April 8, 1930. A. S. FITZ GERALD 1,754,154

ELECTRORESPONSIVE DEVICE

Filed Oct. 3, 1928

Fig. 1.

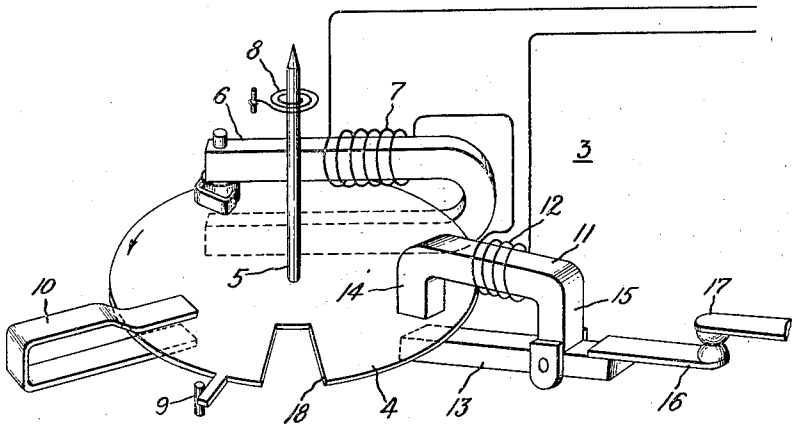
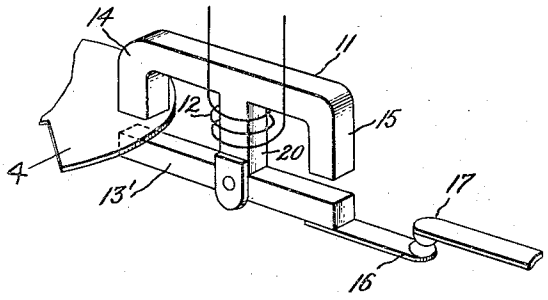


Fig. 2.



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UNITED STATES PATENT OFFICE

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ELECTRORESPONSIVE DEVICE

Application filed October 3, 1928. Serial No. 310,055.

My invention relates to improvements in electro-responsive devices such as relays, especially to relays of the induction disc type, and has for an object the provision of an improved circuit controlling mechanism for use in cooperation with such relays.

Relays of the induction disc type are employed to initiate the operation of protective apparatus such as circuit breakers by interrupting or completing the control circuits thereof. It has hitherto been common to attach an arm to the shaft upon which the disc is mounted, such arm engaging contacts upon a predetermined movement of the disc thereby closing an electric circuit. In certain cases, however, it is desirable to have a circuit opening action of the contacts. This action should be quickly performed to avoid burning the contacts and consequently independent of the speed of the movable member and the force available to move it.

In accordance with my invention an improved circuit controlling mechanism is provided which overcomes the above mentioned disadvantage without imposing an undesirable load upon the relay, and whose operation depends upon a predetermined movement of the movable member of the relay.

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

In the accompanying drawing Fig. 1 illustrates in perspective a relay embodying my invention and Fig. 2 is a part perspective view of a modification of my invention.

Fig. 1 shows a conventional induction relay 3 including a disc 4 made of a substantially non-magnetic but current-conductive material such as copper or aluminum, mounted on a shaft 5. The disc 4 is rotated in the direction of the arrow marked thereon by a shaded pole electromagnet 6, when energized by an alternating current in a coil 7. The disc 4 is moved against the bias of a spring 8 which normally holds the disc in position against a stop 9. For delaying the movement of the disc 4 a drag magnet 10 may be provided.

In accordance with my invention I provide means, such as a U-shaped magnet 11 energized by a coil 12 which may be in series with the coil 7, for actuating a movable contact controlling member such as the armature 13 on a predetermined movement of the disc 4. The magnet 11 is positioned to have its leg 14 spaced on one side of the disc 4 and the armature 13, which is pivoted on the second leg 15, extending under the leg 14 on the other side of the disc. Sufficient space is left between the armature and the leg 14 to permit free movement of the disc 4 therebetween. A contact 16 is attached to the other end of the armature 3 and cooperates with a contact 17 to control a circuit which is not shown.

In order to cause a quick movement of the armature so as to obtain a snap action at the contacts 16 and 17, I provide in accordance with my invention an opening such as a notch 18 cut into the periphery of the disc 4 and of a size sufficient to permit the passage of the armature 13 therethrough into engagement with the leg 14.

When the disc 4 is in its normal position against the stop 9, the disc 4 in effect increases the reluctance of the magnetic circuit of 11 and 13 and permits the armature 13 to assume by action of gravity, or a spring if desired, the position illustrated in Fig. 1 in which the contacts 16 and 17 are closed. Upon movement of the disc 4 however, the notch 18 is rotated to a position above the armature 13 whereby the reluctance of the magnetic circuit is reduced, the armature 13 attracted by magnet 11 and the contacts 16 and 17 quickly separated. It is to be noted that this operation is dependent only on the position of the disc 4 so that the time of movement thereof and the force available for movement do not effect the contact operation.

It will of course be obvious to those skilled in the art that the coils 7 and 12 may be connected to be energized in accordance with the current in a circuit to be protected in any suitable manner.

While I have illustrated my invention as applied to an induction type of over current relay, it obviously is not so limited but may

be applied to relays operative in response to other abnormal circuit conditions.

Fig. 2 illustrates a modification of the circuit-breaking mechanism in that the magnet 11 is provided with a third leg 20 located between the legs 14 and 15. The armature 13′ is pivoted at its center on leg 20 upon which coil 12 is wound. The magnetic circuit therefore divides itself into two parallel paths through the legs 14 and 15. When the disc 4 is interposed between leg 14 and the armature 13′, the magnetic reluctance in the path between leg 14 and the armature is so great that the armature will be drawn toward leg 15 which will positively hold the armature and therefore the contact 16, against contact 17. The legs 14 and 15 may be so proportioned that leg 15 will be saturated by a current in coil 12 which is smaller than that required to rotate the disc 4, and that leg 14 will not become saturated at any current flowing in this coil prior to the operation of the protective apparatus. The leg 14 may then exert a pull on armature 13′ large enough to hold the contact 16 in engagement with the contact 17 under normal conditions and leg 14 may, upon an increase of current in this coil, exert a sufficiently greater pull when the notch 18 is above armature 13′, to overcome the pull of leg 15 and quickly to separate the contacts 16 and 17.

The embodiment of the invention illustrated and described herein has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of being modified to meet the different conditions encountered in its use and I therefore aim to cover by the appended claims all modifications within the true 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 relay including a rotatable disc, a circuit interrupting mechanism including an electromagnet and an armature placed on opposite sides of said disc, means for actuating said armature to a position adjacent said magnet upon a predetermined rotation of said disc, and contacts arranged to be actuated when said armature moves to said position.

2. A relay including a rotatable disc, an electric circuit controlling mechanism including cooperating contacts and a magnet having an armature arranged to control said contacts when actuated by said magnet, and means for actuating said armature upon a predetermined rotation of said disc.

3. A relay including a disc and means for rotating said disc, an electromagnet provided with an armature, said magnet and armature being arranged to have said disc project between them and thereby increase the reluctance of the magnetic circuit of said magnet and armature, an opening in said disc which registers with the cooperating poles of the armature and its magnet to permit the attraction of the armature by said magnet after a predetermined movement of the disc, and contacts arranged to be actuated when said armature is attracted.

4. A relay including a rotatable disc, a circuit interrupting mechanism, and actuating means therefor, including an electromagnet and an armature arranged to provide two parallel magnetic circuits, means for positioning said armature in accordance with the flux distribution in said magnetic circuits dependent on the position of said disc.

5. A relay including a rotatable disc, a circuit interrupting mechanism including an electromagnet and an armature placed on opposite sides of said disc and means for actuating said armature upon a predetermined rotation of said disc.

6. A relay including a movable non-magnetic electric current conducting member, an electric circuit controlling mechanism including cooperating contacts and a magnet having an armature arranged to control said contacts when actuated by said magnet, and means for actuating said armature upon a predetermined movement of said member.

7. A relay including a movable member, circuit controlling mechanism, and actuating means therefor including an electromagnet and an armature arranged to provide two parallel magnetic circuits, and means for positioning said armature in accordance with the flux distribution in said magnetic circuits, said movable member being arranged to control said flux distribution in accordance with its position.

8. A relay including a disc and a circuit controlling mechanism including an E-shaped magnet having an armature pivoted on the center leg thereof, said magnet being positioned to have the disc project between the armature and one of the outer legs of the magnet, a coil wound on the center leg to produce flux through the legs of said magnet whereby said armature is attracted by the outer leg remote from the disc to actuate said mechanism to one position, a notch in said disc arranged to register with the armature when the relay is energized by a predetermined current for a predetermined time to permit the leg adjacent the disc to attract the armature and thereby to actuate said mechanism to another position.

In witness whereof, I have hereunto set my hand this 2nd day of October, 1928.

ALAN S. FITZ GERALD.