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W. HERDEN

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HIGH SPEED CIRCUIT INTERRUPTER

Filed Jan. 18, 1930

Fig. 1

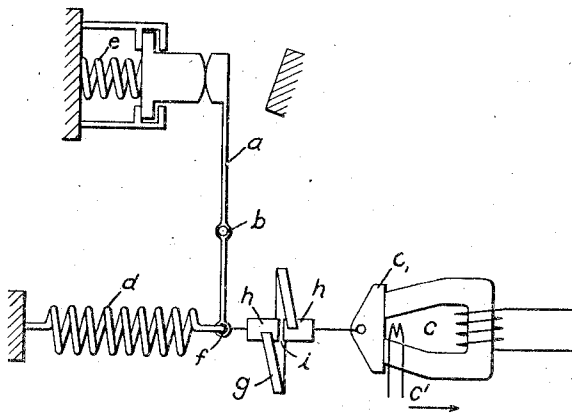
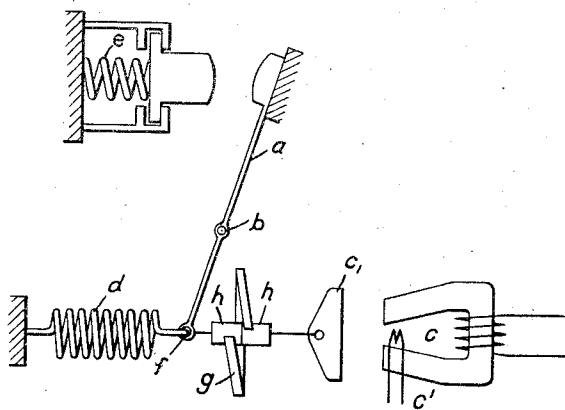


Fig. 2



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UNITED STATES PATENT OFFICE

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HIGH SPEED CIRCUIT INTERRUPTER

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My invention relates to circuit controlling devices and has for its principal object to increase the operating speed thereof.

In the case of large switches for heavy duty circuits, relatively great masses must be moved rapidly. This is especially true with quick acting circuit interrupters, of the type shown in the Trittle Reissue Patent No. 15,441. The acceleration of the switch parts of such a circuit interrupter takes place by means of strong springs, which, after a sufficient weakening of a magnetic holding force in response to predetermined conditions such as overload, rapidly move the switch parts into the disconnected position. Now the quicker this has to take place, the stronger and larger must the holding magnet be. Together with this spring return force, the holding magnet, however, must balance another force, which occurs through the pressing together of the contacts, the so-called contact pressure.

One of the special objects of the invention is an impact arrangement which enables both the spring tension and the contact pressure to be used as a power accumulator, which is employed for the acceleration of the movable switch parts. According to the invention, this is effected by interposing between a mass such as the armature of the electromagnet which holds the switch in the connected position and the switch parts to be accelerated, an elastic member which is arranged to produce an impact and thereby an increased accelerating effect.

A constructional example of the invention is represented diagrammatically in the drawings. Fig. 1 shows the power accumulator in the loaded condition with the switch closed. Fig. 2 shows it in the unloaded condition with the switch open.

The switch lever a which is the member to be operated quickly is arranged so as to be rotatable about the point b . The switch is maintained in the closed position under normal load conditions by means of the holding force of the magnet c exerted on the armature c_1 which has considerable mass, in opposition to which the force of spring d and the pressure force of contact spring e

act to bias the switch to the open position. Between the point of engagement f of the spring d and the point of engagement of the armature mass c_1 of the holding magnet with the switch lever a the power accumulator spring g with the impact members h are located. The manner of working of the arrangement is as follows:

In the closed position of the switch as shown in Fig. 1 a condition of equilibrium prevails in the lever system. Thus the sum of the torques acting about the point b is zero, and the switch lever a remains at rest. In this condition, the tension force of spring g must counterbalance the torque of the holding magnet, as well as the contact pressure and the impact members h are drawn a distance apart i due to tensioning the spring g .

Assuming that the closing movement of the switch is effected by moving the excited magnet c in the direction of the arrow, the magnet must be moved further by the amount of the gap i between the impact members h than would have been the case if the spring g had not been used. The work accomplished in this case, namely, the product of the force exerted on the magnet c and the distance i is accumulated in the system. When the spring d becomes free to effect the cutting-out movement the accumulated power is again made serviceable. Thus when the holding force of the magnet c is reduced in response to predetermined overload conditions by the releasing winding c' , a resulting unbalance of the moments acting on switch lever a occurs. At first the spring g acts to accelerate the armature mass c_1 of the holding magnet. This results in the gap i becoming smaller. During the shortening of gap i the arm a and the point f remain substantially at rest due to the force required to accelerate the armature mass c_1 until the counterclockwise turning moment due to spring g becomes smaller than the clockwise turning moment due to the spring forces e and d . As soon as unbalance occurs, however, the point f also commences to move. Thereby the disconnecting movement of the switch lever a

is started, which as long as a gap exists between the impact members h is effected with an acceleration which corresponds to the difference of the clockwise and counter-clockwise turning moments.

At the moment when the impact members come together, that is when the gap z disappears, the momentum already acquired by the armature mass of the magnet is immediately transmitted to the remaining movable members of the system, and the further movement of the switch lever a therefore takes place with the full effect of the clockwise moments of spring d and the additional impact force of the magnet armature. With correct adjustment of the individual masses, forces and paths in this arrangement a considerably more rapid separation of the contacts will be obtained than would be the case with the biasing spring d acting alone. If time distance curves of the switch arm movement are plotted first without the springs g acting and secondly with the springs g acting and the two curves are compared with one another, it will be found that the second curve shows a slower initial movement, but that after an exceptionally short time the two curves cut one another and for a path such as in practice is necessary for the starting and the blowing-out of the arc between the switch contacts quite a considerable saving in time is affected.

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

1. In combination, a movable switch member, a spring biasing the member to move in one direction, a relatively movable mass mounted for movement into impact with the switch member, a second spring connected between the member and said relatively movable mass for holding the member against movement by the first spring, and means for releasing the mass to be operated by said second spring into impact with the switch member and thereby accelerate the movement of the member by the first spring.

2. In combination, a switch member movable between two circuit controlling positions, means for biasing the member to one position, a relatively movable mass resiliently connected with said member, and an electroresponsive device having means for holding the mass with said resilient connection under strain to maintain the member in the other position under certain predetermined conditions and for releasing the mass under other predetermined conditions to accelerate the movement of the circuit controlling member from said other position in accordance with its bias.

3. In combination, separable contacts, an operating member therefor movable through a limited distance before effecting separation of the contacts, means for biasing the operating member to effect separation of

the contacts, an electromagnet having a movable magnetic member for holding the operating member against its bias, and a spring connection between the magnetic member and the operating member to accelerate the magnetic member upon release thereof during movement of the operating member through said limited distance and thereby increase the speed of separation of the contacts.

In witness whereof, I have hereunto set my hand this 3rd day of January, 1930.
WILHELM HERDEN.