Aug. 4, 1931. G. A. BURNHAM 1,816,894

CIRCUIT INTERRUPTER AND MAGNETIC ARC EXTINGUISHING DEVICE THEREFOR

Filed April 23, 1929

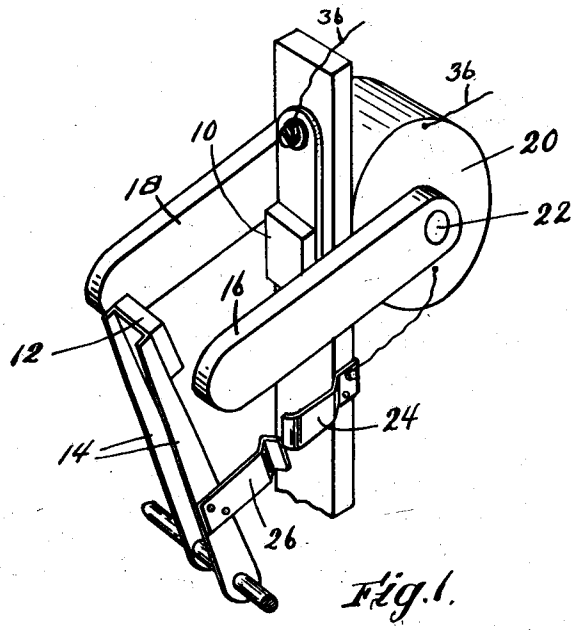


Fig. 1.

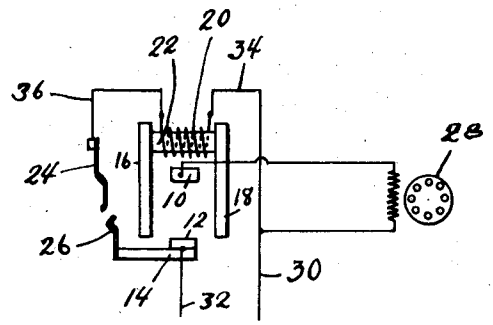


Fig. 2.

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UNITED STATES PATENT OFFICE

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CIRCUIT INTERRUPTER AND MAGNETIC ARC EXTINGUISHING DEVICE THEREFOR

Application filed April 23, 1929. Serial No. 357,565.

This invention relates to electric switches and circuit interrupters especially adapted to control alternating current circuits and particularly those having inductive loads therein.

One of the objects of the present invention is the provision of an alternating current electric switch having magnetic means to blow out the circuit interrupting arc and to remove the conducting ions from the arc space between the separated contact members of the switch, wherein the energizing winding of the magnetic means is connected across the alternating current circuit and thus is energized by the potential thereof.

A further object of the invention is the provision of means to provide a magnetic field in the arc space between the separated contact members of the switch, which magnetic field shall exist in said arc space at the time the current of the arc passes through the zero point of the current wave whereby to remove the conducting ions from the arc space at the time best suited for such removal, thus to permit the normally insulating medium between the separated contact members instantly to recover its full dielectric strength and thereby prevent the re-establishment of the circuit interrupting arc.

A further object of the invention is the provision of electro-magnetic means for blowing out and causing the extinguishment of the arc, the energizing winding of which means is energized from the potential of the circuit and which is so arranged that the winding is connected to the circuit only at the time the switch is in operation and is out of the circuit when the switch is open and also when it is closed, thereby to save current consumption, prevent burning out of the energizing winding, permit a heavier winding to be used and provide for other advantages.

A further object of the invention is generally to improve the construction of electric switches and arc-eliminating means.

Fig. 1 is a perspective view of an electric switch embodying the present invention, only those parts necessary to illustrate the invention being shown.

Fig. 2 is a diagram of the preferred connection of the switch and blow-out magnet to the circuit.

The switch here shown, which is especially adapted, although not necessarily limited, to the control of induction motor circuits, includes the stationary contact member 10 and the movable contact member 12 carried at the upper end of the pivoted switch arm 14. A blow-out or arc-extinguishing electro-magnet of U-shape has its poles 16 and 18 disposed on opposite sides of and parallel to the path of movement of the movable switch member 14 and in position to set up a magnetic field therebetween and in the arc space between the separated contact members in a position to force the circuit interrupting arc upwardly and to drive the conducting ions out of the arc space between the separated contact members. The electro-magnet is provided with an energizing winding or coil 20 which is disposed on the core 22 connecting the pole pieces 16 and 18.

In accordance with this invention, said winding 20 is a potential winding and is arranged to be connected across the circuit controlled by the switch and thus be energized at the potential of said circuit. The circuit of said winding is controlled by an auxiliary stationary contact member 24 and a cooperating auxiliary contact member 26 which is carried by and is movable with the movable switch arm 14. The arrangement of the auxiliary contact members is such that when the switch is closed, the auxiliary contact members are out of engagement but when the switch begins to open, the contact member 26 engages and rides over the flat face of the stationary contact member 24. The auxiliary contact members are also so arranged that they are separated when the switch is in its fully opened position and after the circuit interrupting arc has been extinguished. Thus the coil 20 is energized only during the time of circuit interruption and is disconnected from the circuit when the switch is fully closed and also when it is fully open. In the diagram of connections shown in Fig. 2, which is the preferred arrangement, the load device 28, which is here shown as an induction motor, is connected to the power circuit

conductors 30 and 32 through the contact members 10 and 12 of the switch. One terminal 34 of the winding 20 is connected directly to one of the power conductors as the conductor 30 and the other terminal 36 is connected through the auxiliary contact members 24 and 26 with the other power conductor 32, thus placing the coil directly across the power circuit and causing it to be energized by the potential thereof. By energizing the coil 20 from the potential of the circuit, the magnetic flux set up by the coil in the arc space between the separated contact members of the switch is caused to be out of phase with the arc current since the load 28 is an inductive load. When the arrangement is used to control a transmission line, for instance, the same conditions will be present, for, even if the load is not an inductive load, the inductance of the transmission line will be such as to cause the current to lag behind the potential of the circuit. If the load happens to be a capacitative load, as when the circuit is feeding a synchronous motor with an over-excited field, the line current will lead the line voltage. In either case, however, the magnetic field due to the winding 20 will be displaced with respect to the arc current. If the current and potential happen to be in phase in the circuit, the magnetic flux will still be displaced relative to the line current by reason of the inductance of the magnet potential coil 20. Thus, the potential coil 20 is caused to set up a magnetic flux which exists in the arc space at the time the arc current passes through the zero point of the current wave. The magnetic field can thus act to remove conducting ions from the arc space so as to effect the immediate restoration of the full dielectric strength of the insulating medium between the separated contact members and thus prevent the re-establishment of the arc. The magnetic field set up by the potential winding 20 is also independent of the arc current so that a strong magnetic field can be provided while the arc current is diminishing, thus to act strongly on the arc at the time the arc is weak.

Thus, by energizing the coil 20 from the potential of the circuit, a new result is obtained over the usual type of blow-out magnet wherein the energizing winding is in series with the arc current so that the magnetic flux of the blow-out magnet falls with the arc current and is not in existence at the time the arc passes through the zero point of the wave.

It has been proposed to interrupt the alternating arc by a blow-out magnet the winding of which is energized by a continuous current. Such an arrangement is not commercially practicable, however, as it necessitates two sources of current, which usually are not available, especially in industrial installations.

I claim:

1. An electric switch for the control of an electric circuit having contact members which are separable in the circuit, and a blowout magnet for the circuit interrupting arc having an energizing winding that is energized at the full potential of the circuit during the time that the arc exists.

2. An electric switch adapted to connect a load to a line having separable contact members between which the circuit interrupting arc is adapted to be drawn, and electro-magnetic means to set up an arc-extinguishing magnetic field between the separated contact members having an energizing winding that is connected across the line side of the switch and is energized from the potential of the line irrespective of the continuance of the arc.

3. An electric switch having separable contact members between which a circuit interrupting arc is adapted to be drawn, and electro-magnetic means operative independently of the continuance of the arc to set up a magnetic field in the arc space between the separated members having an energizing winding that is connected across the circuit controlled by the switch and is energized by the potential of the circuit and provides an alternating magnetic field which is normally angularly-displaced with respect to the arc current.

4. An electric switch adapted to control a circuit wherein the voltage and current of the circuit are angularly-displaced and having separable contact members connected in series with the circuit, and a blow-out magnet for the circuit interrupting arc formed between the separated contact members having an energizing winding connected across and energized by the potential of the circuit irrespective of the continuance of the arc.

5. An electric switch for controlling an electric circuit having separable contact members, a blow-out magnet for the circuit interrupting arc having an energizing winding, and means for energizing said winding from the circuit potential irrespective of the continuance of the arc and only during the time the switch is operating.

6. An electric switch for controlling an electric circuit having separable contact members, a blow-out magnet for the circuit interrupting arc having an energizing winding which is normally unenergized, means to connect said winding to the circuit at the time the switch opens, and means to maintain said winding energized at full circuit potential for a time during which the arc is normally extinguished and thereafter to disconnect said winding from the circuit.

7. An electric switch for controlling an electric circuit having separable contact members, a blow-out magnet for the circuit

interrupting arc between said contact members having an energizing winding which is connected across and is energized by the potential of the circuit irrespective of the existence of an arc between the separated contact members, and auxiliary contact members controlling the energization of said winding and operated by the switch arranged to be disengaged when the switch is open and also when it is closed and to be engaged only between open and closed positions of the switch.

8. An electric switch for controlling an electric circuit having separable contact members, a blow-out magnet for the circuit interrupting arc between said contact members having an energizing winding which is adapted to be connected across and energized by the potential of the circuit irrespective of the continuance of the arc, and auxiliary contact members in series with said energizing winding and operated by said switch to connect said winding across the switch circuit only when the switch is operating.

In testimony whereof, I have signed my name to this specification.

GEORGE A. BURNHAM.