

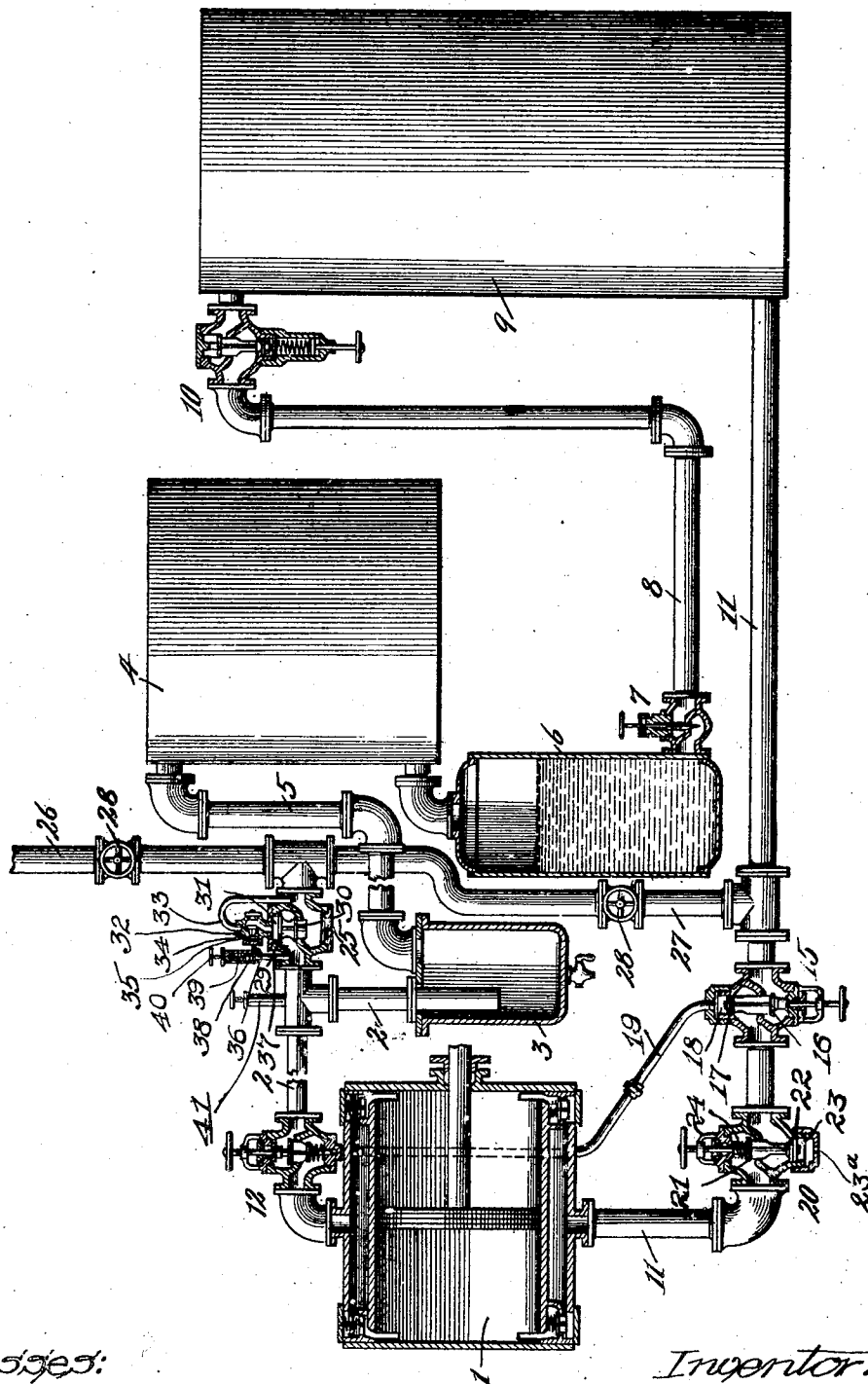
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SAFETY SYSTEM FOR AMMONIA REFRIGERATING APPARATUS.
APPLICATION FILED SEPT. 28, 1908.

933,731.

Patented Sept. 7, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



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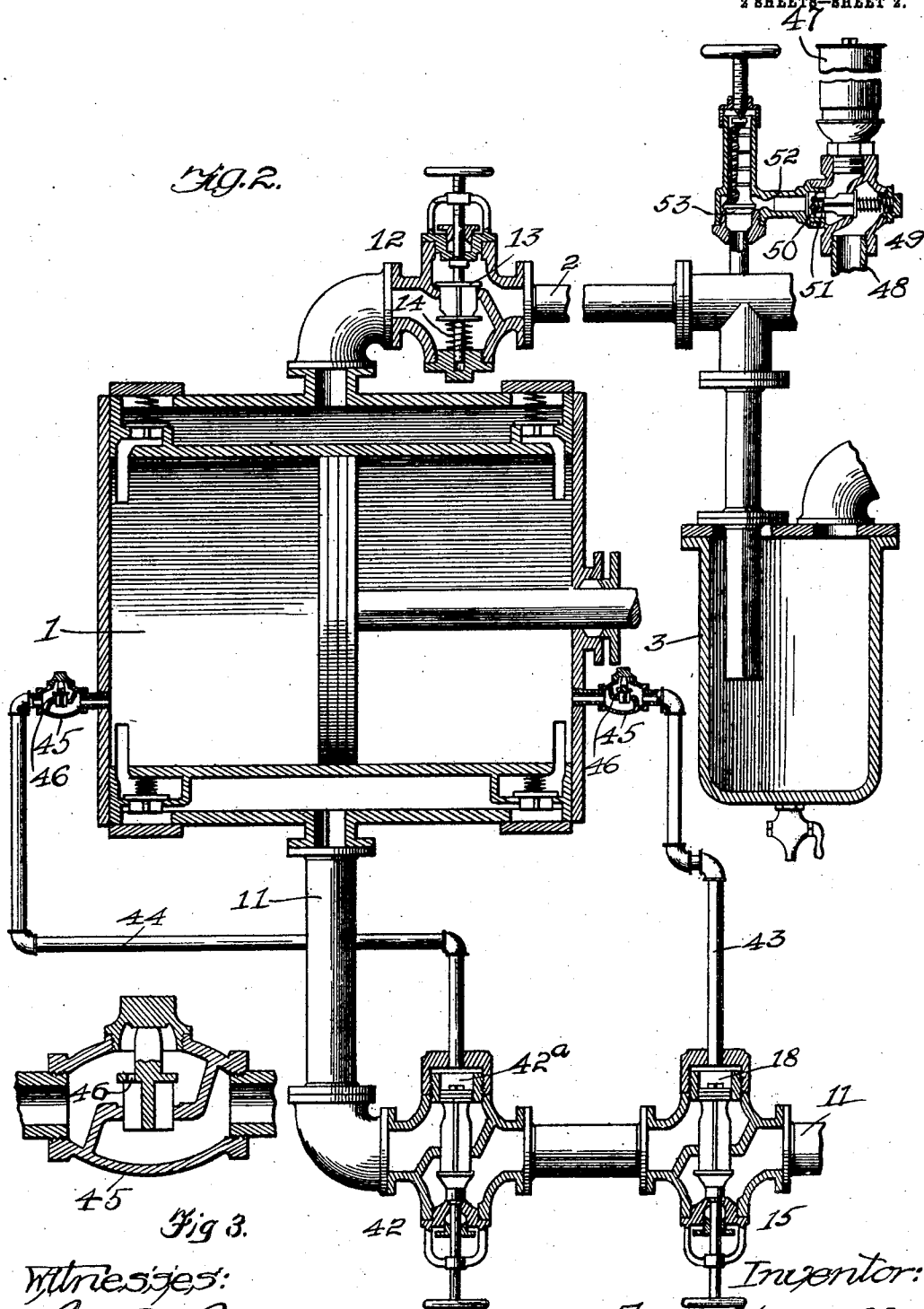
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UNITED STATES PATENT OFFICE.

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SAFETY SYSTEM FOR AMMONIA REFRIGERATING APPARATUS.

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Specification of Letters Patent.

Patented Sept. 7, 1909.

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To all whom it may concern:

Be it known that I, FRANK HENNEBÖHLE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Safety Systems for Ammonia Refrigerating Apparatus, of which the following is a specification.

One of the objects of this invention is to provide means for automatically cutting off the escape of ammonia upon the occurrence of a break in those portions of the system which are most liable to such an accident.

Another object is to provide a safe relief for excessive pressure in the system.

A further object is to provide means for obtaining a warning signal whenever the pressure in the system rises above the predetermined point.

In the accompanying drawings Figure 1 is a diagram illustrating one embodiment of my invention. Fig. 2 is a diagrammatic view of another embodiment of the invention. Fig. 3 is a sectional view, on an enlarged scale, of one of the check valves.

Referring to Fig. 1: The compressor 1 is arranged to discharge through the pipe 2 into a separator 3, which latter is connected with the condenser 4 by means of the pipe 5. The liquefied ammonia-gas flows from the condenser 4 into the storage tank or drum 6. The liquid ammonia escapes from the storage drum 6 through an expansion valve 7 into a pipe 8 communicating with the space or apparatus 9 to be cooled. In the pipe 8 is located a pressure-reducing valve 10. 11 is a return or suction main extending from the cooling space 9 to the compressor 1. That portion of the system extending between the compressor 1, through the separator, condenser and storage drum to the expansion valve 7 is under high pressure, 280 pounds being a pressure commonly employed in practice.

In order to prevent the escape of gas from the high pressure portion of the system, I provide a check valve 12 in the pipe 2. The valve disk 13 of said valve is normally held open by a spring 14 to prevent wearing of the valve disk through frequent seating thereof. Any breakage in the discharge side of the compressor, permitting the escape of gas to the atmosphere, or a break in the pipe 2 between the compressor and the check valve 12 will permit the pressure in the system to seat the valve disk 13 against the

force exerted by the spring 14. A reduction in pressure due to such an accident also is utilized to cut off the flow of gas through the suction main 11 to the compressor, by means of a check valve 15 located in said suction main, said valve comprising a valve disk 16 adapted to cut off the flow of gas through the suction main. A piston 17 connected to the stem of said valve disk is mounted in a cylinder 18 which is open to the pressure in the pressure side of the compressor through the medium of a pipe 19. A reduction of pressure at the pressure side of the compressor or in the system between the compressor and the check valve 12 will enable the pressure in the suction main to overbalance the pressure in the cylinder 18 and seat the valve disk 16.

20 is a check valve located in the suction main 11 between the check valve 15 and the compressor 1. The check valve 20 comprises a valve disk 21 to the stem of which is fixed a piston 22 which is mounted in a cylinder 23. An opening 23* admits atmospheric pressure to the cylinder 23. The disk 21 and the piston 22 being of equal area, it will be seen that the valve is balanced. The weight of the slidable valve member 21 22, assisted by the spring 24, tends to seat the closure 21. In the operation of the compressor, atmospheric pressure upon the under side of the piston 22 opens the valve. Should a break occur between the valve 20 and the compressor, the spring 24 and the weight of the structure 21 22 immediately closes the valve.

In order to provide a safe relief for excessive pressure in the portion of the system extending between the compressor and the expansion valve 7, I connect a relief valve 25 with the pipe 2, said relief valve being arranged to discharge to the atmosphere through a pipe 26 or into the suction main 11 through a pipe 27.

28 are cut-off valves inserted in the pipes 26 and 27 so that the relief valve may be arranged to discharge into the atmosphere or the suction main as desired.

29 is a piston fixed with relation to the valve disk 30 of the relief valve 25, said piston being loosely mounted in a cylinder 31. Normally, the cylinder 31 is under the same pressure as exists in the inlet side of the relief valve 25, by reason of leakage of gas past the piston 29 into said cylinder. The piston 29 is somewhat larger in area than the valve disk. The pressure in the cylinder 31

is arranged to be relieved by means comprising a valve 32 connecting at one end with said cylinder and at its other end with a pipe 33 leading to the outlet side of the valve 25 or any other place in which the pressure is relatively low. The valve disk 30 of the valve 25 is normally held seated by the pressure in said valve and in the cylinder 31. Said valve disk is arranged to be unseated by a piston 34 located in a cylinder 35, said cylinder communicating with the inlet side of the valve 25 through the pipes 36 and 37. The passage of pressure fluid through the pipes 36 and 37 is normally prevented by a valve member 38 held to its seat by a spring 39. The pressure of the spring 39 may be adjusted by means of a screw 40 so as to cause the relief valve to operate at any desired pressure. When the pressure in the high-pressure portion of the system rises above that to which the spring 39 is set, the valve member 38 is unseated, the piston 34 moved to open the valve 32, whereupon the pressure above the piston 29 is reduced, permitting the pressure in the inlet side of the valve 25 to unseat the valve member 30. The excess pressure then escapes into the atmosphere or the suction main 11, as desired. If desired, an alarm whistle 41 may be inserted in the pipe 2 at any convenient or suitable point.

When an expansion valve is depended upon to furnish the desired pressure in the cooling room or appliances, frequent adjustments of said expansion valve are necessary. I obviate the necessity for such adjustments by providing in the pipe 8 extending between the expansion valve and the cooling appliances, a pressure-reducing valve 10 adapted to reduce the pressure in said pipe to the desired point. For example, the expansion valve 7 may be set to discharge ammonia into the pipe 8 at a pressure in the neighborhood of forty pounds, and the reducing valve 10 may be set to reduce the pressure to, say twenty pounds, or any other pressure desired. The reducing valve 10 may be set to deliver the vaporized ammonia at a uniform pressure, and is not affected by slight variations of pressure in the pipe 8.

The arrangement hereinbefore described for preventing the escape of gas into the atmosphere is particularly well suited to an apparatus in which the pressure in the suction main is about that of the atmosphere. Where it is desired to carry a pressure of, say, twenty pounds, in the cooling appliances and return pipe, the construction shown in Fig. 2 may be employed. As therein shown, a valve 42 similar to the valve 15 is substituted for the valve 20, and said valves 15 and 42 connected with the opposite ends of the compressor cylinder by

means of pipes 43 and 44, respectively. A check valve 45 is inserted in each of the pipes 43 and 44, said valves opening to admit pressure fluid to the cylinders 18 and 42^a. Means is provided for permitting a relatively slow escape of the pressure fluid trapped in the cylinders 18 and 42^a, as, for example, a small port 46 extending through the closure of each check valve 45.

In the construction last described the valves 15 and 42 are normally open, and the ammonia is fed to the compressor at the pressure existing in the return pipe 11. Referring to Fig. 2, should a break occur in the right-hand cylinder head or in the pipe 2 between the compressor 1 and the valve 12, the pressure in the cylinder 18 will be quickly reduced by reason of leakage through the port 46, and the pressure in the suction main will close the valve 15. A similar accident at the opposite end of the compressor cylinder will result in the automatic closing of the valve 42.

If desired, a signal device such as is illustrated in Fig. 2 may be used. A whistle 47 connected with a steam or compressed air supply pipe 48 is controlled by a valve 49 that is arranged to be operated by a piston 50 and cylinder 51. The cylinder 51 is connected with the high-pressure portion of the system by means of a passage 52 controlled by a spring-pressed valve member 53. When the pressure in the system rises above that at which the valve member 53 is set, ammonia is admitted to the cylinder 51, whereupon the valve 49 is opened to admit steam to the whistle 47. The valve member 53 is open only for a moment, being seated by its spring. The ammonia trapped in the cylinder 51 gradually leaks past the piston 50 and is too small in quantity to be objectionable.

The valves 12, 15, 20 and 42 close tightly, automatically; therefore the hand wheels herein illustrated may be omitted, if preferred, as accidents frequently occur through failure to open a valve that has been closed by hand. The valve 12 may be inverted, if desired, the spring 14 omitted, and the disk 13 normally held unseated by gravity. In such a construction, as well as in the one shown, the valve operates upon a slight variation in the pressure.

It is obvious that the relief valve 25 may be employed in any pressure-fluid system.

I wish it to be understood that I desire not to be limited to the details herein shown and described, inasmuch as said details are illustrated merely to disclose practical constructions embodying the invention, and various modifications will occur to persons skilled in the art.

I claim as my invention:

1. In refrigerating apparatus, in combination, a compressor having inlet and dis-

charge means, and means for automatically closing the inlet upon a reduction of the pressure in the discharge means.

2. In refrigerating apparatus, in combination, a compressor having discharge means; a suction main; a cut-off valve in said suction main arranged to be closed by pressure in said main; a piston and cylinder operating to hold said valve open; and a means of communication between said cylinder and the discharge means.

3. In refrigerating apparatus in combination, a compressor cylinder; a suction main; a cut-off valve in said suction main arranged to be closed by pressure in said main; and pressure-fluid-actuated means connected with one head of said cylinder for holding said valve open.

4. In refrigerating apparatus, in combination, a compressor cylinder; a suction main; two cut-off valves in said suction main; and two pressure-fluid-actuated means connected with the opposite heads of said cylinder, and each controlling one of said cut-off valves.

5. In refrigerating apparatus, in combination, a compressor; a suction main; a cut-off valve in said suction main; a piston and cylinder for operating said valve; a pipe connecting said cylinder with said compressor; and a check valve in said pipe adapted to permit the gradual escape of the fluid trapped in said cylinder.

6. In refrigerating apparatus, in combination, a compressor; a suction main; a discharge pipe; a relief valve for said discharge pipe; pressure-fluid-actuated means for holding said relief valve closed; and pressure-fluid-actuated means communicating with said discharge pipe for rendering inoperative the first mentioned pressure-fluid-actuated means.

7. In refrigerating apparatus, in combination with the high pressure portion of the apparatus, a relief valve comprising a valve closure; a piston and cylinder to operate said closure, said cylinder being open to the pressure in the high pressure portion of the system; a relief connection for said cylinder; a valve in said relief connection; a piston and cylinder for operating said last mentioned valve; a connection between said last mentioned cylinder and the high pressure portion of the system; and a pressure-actuated valve in the last mentioned connection.

8. In refrigerating apparatus, in combination, a compressor; a suction main for the fluid to be compressed; a valve casing in said suction main, having a valve seat; a valve

member in said casing arranged to be seated upon said seat; and means actuated by atmospheric pressure for unseating said valve member in the operation of the compressor, said valve member being arranged to be automatically seated upon a breakage between the compressor and the valve casing.

9. In refrigerating apparatus, in combination, a compressor; a suction main; and a balanced stop valve in said main, said valve comprising a casing, a balanced structure comprising a valve disk and a piston, said casing including a cylinder in which said piston is mounted, said cylinder having an opening therein to place said piston under atmospheric pressure, said balanced structure being movable to seat the valve disk upon breakage of the main between the stop valve and the compressor.

10. The combination of a whistle and means for connecting said whistle with a source of pressure fluid, a valve controlling said whistle, pressure-fluid-actuated means connected with another source of pressure fluid for operating said valve, and a valve arranged to be opened by fluid pressure, said last mentioned valve controlling said pressure-fluid-actuated means.

11. In refrigerating apparatus, in combination, a closed system; a compressor and an expansion valve in said system; a check valve located in said system between the compressor and the expansion valve; a safety stop valve in the suction side of the system, said stop valve tending to seat under the pressure in the suction side; and means actuated by the pressure between the compressor and the check valve for holding the stop valve open.

12. In refrigerating apparatus, in combination, a closed system; a compressor and an expansion valve in said system; a check valve located in said system between the compressor and the expansion valve; a safety stop valve in the suction side of the system, said stop valve tending to seat under the pressure in the suction side; a cylinder; a piston in said cylinder and connected with said stop valve; and means for communication between said cylinder and the portion of the system between the compressor and said check valve, the pressure in said cylinder tending to hold said stop valve open.

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