

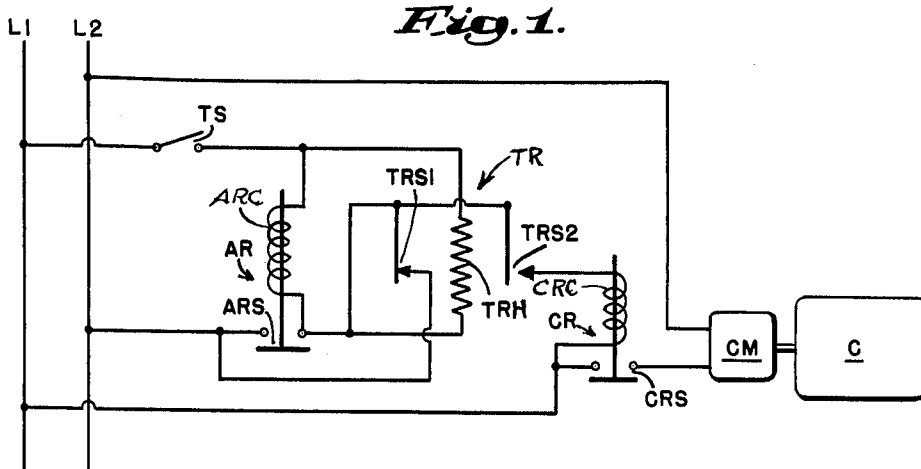
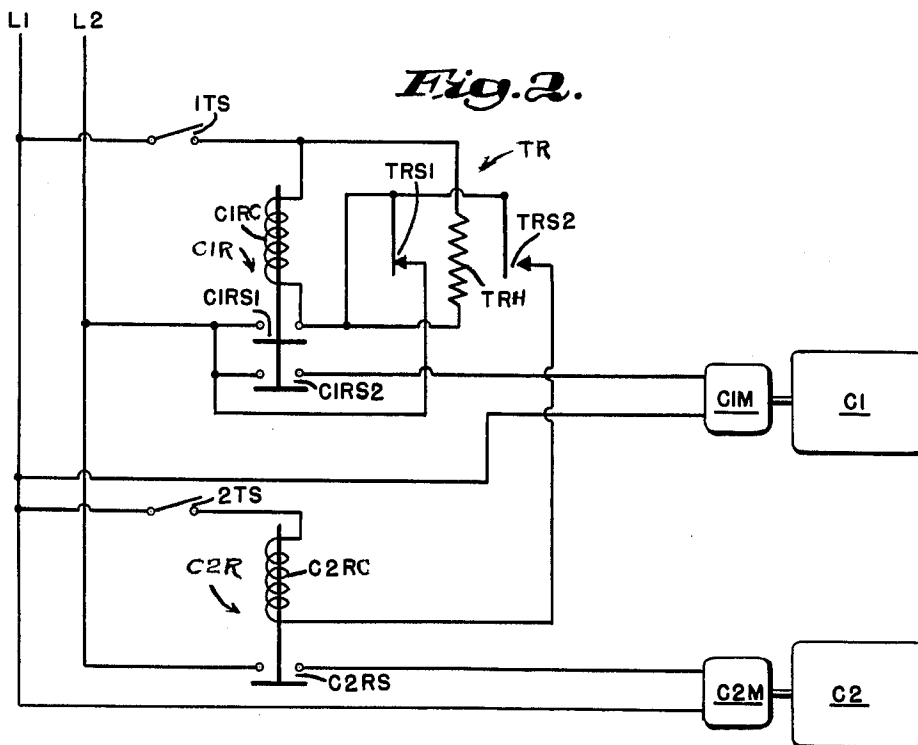
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W. K. KYLE

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CONTROL CIRCUITS OF MOTORS OF REFRIGERANT COMPRESSORS

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Inventor:
Willie K. Kyle,
by Robert J. Palmer,
Attorney

1

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CONTROL CIRCUITS OF MOTORS OF
REFRIGERANT COMPRESSORS

William K. Kyle, Staunton, Va., assignor to Westinghouse
Electric Corporation, Pittsburgh, Pa., a corporation of
Pennsylvania

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This invention relates to time delay circuits for controlling the motors of refrigerant compressors.

A time delay is desired in starting a refrigerant compressor of an air conditioning unit by a thermostat, the contacts of which may chatter, and without the time delay, may cause the compressor to cycle. A time delay is also desired in starting a refrigerant compressor after it has been turned off, for preventing too rapid cycling rates, and to permit pressure equalization so that the compressor can easily be restarted. A time delay is also desired for delaying restarting after a power failure to permit the power supply system to stabilize and regain normal voltage. A time delay is also desired for delaying the starting of a second compressor of a two-compressor system by a two-step thermostat for reducing the power load.

Objects of this invention are to simplify, and reduce the costs of time delay control circuits of motors of refrigerant compressors.

This invention will now be described with reference to the annexed drawings, of which:

FIG. 1 is a diagrammatic view of a one-compressor system embodying this invention, and

FIG. 2 is a diagrammatic view of a two-compressor system embodying this invention.

Referring first to FIG. 1, a refrigerant compressor C is driven by an electric motor CM. The motor CM is connected through switch CRS of starter relay CR to electric supply lines L1 and L2. Switch TS which may be a switch of a thermostat, is connected to the line L1, and in series with heater resistor TRH of thermal relay TR, and switch ARS of auxiliary relay AR to the supply line L2. Energizing coil ARC of the relay AR is shunted across the resistor TRH. The switch ARS which is normally open, is shunted across normally closed switch TRS1 of the relay TR. Energizing coil CRC of the starter relay CR is connected in series with normally open switch TRS2 of the relay TR, and the switch ARS to the lines L1 and L2.

When the switch TS closes, it energizes through the closed switch TRS1, the coil ARC of the relay AR, and the heater resistor TRH of the relay TR. The relay AR quickly closes its switch ARS. The switch TRS1 heated by the now energized, heater resistor TRH, warps open, but the resistor TRH and the coil ARC remain energized through the now closed switch ARS. The heated switch TRS2 warps closed after a time delay period, energizing the coil CRC of the starter relay CR which closes its switch CRS, starting the compressor motor CM. Thus, there is an "On" timing period.

When the switch TS is opened, or when there is a power failure, the relays AR and TR are deenergized. The relay AR opens its switch ARS. The switch TRS2 warps open, and the switch TRS1 warps closed after a time delay period. Thus, there is an "Off" timing period.

Both the "On" and the "Off" timing periods are used to provide from approximately four to six minutes delay, about twice that which can be provided by conventional, relatively inexpensive, thermal time delay relays.

Referring now to FIG. 2, a first stage, refrigerant compressor C1 is driven by an electric motor C1M. A first stage switch 1TS of a two-stage thermostat, is connected in series with energizing coil C1RC of starter relay

2

C1R of the motor C1M, and normally open switch C1RS1 of the relay C1R to the supply lines L1 and L2. Heater resistor TRH is shunted across the coil C1RC. The motor C1M is connected in series with normally open switch C1RS2 to the supply lines.

Second stage, compressor motor C2 is driven by electric motor C2M. The motor C2M is connected in series with normally open switch C2RS to the supply lines. Second stage thermostat switch 2TS is connected in series with energizing coil C2RC of the relay C2R, normally open switch TRS2 of the relay TR, and the normally open switch C1RS1 to the supply lines.

When the switch 1TS closes, it energizes the coil C1RC of the relay C1R, and the heater resistor TRH of the relay TR, through the normally closed switch TRS1 of the relay TR. The relay C1R closes its switches C1RS1 and C1RS2. The switch TRS1 warps open, but the coil C1RC and the resistor TRH remain energized through the now closed switch C1RS1. The now closed switch C1RS2 energizes the compressor motor C1M which starts the first stage compressor C1. The switch TRS2 warps closed after a time delay period.

When the switch 2TS closes, it energizes the coil C2RC of the starter relay C2R through the now closed switches TRS2 and C1RS1. The switch C2RS closes and energizes the motor C2M, starting the second stage compressor C2.

In the embodiment of FIG. 2, if both switches 1TS and 2TS are closed at the same time, the first stage compressor C1 is started without delay, but the starting of the second stage compressor motor C2M is delayed by the time required for the switch TRS2 to warp closed. Thus, both compressor motors cannot be started at the same time, thus reducing starting power.

When the switch 1TS opens or there is a power failure, quick reclosing of the switch 1TS or quick restoration of power cannot restart the compressor motor C1M until the switch TRS1 has had time to warp closed.

What is claimed is:

1. A control circuit for a motor of a refrigerant compressor, comprising a first relay having an energizing coil, and having a normally open switch which closes when said coil is energized; a thermal relay having a heater resistor connected across said coil, having a normally closed switch which opens after said resistor is energized, and having a normally open switch which closes after said resistor is energized; electric supply connections; a control switch; means including said control switch and said normally closed switch in series for connecting said coil and said resistor to said connections; a starter relay for said motor, said starter relay having an energizing coil, and having a normally open switch which closes when said last mentioned coil is energized; means including said last mentioned switch for connecting said motor to said connections, and means including said normally open switch of said thermal relay and said switch of said first relay in series for connecting said coil of said starter relay to said connections.

2. A control circuit for the first and second motors of the first and second refrigerant compressors respectively, of a two-stage refrigeration system, comprising a first relay having an energizing coil, and having normally open first and second switches which close when said coil is energized; a thermal relay having a heater resistor connected across said coil, having a normally closed switch which opens after said resistor is energized, connected across said first switch, and having a normally open switch which closes after said resistor is energized; electric supply connections; a control switch; means including said control switch and said closed switch in series for connecting said coil and said resistor to said connections; means including said second switch for connecting said

3

first motor to said connections; a starter relay for said second motor, said starter relay having an energizing coil, and having a normally open switch which closes when said last mentioned coil is energized; means including said last mentioned switch for connecting said second motor to said connections; a second control switch; and means including said second control switch, said normally open switch of said thermal relay and said first switch in series for connecting said coil of said starter relay to said connections.

3. A control circuit as claimed in claim 2 in which said

4

first and second control switches are first and second stage thermostat switches respectively.

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ORIS L. RADER, *Primary Examiner*.