June 10, 1941. G. C. PEARCE 2,245,049

REFRIGERATING APPARATUS

Filed July 28, 1939

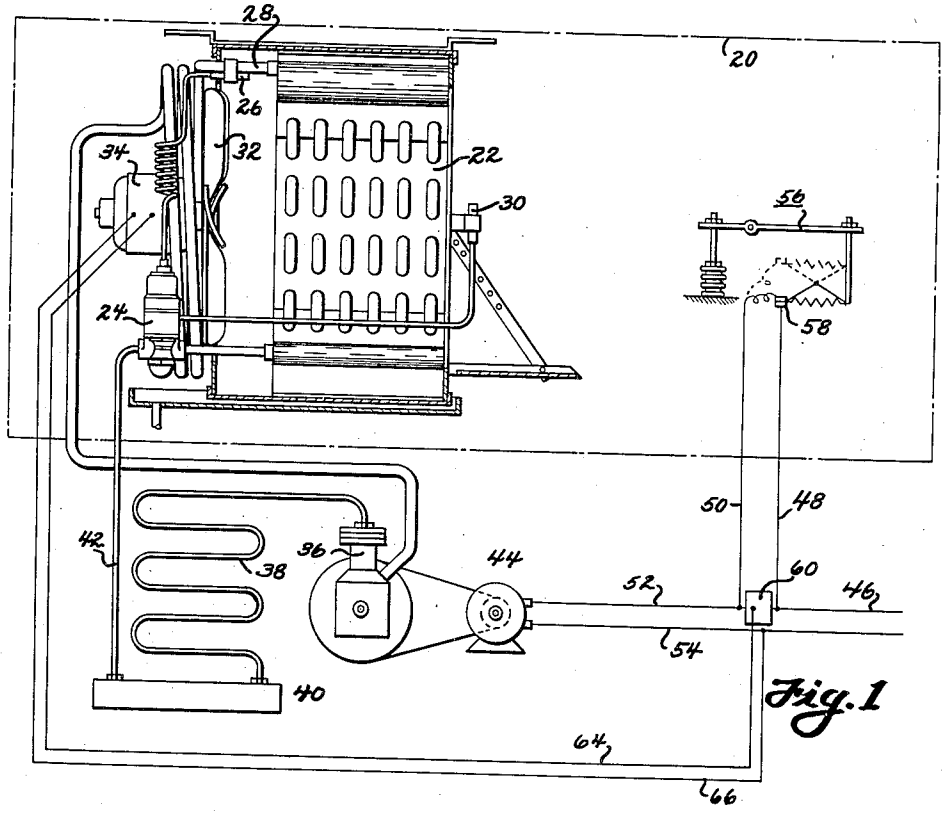


Fig. 1

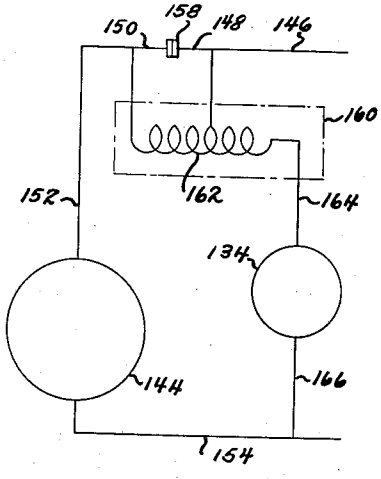


Fig. 3

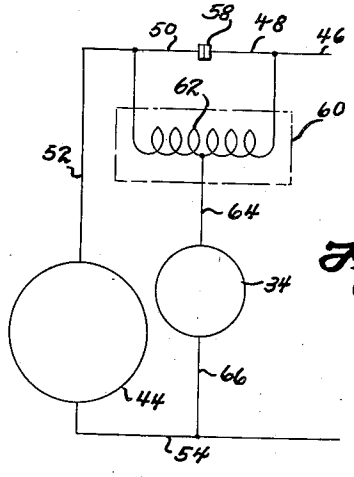


Fig. 2

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Patented June 10, 1941 2,245,049

UNITED STATES PATENT OFFICE

2,245,049

REFRIGERATING APPARATUS

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Application July 28, 1939, Serial No. 287,108

4 Claims. (Cl. 62—4)

This invention relates to refrigerating apparatus and more particularly to electrical systems having a main motor and an auxiliary motor which is run at one speed when the main motor operates and at a different speed when the main motor is stopped.

In refrigerating systems employing forced air evaporator units for walk-in coolers and other applications it is considered desirable to reduce the fan speed when the compressor is idle. It has been customary in order to reduce the speed of the fan to insert a reactor in series with the fan motor. This requires an additional switch or an additional set of switch contacts and also causes considerable waste of electrical energy. In other systems it may be sometimes desirable to increase the fan speed to provide increased circulation when the compressor is idle.

It is an object of my invention to provide an electrical system for forced air refrigeration and other electrically analogous applications wherein a simplified control system is provided for changing the fan speed when the motor-compressor unit is stopped.

It is also an object of my invention to provide such a system in which the minimum amount of current is wasted.

It is another object of my invention to provide a control system which provides a different fan speed which does not vary greatly under different load conditions.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a view of a forced air refrigerating system partly diagrammatic for a walk-in cooler;

Fig. 2 is a wiring diagram for the electrical system shown in Fig. 1 providing a reduced fan speed; and

Fig. 3 is a wiring diagram of a system similar to Figs. 1 and 2 with a step-up auto-transformer for providing increased fan speed.

Briefly, I have shown a simple refrigerating system with a forced air evaporating unit for a walk-in cooler. A thermostat control responsive to the temperature of the air in the walk-in cooler is provided for starting and stopping the motor-compressor unit. An auto-transformer is placed in shunt with the contacts of the thermostat switch and has its reactance coil tapped and connected to the conductor which connects to the fan motor. By this arrangement the fan motor as well as the main compressor motor receive full voltage when the contacts are closed, but when the contacts are open the voltage applied to the fan motor is reduced in accordance with the position of the tap on the auto-transformer. In this way the speed of the fan motor will be reduced when the compressor stops without the use of an additional control mechanism.

In Fig. 3 is provided a similar system with a step-up auto-transformer providing increased voltage and speed for the fan motor when the contacts are open.

Referring now more particularly to the drawing there is indicated diagrammatically a walk-in cooler 20 containing a forced draft evaporating means including a finned evaporator 22 provided with a deflector and a pan for catching moisture dripping from the evaporator. An expansion valve 24 is provided for controlling the flow of liquid refrigerant into the bottom of the evaporator 22. The expansion valve is provided with a thermostat bulb 26 mounted upon the suction line 28 and another thermostat bulb 30 in the air stream so that by these two bulbs the flow of liquid to the evaporating means is controlled. The cooling of either of the bulbs 26 and 30 will tend to close the valve 24 while the warming of the bulbs will tend to open it. A propeller type fan 32 driven by an electric motor 34 is provided for circulating air through the evaporator 22.

A compressor 36 is provided for drawing evaporated refrigerant through the suction conduit 28. This compressor compresses the refrigerant and pumps the compressed refrigerant into the condenser 38 where it liquefies and collects in a receiver 40. From the receiver 40 the liquid refrigerant is conducted by the supply line 42 to the expansion valve 24 which controls the flow of liquid refrigerant into the evaporator 22.

The compressor is driven by an electric motor 44. The electric motor 44 is supplied with electric energy through the conductors 46, 48, 50, 52 and 54. A thermostatic switch generally designated by the reference character 56 is located within the walk-in cooler 20 and is provided with a set of switch contacts 58 which connect the conductors 48 and 50 to close the circuit to the main driving motor 44 so as to cause the operation of the refrigerating system. Shunted across the contacts 58 as well as conductors 50 and 48 is a step-down auto-transformer 60. This auto-transformer is provided with a reactance coil 62 which is connected at its end to the connection between the conductors

46 and 48 on one end and to the junction between the conductors 50 and 52 on the other end so that it shunts the thermostat contacts 58 as well as the conductors 48 and 50. The fan motor 34 has one terminal connected by a conductor 66 to the conductor 54 and a second terminal connected by a conductor 64 to a tap upon the reactance coil 62 of the auto-transformer 60. As shown the conductor 64 taps the reactance coil 62 in about its mid-portion.

When the contacts 58 are closed the main driving motor 44 of the compressor will receive current directly at full line voltage. At this time the fan motor 34 will receive substantially full line voltage since the current will flow in substantially equal amounts proceeding from each end of the reactance coil toward the center portion and thence flow through the conductor 64 through the fan motor which has its other terminal connected by the conductor 66 to the supply conductor 54. Regardless of the amount of voltage transformation, the ampere-turns in each portion will be equal and opposite so that the losses in the transformer will be limited to copper losses when the contacts are closed.

When the contacts are open the fan motor 34 will receive about one-half the line voltage and will use about one-half the amount of its current at full voltage. There will be at this time a small amount of current flowing through the other half of the reactance coil 62 through the main driving motor 44, but this will amount to less than one-half of the reduced current flow through the fan motor 34.

Thus, assuming the line voltage is 115, the voltage applied to the fan motor 34 will be about 55 when the contacts 58 are opened. The reactance coil 62, however, may be tapped at any point so as to give any desired voltage drop from line voltage. Therefore, if it is desired to reduce the fan motor voltage less than one-half, the conductor 64 will tap the reactance coil nearer its connection with the conductor 52. If it is desired to reduce the voltage applied to the fan motor greater than one-half the conductor 64 will tap the reactance coil closer to the conductor 46. A plurality of convenient taps may be provided upon the auto-transformer to give any desired voltage transformation when the contacts are open. Thus taps may be provided to provide 70, 80, or 90 volts when the contacts are open.

In Fig. 3 there is shown a modified form of electrical system in which a step-up auto-transformer is used to raise the voltage applied to the auxiliary motor 134 when the contacts 158 are opened. In Fig. 3 the parts are given numbers corresponding to the diagram shown in Fig. 2 with 100 added to each. Thus, in this circuit, the current is fed to the main motor 144 through the conductors 146 and 148, contacts 158, and the conductors 150 and 152, the last connecting to one terminal of the main or compressor-motor 144 while the current is conducted from the other terminal by the conductor 154. The step-up auto-transformer 160 has one point of its reactance coil 162 connected to the junction of conductors 146 and 148 and another point to the junction of the conductors 150 and 152 so that the contacts 158 are shunted by a portion of the reactance coil 162. The other portion of the reactance coil 162 is connected by the conductor 164 to one terminal of the auxiliary motor 134 which drives the fan. The other terminal of auxiliary motor is connected to the conductor 154.

In this circuit when the contacts are closed the auxiliary motor 134 and the main motor 144 operate at full voltage. When the contacts 158 are opened to stop the main motor 144, the auxiliary or fan motor 134 will be subjected to an increased voltage by reason of the step-up auto-transformer 160 which will cause the motor 134 to operate at an increased speed. The operation of the fan motor at increased speed may be useful in air conditioning systems where it is desired to provide more ventilation when the compressor is idle than when the compressor is in operation.

In this way I have provided a simple system for reducing or increasing the voltage and current applied to the fan in order to reduce the fan speed when the compressor is idle. Only one switch is required which also controls the main driving motor. This switch may be of any suitable type including either the thermostat or low pressure type of control. The only additional equipment required is an auto-transformer which is not expensive.

This form of electrical system may be used with other applications wherein two motors are to be controlled and the smaller motor is to operate at reduced or increased speed when the large motor is idle.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An electrical system including a main driving motor, a set of electrical conductors connected to the main driving motor for supplying electric energy thereto, a switch mechanism having its contacts connected in one of said conductors for stopping the main driving motor, an auto-transformer including a reactance coil shunted around said contacts of the switch mechanism and connected at its ends to said one conductor, an auxiliary motor having its one terminal connected to a tap on said reactance coil of said auto-transformer and its other terminal connected to another of said set of electrical conductors, whereby said auxiliary motor will operate at reduced voltage and speed when the contacts of the switch mechanism are open and at substantially full voltage and speed when the contacts are closed.

2. Refrigerating apparatus including an evaporating means, a compressor and condenser for supplying liquid refrigerant to and for withdrawing evaporated refrigerant from said evaporating means, a main driving motor for driving said compressor, an auxiliary motor for circulating a medium in heat exchange relation with the evaporating means, a set of conductors for conducting electric energy to the terminals of the main driving motor, a switch mechanism including contacts connected in series with one of the conductors for stopping the main driving motor and compressor, an auto-transformer including a reactance coil shunted around said contacts of said switch mechanism with its ends connected to said one conductor upon opposite sides of said contacts, said auxiliary motor having one terminal connected to a tap on the reactance coil of the auto-transformer and the other terminal connected to another conductor of said set.

3. An electrical system including a main driving motor, a set of electrical conductors connected to the main driving motor for supplying electric energy thereto, a switch mechanism having a

set of contacts connected in one of said conductors for stopping the main driving motor, an auto-transformer including a reactance coil having a portion shunted around said set of contacts of the switch mechanism in said one conductor with the ends of said portion connected to said conductor upon opposite sides of said contacts, an auxiliary motor having its one terminal connected to said reactance coil of said auto-transformer and its other terminal connected to another of said set of electrical conductors, whereby said auxiliary motor will operate at a different speed when the contacts are open than when the contacts are closed.

4. Refrigerating apparatus including an evaporating means, a compressor and condenser for supplying liquid refrigerant to and for withdrawing evaporated refrigerant from said evaporating means, a main driving motor for driving said compressor, an auxiliary motor for circulating a medium in heat exchange relation with the evaporating means, a set of conductors for conducting electric energy to the terminals of the main driving motor, a switch mechanism including a set of contacts connected in series with one of the conductors for stopping the main driving motor and compressor, an auto-transformer including a reactance coil having at least a portion shunted around said contacts of said switch mechanism in said one conductor with the ends of said portion connected to said conductor upon opposite sides of said contacts, said auxiliary motor having one terminal connected to the reactance coil of the auto-transformer and the other terminal connected to another conductor of said set.

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