Dec. 3, 1929. H. E. HODGSON 1,737,846

CIRCUIT CONTROLLER FOR LIFTING MAGNETS

Filed Aug. 27, 1928

Fig. 1

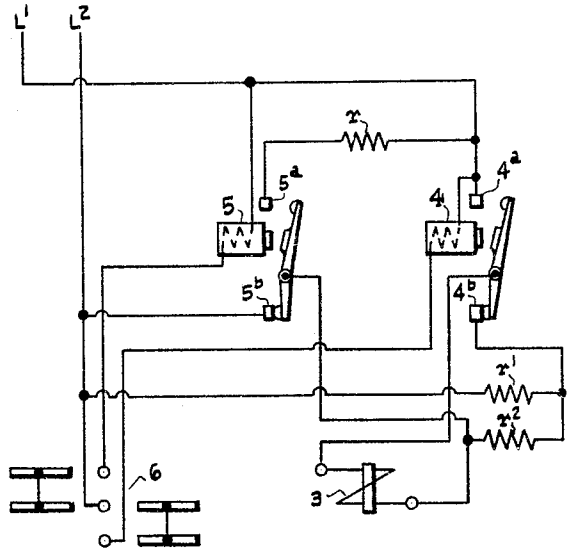
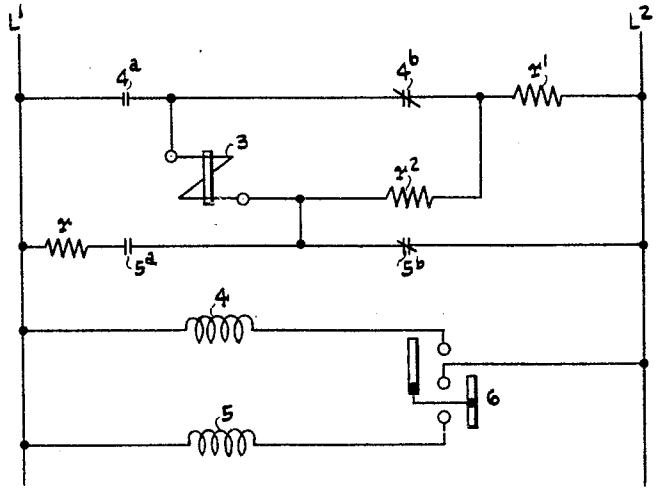



Fig. 2




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# UNITED STATES PATENT OFFICE

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## CIRCUIT CONTROLLER FOR LIFTING MAGNETS

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This invention relates to improvements in circuit controllers for lifting magnets and other inductive devices.

As is well known a lifting magnet requires reversal of current therethrough prior to disconnection and a discharge circuit when disconnected. The reversal of current through the magnet is for quick release of its load while the discharge circuit is for prevention of high induced voltages dangerous to operatives and destructive of the insulation of the magnet and connected devices. On the other hand, a permanent discharge circuit is highly disadvantageous and the controllers heretofore designed to afford the desired circuit commutations including opening of the discharge circuit for lifting have interrupted said circuit in effecting reversal of current and hence during momentary discharge of the magnet. In consequence this preferred type of controller has permitted undesirably high induced voltages as an incident to reversals and has required the use of correspondingly heavy contacts.

The present invention has among its objects to provide a simple and efficient controller affording the aforementioned desired circuit commutations and in addition affording a discharge path for the controlled magnet during the momentary interruption of its circuit for reversal of current flow therethrough.

Another object is to provide a controller of the aforestated character affording control of all circuits of the lifting magnet or other device by a number of sets of contacts not exceeding the number heretofore required and enabling certain of said sets of contacts to be materially reduced in size.

Other objects and advantages of the invention will hereinafter appear.

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

In the drawing

Figure 1 is a full diagrammatic view of a controller for a lifting magnet, while

Fig. 2 is a simplified diagrammatic view of the same controller.

Referring to the drawing, the lifting magnet is represented by a winding 3 to be supplied from lines $L^1$, $L^2$.

The controller comprises resistances $r$, $r^1$ and $r^2$, electroresponsive switches or contactors 4 and 5 of the double throw type and a master switch 6 to energize said contactors selectively. The contactor 4 has normally open up contacts $4^a$ and normally closed down contacts $4^b$ and contactor 5 has normally open up contacts $5^a$ and normally closed down contacts $5^b$. The aforementioned contacts are illustrated in Fig. 2 by parallel lines, the showing of the normally closed contacts being supplemented by a diagonal line.

While lifting magnet controllers employing resistances $r$ and $r^1$ and contactors similar to those illustrated are well known, the control afforded by these elements will be here briefly described. Response of contactor 4 completes circuit from line $L^1$ through its contacts $4^a$ to and through the magnet winding 3 and thence through the down contacts $5^b$ of contactor 5 to line $L^2$, for energization of said winding for lifting. Return of contactor 4 disconnects the magnet winding after establishing a discharge circuit for said winding through resistance $r^1$. Such discharge circuit may be traced from the left hand terminal of the magnet winding through the down contacts $4^b$ of contactor 4 and resistance $r^1$ to line $L^2$ and from line $L^2$ through the down contacts $5^b$ of contactor 5 to the right hand terminal of the magnet winding. After return of contactor 4 response of contactor 5 interrupts the aforementioned discharge circuit and completes circuit from line $L^1$ through resistance $r$ and

contacts $5^a$ to and through the magnet winding 3 in a reverse direction and thence through the down contacts $4^b$ of contactor 4 and resistance $R^1$ to line $L^2$ for reversal of the polarity of said winding. Return of contactor 5 disconnects the winding after re-establishing the discharge circuit aforementioned.

Thus provision is made for protection of the magnet and connected devices against an excessive induced voltage upon final disconnection but as previously set forth the aforedescribed discharge circuit is interrupted by contactor 5 in establishing reverse connection. Accordingly contactor 5 interrupts the aforementioned discharge circuit during discharge of the magnet winding with the result of permitting undesirably high induced voltage and subjecting the contacts $5^b$ to heavy arcing whereas the location of these contacts at the bottom of contactor 5 renders adequate blow-out provisions quite difficult.

However, provision of resistance $r^2$ and connection thereof as illustrated overcomes the difficulties heretofore experienced. As will be observed resistance $r^2$ is connected on one side to the right hand terminal of the magnet winding and on its other side to a point between down contacts $4^b$ of contactor 4 and resistance $r^1$. Thus contacts $4^b$ provide a discharge path through resistance $r^2$ at the time contactor 5 operates to reverse the polarity of the magnet and in so doing interrupting the first described discharge circuit. On the other hand response of contactor 4 to establish lifting connections interrupts the last described discharge circuit as well as the discharge circuit first described.

While as aforestated the first described discharge circuit is opened upon operation of contactor 5 to effect reversal of current said discharge circuit is maintained momentarily after completion of the discharge circuit through resistance $r^2$. Thus parallel discharge circuits are provided momentarily when the current is high and these parallel circuits provide a relatively low discharge resistance even though the resistance $r^2$ is of relatively high ohmic value, whereby the initial peak of induced voltage may be easily confined within safe limits. As is well understood the value of the induced voltage is decreased as the current decreases and accordingly with momentary establishment of the aforementioned parallel discharge circuits the ohmic value of resistance $r^2$ may be such as to prevent it from rendering the magnet sluggish and yet sufficiently low to insure against dangerous peaks of induced voltage following interruption of the other discharge circuit.

Thus with the provisions herein set forth the induced voltage may be kept within safe limits at all times and the arcing on contacts $5^b$ may be greatly reduced.

Whereas the control contacts are preferably embodied in two separate switches and are for convenience specified herein as constituting two switches, it is of course to be understood that the claims are intended to embrace other embodiments of the control contacts, as for example a drum or other structure affording common operating means for all contacts.

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

1. In combination, a winding, a resistance, two switches, each having a pair of normally engaged contacts and a pair of normally disengaged contacts, circuit connections whereby said switches provide for completion of the circuit of said winding inclusive and exclusive of said resistance and reversal of the current flow through said winding and whereby said switches in their normal positions jointly provide a discharge circuit for said winding including said resistance, and another resistance having connections completed by one of said switches when in normal position to afford another discharge path for said winding.

2. In combination, a winding, a plurality of resistors, two double throw switches, circuit connections whereby said switches in their normal positions jointly complete a discharge path for said winding through one of said resistors while one of said switches alone complete a second discharge path for said winding through another of said resistors, and circuit connections whereby said switches are operable to connect said winding to a supply source and to effect reversal of the current flow through said winding.

3. In combination, a winding, a plurality of resistors, two double throw switches, circuit connections whereby operation of one of said switches provides for connection of said winding to a supply source exclusive of said resistors and alternatively provides for interruption of such winding connection and for connection of one of said resistors in shunt with said winding and circuit connections whereby operation of the other of said switches provides for connection of said winding to its supply source for reverse polarity and alternatively provides for disconnection of said winding and establishment of a discharge circuit for said winding through another of said resistors and the other of said switches.

4. In combination, a winding, a plurality of resistors, two double throw switches, circuit connections whereby operation of one of said switches provides for connection of said winding to a supply source exclusive of said resistors and alternatively provides for interruption of said connection and inclusion of said winding and one of said resistors in a closed loop and circuit connections whereby operation of the other of said

switches provides for reverse connection of said winding to its supply source through other of said resistors and alternatively provides for disconnection of said winding and establishment of a second closed loop for said winding including certain of said resistors and contacts of the other of said switches.

In witness whereof, I have hereunto subscribed my name.

HOWARD E. HODGSON.