July 21, 1936. F. DIEHL 2,048,494

CENTRIFUGAL SWITCH

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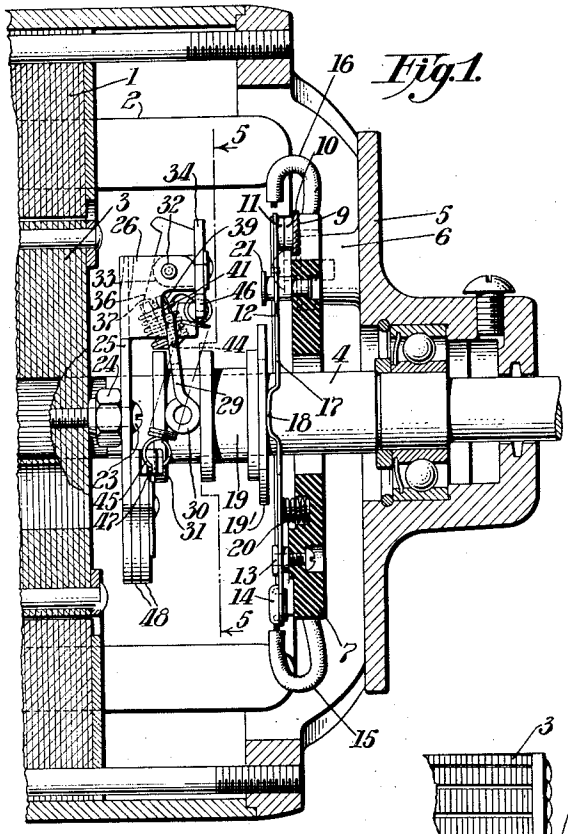


Fig. 1.

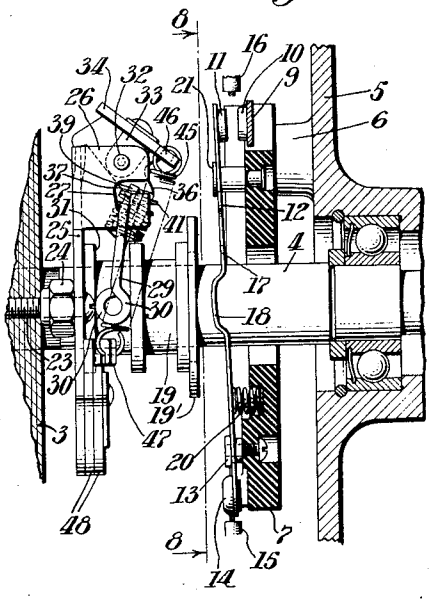


Fig. 2.

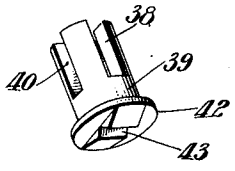


Fig. 4.

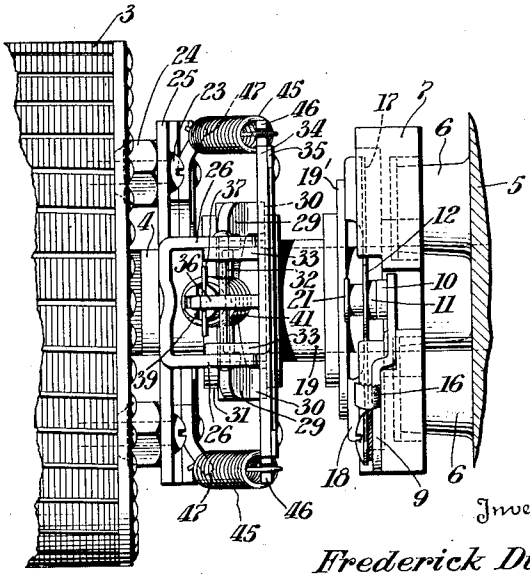


Fig. 3.

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CENTRIFUGAL SWITCH

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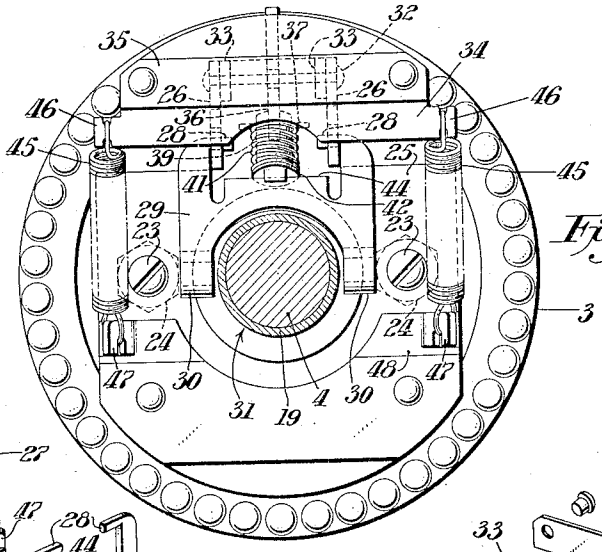


Fig. 5.

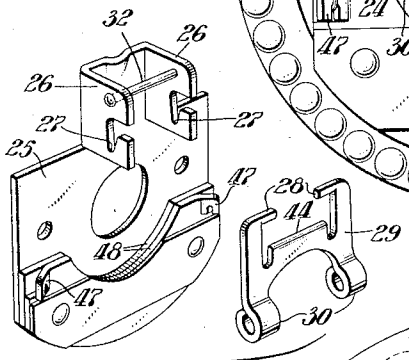


Fig. 6.

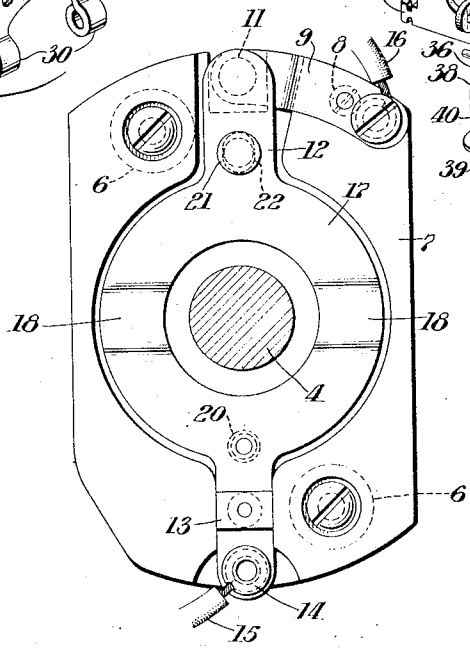


Fig. 8.

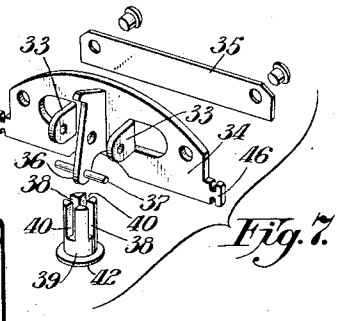


Fig. 7.

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UNITED STATES PATENT OFFICE

2,048,494

CENTRIFUGAL SWITCH

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Application April 4, 1935, Serial No. 14,595

4 Claims. (Cl. 200—80)

This invention relates to centrifugal switches, more particularly of the type commonly used in split phase induction motors to open the starting winding as the motor approaches running speed and to close the starting winding when the motor speed drops below a predetermined low limit. A motor of this type is constructed with a running winding of relatively heavy wire and a starting winding of relatively fine wire disposed at an electrical angle to the main winding to produce the necessary starting torque. The main winding is designed to carry the current required for continuous operation of the motor under load but the starting winding which comprises relatively few turns is designed to safely carry a comparatively heavy starting current for a short time only. Hence if it is not promptly opened or disconnected after having served its starting purpose, it may burn out.

The present invention has for an object to provide a centrifugal switch or so-called "cut-out" which has a snap-action and quickly and widely opens the switch contacts in the starting winding circuit at a predetermined motor speed, the device also functioning reversely to as quickly close the starting winding contacts. Another object of the invention is to provide a centrifugal cut-out which functions in such a way as to eliminate all possibility of fluttering and burning of the electrical contacts heretofore caused by indecisive action of the switch mechanism at certain critical speeds under heavy load.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the accompanying drawings Fig. 1 is a fragmentary sectional view of a split phase induction motor embodying the invention; the switch contacts being closed. Fig. 2 is a similar view showing the contacts open. Fig. 3 is a top view of the parts as shown in Fig. 1. Fig. 4 is a perspective view of an element of the switch operating mechanism. Fig. 5 is a section on the line 5—5, Fig. 1. Figs. 6 and 7 are disassembled perspective views of parts of the switch operating mechanism, and Fig. 8 is a section on the line 8—8, Fig. 2.

1 represents the stator of a split phase induction motor having the usual running and starting windings indicated collectively at 2. The usual squirrel-cage rotor 3 is carried by the motor shaft 4 journaled in the motor end-bonnets one of which is shown at 5.

Stationarily mounted on the inwardly projecting lugs 6 of the end-bonnet 5 is the insulating supporting base 7 upon which is fastened by the screw 8 a terminal plate 9 carrying the stationary contact 10. The movable contact 11 is mounted on one end of the leaf-spring 12 hinged at 13 to the support 7 and having connected to it at 14 one of the terminal conductors 15 in the starting circuit; the terminal plate 9 also being connected in the starting circuit by the conductor 16. The leaf-spring member 12 has a ring-shaped intermediate portion 17, Fig. 8, which surrounds the motor shaft 4 with plenty of clearance space between the two and is formed with a diametrically disposed hump 18 which is pressed upon at times by the insulating washer 19' carried by the sleeve 19 to close the switch; the sleeve 19 being slidably mounted on the motor shaft. The opening or recovery movement of the spring member 12 may be assisted by the small coil-spring 20 arranged between the member 12 and the insulating support 7. The opening movement of the spring-member 12 is limited by the headed stud 21 which passes through the clearance slot 22 in the spring member 12.

Sliding movements endwise of the motor shaft are imparted to the sleeve 19 to control the opening and closing movements of the switch-member 12 by a centrifugally actuated spring-toggle mechanism carried by the rotor 3. Mounted on the rotor 3 by screws 23 and spacing nuts 24 is the sheet-metal supporting plate 25 having the spaced parallel ears 26 which are formed with pivot-slots 27 in which hang the inwardly directed pivotal extensions 28 of the upper arms of an H-shaped toggle-operated lever 29, the lower arms of which are bent to form rounded knobs 30 which engage the side walls of the groove 31 in the sleeve 19.

Pivotally mounted on the pin 32 carried by the ears 26 are the spaced ears 33 of the sheet-metal speed-responsive toggle-operating member 34 the weight of which is disposed mainly to one side of the pivot-point 32 so that the member 34 will be caused to turn from the position shown in Fig. 1 to the position shown in Fig. 2 under centrifugal force. The member 34 may be additionally weighted, if desired, by the attachment thereto of a plate 35.

Projecting from the speed-responsive member 34 between the ears 33 is a toggle-arm 36 carrying a cross-pin 37 which works in the slots 38

of the toggle-thrust element 39 having further slots 40 disposed at 90° to the slots 38 and in which the end of the toggle-arm 36 carrying the cross-pin 37 is received. A coiled expansion spring 41 surrounds the toggle-element 39 between the head 42 thereof and the cross-pin 37. This spring retains the groove 43, Fig. 4, in the end face of the head 42 seated upon the cross-bar 44 of the H-shaped toggle-operated member 29. A pair of recovery springs 45 are connected between the ears 46 of the speed-responsive member 34 and the ears 47 of the weights 48 mounted on the plate 25 to balance the weight of the toggle-mechanism.

When the motor is at rest, the cross-pin 37 is at one side of a line connecting the pivot-pin 32 and cross-bar 44. Hence the spring 41 urges the toggle-member 39 in a direction to swing the H-shaped lever to the right and force the sleeve 19 in a direction to hold the contacts 10, 11, closed. When the motor is started and attains a certain speed the speed-responsive member 34 begins to swing outwardly about its pivot 32 and the toggle-arms 36, 39 approach alinement. When the pin 37 crosses the position of alinement the action of the toggle upon the H-shaped lever 29 is suddenly reversed and the latter is snapped to the position shown in Fig. 2 and the movable contact 11 is suddenly and widely separated from the stationary contact 10, with no possibility of fluttering of the contacts or indecisiveness in the action of the parts. By virtue of the present mechanism the contacts must either be well closed or fully opened and cannot occupy any intermediate position except transitorily.

Having thus set forth the nature of the invention, what I claim herein is:—

1. A centrifugal switch having a rotary shaft, a support fixed to said shaft, a sleeve slidable on said shaft, a lever pivotally connected to said support and operatively engaging said sleeve, a speed-responsive member pivotally mounted on said support and having a toggle-arm, a spring-influenced toggle-arm pivotally engaging said lever and said first mentioned toggle-arm, and a movable electrical contact arranged to be operated by said sleeve.

2. A centrifugal switch comprising a stationary supporting frame, fixed and movable contacts carried by said frame, a rotary shaft journaled in said frame, a sleeve movable endwise of said shaft to operate said movable contact, and a speed-responsive spring-toggle mechanism carried by said shaft for moving said sleeve, said mechanism including pivotally connected toggle elements movable to-and-fro across an intermediate dead-center position, one of said elements being weighted and spring balanced so as to be speed-responsive and the other of said elements being connected to move said sleeve.

3. A centrifugal switch comprising a stationary supporting frame, fixed and movable contacts carried by said fame, a rotary shaft journaled in said frame, a sleeve movable endwise of said shaft to operate said movable contact, and a speed-responsive spring-toggle mechanism carried by said shaft for moving said sleeve, said mechanism including a pivotally mounted weighted toggle-arm, a second toggle-arm having a sliding pivotal engagement with said first mentioned arm, an expansion spring reacting at its opposite ends against the respective toggle-arms, and a pivotally mounted arm acted upon by said second toggle-arm for moving said sleeve.

4. A centrifugal switch comprising a rotary shaft, a supporting plate carried by and normal to the axis of said shaft, said plate having a pair of parallel ears normal to the plane of said plate, a sleeve slidable on said shaft, an H-shaped lever having two of its arms pivotally connected to said ears and its remaining two arms straddling and operatively engaging said sleeve, a speed-responsive member pivotally carried by said ears and having a toggle-arm, a toggle-arm connection between said first mentioned toggle-arm and the cross-bar of said H-shaped lever, and a movable electrical contact member controlled by said sleeve.

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