May 14, 1929. A. F. WELCH 1,713,203

CENTRIFUGAL SWITCH

Filed Oct. 5, 1927

Fig. 1.

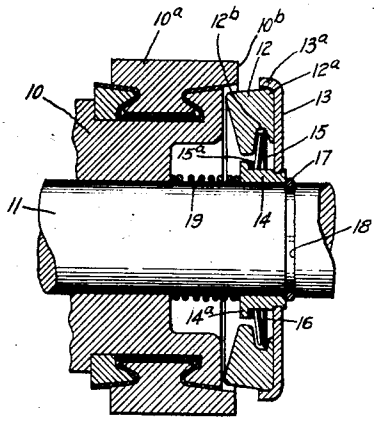


Fig. 2.

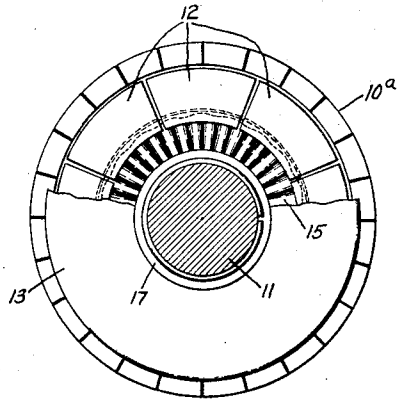


Fig. 3.

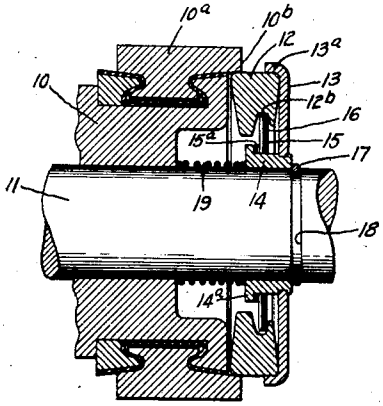


Fig. 4.

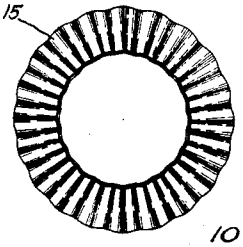


Fig. 5.



Fig. 6.

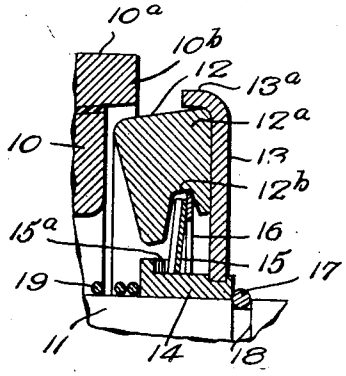
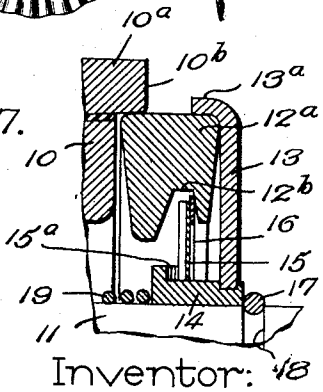


Fig. 7.



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UNITED STATES PATENT OFFICE.

ALFRED F. WELCH, OF FORT WAYNE, INDIANA, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CENTRIFUGAL SWITCH.

Application filed October 5, 1927. Serial No. 224,262.

My invention relates to switches and more particularly to centrifugally actuated switches.

The object of my invention is to provide an improved and simplified centrifugal switch that will open or close the circuit connected thereto with a snap action when it reaches the speed of rotation for which it is adjusted to operate and that will have no tendency to return to its initial position until its speed of rotation has substantially decreased. I obtain these operating characteristics by providing rotatable weights acting on a corrugated spring member of such form that its resistance to the centrifugal force of the weights is decreased as it is deflected thereby from its initial position to control the contacts of the switch.

My invention will be more fully set forth in 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 a part of this specification.

In the drawing, Fig. 1 is a longitudinal section of a commutator short circuiting device embodying my invention; Fig. 2 is an end elevation of the device shown in Fig. 1 partly broken away; Fig. 3 is a view similar to Fig. 1 showing the commutator short circuited; Fig. 4 is an elevation of the corrugated spring member; Fig. 5 is a side elevation of the corrugated spring member shown in Fig. 4; Fig. 6 is an enlarged fragmentary view of the short-circuiting device in the position shown in Fig. 1, and Fig. 7 is an enlarged fragmentary view of the short-circuiting device in the position in which the commutator is short circuited, as shown in Fig. 3.

Referring to the drawing, the centrifugal switch, which I have shown for convenience in illustration, is arranged to short circuit the commutator 10 of a repulsion induction motor. The commutator is secured to a shaft 11 of the motor and includes insulated segments 10^a, the ends of which project beyond the hub of the commutator to form contacts 10^b to engage a suitable short circuiting device. In accordance with my invention the device for short circuiting the commutator comprises a plurality of weights 12 which are supported adjacent the ends of the commutator segments by a plate 13 having a flange 13^a thereon. The flange 13^a engages the edges 12^a of the weights so that they are adapted to be tilted from the position shown in Fig. 1 relative to the plate 13 and brought into engagement with the contacts 10^b of the commutator segments, as shown in Fig. 3. The weights are yieldably retained against the plate 13 and out of engagement with the commutator segments, as shown in Fig. 1, by a corrugated concave annular spring member 15. The spring member is supported on a collar 14 with its inner periphery abutting rings 15^a retained against the flange 14^a of the collar 14 and its outer periphery extending into notches 12^b formed in the weights 12 in engagement with a bearing ring 16. The concave face of the spring member is directed toward the plate 13 so that it can be deflected by the centrifugal force of the weights to decrease the concavity of the surface with a snap action. When the concavity of the spring member 15 is decreased by flexing it from the concave configuration shown in Figs. 1 and 6 toward the flattened configuration shown in Figs. 2 and 7, the movement takes place with a snap action because the initial resistance of the spring member to the force exerted by the weights is a maximum, and decreases as the spring member is flattened. The resistance of the spring member decreases in this manner because as the spring member is flattened the deformation and peripheral elongation thereof becomes less in proportion to the movement of the outer periphery axially of the shaft. By inserting or removing some of the rings 15^a the tension spring member 15 can be varied to change the speed at which the centrifugal device short circuits the commutator. I have found that by providing the spring member 15 with radial corrugations that its resistance to breaking under continually repeated flexure decreasing its concavity is greatly increased so that it is very seldom necessary to replace the same. Flexing a concave plate so as to flatten it subjects the outer periphery to tension and elongation which in a flat plate is resisted by a direct tensional stress in the plate. Radially corrugating such a plate decreases the elongation in the periphery of the plate because the tension is resisted by bending in the corrugations of the plate which tends to flatten them. For this reason ra-

dially corrugating the plate decreases the tensional stress and elongation in its periphery so that it withstands repeated flexure for a much longer period than a plate having a smooth concave surface. Although it is preferred to use a radially corrugated plate in the present embodiment of my invention other forms of corrugated plates may be used. A ring 17 is arranged in the groove 18 in the shaft 11 against the action of a spring 19 in such position that the weights of the short circuiting device can be tilted into engagement with the commutator segments to short circuit the commutator.

In operation of the motor the commutator and the short circuiting device are rotated by the shaft 11 and the centrifugal force of the weights 12 tilts them about their edges 12^a until the weights are brought into engagement with the contacts 10^b of the commutator segments and short circuits the commutator. This movement of the weights under the action of centrifugal force is resisted by the concave spring member 15. The resistance of the spring member to the movement of the weights 12 decreases as its concavity decreases so that initially the spring member offers its maximum resistance to the movement of the weights. However, when the centrifugal force of the weights becomes great enough to flex the spring member from the position shown in Figs. 1 and 6 toward the position shown in Figs. 3 and 7 its concavity will be decreased until it is substantially flat and consequently its resistance to the centrifugal force of the weights will be decreased also, so that when the short circuiting device reaches a speed such that the weights 12 will flex the spring member 15 it will move with a snap action into the position shown in Fig. 3 with the weights 12 in engagement with the contacts 10^b of the commutator segments and short circuit the commutator. Moreover, as the resistance of the spring member 15 has been substantially decreased by flexing it to the position shown in Fig. 3 there will be no tendency for the weights 12 to return to their initial position until there has been a substantial decrease in the speed of rotation of the short circuiting device.

Although in the present instance my invention is embodied in a centrifugal short circuiting device for a commutator, it is apparent that it is applicable as well to a centrifugal switch of any other form. I desire to be understood, therefore, that my invention is not limited to the particular embodiment shown and described 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 comprising a rotatable element and contacts, a corrugated spring member having a concave surface so that it is adapted to be flexed with a snap action to decrease the concavity of said surface, and means actuated by centrifugal force produced by rotation of said element for flexing said spring member and controlling the circuit between said contacts.

2. A centrifugal switch comprising a rotatable element and contacts, a corrugated annular spring member having a concave surface so that it is adapted to be flexed with a snap action to decrease the concavity of said surface and means actuated by centrifugal force produced by rotation of said element for flexing said spring member and controlling the circuit between said contacts.

3. A centrifugal switch comprising a rotatable element and contacts, an annular spring member having radially extending corrugations and a concave surface so that it is adapted to be flexed with a snap action to decrease the concavity of said surface, and means actuated by centrifugal force produced by rotation of said element for flexing said spring member and controlling the circuit between said contacts.

4. A centrifugal switch comprising a rotatable element and contacts, a corrugated annular spring member having a concave surface so that it is adapted to be flexed with a snap action to decrease the concavity of said surface, means for supporting said annular member including a rotatable element engaging its inner periphery, and means actuated by centrifugal force produced by rotation of said element for flexing said annular member about its support and controlling the circuit between said contacts.

5. A centrifugal switch comprising a rotatable element and contacts, a corrugated annular spring member having a concave surface so that it is adapted to be flexed with a snap action to decrease the concavity of said surface, means for securing said annular member to said rotatable element, and means actuated by centrifugal force produced by rotation of said element for flexing said annular member about its support and controlling the circuit between said contacts including weights arranged about the periphery of said member.

6. A centrifugal switch comprising a rotatable element and contacts, an annular spring member having a concave surface so that it is adapted to be flexed with a snap action to decrease the concavity of said surface, means for supporting the inner periphery of said annular member, a plurality of weights arranged about the periphery of said annular member in engagement therewith, and means for controlling the circuit between said contacts including means for movably supporting said weights so that upon rotation of said element the centrifugal

force of said weights will flex said annular member with a snap action and control the circuit between said contacts.

7. In combination with a commutator, an annular spring member having a concave surface so that it is adapted to be flexed with a snap action to decrease the concavity of said surface, a plurality of weights arranged about the periphery of said annular member in engagement therewith and spaced from the segments of said commutator, and means for movably supporting said weights so that upon rotation of said element the centrifugal force of said weights will flex said annular member with a snap action and bring said weights into engagement with the segments of said commutator for short circuiting the same.

In witness whereof, I have hereunto set my hand this 1st day of October, 1927.

ALFRED F. WELCH.