Dec. 15, 1942. R. E. GOULD 2,305,155

REFRIGERATING APPARATUS

Filed Feb. 28, 1941 2 Sheets-Sheet 1

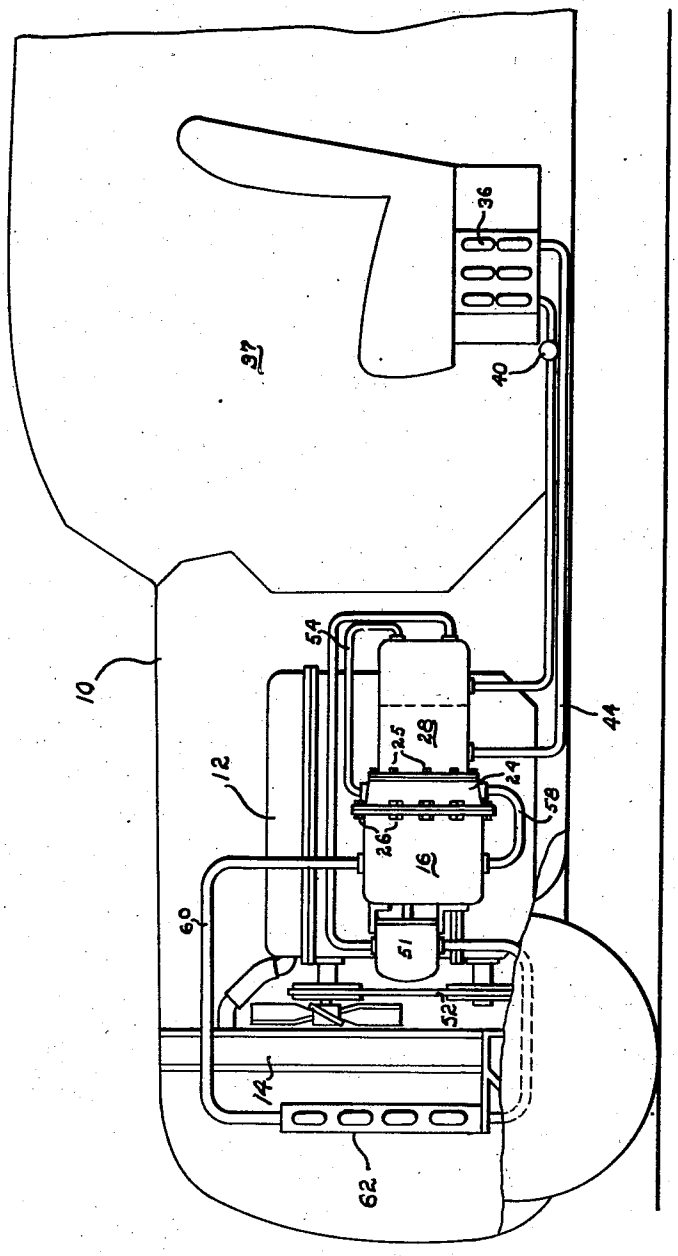

Fig. 1

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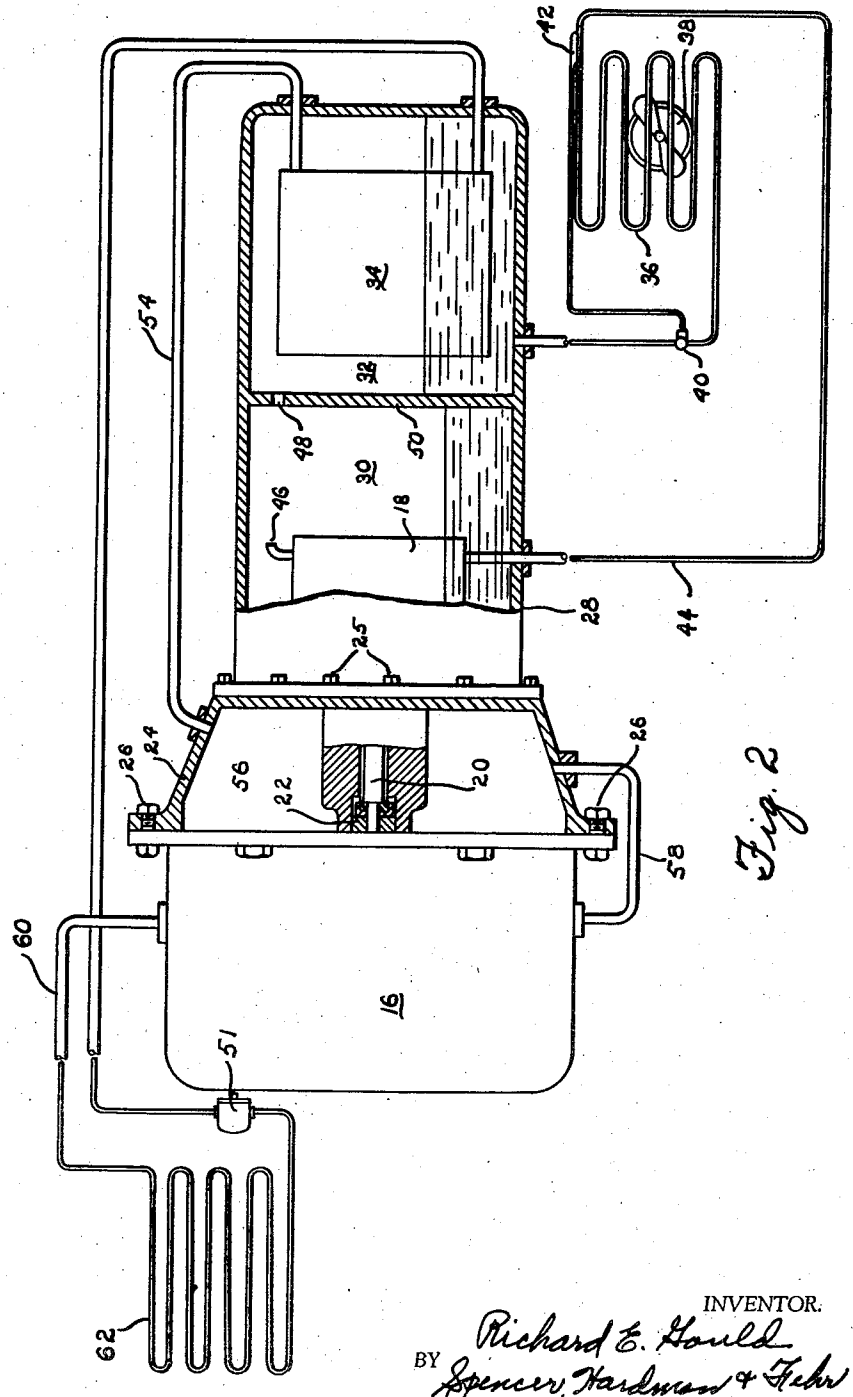

Fig. 2

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2,305,155

REFRIGERATING APPARATUS

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8 Claims. (Cl. 62—117)

This invention relates to refrigerating apparatus and more particularly to an improved refrigerating system for use in conditioning the air in a private automobile or the like.

One object of this invention is to provide a compact self-contained engine driven refrigerant liquefying unit in which a water cooled condenser is built directly into the casing which encloses the compressor.

Another object of this invention is to provide a refrigerating system in which a small high speed engine is used for driving a small compressor at high speed and in which improved means is provided for cooling the compressor, the condenser and the engine.

Still another object of this invention is to provide an improved arrangement for more efficiently cooling the shaft seal in an engine driven refrigerant compressing unit.

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

In the drawings:

Fig. 1 is a side elevational view showing the arrangement of the refrigerating apparatus in a standard automobile; and

Fig. 2 is a view, partly diagrammatic, showing the arrangement of the condenser, the compressor, and the shaft seal cooling apparatus.

Since the space available for mounting a complete air conditioning system in an automobile is very limited, it becomes necessary to make the various parts of the air conditioning apparatus very small and compact. It is also necessary to construct and arrange the parts so that they will not become damaged during shipment or during installation. The system shown in the drawing has been specially designed so as to include the above mentioned desirable features and at the same time be easy to install.

In the drawings, reference numeral 10 designates a conventional passenger automobile driven by means of the internal combustion engine 12, which is of conventional construction. The waste heat of the engine 12 is dissipated by means of the usual engine radiator 14 located in front of the automobile engine 12. The refrigerating apparatus comprises an internal combustion engine 16 adapted to be driven at speeds ranging up to 4,000 revolutions per minute. The engine 16 drives a rotary compressor 18 connected to the engine 16 by means of the shaft 20. A shaft seal 22 is provided so as to prevent the escape of refrigerant along the compressor shaft. The shaft seal 22 is arranged within a housing 24 which is bolted to the main engine housing by means of bolts 26. The compressor 18 is enclosed within a cylindrical housing 28 which is bolted to the housing 24 by means of bolts such as 25 and which is provided with a compressor chamber 30, and a condensing chamber 32. A water coil 34 is provided within the condensing chamber 32 for removing the heat of condensation.

The air to be conditioned is circulated in thermal exchange with a volatile refrigerant evaporator 36 mounted within the passenger compartment 37 of the automobile. Air is circulated over the evaporator 36 by means of an electric fan unit 38. The construction and arrangement of the fan unit 38 and the evaporator 36 are broadly immaterial. As shown in Fig. 1, the evaporator may be located under the front seat of the passenger compartment. As shown in Fig. 2, the flow of refrigerant to the evaporator is controlled by a conventional thermostatic expansion valve 40. The valve 40 is provided with the usual thermostatic bulb 42 located adjacent the outlet of the evaporator so as to prevent an excessive amount of refrigerant from being supplied to the evaporator 36.

The refrigerant vaporized in the evaporator 36 is withdrawn through the vapor line 44 by the compressor 18. The compressed refrigerant leaving the compressor 18 discharges through the outlet 46 into the compressor chamber 30 which serves as an oil reservoir. The compressed refrigerant vapor flows from the chamber 30 into the condensing chamber 32 through the passage 48 provided in the wall 50 which separates the chamber 30 from the chamber 32. The compressed refrigerant entering the chamber 32 condenses on the outer surface of the water coil 34 and collects in the bottom of the chamber as shown in Fig. 1.

Cooling water is supplied to the water coil 32 by the pump 51 arranged to be driven by the engine 16. The water leaves the coil 34 through the passage 54 which discharges the water into the shaft seal cooling chamber 56. From the shaft seal cooling compartment 56, the water flows through a pipe line 58 leading to the internal combustion engine 16 where the water absorbs the heat generated by the internal combustion engine 16. The water thus heated flows from the engine 16 through the line 60 which conveys the heated water to a special water cooling radiator 62 located in front of the main engine radiator 14.

By virtue of the above described arrangement the water which is used for cooling the various portions of the refrigerating system, first flows through the condenser coil **34** wherein the coldest water is required and thereafter flows through the shaft seal cooling chamber **56** wherein somewhat warmer water may be used. After leaving the shaft seal cooling chamber **56**, the water is used for cooling the high speed internal combustion engine **16** which operates at a temperature much higher than the temperatures prevailing in the shaft seal cooling chamber **56**. With this arrangement all of the heat given off by the apparatus is dissipated through a single radiator **62**. This makes it possible to use a single pump for circulating all of the cooling water of the refrigerant liquefying system.

While I have shown the pump **51** operated by the internal combustion engine **16**, it is within the purview of this invention to have the pump **51** driven by the main fan belt **52**. However, the arrangement shown is the preferred arrangement since with such an arrangement the pump **51** will operate at a suitable speed at all times when the engine **16** operates. The engine **16** is a conventional high speed engine which may, for example, be of the general type commonly used for outboard motors.

For purposes of illustration, the refrigerant liquefying apparatus has been shown located beside the main car engine **12**. However, it could be located most anywhere on the car, such as under the chassis or in the trunk compartment of the car without the necessity of disturbing the relationship between the compressor and the condenser since the compressor and the condenser are both located within the same casing.

In order to simplify the disclosure, the usual safety devices such as the high pressure cutout control and the like have been omitted whereas in actual practice all of the usual controls would be used. Since the controls form no part of my invention they have not been shown.

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. A refrigerant liquefying unit comprising in combination, a casing, a high speed internal combustion engine within said casing, a compressor within said casing having a shaft driven by said engine, shaft seal means for preventing the escape of refrigerant from said compressor along said shaft, means for discharging compressed refrigerant into said casing, a cooling coil within said casing for condensing the compressed refrigerant within said casing, means forming a shaft seal cooling chamber within said casing, and means for circulating a cooling fluid through said cooling coil, said shaft seal cooling chamber and thereafter in thermal exchange with said engine.

2. In combination with an automobile having a passenger compartment, an evaporator for cooling air for said compartment, a refrigerant liquefying unit for supplying liquid refrigerant to said evaporator comprising in combination, a casing, a high speed internal con bustion engine within said casing, a compressor within said casing having a shaft driven by said engine, shaft seal means for preventing the escape of refrigerant from said compressor along said shaft, means for discharging compressed refrigerant into said casing, a cooling coil within said casing for condensing the compressed refrigerant within said casing, means forming a shaft seal cooling chamber within said casing, and means for circulating a cooling fluid through said cooling coil, said shaft seal cooling chamber and thereafter in thermal exchange with said engine.

3. A refrigerant liquefying unit comprising in combination, a casing, an internal combustion engine within said casing, a compressor within said casing having a shaft driven by said engine, shaft seal means for preventing the escape of refrigerant from said compressor along said shaft, means for condensing the compressed refrigerant, means forming a shaft seal cooling chamber within said casing, a condenser cooling coil, and means for circulating a cooling fluid through said cooling coil, said shaft seal cooling chamber and thereafter in thermal exchange with said engine.

4. In combination with an automobile having a passenger compartment, an evaporator for cooling air for said compartment, a refrigerant liquefying unit for supplying liquid refrigerant to said evaporator comprising in combination, a casing, an internal combustion engine within said casing, a compressor within said casing having a shaft driven by said engine, shaft seal means for preventing the escape of refrigerant from said compressor along said shaft, means for condensing the compressed refrigerant, means forming a shaft seal cooling chamber within said casing, a condenser cooling coil, and means for circulating a cooling fluid through said cooling coil, said shaft sealing cooling chamber and thereafter in thermal exchange with said engine.

5. In combination with an automobile having a passenger compartment, and an engine compartment, an evaporator for cooling air for said passenger compartment, a refrigerant liquefying unit for supplying liquid refrigerant to said evaporator comprising in combination, a casing located in the main engine compartment of said automobile, an internal combustion engine within said casing, a compressor within said casing having a shaft driven by said engine, shaft seal means for preventing the escape of refrigerant from said compressor along said shaft, means for condensing the compressed refrigerant, means forming a shaft seal cooling chamber within said casing, a condenser cooling coil, and means for circulating a cooling fluid through said cooling coil, said shaft seal cooling chamber and thereafter in thermal exchange with said engine.

6. A refrigerant liquefying unit comprising in combination, a casing, an internal combustion engine within said casing, a compressor having a shaft driven by said engine, shaft seal means for preventing the escape of refrigerant from said compressor along said shaft, means for condensing the compressed refrigerant, means forming a shaft seal cooling chamber within said casing, a condenser cooling coil, and means for circulating a cooling fluid through said cooling coil, said shaft seal cooling chamber and thereafter in thermal exchange with said engine.

7. Apparatus for conditioning the air for an automobile having a passenger compartment and an engine compartment comprising in combination, an evaporator, means for cooling air for said passenger compartment by said evaporator, a refrigerant liquefying means adapted to be mounted within said engine compartment for supplying liquid refrigerant to said evaporator, said refrigerant liquefying apparatus comprising a casing, a compresor within said casing pro-

vided with a drive shaft, means within said casing for supplying power to said compressor drive shaft, shaft seal means for preventing the escape of refrigerant from said compressor along said drive shaft, a condensing chamber within said casing, a shaft seal cooling chamber, a heat dissipating radiator adapted to be mounted in said engine compartment, means for circulating a cooling fluid through said condensing chamber, said shaft seal cooling chamber and thereafter through said heat dissipating radiator.

8. Refrigerant liquefying apparatus comprising in combination, a casing, a compresosr within said casing, a drive shaft for said compressor, an internal combustion engine for driving said shaft, a shalt seal for preventing the escape of refrigerant from said compressor, means for cooling said shaft seal, a condenser, and a closed cooling system for supplying a cooling medium to said condenser, said shaft seal cooling means and said internal combustion engine, said closed cooling system including a heat dissipating coil and means for circulating air over said heat dissipating coil.

RICHARD E. GOULD.