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AUTOMATIC MOTOR STARTER AND OVERLOAD CONTROL AND WARNING MEANS

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FIG. 1

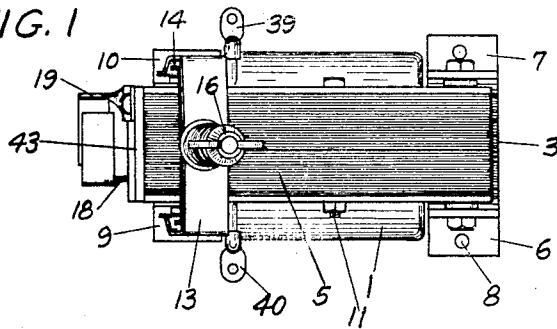


FIG. 3

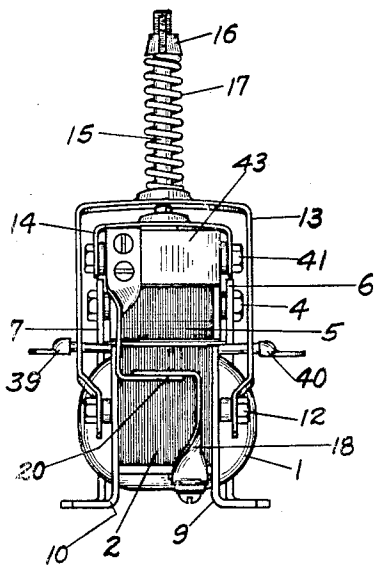


FIG. 2

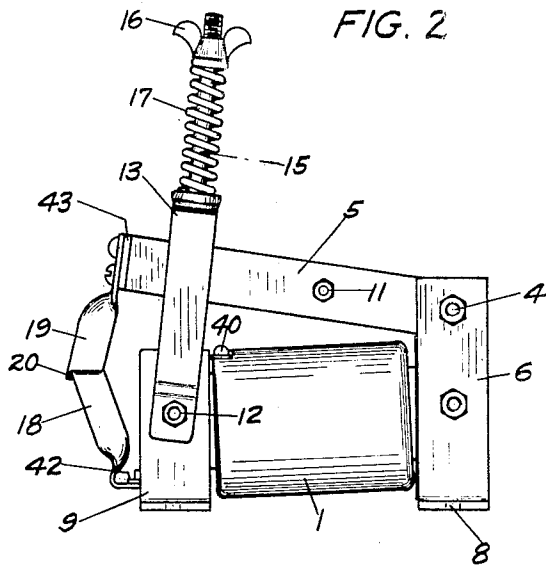
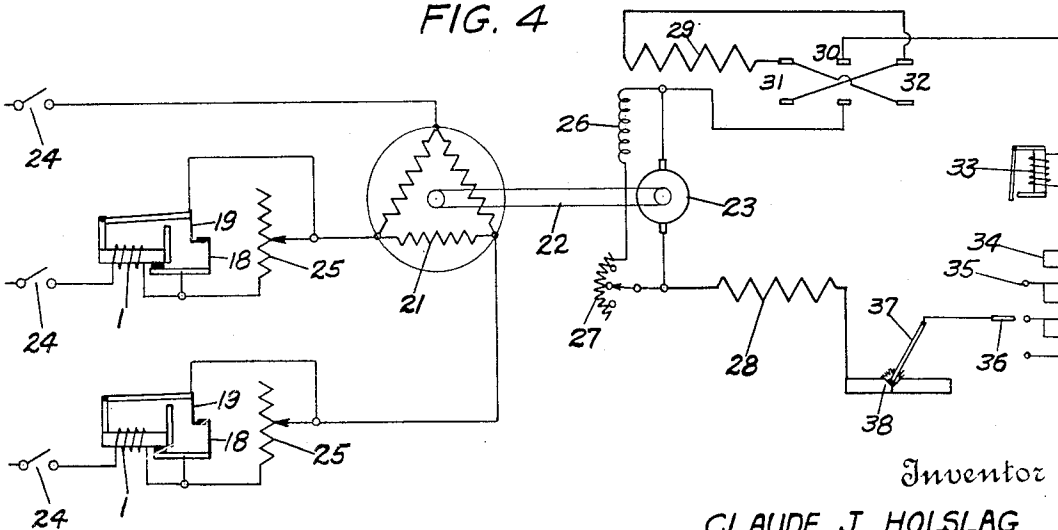


FIG. 4



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AUTOMATIC MOTOR STARTER AND OVER-
LOAD CONTROL AND WARNING MEANSClaude Joseph Holslag, South Orange, N. J., as-
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pany, Newark, N. J.

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8 Claims. (Cl. 172—289)

This invention relates to automatic means for controlling the operation of an electric motor and at the same time give an audible warning if the motor is being overloaded.

5 My invention is particularly adapted for use in connection with alternating current motors. For the purpose of starting such machines, it is the usual practice to provide a manually operated control comprising, usually, an inductive react-
10 ance associated with a starting switch having two positions; a starting position wherein the resistance or inductive reactance is thrown into the motor circuit until it comes up to speed, when the switch is thrown over to running position
15 which applies full voltage of the line to the motor.

However, in such devices, there is nothing to prevent overloading the motor, and while auto-
20 matic circuit breakers may be installed to prevent overloads, the same as used in connection with generators, the installation of such devices means greater initial and operating expense. By my arrangement, all that is required on the part of the operator, is the mere closing of a service
25 switch, and the combination control and warning means takes care of the rest.

My improvement on this class of apparatus will be best understood by the annexed drawing, wherein:

Figure 1 is a plan view of the control and
30 warning means adapted to be connected into the motor circuit.

Figure 2 is a side elevation of the device shown in Figure 1.

Figure 3 is an end view looking from the left
35 of Figure 2.

Figure 4 is a schematic diagram showing the application of the control means to a motor used for driving an arc welding generator.

In the various figures, 1 is a winding carried
40 on a stationary part of a core of magnetic material which terminates in polar ends 2 and 3. The polar end 3 projects a short distance above the winding 1, and to this is pivoted by any satisfactory means, as by a bolt 4, a movable part 5.
45 Preferably all parts of the core are of laminated sheet iron or steel, and as shown in Figures 1 to 3 inclusive, the core end 3 is held together by L-shaped brackets 6 and 7 which are also used for mounting the reactor on a suitable support
50 by means of the holes 8. Likewise, the core end 2 is provided with similarly shaped brackets 9 and 10 which are also used for mounting the reactor.

Preferably, the movable part 5 of the core is
55 provided with a bolt 11 to help hold the stack

of laminations together which make up the movable part 5 of the core.

Passing through the brackets 9 and 10 and the core end 2, is a bolt 12 which pivotally fastens a U-shaped yoke 13 to the core. Positioned within
60 the yoke 13, but pivoted by studs 41 to the member 5, is a supplemental U-shaped yoke 14 to which is attached a stud 15 which passes through the yoke 13 and has a nut 16 on the outer end thereof for varying the tension of the spring 17.
65 The spring 17 normally holds the movable core member 5 in the position illustrated in the various figures, particularly Figure 2, wherein it is seen that a large air gap is introduced between the member 5 and the core pole 2. Under this condi-
70 tion, the impedance of the reactor is relatively low and does not materially affect the normal operation of the motor which will be referred to later.

Attached to the core member 2, but insulated
75 therefrom by insulator 42, is a contact member 18 which is adapted to engage a contact member 19 fastened to plate 43 on the movable member 5. In the normal operation of the motor, the mem-
80 bers 18 and 19 are in engagement over a considerable area, indicated at 20, the purpose of which will be later pointed out.

To illustrate the application of my improve-
ment to an electric motor, I have shown, schematically, in Figure 4, a three-phase alter-
85 nating current motor of the induction type to which is connected, by a shaft 22, a welding generator 23. In two of the phases of the motor 21, I have introduced one of my control and
90 warning devices. I have found two such devices in the circuit of such a motor sufficient, although another device may be connected into the other lead wire. A three-pole switch 24 is indicated for applying current to the motor 21. When the
95 switch 24 is closed, the initial rush of current to the motor 21 is choked back by the movement of the reactor, whereby the movable member 5 is actuated by the additional flux created by the first current impulse, and as the member 5 en-
100 gages the polar end 2, the magnetic circuit is closed and the impedance of the reactor is greatly increased, thereby choking down the current, but the motor will start and come up to speed in a short interval of time.

As the motor approaches its normal running
105 speed, the spring 17 overcomes the action of the flux on the movable member 5, and this moves to open position as indicated in Figure 2, and will stay in this position while the motor is running
under conditions not greatly exceeding normal 110

load; but as soon as the load becomes abnormal, the additional flux created by the winding 1 will draw the movable member 5 downward to the closed position as in starting. Due to the fact that the member 5 is pivoted at 4, and must therefore have a relatively loose joint in connection with the polar end, the member 5 is violently vibrated under this condition, and the reactor begins to howl and shriek, giving a very positive audible warning signal that the motor is being badly overloaded.

As shown in Figure 4, each reactor may be associated with an additional impedance 25 which, in the normal position of the switch contacts 18 and 19, is short-circuited, and this short circuit is only open during the period of starting and during the period of heavy overload. The increased impedance of the reactor and the further introduction of impedance 25, when it is used, into the motor circuit, under these conditions will cut down the ability of the motor to deliver this overload, and the speed will drop; likewise, the voltage on the generator which is being driven, and the control device will thus automatically relieve the load from the motor, even though the attendant should fail to obey the warning delivered by the reactor as above set forth.

The welding generator 23 is illustrated as having a shunt winding 26 and a control rheostat 27, a main series winding 28, and a series winding 29 which, by means of the switch 30, can be connected in differential or cumulative relationship with the series winding 28. With the series in the welding circuit, is a reactor 33 which is preferably similar to the form shown in Figures 1 to 3 inclusive. A resistance 34, having taps 35, may also be provided, and a plug 36 is used to connect with the taps 35. The welding electrodes are indicated by the numbers 37 and 38, the numeral 37 indicating the movable electrode, while 38 indicates the work in which the weld is being made.

When the switch 30 is in one position; for example 31, the current in the welding circuit goes through the winding 29 in one direction, which, for the purpose of illustration, may be considered as giving a differential action; and when in the position 32, the welding current goes through the winding 29 in the opposite direction, giving a cumulative action for purposes such as pointed out in my Patent 1,719,112.

I have found that at the time the arc is being struck, the current draw through the motor is about the same as that required in starting the motor, when using the ordinary starting devices, and this means disturbances in the power supply circuits, which disturbances may, under certain conditions be very objectionable, and my automatic control means acts to greatly reduce these disturbances so that they will not be objectionable.

While my invention is particularly adapted for use in an arc welding circuit, it may have other applications.

Having thus described my invention, what I claim is:

1. In combination with a motor, starting and overload control means in the motor circuit comprising a reactor having stationary and movable magnetic core parts, means for normally holding the movable core part in a position to leave a substantial air gap in the magnetic circuit of the core, a winding on the core proportioned according to the output of the motor and adapted to be connected into the motor circuit so as to

actuate the movable core part to closed core position only at the time of starting up the motor, and at time of excessive overloads.

2. In combination with a motor, an apparatus in the motor circuit including an automatic starter and overload control means for the motor as set forth in claim 1, further characterized in that an auxiliary impedance is associated with the reactor, and further, an electrical contact is actuated by the movable part of the core, said contact acting to control a circuit through said auxiliary impedance.

3. An automatic motor starter and overload control means comprising, a reactor having stationary and movable magnetic core parts, a winding on the stationary part of the core for connection into the motor circuit, a pivotally mounted yoke carried on one end of the stationary part of the core, a supplemental yoke pivotally mounted on the end of the movable part of the core and within the periphery of the first-mentioned yoke, a stud carried by the second yoke and extending through the first, a spring supported by said stud and positioned exteriorly of the first yoke, and means for adjusting the tension of the spring to normally hold the core parts in open magnetic circuit condition, and to control the actuation of the movable part of the core by said winding, as and for the purposes described.

4. An automatic motor starter and overload control means comprising, a reactor having stationary and movable magnetic core parts, a winding on the core for connection into the motor circuit, a pair of U-shaped members positioned, one within the other, the outer one being pivoted at its open ends to one end of the fixed part of the core, while the inner one is similarly connected to the corresponding end of the movable part of the core, a stud carried by the inner member and extending through the outer member, a spring supported by said stud exteriorly of said outer U-shaped member, and means for adjusting the tension of the spring to normally hold the core parts in open magnetic circuit condition, and to control the actuation of the movable part of the core by said winding, as and for the purposes described.

5. In combination with a motor, starting and overload control means in the motor circuit comprising, a reactor having stationary and movable magnetic core parts, a single winding on the core for connecting into the motor circuit, means for holding the core parts in position to give a large air gap and hence least reactance during normal operation of the motor, a part of the core being movable against said means to close said gap to give maximum reactance only when the motor is being started or heavily overloaded.

6. In combination with a motor, an apparatus in the motor circuit including an automatic starter and overload control means for the motor as set forth in claim 5, further characterized in that a separate impedance is associated with the reactor in the motor circuit, and a pair of contacts actuated by the reactor for switching said impedance into and out of circuit.

7. In combination with an induction motor, an apparatus in the motor circuit including an automatic starter and overload control means for the motor as set forth in claim 5, further characterized in that the movable part of the core is so mounted as to vibrate freely to give an audible indication of heavy current draw through the motor.

8. An automatic motor starter and overload control and warning means including, a reactor having a magnetic core and a winding thereon adapted to be connected in series with the motor, 5 said reactor having a part of its core movable and normally held in relatively wide open core position, said movable part of the core being loosely pivoted to a stationary part and adapted to be strongly vibrated when the current through said 10	winding exceeds to some extent the normal current flowing through the winding to the motor; means cooperating with said movable part of the core for determining when said part will move to close the magnetic circuit of the core of the reactor under the influence of the flux set up by said winding, said means allowing said magnetic circuit to be closed only at the time of starting the motor and when the motor is overloaded. 80
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