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CONTROL APPARATUS FOR UNLOADING COMPRESSORS

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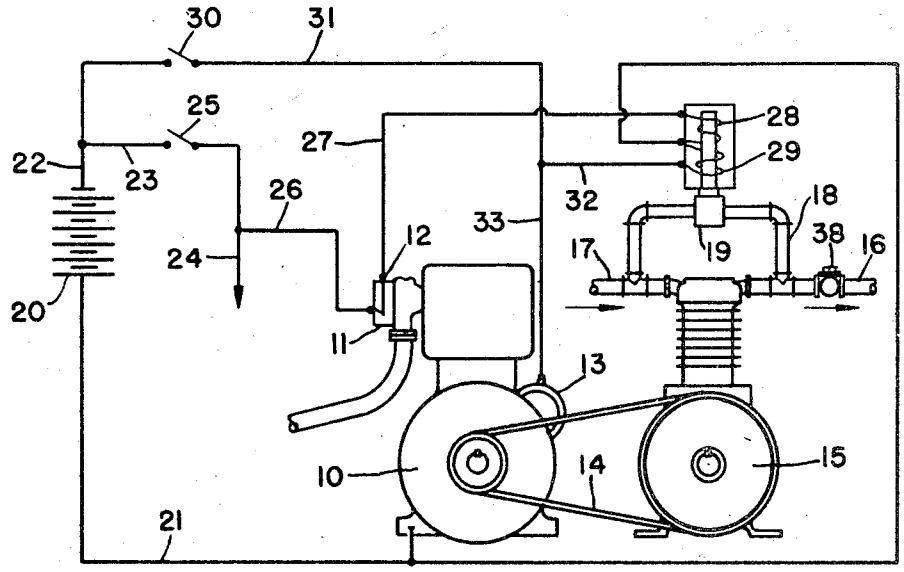


Fig. 1

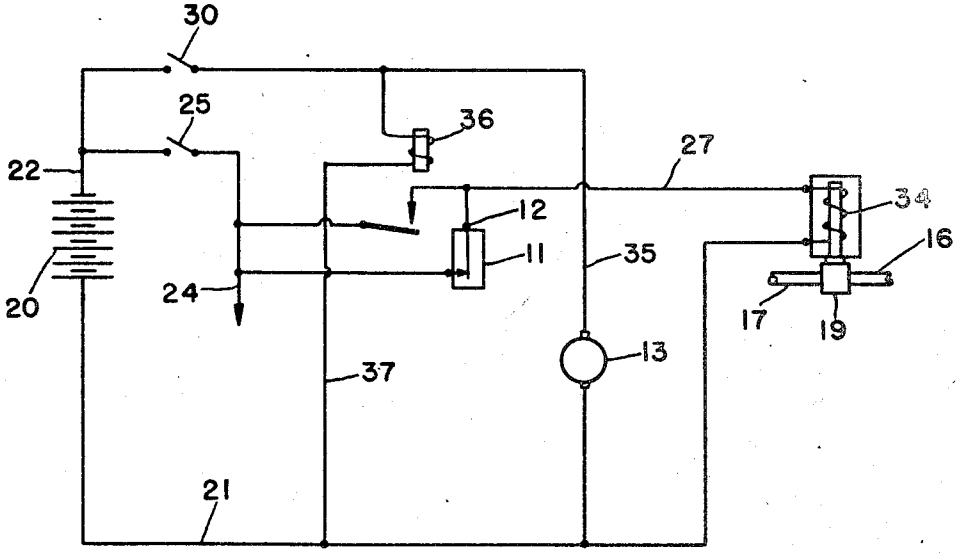


Fig. 2

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CONTROL APPARATUS FOR UNLOADING COMPRESSORS

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7 Claims. (Cl. 230—3)

The object of my invention is to provide an internal combustion engine operating compressor with means whereby the internal combustion engine may be easily started.

Another object of my invention is to unload the compressor during the starting period of the internal combustion engine.

Another object of my invention is to control the unloading of the internal combustion engine responsive to the temperature of the manifold. An internal combustion engine has little or no power when it is cold and will not pull a refrigerating compressor until it is warmed up. It is, therefore, necessary to unload the compressor until the engine is warm and during the cranking or starting of the engine in order that the starter motor may not be called upon to turn over a heavily loaded compressor. The temperature of the exhaust manifold corresponds very closely to that of the engine walls during the warming up period of the engine, and an unloading control responsive to the manifold temperature will be approximately responsive to the temperature of the cylinder walls.

The foregoing and many other specific features of my invention are set forth in the following specification, where I describe what I consider the preferred embodiments of my invention. These are illustrated in the accompanying drawing where—

Figure 1 diagrammatically shows the invention with a double winding solenoid valve, and Figure 2 shows the invention with a single solenoid valve winding.

Referring to Figure 1, an internal combustion engine 10 with manifold 11 is started by cranking motor 13 and is connected to the compressor 15 by means of the belt 14. The compressor 15 has a low pressure inlet 17 and a high pressure outlet 16 with a check valve 38. There is a bypass 18 from the low pressure to the high pressure side to allow the unloading of the compressor, which is accomplished by a valve 19, which is a solenoid valve responsive to the windings 28 and 29. The battery 20 furnishes the power through the line 22 and 23 to the ignition switch 25 and through the line 26 to the thermostat 12, which is responsive to the temperature of the exhaust manifold, and through the line 27 and line 21 to energize the said solenoid valve through the winding 28, whereby upon the closing of the ignition switch 25 the circuit will be completed to the winding coil 28 of the unloading valve 19 through the manifold thermostat 12, which is adjusted to hold its contacts closed until the manifold reaches a pre-determined temperature. The winding 28 of the unloading valve need not be strong enough to open the valve but must have sufficient strength to hold the valve open. The line 24 is connected to the ignition coil. The closure of the starting switch 30 supplies current to the cranking motor 13 through the line 31 and 33 and to the winding 29 through the line 31 and 32.

The winding 28 has a sufficient number of ampere turns to open the valve, thus bypassing the compressor. When the engine runs, the starting switch is open but since the exhaust manifold is still cold, the winding 28 of the solenoid will hold it open until the manifold has reached a temperature sufficiently high to open the thermostat contacts, interrupting the current of the winding 28 to the valve and allowing the valve to close, thus loading the compressor. Should the engine be started when it is still warm from a previous operation, the circuit through the winding 29 during the cranking period will open up the bypass valve 19, thus unloading the compressor only when the cranking motor is operating.

Referring to Figure 2, the same result may be accomplished through a single winding of a solenoid valve whereby the ignition switch supplies current to the ignition system and to the unloading valve through the manifold thermostat in the same manner as was described in Figure 1. The circuit of the cranking motor includes the lines 35, 37 and 21 to the relay 36, which operates whenever current is supplied to the motor. This relay carries contacts which short-circuit the manifold thermostat during the cranking period, insuring that the compressor will always be unloaded during this period regardless of manifold temperature. In Figure 2 single winding is designated by figure 34.

While I have described the foregoing preferred embodiments of my invention, I contemplate that many changes may be made without departing from the scope or spirit of my invention.

I claim:

1. The combination of a compressor, an internal combustion engine with an exhaust manifold, a cranking motor put in motion by a starter switch to start said engine, a bypass from the low pressure to the high pressure side of the compressor, a solenoid valve controlling the bypass, and means to open the said valve when the starter switch is closed and to keep said valve open until the exhaust manifold attains a predetermined temperature.

2. The combination of a compressor, an internal combustion engine with an exhaust manifold, a cranking motor put in motion by a starter switch to start said engine, a by-pass from the low pressure to the high pressure side of the compressor, an electrically operated valve controlling the by-pass, and means to open the said valve when the cranking motor is energized and to keep said valve open until the cranking motor is de-energized.

3. The combination of a compressor, an internal combustion engine with an exhaust manifold, a cranking motor to start said engine, a by-pass from the low pressure to the high pressure side of the compressor, an electrical valve controlling the by-pass, means to open said valve when cranking motor is energized and until it is de-energized, irrespective of the temperature of the engine.

4. The combination of a compressor, an internal combustion engine with an exhaust manifold, a cranking motor to start said engine, a by-pass from the low pressure to the high pressure side of the compressor, an electrical valve controlling the by-pass, means to open said valve when cranking motor is energized and until it is de-energized, irrespective of the temperature of the engine, and means to make the operation of said valve responsive to temperature of engine when cranking motor is de-energized.

5. A compressor, a by-pass from the low pressure side to the high pressure side, a valve controlling the by-pass, an internal combustion engine, a thermostat controlled by the heat of said engine, a cranking motor, a solenoid controlling the operation of said valve, an electrical circuit including an ignition switch, a source of power, a thermostat responsive to the heat of engine, a solenoid valve, a second electrical circuit including a source of power, a starter switch, a cranking motor, and said solenoid valve, said circuits operating to control the operation of said valve.

6. The combination of a compressor, an internal combustion engine with an exhaust manifold, a cranking motor to start said engine, a by-pass from the low pressure to the high pressure side of the compressor, an electrical valve controlling the by-pass, an electrical circuit including a source of power, a cranking motor and said valve, and a thermostat responsive to the heat of the engine whereby the action of the valve is responsive to said cranking motor and thermostat.

7. The combination of a compressor, an internal combustion engine with an exhaust manifold, a cranking motor to start said engine, a by-pass from the low pressure to the high pressure side of the compressor, an electrical valve controlling the by-pass, an electrical circuit including a source of power, a cranking motor and said valve, and a thermostat responsive to the heat of the engine whereby the action of the valve is responsive to said cranking motor and thermostat, and means to shunt the thermostat when the cranking motor is in operation.

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