

Jan. 12, 1960

P. HUTT

2,921,147

ENCLOSED DOUBLE ROTARY SWITCH

Filed Sept. 3, 1957

2 Sheets-Sheet 1

FIG. 1.

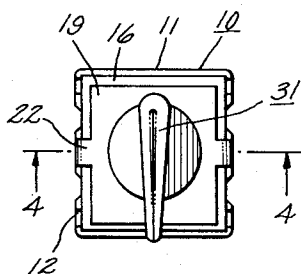


FIG. 2.

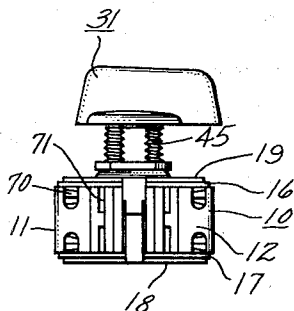


FIG. 4.

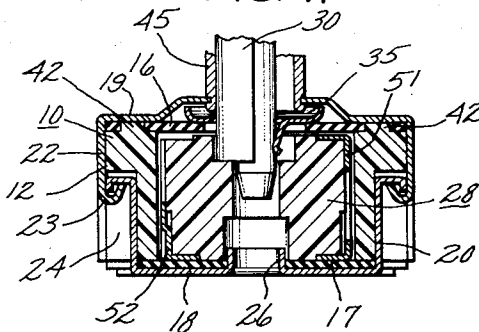
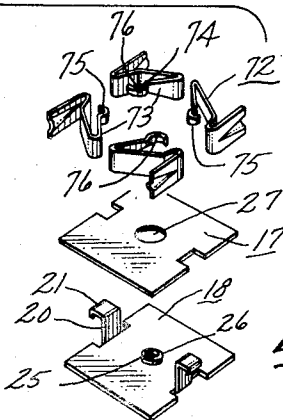
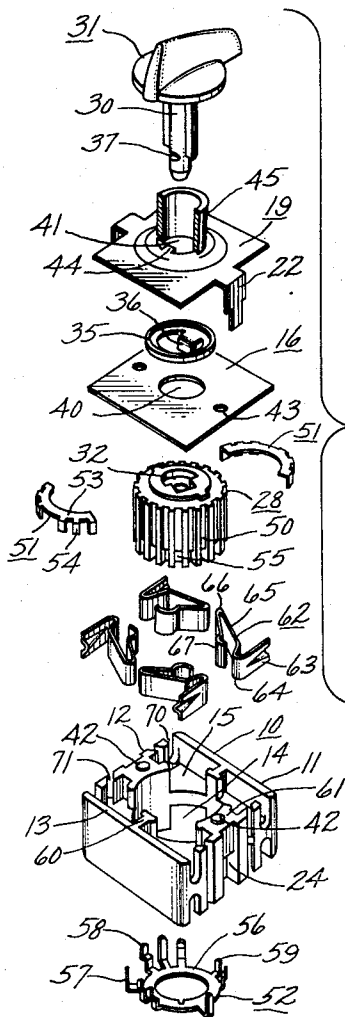


FIG. 3.



Inventor:  
Philip Hutt  
Richard L. Caslin  
by Allard A. Braddock  
His Attorneys

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P. HUTT

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FIG. 5.

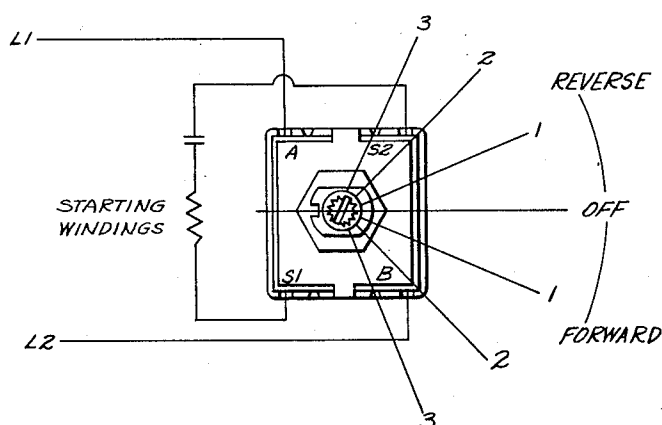
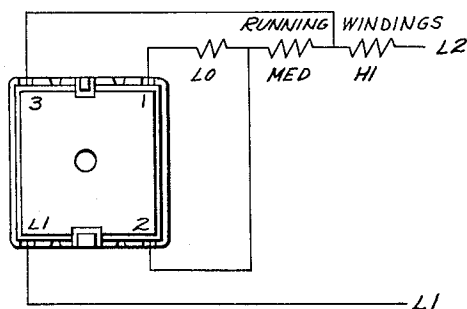


FIG. 6.



Inventor:  
Philip Hutt.  
Richard L. Caslin  
by Allard G. Braddock  
His Attorneys

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## ENCLOSED DOUBLE ROTARY SWITCH

Philip Hutt, Milford, Conn., assignor to General Electric Company, a corporation of New York

Application September 3, 1957, Serial No. 681,550

5 Claims. (Cl. 200—6)

The present invention relates to an electric switch and particularly to a double rotary switch of the slow make, slow break type that is capable of controlling both the speed as well as the direction of rotation of either a split phase or a shaded pole motor. A switch of this type has found its greatest use with such motors that are incorporated in electric window fans for the intake and exhaust of the air from the room.

The common practice of switching electrically reversible fan motors is to use one switch for energizing the motor from the power source and an entirely separate switch for reversing the direction of rotation of the motor. This invention is concerned with a double rotary switch enclosed in a single switch housing for selecting both the speed and direction of rotation of an electric fan, depending upon the direction in which the switch handle is turned and the amount that it is turned from the Off position. This switch is an improvement over the switch of my copending application Serial No. 531,776, now Patent No. 2,813,158, which was filed on August 31, 1955, and assigned to the same assignee as is the present invention.

The primary object of this invention is to provide an enclosed housing of reduced size for a double rotary switch.

A further object of this invention is to provide a novel housing for a double rotary switch with both top and bottom cover plates that may easily be assembled to the housing.

A further object of this invention is to provide a novel switch rotor with bridging contacts for a double rotary switch.

This switch is characterized by the fact that the housing includes a molded insulating base of square shape having side walls and open top and bottom walls. Insulating plates of thin sheet material close the top and bottom walls and are held down by metal covers fitted over the plates. Each cover includes a pair of side arms which straddle the housing and interengage with the comparable side arms of the opposite cover to hold the switch housing intact.

The housing includes a horizontal partition parallel with the top and bottom walls for dividing the housing into an upper and a lower switch chamber. A large circular opening is established in the partition for receiving a switch rotor that is turned by means of the handle of the switch. Each upper and lower chamber has inwardly extending abutments on the side walls adjacent the center of each wall to form corner pockets for supporting the switch contacts. The before-mentioned application Serial No. 531,776 contains claims directed to the specific nature of the switch contacts that have been adopted in the present invention.

The switch rotor is provided with bridging contacts at each end for making engagement with the switch contacts. The periphery of the rotor is fluted and each bridging contact has narrow extensions which protrude along the sides of the rotor into some of the flutes.

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There are many more flutes in the rotor than there are extensions in the bridging contacts so that there are vacant flutes to cooperate with the switch contacts and serve as an indexing or detent means.

My invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Fig. 1 is a top plan view of a completely assembled rotary switch embodying my invention.

Fig. 2 is a front elevational view of the switch of Fig. 1 showing the wire-receiving openings in the switch housing.

Fig. 3 is an exploded view partly in cross-section showing in detail the various parts of an enclosed double rotary switch of the present invention.

Fig. 4 is a cross-sectional elevational view on an enlarged scale taken on the lines 4—4 of Fig. 1.

Fig. 5 is a circuit diagram of the upper switch connections for controlling the direction of rotation of a split phase motor.

Fig. 6 is the circuit diagram of the lower switch connections for changing the speed of rotation of a split phase fan motor.

Referring in detail to the drawing and in particular to the exploded view of Fig. 3, the main parts of the switch housing comprise a molded insulating base 10 having opposed side walls 11 and 12 and open top and bottom walls 13 and 14 respectively. A central horizontal partition 15, that is parallel with the top and bottom walls 13 and 14, is formed within the base 10 for dividing the base into an upper and a lower switch chamber, as will be better understood hereinafter.

The top and bottom walls are closed by insulating plate members 16 and 17 respectively to provide a totally enclosed switch housing. A bottom cover plate 18 of metal is placed under the bottom insulating plate 17; while a top cover 19, also of metal, is located over the top insulating plate 16. The bottom cover 18 has a pair of parallel side arms 20 extending upwardly from opposed side edges of the cover. The free end of each arm is bent outwardly and then down into an L-shaped lip or hook 21. The top cover member 19 also includes a parallel pair of side arms 22 but extending downwardly from opposite side edges of the cover. The side arms 22 of the top cover are first formed as flat blades so that they will easily slide down in recesses 24 in the outer surface of the side walls 12 of the base 10. Later, the tips of the side arms 22 are rolled inwardly as at 23 of Fig. 4 to be in gripping engagement with the hooked ends 21 of the side arms 20 of the bottom cover member. Hence, the interlocking engagement between the side arms 20 and 22 of the bottom and top cover members respectively clamp the insulating plates 16 and 17 over the open top and bottom walls of the base, and sandwich the switch elements therebetween. The side arms of the cover members are located within the recesses 24 in the side walls 12 so that the arms do not protrude outwardly from the switch housing.

The center of the bottom metal cover 18 has a circular opening 25 defined by an inwardly facing collar 26. This collar is received in a plain opening 27 of the bottom insulating plate 17. The purpose of the collar 26 is to serve as a lower center bearing within a recess in the bottom of a switch rotor 28 as seen in Fig. 4. The movement of the switch rotor 28 is controlled by a shaft 30 of a switch handle 31. The transverse cross-section of the handle shaft 30 has the appearance of two semi-circular shapes of different sizes face-to-face as seen in Fig. 3. There is a similarly shaped opening 32 in the top of the switch rotor 28 for receiving the shaft in the rotor. An annular clip 35 is confined between the top

cover 19 and the top insulating plate 16 for holding the handle shaft in place. A downwardly-inclined spring locking tongue 36 is formed as an inner extension of the clip 35 to snap into a transverse notch 37 in the handle shaft and releasably hold the handle in the switch housing.

It will be well understood by those skilled in this art that many modifications may be substituted for the method of connecting the switch handle 31 to the switch rotor 28. One common expedient would be to fasten a plain metal shaft in the switch rotor and provide means for attaching the switch handle to the free end of the shaft. In any event, the top insulating plate 16 must have an opening such as 40 and the top cover 19 an opening 41 where the handle shaft 30 may enter the switch housing and connect with the rotor. Small locating pins 42 are molded on the top of the base 10 to mate with similar openings 43 in the insulating plate 16 to facilitate the proper assembly of the top cover member.

Means are provided to limit the amount of rotation of the handle shaft 30 so the handle can only turn through an angle of a certain number of degrees to the right and a certain number of degrees to the left from the center Off position of the switch. This feature is provided by an inner tab 44 on the edge of the opening 41 in the top cover 19 shown in Fig. 3. As is the common practice in this art, an externally threaded nozzle 45 is attached in the opening 41 of the top cover 19 for mounting the switch on an appliance which it is to control.

The rotor 28 has a fluted or grooved periphery 50 for cooperation with two upper bridging contacts 51 and a lower bridging contact 52. As illustrated in Fig. 5 of the accompanying drawing, the upper switch chamber is designed to control the direction of rotation of a split phase fan motor by reversing the polarity of the starting windings. Consequently, the upper bridging contact 51 is relatively simple as compared with the more complicated lower bridging contact 52 for switching the taps of the running windings of a fan motor as shown in the circuit diagram of Fig. 6. The upper bridging contact 51 has a flat arcuate shape 53 with two groups of three downward extensions 54 which are adapted to fit within the flutes 50 of the rotor to be flush with the periphery thereof.

The lower portion of the switch rotor 28 is provided with deeper flutes 55 for accommodating the special configuration of some of the extensions of the lower bridging contact 52. This contact 52 is basically a flat annular member 56 with a series of upward extensions 57 which are similarly adapted to lie within the flutes 50 of the rotor 28. Some of the extensions such as 58 have a stepped configuration whereby the lower portions will be recessed in the deep flutes 55 while the upper portions will lie flush with the periphery of the rotor 28 in the usual manner for reasons which will be explained hereinafter. As shown in Fig. 3, one of the extensions 59 is shortened and its outer surface is flush with the periphery of the rotor 28.

Looking at the base 10 of Fig. 3, and particularly the upper chamber thereof, it will be seen that there is an inwardly directed central abutment 60 on each side wall 11 and comparable abutments 61 on the side walls 12. This arrangement establishes four corner pockets in which are positioned in edgewise fashion four Z-shaped spring contacts 62. Each contact 62 is made of thin strip material such as Phosphor bronze and has a terminal end 63 that serves as a spring locking tongue for wedging engagement with a bare lead wire (not shown). The locking tongue has a rounded end 64 that merges with an intermediate portion 65 which is also formed with a rounded end 66 that is joined with a spring contacting finger 67. The rounded ends 64 and 66 are confined within opposed corners in the pocket to support the contact 62 in the proper relationship with the switch rotor 28 and the lead wires that are to be connected to the switch. Conductor wire-receiving openings 70 are formed in the side walls 12 of base 10 so the conductors will be wedged

between the inner surfaces of the side walls 11 and the free ends of the spring locking tongue 63. An access opening 71 is formed adjacent each conductor wire-receiving opening 70 so that a small tool such as a screwdriver or nail may be inserted into the switch base and against the underside of the locking tongue 63 to deflect the locking tongue and release the conductor wire.

The lower switch chamber is constructed in the same manner as the upper switch chamber described above.

There is one difference, however, in the design of the switch contacts 72 for use in the lower switch chamber as seen in Fig. 3. The Z-shape of the contacts 72 when viewed in the edgewise position is the same as the upper contacts 62. The change that has been made is in the spring fingers 67 of contact 62. Looking at Fig. 3, it will be clear that all of the comparable spring fingers 73 of contacts 72 are of reduced width so that the actual contacting tip 74 is less than half the width of the contacting finger 67 of the upper contact. Also, one pair of opposite contacting fingers 75 are arranged adjacent the bottom edge of the contact while the other pair of contacting fingers 76 are arranged adjacent the top edge of the contacts 72. Now comparing these structural details of the contacts 72 with the lower bridging contact 52, it is clear that only the upper contacting fingers 76 will engage all of the extensions 57 and 58. The other pair of contacts having the lower contacting fingers 75 will engage only the straight extensions 57 and the shortened extension 59 of the bridging contact, because of the stepped back configuration of the extensions 58 within the deep flutes or grooves 55 of the rotor.

Having described above my invention of a novel double rotary switch, it should be readily apparent to those skilled in this art that I have devised a unique switch housing of compact size wherein the switch elements may be readily assembled in the housing and fully enclosed thereby. While the preferred embodiment of this invention includes switch contacts having spring locking tongues at their terminal ends, it should be appreciated that screw terminals or solder lugs could be substituted with little difficulty. Also, a greater variation of different circuits through the switch could be obtained by carrying the extensions 57 or 58 of the lower bridging contact 52 upward into the upper switch chamber for making engagement with the upper switch 62.

Modifications of this invention will occur to those skilled in this art. Therefore, it is to be considered that this invention is not limited to the particular embodiments disclosed since it is the intention to cover all modifications which are within the true spirit and scope of this invention.

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

1. An electric switch housing comprising an insulating base having side walls and open top and bottom walls, each of the two open walls being closed by an insulating plate and a metal cover over each insulating plate, each cover having at least two opposed side arms which extend along outer opposite side walls of the housing, said side arms of each cover interlocked with comparable adjacent side arms of said other cover adjacent the mid-height of the base thereby to hold the housing assembly intact with each insulating plate forced into secure engagement with said base by each cover, each side arm of one of said covers having an outwardly directed reversed hook end while the ends of the side arms of the other cover are formed inwardly and over the complementary adjacent hook ends of the first cover thereby to provide the interlocking of the side arms, the interior of said housing being adapted to support various switch elements, an opening through the top portion of the housing for receiving a shaft of a switch handle that is used to change the various positions of the switch elements, and apertures in the side walls of the housing

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for making terminal connections with some of said switch elements.

2. An electric switch housing as recited in claim 1, there being a horizontal partition formed in said insulating base and located adjacent the mid-height of said housing and parallel to the top and bottom walls thereof, said partition establishing an upper and a lower switch chamber, and a relatively large circular opening through the partition adapted to receive a switch rotor that is to be driven by the switch handle through its shaft, said switch rotor having a recess in the bottom thereof, the cover for the open bottom wall including a bearing that mates with the recess of said switch rotor to hold the rotor centered for pivotal movement about its vertical axis.

3. A rotary electric switch comprising a hollow housing of insulating material having four side walls and an open top and bottom, a central partition arranged in the housing parallel to the open top and bottom to define an upper and a lower switch chamber, a large circular opening through the partition, and a switch rotor located within the opening and extending into both the upper and lower switch chambers, each chamber including at least one bridging contact supported on said rotor, and switch contacts positioned in the corners of both upper and lower chambers for making electrical connection with the corresponding bridging contacts, the lower chamber being closed by a bottom cover plate fitted over the open bottom of the housing, while the upper chamber is closed by a top cover plate extending over the open top, the top and bottom cover plates each including a pair of side arms which extend generally parallel to opposite sides of the housing and are interlocked to hold the switch assembly intact, the side arms of a first one of said cover plates being recessed within the outer surface of the housing and having outwardly projecting L-shaped lips that are braced against the housing, the free end of each side arm of a second one of said cover plates being formed inwardly and then over an adjacent lip of said first cover plate thereby to grippingly engage said first cover plate and provide a tight interlocking action between said cover plates adjacent midheight of said hollow insulating housing.

4. A rotary electric switch comprising a hollow housing of insulating material having four side walls and top and bottom walls, a central partition arranged in the housing parallel to said top and bottom walls to define

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an upper and a lower switch chamber, a large circular opening through the partition, and a switch rotor located within the opening and extending into both the upper and the lower switch chambers, said switch rotor of cylindrical shape and having a fluted periphery, each chamber including at least one bridging contact supported on said rotor, and switch contacts positioned in the corners of both upper and lower chambers for making electrical connection with the corresponding bridging contacts, both the upper and lower bridging contacts having narrow extensions which are disposed flush in some of the flutes of the rotor for making engagement with the switch contacts, there being many more flutes on the rotor than there are extensions on the bridging contacts so that the vacant flutes cooperate with the switch contacts and serve as detent means to temporarily hold the rotor in the various switch positions.

5. A rotary electric switch as recited in claim 4 wherein one of the bridging contacts is a ring member fitted over one end of the switch rotor, there being a plurality of narrow extensions formed on the ring member and positioned in some of the flutes of the said rotor, some of the extensions being flush with the periphery of the rotor while other extensions have stepped configurations whereby only an upper step of each such extension is flush with the periphery of the rotor for making engagement with the switch contacts, the switch contacts which are arranged to engage the ring type bridging contact having narrow contacting surfaces for engaging the flush portions of the extensions, one pair of opposed contacts being adapted to engage only the first-mentioned flush extensions.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |                 |               |
|-----------|-----------------|---------------|
| 1,305,649 | Freytag         | June 3, 1919  |
| 1,718,478 | Morse           | June 25, 1929 |
| 2,020,000 | Schellenger     | Nov. 5, 1935  |
| 2,035,505 | Petersen        | Mar. 31, 1936 |
| 2,634,344 | Robinson et al. | Apr. 7, 1953  |
| 2,659,792 | Boardman        | Nov. 17, 1953 |
| 2,723,327 | Gilbert         | Nov. 8, 1955  |

##### FOREIGN PATENTS

|         |               |               |
|---------|---------------|---------------|
| 893,008 | France        | Jan. 17, 1944 |
| 720,636 | Great Britain | Dec. 22, 1954 |