Jan. 26, 1971 H. V. VIND 3,559,015

THERMIC STARTING DEVICE

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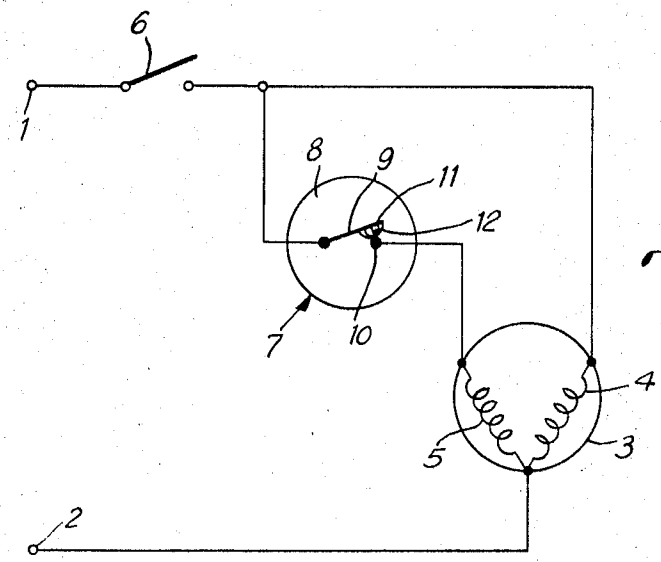


Fig. 1

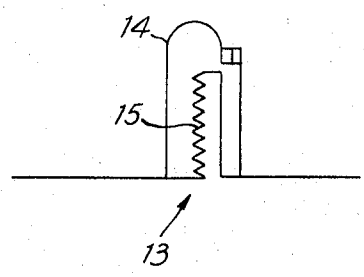


Fig. 2

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THERMIC STARTING DEVICE

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Int. Cl. H02p 1/44
U.S. Cl. 318—221 2 Claims

ABSTRACT OF THE DISCLOSURE

A single-phase motor having a main winding and a starting winding in a split-phase configuration. A bimetallic switch normally closed when the motor is deenergized. Gaseous heating means encloses the switch contacts and heats a movable contact of the switch when it has opened thereby keeping the switch opened so that the starting winding, in series with the switch, is maintained in an open condition so the starting winding is deenergized. The gaseous heating means is constructed as a flow discharge device.

This application is a continuation of Ser. No. 562,168, filed July 1, 1966, now abandoned.

This invention relates generally to methods of starting single-phase asynchronous motors and more particularly to thermal starting devices for such motors.

Thermal starting devices, for use on single-phase induction motors, are known where a thermal resistance, for example, is placed in series with a bimetal switch and during the passage of current therethrough will heat the bimetal contact of the switch so that the switch opens. Such devices are controlled as to the period of operation, and therefore the time in which they open, by the bimetal switch contact and once the switch has opened the current flow through the switch is broken such that the bimetal contact will tend to cool and therefore again close. Such known switches require another device for keeping the bimetallic switch open.

Other known thermal starting devices are known in which a bimetallic switch contact is heated by a resistor in series with the main winding of the motor. In these devices the heating of the thermal switch is dependent upon the current in the main winding which is substantially a function of the load. The opening period or starting period of such switches is generally not accurately controlled in view of the variable range of voltages applied thereto.

A principal object of the present invention is the provision of a thermal starting device for use in starting induction motors and capable of accurately controlling the starting period.

Another object of the present invention is to provide a thermal protective device which will avoid damage to a motor in the event that the motor is unable to start due, for example, to it being frozen, blocked or the like.

A feature of the invention is the provision of thermal starting apparatus having a thermal-responsive switch which is connected in series with the starting winding of an induction motor and is generally closed when the motor is deenergized. The switch comprises a bimetal contact which will open automatically in an accurately controlled period of time to determine the starting period of the motor. The switch is held open by an additional heating device.

Another feature of the invention is the provision of an additional heating device in the control apparatus for the thermal switch in which the current and voltage applied thereto is substantially constant so that the additional heating device's efficiency is substantially constant and

can be accurately regulated to a required value. The current and voltage applied to the additional heating device are completely independent of the load applied to the motor.

Still another feature of the present invention is the provision of a thermally-operated device in which the bimetal switch or thermally-operated switch can be operated at a low heat value, and therefore a low current value, so that it can be used in a circuit branch having a large resistance and itself can have a large resistance so that the apparatus can be used in an auxiliary or starting winding circuit of an induction motor in which the resistance is generally higher than the main motor winding.

Other features and advantages of the switching apparatus in accordance with the present invention will be better understood as described in the following specification and appended claims, in conjunction with the following drawings in which:

FIG. 1 is a schematic of a single-phase asynchronous or induction motor with a starting device, according to the invention, connected thereto; and

FIG. 2 is a schematic of a second embodiment of the starting device in accordance with the invention.

As illustrated in the drawing, FIG. 1 illustrates a motor circuit having connections or terminals **1**, **2** to which an alternating power source, not shown, can be connected to apply power to a single-phase motor **3** which is provided with a main winding **4** and an auxiliary or starting winding **5** connected in a split-phase configuration. A starting switch **6**, illustrated in the open position, is connected in the circuit for starting the motor.

A starting device **7**, in accordance with the invention, is connected in the motor circuit and comprises a glow discharge device **8** internally of which is housed a bimetal switch **9** comprising a stationary contact **10** and a bimetallic movable contact **11**. The movable contact **11** is generally in electrical contact with the stationary contact **10** so that the switch **9** is normally closed when the motor is in a deenergized condition.

When the starting switch **6** is closed the split-phase currents in the windings **4**, **5** generally have a relatively small phase difference so that the vector difference between the windings' voltages is relatively small. Closing the starting switch **6** causes a torque to be developed by the motor for starting. The current passing through the switch **9** will heat the bimetal contact **11** so that it opens the switch and a glow discharge **12** is formed between the two contacts. As the switch opens the phase difference between the voltages to the motor increases so that the vector difference between the windings' voltages result in a potential difference sufficient to effect the glow discharge in the device **8**.

The glow discharge **12** is sufficient to maintain the movable contact **11** heated and the thermally-operated switch **9** open so that the starting winding **5** is deenergized. Thus, in view of the fact that the parameters in this apparatus can be substantially accurately determined, the automatic starting apparatus can accurately control the starting period.

A second embodiment of a starting device or apparatus **13**, in accordance with the invention, is illustrated in FIG. 2. In the second embodiment a bimetal switch **14**, which has a stationary contact and a long curved bimetallic movable contact, and a heating resistor **15**, shunting the switch, comprise the appparatus **13**. The resistor **15** has a relatively high resistance and is connected in series with a starting winding of a motor, not shown, of the type illustrated in FIG. 1. The thermally-operated switch movable contact and the stationary contact are normally closed so that when a starting switch, not shown, is closed applying

power to the motor the thermally-operated bimetal switch **14** will open in the manner of the switch **9** heretofore described.

It can be seen that since the resistor **15** has a high resistance the initial starting current, to the starting winding, not shown, flows through the thermally-operated switch **14** and when this switch opens the current flow is through the resistor **15**. The current flow can be accurately determined by the resistance characteristics of the resistor **15** and the resistance offered by the auxiliary winding or starting winding of the motor to which the resistor **15** is connected in series.

Those skilled in the art will recognize that the starting device, according to the invention, also functions as a protective device since the starting period of an induction motor can be accurately controlled. If the motor does not start, for example, if it is for any reason blocked, the bimetal switch opens eventually and is kept open, by an additional heating device, **15**, until the motor starting switch is turned off so that the auxiliary or starting winding is protected and the entire circuit will be protected when the motor is eventually turned off.

While preferred embodiments of the invention have been shown and described, it will be understood that many modifications and changes can be made within the true spirit and scope of the invention.

What I claim and desire to be secured by Letters Patent is:

1. In combination with a single phase motor having a main winding for driving the motor and a starting winding, a thermally-responsive switch having a stationary contact and a bimetallic movable contact in series with said starting winding, said switch being normally closed when said motor is deenergized, connections to apply current to said main winding and to said starting winding to operate the motor thereby heating said bimetallic movable contact and causing it to open said switch, gaseous heating means enclosing said switch contacts rendered effective to continue to heat said movable contact when said switch is open thereby to maintain said switch open and said starting winding deenergized, said windings being connected in a split-phase configuration, and means connecting said heating means to have applied thereto a potential difference across said windings and induced voltage existing in said starting winding when said switch is open effective to energize said heating means to render said heating means effective to maintain said switch open.

2. In combination with a single-phase motor having a main winding and a starting winding, means for disconnecting the starting winding after starting comprising, a glow discharge device, a thermally-operated switch in said glow discharge device in series with said starting winding and closed when said motor is deenergized, said switch comprising a bimetallic movable contact operable to an open position in response to heat, connections for applying an electrical voltage to said main winding and said starting winding including connections for applying current to said bimetallic contact in series with said starting winding, means connecting said windings in a split-phase configuration so that there is a potential difference between said windings and an induced voltage in said starting winding when said switch is open, means connecting said glow discharge device so that said potential difference between said winding and said induced voltage is applied across said device, said potential being sufficient to cause a glow discharge in said glow discharge device when said movable switch contact opens to effect said glow discharge to maintain said movable contact open to maintain said thermal switch open and thereby maintain said starting winding out of circuit.

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