Nov. 17, 1964 R. E. SEELY 3,157,761

SPEED RESPONSIVE SWITCH HAVING A PIVOTALLY MOUNTED OPERATING MEMBER WITH AN INTEGRAL CONTACT

Filed Aug. 30, 1961

Fig. 1.

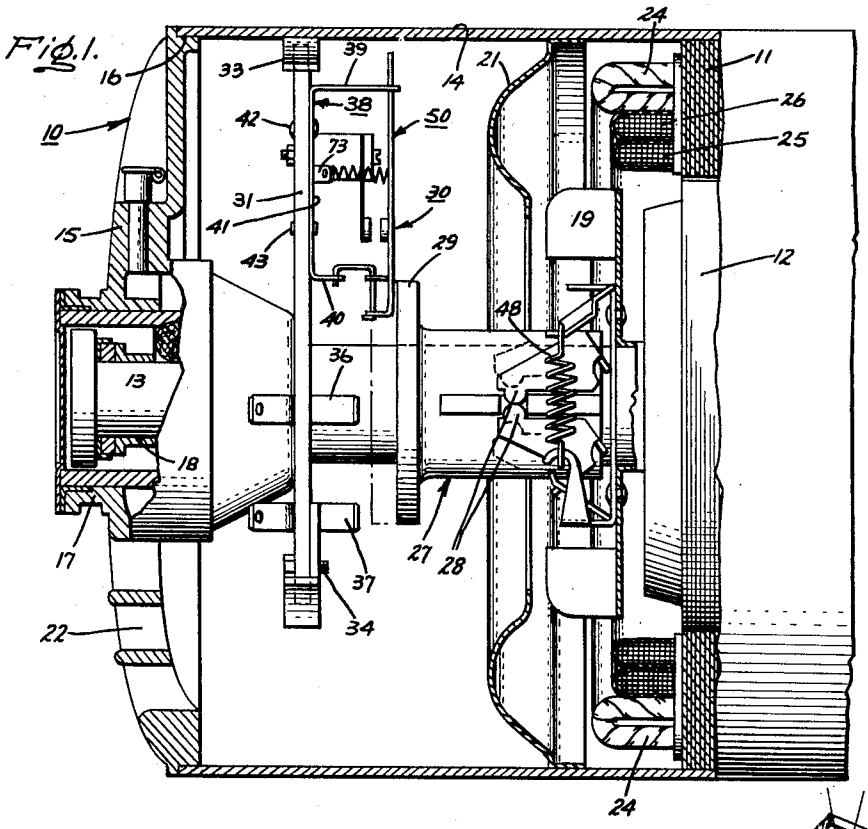


Fig. 4.

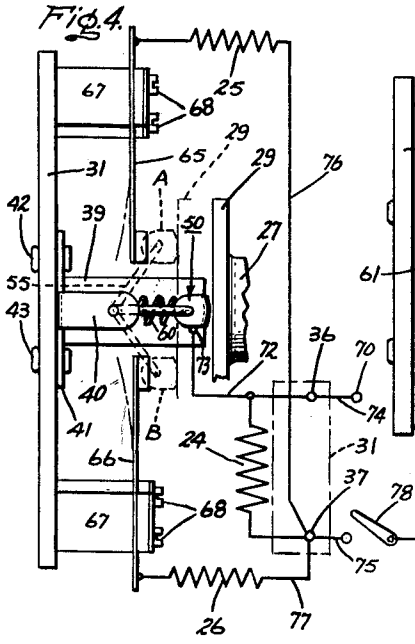


Fig. 2.

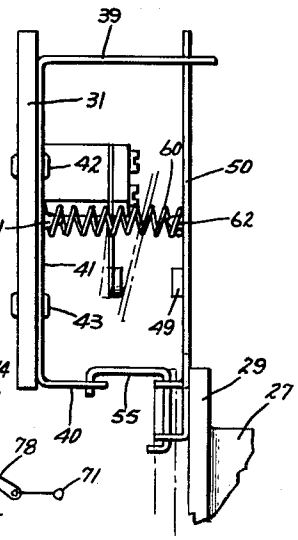
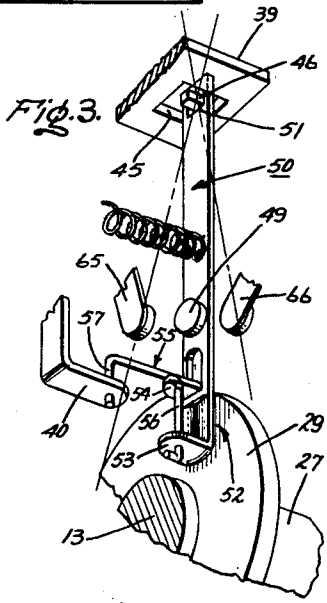


Fig. 3.



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SPEED RESPONSIVE SWITCH HAVING A PIVOTALLY MOUNTED OPERATING MEMBER WITH AN INTEGRAL CONTACT

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6 Claims. (Cl. 200—80)

This invention relates to switch assemblies for dynamoelectric machines, and more particularly to a switch assembly of the speed responsive type generally employed for controlling the winding circuits of single phase induction motors.

It is the general object of this invention to provide an improved centrifugal type switch assembly for a dynamoelectric machine, and more particularly to provide an improved switch assembly for controlling the winding circuit of a split phase motor, which is adapted for use with a standard centrifugal switch operator and is responsive to the speed and direction of motor shaft rotation.

It is a further object of this invention to provide an improved reversible type circuit selector switch assembly of simple construction for a split phase motor which includes inexpensive and easily assembled component parts.

In carrying out the objects of this invention in one form thereof, I provide an improved switch assembly particularly suitable for use with a speed responsive switch actuating device in a single phase reversible motor. In the preferred embodiment, the assembly includes a base having two spaced apart outstanding brackets and a switch operating member carrying a movable contact intermediate its ends for alternate electrical engagement and disengagement with a pair of stationary contacts. One end of the switch operating member is pivotally connected to one of the brackets while the other end of the member is swingably supported at the other bracket by a wire means. The switch operating member is biased away from the stationary contact elements such that upon frictional engagement of the actuating device at a predetermined motor speed with the switch operating device, the biasing means is overcome and the one end of the switch operating member is swung around the wire supporting bracket, thereby carrying the movable contact into selective engagement with either of the stationary contact elements.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. My invention, itself, however, both as to its organization and mode of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing.

In the drawing, FIG. 1 is a side elevational view, partly in section, of one end of a small horsepower single phase split phase reversible induction motor which incorporates one form of the improved switch assembly of this invention therein;

FIG. 2 is an enlarged side elevational view, of a portion of the motor of FIG. 1 to show my improved switch assembly in more detail;

FIG. 3 is a partially exploded view in perspective of the switch of FIG. 2; and

FIG. 4 is a schematic circuit diagram, illustrating the improved switch assembly of FIGS. 1 through 3 inclusive in the motor circuit of the reversible single phase split phase motor of FIG. 1.

Referring now to the drawing in more detail, and specifically to FIG. 1, I have illustrated one form of my invention as being incorporated in a single phase split phase reversible induction motor 10 having a stationary

core member or stator 11 of conventional construction and a rotor 12 fixed secured to shaft 13. The rotor is shown as being provided with the well known cast squirrel cage winding. Stator 11 is supported within a cylindrical shell 14, closed at each end by an end shield assembly 15 which is secured to shell 14 by a rabbet connection, at 16. For simplicity of illustration, only one end shield has been shown and as illustrated, it is formed with a bearing housing 17 in which is housed a bearing 18 for rotatably supporting each end of shaft 13. A fan 19 is mounted on the shaft 13 and baffle member 21 is arranged within shell member 14. Openings 22 are formed in each end shield 15 and ventilating air is drawn through these openings by the fan 19 in the standard fashion and around the baffle member 21 to cool the interior portion of the motor.

In single phase split phase induction motors, one or more main or running windings are generally provided, together with at least one starting winding, which is physically and electrically displaced from the main windings. Thus, energization of the main and start windings during starting conditions of the motor produces two phase starting flux. To illustrate my invention, the single phase motor 10 of the exemplification under consideration is of the reversible split phase type, in which stator 11 carries one main winding 24 and two substantially identical start windings 25, 26 only one of which is energized with the main winding 24 during starting conditions to effect a given direction of rotation.

In the exemplification, the preferred form of my improved switch assembly, generally identified by numeral 30, controls the direction of rotation of shaft 13 during starting by pre-selecting the particular start winding circuit to be closed, and also functions to disconnect the energized start winding from the power source when the speed of the motor exceeds a predetermined value.

In order to operate switch assembly 30 in the desired manner, a speed responsive or switch actuating device, such as that indicated by numeral 27, is mounted on shaft 13, adjacent one side of the rotor, for rotation therewith during operation of motor 10. This is shown as being a centrifugal mechanism of the type described in Patent 2,149,108 of A. F. Welch, assigned to the same assignee as the present application. This centrifugal mechanism includes a pair of weights 28, adapted to react upon centrifugal force at a predetermined speed to move push-collar 29 axially on shaft 13 for controlling the operation of switch assembly 30, and a pair of tension springs 48 for resiliently biasing the weights in the well known fashion.

As seen in FIG. 1, my switch assembly 30 is mounted in operative relation with push-collar 29 of the centrifugal mechanism. As illustrated, switch assembly 30 is carried by a supporting terminal board member 31, fastened within shell 14 between end shield 15 and baffle 21 by several mounting lugs and brackets, denoted at 33 and 34. Member 31 is preferably formed of suitable insulating material, such as fiberboard, and carries substantially Z-shaped terminal posts 36 and 37, each including male portions extending axially on either side of the terminal board member and adapted to be engaged by conventional female quick connect members (not shown). End shield 15 is provided with an opening (not shown) in communication with the posts permitting access to the interior of motor 10 for making the necessary external connections from one side of the posts to a suitable power source of single phase alternating current.

Referring now to the preferred embodiment of switch assembly 30, it will be seen from an inspection of the drawing that the switch includes a base 38, preferably stamped out of a single piece of electrical conductive substantially rectangular sheet material, such as relatively

stiff steel, and bent into the desired configuration most clearly shown in FIGS. 1 and 2. More specifically, the ends of the stamped out piece are bent to provide rear and forward outstanding or upright brackets 39 and 40, integrally joined together by a flat central bight portion 41 having its bottom surface adapted to be secured to the terminal board member 31 in any convenient fashion, as by a pair of hollow type rivets 42 and 43. The outer end of rear bracket 39 is formed with a centrally located slot 45 having a pivot projection 46 provided on the upper wall of the slot for pivotally supporting one end of a movable switch operating member 50, which is operated by speed responsive device 27 in a manner to be explained below.

With specific reference to the construction of switch operating member 50, best seen in FIG. 3, the member functions as the movable contact arm of switch assembly 30, carrying contact 49 intermediate its ends 51, 52, and is accordingly formed from suitable electric conductive rectangular sheet material, for example steel or brass. End 51 of member 50 is provided with a suitable opening 53 for accommodating projection 46 of base bracket 39. It should be noted that slot 45 is dimensionally greater in width than the width of member 50 to facilitate the entry of end 51 of member 50 into the slot and onto pivot projection 46.

In order to support the other end 52 of member 50 for swingable, angular movement in response to axial travel of push-collar 29 of mechanism 27, the extreme end of member 50 extends beyond upright bracket 40 and is bent such that it provides a protruding journal or tab section 53, which projects in the general direction of base 41, substantially parallel to bracket 40. Between section 55 and movable contact 49, a U-shaped portion is cut from member 50 and is formed into a second protruding journal or tab section 54, which also extends toward base 41. A stiff piece of wire forming a generally U-shaped link 55 has its longer leg 56 extending through aligned holes in the respective protruding sections 53 and 54 of member 50, the sections being rotatably secured between the bight portion of the wire and the hooked over end of wire leg 56.

The shorter leg 57 projects through a hole in bracket 40, which acts as the pivot post for swingably supporting end 52 of member 50. Interposed between sections 53 and 54 is a depression 58 to provide a crowned surface on the other side face of member 50 for frictional engagement with push-collar 29. It should be noted at this point that the portion of member 50, which forms section 53, is preferably cut intermediate the crowned surface and movable contact 49 so that the reduction in the total cross section area of member 50 at this point does not adversely affect the amount of material available for either the electrical path through member 50 to contact 49 or for the crowned surface interacting with push-collar 29.

In reference to FIG. 2 of the drawing, it will be seen that a spring 60 resiliently biases member 50 away from flat base portion 41 and at the same time holds the pivot projection 46 and bracket slot 41 in an assembled relation. Spring 60 is retained under compression between base member 38 and member 50, the spring being maintained in the proper position by protuberances or bosses 61 and 62 furnished approximately centrally of the respective members.

It will readily be appreciated from the description of switch assembly 30 presented so far that the fabrication of base 38 and movable member 50 is exceedingly inexpensive, since only low cost stamping and bending operations as well as excellent utilization of materials are involved. Further, the assembly of member 50 with base 38 may easily be accomplished, once wire 55 has been attached to sections 53 and 54 as set forth above, merely by inserting one end of member 50 into bracket slot 45 and sliding wire leg 57 into the complementary hole in bracket 40. Member 50 is then moved forward until the pivot projection 46 of bracket 39 enters slot 51 and spring 60 is mounted over bosses 61 and 62.

As previously mentioned, switch assembly 30 is utilized in the present exemplification to connect either start winding 25 or 26 with a power source during starting conditions to effect reverse rotation of the motor. To achieve this purpose, the illustrated switch incorporates a pair of angularly spaced apart or offset fixed inherently resilient or flexible contact elements 65 and 66 suitably attached, as by insulating blocks 67 and screws 68, on the terminal board 31, one on either side of base 38 for selective electrical engagement and disengagement with movable contact 49.

One possible circuit for energizing and deenergizing starting windings 25, 26 through the intermediary of switch assembly 30 is schematically represented in FIG. 4. In the illustrated arrangement, movable contact 49 is connected to one side of alternating current power source 70–71 by conductor 72 attached to the internal male portion of terminal post 36. Since member 50 and base 38 are formed of electrical conductive material, movable contact 49 may be conveniently connected to one side of the power source 70–71 by attaching one end of the conductor to a male projection 73 (FIG. 1), integrally provided on one end of flat base portion 41, and the other end of the conductor to the internal male portion of post 36. The external portion of post 36 may be connected by external line 74 to 70. Starting winding 25 is shown in series circuit with contact element 65 and line 75 through conductor 76 and post 37, while starting winding 26 and contact element 66 are connected to post 37 by conductor 77. Main winding 24 is in series connection with lines 74, 75 and in parallel with the start windings. Any conventional switching arrangement, such as manual switch 78 in line 75, may be employed to establish or complete the motor circuit with power source 70–71.

Still referring to FIG. 4, the operation of my improved switch assembly will be explained in connection with the illustrated application. When the motor 10 is at standstill, push-collar 29 of mechanism will reside in its extended or inoperative position (toward the left as seen in the drawing), indicated by the broken lines, and movable contact 49 will be held into engagement with either contact element 65 or 66 by the push-collar, which overcomes the bias of spring 60. Assuming for purposes of illustration that switch 78 is open and swingable member 50 is initially held by the push-collar 29 in position A, that is, with movable contact 49 in engagement with contact element 65, then start winding 25 will be in circuit with lines 74 and 75. If it is assumed further that starting winding 25, when energized with main winding 24, produces a clockwise shaft rotation, and the energization of starting winding 26 with main winding 24 effects a counterclockwise rotation, then to initiate clockwise operation manual switch 78 is moved to the closed position. This completes the winding circuits of main winding 24 and starting winding 25 with power source 70–71 through the circuit components previously outlined. As the motor starts up in a clockwise direction and its speed increases beyond a predetermined value, push-collar 29 is moved axially along shaft 13 to the retracted position (shown in solid in the various figures) by centrifugal weights 28, which overcome the bias of tension springs 43. As the push-collar moves axially toward the right in the figures to its retracted position, spring 60 will maintain end 52 in abutting relation with device 27, and the frictional contact of the crowned surface of actuator end 52 with push-collar 29 will cause end 52 to swing in the direction of rotation. Consequently, wire 55 turns around its pivot at bracket 40 and, coacting with spring 60, imparts a positive angular motion or path of travel to end 52 of member 50 until it has moved to the extreme right (as viewed in the drawing), upright over bracket 40. This action disengages movable contact 49 from element

65, opening the circuit for start winding 25, and the motor operates at normal speed with only the main winding 24 being energized. When in its retracted position, push-collar 29 is preferably out of engagement with actuator end 52, which is maintained in the upright position by compression spring 60.

To shut off the motor, manual switch 78 is thrown to break the motor circuit, i.e., deenergizing main winding 24 by opening line 75, and the rotor gradually slows down until its speed falls below a predetermined level at which time the push-collar 29 will be forced axially toward the left. At this time push-collar 29 engages end 52 of member 50, causing it to swing downwardly from the upright location to position B (FIG. 4) and into contact with element 66, thereby compressing spring 60 and placing start winding 26 in circuit with manual switch 78 which is now opened. It is preferred that the total angular swing of member 50 is such that it will move inherently resilient contact elements 65 and 66 a slight distance toward base 38 during the engagement of the movable contact 49 with each of the respective elements. This produces a wiping action on the faces of the engaging contacts, which tends to make the switch self-cleaning.

Conversely, for starting the motor in a reverse direction, that is, initiating counterclockwise rotation, manual switch 78 is again reclosed and start winding 26 is completed through switch assembly 30 and the circuit already described in connection with FIG. 4. Gradually, as the motor picks up speed in the counterclockwise direction, centrifugal action of weights 28 overcomes the bias of springs 48, causing the retraction of push-collar 29 at a predetermined speed. Movable contact 49 in turn, is lifted away from engagement with element 66 by compression spring 60, cutting starting winding 26 out of the winding circuit. Since counterclockwise operation of the motor is the same as, but the reverse of, clockwise rotation, the foregoing explanation of the clockwise operation will serve to describe the angular movement of member 50 in either direction. Suffice it to say that after manual switch 78 is opened to terminate motor operation, the conjoint action of push-collar 29 and wire 55 will define a positive arcuate path of travel for movable contact 49, which will swing into engagement with contact element 65 (position A). Thus, member 50 of switch assembly 30 is in position to energize starting winding 25 once again for clockwise motor rotation.

It will be recognized from the foregoing that I have provided an improved yet low cost switch assembly, adapted for use with standard centrifugal actuating devies. The fabrication of the switch is relatively inexpensive since I form the switch components by low cost manufacturing techniques and effect a savings in material. Moreover, the parts are easily assembled together and the completed unit may readily be mounted in a motor.

It should be apparent to those skilled in the art, while I have shown and described what at present is considered to be the preferred embodiment of my invention in accordance with the patent statutes, changes may be made in the structure disclosed without actually departing from the true spirit and scope of this invention, and I therefore intend to cover in the following claims all such equivalent variations as fall within the invention.

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

1. In a motor having a switch actuating device, a switch assembly comprises a set of spaced apart stationary contact elements, at least one outstanding bracket, a switch operating member for moving electrical means selectively into and out of engagement with said spaced apart contact elements, means pivotally supporting a first section of said member, link means pivotally connected to and journaled between a second section of said member and a segment of said bracket for swinging said second section of said member around said segment of said bracket whereby said switch operating member moves said electrical means into selective engagement with said stationary contact elements at predetermined times.

2. In a motor having a switch actuating device, a switch assembly comprising a set of spaced apart stationary contact elements, a base having at least one outstanding bracket, a switch operating member carrying electrical means for selectively engaging said spaced apart contact elements and having at least one protruding journaling section, means for pivotally attaching one end of said member to said base, and a link pivotally connected at its opposite ends respectively to said protruding section and to said bracket for swinging said protruding section of said member relative to said bracket, so that the electrical means of said switch operating member may be moved into selective engagement with said stationary contact elements by the switch actuating device at predetermined times.

3. In a motor having a motor speed responsive switch actuating device, a switch assembly comprising a set of spaced apart stationary contact elements, a base having at least one outstanding bracket, a switch operating member including electrical means for selective engagement and disengagement with said spaced apart contact elements and at least one protruding journaling section adjacent one end extending generally toward said base bracket, means for pivotally attaching the other end of said member to said base, wire means pivotally connected at its opposite ends to said bracket and to said protruding section for swinging said one end relative to said bracket, and means normally biasing said swingably supported end of said switch operating member away from the stationary contact elements, the electrical means of said switch operating member arranged to be swung into selective engagement with said stationary contact elements by the switch actuating device when the motor operates below a predetermined speed.

4. In a reversible motor having a motor speed responsive switch actuating device, a switch assembly comprising first and second spaced apart outstanding brackets, a switch operating member formed from a substantially rectangular sheet of electrical conductive material and carrying a contact intermediate its ends, means for pivotally attaching one end of said switch operating member to said first bracket, the other end of said member being bent over to form a protruding journal section, a second journal section formed in said member adjacent to and substantially parallel with the first section, relatively stiff wire means having one end journaled by said first and second sections and the other end journaled by said second bracket for pivoting said other end of said member around said second bracket, means for biasing said switch operating member away from said stationary contacts, said member having means arranged to be frictionally engaged by the actuating device whereby a predetermined movement of the speed responsive device will overcome said biasing means and swing the contact of said switch operating member into selective engagement with either of said stationary contact elements.

5. In a reversible motor having a motor speed responsive switch actuating device, a switch assembly comprising a pair of spaced apart stationary contact elements, a base including a pair of spaced apart outstanding brackets, a switch operating member formed from a substantially rectangular sheet of electrical conductive material and carrying a contact intermediate its ends, means for pivotally attaching one end of said switch operating member to one bracket for angular movement, the other end of said member being bent over generally toward said base to form a protruding journal section, a generally U-shaped journal section cut from said member spaced from and bent substantially parallel to said protruding section, a relatively stiff wire journaled at one end to said sections and at the other end to the other of said brackets for swingably supporting said other end

of said switch operating member, means for biasing said switch operating member away from said stationary contact elements, the part of said member disposed between said sections being formed with a curved surface arranged to be frictionally engaged by the actuating device, whereby a predetermined movement of the speed responsive device will overcome said biasing means and swing the contact of said switch operating member into selective engagement with either of said stationary contact elements.

6. In a motor having a motor speed responsive switch actuating device, a switch assembly comprising at least one stationary contact element, a base including a pair of spaced apart outstanding brackets, a movable switch operating member formed from a sheet of electrical conductive material having a contact element afixed thereto intermediate its ends, means for pivotally attaching one end of said member to one of said outstanding brackets for angular movement, at least one protruding journal section formed adjacent the other end of said member projecting generally toward said base, a link having one end extending through a hole in said section in journaling relation therewith and having the other end passing through and pivotally supported by the other outstanding bracket of said base for swingably supporting said other end of said switch operating member, and spring means biasing said switch operating member away from said base and stationary contact element.

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