No. 856,433. PATENTED JUNE 11, 1907.

K. TORNBERG.

CENTRIFUGAL SWITCH FOR ELECTRIC MOTORS.

APPLICATION FILED JULY 10, 1905.

Fig. 1

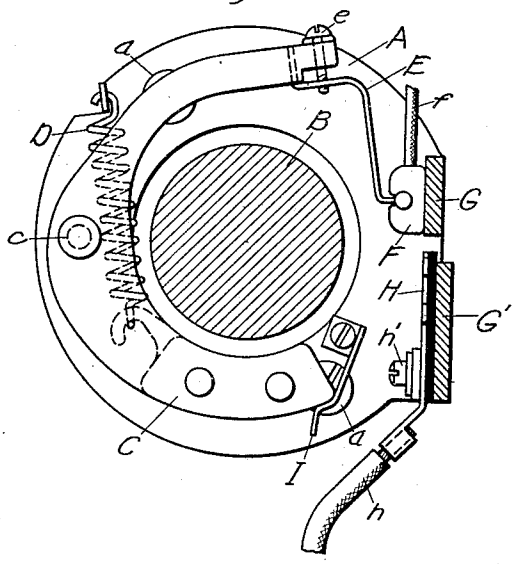


Fig. 2

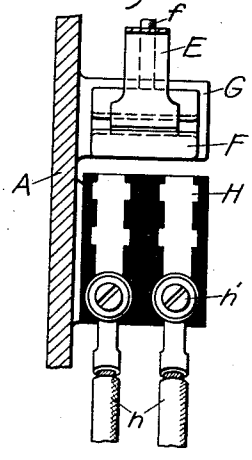
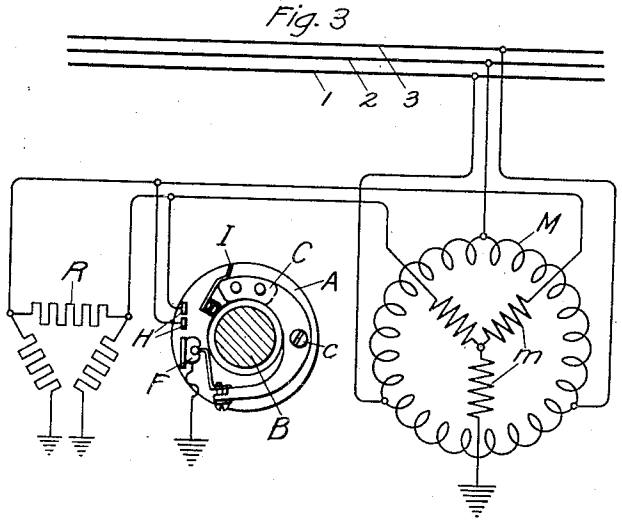


Fig. 3



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CENTRIFUGAL SWITCH FOR ELECTRIC MOTORS.

No. 856,433. Specification of Letters Patent. Patented June 11, 1907.

Application filed July 10, 1905. Serial No. 268,951.

To all whom it may concern:

Be it known that I, KNUT TORNBERG, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Centrifugal Switches for Electric Motors, of which the following is a specification.

My invention relates to centrifugally-actuated switches for electric motors, and is particularly adapted for use in connection with induction motors of the type designed to start with the resistance in series with the rotor winding and to run when up to speed with the resistance short-circuited.

Numerous types of centrifugally-actuated switches have been designed heretofore for the purpose of short-circuiting the rotor resistance automatically when a predetermined speed is reached.

My invention relates to this type of switch, and its object is to provide a novel arrangement of the switch, whereby a number of advantageous features are obtained which are not present in such switches as heretofore constructed.

One feature of my invention consists in so mounting the contact carried by the centrifugally-movable member of the switch that it is moved by said member substantially at right-angles to a centrifugal direction, and is capable of movement in a centrifugal direction relative to said member, and arranging the contacts to be engaged by the first contact so as to receive the pressure due to the centrifugal force of the first contact. By means of this arrangement the pressure between the electrical contacts is in no wise dependent upon the centrifugal force of the actuating member, so that the centrifugal force of the actuating member and its restraining spring may be correlated as desired, without affecting the pressure between the electrical contacts.

My invention further comprises so arranging the contacts that the resistances connected to the several phases of the rotor winding will always be simultaneously short-circuited.

Another feature of my invention consists in so arranging the contact carried by the centrifugally-movable member that it is self-alining.

Another feature of my invention consists in providing a catch engaging the centrifugal member at starting and adapted to restrain its movement until the centrifugal force reaches a predetermined amount. By this means a more positive action at a more definite speed is obtained than in former structures.

My invention will best be understood by reference to the accompanying drawings, in which

Figure 1 shows an end elevation of a centrifugally-actuated switch arranged in accordance with my invention; Fig. 2 shows a detail side elevation of the electric contacts of the switch; and Fig. 3 is a diagram of circuit connections.

Referring first to Figs. 1 and 2, A represents a supporting plate which is secured to the armature or rotor of the motor by screws or bolts *a a*. B represents the armature shaft. C represents the centrifugally-movable actuating member of the switch, which is pivoted on the plate A at *c*, and is provided with a restraining-spring D opposing its centrifugal movement. E represents a leaf-spring secured at one end to the centrifugally-movable member C, provided with an adjusting screw *e*, and carrying at its free end a contact F, which, when the motor is at rest bears against a slide or guide G. It will be seen that the spring E forms a connection between the member C and contact F, which is adapted to permit a centrifugal movement of the contact F relative to the member C, while the centrifugal movement of the member C will move the contact F in a substantially circumferential direction along the guide G. The slide over which the contact F moves is formed in two portions, one of which comprises the contacts H supported on and insulated from a projection G' from the plate A. With this arrangement it will be seen that when the centrifugal member C is thrown outward by centrifugal force, the contact F will be moved along the slide so as to engage the contacts H. The pressure with which contact F will bear upon contacts H depends only upon the speed of the motor and the weight of contact F. In other words, it is entirely independent of the centrifugal force of the actuating member and the restraining force of the spring D. These

two latter forces may be adjusted as desired, without in any way altering the effective pressure between electrical contacts.

The contact F is pivotally mounted on the end of the spring E, as is clearly shown in Figs. 1 and 2, so that this contact is self-alining. The two contacts H are alined in axial direction, as clearly shown in Fig. 2, so that the contact block F necessarily engages both contacts H simultaneously. As will presently be seen, this results in short-circuiting all the phases of the rotor winding simultaneously. The contacts H H are provided with leads *h* connecting them to the rotor winding, while the contact F is preferably grounded either through its support or by means of a flexible lead *f*.

In order to obtain a more positive action of the switch I provide in addition to the usual restraining spring D a spring catch I adapted to engage the centrifugally-movable member C only at starting. This catch serves to restrain the member C against movement until its centrifugal force reaches a predetermined amount. When this amount is reached the member C slips past the catch I and moves quickly to its extreme outward position. This snap-action is assisted by the friction of contact-block F on the slide G.

Now, referring to Fig. 3, M represents the primary winding of the motor, which is supplied with three-phase current from any suitable source indicated by the line-wires 1, 2 and 3. *m* represents the rotor or secondary winding of the motor, which is short-circuited through the starting resistance R. In this figure two of the terminals of the windings *m* are connected by suitable leads directly to the resistance and the third terminal is connected through a ground connection. The contact H of the centrifugally-actuated switch is connected to the two former terminals, and the contact-block F is connected through ground to the third terminal. Consequently, when contact-block F bridges the contacts H all three phases of the rotor winding are short-circuited, and since the contacts H are arranged to be engaged simultaneously by the block F, as shown in Fig. 2, all three phases are short-circuited simultaneously.

Although I have shown my invention as applied to a three-phase induction motor, it will be understood that it is not limited to a motor of this particular type. Furthermore, my invention comprises a number of features which, while I prefer to use them together, may be used independently, and which I desire to claim whether used together or not.

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

1. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a switch contact operated by said member, a connection between said contact and said member adapted to move said contact in a substantially circumferential direction when said member is moved centrifugally and to permit a centrifugal movement of said contact relative to said member, a slide adapted to be traversed by said contact when moved circumferentially and to restrain it against centrifugal force, and a switch contact connected to the armature winding of the motor and forming a portion of said slide.

2. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a leaf spring secured at one end to said member and extending in a substantially circumferential direction, a contact carried at the free end of said spring, a slide adapted to be traversed by said contact and to restrain it against centrifugal force, and a contact connected to the armature winding of the motor and forming a portion of said slide.

3. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a leaf spring secured at one end to said member and extending substantially at right angles to a centrifugal direction, a contact carried at the free end of said spring, a slide adapted to be traversed by said contact and to restrain it against centrifugal force, and a contact connected to the armature winding of the motor and forming a portion of said slide.

4. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a self-alining contact carried by said member, a connection between said contact and said member adapted to permit a centrifugal movement of said contact relative to said member and to move said contact substantially at right angles to a centrifugal direction when said member is moved, a slide adapted to be traversed by said contact when moved, and a contact connected to the armature winding of said motor and forming a portion of said slide.

5. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a leaf spring secured at one end to said member and extending substantially at right angles to a centrifugal direction, a self-alining contact carried at the free end of said spring, a slide adapted to be traversed by said contact and to restrain it against centrifugal force, and a contact connected to the armature winding of the motor and forming a portion of said slide.

6. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a contact block carried by said member and

adapted to be moved by said member in a substantially circumferential direction, and a pair of axially-alined contacts adapted to be bridged by said contact block.

7. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a pivotally-mounted contact block carried by said member and adapted to be moved by said member in a substantially circumferential direction, and a pair of axially-alined contacts connected to the armature winding of the motor and adapted to be bridged by said contact block.

8. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a self-alining contact block carried by said member, a connection between said contact and said member adapted to permit a centrifugal movement of said contact relative to said member and to move said contact substantially at right angles to a centrifugal direction when said member is moved, a slide adapted to be traversed by said contact when moved, and pair of alined contacts connected to the armature winding of the motor and adapted to be bridged by said contact block.

9. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a catch adapted to engage said member at starting only and to restrain it from movement until the centrifugal force of said member reaches a predetermined amount, a contact carried by said member, and a second contact connected to the armature winding of the motor and adapted to be engaged by the first contact.

10. In a motor, a centrifugally-actuated switch carried by the motor armature comprising a centrifugally-movable member, a spring secured to said member and opposing its centrifugal movement, a spring catch engaging said member at starting only and adapted to restrain it from movement until the centrifugal force of said member reaches a predetermined amount, a contact carried by said member, and a second contact connected to the armature winding of the motor and adapted to be engaged by the first contact.

11. In an induction motor, a resistance connected in series with the motor winding, a centrifugally-movable member carried by the rotor, a contact block carried by said member, a connection between said contact block and said member adapted to permit a centrifugal movement of said contact block relative to said member and to move said contact block substantially at right angles to a centrifugal direction when said member is moved, a slide adapted to be transversed by said contact block when moved, and a pair of short-circuiting contacts connected to said resistance and forming a portion of said slide.

12. In an induction motor, a resistance connected in series with the rotor winding, a centrifugally-movable member carried by the rotor, a contact block carried by said member and adapted to be moved by said member in a substantially circumferential direction, and a pair of axially-alined short-circuiting contacts connected to said resistance and adapted to be bridged by said contact block.

In witness whereof, I have hereunto set my hand this thirtieth day of June 1905.

KNUT TORNBERG.

Witnesses:
JOHN A. McMANUS, Jr.,
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