May 23, 1933. G. A. BUVINGER 1,911,012

REFRIGERATING APPARATUS

Filed Feb. 28, 1930

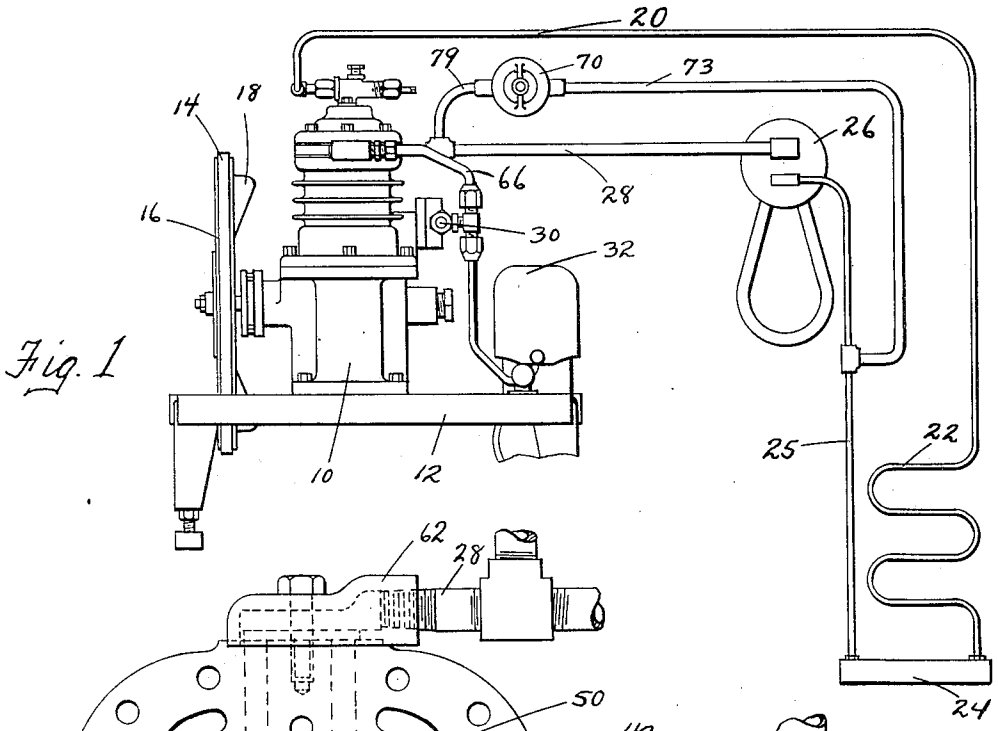


Fig. 1

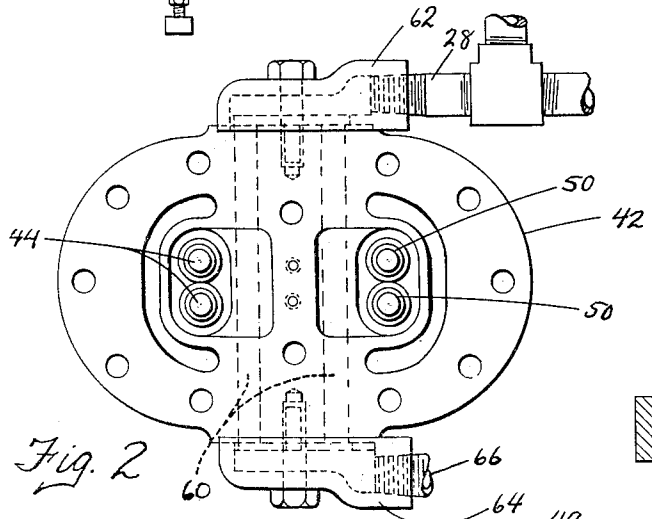


Fig. 2

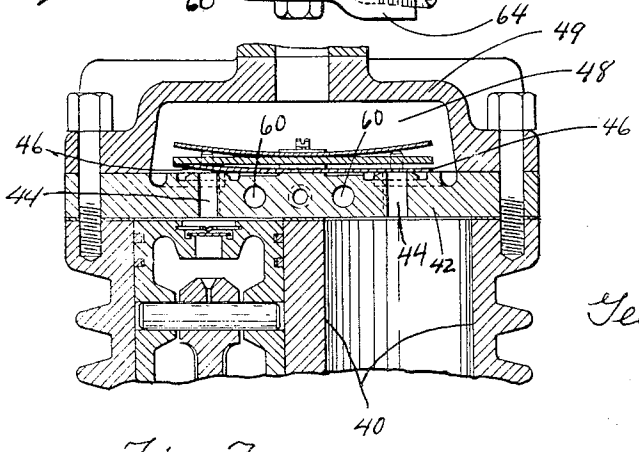


Fig. 3

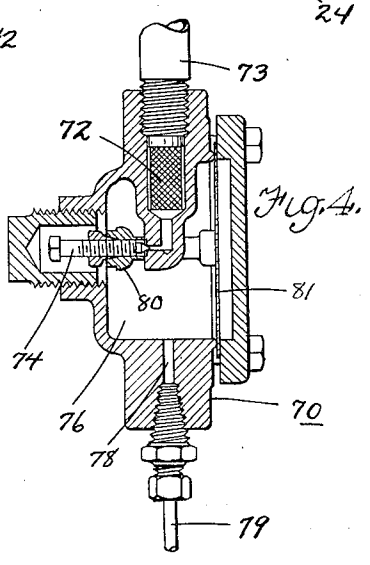


Fig. 4.

George A. Buvinger

INVENTOR

BY

Spencer Hardman & Fehr ATTORNEYS

Patented May 23, 1933

1,911,012

UNITED STATES PATENT OFFICE

GEORGE A. BUVINGER, OF DAYTON, OHIO, ASSIGNOR TO FRIGIDAIRE CORPORATION, OF DAYTON, OHIO, A CORPORATION OF DELAWARE

REFRIGERATING APPARATUS

Application filed February 28, 1930. Serial No. 432,114.

This invention relates to refrigerating apparatus and particularly to a novel construction of compressors and their arrangement in such apparatus.

It is an object of the invention to provide improved means for cooling the working cylinder of the compressor, particularly for cooling the cylinder head.

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 shows a side elevation of a compressor embodying the invention, the refrigerating system to which it is attached being indicated diagrammatically;

Fig. 2 is a top plan of the cylinder head;

Fig. 3 is an enlarged sectional view of a portion of the compressor; and

Fig. 4 is a sectional view of a control valve.

Refrigerating compressors are commonly provided with a flywheel into which is built a fan for circulating cooling air over the body of the compressor. Compressors of this type heretofore used are not wholly satisfactory particularly when of large size because the parts which need cooling the most are apt to be cooled the least, that is the hottest part is the cylinder head which is inside the compressor structure and cannot be reached by the air which blows over the compressor body.

It is one of the objects of this invention to utilize the returned or evaporated refrigerant for cooling parts of the compressor which are not cooled by the circulating air.

Referring to Fig. 1 a compressor 10 mounted on a base 12 is driven by any suitable motor, not shown, through the agency of a belt 14 running on a flywheel 16 in which may be included fan blades 18 for circulating air over the compressor. The compressor is connected to a refrigerant circuit including a conduit 20 which receives high pressure gaseous refrigerant discharged by the compressor, a condenser or liquefying means 22, a reservoir 24, an evaporator 26 and a conduit 28 which returns low pressure gaseous refrigerant to the compressor crankcase through an intake 30. The evaporator 26 may be of the flooded type, wherein the pressure of the refrigerant bears a direct relation to the temperature and may be constructed, for example as shown in the patent to Osborn, No. 1,556,708. The compressor may be started and stopped in response to the refrigerating demand on the evaporator by means of an automatic switch 32 which opens and closes in response to the pressure of the evaporator.

As shown in Fig. 3 the compressor includes a pair of cylinders having side walls 40 and an end wall or cylinder head in the form of a valve plate 42 in which are formed discharge passages 44 controlled by check valves 46 for discharging compressed gaseous refrigerant from the cylinders to the discharge chamber 48 in the compressor head 49.

As indicated in Figs. 2 and 3 the valve plate is formed with a valve seat 50 around each discharge passage 44 which seat cooperates with a check valve 46. The structure so far described is well-known and its particular form is immaterial to the present invention. Since the cylinder walls and valve plate as well as the compressor head 49 are ordinarily made of cast iron which is a rather poor conductor of heat, points within the compressor may become very hot. It has been my experience that the temperature developed within the cylinder and discharge chamber may be sufficient to cause damage to the apparatus particularly to the valves and seats in spite of cooling applied to the outside of the compressor. Hot spots or zones may develop within the compressor and break down the lubricating oil, causing a deposit of thick gummy substance in the apparatus which collects on the valves and seats and causes the valves to leak and also stops up screens and small orifices which as is well-known are usually provided in the refrigerating system.

In the valve plate or cylinder head 42 I form passages 60 which are separate from, but pass adjacent to the discharge passages 44. Preferably two of such passages are formed, one adjacent each pair of discharge

passages. An intake manifold 62 and a discharge manifold 64 are attached to the edges of the valve plate so as to communicate with the passages 60 and to these manifolds are connected the conduit 28 and conduit 66 respectively, the latter establishing communication between the discharge manifold 64 and the intake 30 of the compressor. By this arrangement all refrigerant taken into the compressor from the refrigerant circuit passes through the passages 60 and since this refrigerant is cold it serves to cool the valve plate particularly the portions adjacent the valve seats and discharge passages.

Since all of the refrigerant discharged from the evaporator 26 is, during proper operating conditions, in the form of a gas it may be desirable in some instances to admit liquid refrigerant to the passages 60 in order to provide greater cooling effect. This may be conveniently accomplished by means of a valve 70 in a by-pass circuit 72 which admits liquid refrigerant from the liquefying portion of the refrigerant circuit directly to the intake manifold 62. One suitable form of valve 70 is shown in Fig. 4. This includes an inlet 72 connected to the liquid conduit 25 through a conduit 73 and communicating, under the control of a needle valve 74 with a chamber 76 having an outlet 78 connected to the intake manifold 62 through conduit 79. The valve is adjustably supported on a yoke 80 which is connected to and actuated by a flexible diaphragm 81 which is moved to open the valve by atmospheric pressure and moved to close the valve by the pressure of the vapor in the chamber 76 which equals the pressure of the evaporator 26. The automatic switch 32 may be set to operate the compressor to maintain, for example, subatmospheric pressure in the evaporator whenever the compressor is operating. Therefore whenever the compressor is operating the valve 74 will open to admit liquid refrigerant to the valve plate. The amount admitted may be suitably regulated by adjusting the needle, to furnish the requisite amount of refrigeration for cooling the valve plate.

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. Refrigerating apparatus comprising in combination a circuit for volatile refrigerant and a compressor connected to withdraw gaseous refrigerant at low pressure from said circuit and to discharge gaseous refrigerant at high pressure to said circuit, said compressor including a cylinder, a valve plate forming a wall of the cylinder and a discharge valve cooperating with said plate, the plate having a passage formed therein, and said circuit being connected to discharge low pressure gaseous refrigerant through said passage to the intake of said compressor.

2. Refrigerating apparatus comprising in combination a circuit for volatile refrigerant and a compressor connected to withdraw gaseous refrigerant at low pressure from said circuit and to discharge gaseous refrigerant at high pressure to said circuit, said compressor including a cylinder, a valve plate forming a wall of the cylinder and a discharge valve cooperating with said plate, the plate having a passage formed therein, and said circuit including liquefying means and being connected to discharge low pressure gaseous refrigerant through said passage to the intake of said compressor, and means for admitting liquid refrigerant to said passage.

3. Refrigerating apparatus comprising in combination a circuit for volatile refrigerant and a compressor connected to withdraw gaseous refrigerant at low pressure from said circuit and to discharge gaseous refrigerant at high pressure to said circuit, said compressor including a cylinder, a valve plate forming a wall of the cylinder, a discharge passage for compressed gaseous refrigerant through said plate, and a separate passage through the plate adjacent the discharge passage, said circuit being connected to discharge low pressure gaseous refrigerant through said separate passage.

4. Refrigerating apparatus comprising in combination a circuit for volatile refrigerant and a compressor connected to withdraw gaseous refrigerant at low pressure from said circuit and to discharge gaseous refrigerant at high pressure to said circuit, said compressor including a cylinder, a valve plate forming a wall of the cylinder, a discharge passage for compressed gaseous refrigerant through said plate, and a separate passage through the plate adjacent the discharge passage, said circuit including liquefying means and being connected to discharge low pressure gaseous refrigerant through said separate passage, and means for admitting liquid refrigerant to said separate passage.

5. Refrigerating apparatus comprising in combination a circuit for volatile refrigerant and a compressor, said circuit having a liquefying portion connected to receive high pressure gaseous refrigerant from the compressor and an evaporating portion connected to discharge low pressure gaseous refrigerant to the compressor, said compressor including a cylinder wall having a passage formed therein, and a pressure responsive valve for by-passing liquid refrigerant from the liquefying portion to said passage.

6. A refrigerant compressor including a cylinder, a valve plate forming a wall of the cylinder, a discharge valve passage for compressed gaseous refrigerant extending through said plate, said valve plate having a

valve seat thereon surrounding said discharge passage and a valve cooperating with said seat for controlling the flow of refrigerant through the passage, a separate passage through the plate adjacent the discharge passage, an inlet passage for the compressor, means connecting said separate passage and said inlet passage, the refrigerant pumped by the compressor being drawn through said separate passage in the valve plate before entering the compressor to cool the valve plate.

7. Refrigerating apparatus including a compressor, a condenser, and an evaporator, said compressor having a cooling passage therein, means for conducting refrigerant discharged from said compressor to said condenser and from said condenser to said evaporator, means for conducting refrigerant from said evaporator to said cooling passage and from said cooling passage to the inlet of said compressor, by-pass means for conducting liquid refrigerant to said cooling passage, and pressure responsive means for controlling the flow of liquid refrigerant through said by-pass means.

In testimony whereof I hereto affix my signature.

GEORGE A. BUVINGER.