Oct. 22, 1963 J. J. FINN 3,107,843

COMPENSATING THERMOSTATIC CONTROL SYSTEM FOR COMPRESSORS

Filed Jan. 23, 1961

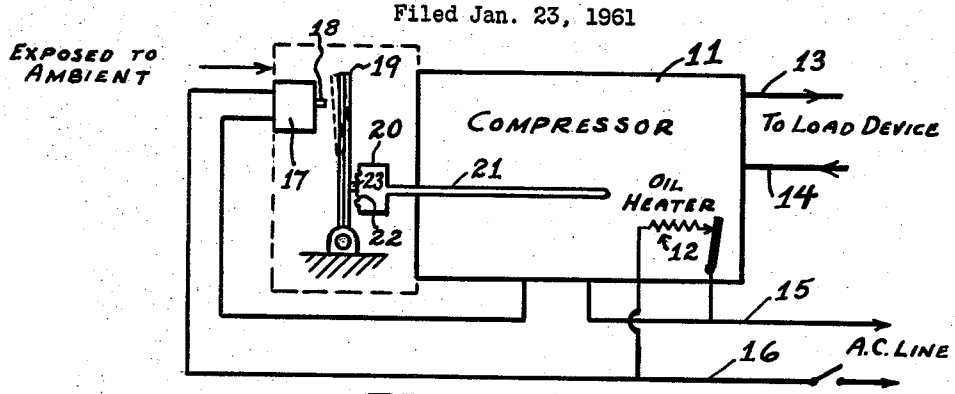


FIG. 1

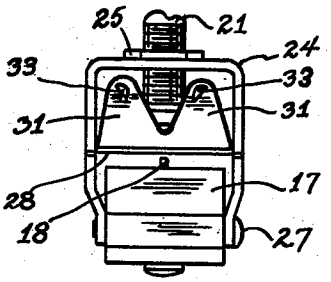


FIG. 4

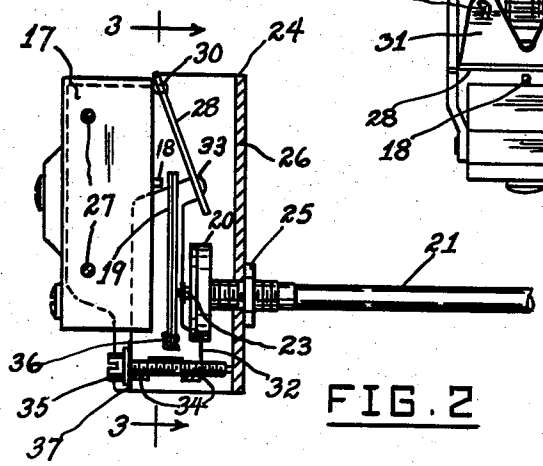


FIG. 2

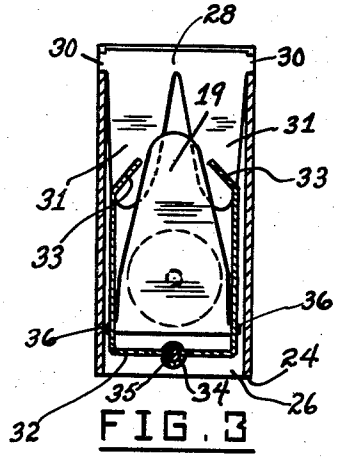


FIG. 3

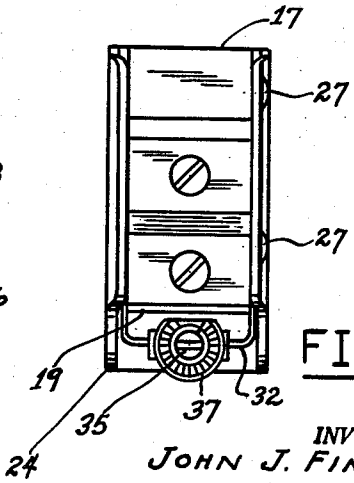


FIG. 5

INVENTOR.
JOHN J. FINN
BY Herman J. Gordon
ATTORNEY

United States Patent Office 3,107,843 Patented Oct. 22, 1963

3,107,843

COMPENSATING THERMOSTATIC CONTROL SYSTEM FOR COMPRESSORS

John J. Finn, Rockville, Md., assignor to Electro-Therm, Inc., Silver Spring, Md.

Filed Jan. 23, 1961, Ser. No. 84,362
9 Claims. (Cl. 230—6)

This invention relates to control devices for compressors, and more particularly to an improved thermostatic control system for a compressor.

A main object of the invention is to provide a novel and improved control system for a compressor, for example, for use in a refrigeration system, said control system being provided with means to prevent energization of the compressor until the oil used therein has been heated sufficiently to substantially minimize mixing of the oil with the refrigerant employed in the compressor, the control system being provided with means to compensate for ambient temperature conditions, whereby to prevent excessive delay in starting the compressor under conditions of relatively low ambient temperature.

A further object of the invention is to provide an improved starting system for a compressor of the type provided with means to heat the compressor oil prior to energization of the compressor, for the purpose of minimizing or preventing mixing of the oil with the refrigerant employed in the compressor, said starting system being provided with means for compensating for low temperature ambient conditions to prevent excessive delay in starting the compressor under such conditions, the system involving relatively simple parts and being reliable in operation.

A still further object of the invention is to provide an improved compensating thermostatic switch device for use in compressor starting systems, or the like, for introducing a correction for ambient temperature conditions to prevent excessive time delays in the operation of the switch device under certain ambient conditions.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIGURE 1 is a schematic diagram illustrating an improved compressor starting control system constructed in accordance with the present invention.

FIGURE 2 is a vertical cross-sectional view taken through a compensating thermostatic switch assembly according to the present invention, which may be employed in the improved system of FIGURE 1.

FIGURE 3 is a vertical cross-sectional view taken substantially on the line 3—3 of FIGURE 2.

FIGURE 4 is a top view of the assembly of FIGURES 2 and 3.

FIGURE 5 is a front elevational view of the assembly of FIGURES 2, 3 and 4.

In starting a compressor of the type employing Freon, or similar refrigerant, it is necessary to first heat the lubricating oil used in the compressor to a relatively high temperature, such as 120° F., before energizing the compressor, to minimize or prevent mixing of the Freon with the oil. Thus, a suitable heating unit **12**, diagrammatically illustrated in FIGURE 1, is employed to heat the oil in the compressor, and energization of the compressor motor is delayed until the oil reaches the proper temperature. With this type of arrangement, in warm weather the compressor motor will be energized after only a relatively short time delay, since the rise in temperature of the compressor oil due to the heat furnished thereto by the heater unit **12** will occur relatively rapidly.

However, in cold weather, the rise in temperature of the compressor oil occurs at a much slower rate, and this

produces an excessive time delay in starting the compressor.

When the oil mixes with the refrigerant, the lubricating efficiency of the oil is reduced, since the refrigerant impairs the lubricating qualities of the oil. Since it is usually desirable to avoid an excessive time delay in starting the compressor, and since a certain amount of mixing of the oil and Freon can be tolerated under cold weather conditions, the time delay can be held substantially constant under all ambient conditions by providing suitable compensation for ambient temperature in the compressor starting circuit. A prime purpose of the present invention is to provide a means for introducing such compensation.

Referring to the drawings, **11** designates a conventional refrigeration compressor which is connected to a suitable refrigerant circuit by means of the refrigerant conduits **13** and **14**. A conventional oil heating unit **12**, which may be thermostatically controlled, is mounted in the compressor to preheat the compressor oil, for example, to a temperature of 120° F., to prevent or minimize mixing of the oil with the refrigerant. The heating unit **12** may be connected across a pair of power supply conductors **15** and **16**, as shown, the compressor motor being connected to said supply conductors through a microswitch **17**, which is normally open, and which closes when its operating pin **18** is engaged by a pivoted tongue member **19**. Tongue member **19** is pivoted to a suitable stationary support and is rotated in a counterclockwise direction, as viewed in FIGURE 1, by the action of a bellows **20** connected to a thermostat tube **21**, containing a suitable expansible fluid, which is mounted in the compressor **11** so as to be in thermal contact with the compressor oil. The rise in temperature of the oil expands the fluid in the tube **21** and causes the diaphragm element **22** of the bellows to deflect outwardly, the center abutment pin **23** of the diaphragm element engaging the tongue member **19** to rotate same counterclockwise, whereby eventually said tongue member engages pin **18** to close the microswitch **17** and energize the compressor motor.

The tongue member **19** comprises a bimetal body which is exposed to ambient temperature and which deforms in accordance therewith. Thus, under cold weather conditions, the tongue member **19** will deform in the manner shown in dotted view, so that its upper portion more closely approaches the microswitch operating pin **18**. Therefore, the amount of temperature rise of the compressor oil required to close the microswitch is reduced in accordance with the reduction in ambient temperature, and excessive time delay in starting the compressor is thereby avoided. By suitably arranging the bimetal tongue **19** relative to the diaphragm **22** and the microswitch operating pin **18**, the time delay for operating the compressor may be held substantially constant over a wide range of ambient temperature conditions.

Referring to FIGURES 2, 3, 4 and 5, **24** designates a generally channel-shaped supporting bracket which is adapted to be fastened to a wall of the compressor. Threadedly engaged through the lower portion of the main wall **26** of the supporting bracket is the thermostat tube **21**, being locked thereto by a suitable locknut **25**. The microswitch **17** is secured between the flanges of bracket **24** parallel to the main wall **26** by a pair of transverse fastening bolts **27**, **27**. An inclined resilient plate member **28** is rigidly secured at its top corners to the top marginal portions of the bracket flanges, as shown at **30**, **30**, and extends downwardly and inwardly in the bracket. The spring plate **28** is formed with a pair of depending arms **31**, **31**, and the ends of the arms of a rigid, generally U-shaped bracket member **32** are

rigidly secured respectively to the lower ends of said arms 31, 31 at 33, 33. The bight portion of bracket member 32 is centrally formed with a pair of spaced aligned sleeve elements 34, 34, and an adjustable abutment screw 35 is threadedly engaged through said sleeve elements, abutting the lower portion of main wall 26, whereby to adjust the position of the bracket member 32 relative to said main wall, against the tension of spring plate 28.

The bimetal tongue 19, which is of generally triangular shape, is pivoted at 36, 36 to the lower portions of the side arms of bracket member 32, and is thus supported in an upstanding position with its top end disposed between arms 31, 31 and the microswitch operating pin 18.

A fixed index disc 37 may be provided on the outermost sleeve member 34 adjacent the head of the abutment screw 35, and said screw head may be provided with a suitable index mark, enabling the screw to be adjusted to provide a predetermined time delay in the actuation of the pin 18 by the bimetal tongue 19.

As previously described, the abutment pin 23 of the bellows diaphragm engages the lower portion of tongue 19 to rotate said tongue toward the actuating pin 18 of the microswitch responsive to the expansion of the thermostatic fluid in the tube 21, which is in contact with the compressor oil and which therefore responds to the rise in temperature thereof.

While a specific embodiment of a compressor starting control system has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. In combination, an electrically driven compressor of the type employing oil lubricant, heating means mounted in the compressor in a position to heat the lubricant in the compressor, a normally open control switch, an energizing circuit connected to said compressor through said control switch, temperature-sensitive means in thermal contact with the oil lubricant and operating responsive to a predetermined rise in temperature in said oil lubricant to close said control switch, and additional temperature-sensitive means exposed to ambient temperature adjacent said compressor and operating responsive to low ambient temperature adjacent the compressor to close said control switch prior to said predetermined rise in temperature.

2. In combination, an electrically driven compressor of the type employing oil lubricant, heating means mounted in the compressor in a position to heat the lubricant in the compressor, a normally open control switch, an energizing circuit connected to said compressor through said control switch, a pivoted bimetal member mounted adjacent said control switch and closing same responsive to a predetermined degree of rotation thereof, and temperature-sensitive means in thermal contact with the oil lubricant and operating to rotate said member through said predetermined degree of rotation responsive to a predetermined rise in temperature in said oil lubricant, said pivoted bimetal member being exposed to ambient temperature and being deformable responsive to low ambient temperature adjacent the compressor to close said control switch prior to said predetermined rise in temperature.

3. In combination, an electrically driven compressor of the type employing oil lubricant, heating means mounted in the compressor in a position to heat the lubricant in the compressor, temperature-sensitive means in thermal contact with the oil lubricant and operating to energize said compressor responsive to a predetermined rise in temperature in the oil lubricant, and additional temperature-sensitive means exposed to ambient temperature adjacent said compressor and operating responsive to low ambient temperature adjacent said compressor to energize said compressor prior to said predetermined rise in temperature.

4. In combination, an electrically driven compressor of the type employing oil lubricant, a normally open control switch, an energizing circuit connected to said compressor through said control switch, a heater mounted in the compressor in a position to heat the lubricant in the compressor, a pivoted temperature-sensitive bimetal arm mounted adjacent said control switch and closing same responsive to a predetermined degree of rotation of said arm, and temperature-sensitive means in thermal contact with the oil lubricant and operating to rotate said arm through said predetermined degree of rotation responsive to a predetermined rise in temperature in said oil lubricant, said bimetal arm being exposed to the ambient temperature adjacent said compressor and being constructed and arranged to deform in a direction to close said control switch prior to said predetermined rise in temperature responsive to a relatively low ambient temperature.

5. In combination, an electrically driven compressor of the type employing oil lubricant, a normally open control switch, an energizing circuit connected to said compressor through said control switch, a heater mounted in the compressor in a position to heat the lubricant in the compressor, a pivoted temperature-sensitive bimetal arm mounted adjacent said control switch and closing same responsive to a predetermined degree of rotation thereof, and temperature-sensitive means in thermal contact with the oil lubricant and operating to rotate said arm through said predetermined degree of rotation responsive to a predetermined rise in temperature in said oil lubricant, said bimetal arm being exposed to the ambient temperature adjacent said compressor and being constructed and arranged to warp in a manner to move a portion thereof more closely adjacent to said control switch and to close said control switch prior to said predetermined rise in temperature responsive to a relatively low ambient temperature.

6. A compressor switch device comprising a support, a thermostat chamber mounted on said support and having a movable temperature responsive abutment element, a switch mounted on said support, an actuating pin on said switch, and a temperature-sensitive bimetal arm pivoted to said support and being disposed directly between said abutment element and said actuating pin, said abutment element and actuating pin being located on opposite sides of said bimetallic arm and being engageable by said opposite sides, means to rotate said arm to operatively engage with said pin responsive to a predetermined rise in temperature of said thermostat chamber, said bimetal arm being exposed to ambient temperature and being deformable responsive to relatively low ambient temperature to operatively engage said pin prior to said predetermined rise in temperature.

7. A compressor switch device comprising a support, a thermostat chamber mounted on said support and having a movable temperature-responsive abutment element, a switch mounted on said support, an actuating pin on said switch, and a temperature-sensitive bimetal arm pivoted to said support and being disposed directly between said abutment element and said actuating pin, said abutment element and actuating pin being located on opposite sides of said bimetallic arm and being engageable by said opposite sides, means to rotate said arm to operatively engage with said pin responsive to a predetermined rise in temperature of said thermostat chamber, said bimetal arm being exposed to ambient temperature and being mounted in a position so that it will deform responsive to a relatively low ambient temperature to cause a portion thereof to approach said pin, whereby to operatively engage said pin prior to said predetermined rise in temperature under relatively low ambient temperature conditions.

8. A compressor switch device comprising a support, a

thermostat chamber mounted on said support and having a movable temperature-responsive abutment element, a switch mounted on said support, an actuating pin on said switch, a temperature-sensitive bimetal arm, and means adjustably and pivotally supporting said arm on said support directly between said abutment element and said actuating pin, said abutment element and actuating pin being located on opposite sides of said bimetallic arm and being engageable by said opposite sides, means to rotate said arm to operatively engage with said pin responsive to a predetermined rise in temperature of said thermostat chamber, said bimetal arm being exposed to ambient temperature and being constructed and arranged so that it will deform responsive to relatively low ambient temperature to cause a portion thereof to approach said pin, whereby to operatively engage said pin prior to said predetermined rise in temperature under relatively low ambient temperature conditions.

9. A compressor switch device comprising a support, a switch mounted on said support and having a movable actuating element, a temperature-sensitive bimetal arm pivoted to said support in a position to operatively engage said actuating element, and compressor temperature-responsive abutment means on the support engageable with said arm to move same toward the actuating element and

to normally operatively engage the actuating element responsive to a predetermined compressor temperature rise, said actuating element and abutment means being located on opposite sides of said bimetal arm and being engageable by said opposite sides, said bimetal arm being exposed to ambient temperature and being deformable responsive to low ambient temperature in a manner to cause a portion thereof to move toward said actuating element, whereby to operatively engage said element prior to said predetermined compressor temperature rise under relatively low ambient temperature conditions.

References Cited in the file of this patent

UNITED STATES PATENTS

1,637,042	Hutt	July 26, 1927
1,821,853	Short	Sept. 1, 1931
1,927,934	Ford	Sept. 26, 1933
2,107,887	Davenport	Feb. 8, 1938
2,145,354	Hull	Jan. 31, 1939
2,175,913	Philipp	Oct. 10, 1939
2,197,230	Waddell	Apr. 16, 1940
2,390,650	Hollatz, et al.	Dec. 11, 1945
2,400,665	Thomas	May 21, 1946
2,550,344	Godshalk	Apr. 24, 1951
2,736,970	Engel	Mar. 6, 1956