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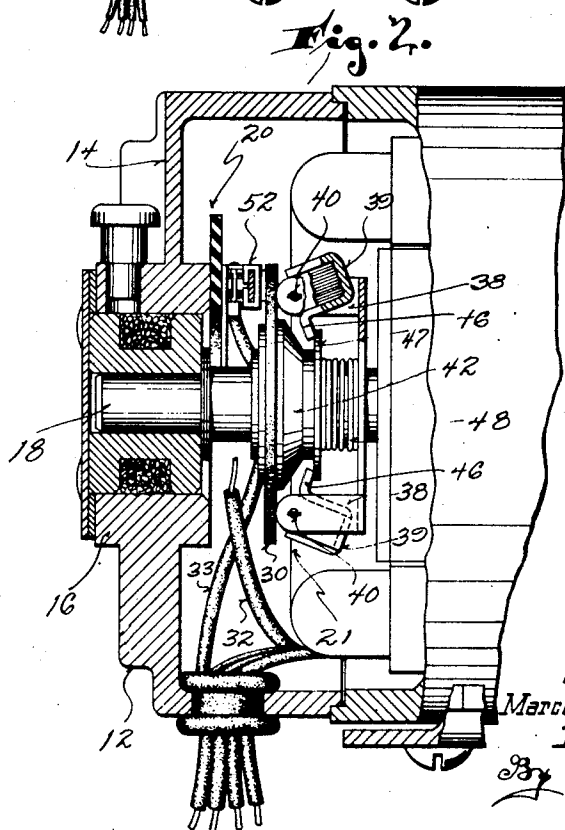
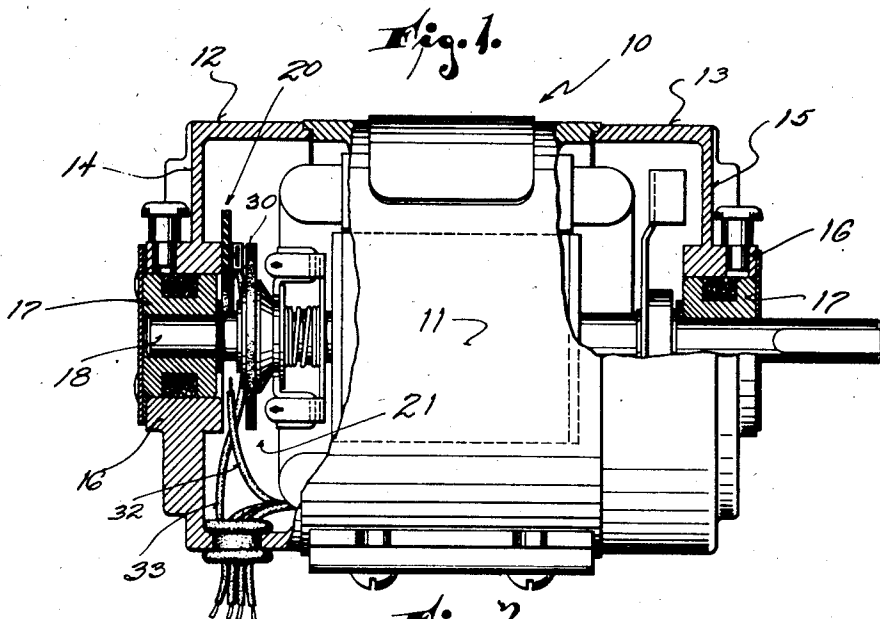
C. JANECKY ET AL

2,487,555

CENTRIFUGAL SWITCH

Filed Sept. 12, 1947

2 Sheets-Sheet 1



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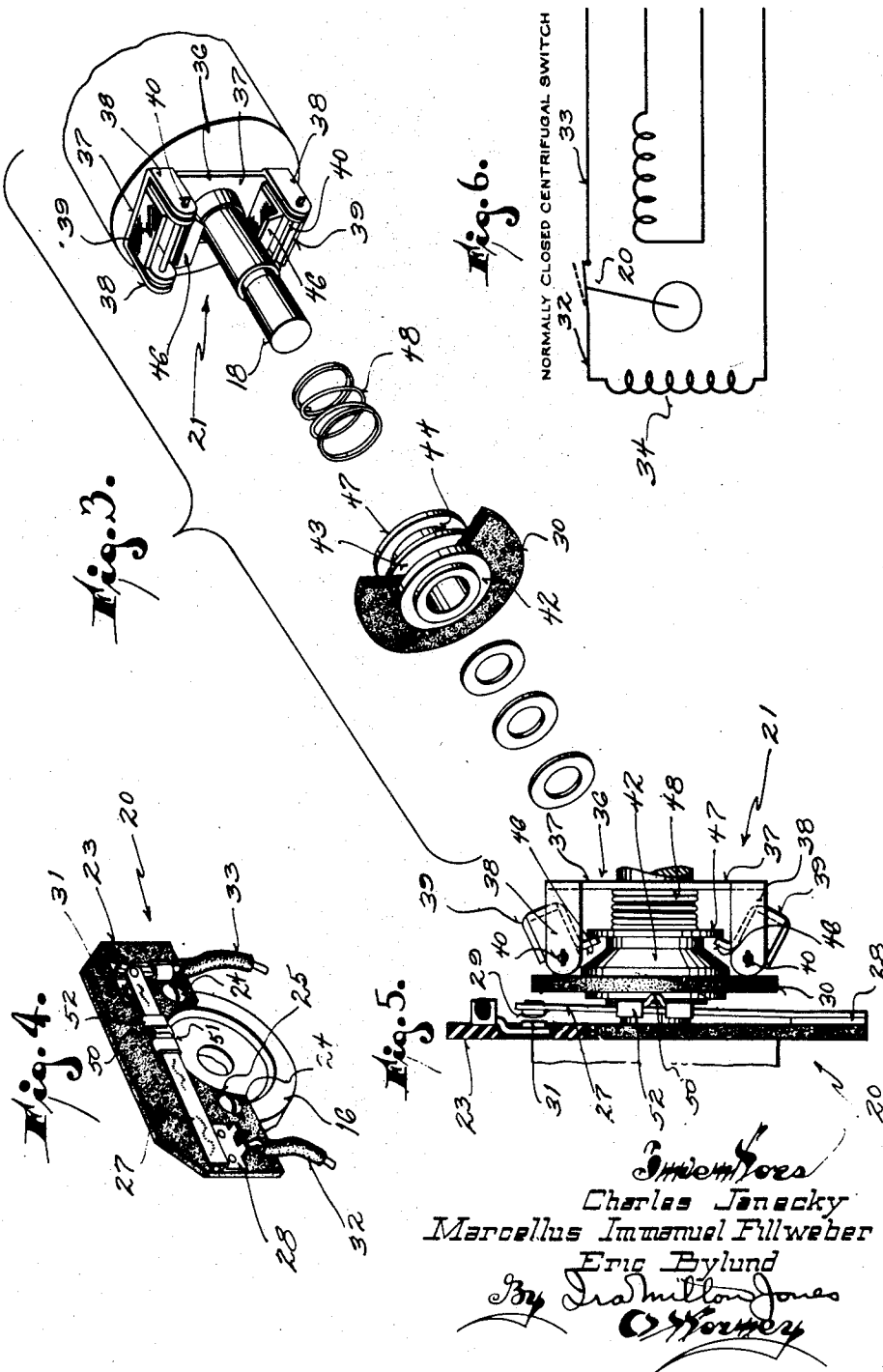
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UNITED STATES PATENT OFFICE

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CENTRIFUGAL SWITCH

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2 Claims. (Cl. 200—80)

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This invention relates to centrifugal switches and has more particular reference to centrifugal switches of the type such as are used with electric motors to disconnect the starting winding of the motor from the source of E. M. F. after the armature shaft of the motor has attained a predetermined speed of rotation.

One of the objects of this invention resides in the provision of an exceptionally compact switch assembly and centrifugally responsive switch actuating means which are adapted to be positioned inside one end wall of a motor housing and wherein the switch assembly is carried entirely by said end wall of the housing to form a subassembly therewith.

Another object of this invention resides in the provision of a centrifugal switch arrangement for electric motors and the like wherein the centrifugally responsive switch actuator has a novel connection with the contactor of the switch.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a side elevational view of an electric motor having its housing broken away at the ends of the motor to illustrate the application of the centrifugal switch arrangement of this invention thereto;

Figure 2 is an enlarged sectional view of one end of the motor illustrating the centrifugal switch arrangement of this invention in the position it occupies during normal running speeds of the motor;

Figure 3 is an exploded perspective view of the end portion of the armature shaft of the motor with the parts of the centrifugally responsive switch actuating mechanism separated therefrom and shown in their proper order of as-

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sembly along the axis of the armature shaft extended;

Figure 4 is a perspective view of the switch assembly per se illustrating the manner in which the same is attached to the end wall of a motor housing;

Figure 5 is a detailed plan view of the centrifugal switch arrangement showing the parts in their positions obtaining during normal running speeds of the motor, and with a portion of the switch mounting plate broken away and shown in section; and

Figure 6 is an electrical diagram illustrating the manner in which the switch controls the disconnection of the starting winding of the motor from the circuit.

Referring now more particularly to the accompanying drawings, the numeral 10 generally designates an electric motor having a housing comprising the usual intermediate shell 11 and end caps 12 and 13 at the front and rear ends of the housing respectively. In the motor shown both of the end caps are substantially cup-shaped and their bottom walls provide front and rear end walls 14 and 15 respectively for the motor housing. Each of the end walls 14 and 15 is provided with a central hub 16 in which a bearing is mounted to rotatably journal the opposite ends of the armature shaft 18 of the motor.

The centrifugal switch arrangement of this invention includes a switch assembly 20 carried by the front end wall 14 inside the cap 12, and a centrifugally responsive switch actuating mechanism 21 carried by the armature shaft inwardly of the switch assembly 20.

As shown best in Figures 4 and 5, the switch assembly comprises a relatively flat elongated mounting plate 23 of insulating material mounted on the hub 16 of the front end wall 14 at the inner end of the hub so as to be inside the end cap 12. A pair of substantially diametrically opposite screws 24 passing through suitable apertures (not shown) in the plate and received in threaded holes in the hub serve to hold the plate attached to the hub.

This manner of attaching the mounting plate to the end wall 14 of the motor housing disposes the body of the plate substantially normal to the axis of the armature shaft and directly above the

same, it being noted that the underside of the plate is notched out as at 25 to provide clearance for the shaft. The outer side of the plate thus bears directly against the inner end of the hub while the inner side of the mounting plate faces the centrifugally responsive switch actuating mechanism 21 on the armature shaft immediately to the rear of the mounting plate.

Flatwise overlying the inner side of the mounting plate is a spring blade contactor 27. The contactor 27 is elongated and made of relatively thin spring stock, one end of the blade being anchored to the mounting plate as at 28 at one side of the shaft axis, and the opposite free end of the blade lying at the other side of the shaft axis and carrying a contact point 29 thereon, as shown best in Figure 5. The blade extends across the inner face of the mounting plate and across the armature shaft directly above the same to be positioned between the mounting plate and a switch actuating disc 30 slidable axially on the armature shaft and forming a part of the actuating mechanism 21.

The contactor blade is also tensioned so as to tend at all times to assume an unflexed position with its free end portion spaced from the inner face of the mounting plate 23 to thereby hold the contact point 29 on the blade disengaged from a stationary contact 31 fixed on the mounting plate directly alongside the free end of the blade.

Suitable leads 32 and 33 connect with the anchored end of the contactor blade and the stationary contact respectively, and when the switch is closed by flexure of the blade toward the mounting plate to engage the contact point 29 with the stationary contact 31, the starting winding 34 of the motor is connected in the circuit as shown in Figure 6. When the contactor blade is free to hold itself disengaged from the contact 31, the switch is open and the starting winding 34 is disconnected from the motor circuit.

The centrifugally responsive switch actuating mechanism 21 controls the switch 20 in accordance with the speed of rotation of the armature shaft. This mechanism comprises a bracket 36 fixed on the armature shaft to rotate therewith, and located a distance inwardly from the switch assembly 20. The bracket 36 has substantially diametrically opposite arms 37 extending therefrom, and each of the arms, at its outer extremity, has a pair of laterally spaced, forwardly extending ears or standards 38 thereon. These ears are bent up from the opposite side edges of the arms and the ears of each pair are parallel to one another and to the axis of the armature shaft.

Substantially U-shaped weights 39 are pivotally and eccentrically suspended from said standards, between the same, by pivot pins 40 extending transversely across the outer end portions of each pair of standards and journalling the weights for swinging motion on axes parallel to one another and normal to the axis of the armature shaft.

The weights 39 are held by their ears or standards 38 at diametrically opposite sides of a bushing 42 freely slidably mounted on the armature shaft between the bracket 36 and the mounting plate 23 of the switch assembly. The bushing 42 is provided with a pair of axially spaced circumferential grooves in its outer periphery, the forward groove 43 having the disc 30 received therein so that the disc is drivingly connected with the bushing, and the rearmost groove 44 being

positioned substantially in line with the pivots 40 for the centrifugal weights 39.

The weights 39 are operatively connected with the bushing 42 through the medium of lips 46 on the weights bent inwardly toward the shaft axis and engaging in the groove 44 at the rear of the bushing. These lips bear against the annular flange 47 defining the rear side of the groove 44 during swinging of the weights on their pivots in response to centrifugal force when the armature shaft is rotated in excess of a predetermined starting speed at which the starting winding 34 is no longer needed, and the weights thus act to draw the bushing and the disc 30 thereon rearwardly away from the switch assembly.

The speed at which the centrifugal weights 39 operate to draw the bushing 42 rearwardly away from the switch assembly is determined by the resistance offered by an expansion spring 48 on the armature shaft and confined between the rear end of the bushing 42 and the bracket 36, it being understood that the spring yields during rearward sliding of the bushing effected by the weights 39 but that it has sufficient force to move the bushing and the disc 30 thereon forwardly toward the switch assembly when the armature shaft is rotating at a speed less than said predetermined speed or when the shaft is at rest.

As stated previously, the disc 30 lies immediately to the rear of the contactor blade 27, and the front face of the disc is engaged by a shoe 50 on the contactor blade 27 projecting rearwardly from the mid-portion of the blade. The shoe 50 is rounded so as to reduce friction between it and the disc 30 inasmuch as the disc may at times rotate with the bushing even though the latter is freely received on the armature shaft.

The shoe 50 is formed as an outwardly pressed projection on the mid-portion of a clip 51 having its opposite ends embracing the contactor blade at longitudinally spaced areas of the blade and clinched over the sides of the blade as at 52 so as to firmly secure the clip in place on the blade. The shoe 50 is (at all times) maintained in engagement, under spring pressure, with the front face of the disc 30 whenever the motor is at rest as well as during starting of the motor by the bias on the contactor blade tending to move the blade away from the switch mounting plate 23. The disc, however, is drawn slightly out of contact with the shoe by response of the weights to centrifugal force at normal running speeds of the motor so as to avoid noisy operation and wear on the disc and shoe. This is possible because the free position of the spring blade 27 is reached slightly before the disc 30 reaches its fully retracted position during swinging of the weights in response to centrifugal force.

Aside from its function of affording an operating connection between the contactor blade and the switch actuating disc 30, with the condition of the switch determined by the axial disposition of the disc 30 on the armature shaft, the clip also serves to reinforce and lend stiffness to the medial portion of the contactor blade. Such reinforcement of the blade is necessary since the blade is made of relatively thin material and bears the expansive force of the coil spring 48 in the closed position of the switch.

In the "at rest" condition of the motor the expansion spring 48 holds the bushing 42 and the disc 30 thereon in its forward position, and the disc acting through the shoe 50 on the contactor blade holds the latter flexed with the contact point 29 on the blade engaged with the stationary

contact 31 to maintain the switch closed and the starting winding in the circuit. In this closed position of the switch, it is important to note that the contactor blade defines the forward limit of sliding motion of the bushing 42 and the disc 30 thereon and holds the bushing connected with the weights 39 against the tendency of the spring 48 to disrupt its connection with the weights.

After energization of the starting winding by closure of a proper line switch (not shown) the armature shaft rotates and picks up speed until it reaches the predetermined speed of rotation at which the centrifugally responsive weights 39 overcome the force of the expansion spring 48 and in swinging in a counterclockwise direction force the bushing rearwardly along the armature shaft to allow the contactor blade to disengage itself from the stationary contact 31. Such rearward motion of the blade toward an unflexed position opens the switch and disconnects the starting winding from the circuit.

At the time the centrifugal weights respond to centrifugal force and begin to slide the bushing rearwardly along the armature shaft, it will be noted that the force of the spring blade 27 tending to return to an unflexed condition is added to the force of the weights to aid the same in overbalancing the force of the expansion spring 48.

From the foregoing description taken together with the accompanying drawings, it will be apparent that this invention provides an exceedingly compact but highly efficient centrifugal switch arrangement for electric motors and other similar devices; and that a novel cooperation is achieved between the parts of the switch assembly and the centrifugally responsive switch actuating mechanism in that a part of the switch mechanism, with the latter attached to the end cap of the motor housing to form a sub-assembly therewith, automatically positions the switch actuator on the armature shaft upon securement of the end cap in place closing the front end of the motor housing.

What we claim as our invention is:

1. A unitary switch assembly for an electric motor of the type having a shaft provided with centrifugally responsive switch actuating means, the actuator of which is biased toward one end wall of the motor housing to a position closely adjacent to said end wall but is caused to be moved away from said end wall against said bias in consequence to rotation of the shaft in excess of a predetermined speed, said switch assembly comprising: a relatively flat elongated insulating plate readily attachable to said end wall of the motor housing in a position crosswise of and substantially directly alongside the shaft, the attachment of the insulating plate to said end wall disposing the plate between the switch actuator and said end wall with one side of the plate facing the actuator; an elongated relatively narrow spring strip anchored substantially flatwise at one end to one end portion of said insulating plate at said side thereof which is to face the switch actuator and extending lengthwise across the plate to have its free end adjacent to the opposite end portion of the plate, said strip providing a resilient contactor blade lying crosswise and entirely to one side of the shaft between the plate and actuator when the plate is in position on said end wall, the blade being tensioned so as to normally hold its free end spaced a slight distance

from said side of the plate; a stationary contact fixed on said plate adjacent to the free end of the contactor blade so as to be engaged thereby upon flexure of the blade toward the plate; and a projection on the medial portion of the blade extending outwardly of the blade away from said plate and toward the switch actuator to be held in engagement with the actuator by the tension on the blade, said projection providing an anti-friction surface against which the switch actuator bears to normally hold the contactor blade flexed and engaged with the stationary contact.

2. A unitary switch assembly for an electric motor of the type having a shaft provided with centrifugally responsive switch actuating means, the switch actuator of which is biased toward one end wall of the motor housing to a position closely adjacent to said end wall but is caused to be moved away from said end wall against said bias in consequence to rotation of the shaft in excess of a predetermined speed, said unitary switch assembly comprising: a relatively flat elongated insulating plate having a substantially rectangular outline and having a notch formed medially in one longitudinal edge portion thereof, said plate being readily attachable to said end wall of the motor housing in a position crosswise of and substantially directly alongside the shaft with said notch receiving a portion of the shaft and with the plate disposed between the switch actuator and the end wall of the motor housing; an elongated relatively straight spring strip anchored substantially flatwise at one end to one end portion of the insulating plate at the side thereof which is to face the switch actuator when the plate is in position on said end wall, said spring strip extending lengthwise across the plate to have its free end adjacent to the opposite end portion of the plate and providing a resilient contactor blade lying crosswise and entirely to one side of the shaft adjacent to the bottom of the notch in the plate and between the plate and the actuator when the plate is in position on said end wall of the motor, said blade being tensioned so as to normally hold its free end spaced a slight distance from said side of the plate; a stationary contact on the plate adjacent to the free end of the contactor blade so as to be engaged thereby upon flexure of the blade toward the plate; and a projection on the medial portion of the blade adjacent to the bottom of the notch in the insulating plate and extending outwardly from the side of the blade remote from the plate and toward the switch actuator to be held in engagement with said actuator by the tension on the blade, said projection providing an anti-friction surface against which the switch actuator bears to normally hold the contactor blade flexed and engaged with the stationary contact.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,325,016	Harley	Dec. 16, 1919
1,935,304	Weber	Nov. 14, 1933
1,991,718	Armstrong	Feb. 19, 1935