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PUMP FOR REFRIGERATING APPARATUS

Filed March 30, 1929

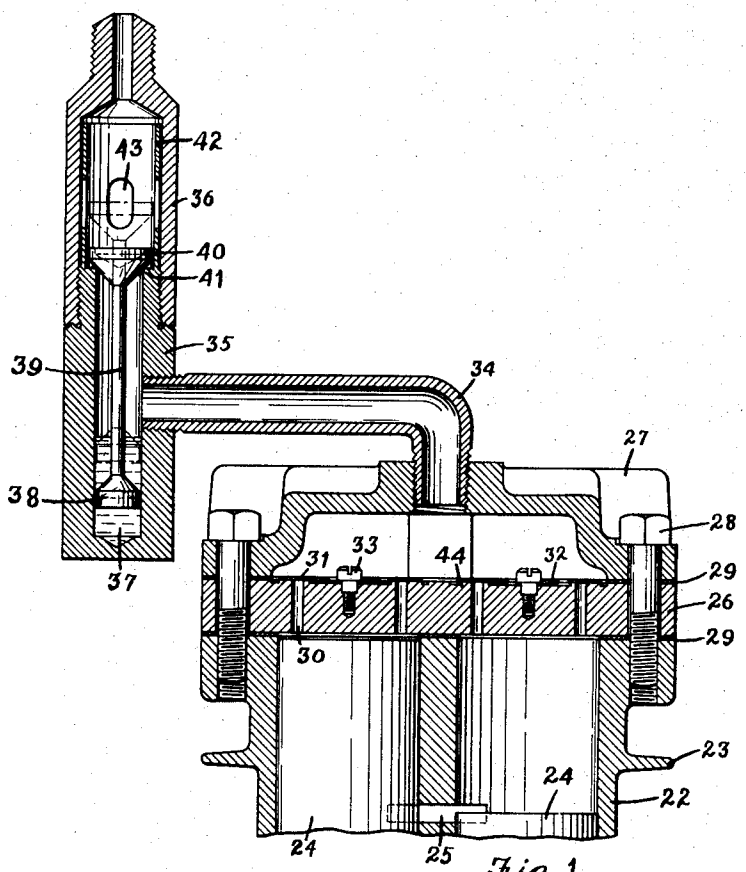


Fig. 1

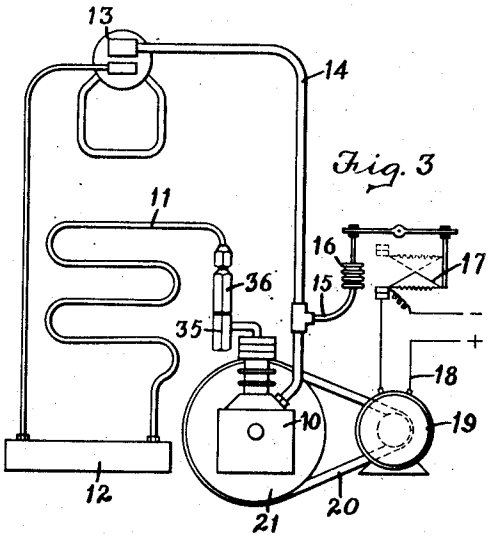


Fig. 3

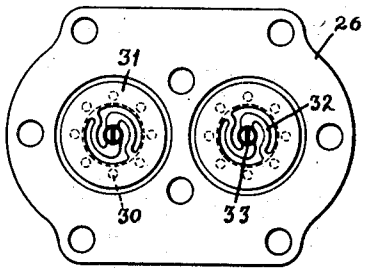


Fig. 2

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PUMP FOR REFRIGERATING APPARATUS

Application filed March 30, 1929. Serial No. 351,345.

This invention relates to refrigerating apparatus and especially to the provision of valves in certain portions of the refrigerating system.

An object of the invention is to provide a check valve for operation when the compressor stops.

Another object of the invention is the provision of a check valve in order that the compressor valve may be designed from the standpoint of an efficient and quiet operation.

Another object of the invention is the provision of a plurality of valves whereby the refrigerant will not become excessively heated in passing from the low pressure to the high pressure side of the system.

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 invention is clearly shown.

In the drawing:

Fig. 1 is a vertical cross section thru the top of a compressor and check valves attached thereto.

Fig. 2 is a top view of the valve plate and its valves employed in the compressor disclosed in Fig. 1.

Fig. 3 is a more or less diagrammatic arrangement of refrigerating apparatus to which the invention may be applied.

One of the problems confronting inventors designing refrigerating apparatus is the design of the valves separating the low pressure and high pressure portions in the system. These valves heretofore had to be designed not only from an efficient pumping standpoint but also so designed as to withstand the back pressure of the refrigerant when the compressor stops. It has heretofore been the custom to use a relatively small valve in the valve plate with the result that the valve had to lift a relatively great distance to permit the required amount of refrigerant to pass therethrough. The consequence of this rather high lift is a tendency to produce considerable heat in the valve plate. The back slap of the valve also has a tendency to produce noise which is very undesirable in household appliances in constant or intermittent operation. Accordingly the invention contemplates the provision of an additional fluid pressure operated valve that will operate as a check valve when the compressor stops. This check valve will prevent back pressure on the valves in the valve plate with the result that the valves and seats in the valve plate can be very much increased in size and consequently the lift and slap of the valve can be reduced and this will result in more quiet operation. Accordingly the invention allows the same flow of refrigerant for a shorter lift of the valve thru the larger valve seats and this results in less heat than in the case of a high lift and strong back slap of the valves of the prior art. On the other hand, the same amount of valve lift could be retained with the new arrangement and a much slower acting compressor designed with the result that the force of the back slap and the noise therefrom is reduced.

Fig. 3 discloses some of the usual refrigerator elements used in certain types of refrigerating apparatus. It is not intended to limit the application of the invention to particular forms disclosed as such forms are used merely by way of illustration. A compressor 10 forwards the compressed gas to the condenser 11 where the refrigerant is changed to a liquid by any convenient cooling means such as a fan and then descends to receiver 12. From the receiver 12 the refrigerant is sent to a cooling unit 13 preferably of a flooded float control type illustrated in the patent to R. G. Osborn, 1,556,708 issued October 13, 1925. Upon evaporation the refrigerant now in a gas form returns by means of the conduit 14 to the compressor 10. A conduit 15 preferably leads from the conduit 14 to a bellows 16 controlling a snap switch 17 which actuates a set of contacts interposed in the electrical connections 18 of the motor 19. The motor 19 is connected to and runs the compressor by means of a belt 20 and compressor pulley 21. Suitable cooling means for the compressor and motor, such as fans, may be installed if desired. In

this system the high pressure side or portion extends from the top of the valve plate of the compressor to the cooling unit where the refrigerant is evaporated. The low pressure side extends from the cooling unit to the underside of the valve plate. This invention is especially concerned with the elements and conditions about the low pressure and high pressure boundary at the valve plate.

In Fig. 1 is illustrated the elements dividing the low pressure side from the high pressure side of the system within the compressor. The refrigerant preferably sulphur dioxide, altho methyl chloride, ethyl chloride, ammonia or their equivalents may be used, is returned to the compressor 10 in a gaseous state. Within the compressor are one or more pistons preferably two reciprocating pistons 24 mounted upon a crank shaft or upon eccentrics on a straight shaft as desired. The gas preferably enters the upper portion of the cylinder body 22 by means of the gas port 25 altho there may instead or in addition be valves or some such entry in the pistons 24. Fins 23 upon the cylinder body aid in the dissipation of heat. Upon the cylinder body 22 is the valve plate 26 with the compressor head 27 mounted thereon by means of the screws 28. Suitable gaskets 29 are inserted between the head plate and body of the compressor. Thru the valve plate are a series of holes 30 preferably equally spaced on the circumference of a circle whose center coincides with the axis of the piston. At the upper end of these holes is preferably an annular valve seat 44. A valve, preferably of spring steel covers those holes and is fastened to the valve plate by means of the screws 33. The valve preferably consists of a flat annular portion 31 supported by the flexible and preferably integral arms 32. Upon the up-stroke of one of these pistons the gas is compressed in the passage ways 30 and when so compressed raises the valve and passes thru to the head 27 in a compressed or high pressure state. Upon the down stroke of the piston the valve closes and compressed gas is passed thru the valve above the other piston if two or more pistons are used. Accordingly the valve plate and its valves mark the boundary between the low pressure and high pressure side of the system and gaseous refrigerant passes thru to the head as long as the pistons are working.

The bellows 16 responds to the temperature pressure characteristics of the evaporator 13 and starts and stops the motor automatically. When the motor 19 is stopped the high pressure in the head 27 and its connections thereto will immediately react against the valves 31. The valves 31 however have to be very thin for efficient operation and with the large area as disclosed this back pressure might result in injurying the valves. Accordingly instead of using the smaller sized valves of the prior art applicant has designed means for preventing this back pressure effecting the valves. A preferred form of this means is disclosed in Fig. 1 altho it is not intended to limit the invention to the specific type of apparatus disclosed. A connection 34 preferably L-shaped extends from the compressor head 27 to a check valve which in its preferred form includes two casing members 35 and 36. In the lower part of the casing 35 is a reservoir for a fluid preferably a liquid such as oil. The casing 35 preferably has a valve seat 41 therein for a valve 40 of a somewhat conoidal shape. A stem 39 is preferably connected to the valve and extends downward to a piston 38 preferably of conoidal shape in the liquid 37. Thus the piston 38 forms a slow acting valve in the casing 35 by its moving against the resistance offered by the body of liquid 37. The specific structure is commonly referred to as a dash pot valve. Upon the upper part of the casing 35 is preferably an extension 42 having ports or openings 43 therein. With this arrangement when the pistons 24 and the valves 31 are operating the high pressure refrigerant flows thru the head 27 to the connection 34, raises the check valve to the position in dotted lines and the refrigerant flows about the valve 40 on the inside and outside of the extension 42 and thence onward to the condenser 11 where it is cooled to a liquid state. Thus, upon the down or intake stroke of the piston 24, the valve 31 will close on its seat and open upon the up or compressing stroke. As long as the compressor is operating the fluid pressure operated check valve 40 will remain open. Due to the damping effect of the oil the check valve will not rattle up and down with any slight variation in the pressure of the refrigerant as it passes by the head of the check valve. When the piston 24 stops operating the refrigerant above the head of the check valve will force the head 40 down in its valve seat 41 and thus make the check valve operate to cut off the pressure of the high side of the system from affecting the valves 31. Thus the fluid pressure operated check valve 40 will seat only when the compressor is idle. While two cylinders are disclosed the invention is applicable to one or more cylinders or in fact to any type of compressor.

The invention has a decided advantage of allowing the valves 31 to be designed purely from the standpoint of an efficient pumping operation including quietness of operation. The pressure on the high pressure side is taken care of by the seating of the check valve 40 when the compressor is idle. Thus a much larger valve 31 and valve seat 44 can be used than would otherwise be possible. By way of example the valve seat in a valve plate in a standard compressor with ¼ horse-power normally has a circumference of 1.27 inches without a check valve. The use of a check

valve according to applicant's invention allows the valve seat 44 to have a circumference of 4.71 inches. Due to such an increase in size of the valve seat the compressed refrigerant would not have to pass so rapidly thru the valve and valve seat due to this increased area and accordingly less heat will be produced in the compressor valve plate and other elements connected thereto. Due to the fact that the piston 38 is positioned in a liquid at all times, the check valve 40 will be quiet in operation especially as its preferred conoidal form directs the refrigerant gas equally about its circumference.

While the form of embodiment of the invention as herein disclosed constitutes 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 part of a refrigerating system, having a low pressure portion and a high pressure portion, a pump for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle, and a dash-pot for preventing closing of said valve while the pump is in operation.

2. A part of a refrigerating system, having a low pressure portion and a high pressure portion, a pump for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle, means for preventing closing of said valve while the pump is in operation, and a valve between the low pressure portion and the high pressure portion for maintaining a differential in pressure in said portions while the refrigerant is circulated from the low to the high pressure portion.

3. A part of a refrigerating system having a low pressure portion and a high pressure portion, a pump for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle, and means providing a time lag between the opening and closing of said valve for preventing closing of said valve while the pump is in operation, and a valve between the low pressure portion and the high pressure portion for maintaining a differential in pressure in said portions while the refrigerant is circulated from the low to the high pressure portion.

4. A part of a refrigerating system having a low pressure portion and a high pressure portion, a pump for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle, a dash-pot for preventing closing of said valve while the pump is in operation, and a valve between the low pressure portion and the high pressure portion for maintaining a differential in pressure in said portions while the refrigerant is circulated from the low to the high pressure portion.

5. A part of a refrigerating system having a low pressure portion and a high pressure portion, a pump having a reciprocating piston for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle, and means for preventing closing of said valve during the suction stroke of said piston.

6. A part of a refrigerating system having a low pressure portion and a high pressure portion, a pump having a reciprocating piston for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle, and means providing a time lag between the opening and closing of said valve for preventing closing of said valve during the suction stroke of said piston.

7. A part of a refrigerating system having a low pressure portion and a high pressure portion, a pump having a reciprocating piston for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle, and a dash-pot for preventing closing of said valve during the suction stroke of said piston.

8. A part of a refrigerating system having a low pressure portion and a high pressure portion, a pump having a reciprocating piston for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle, means for preventing closing of said valve during the suction stroke of said piston, and a valve between the low pressure portion and the high pressure portion for maintaining a differential in pressure in said portions while the refrigerant is circulated from the low to the high pressure portion.

9. A part of a refrigerating system having a low pressure portion and a high pressure portion, a pump having a reciprocating piston for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle, means providing a time lag between the opening and closing of said valve for preventing closing of said valve during the suction stroke of said piston.

10. A part of a refrigerating system having a low pressure portion and a high pressure portion, a pump having a reciprocating piston for circulating refrigerant from said low pressure portion to said high pressure portion, a valve in said high pressure portion normally closed when the pump is idle,

a dash-pot for preventing closing of said valve during the suction stroke of said piston, and a valve between the low pressure portion and the high pressure portion for maintaining a differential in pressure in said portions while the refrigerant is circulated from the low to the high pressure portion.

11. A part of a refrigerating system, having a low pressure portion and a high pressure portion, a pump for circulating refrigerant from said low pressure portion to said high pressure portion, said pump having a relatively large discharge valve, a second valve in said high pressure portion beyond said discharge valve, said second valve being normally closed when the pump is idle, and means for maintaining said second valve continuously open while the pump is in operation.

In testimony whereof I hereto affix my signature.

OTTO M. SUMMERS.