Sept. 3, 1935. W. V. MUSTO 2,013,167

REFRIGERATING SYSTEM

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Fig. 1.

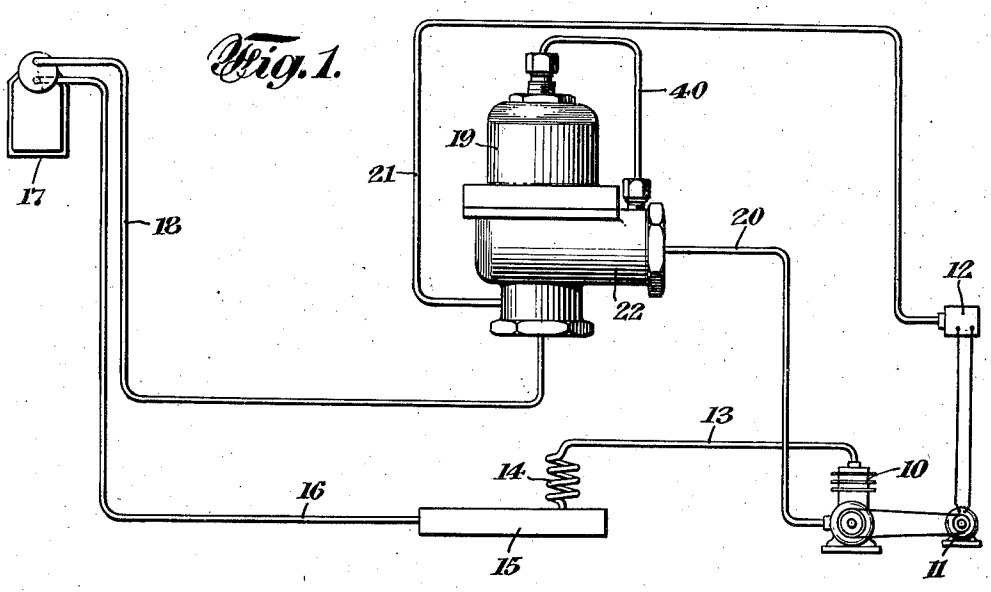


Fig. 2.

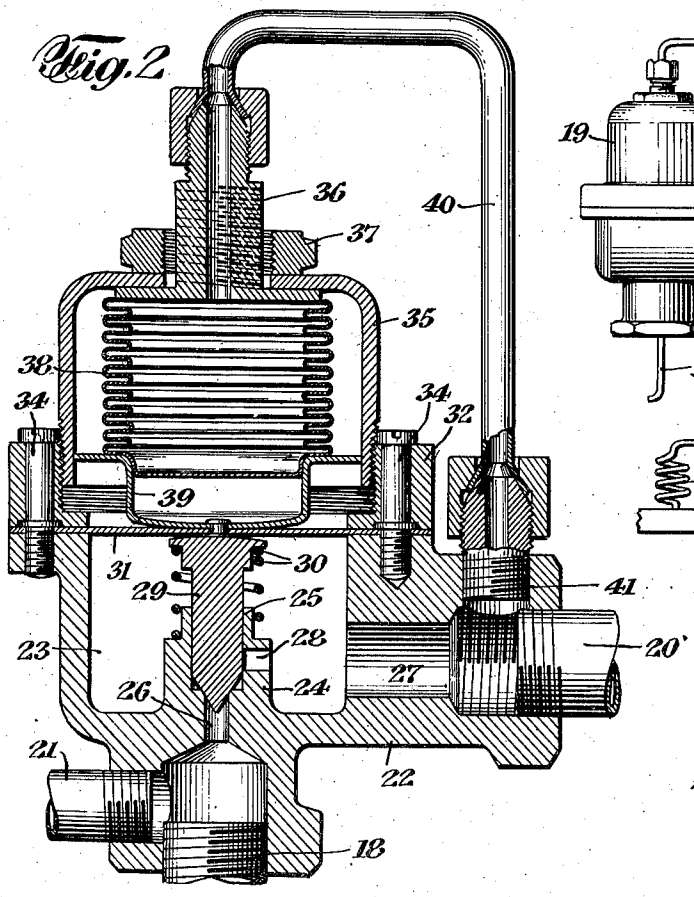
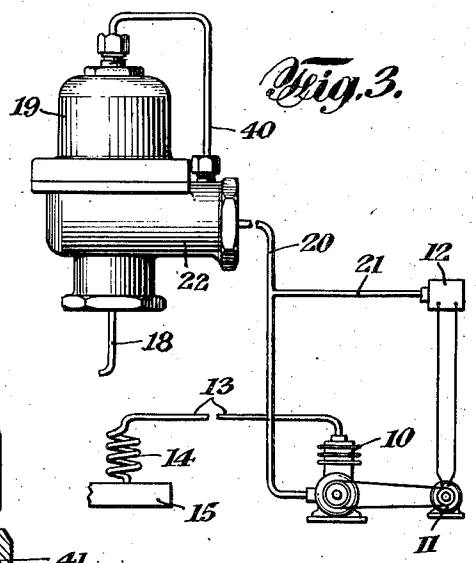


Fig. 3.



INVENTOR
William V. Musto
BY
Kenyon & Kenyon
ATTORNEYS.

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REFRIGERATING SYSTEM

William V. Musto, North Bergen, N. J.

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9 Claims. (Cl. 62—3)

This invention relates to refrigerating systems.

In the present type of automatic refrigerating systems, the full pressure developed in the expansion coil by evaporation of the refrigerant is applied to the intake of the compressor, thereby greatly overloading the compressor at starting. Such overload is undesirable for many reasons, among them being excessive wear of the compressor, overload of the driving motor, blowout of motor fuse, burnout of motor, etc., all of which seriously impair the efficient and economical operation of the system.

Also, by reason of such overload, a stronger motor is required to start the compressor than is required to keep it running under normal conditions.

An object of this invention is to prevent overloading of the compressor, thereby avoiding the undesirable conditions above referred to and insuring efficient and economical operation of the refrigerating system.

According to this invention, a valve is interposed in the system between the expansion coil and the compressor intake and is actuated in response to the pressure existing in the system between the valve and the compressor to maintain such pressure at a value not exceeding the normal load for which the compressor is designed. With such an arrangement, the compressor cannot be overloaded and efficient and economical operation of the system will be attained.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawing, wherein:

Fig. 1 is a diagrammatic view of a refrigerating system embodying the invention;

Fig. 2 is a vertical section through the valve and its operating means; and

Fig. 3 is a fragmentary diagrammatic view of a modification of the invention.

In Fig. 1, 10 is a compressor driven by a motor 11 which is controlled by means of a bellows-type switch 12. A pipe 13 leads from the outlet of the compressor 10 through the condenser 14 to the gas receiver 15. A pipe 16 leads from the receiver 15 to the expansion coil 17 from which a pipe 18 leads to the valve housing 19. A pipe 20 leads from the valve housing 19 to the compressor 10 and a pipe 21 leads from the valve to the switch 12.

The valve housing 19 comprises a casting 22 having threaded sockets in which are received the ends of the pipes 18 and 20. The casting is recessed at 23 and is provided with a central boss 24 having a bore 25 terminating in a smaller diameter passageway 26 connecting with the pipe 18. The casting also is provided with a passageway 27 communicating with the pipe 20 and a passageway 28 extends from the bore 25 through the wall of the boss 24. A valve 29 is slidably mounted in the bore 25 and has its lower end tapered to seat in the upper end of the passageway 26. A spring 30 is interposed between the head of the valve 29 and a shoulder on the boss 24.

A diaphragm 31 closes the recess 23 and is clamped to the casting by a ring 32 through which pass bolts 34 threaded into the casting. A bell 35 has screw-threaded connection with the ring 32, making it adjustable toward and away from the casting 22. A headed nipple 36 extends through an opening in the upper end of the bell and is held in assembled relation by a nut 37, the connection being sufficiently loose that the bell may be rotated without rotating the nipple or the nut. The head of the nipple constitutes one end of a bellows member 38, the other end of which has soldered thereto a plate 39, the plate being connected to the diaphragm 31. A pipe 40 leads from the nipple 36 to a passageway 41 in the casting 22 communicating with the pipe 20.

The pressure developed in the coil 17 is applied through the pipe 18 to the bottom end of the valve 29 tending to lift it while the pressure in the pipe 20 is applied through the pipe 40 and bellows 38 to the top of the valve tending to close it, the spring 30 tending to maintain the head of the valve in contact with the diaphragm 31. The valve will remain closed so long as the force tending to move the valve down exceeds the force tending to move the valve up. By reason of the large area of the bellows member 38, a very small pressure in the pipe 20 will hold the valve closed against a much higher pressure in the pipe 18. The bellows member 38 is so designed and adjusted that any pressure in the pipe 20 exceeding the normal load for which the compressor is designed, will hold the valve 29 closed against the pressure at which the switch 12 is set to operate, the pressure in the pipe 18 being applied to the switch 12 through the pipe 21. Thus, when the switch 12 is closed and the motor 11 started, the pressure applied to the intake of the compressor 12 does not exceed the normal load for which it is designed and easy starting of the compressor is effected. As operation of the compressor reduces pressure in the pipe 20 below its normal load, the force exerted by the bellows 38 on the valve 29 will decrease, thus permitting the force exerted by the gas in the pipe 18 to lift the valve 29.

Gas will then flow from the pipe 18 into the pipe 20, but should pressure in the pipe 20 tend to exceed the normal load of the compressor, the force applied by the bellows 38 to the valve 29 will increase again sufficiently to close the valve. This action will continue until the pressure in the pipe 18 does not exceed the normal load for the compressor.

The bellows member may be so adjusted that a vacuum is at all times maintained in the pipe 20, such condition being desirable in certain types of refrigeration. Such adjustment may be effected by rotating the bell 35 to compress the bellows 38 sufficiently that the force applied thereby to the valve 29 will maintain the valve closed with the desired vacuum in the pipe 20 against pressure in the pipe 18 up to the switch operating pressure. Increase of vacuum in the pipe 20 above the predetermined value will permit contraction of the bellows 38 to lift the diaphragm 31, thereby permitting gas in the pipe 18 to push up the valve 29 and flow to the pipe 20. Such flow will continue until the vacuum in the pipe 20 is decreased to the predetermined value whereupon the force applied by the bellows member 38 will again seat the valve 29.

The valve may also be incorporated in a refrigerating system as shown in Fig. 3. In this modification, the switch 12 is connected by the pipe 21 to the pipe 20 rather than to the pipe 18 as in the modification disclosed in Fig. 1. In this modification, the valve 29 acts as a safety valve in the event that the motor fuse blows out but does not operate during normal operation of the system. When the motor fuse blows out, the valve shuts off when the pressure applied to the intake of the compressor exceeds a predetermined minimum thus preventing full pressure in the coil from being impressed on the intake of compressor. The arrangement of Fig. 3 performs one of the functions of the arrangement shown in Fig. 1, but lacks the function of protecting the compressor against overload during normal operation.

With the arrangement shown in Fig. 1, a motor of less power can be used than could be used without the valve and also starting of the system is facilitated by reduction of pressure applied to intake of compressor. The arrangement of Fig. 3 merely facilitates starting the system after a shut down by protecting the compressor against overload.

It is of course understood that various modifications may be made in the system above described, without in any way departing from the spirit of the invention as defined in the appended claims.

I claim:

1. In a refrigerating system, an expansion coil, a compressor, a casing having a single inlet and an outlet, a pipe learing from said coil to said inlet and a pipe leading from said outlet to said compressor, a valve movable to open and close said inlet, a diaphragm closing said casing and engaging said valve, a bellows member exterior of said casing and having one end engaging said diaphragm, and a pipe leading from said bellows member to said casing outlet.

2. In a refrigerating system, an expansion coil, a compressor, a casing having an inlet and an outlet, a pipe leading from said coil to said inlet and a pipe leading from said outlet to said compressor, a valve movable to open and close said inlet, a diaphragm closing said casing and engaging said valve, a bellows member having one end engaging said diaphragm, a bell enclosing said bellows member and adjustably attached to said casing, and a pipe leading from said bellows member to said casing outlet.

3. In a refrigerating system, an expansion coil, a compressor, a casing having an inlet and an outlet, a pipe leading from said coil to said inlet and a pipe leading from said outlet to said compressor, a valve movable to open and close said inlet, a diaphragm closing said casing and engaging said valve, a bellows member having one end engaging said diaphragm, a belt enclosing said bellows member and adjustably attached to said casing one end of said bellows member being attached to said bell and the other end being attached to said diaphragm, and a pipe leading from said bellows member to said casing outlet.

4. In a refrigerating system, an expansion coil, a compressor, a casing having an inlet and an outlet, a pipe leading from said coil to said inlet and a pipe leading from said outlet to said compressor, a valve movable to open and close said inlet, a diaphragm closing said casing and engaging said valve, a bell having threaded connection with said casing, a bellows member rotatably supported at one end by said bell and connected at its other end to said diaphragm, and a pipe leading from said diaphragm to said casing outlet.

5. In a refrigerating system, a coil, a compressor, a conduit leading from the coil to the compressor, a check valve in said conduit completely controlling flow of refrigerant from said coil to said compressor, and pressure responsive means connected between said valve and compressor for controlling operation of said valve.

6. In a refrigerating system, a coil, a compressor, a conduit leading from the coil to the compressor, a valve in said conduit completely controlling communication between said coil and compressor and operable in response to pressure developed in the coil to permit flow of said refrigerant from said coil to said compressor, and means responsive to pressure applied to the intake of the compressor for opposing opening movement of said valve.

7. In a refrigerating system, an expansion coil, a compressor, a valve between the expansion coil and compressor completely controlling communication therebetween, and means responsive to the pressure in the system between the valve and compressor for actuating said valve.

8. In a refrigerating system, an expansion coil, a compressor, a valve between the expansion coil and compressor completely controlling communication therebetween, and means responsive to the pressure differential across the valve for actuating said valve.

9. In a refrigerating system, an expansion coil, a compressor, a relief valve between said coil and compressor completely controlling communication therebetween, a bellows member attached to said valve and operative to move said valve toward closed position with increase of pressure therein, and means for supplying to said bellows member the pressure existing between said valve and said compressor.

WILLIAM V. MUSTO.