J. R. CRAIGHEAD.

ELECTRICAL APPARATUS.

APPLICATION FILED SEPT. 20, 1916.

1,325,235. Patented Dec. 16, 1919.

Fig. 1.

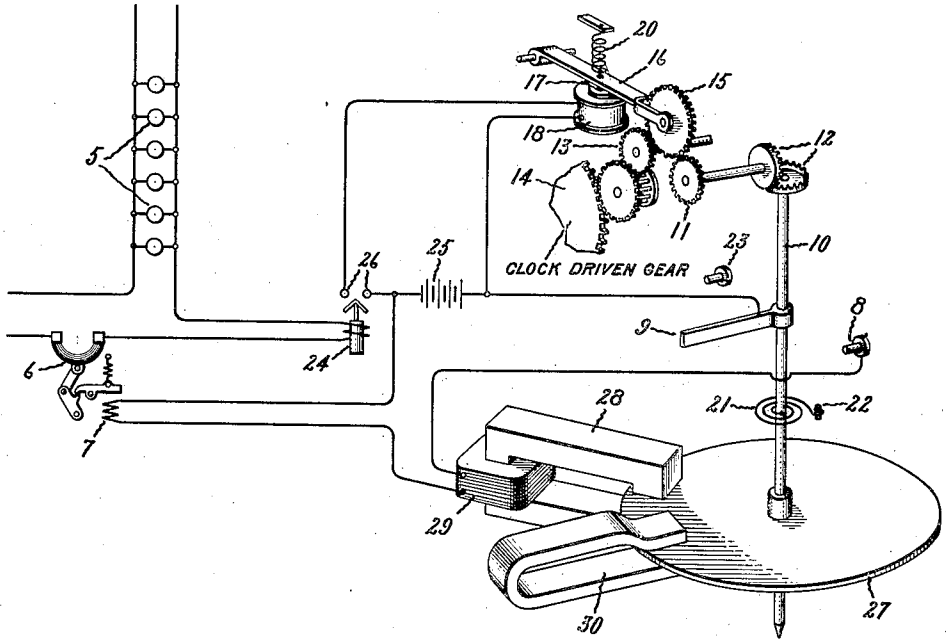


Fig. 2.

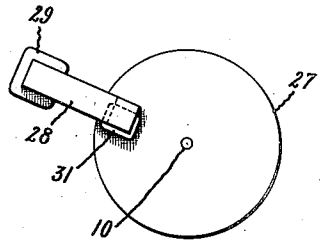
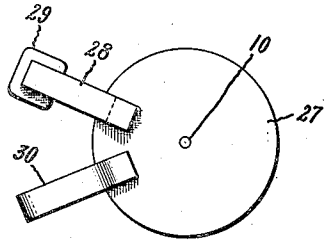


Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES R. CRAIGHEAD, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRICAL APPARATUS.

1,325,235. Specification of Letters Patent. Patented Dec. 16, 1919.

Application filed September 20, 1916. Serial No. 121,335.

To all whom it may concern:

Be it known that I, JAMES R. CRAIGHEAD, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Electrical Apparatus, of which the following is a specification.

My invention relates to electrical apparatus, and particularly to apparatus for electrically imparting an impulse to a movable member, such, for example, as apparatus for imparting an impulse to a movable contact for accentuating the engagement of two relatively movable contacts.

The object of the invention is to provide an improved apparatus for electrically imparting an impulse to a movable member. More particularly, the object of the invention is to provide an improved contact accentuating device. Other objects of the invention will be brought out hereinafter.

The novel features of the invention which I believe to be patentable are definitely pointed out in the appended claims. The invention itself and the construction and mode of operation of an apparatus embodying the invention will be best understood from the following description taken in conjunction with the accompanying drawing, in which:

Figure 1 is a diagrammatic view partly in perspective of a circuit interrupter embodying the invention; and Figs. 2 and 3 are explanatory detail views.

In Fig. 1 of the drawing, I have diagrammatically represented an electrical installation 5, in whose circuit is arranged a circuit breaker or interrupter 6. The circuit breaker is of the well known electromagnetic type having a trip coil 7. The trip coil is designed to be energized by the engagement of two relatively movable contacts 8 and 9, whose relative movement is effected by a time relay.

The contact 8 is fixed, while the contact 9 is secured to a pivotally mounted shaft 10. For the purposes of explanation, I will assume that the shaft 10 is to be driven at a uniform speed upon the occurrence of a predetermined overload in the installation 5, but it will, of course, be understood that the shaft 10 might equally well be driven at any desired speed as, for example, at a speed proportional to the overload. Thus, I have shown a gear 11 operatively connected to the shaft 10 through crown gearing 12, and a gear 13 operatively connected to a clock-driven gear 14. The gear 14 may be driven by a clock, as suggested, or by any other suitable constant speed driving mechanism, such, for example, as a constant speed electric motor. The gears 11 and 13 are designed to be operatively connected together by means of a movable gear 15. The gear 15 is carried at the end of a pivoted arm 16 and is normally held out of engagement with the gears 11 and 13 by means of a spring 20. The armature 17 of an electromagnet 18 is secured to the arm 16, and when the electromagnet is energized the armature 17 and arm 16 are drawn down until the gear 15 meshes with the two gears 11 and 13. The shaft 10 is then driven by the clock-driven gear 14 at constant speed, and the movable contact 9 moves toward its coöperating fixed contact 8.

A spiral spring 21 secured at one end to the shaft 10 and at its other end to a fixed pin 22 normally operates to hold the shaft 10 and contact 9 in their initial positions, determined by the engagement of the contact 9 with a fixed stop 23. A current responsive relay 24 is included in series with the installation 5, and operates to complete the circuit of the electromagnet 18 upon the occurrence of a predetermined overload in the installation. Thus, upon the occurrence of the predetermined overload at which it is desired that the contact 9 should start to move toward contact 8, the electromagnet 18 is energized from any suitable source, such as a battery 25, by the bridging of the contacts 26. The gear 15 is thereupon drawn into engagement with the gears 13 and 11, and the contact 9 moves at a uniform speed toward the contact 8. Upon the engagement of these contacts 8 and 9, the improved contact accentuating device of my present invention gives an impulse to the movable contact 9, thereby insuring a firm engagement of the contacts.

My improved contact accentuating device is broadly an electric motor element which operates upon a change in the value of the current flow in the current carrying coil thereof. In Figs. 1 and 3, the contact accentuator consists of a disk armature 27, of suitable conducting material, such, for example, as aluminum, copper, or the like,

secured to the shaft 10 and arranged to rotate in the air gap of a magnetic core 28. A current carrying coil 29 is mounted on the core 28 and is electrically connected in series relation with the trip coil 7 and the contacts 8 and 9. A permanent magnet 30 has its poles arranged on opposite sides of the disk armature 27, and is so positioned with respect to the poles of the magnetic core 28, that a large portion of any eddy currents set up in the armature 27 by a change in the current flowing in the coil 29 cuts the flux of the magnet 30 at right angles.

The operation of the contact accentuating device is as follows:—When the movable contact 9 just engages the stationary contact 8, the circuit including the trip coil 7 and coil 29 is completed through the battery 25. The current flowing in this circuit increases from zero to a constant value, determined by the circuit resistance and impressed voltage. During this increase in the value of the current flow in this circuit, there is a corresponding increase in the flux across the poles of the magnetic core 28, and this increase in flux sets up eddy currents in the disk armature 27. These eddy currents cooperate with the flux of the magnet 30 to produce a motor action, resulting in a slight impulse to the armature, which operates to accentuate the engagement of the contacts 8 and 9. In other words, the device is so designed that an increase in the flux resulting from the coil 29 tends to move the contact 9 toward the contact 8.

The contact accentuating device of my present invention merely imparts an impulse to the coöperating contacts at the instant of their engagement, and then ceases to exert any influence as long as the contacts remain engaged. This is because the motor action of the device depends upon a change in the value of the current flow in the coil 29, and it is only while the value of the current flow in this coil is undergoing a change, that eddy currents are induced in the armature 27. It will be apparent, however, that when the contacts 8 and 9 disengage the value of the current flow in the coil 29 decreases to zero, and the resulting decrease in the flux across the poles of the magnetic core 28 produces eddy currents which react with the flux of the permanent magnet 30 to produce an impulse tending to separate the contacts. Thus, the improved contact accentuator not only operates to secure a better engagement of the contacts, but also insures a quick break of the contacts.

The permanent magnet 30 can be dispensed with by mounting a short-circuiting coil 31 on a portion of the pole face of the magnetic core 28, as illustrated in Fig. 2 of the drawing. The short-circuited coil forms in effect a shaded-pole induction motor element, and a shifting magnetic field is produced by a change in the value of the current flow in the coil 29. This shifting magnetic field only occurs during the change in the current flowing in the coil 29, and hence an impulse is imparted to the contact 9 upon the engagement of this contact with the fixed contact 8, as well as upon the disengagement of these contacts.

From the foregoing description it will be seen that my improved impulse imparting device operates only at the instants that impulses are advantageous. As soon as the need for the impulse is over, the agencies causing the impulse cease to operate, and hence no continuing force is present. In addition to giving an impulse for accentuating the engagement of the contacts, the device also gives an impulse for separating the contacts. While I have described the device in combination with a time relay and circuit interrupter, it will, of course, be understood that the device may be embodied in any apparatus where relatively movable cooperating contacts are used. The coil 29 may also be included in a separate circuit controlled by the relatively movable contacts, instead of being included in the same circuit as the main actuating device, such as the tripping coil 7. Many other applications of my invention besides that specifically mentioned herein as well as many modifications in the particular embodiment of the invention herein illustrated and described will be apparent to those skilled in the art. I wish to cover, therefore, in the appended claims all applications and modifications of the invention within its generic spirit and scope.

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

1. The combination with relatively movable coöperating electric contacts of means for immediately accentuating the engagement of said contacts comprising a rotatable disk armature of conducting material operatively connected to one of said contacts, electromagnetic means operatively related to said armature, and means including said contacts and said electromagnetic means for imparting to said armature upon the engagement of said contacts a momentary impulse only tending to move the contacts into better engagement.

2. The combination with relatively movable coöperating electric contacts of means for immediately accentuating the engagement of said contacts comprising a rotatable disk armature of conducting material, electromagnetic means including a current carrying coil operatively related to said armature, means coöperating with said electromagnetic means for imparting an impulse to said armature upon a change in the value of the current flow in said coil, and

means for causing a change in the value of the current flow in said coil upon the engagement of said contacts whereby a momentary impulse only is imparted to said armature tending to move the contacts into better engagement.

3. The combination with relatively movable coöperating electric contacts of means for accentuating the engagement of said contacts comprising a disk armature of conducting material, electromagnetic means including a current carrying coil operatively related to said armature, means coöperating with said electromagnetic means for imparting to said armature an impulse tending to move said contacts toward each other when the value of the current flow in said coil changes in one direction and away from each other when the value of the current flow in said coil changes in the other direction, and means for causing the value of the current flow in said coil to change in the one direction when said contacts engage and in the other direction when said contacts disengage.

4. The combination with relatively movable coöperating electric contacts of means for immediately accentuating the engagement of said contacts comprising an electric motor element having a current carrying coil and operatively connected to one of said contacts so as to impart a momentary impulse only to this contact tending to move the contact toward the other contact upon a predetermined change in the value of the current flow in said coil, and means whereby the engagement of said contacts effects such predetermined change in the current flow in said coil.

5. The combination with a movable member of means for imparting a momentary impulse only to said member comprising a rotatable disk armature of conducting material operatively related to the member, electromagnetic means including a current carrying coil operatively related to said armature, and means whereby the value of the current flow in said coil is changed thereby producing a motor action between said electromagnetic means and said armature when it is desired to impart the momentary impulse to said member.

6. The combination with a movable member of means for imparting a momentary impulse only to said member comprising an electric motor element having a current carrying coil and a rotatable armature operatively connected to said member, and means whereby the value of the current flow in said coil is changed thereby producing a motor action of said element when it is desired to impart the impulse to said member.

7. The combination with a movable member of means for imparting an impulse to said member comprising an element of conducting material operatively connected to said member, means for causing a flow of current in said element at the instant it is desired to impart the impulse to said member, and means whereby the current flowing in said element is caused to react with a magnetic flux thereby producing a motor action which imparts the desired impulse to said member.

8. The combination with relatively movable coöperating electric contacts of means for accentuating the engagement of said contacts comprising a disk armature of conducting material, means for setting up eddy currents in said disk when said contacts engage, and means for setting up a magnetic flux and including said last mentioned means whereby the eddy currents flowing in said disk react with the magnetic flux thereby producing a motor action which accentuates the engagement of said contacts.

In witness whereof, I have hereunto set my hand this 19th day of Sept., 1916.

JAMES R. CRAIGHEAD.