

March 4, 1947.

G. T. WRIGHT

2,416,973

CENTRIFUGAL SWITCH

Filed Dec. 20, 1944

Fig. 1.

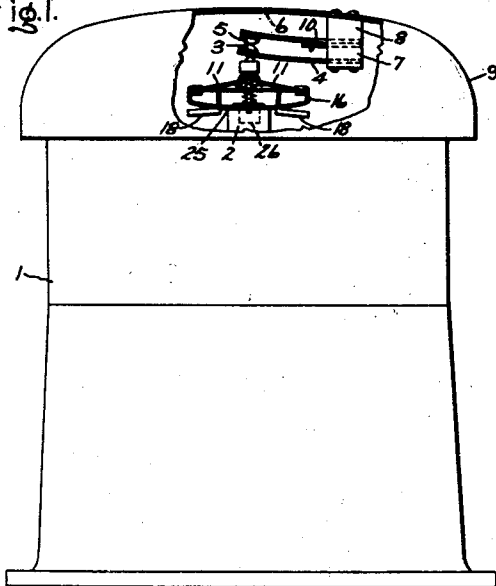


Fig. 6.

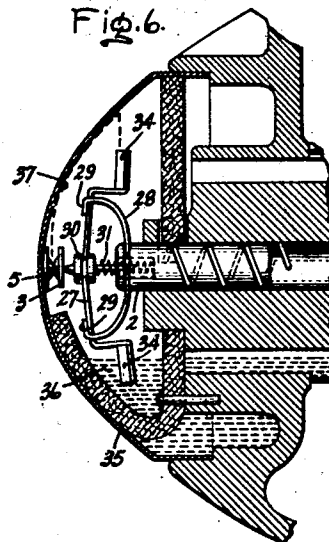


Fig. 2.

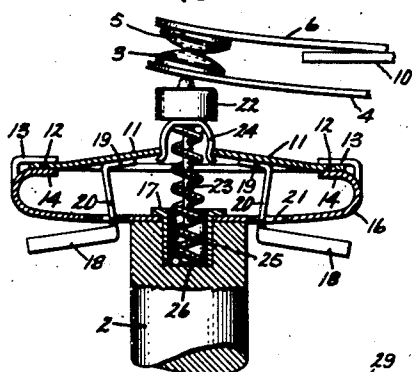


Fig. 3.

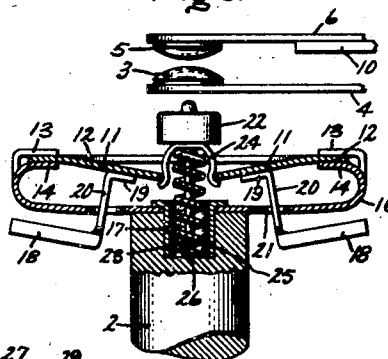


Fig. 5.

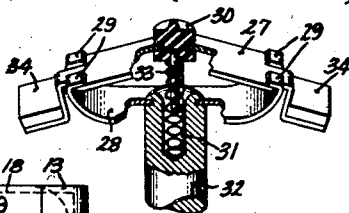
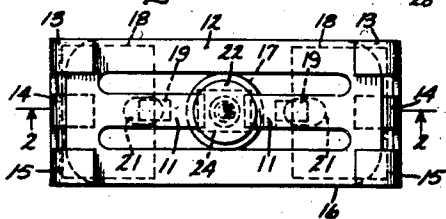


Fig. 4.



Inventor:
George T. Wright
by *Harry C. Dunham*
His Attorney

UNITED STATES PATENT OFFICE

2,416,973

CENTRIFUGAL SWITCH

George T. Wright, Fort Wayne, Ind., assignor to
General Electric Company, a corporation of
New York

Application December 20, 1944, Serial No. 568,981

14 Claims. (Cl. 200—80)

1

2

My invention relates to centrifugal devices and in particular to centrifugal switches of the type used for controlling the circuits of starting windings for dynamo-electric machines.

An object of my invention is to provide an improved and simplified centrifugal switch.

Another object of my invention is to provide an improved centrifugal switch in which the contacts are arranged to break the circuit therebetween by a snap-acting switch.

Further objects and advantages of my invention will become apparent and my invention will be better understood from the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In the drawing, Fig. 1 is a side elevational view of a dynamoelectric machine, partly broken away, showing an embodiment of my invention provided therein; Fig. 2 is an enlarged side elevational view, partly broken away, of the switch shown in Fig. 1 illustrating the position of the elements of the switch in closed circuit position; Fig. 3 is a view similar to Fig. 2 with the switch elements shown in open circuit position; Fig. 4 is a plan view of the centrifugal operating device for the embodiment of my invention shown in Figs. 1, 2, and 3; Fig. 5 is a perspective view, partly broken away, of a modification of the centrifugal operating device for my improved switch; and Fig. 6 illustrates another application of my improved switch construction.

Referring to the drawing, I have shown in Figs. 1 to 4, inclusive, a dynamoelectric machine having a stationary member 1 and a rotatable member mounted on a shaft 2 supported in the stationary member. This dynamoelectric machine may be considered as a single phase induction motor with excitation provided by a main field exciting winding and a starting field exciting winding which is adapted to be deenergized when the rotatable member of the machine attains a predetermined speed and to be energized when the rotatable member operates below the predetermined speed or is stationary and power is turned on the machine. In order to connect and disconnect such a starting winding in the electrical circuit of the machine at the desired speed, I provide a centrifugal switch which is adapted to close the electrical circuit of the winding for all speeds below a predetermined speed and to open the circuit of the

starting winding through the contacts of the switch above this predetermined speed. This centrifugal switch includes an electrical contact 3 which is resiliently mounted on a flexible leaf spring 4 and is adapted to make and break an electrical circuit with another electrical contact 5 which is resiliently mounted on another leaf spring element 6. The two resilient mountings for the contacts 3 and 5 are insulated from each other by an insulating element 7 and are suitably mounted on another insulating element 8 secured to an end shield 9 of the stationary member 1 of the machine. The mounting member also includes a relatively rigid retaining plate 10 which is adapted to provide a stop for limiting the movement of the electrical contact 5 toward the contact 3 by limiting the movement of the leaf spring 6 such that the two contacts 3 and 5 are arranged relatively close to each other and out of engagement in open circuit relationship when the two leaf springs are not deflected, as shown in Fig. 3. The contacts of the spring are adapted to be operated by a centrifugally operable overcenter snap spring device which includes a snap spring formed as two fingers 11 extending inwardly from a mounting plate portion 12 which is secured at each end thereof between three fingers 13, 14, and 15 formed on a supporting clip member 16 which is secured by a hollow rivet 17 to the rotatable member shaft 2. A pair of weights 18 is secured to the snap spring member for operating the spring fingers 11 across dead center in response to the action of centrifugal force on the weights 18. One of these weights is secured to each of the snap spring fingers 11 in any suitable manner, as by welding or brazing of an end 19 of the weights to the fingers 11, and the weight 18 is provided with an angularly extending link portion 20 which extends from the end 19 to the weighted portion of the weight 18 through an opening 21 formed in the mounting clip 16. The switch contacts 3 and 5 are adapted to be operated by a closing member 22 having an engaging element formed as a cap 22 of insulating material mounted on a guide pin 23, which are both secured to a spring clip 24 having spring fingers arranged in operative engagement with the inner ends of the snap spring fingers 11 and biased outwardly from the rotatable member shaft 2 towards the contacts 3 and 5 by a resilient coil spring 25. This coil spring is arranged in engagement with the engaging member clip 24 and with the inner end of a socket 26 formed in the end of the rotat-

3

able member shaft 2 for biasing the engaging member cap 22 away from the rotatable member and towards the spring contacts for closing these contacts against the action of the snap spring fingers 11 below a predetermined speed of the rotatable member. The weight members are formed such that when the rotatable member attains a predetermined speed the centrifugal force on the weighted portion thereof moves these members outwardly away from the axis of rotation of the rotatable member shaft 2, thereby drawing the snap spring fingers 11 towards the end of the shaft 2 and away from the switch contacts 3 and 5 against the compressive force of the coil spring 25. The snap spring fingers 11 and the rigid stop 10 are so positioned as to cause the fingers 11 to pass dead center either prior to or at the time that the rigid stop member 10 prevents further movement of the contact 5 towards the contact 3, thereby providing for a quick snap and breaking of the electrical contact between the contacts when the spring fingers 11 pass over dead center, thus minimizing arcing and burning or pitting of the switch contacts.

In Fig. 5, I have shown another embodiment of my improved centrifugal operating device for a centrifugal switch in which a pair of spring fingers 27 formed as an overcenter spring member are held in place by a spring clip member 20 formed with a pair of fingers 29 on each end thereof which extend over shoulders on the spring fingers 27. This centrifugal device is adapted to operate a set of contacts 3 and 5 similar to those shown in the other figures of the drawing by a closing member including an engaging element formed as a cap 30 of insulating material mounted in an opening between the two spring fingers 27 and arranged in operative engagement with a coil spring 31 which is adapted to bias the cap 30 towards the contacts of the switch and away from a shaft 32 of the rotatable member of a dynamoelectric machine. In order to maintain these elements of the centrifugal operating device in proper alignment, a pin 33 is secured in the inner end of the cap 30 and extends into the resilient coil spring 31 into the end of the pocket in the shaft 32. A centrifugal weight 34 is secured to the end of each of the snap spring fingers 27 for operating the spring fingers across dead center in response to the action of centrifugal force on the weight. These weights are formed such that when the rotatable member attains a predetermined speed, the centrifugal force thereon moves these weights outwardly away from the axis of rotation of the rotatable member shaft 32, thereby drawing the snap spring fingers 27 towards the end of the shaft and away from the switch contacts against the compressive force of the coil spring 31. The snap spring fingers 27 are so located as to provide for a quick snap and breaking of electrical contacts when the spring fingers pass over dead center. The coil spring 31 is adapted to bias the operating cap member 30 into closed switch contact position away from the end of the shaft 32 for all speeds of the rotatable member below a predetermined value. This construction operates in the same manner as the switch shown in Figs. 1 to 4, inclusive, and is a simpler device with fewer moving parts.

In Fig. 6, I have shown another application of my improved switch construction, in which the switch contacts 3 and 5 are mounted in an enclosing end shield 35 of a horizontal shaft motor

4

and are adapted to be operated by a centrifugal operating device embodying my improved construction. For illustrative purposes, the centrifugal device is shown the same as that of Fig. 5 in which the weight elements 34 are secured to the ends of the spring fingers 27. In such an arrangement, the weight elements 34 of the centrifugal device dip into oil 36 in the lubricant reservoir and during operation throw it outwardly, as shown by the dotted line 37 against the end shield from which it drains back to the reservoir and passes over the contacts 3 and 5, and thereby supply lubricant to the contacts during normal operation of the dynamoelectric machine. This film of oil is wiped from between the contacts when closed and is drawn toward the center of the contacts by surface tension when the contacts are opened to aid in extinguishing the current therebetween. This has been found to be very effective in operation.

While I have illustrated and described a particular embodiment of my invention, modifications thereof will occur to those skilled in the art. I desire it to be understood, therefore, that my invention is not to be limited to the particular arrangement disclosed, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

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

1. A centrifugal switch including a pair of electrical contacts, an overcenter snap spring, means including a pair of weights secured to said snap spring on the side thereof away from said contacts in a position for movement outwardly under the influence of centrifugal force and for moving said snap spring in a direction past dead center away from said contacts above a predetermined speed, means for biasing said switch contacts below a predetermined speed to closed position against the action of said snap spring and said weights.

2. A centrifugal switch including a pair of electrical contacts, a rotatable member, an overcenter snap spring, means for securing said snap spring to said rotatable member, means including a pair of weights secured to said snap spring on the side thereof away from said contacts in a position for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for moving said snap spring in a direction past dead center away from said contacts above a predetermined speed, means for biasing said switch contacts below a predetermined speed to closed position against the action of said snap spring and said weights.

3. A centrifugal switch including a pair of electrical contacts, an overcenter snap spring, means including a pair of weights secured to said snap spring on the side thereof away from said contacts in a position for movement outwardly under the influence of centrifugal force and for moving said snap spring in a direction past dead center away from said contacts above a predetermined speed, means including a switch contact closing member, and resilient means for biasing said switch closing member towards said switch contacts for closing said contacts below a predetermined speed against the action of said snap spring and said weights.

4. A centrifugal switch including a pair of electrical contacts, a rotatable member, an overcenter snap spring formed as two fingers, means for securing said snap spring to said rotatable

5

member, means including a pair of weights rigidly secured one on each of said snap spring fingers in a position and at an angle for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for biasing said snap spring fingers in a direction past dead center away from said contacts above a predetermined speed, means for biasing said switch contacts to closed position below a predetermined speed against the action of said snap spring fingers and said weights.

5. A centrifugal switch including an electrical contact, means for mounting said electrical contact, a second electrical contact, means for mounting said second electrical contact adjacent said first-mentioned contact, means forming a stop for retaining said second contact normally out of contact with said first-mentioned contact, a rotatable member, an overcenter snap spring, means for securing said snap spring to said rotatable member, means including a pair of weights secured to said snap spring on the side thereof away from said contacts in a position for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for moving said snap spring in a direction past dead center away from said contacts above a predetermined speed, means including a switch contact closing member, and resilient means for biasing said switch closing member towards said switch contacts for closing said contacts against the action of said snap spring and said weights below a predetermined speed.

6. A centrifugal switch including an electrical contact means for mounting said electrical contact, a second electrical contact, means for mounting said second electrical contact adjacent said first-mentioned contact, means forming a stop for retaining said second contact normally out of contact with said first-mentioned contact, a rotatable member, an overcenter snap spring, means for securing said snap spring to said rotatable member, means including a pair of weights rigidly secured to said snap spring on the side thereof away from said contacts in a position for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for moving said snap spring in a direction past dead center away from said contacts above a predetermined speed, means including a switch contact closing member operatively engaging said snap spring, and resilient means for biasing said switch contact operating member away from said rotatable member and towards said switch contacts for closing said contacts against the action of said snap spring and said weights below a predetermined speed.

7. A centrifugal switch including an electrical contact, means for resiliently mounting said electrical contact, a second electrical contact, means for resiliently mounting said second electrical contact adjacent said first-mentioned contact, means forming a stop for retaining said second contact normally out of contact with said first-mentioned contact when said resilient mounting means are not deflected, a rotatable member, an overcenter snap spring, means for securing said snap spring to said rotatable member, means including a pair of weights rigidly secured to said snap spring in a position and at an angle for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for biasing said snap spring in a direction past dead center away from said contacts, means including a switch contact closing

6

member having an engaging element operatively engaged with said snap spring, and resilient means for biasing said engaging element away from said rotatable member and towards said switch contacts for closing said contacts against the action of said snap spring and said weights below a predetermined speed.

8. A centrifugal switch including a pair of electrical contacts, with means for retaining said contacts normally out of closed circuit relation, a rotatable member, an overcenter snap spring formed as two fingers, means for securing said snap spring to said rotatable member, means including a pair of weights rigidly secured one on each of said snap spring fingers on the side thereof away from said contacts in a position for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for moving said snap spring fingers in a direction past dead center away from said contacts, means including a switch contact closing member operatively engaging said snap spring fingers, and resilient means arranged in engagement with said switch contact closing member and said rotatable member for biasing said switch contact closing member away from said rotatable member and towards said switch contacts for closing said contacts against the action of said snap spring fingers and said weights below a predetermined speed.

9. A centrifugal switch including a pair of electrical contacts, with means for retaining said contacts normally out of closed circuit relation, a rotatable member, an overcenter snap spring formed as two fingers, means for securing said snap spring to said rotatable member, means including a pair of weights secured one on each of said snap spring fingers in a position for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for moving said snap spring fingers in a direction past dead center away from said contacts, means including a switch contact closing member having an engaging element of insulating material operatively engaged with the ends of said snap spring fingers, and resilient means arranged in engagement with said engaging element and said rotatable member for biasing said engaging element away from said rotatable member and towards said switch contacts for closing said contacts against the action of said snap spring fingers and said weights below a predetermined speed.

10. A centrifugal switch including a pair of electrical contacts, with means for retaining said contacts normally out of closed circuit relation, a rotatable member, an overcenter snap spring formed as two fingers, means for securing said snap spring to said rotatable member, means including a pair of weights rigidly secured one on each of said snap spring fingers in a position and at an angle for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for biasing said snap spring fingers in a direction past dead center away from said contacts, means including a switch contact closing member having an engaging element of insulating material operatively engaged with the ends of said snap spring fingers, and resilient means including a coil spring arranged in engagement with said engaging element and said rotatable member for biasing said engaging element away from said rotatable member and towards said switch contacts for closing said contacts against the action of said snap

spring fingers and said weights below a predetermined speed.

11. A centrifugal switch including a pair of electrical contacts, a rotatable member, an over-center snap spring formed as two fingers, means for securing said snap spring to said rotatable member, means including a pair of weights secured one on each of said snap spring fingers on the side thereof away from said contacts in a position for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for moving said snap spring fingers in a direction past dead center away from said contacts above a predetermined speed, means including a switch contact closing member having an engaging element of insulating material operatively engaged with the ends of said snap spring fingers, and resilient means arranged in engagement with said engaging element and said rotatable member for biasing said engaging element away from said rotatable member and towards said switch contacts for closing said contacts against the action of said snap spring fingers and said weights below a predetermined speed.

12. A centrifugal switch including a pair of electrical contacts, a rotatable member, an over-center snap spring formed as two fingers, means for securing said snap spring to said rotatable member, means including a pair of weights rigidly secured one on each of said snap spring fingers on the side thereof away from said contacts in a position for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for moving said snap spring fingers in a direction past dead center away from said contacts, means including a switch contact closing member operatively engaging the ends of said snap spring fingers, and resilient means arranged in engagement with said engaging element and said rotatable member for biasing said engaging element away from said rotatable member and towards said switch contacts for closing said contacts against the action of said snap spring fingers and said weights below a predetermined speed.

13. A centrifugal switch including a pair of electrical contacts, a rotatable member, an over-center snap spring formed as two fingers extending inwardly from a mounting plate, means including a supporting member for securing said snap spring to said rotatable member, means including a pair of weights secured one on each of said snap spring fingers on the side thereof away from said contacts in a position for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for moving said snap spring fingers in a direction past dead center away from said contacts above a predetermined speed, means including a switch contact closing member having an engaging element of insulating material and a guide pin secured thereto with a clip arranged in operative engagement with the ends of said snap spring fingers, and resilient means including a coil spring arranged in engagement with said engaging element and said rotatable member for biasing said engaging element away from said rotatable member and towards said switch contacts for closing said contacts against the action of said snap spring fingers and said weights below a predetermined speed.

14. A centrifugal switch for a dynamoelectric machine arranged in a lubricant reservoir and including a pair of electrical contacts, means for mounting said electrical contacts normally out of lubricant in said reservoir, a rotatable member, and a centrifugal operating device including an overcenter snap spring, means for securing said snap spring to said rotatable member, means including a pair of weights rigidly secured to said snap spring in a position for movement outwardly from the axis of said rotatable member under the influence of centrifugal force and for moving said snap spring in a direction past dead center away from said contacts above a predetermined speed, said centrifugal operating device being arranged to extend in said lubricant reservoir into lubricant at normal lubricant level for supplying lubricant from said reservoir to said contacts during normal operation of said machine, means including a switch contact closing member operatively engaging said snap spring, and resilient means for biasing said switch contact closing member towards said switch contacts for closing said contacts against the action of said snap spring fingers and said weights below a predetermined speed.

GEORGE T. WRIGHT.