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CONTROL DEVICE

Calvin J. Werner and Carl H. Kindl, Dayton,
Ohio, assignors to General Motors Corpora-
tion, Detroit, Mich., a corporation of Delaware

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This invention relates to control devices, and more particularly to one operating responsive to the speed of a movable member, such as are used for controlling an electric motor.

An object of the present invention is to provide a control device that is responsive to the speed of a movable member and that minimizes mechanical operating noise.

In the disclosed embodiment of this invention, the control device incorporates a combination operable cooperatively with a movable member or shaft and comprising a magnet, a movable armature having a normal position with respect to the magnet, a speed responsive means effecting a change of the air gap between armature and magnet in response to a change in speed of the rotatable member or shaft, which change in air gap effects movement of the armature with respect to the magnet, and control means actuated by the armature.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred embodiment of one form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a fragmentary sectional view of an electric motor equipped with the present invention. In this view the automatic control device is shown in normal position.

Fig. 2 is a view similar to Fig. 1 showing the control device in operated position.

Fig. 3 is a fragmentary detail view taken in a direction of the arrow of Fig. 1.

Fig. 4 is a view similar to Fig. 3, taken substantially in a direction of the arrow of Fig. 2.

Referring to the drawing, the motor is shown comprising a frame 20, having field windings 21. An end cover 22 is attached to the frame 20 in any suitable manner, said end cover providing a bearing 23 which supports one end of the armature or rotor shaft 24.

A lug 25 is provided on the inner surface of the end cover 22, this lug forming a mounting block for the magnet 26 of the control device. Another lug 27 on the cover 22 comprises a mounting block for stops or terminals of the control device.

Referring to Figs. 3 and 4 in particular, a stationary contact element 28 is shown mounted on the lug 27, insulated therefrom by the member 29. Another stationary contact 30 is insulatingly carried by said lug 27. Contacts 28 and 30 are in alignment and properly spaced so as to have the movable arm 31 carrying contacts 32 and

33 on opposite sides thereof positioned therebetween. The arm 31 which carries contacts 32 and 33 is secured to a resilient blade spring 34, one end of which is shown riveted to the end 35 of the magnet 26. The resilient blade spring 34 has a member 36 attached thereto, which member is of magnetic material and forms the movable armature of the control device. The other end or pole of the magnet 26 is designated by the numeral 40. In the present instance the magnet 26 is shown as a permanent magnet, but it may clearly be understood that this could be an electromagnet having a winding adapted to be brought into the circuit and energized when the circuit to the motor is closed for running purposes.

It will be seen that the air gap between the armature 36 and the opposite pole 40 of the magnet is so great that the magnetic reluctance will render the magnetic force ineffective to move the armature 36 toward the pole end 40 and consequently the blade spring 34 will normally bias to cause contact 32 on arm 31 to engage the stationary contact 28.

In order to move the contact 32 out of engagement with contact 28 it is necessary to introduce a magnetizable element between the armature 36 and the pole end 40 of the magnet so as to reduce the magnetic reluctance and render effective the magnetic force to attract the armature 36. In the present instance applicants have provided a centrifugal governor 50 on the shaft 24 which governor includes a weight member 51 normally biased into the position as shown in Fig. 1 by a spring 52. At a predetermined R. P. M. of the shaft 24 a speed responsive weight 51 will be moved into the position as shown in Fig. 2. In its normal position this speed responsive element or weight 51 is sufficiently out of the magnetic field of the magnet 26 so as not to cause movement of the armature 36. This is clearly shown in Figs. 1 and 3. However, when the magnetizable weight or speed responsive element 51 of the governor 50 is moved into the position as shown in Figs. 2 and 4, said element enters into the magnetic field of the magnet 26, reducing the magnetic reluctance by closing the air gap between the armature 36 and the pole end 40 of the magnet so that the magnetic force may attract the armature 36 by flexing spring blade 34, moving it into the position as shown in Fig. 4, in which position contact 32 is out of engagement with contact 28, and contact 33 is in engagement with the stationary contact 30.

In the present drawing, the control device

when in normal position permits certain contacts to engage while, when moved into the active or operated position, in response to speed in this instance, these certain contact engagements are broken and others are made. It may clearly come within the realm of the present invention where, instead of breaking one contact and closing another one, the movable contact member is merely moved from normal stop engaging position into the active contact making position, or in another instance at a predetermined speed a circuit may be broken by moving the movable contact out of engagement with a live terminal into a position in which it merely engages a stop. These are modifications which are merely obvious and entail no invention.

From the foregoing it may clearly be seen that applicants have provided a control device adapted to be actuated in response to the movement of a speed responsive element without noisy operation, for no actual mechanical contacts are made to move the control device, this being done magnetically. The only actual contact made by moving parts is that made by the moving control element, in this instance the movable contact engaging either terminals or stops.

From the foregoing description of the construction and mode of operation of this control device, it will be clearly understood that the device chiefly includes a rotatable member 24; control means 28, 30, 31, 32 and 33; a magnet 26 and an armature 36, at least one of which (armature 36 as disclosed) is movable in response to magnetic force between them to actuate the control means 28, 30, 31, 32 and 33; and means 51 and 52 comprehending a spring 52 having one end connected to the rotatable member 24 for controlling the reluctance of the magnetic path between the armature 36 and magnet 26 in response to the speed of the rotatable member 24.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A control device comprising, in combination, a rotating member; a magnet; a hinged, polar extension for said magnet; speed responsive means driven by the rotatable member and movable between the polar extension and the other pole of the magnet to reduce the magnetic reluctance therebetween for effecting movement of the polar extension; and a control device actuated by said polar extension.

2. A control device comprising, in combination, a magnet; a blade spring attached at one end to one of the ends of the magnet; a contact carried by said blade spring; a stationary contact adapted to be engaged by said contact; a magnetizable member carried by the blade spring, said member forming an extension for the one pole of the magnet; and means adapted to be moved into the air gap between the magnetizable member and the opposite pole of the magnet, for reducing the magnetic reluctance therebetween and effecting movement of the contact carrying blade spring relatively to the stationary contact.

3. A control device comprising, in combination, a magnet; a blade spring attached at one end

to one of the ends of the magnet; a contact carried by said blade spring; a stationary contact adapted to be engaged by said contact; a magnetizable member carried by the blade spring, said member forming an extension for the one pole of the magnet; and a centrifugal governor having a magnetizable member adapted, in response to centrifugal force, to be moved into the air gap between the magnetizable member and the opposite pole of the magnet, for reducing the magnetic reluctance therebetween and effecting movement of the contact carrying blade spring relatively to the stationary contact.

4. A control device comprising, in combination, a magnet; a flexible, non-magnetic member attached at one end to the one end of the magnet; a magnetizable element carried by the flexible member; a control device having a stationary and a movable part, the movable part being connected to the flexible member; and a governor having a magnetizable weight adapted, at a predetermined speed, to move into the air gap between the magnetizable element on the flexible member and the opposite pole of the magnet for reducing the magnetic reluctance therebetween and rendering the magnetic force effective to actuate the movable part of the control device.

5. A control device responsive to speed comprising, in combination, a rotatable member; a magnet; a movable armature having a normal position with respect to the magnet; means comprehending a resilient member effecting control of the air gap between the armature and magnet below a predetermined speed of the rotatable member and in response to changes of speed of the rotatable member; and control means actuated in response to the change in air gap corresponding to a speed above said predetermined speed.

6. A control device responsive to rotary speed comprising, in combination, a rotatable member; control means; a magnet and an armature, at least one of which is movable in response to the magnetic force between them to actuate the control means; and means comprehending a spring having one end connected to the rotatable member for controlling the reluctance of the magnetic path between the armature and magnet in response to the speed of the rotatable member.

7. A control device for a motor having a shaft comprising, in combination, a stationary magnet; a resiliently mounted armature having a normal position with respect to the magnet; a magnetic member pivotally mounted on the shaft and normally biased away from the armature and magnet, said magnetic member being movable toward the magnet and armature under the influence of centrifugal force when the shaft rotates to effectively reduce the reluctance of the magnetic path between the armature and magnet and effect movement of the armature.

8. A control device for a motor having a frame and a shaft comprising, in combination, a resiliently biased member secured to the frame, a second member pivotally secured to the shaft and rotatable therewith, and magnetic means, said second member being movable responsive to centrifugal force to effect movement of the resiliently biased member with respect to the magnetic means.

CALVIN J. WERNER.
CARL H. KINDL.