

April 23, 1935.

F. SIMMONS

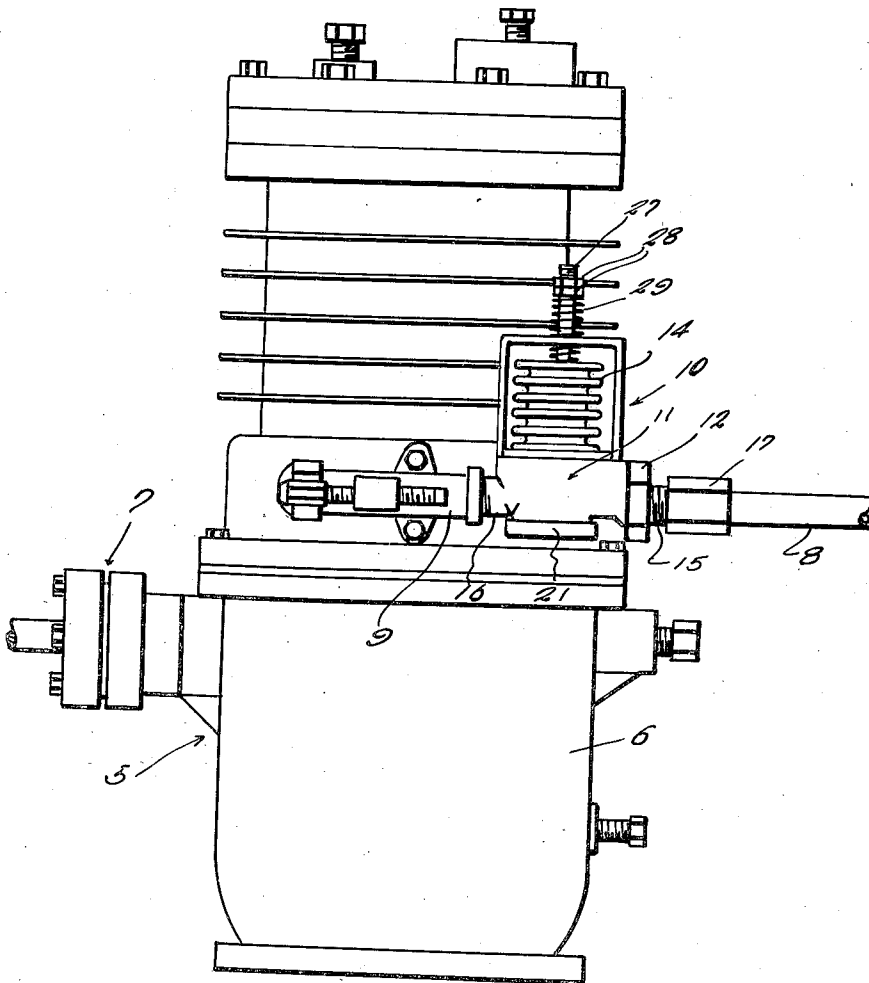
1,998,852

DIFFERENTIAL PRESSURE CONTROL VALVE

Filed March 16, 1934

2 Sheets-Sheet 1

Fig. 1.



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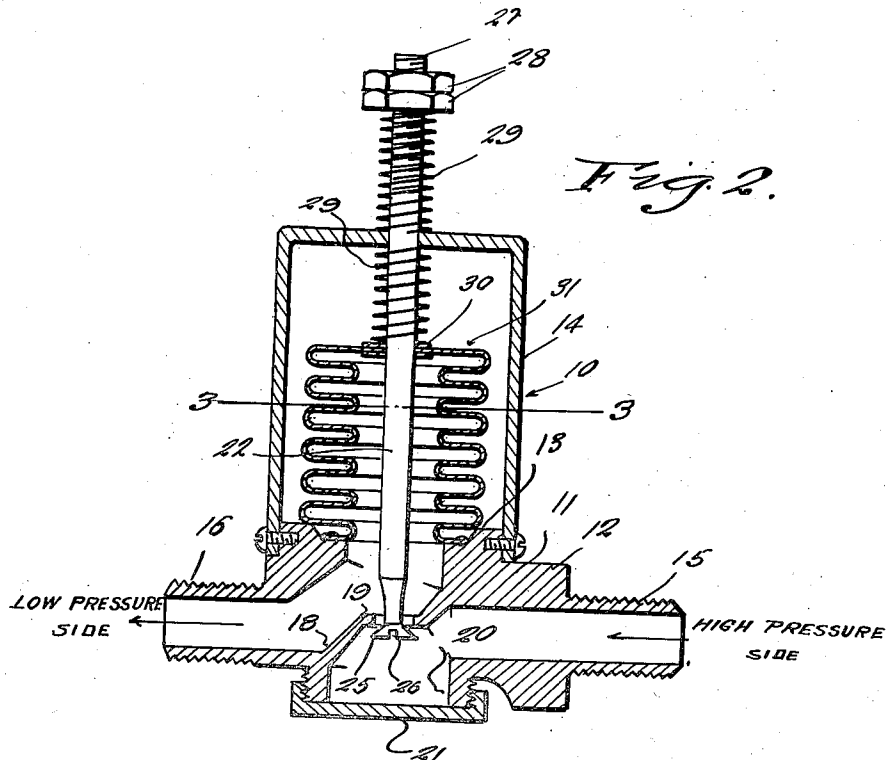


Fig. 3.

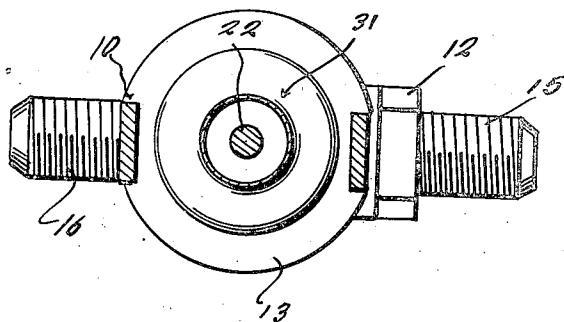
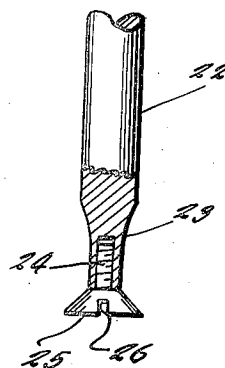


Fig. 4.



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UNITED STATES PATENT OFFICE

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DIFFERENTIAL PRESSURE CONTROL VALVE

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Application March 16, 1934, Serial No. 715,962

1 Claim. (Cl. 50—23)

This invention relates to an improved differential pressure control valve, that is an automatic shut off valve adaptable for installation in fluid and gaseous conduction lines.

Although the valve is susceptible of general usage in pipe lines carrying different kinds of fluids and mediums, it is especially, but not necessarily, adapted for use in a refrigerant supply line such as is connected to a conventional or typical compressor constituting a part of a power actuated refrigeration system, for example of the present day domestic type.

Stated more explicitly, the valve is expressly designed for use on the modern types of commercial and domestic refrigeration units using high pressure condensing systems and refrigerants of low boiling point. Such units, being of necessity designed to maintain a vacuum in the compressor crank-case are fitted with a syphon type stuffing-box at the crank-shaft exit. When a system is placed out of service and allowed to stand idle for some time a severe pressure strain is placed on this stuffing box, due to the lower boiling refrigerant vaporizing in the cooling coil; travelling through the suction line, and coming to rest in the crank-case, occasionally causing dangerous leakage of gas.

This vaporized refrigerant gradually condenses in the crank-case, and the lubricating oil therein, being lighter and floating upon the liquid refrigerant, is raised to such a height that it is thrown upward by the pistons, and forced through the pistons and exhaust or flapper valves into the condensing coils, leaving the crank-case short of lubricant. When placed back in service, a system in which the above condition exists will invariably overheat, usually to the extent of burning out the motor, unless a restriction is placed on the suction valve before starting.

As will be hereinafter made evident the principal novelty is predicated upon the particular valve, that is the specific construction of said valve.

Other features and advantages will become more readily apparent from the following description and drawings.

In the drawings:

Figure 1 is an elevational view showing a typical commercial compressor disclosing the improved safety refrigerant control valve incorporated in the refrigerant supply line.

Figure 2 is a view, essentially in section, showing the valve per se.

Figure 3 is a horizontal sectional view taken

approximately on the plane of the line 3—3 of Figure 2.

Figure 4 is an enlarged detail sectional and elevational view showing the valve stem and valve elements detachably connected thereto.

Referring now to Figure 1 of the drawings it will be seen that the compressor is denoted by the numeral 5. Among other parts, this includes a crank case 6 wherein the so-called exit side of the crank shaft passes through an adapter 7 in which the syphon projection (not shown) is located. This so-called adapter 7 is generally referred to in the trade as a syphon equipped stuffing box for the complementary portion of a crank shaft. The refrigerant supply line or pipe is differentiated by the numeral 8 and the fitting is indicated at 9. The improved safety or differential control valve is represented, as a unit, by the numeral 10. It is installed between the fitting 9 and the supply pipe 8.

This valve is detailed in Figure 2 and by referring to this figure it will be observed that it comprises a casing or body 11 of appropriate shape and dimensions fashioned at one end to provide a tool gripping nut 12, and having its upper or top portion 13 of circular construction to accommodate and facilitate attachment of a guard 14. On one side the body is formed with an intake nipple 15 and on a diametrically opposite side with the discharge or outlet nipple 16. The nipple 15 is connected to the pipe 8 through the instrumentality of an appropriate union 17 as shown in Figure 1. Any suitable means is provided for connecting the outlet nipple with the standard fitting 9 of the compressor. On its interior the body of the valve is provided with a partition or diaphragm 18 constructed to provide an orifice or valve seat 19. Below this the body is formed with a neck 20 screw threaded to accommodate a removable cap 21. The features 20 and 21 serve primarily as a hand hole or means permitting access to be had to the valve, valve stem and seat.

The valve stem is denoted by the numeral 22 and has a lower reduced end portion 23 formed with a screw threaded socket to accommodate the attaching shank 24 of the valve element or head 25. This valve head is of a beveled type and made to successfully contact the valve seat 19. It is provided with a screw driver kerf 26 whereby to permit it to be conveniently removed or replaced so that it will operate appropriately under all circumstances.

The valve stem extends up and slidably through the guard 14 and it is screw threaded as indi-

cated at 27 to accommodate companion adjusting nuts 28 for the regulating springs 29. It will be noted that the intermediate portion of the valve stem has a leakproof connection as at 30 with the top of the bellows or syphon regulator 31. This regulator has a thermostatic or automatic action and is appropriately attached to the disk like portion 13 of the body of the valve. It is obviously expansible and contractible and its degree of activity can be regulated through the instrumentality of the springs 29 which are tensioned to the requisite degree as conditions require.

In practice, the fitting commonly used on suction line valves of present type refrigeration units (not shown) is removed and the nipple 16 of the improved safety valve 10 is attached to the part of the fitting 9 shown in Figure 1. The suction line 8 from the cooling coil (not shown) is connected to the nipple 15. A compound gage (not shown) connected to the regular fitting provided for the same, is then temporarily installed and the pressure control adjusting nuts 28 are adjusted up or down, as the case may be, until the desired valve shut off pressure is obtained. The heat laden vapor passes through the valve in a direction indicated by the arrows, but when the desired pressure on the outlet side 16 is reached, the valve closes. Obviously the valve closes as a result of pressure exerted within the bellows syphon 31 causing the same to expand and raise the valve stem 22 to seat or close the valve head 25 against its seat 19. Moreover when the pressure within the bellows is reduced to a predetermined degree the syphon contracts forcing the valve stem down and opening the valve automatically. Thus, the valve is in a sense an equalizing safety or differential control device. The valve remains closed until the operation of the piston reduces the crank case pressure below the closing point. No matter what pressure exists on the side 15, pressure on the side 16 can never exceed the amount set for, as immediately this starts to occur the safety valve closes. With a zero pressure on the side 16, the valve will remain open, offering no interference with normal operating conditions. Thus the valve is automatic in that it develops the desired differential or equalizing action on either side depending on normal and abnormal pressure conditions.

It has been found that a valve of this type when used in refrigerating systems eliminates leaks at the stuffing box from excess pressure, overcomes the necessity of placing manual restrictions on units being put back in service. It reduces gas leaks and loss of refrigerant to a minimum, obviates the necessary of scrubbing oil in so-called "warm" jobs. It protects the flapper and piston valves against oil hammering, overcomes overloading of the condensing units, with the at-

tendant burnt out motors, blown fuses, carbonized systems due to entrance of excess heat. It is simple and economical, susceptible of expeditious installation without requiring changes in the existing or stock parts, simple to adjust and all adjustments are easily accessible. When properly adjusted it requires no further attention throughout the life of the unit.

It is understood that although the invention is described as particularly adaptable for use in a refrigerant circulation line it is susceptible of adequate employment and proper utility in various other lines requiring the use of a substantially automatically operable control valve.

It is thought that persons skilled in the art to which the invention relates will be able to obtain a clear understanding of the invention after considering the description in connection with the drawings. Therefore, a more lengthy description is regarded as unnecessary.

Minor changes in shape, size, and rearrangement of details coming within the field of invention claimed may be resorted to in actual practice, if desired.

Having thus described my invention, what I claim as new is:

In a refrigerating system, means for automatically closing the pipe line leading to the compressor when crank case pressure in the compressor becomes excessive, comprising a valve casing located in the pipe line, said casing having an opening passing through its top and in communication with the low pressure side of the line, a valve seat formed in the casing and opening downwardly into the high pressure side of the casing for placing the opening in communication with the high pressure side, a one piece valve stem passing through the first mentioned opening and through the valve seat, a valve having a threaded part threaded to the lower end of the stem and moving upwardly against the seat when moving to closed position, a bellows having its lower end connected with the top of the valve casing and surrounding the upper end of the opening and through the top of which the stem passes, means for connecting the top of the bellows with the stem, a cap-like member connected with the top of the valve casing and enclosing the bellows and having a hole in its top through which the stem passes, a spring encircling a part of the stem and having one end bearing against the top of the bellows and its other end against the top of the cap-like member, a second spring encircling the outer part of the stem and having one end bearing against the top of the cap-like member and a nut threaded on the upper end of the stem and bearing against the top of the last mentioned spring.

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