclosure, an elongated leaf element disposed within said enclosure, said leaf element being of electrical conducting material and having a movable end provided with an upper and a lower movable electric contact, said movable contacts being interposed between the aforementioned opposed stationary contacts, said leaf element being resiliently yieldable and having a fixed end provided with terminal means extending to the exterior of the hollow enclosure, said leaf element being prestressed so as resiliently to press a movable contact thereon into engagement with a stationary contact in said enclosure, and means connected with said leaf element for moving the movable end thereof so as to diseastablish said engagement between a movable contact and a stationary contact and resiliently press a different movable contact on the leaf member into engagement with a different stationary contact in said enclosure.

8. The combination of claim 7 wherein the hollow enclosure is provided with at least two stationary electric contacts at the same level, said leaf element being formed with a plurality of tab-like projections at its movable end, each of said projections mounting at least one contact at the same level, and one of said projections mounting two contacts disposed for respective mating engagement with said two opposed stationary contacts.

9. The combination of claim 8 wherein the hollow enclosure is provided with a dielectric wall between said two stationary contacts.

10. The combination of claim 8 wherein the hollow enclosure is provided with at least one dielectric stationary contact element, said dielectric stationary contact element being disposed at the same level as an electric stationary contact and being selectively engageable with one of said tab-like projections on the movable end of the leaf element.

11. A starting switch for electric motors comprising a body assembly, a pair of stationary electric contacts mounted in opposed relation on said body assembly, said body assembly including means insulating the stationary contacts from each other, movable electric contact means interposed between said stationary contacts for selective reciprocation therebetween, a resilient cantilevered element supporting said movable electric contact means at the free end thereof, said cantilevered element being under uniform stress when said contact means makes normal engagement with one of said stationary contacts, and actuating means connected to said cantilevered means intermediate the free and the fixed ends thereof whereby to relieve the stressed condition of that portion of the cantilevered means between the free end thereof and the said point of connection when the movable contact means is moved out of engagement with said one stationary contact and to establish a reversed stress in said portion when the movable contact means is moved into engagement with the other stationary contact.

12. The combination of claim 11 wherein the actuating means includes an actuating arm mounted for movement relative to the cantilevered means, and means including a torsion spring interconnecting said arms with the cantilevered element, said torsion spring being prestressed to induce corresponding movement between the actuating arm and the cantilevered means except when a predetermined reverse stress is establishd in the aforementioned portion of the latter.

References Cited in the file of this patent

UNITED STATES PATENTS

1,893,179	Parsons	Jan. 3, 1933
2,117,047	Wheelock	May 10, 1938
2,327,069	Satterlee	Aug. 17, 1943
2,330,320	Watson	Sept. 28, 1943
2,454,185	Kmiecik	Nov. 16, 1948
2,468,673	Kaminky	Apr. 26, 1949
2,563,830	Frese	Aug. 14, 1951

FOREIGN PATENTS

956,364	France	Apr. 1, 1949