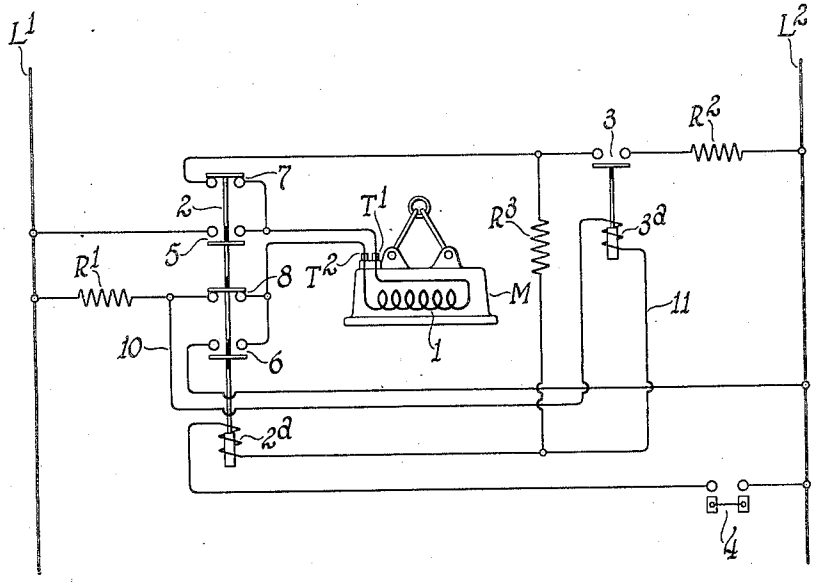
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CONTROLLER FOR INDUCTIVE DEVICES

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CONTROLLER FOR INDUCTIVE DEVICES

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This invention relates to controllers for inductive devices, and while not limited thereto is particularly applicable to controllers for inductive devices such as lifting magnets.

Lifting magnet controllers are commonly arranged to supply a limited amount of reverse current to the magnet winding when the same is disconnected from the source of supply. The magnet winding is thus allowed to discharge into the supply line and under the action of the reverse current the magnetic flux is quickly reduced to zero value to thereby insure quick dropping of the load. It has heretofore been proposed to provide such controllers with a drop control switch for establishing reverse power connections for the magnet winding, such switch being responsive to the discharge current of the magnet winding upon disconnection thereof from the supply circuit and being adapted to drop out when the flux in the magnetic circuit of said winding approaches zero value. In practice it has been found that control of the drop control switch in this manner is open to certain objections. For example, in controllers for large lifting magnets the drop switch is controlled by exceedingly heavy discharge currents and the velocity of the switch in closing is likely to cause breakage of the switch parts. Also it is necessary to design the drop switch to suit the discharge current values and therefore a controller of the aforesaid character is not adapted to effect proper control of magnets of widely varying sizes.

The present invention has among its objects to provide an improved controller for lifting magnets or other inductive devices which overcomes the disadvantages of controllers of the character hereinbefore described.

Another object is to provide a lifting magnet controller of the aforesaid character which acts upon movement of a master switch to off position to automatically establish reverse power connections for the magnet and to interrupt such connections after a time which is a function of the load on the magnet and the total flux in the magnet.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawing diagrammatically illustrates an embodiment of the invention which will now be described, it being understood that the embodiment illustrated may be modified without departing from the spirit and scope of the appended claims.

Referring to the drawing, the same illustrates an inductive device M in the form of a lifting magnet having an energizing winding 1 to be supplied with current from a supply circuit indicated by lines L^1—L^2.

The controller comprises electroresponsive switches 2 and 3 which are under the control of a master switch 4. Switch 2 is provided with normally open contacts 5 and 6 for connecting magnet winding 1 across lines L^1—L^2 during load lifting operations, and said switch is also provided with normally closed contacts 7 and 8 for establishing a circuit which provides for reversal of the current supplied to said magnet winding, such circuit being also controlled by switch 3 and including discharge resistances R^1 and R^2. The contacts 7 and 8 of switch 2 also serve to connect the operating winding 3^a of switch 3 across the terminals of magnet winding 1 in series with a resistance R^3.

The function and operation of the aforedescribed controller will now be more fully described. To energize the magnet for lifting master switch 4 is moved to closed position and both of the switches 2 and 3 are then energized by a circuit extending from line L^1 through resistance R^1 by conductor 10, to and through the operating winding 3^a of switch 3, by conductor 11, to and through the operating winding 2^a of switch 2 and through the master switch 4 to line L^2. Upon response of switches 2 and 3 magnet winding 1 is energized by a circuit extending from line L^1, through contacts 5 to terminal T^1 of the magnet winding, through said magnet winding to terminal T^2 and through contacts 6 to line L^2.

To release a load carried by the lifting magnet, master switch 4 is moved to open position to interrupt the aforedescribed energizing circuit for switches 2 and 3. Switch 2 then drops out to interrupt the aforedescribed energizing circuit for magnet winding 1. Switch 3, however, remains in closed position, the same being maintained energized by a circuit extending from line L^1, through resistance R^1, by conductor 10, to and through the operating winding 3^a of said switch, by conductor 11, through resistance R^3 and through said switch and resistance R^2 to line L^2. Upon dropping out of switch 2 circuit is established from line L^1, through resistance R^1, through contact 8 to terminal T^2, through magnet winding 1 to terminal T^1, through contacts 7 and switch 3, and through resistance R^2 to line L^2. Also the operating winding 3^a of switch 3 is connected in a circuit extending from terminal T^2 of magnet winding 1, through contacts 8, by

conductor 10, through the operating winding 3a, by conductor 11, through resistance R^3 and through contacts 7 to terminal T^1 of said magnet winding. Thus upon dropping out of switch 2 the line connections for the magnet winding are reversed, and as is well known the induced voltage of the magnet winding will then oppose and exceed the voltage of the supply circuit L^1—L^2 and the magnet winding will thus act to supply current to said supply circuit through the resistances R^1 and R^2. Also since the operating winding 3a is connected across the terminals of the magnet winding in series with the resistance R^3 the same will be subjected to the discharge voltage of said winding. After a predetermined interval determined by the value of the discharge resistances R^1 and R^2 the discharge voltage of the magnet winding 1 drops below the voltage of the supply circuit L^1—L^2 and current is then supplied from said supply circuit to said magnet winding in the reverse direction. The current now begins to build up in the reverse direction in the magnet winding 1 and since the operating winding 3a of switch 3 is connected across the terminals of magnet winding 1 in series with the resistance R^3 the current passing through said winding will decrease as the terminal voltage of the magnet drops. When the flux in the magnetic circuit is reduced by the reverse current to such a value as to permit dropping of the load carried by the lifting magnet the terminal voltage of the magnet is reduced to a relatively low value which permits opening of switch 3. The reverse power connections for the magnet winding 1 are thus interrupted to prevent building up of the flux in a reverse direction.

In connection with the foregoing it should be noted that the aforedescribed controller is capable of controlling lifting magnets of various sizes since operation of the switch to establish reverse power connections for dropping of the load is not dependent upon the value of the discharge current of the magnet winding. Furthermore it should be noted that the time which elapses before switch 3 drops out to interrupt the reverse power connections for the winding is a function of the load on the magnet and the total flux in the magnetic circuit.

What I claim as new and desire to secure by Letters Patent is:

1. A system for energizing and deenergizing an inductive winding comprising a first circuit for supplying current to said winding in one direction, a second circuit for supplying current to said winding in a reverse direction, electromagnetic switching means operable when energized to close said first circuit and when deenergized to open said first circuit and complete said second circuit, and an electroresponsive switch for interrupting said second circuit upon completion thereof by said switching means, said switch being moved to closed position upon energization of said switching means and being movable to open position upon a predetermined electrical condition of said winding.

2. A system for energizing and deenergizing an inductive winding comprising a first circuit for supplying current to said winding in one direction, a second circuit for supplying current to said winding in a reverse direction, means for closing and opening said first circuit and for closing said second circuit upon opening of said first circuit, said means including a switch for controlling said second circuit, and means for controlling said switch to provide for closure thereof upon establishment of said first circuit and for opening thereof under a given electrical condition in said winding upon closure of said second circuit.

3. A system for energizing and deenergizing an inductive winding comprising a first circuit for supplying current to said winding in one direction, a second circuit for supplying current to said winding in a reverse direction, means for closing and opening said first circuit and for closing said second circuit upon opening of said first circuit, said means including a normally open electromagnetic switch connected in said second circuit, and means for energizing said switch upon closure of said first circuit and for subjecting said switch to the discharge voltage of said winding upon establishment of said second circuit to provide for opening thereof when said discharge voltage approaches a given value.

4. The combination with a lifting magnet having an energizing winding, of a pair of electromagnetically operated switches, one of said switches being responsive to supply current to said winding in one direction and being adapted when deenergized to supply current to said winding in a reverse direction through the medium of the other of said switches, means for effecting closure of said second mentioned switch upon response of said first mentioned switch, and means acting upon deenergization of said first mentioned switch for maintaining said second mentioned switch closed until the discharge voltage of said magnet drops to a predetermined value.

5. The combination with a lifting magnet having an energizing winding, of a pair of electromagnetically operated switches, one of said switches being responsive to supply current to said winding in one direction and being adapted when deenergized to supply current to said winding in a reverse direction through the other of said switches upon response thereof, a master switch for establishing an energizing circuit for both of said switches, and circuit connections controlled by said first mentioned switch for subjecting said second mentioned switch to control by the discharge voltage of said winding upon opening of said master switch.

6. A system for energizing and de-energizing an inductive winding, comprising a first circuit for supplying current to said winding in one direction, a second circuit for supplying current to said winding in a reverse direction, means for closing and opening said first circuit and for closing said second circuit upon opening of said first circuit, said means including a normally open switch for controlling said second circuit and means for controlling said switch to effect closure thereof upon establishment of said first circuit and for maintaining the same in closed position until the flux in the magnetic circuit of said winding is reduced to a given value.

HOWARD E. HODGSON.