Feb. 4, 1941. R. LEWIS 2,230,961

LEAK ALARM FOR REFRIGERATING SYSTEMS

Filed June 13, 1940

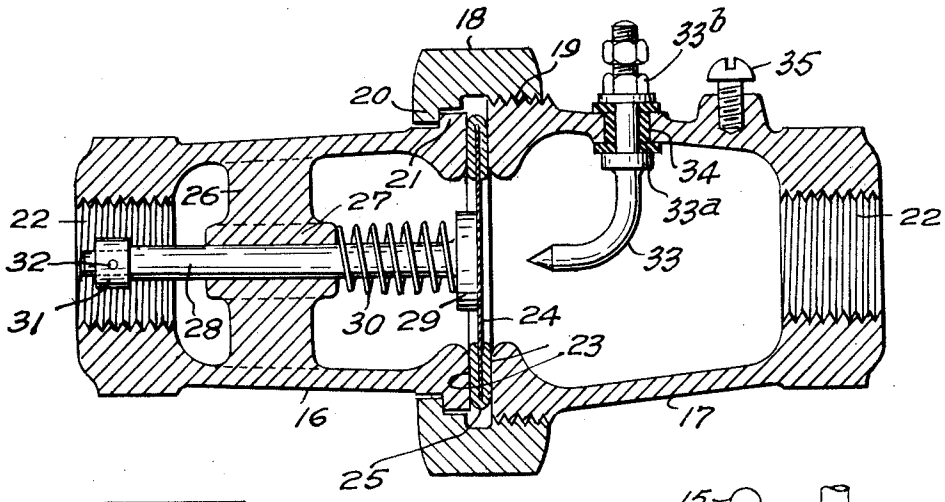


FIG. 2

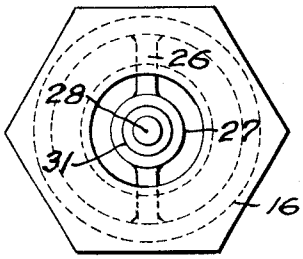


FIG. 3

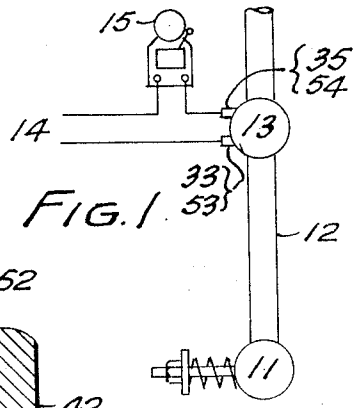


FIG. 1

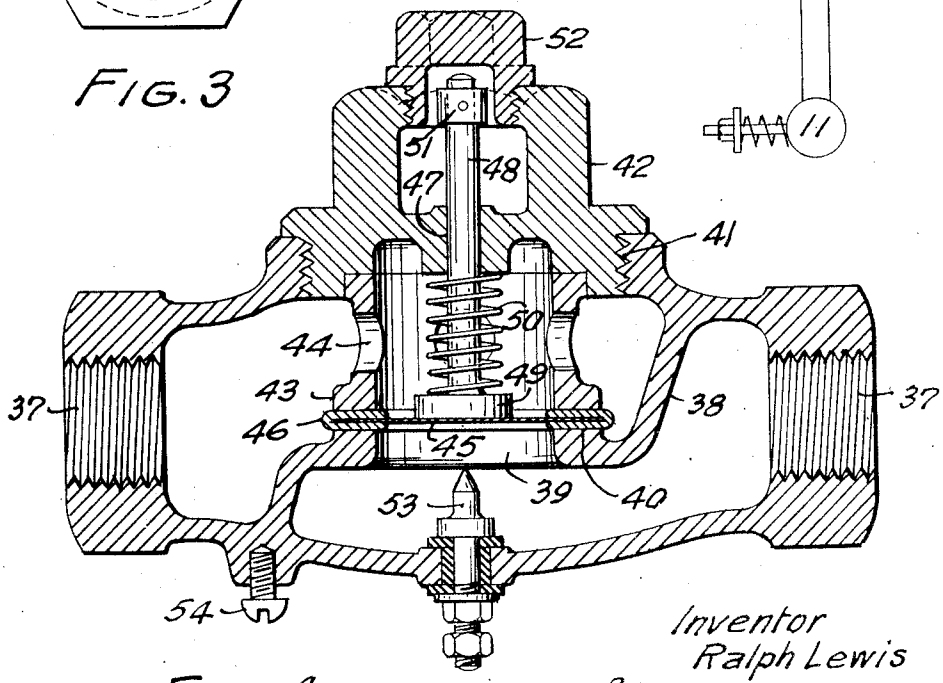


FIG. 4

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LEAK ALARM FOR REFRIGERATING SYSTEMS

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4 Claims. (Cl. 177—311)

This invention relates to improvements in leakage alarms for refrigerating systems and the primary object of the invention is to provide means for detecting and giving notice of leakage of refrigerant from refrigerating systems. A further object is to provide a leakage alarm as aforesaid which is simple and inexpensive in construction and certain and positive in operation. A still further object is to provide a leakage alarm especially designed for use outside the safety valve of a refrigerating system which alarm will not interfere in any way with the relieving of pressure in the system. Various other objects and the advantages of the invention may be ascertained from the following description and the accompanying drawing.

The regulations of municipal and other authorities as a rule require that refrigerating system safety blow-off valves be piped to a point outside the building in which the system is installed so that in the event of excessive pressure being developed in the system the refrigerant will be discharged outside the building. It frequently happens that the safety valves leak sufficiently to cause considerable loss of refrigerant and this loss may go unobserved for some time, even in the case of highly odourous refrigerants such as ammonia, owing to the escaping refrigerant being discharged outside the building, usually above the roof.

According to the present invention, there is provided in the vent pipe from the safety valve or other exit valve to the outer atmosphere, and preferably close to the safety valve or other exit valve, an alarm device containing a diaphragm normaly closing the vent pipe and separating the contacts of an electric alarm circuit. The diaphragm is rupturable by fluid pressure below that at which the safety valve is set. Leakage of refrigerant past the safety or other exit valve of the system builds up a pressure in the vent pipe between the exit valve and alarm device and when this reaches the rupture point of the diaphragm, the diaphragm ruptures and releases the electric contacts for engagement to close the alarm circuit.

In greater detail the invention comprises the features and combinations of features herein described and/or illustrated in the accompanying drawing, together with all such modifications thereof and substitutions of equivalents therefor as are within the scope of the appended claims.

In the accompanying drawing which illustrates two embodiments of the invention, but to the details of which the invention is not confined as various modifications are possible and contemplated:

Fig. 1 is a diagram illustrating the arrangement of the device in relation to a safety or other exit valve.

Fig. 2 is a central longitudinal sectional view of one form of alarm actuating device.

Fig. 3 is an end elevation of the device shown in Fig. 2.

Fig. 4 a central longitudinal sectional view of another form of alarm actuating device.

Referring more particularly to the drawing and especially to Figs. 1, 2, and 3, 11 designates a safety blow-off valve or other exit valve of a refrigerating system and 12 designates a vent pipe leading from said valve to a remote point, preferably external of the building containing the system. A leak alarm actuating device, designated as a whole by the numeral 13, is disposed in the pipe 12 close to the valve 11 and is connected in an electric circuit 14 with an alarm device such as the bell 15.

The alarm actuating device 13 comprises a pair of complementary hollow body parts 16 and 17 connected together in any suitable way, as by the coupling 18 screw threaded to one of the parts as at 19 and having an internal flange 20 bearing against an external flange 21 on the other body part. Each of the body parts is adapted at its free end for connection in the vent pipe 12, for example by the screw threads 22.

The adjacent ends of the body parts are formed with preferably parallel facing surfaces 23 between which the peripheral portion of a diaphragm 24 is clamped when the body parts are properly assembled. If desired, gaskets 25 may be interposed between the clamping faces 23 and the diaphragm. The diaphragm is composed of any suitable material which is proof against corrosion by the refrigerant, for example thin sheet lead. The thickness of the diaphragm is such that it will be ruptured by fluid pressure considerably below that for which the safety valve is set.

One of the body parts, for example the part 16, is provided internally with a spider 26 supporting a guide 27 in which is a plunger 28, slidably mounted for movement in the axial direction of the body. The inner end of the plunger is provided with a head 29 which is normally pressed against the diaphragm by a spring 30 compressed between the head and the inner end of the guide 27, the spring being of such strength that it is incapable of exerting sufficient

thrust against the diaphragm to rupture the same.

The expansive capacity of the spring is such that, upon rupture of the diaphragm, the spring will propel the plunger head into engagement with an electric contact (hereinafter described) located on the opposite side of the diaphragm. The outer end of the plunger is provided with a retaining collar 31 attached in any suitable way, as by a cotter pin 32, at such distance from the guide as not to interfere with the aforesaid activation of the plunger.

The other body part 17 is provided with an electric contact element 33 which passes out through the wall of the body part and is electrically insulated therefrom by an insulating bushing 34 clamped between a shoulder 33a on the contact within the body and a nut 33b on the contact outside the body. The inner end of the contact is turned toward the diaphragm and is preferably pointed, as shown. At a suitable distance from the contact 33, a binding screw 35 is mounted on and electrically connected to the body. The contact 33 and screw 35 are connected to the two sides of the alarm circuit.

In Fig. 4 there is shown another embodiment of the invention which has the advantage over that already described that the diaphragm is more easily replaced but has the disadvantage that it lacks the straight-through flow passage of the first form. In this form, the body, designated 36, is of generally tubular form and adapted at its ends for attachment in the vent pipe 11, as by the screw threads 37. Between its ends the body is provided with an internal transverse wall 38 formed with a flow opening 39 communicating the body bore on opposite sides of the wall 38. One side of the wall is formed with an annular seat 40 surrounding the opening 39. The body is formed with a lateral opening 41 in axial alignment with and larger than the flow opening 39 and seat 40 and on that side adjacent the seat. The opening 41 is normally closed by a bonnet or plug 42 attached to the body in any suitable way as by being screw threaded thereinto. The bonnet is provided with a skirt 43, either integral or separate, which extends into close proximity with the seat 40 and is of approximately the same dimensions as the seat, so as to register therewith. This skirt is formed with flow openings 44 permitting fluid outside the skirt to flow into the interior of the skirt. A rupturable diaphragm 45 is clamped between the seat 40 and the end of the skirt, gaskets 46 being interposed if desired. The bonnet 42 is provided with a bore 47, coaxial with the skirt and seat, which constitutes a guide for a plunger 48 having a head 49 normally urged against the diaphragm by a spring 50 compressed between the head and the guide portion of the bonnet. The outer end of the plunger is provided with a retaining collar 51 secured thereto in any suitable way. The outer end of the plunger may be covered by a cap 52 screwed or otherwise suitably connected to the bonnet to prevent escape of fluid which would pass between the guide and the loosely fitting plunger. On the opposite side of the wall 38 from said plunger, the body is provided with an electric contact 53 and a binding screw 54, both mounted in the body as already described.

It will be seen that the parts 36 and 42 constitute body parts clamping between them the diaphragm 45 and respectively carrying the plunger 48 and contact 53, thus providing the same organization as the form of Figs. 2 and 3.

The alarm actuating device 13 is installed with the plunger located between the valve 11 and the diaphragm 24 or 45 so that the expansive pressure of the spring 30 or 50 and the pressure of any fluid in the pipe 12 between the valve 11 and the device 13 act in the same direction on the diaphragm.

If refrigerant leaks past the valve 11 it accumulates in the pipe 12 between the valve 11 and the diaphragm 24 or 45 and builds up a pressure which, if the leakage is sufficient, ruptures the diaphragm and releases the plunger 28 or 48 which is propelled by the spring 30 or 50 against the contact 33 or 53 thus closing the circuit of the alarm device 15.

As the diaphragm is such as to rupture at pressure below that for which the safety valve is set, it will be understood the actuating device will operate without there being any previous operation of the safety valve and it will also be understood the diaphragm will not interfere with the escape of refrigerant if the safety valve opens to relieve excess pressure in the system. In addition to operating as a leak alarm the device will obviously operate as a blow-off alarm when the safety valve operates.

While the device has been designed and described with particular reference to refrigerating systems, it will be understood it equally is applicable to other fluid pressure systems.

Having thus described my invention, what I claim is:

1. In a fluid pressure system, in combination with a relief valve and vent pipe leading therefrom, a diaphragm closing said pipe outwardly of the valve; a plunger between the diaphragm and valve spring pressed against the diaphragm and constituting one contact in an alarm circuit; a second contact on the opposite side of said diaphragm from the plunger, electrically insulated from the plunger; an alarm device and a normally open powering circuit connecting said alarm device, plunger and contact, said circuit being closable by engagement of the plunger and contact upon rupture of the diaphragm.

2. In a fluid pressure system, in combination with a relief valve and vent pipe leading therefrom, a leak alarm actuating device in the vent pipe outwardly of the valve comprising a body supporting a rupturable diaphragm in such wise as to close the vent pipe, a plunger on that side of the diaphragm adjacent the valve, an electric contact on the opposite side of said diaphragm from the plunger, and a spring normally pressing the plunger against the diaphragm and adapted to propel the plunger into engagement with the contact upon rupture of the diaphragm; an alarm device and an electric powering circuit therefor connected to said plunger and contact and normally open thereat.

3. An alarm actuating device for fluid pressure systems comprising a body including complementary parts releasably connected together and constituting a fluid flow passage, a plunger slidably mounted in one of said parts, an electric contact in and electrically insulated from the other body part, a spring urging said plunger toward said contact and a diaphragm clamped between the body parts closing the flow passage and restraining said plunger from engagement with said contact.

4. An alarm actuating device for fluid pressure systems comprising a body including complementary parts releasably connected together and constituting a fluid flow passage, a guide in one

of said parts, an electric contact carried by and insulated from the other body part, extending into alignment with said guide, a headed plunger in the guide, a spring compressed between the guide and plunger head urging the plunger toward said contact and a rupturable diaphragm clamped between the body parts, closing the flow passage therethrough and restraining the plunger from engagement with said contact and means to connect said contact and plunger in an electric alarm circuit.

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