April 28, 1931. G. H. WHITTINGHAM 1,802,691

FRICTION SWITCH FOR ELECTRIC CIRCUITS

Filed May 25, 1929

FIG. 1.

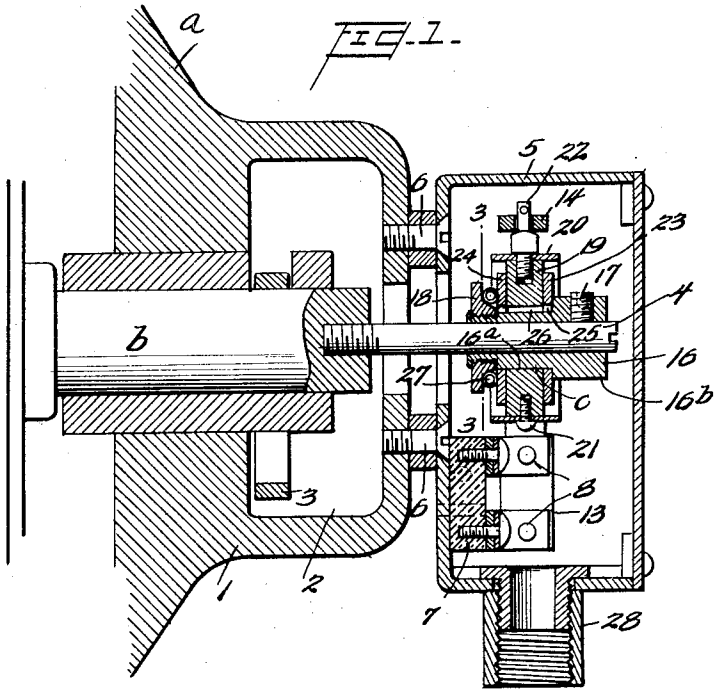


FIG. 2.

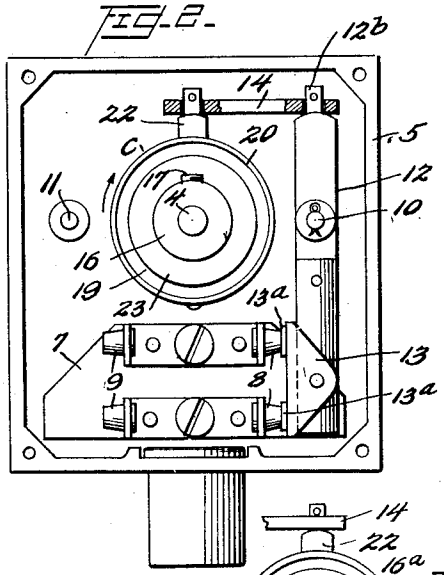


FIG. 4.

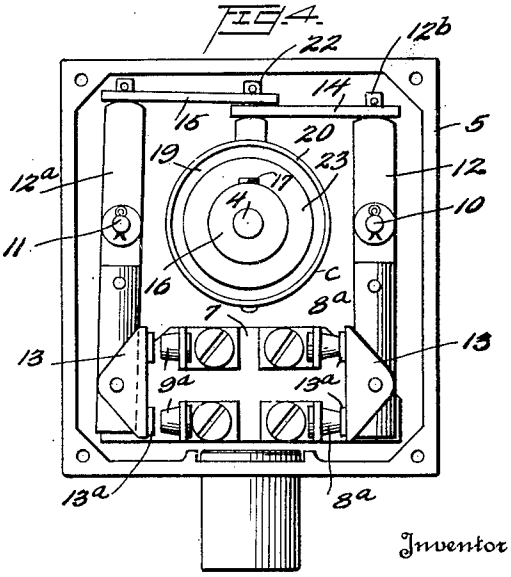
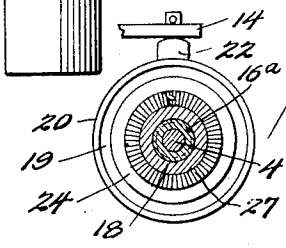


FIG. 3.



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UNITED STATES PATENT OFFICE

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FRICTION SWITCH FOR ELECTRIC CIRCUITS

Application filed May 25, 1929. Serial No. 365,915.

This invention relates to a frictionally operated switch adapted for application to reversible shafts, such as the armature shaft of an electric motor, the purpose of the invention being to provide means for opening or closing an electric circuit automatically when the shaft starts to move in the reverse direction to that in which it has been running.

The switch has various uses, one of which is as an aid in the stoppage of induction motors. Thus, when a braking action is applied to an induction motor of the wound-rotor type, to stop it, by temporarily reversing the phases of the current in the rotor circuits, in well known manner, the switch of the present invention may be used to control said circuits so that they will be opened after the motor has been brought to a stop and at the very commencement of the movement of the rotor in the opposite direction.

In the accompanying drawing,

Fig. 1 is a central section through one end of an electric motor bearing, taken on the line of the rotor shaft and through the friction switch attachment;

Fig. 2 is a front elevation of the friction switch, the front of the switch casing being removed;

Fig. 3 is a section on the line 3—3 of Fig. 1; and,

Fig. 4 is a view similar to that shown in Fig. 2, but having two switch levers connected to the friction device.

Referring to the drawing, *a* indicates the stator of an electric motor, and *b* indicates the rotor shaft, journaled in a bearing 1, having the usual oil cavity 2 into which a ring 3 on the shaft dips.

In applying my attachment to a motor, a hole is drilled axially in the end of the rotor shaft and a spindle 4 is threaded into this opening. This spindle carries the friction device *c* and this device is enclosed in a casing 5, which is conveniently attached to the end of the motor bearing by screws 6. A block of insulating material 7 is secured to the back of the casing 5, and pairs of switch contacts 8 and 9 are mounted upon this block, as shown in Fig. 2. Studs 10 and 11 project from the back of the casing 5, at opposite sides of the rotor shaft, and a switch lever 12, made of insulating material, has an opening adapted to pass over either of said studs. In the drawing, Fig. 2, the lever 12 is arranged vertically in the casing and it has at its lower end a pivoted contact member 13, having contacts 13^a adapted to engage the contacts 8 if the lever is mounted upon the stud 10, or to engage the contacts 9 if the lever is mounted upon the stud 11; or two levers 12 and 12^a can be mounted upon the studs, as shown in Fig. 4, where it is desired to operate two switches. The upper end of the lever 12 is connected by a link 14 to the friction device, and in Fig. 4, the upper end of the switch lever 12^a is connected to said device by a link 15. These levers are adapted to rock in a plane at right angles to the rotor shaft and are centrally pivoted, and the links lie in the same plane and are connected to the friction device in such manner that the latter gives a tangential thrust to the links.

The friction device comprises the spindle 4, which rotates with the motor shaft, and a sleeve 16, which is secured to the spindle as by a set screw 17. The central portion 16^a of the sleeve is cylindrical and of smaller diameter than the end portion 16^b, and the inner end of the sleeve is threaded to receive an internally threaded cone 18. Between the enlarged portion or head 16^b and the cone is mounted a friction disk 19, having a central opening within which the sleeve may rotate. This friction device, which is preferably made of wood impregnated with lubricating material, has a surrounding metal rim 20 secured to it by a screw 21 and by a post or pintle 22, to which latter the link 14 is loosely connected. Metal washers 23 and 24 surround the central portion of the sleeve 16, at opposite sides of the friction disk 19, and each of these washers has a tongue 25 which enters a longitudinal keyway 26 in said central portion and locks the washer to the sleeve so that the former must rotate with the latter.

The washer 23 is interposed between the head of the sleeve and the friction disk, and the washer 24 is interposed between the friction disk and an endless helical spring 27 which surrounds the conical part of the ad-

justable cone 18. The internal diameter of the spring, when relaxed, is approximately the same as that of the smaller end of the cone and when the cone is adjusted toward the washer 24, the spring is pressed upwardly on the cone and expanded thereon, and the tendency of the spring to contract to its normal diameter causes it to apply a yielding pressure to the washer. This pressure is applied to the washer on a circular line concentric with the spindle and hence all parts of the washer bear with the same pressure against the friction disk.

The connecting link 14, Fig. 2, prevents the friction disk from turning with the spindle and washers. When the motor is rotating in the direction of the arrow, Fig. 2, the friction of the washers upon the disk will cause the link 14 to exert pressure against the switch arm 12, tending to hold the contacts 13^a in engagement with the stationary contacts 8; but if the motor is stopped and reversed the friction disk will move a slight distance in the direction opposite to that indicated by the arrow in Fig. 2 and the link 14 will rock the switch arm to open position. The link 14 has perforations in its ends through which a pintle 22 on the friction disk and a pintle 12^b on the switch lever extend. These pintles are substantially parallel and the openings in the link are large enough to provide a loose fit between the link and the pintles. It is to be noted that the friction device is supported entirely on the spindle 4, and as this spindle is applied to the rotor shaft by boring and threading a hole in the latter, unless the boring is accomplished with great precision there may be a slight eccentric movement to the spindle and the vibrating movement would be communicated to the switch arm if the friction disk were rigidly connected to the arm. With the construction described, any eccentric movement of the spindle and friction disk would merely cause an up-and-down movement of the pintle 22 and a slight rocking movement of the link 14 about its point of connection with the switch arm; but the switch arm itself would not be affected by this rocking movement, and constant pressure, tending to keep the switch closed, would be applied as long as the motor runs in the direction indicated by the arrow in Fig. 2.

As the heat generated by the friction causes exudation of the lubricating fluid on the surface of the friction disk, which might be thrown off from the periphery of the friction washers 23 and 24, the rim 20 surrounding the friction disk is made wide enough to project slightly past the planes of the washers, as shown in Fig. 1, and these projecting portions of the rim will catch any fluid particles thrown off and prevent them from being thrown on to the switch contacts.

If the motor to which the device is applied is connected so as to run in the counterclockwise direction, the switch lever 12, in Fig. 2, can be taken off of the stud 10 and mounted upon the stud 11, and while the motor is running in the last mentioned direction, the switch contacts 13^a will be held in engagement with the contacts 9, and a slight reverse movement of the motor armature will cause the switch to open. Each contact 8 in Fig. 2 is shown connected to a contact 9 so that changing the switch lever from one stud to the other will not change the electrical connections.

In Fig. 4, the two links 14 and 15 are connected to the pintle of the friction device and each link is connected to a separate switch lever. With this arrangement, when the motor runs in clockwise direction, the switch lever 12 will be in closed position and the lever 12^a will be in open position, and when the motor runs in the opposite direction, the positions of the levers will be reversed. In this figure, the contacts 8^a are not connected to the contacts 9^a so that the switches may open and close independent circuits. That is, the contacts 8^a will form terminals for one circuit and the contacts 9^a will form terminals for another circuit. The wires leading to the stationary contacts, not shown in the drawing, enter the casing 5 through a tubular fitting 28 connected to the bottom of the casing.

What I claim is:

1. The combination with a spindle and means for rotating the same, of a centrally pivoted switch lever adapted to rock in a plane transversely of the axis of the spindle and having a pintle at one end, a member journaled upon the spindle and having a radially projecting pintle, a link extending tangentially from said member to one arm of the lever and loosely connected to the pintle on said member and lever, and means rotatable with the spindle and frictionally engaging said member.

2. The combination with an electric motor and a housing supported on the stator thereof, of a spindle projecting axially from the rotor shaft into said housing, a member journaled on said spindle, means rotatable with the spindle and frictionally engaging said member, stationary contacts facing oppositely in said housing, a switch lever having a bearing between its ends and having a contact member at one end, studs in said housing for pivoting said lever on either side of the spindle to engage either of the oppositely facing contacts, and a link loosely connecting said member with the end of the lever opposite its contact member.

3. The combination with a motor and a switch member, of means for moving said member when the direction of movement of the rotor shaft changes comprising a spindle rotatable by said shaft, a friction disk journaled on the spindle, a washer rotatable with

the spindle and engaging one side of the friction disk, a cone bearing surrounding the spindle and adjustable toward and from said washer, an endless helical spring surrounding said cone bearing and resting against the side of said washer, and a link connecting said friction disk with said switch member.

4. The combination with a motor and a switch member, of means for moving said member when the direction of movement of the rotor shaft changes comprising a spindle rotatable by said shaft, a sleeve secured to the spindle, a friction disk journaled on the sleeve, washers on opposite sides of said disk and keyed to the sleeve, a cone bearing adjustable on the sleeve toward and from one of said washers, an endless helical spring surrounding said cone bearing and resting against the side of said latter washer, and a link connecting said friction disk with said switch member.

In testimony whereof I affix my signature.

GEORGE H. WHITTINGHAM.