June 21, 1955 M. A. ELLIOTT 2,711,503

SINGLE PHASE MOTOR CONTROL RELAY

Filed Oct. 30, 1952

Fig. 1.

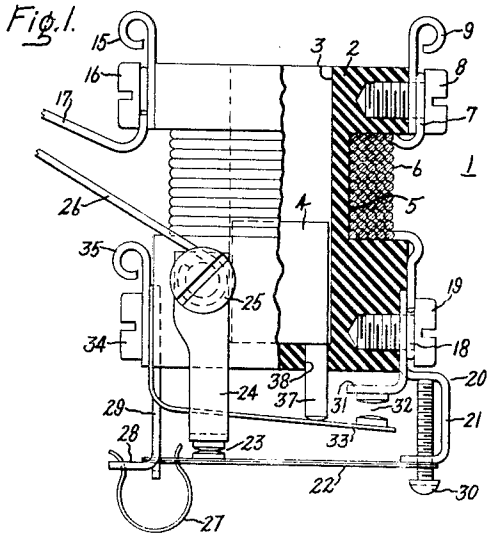
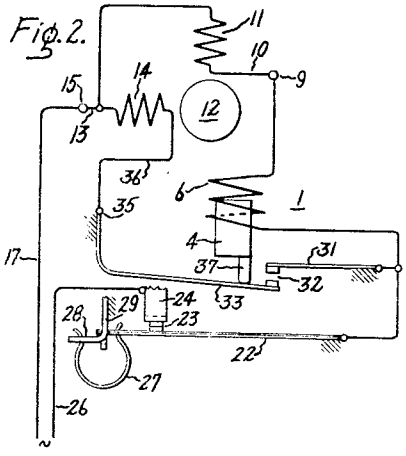


Fig. 2.



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United States Patent Office 2,711,503 Patented June 21, 1955

2,711,503

SINGLE PHASE MOTOR CONTROL RELAY

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Application October 30, 1952, Serial No. 317,789

5 Claims. (Cl. 318—221)

My invention relates to electrical protective devices and pertains more particularly to motor starting relays.

Some motor starting relays include a bimetallic overload strip adapted for flexing and opening a supply circuit at a predetermined temperature and means for heating the overload strip in accordance with current flow through the supply circuit. Such relays usually further include a coil adapted for being energized sufficiently to lift a magnetic plunger only when the current in the motor running winding surges or exceeds a predetermined maximum, as during starting or any other motor stalling condition. In its lifted position the plunger permits a pair of starting contacts to close for completing the motor starting winding circuit to assist in bringing the motor up to speed. When the motor attains its operating torque, the current surge subsides and the plunger is dropped by the coil. In its dropped position, the plunger opens the starting contacts and breaks the starting winding circuit. Additionally, there is usually included in series in the starting winding circuit an electrical heater adapted for supplying auxiliary heat to the bimetallic overload strip. If and when the stalled condition of the motor is such that the motor does not come up to speed and the coil fails to drop the plunger within a predetermined starting time, the heat from both the heater in the starting circuit and the means whereby the overload strip is heated in accordance with current flow through the supply circuit causes the overload strip to flex for opening the supply circuit and thereby protecting the motor.

The primary object of my invention is to provide a new and improved motor starting relay.

Another object of my invention is to reduce in number the elements comprising a motor starting relay.

Another object of my invention is to provide in a motor starting relay an element which will serve as both a contact arm and an electrical heater.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In carrying out the objects of my invention, I have provided a motor starting relay having a bimetallic overload strip and a starting contact arm disposed adjacent the overload strip and formed a high resistance material.

For a better understanding of my invention, reference may be had to the accompanying drawing in which:

Fig. 1 is an enlarged partially sectionalized view illustrating my invention; and

Fig. 2 is a schematic showing of a motor circuit having my invention incorporated therein.

Referring to Fig. 1, I have shown a motor starting relay generally designated 1. The relay 1 includes a bobbin 2 formed of plastic or any other similarly insulative material. Formed centrally in the bobbin 2 is an upwardly opening bore 3. Provided for being received in the bore 3 and operating therein is a magnetic plunger 4 preferably formed of soft iron.

Formed on the exterior of the bobbin 2 is a peripheral groove 5. Wound on the bobbin 2 in the groove 5 is a coil 6 of electrically insulated wire. One end of the wire from which the coil 6 is formed terminates in a loop designated 7 which is secured by a screw 8 to the upper portion of the bobbin 2. Also secured to the upper portion of the bobbin 2 by the screw 8 and in electrical connection with the loop 7 is a terminal 9. As seen in Fig. 2 the terminal 9 is adapted for having a lead 10 to one end of the running winding circuit 11 of a motor generally designated 12 electrically connected thereto. A lead 13 common to the other end of the running winding circuit 11 and the motor starting winding circuit designated 14 is connected electrically to a second terminal 15 secured to the opposite side of the bobbin 2 by a screw 16. The screw 16 is also effective for electrically connecting a line 17 of a supply circuit to the terminal 15.

The end of the coil 6 opposite the loop 7 terminates in another loop indicated by 18 which is secured by a screw 19 to the lower portion of the bobbin 2. Also secured to the lower portion of the bobbin 2 by the screw 19 and in electrical connection with the loop 18 is a bracket 20. Formed off the bracket 20 is a pendent U-shaped arm 21. Suitably secured, as by welding, to the outer leg portion of the U-shaped arm 21 is a bimetallic overload strip 22 formed of high resistance materials. Carried on the upper surface of the overload strip 22 inwardly of the free end thereof is one of a pair of motor contacts 23. The other of the pair of contacts 23 is secured to an electrically conductive arm 24 secured by a screw 25 to the lower portion of the bobbin 2. In addition to securing the arm 24 to the bobbin 2, the screw 25 is effective for electrically connecting a second line 26 in the supply circuit to the conductive arm 24.

In the arrangement described to this point the overload strip 22 is adapted for being energized and heating up in accordance with the current in the supply circuit. Additionally, the overload strip 22 is adapted to flex at a predetermined temperature for opening the contacts 23 thereby to open the supply circuit. It is to be understood that while I have shown and described the overload strip 22 as being a combined bimetal and heater, it could be simply a bimetal and heated in accordance with the current in the supply circuit by an electrical heater connected in series in the supply circuit and disposed adjacent the bimetal.

Provided for biasing the overload strip 22 to a contact closing position and determining the temperature at which the overload strip will flex and open the contacts is a substantially U-shaped spring 27. One leg of the spring 27 is positioned in a suitable aperture formed in the overload strip between the extremity thereof and the contacts 23. The other leg of the spring 27 is positioned in a suitable aperture in a laterally extending portion 28 of a pendent arm 29, which is secured to the lower portion of the bobbin 2 in such a manner as to be insulated from the other elements thereon. In addition to providing support for one end of the spring 27, the arm 29 effectively guides the flexing movements of the overload strip 22.

Provided for adjusting the operating temperature of the overload strip 22 by adjusting the pressure between the contacts 23 is an adjusting screw 30. The adjusting screw 30 is threaded in the outer leg portion of the U-shaped arm 21 of the bracket 20 and engages the inner leg portion. It will be seen that by turning the screw 30 outwardly, the full force of the spring 27 may be exerted on the overload strip and a relatively high temperature will be required to flex the overload strip. By turning the screw 30 inwardly, the pressure between the contacts 23, as effected by the spring 27, will be decreased and the

overload strip 22 will flex for opening the contacts at a lower temperature.

Also formed off the bracket 20 is a contact arm 31, to which is secured one of a pair of starting contacts 32. The other of the pair of starting contacts 32 is carried on the upper side of the free end of an element 33 disposed adjacent the overload strip 22. The element is formed of a resilient high resistance material, such as nichrome, and serves as both a contact arm and an electrical heater. The portion of the contact arm 33 opposite the contacts extends upwardly along the lower side portion of the bobbin 2 and is secured to the bobbin by a screw 34. The screw 34 also secures to the bobbin and electrically connects to the contact arm 33 a terminal 35. The terminal 35 is adapted for being electrically connected by a lead 36 to the end of the starting winding circuit 14 opposite the above-mentioned common lead 13, in the manner shown in Fig. 2.

Provided for cooperating with the contact arm 33 to determine whether the contacts 32 are open or closed is a finger 37. The finger 37 extends from the lower end of the above-mentioned plunger 4 and projects through an aperture 38 formed in the bobbin 2 in the bottom of the bore 3.

When by controlling means (not shown) the supply of current to the motor 12 through the leads 17 and 26 is cut off or when the motor is operating normally and the current in the supply and running winding circuits is below a predetermined maximum, the overload strip is below the predetermined flexing temperature and so positioned that the contacts 23 are closed in the manner shown in Figs. 1 and 2. Also, under these conditions the plunger 4 rests on the bottom of the bore 3, and the finger 37 thereon depresses the contact arm 33 for maintaining the contacts 32 open in the manner also shown in Figs. 1 and 2. Therefore, when current is supplied to the leads 17 and 26 by the controlling means for starting the motor and during normal running of the motor, a circuit is completed through the running winding 11, the coil 6 and the overload strip 22, and the overload strip is energized or heated in accordance with the current flow therethrough. Now during starting or under any other motor stalling conditions the motor current surges or exceeds the above-mentioned predetermined maximum. This results in the coil 6 being energized sufficiently for lifting the plunger 4 to enable the starting contacts 32 to close. When the starting contacts 32 are closed in this manner a circuit through the starting winding 14 and the contact arm 33 is completed. As a result, the motor starting winding 14 is energized for assisting in bringing the motor up to speed or overcoming the stalling condition and the contact arm 33 is energized and commences to heat up.

Under normal operating conditions the motor will attain full operating torque or come up to speed after a predetermined starting time and the current surge in the circuit will subside to a normal operating rate of flow, causing the coil 6 to drop the plunger 4 for opening the starting contacts 32 by means of the finger 37 and thereby cutting out the starting winding circuit 14. If and when the stalled condition of the motor is such that the current surge fails to subside and the coil fails to drop the plunger after the predetermined starting time, the heat generated by the nichrome contact arm 33, together with the heat generated by the overload strip itself, becomes sufficient for flexing the overload strip to open the contacts 23 and thereby open the supply circuit. In this manner the supply circuit is expeditiously opened when the current therein surges or exceeds the predetermined maximum for more than the predetermined starting period, which results in greater motor protection.

It will be seen that I have provided a motor starting relay wherein a single element, namely, the nichrome element 33, serves as both a contact arm and an electrical heater. Thus, I have provided a means for reducing in number the elements of a starting relay to arrive at

economies in material and assembly time and a more compact device.

It will be seen further that while I have shown and described my invention as being incorporated in a motor circuit for protecting the motor under stalled conditions, my invention is equally applicable to any apparatus in which economies may be arrived at by employing a combined contact arm and heater.

While I have shown and described a specific embodiment of my invention I do not desire my invention to be limited to the particular form shown and described, and I intend by the appended claims to cover all modifications within the spirit and scope of my invention.

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

1. In a thermal protective device including a bimetallic overload strip for opening a circuit at a predetermined temperature, a contact arm for controlling a second circuit, said contact arm being of a high resistance material and being disposed in a predetermined position wherein it is effective to supply heat to said overload strip, completion of said second circuit through said contact arm resulting in said contact arm becoming heated to supply heat to said overload strip.

2. In a thermal protective device including a bimetallic overload strip for opening a circuit at a predetermined temperature, a nichrome contact arm for controlling a second circuit, said contact arm being disposed adjacent said overload strip, completion of said second circuit through said contact arm resulting in said contact arm becoming heated to supply heat to said overload strip.

3. In a motor starting relay adapted for being connected in the circuit of a motor having a running and a starting winding circuit in parallel across a supply circuit, said relay including a bimetallic overload strip adapted to make and break said supply circuit at a predetermined temperature, means for heating said overload strip in accordance with current flow in said supply circuit, a coil disposed in said running winding circuit, and an element disposed in said starting winding circuit, said element being both a contact arm and a heater, said element being actuated by said coil when the current in said running winding circuit exceeds a predetermined maximum to close said starting winding circuit, said element being energized when said starting winding circuit is closed, said element and said means being effective to heat said overload strip to said predetermined temperature to open said supply circuit when said current exceeds said predetermined maximum for more than a predetermined time.

4. A motor starting relay for an electric motor circuit comprising a supply circuit, a bimetallic member disposed in said supply circuit to make and break said circuit, said motor circuit having a starting winding circuit and a running winding circuit in parallel, said starting circuit including a contact arm, said contact arm being disposed to break said starting circuit, means disposed in said running circuit to permit said contact arm to make said starting circuit when the current in said running circuit exceeds a predetermined maximum, said contact arm being of a high resistance material, means to normally urge said bimetallic member to close said supply circuit, said contact arm being heated upon passing of current therethrough, said contact arm being positioned adjacent said bimetallic member to supply heat to said bimetallic member, said bimetallic member responding to said heat from said contact arm and to heat generated by current passing through said bimetallic member to overcome said normally urging means and break said supply circuit when the current flowing through said supply circuit exceeds a predetermined maximum for a predetermined period.

5. A motor starting relay for an electric motor circuit comprising a supply circuit, a bimetallic member disposed in said supply circuit to make and break said circuit, said motor circuit having a starting winding circuit and a run-

ning winding circuit in parallel, said starting circuit including a contact arm, said contact arm being disposed to break said starting circuit, a coil in said running circuit, a magnetic plunger disposed in said coil, said plunger holding said contact arm in its break position when the current in said coil is below a predetermined value, said plunger lifting when the current in said coil exceeds a predetermined maximum to permit said contact arm to close said starting circuit, said contact arm being of a high resistance material, means to normally urge said bimetallic member to close said supply circuit, said contact arm being heated upon passing of current therethrough, said contact arm being positioned adjacent said

bimetallic member to supply heat to said bimetallic member, said bimetallic member responding to said heat from said contact arm and to heat generated by current passing through said bimetallic member to overcome said normally urging means and break said supply circuit when the current flowing through said supply circuit exceeds a predetermined maximum for a predetermined period.

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