Oct. 6, 1931. W. A. BEIMLING ET AL 1,826,040

COOLING SYSTEM

Filed Feb. 11, 1926

Fig. 1.

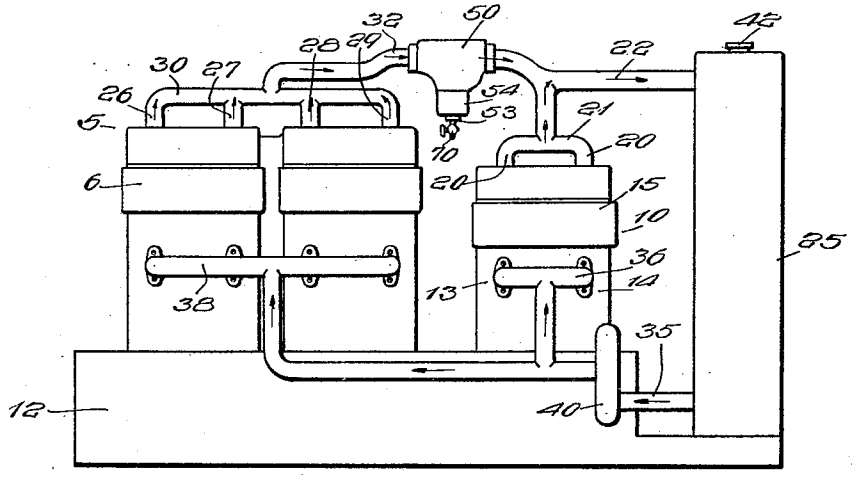
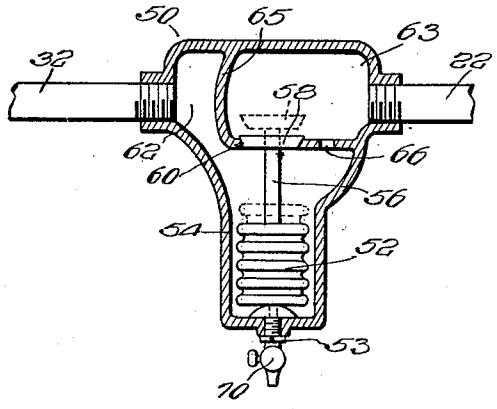


Fig. 2.



Witnesses:
William P. Kilroy
Harry W. LaWhite.

Inventors
William A. Beimling
Floyd B. Peterson
By Brown, Boettcher & Skinner
Attys.

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UNITED STATES PATENT OFFICE

WILLIAM A. BEIMLING AND FLOYD B. PETERSON, OF MILWAUKEE, WISCONSIN, ASSIGNORS TO NATIONAL BRAKE & ELECTRIC COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN

COOLING SYSTEM

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This invention relates to cooling systems, and while capable of use with other combinations has particular utility in connection with fluid compressor and internal combustion engine or driving motor combinations, and the like.

At present, due to the different temperature requirements and operating characteristics of the fluid compressor and the internal combustion engine, the matter of maintaining both the engine and the compressor at their most efficient operative temperatures has been a difficult one.

As well understood in the art, an internal combustion engine has a temperature range at which it performs best and with greatest efficiency and flexibility. When the cylinder temperature drops below or exceeds this working range, the efficiency, flexibility, and all around performance decreases. It is desirable to cool the engine so that it will not overheat and, at the same time, the engine must not be excessively cooled but must be permitted to operate at the working temperature or range of working temperatures at which the best efficiency, flexibility and all around performance is secured.

With a fluid compressor, pump, or the like, however, it is desirable that the heat be more completely carried away. While, of course, it is undesirable that the cylinder temperatures of a compressor or the like be so low that they will interfere with proper lubrication, in a combination of this sort the best working temperatures of the engine are higher than those of the compressor. It is desirable that the compressor operates or runs cool while the engine operates or runs sufficiently warm to secure the best results. In an internal combustion engine it is desirable to increase the cooling effect when the temperature conditions are high and to decrease the cooling effect when the engine is too cool, but in the absence of the warm or heated working range when the compressor is running cool, it is desirable that it continue to run cool without decreasing the cooling effect of the cooling system thereon.

It is the object of our invention to provide an improved method of and means for cooling a compressor and engine combination of this sort that will better serve the purpose for which intended and provide a high working efficiency of both the compressor and engine at all times.

Another object is to provide for doing this with a common cooling system for both the engine and the compressor.

Another object is to deliver the working fluid through the compressor continuously in the operation of the compressor, extending said delivery to the engine and thermally controlling the extended delivery to the engine to increase the cooling effect of the engine when the temperature conditions are high, and to decrease the cooling effect of the engine when the engine is too cool without correspondingly changing the cooling effect on the compressor.

To acquaint those skilled in the art with the manner of constructing and practicing the invention, we shall now describe a particular embodiment of the invention in connection with the accompanying drawings, in which:—

Figure 1 is a more or less diagrammatic side elevational view of a compressor and engine combination embodying the invention; and

Fig. 2 is an enlarged detail section of the thermally controlled means for thermally controlling the cooling effect upon the engine.

In the particular embodiment of the invention shown in the drawings, 5 designates the internal combustion engine having cooling jacket means 6 around the cylinders thereof as well understood in the art. While the engine 5 is illustrated in the drawings as having four cylinders, it is to be expressly understood that any desired number of cylinders may be employed. The particular type and structure of the engine 5 is immaterial and may vary, as may the cooling or water jacket means 6, which are shown as surrounding the cylinders of the engine in the usual or standard manner.

The fluid compressor designated at 10 is shown as mounted with the engine 5 upon a common base 12. The compressor is illustrated as having two cylinders 13 and 14, but

it is to be understood that the compressor may also have any desired number of cylinders, and its particular type and form is immaterial and may be varied as desired. The cooling jacket means of the compressor is shown at 15 as surrounding the cylinders 13 and 14.

The water or other cooling medium is circulated through the jacket means 6 of the engine, and through the jacket means 15 of the compressor. The jacket means 15 opens adjacent its upper end at 20 into the outlet manifold 21 which communicates through a conduit or suitable connection 22 with the top of the radiator 25, which may be of any suitable or preferred form or construction. The jacket means 6 opens adjacent its upper end at 26, 27, 28 and 29 into the outlet manifold 30, which is connected through a conduit or connection 32 with the conduit or connection 22, and through said connection 22 with the radiator 25.

From the radiator 25 the cooling medium is returned to the jacket of the compressor 10 through a conduit or connection 35 and a manifold 36, and to the engine through the conduit or connection 35 and a manifold 38. A pump is more or less diagrammatically illustrated at 40 for maintaining the circulation through the system, but it is to be understood that any other means of maintaining the cooling medium circulation through the compressor and engine jackets may be employed. The radiator 25 may have the usual filler cap 42.

To thermally control the cooling effect on the engine 5, we thermally control the circulation of cooling medium through the jacket thereof and to do this without affecting the cooling effect upon the compressor 10 we interpose a thermally controlled valve 50 in the conduit or connection 32 and between the outlet from the engine and the outlet from the compressor. Any suitable or preferred thermostat or thermo-sensitive means may be employed. That shown is of the vapor bellows type comprising a collapsible corrugated resilient vessel or bellows 52, fixedly secured at its lower end as by a nut 53 to the bottom wall of the thermostat or valve housing 54 and having its opposite or movable end wall connected by a stem 56 to a valve 58 which controls a port 60, and thereby communication between the inlet side 62 and the outlet side 63. The outlet from the engine jacket communicates with the inlet side 62, and the outlet side 63 communicates with the connection 22 between the compressor jacket and the radiator 25.

The partition 65 which separates the inlet 62 from the outlet 63 of the housing 54 is preferably provided with a relatively small port or opening 66. This port 66 forms a by-pass around the thermally controlled port 60, so that when the valve 58 is seated and said port 60 closed, a restricted by-pass circulation will be permitted through the engine jacket 6. The housing 54 may have a drain cock 70.

The driving motor 6 and compressor 10 may be operatively connected in any suitable manner so that the compressor will be driven by the motor.

From the foregoing it will now be apparent that there are a pair of cooling medium circuits, one for the engine or driving motor 5, and the other for the compressor 10. The radiator 25 forms common means for cooling the cooling medium of the cooling circuits of both the compressor and the engine, which circuits are connected in parallel through the radiator.

In operation when the thermally controlled valve 58 is closed as shown in full lines in Fig. 2, the pump 40 maintains the circulation of the water or other cooling medium employed through the cooling circuit of the compressor 10 only, except for the relatively small or restricted by-pass circulation permitted through the engine circuit by way of the by-pass port 66 at such time. When the valve 58 is closed the temperature of the engine is at or below the desired operative temperature or temperature range, the closed position of the valve shutting off the cooling circulation through the engine circuit at this time, and decreasing or preventing any increase in the cooling effect, the restricted by-pass through the engine circuit preferably providing merely a relief flow for the medium circulated into the engine jacket and not materially increasing the cooling effect upon the engine.

When, in the operation of the engine as, for example, after it has been run for a while under temperature conditions permitting it, and the temperature rise exceeds the maximum operative temperature or range that is the temperature above which the efficiency of the engine decreases, the thermally sensitive element 52 expands and opens the valve 60, as shown in dotted lines in Fig. 2. Thereupon, a circulation of the cooling medium is established through both the engine and compressor circuits at the same time to increase the cooling effect upon the engine and to maintain the cooling effect upon the compressor. This continues until the temperature of the engine again drops to the minimum operative temperature, whereupon the element 52 contracts and closes the valve 58 to decrease the cooling effect upon the engine or prevent further material increase therein, the cooling of the compressor again continuing, as before.

Thus a common cooling system is provided for the compressor and engine and the system maintains a constant or continued circulation and cooling effect upon the compressor and, at the same time, a thermally

controlled circulation for the engine which starts automatically with an undesirable temperature rise to establish a cooling medium circulating through the engine jacket and thereby set up a cooling effect upon the engine and stops automatically with an undesirable temperature drop to decrease or terminate the cooling effect upon the engine, all independently of the constant or continued compressor circulation which continues independently thereof and uninterrupted thereby.

In this manner the compressor can be kept cool and the motor or engine warm, or at least at the desired operative temperature or within the desired operative temperature range at all times.

The controlling of the delivery of cooling medium to the engine independently of the delivery to the compressor provides for raising the idling temperature of the engine and maintaining the same within the temperature range of greatest efficiency without correspondingly raising the temperature of the compressor. The compressor is maintained at its most efficient temperature and the raising of the idling temperature of the engine prevents stalling of the engine as the load is applied following an idling period.

We do not intend to be limited to the precise details or particular combination shown or described.

We claim:—

1. In an internal combustion engine and compressor combination wherein the mechanisms have different operating temperature requirements, the method of cooling the mechanisms which comprises delivering a common cooling medium to the mechanisms, varying the delivery to the mechanism having the higher temperature requirement, and maintaining the delivery to the mechanism having the lower temperature requirement substantially constant.

2. The method of cooling a compressor and internal combustion engine combination which comprises delivering a common cooling medium to the compressor and engine, interrupting the delivery to the engine, and maintaining continuous delivery to the compressor irrespective of interruptions of delivery to the engine.

3. In combination, a compressor, an internal combustion engine, a cooling circuit for the compressor, a cooling circuit for the internal combustion engine, a radiator common to both circuits, and thermally operated means for controlling the flow in the cooling circuit for the internal combustion engine without reducing the flow in the compressor circuit below a desired limit.

4. In combination, a compressor, an internal combustion engine, a cooling circuit for the compressor, a cooling circuit for the internal combustion engine, a radiator common to both circuits, said circuits being connected in parallel to the radiator, and thermally operated means for interrupting the flow in the cooling circuit for the internal combustion engine without interrupting the flow in the compressor circuit.

5. In combination, a compressor, an internal combustion engine, a cooling circuit for the compressor, a cooling circuit for the internal combustion engine, a radiator, common conduits connecting said circuits in parallel with the radiator, and thermally operated means in one of the common conduits between the compressor and the internal combustion engine for independently interrupting the flow in the circuit for the internal combustion engine.

6. In combination, a compressor, an internal combustion engine, a cooling circuit for the compressor, a cooling circuit for the internal combustion engine, a radiator, common conduits connecting said circuits in parallel with the radiator, a valve disposed in one of the common conduits between the compressor and the internal combustion engine for controlling the flow in the internal combustion engine circuit independently of the compressor circuit, and thermo-responsive means controlling the operation of said valve in response to variations in temperature in the internal combustion engine circuit, the compressor circuit being continuous irrespective of interruptions in the internal combustion engine circuit.

In witness whereof, we hereunto subscribe our names this 3rd day of Feb., 1926.

WILLIAM A. BEIMLING.
FLOYD B. PETERSON.