Jan. 8, 1929.

1,698,322

O. STÖBE

CENTRIFUGAL DEVICE

Filed Oct. 10, 1925

Fig. 1.

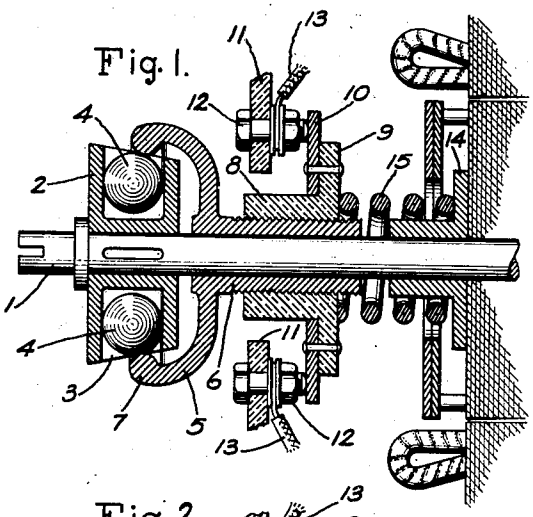


Fig. 2.

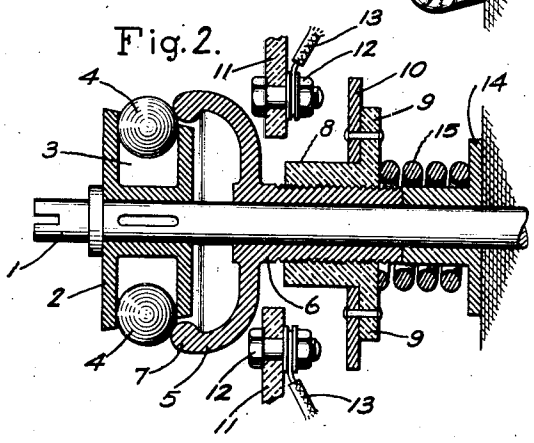


Fig. 3.

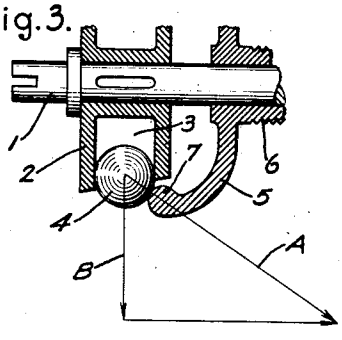
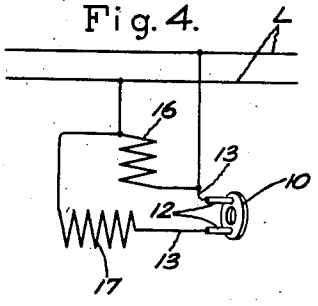


Fig. 4.



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UNITED STATES PATENT OFFICE.

OTTO STÖBE, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CENTRIFUGAL DEVICE.

Application filed October 10, 1925, Serial No. 61,812, and in Germany October 30, 1924.

My invention relates to dynamo-electric machines, and particularly to the construction of a circuit controlling centrifugal device which rotates with the rotor of the machine. An object of my invention is the provision of an improved device of this nature which shall be simple in construction, positive in operation, durable, and economical of manufacture.

My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing Fig. 1 is a cross-sectional view of a portion of a dynamo-electric and a centrifugal device embodying my invention attached thereto, the parts being in a position of rest; Fig. 2 is a similar view with the parts of the centrifugal device in the position assumed at full speed; Fig. 3 is a detail including a force diagram; and Fig. 4 is a circuit diagram illustrating one application of my invention.

For the purpose of illustrating my invention I have shown it applied to an induction motor of the type having a starting winding which is open-circuited when the motor reaches a predetermined speed. The rotor shaft 1 has secured thereto by suitable means such as a key, a circular guide member or cage 2 having on its periphery a series of radial openings 3 and in each opening is a ball 4. Slidably mounted on the shaft is the cup-shaped member 5 having a sleeve portion 6 which is exteriorly screw threaded. The lip portion 7 of member 5 is undercut and has a convex edge to provide a suitable bearing face for engaging the balls 4. The nut 8, shown as of insulating material, is threaded on the sleeve portion 6 and has a flange 9 to which is secured contact ring 10. Opposite this ring and mounted in stationary support 11, also shown as of insulating material, are the contacts 12 to which are attached the wires 13. Between the flange sleeve 14 which is fixed to the rotor and the nut 8 is the coil spring 15 which resiliently holds the nut and the cup-shaped member 5 in the position illustrated by Fig. 1 when the rotor is at rest. In this position the contact ring 10 rests against the contacts 12, and the lip portion 7 of member 5 is in position to engage the balls when they move outwardly at a point slightly to the right of of the plane of their centers. Adjustment of the at-rest position of the member 5, and hence the speed at which the device may be set to operate is affected by rotation of the nut 8 on the sleeve portion 6. Movement of member 5 under the influence of the centrifugal force of the balls is limited by contact of the sleeve portion 6 and the member 14, the limiting position being shown in Figs. 2 and 3. In this position the balls are unable to escape and the direction of force A between the lip portion 7 and the balls makes an angle with the radial force B of the balls such that when the speed is reduced or the rotor comes to rest the parts will be returned by the spring to the position illustrated by Fig. 1.

An important advantage of my construction is that the separation of ring 10 and contacts 12 takes place with a snap action. This is desirable because it prevents arcing between these parts which would cause them to be burned or pitted and unreliable in operation.

Fig. 1 of the drawings shows the relation of parts when the machine is at rest. If the machine is then started, centrifugal force tends to move the balls 4 radially of the guide member 2 bringing them forcibly against the convex lip 7 of member 5 and forces the latter to the right against the spring 15 thereby breaking contact between 10 and 12. As lip 7 moves to the right the point of contact between balls 4 and lip 7 will move to the right around balls 4 and thereby increase the effective component of centrifugal force which they cause in a direction along the axis of the shaft 1, independently of any further increase in the rotational speed of the machine in which it is employed. This will be readily apparent by a comparison of Fig. 1 showing the switch closed and Fig. 2 showing it open. In Fig. 1, the point of contact between the lip 7 and balls 4 is almost along a radius of member 2 passing through the center of the balls so that the component of the force acting along the axis of the shaft to the right of Fig. 1 is comparatively small. However, in Fig. 2 the point of contact between lip 7 and balls 4 is further to the right and the component

of the centrifugal force acting along shaft 1 caused by the rotation of balls 4 is much greater than in the position shown in Fig. 1. This component of centrifugal force increases in accordance with the movement of lip 7 to the right in respect to member 2 and produces an increased acceleration in the movement of lip 7 which is further augmented by the increase in the speed of rotation of the machine as it approaches normal running speed.

It will be clear from the foregoing that I have produced a centrifugal switch in which the effect of the centrifugal force caused by the rotation of the weights for actuating it, increases rapidly after the initial movement of the parts in a direction to open the switch contacts, thereby producing a snap action from closed to open position, or from open to closed position, independently of any change in the rotational speed of the motor after it has become great enough to cause some movement of the member 5 against the force of spring 15.

In the diagram forming Fig. 4 lines L are shown connected to the main winding 16 of the induction motor, and in shunt to this winding is the starting winding 17, the circuit of which is completed by the contact ring 10 and the contacts 12. When the rotor reaches a predetermined speed the centrifugal device opens the circuit of the starting winding at contacts 10 and 12.

While I have shown the centrifugal device as arranged to control the circuit of a starting winding it is obvious that movement of the nut 9 may be arranged to actuate some mechanical device which it may be desired to have operated in response to a predetermined speed of the rotor.

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

1. In a dynamo electric machine, the combination with a rotor shaft, of a weight eccentrically mounted thereon and movable away from the shaft having a surface presented outwardly from the axis of the shaft which is inclined thereto and varies in inclination from one portion to another, a guide for said weight carried by said shaft having means preventing free movement circumferentially or in either direction longitudinally of the shaft, a member movable relative to the shaft having a convex edge in contact with the surface of said weight adjacent its outermost portion and movable relative thereto, whereby the effect of centrifugal force upon the movement of the member is varied as the weight moves away from the shaft under the action of centrifugal force, and circuit controlling means actuated by said member.

2. In a dynamo electric machine, the combination with a rotor shaft, of a plurality of weights arranged around the axis of the shaft and each having a surface presented outwardly from the axis of the shaft which is inclined relative to the shaft and varies in inclination from one portion to another, a guide having means preventing free movement of said weights circumferentially or in either direction longitudinally of the shaft, said weights being movable outwardly from the shaft, an annular member surrounding said shaft provided with a convex edge contacting with the outwardly presented surfaces of said weights, said member being movable longitudinally of the shaft and relative to the weights thereby varying the component of centrifugal force longitudinally of the shaft caused by the rotation of the weights about the axis of the shaft, stop members for engaging the annular member for limiting its range of movement, and circuit controlling means including one of said stops actuated by said member.

3. In a dynamo electric machine, the combination with a rotor shaft, of a guide member secured to the shaft having a plurality of balls carried thereby, said member having means for restricting the movement of said balls to a direction radially of the shaft, a member surrounding said shaft having a convex edge partially surrounding said balls to restrict their outward movement and arranged to force said member longitudinally of the shaft by centrifugal force thereby shifting the point of contact between said member and said balls and increasing the component of centrifugal force longitudinally of the shaft, and circuit controlling means actuated by said member.

4. In a dynamo electric machine, the combination with a rotor shaft, of a guide member secured thereto, having a plurality of balls carried thereby, said guide member being provided with means restricting the movement of said balls radially of said shaft, a member slidable longitudinally on the rotor shaft having a convex edge partially surrounding said balls and limiting their radial movement, said lip contacting said balls adjacent their outermost portion relative to the axis of the shaft, whereby the component of centrifugal force exerted by the balls longitudinally of the shaft is increased as they move outwardly upon rotation of the rotor shaft, means limiting the movement of said member so that it will partially surround the balls throughout its range of movement and means carried by said member for controlling an electric circuit and means contacting with said member tending to close said circuit.

5. In a dynamo electric machine, the combination of a rotor shaft of a weight eccentrically mounted on said shaft having a curved surface presented outwardly of the shaft, a guide member secured to the shaft provided with means for restricting the

movement of the weight to a fixed path outwardly from the axis of the shaft, a member longitudinally movable along the shaft and relative to said weight having a convex portion contacting the outwardly presented curved surface of said weight, whereby the component of centrifugal force exerted by the weight along the shaft increases as said member moves along the shaft, and means carried by said member for controlling an electric circuit.

In witness whereof, I have hereunto set my hand this 19th day of September, 1925.

OTTO STÖBE.